# Virtual Competition

## THE PROMISE AND PERILS OF THE ALGORITHM-DRIVEN ECONOMY

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Harvard University Press
Cambridge, Massachusetts
London, England
2016

Printed in the United States of America

First printing

*Library of Congress Cataloging-in-Publication Data*

Names: Ezrachi, Ariel, 1971– author. | Stucke, Maurice E., author.
Title: Virtual competition : the promise and perils of the
algorithm-driven economy / Ariel Ezrachi, Maurice E. Stucke.
Description: Cambridge, Massachusetts : Harvard University Press, 2016. |
Includes bibliographical references and index.
Identifiers: LCCN 2016018188 | ISBN 9780674545472 (cloth)
Subjects: LCSH: Electronic commerce. | Pricing—Technological innovations.
Classification: LCC HF5548.32 .E996 2016 | DDC 381/.142—dc23
LC record available at https://lccn.loc.gov/2016018188

# Contents

# Preface

Could digital commerce and new technologies actually harm us? Today, the rise of the Internet, Big Data, computer algorithms, artificial intelligence, and machine learning all promise to benefit our lives. On its surface, the online world—with the growth of price comparison websites, dynamic pricing, web promotions, and smartphone apps—seems to deliver in terms of lowering prices, improving quality, widening the selection of goods and services, and hastening innovation.

And yet, could it be that, after the initial procompetitive promise, these technologies lead to higher prices, poorer quality, fewer options presented to us, and less innovation in things we care about, such as our privacy?

Our suggestions may sound heretical and counterintuitive. After all, in many markets, data and technology have visibly stimulated entry, expansion, and competition. We do not dispute these benefits. Technology and Big Data can be beneficial, no doubt. However, once one ventures beyond the façade of competition, a more complex reality emerges.

The dynamics of artificial intelligence, price algorithms, online trade, and competition lead us to uncharted ground—to a landscape that ostensibly has the familiar competitive attributes to which we are accustomed, and yet delivers far less than what we would expect.

The new market dynamic, new technologies, and start-ups have captivated our attention and created a welfare mirage—the fantasy of intensified competition. Yet, behind the mirage, there operates an increasingly well-oiled machine that can defy the free competitive forces we rely on.

Our thesis concerns the implications of the rise of a new—algorithm-driven—power, which changes several structural and behavioral pillars that underpin traditional markets.

Competition, as we knew it—the invisible hand that distributes the necessities of life—is being displaced in many industries with a digitalized hand. The latter, rather than being a natural force, is man-made, and as such is subject to manipulation. The digitized hand gives rise to newly possible anticompetitive behaviors, for which the competition authorities are ill-equipped.

Of course, we agree that the rise of Internet commerce through sophisticated computer algorithms *can* intensify competition in ways that increase our welfare. But, importantly, this is not assured. Our book explores how the paradigm shift can leave some of us better off, while leaving many in society worse off. Moreover, competition authorities may need to reassess and reinterpret the legal tools at their disposal to prevent and punish these unusual new forms of anticompetitive restraints. Even basic questions, such as "Can computers collude?" or "How much choice does the online environment offer?" may be challenging. At times, it may be difficult to see beyond the façade of competition to the toll that the new paradigm has on us, our welfare, and our democratic ideals.

In what follows we explore these dynamics. We consider the possible use of sophisticated price algorithms and artificial intelligence to facilitate collusion or conscious parallelism. We reflect on the expansion of behavioral advertising and the possible use of advanced technology and tracking to engage in "almost perfect" behavioral discrimination. The discussion also explores information harvesting and analysis, the effects of intermediation and price comparison websites, the rise of super-platforms, and their "Frenemy" relationship with independent application developers.

Our exploration of these themes raises challenging questions as to the true competitiveness of present and future online markets. We consider the limits of competition, consumer protection, and privacy law in an advanced algorithm-driven environment, and reflect on the enforcement gaps and policy implications.

This book was born of a question that challenged our minds during a stroll along the River Thames: "What if computers could collude?" To paraphrase T. S. Eliot, that led us on our journey:

> Oh, do not ask, "What is it?"
> Let us go and make our visit.

And so we did. Our research prompted additional questions and stimulating discussions with competition officials, lawyers, economists, computer scientists, philosophers, and engineers. We welcome you to the debate.

# PART I

# Setting the Scene

MUCH HAS BEEN WRITTEN about the transformative effects that recent technological changes have had on our society and well-being. These technological developments in e-commerce, computers, Big Data, and pricing algorithms, have no doubt changed the way we shop and communicate. The dynamics of online commerce have freed customers from reliance on local offerings. Gone are the days when many of our choices were restricted to a few local retailers who controlled which products were placed on the shelves, the deals we struck, and largely the information on which we based our decisions. Advances in technology and changes in communications, transportation, and commerce are expected to further change our environment and promise to increase competition and well-being.

Our discussion in this part presents two contradictory themes. We begin with the commonly accepted promise of the algorithm-driven economy; then we switch gear and outline its perils—its darker and less charted sides.

Chapter 1 explores the many alluring features of online markets and the promise they carry—to increase efficiency, competition, and ultimately our prosperity. The new economic reality promises to be bright.

Chapter 2 looks at key technological developments—the rise of self-learning algorithms and Big Data that are fueling these dynamic innovations—everything from books sold on Amazon to airplane tickets on Orbitz. We illustrate how Big Data and Big Analytics are providing online retailers like Amazon a competitive advantage over brick-and-mortar behemoths like Walmart.

In Chapter 3 we summarize the enforcers' typical approach to digital markets. We note how, given the significant potential benefits of innovation and technology, the rallying cries within the tech industry, and increasingly the antitrust circles, are that only a light regulatory hand, if any, is needed.

Having explored the "promise" of a data-driven economy, we turn in Chapter 4 to introduce its darker sides. Venturing behind the façade of virtual competition, we question the conventional wisdom that the competitive problems of the analog world—collusion, monopoly, and price discrimination—are less likely to reappear in the digital world, where rivals are simply a click away. As the remaining parts of this book explore, variants of these traditional anticompetitive scenarios may develop—with a vengeance.

# 1

# The Promise of a Better Competitive Environment

TODAY, with a few taps on our smartphone, tablet, or computer, we can discover an array of products, reviews, and prices. The Internet has made our world smaller. After watching an entire season of *Downton Abbey* on Amazon Prime, you could, without leaving your home—whether in Oxford, Mississippi, or Oxford, U.K.—aspire to the British aristocracy, buying your Barbour hunting jacket and Hunter boots from a U.K. merchant, your Range Rover from a dealership several hundred miles away, your Rhodesian Ridgeback from a California kennel, your summer rental in the Lake District from a family through Airbnb, and Wordsworth's poems and a sketchpad from Amazon.com. You could find eager sellers on eBay, Fiverr.com, or one of the many tradesmen's advice websites, and join a host of communities, chat rooms, and information websites. Indeed, you could even find your future spouse online to accompany you to your English manor, where you could post photos on Facebook to celebrate your elevated social status. Freed from the restrictions and the tyranny of the former gatekeepers—whether the local media, brick-and-mortar retailers, or tastemakers—we must be better off.

The competitive future appears so bright because the online data-driven competition has many appealing economic features. You want to travel next week to Las Vegas? Previously you would have gone to a travel agent or searched the travel advertisements in the local newspaper. Today you would likely turn to search engines and price comparison websites (PCWs).

The Internet has a constellation of platforms to reduce the time and expense of searching the World Wide Web for what we want. Consumers are increasingly relying on these platforms for purchasing decisions.[1] Indeed, many platforms have established themselves as significant players in the distribution chain.[2] Among the promises of online commerce are greater market transparency, efficiency, and ease of use. All of these, as we'll see, should increase competition in ways that promote our well-being.

## Increasing Market Transparency and Flow of Information

If you shop in a store where the products are not clearly priced, the process can be frustrating. Transparency enables us to readily compare products' price and quality and to choose the product that matches our price/quality requirements. Economists have long recognized that information is a key component in promoting a competitive market, which in turn promotes consumer welfare.[3] Indeed, the undistorted flow of information is one of the conditions of the theoretical economic model of "perfect competition," under which consumers benefit from lower prices, wider choice, and better quality.[4] Market transparency, the OECD noted, "increases efficiency by reducing customers' search costs and allowing suppliers to benchmark their performance with that of their competitors."[5] Market transparency, besides helping buyers, helps sellers "to save costs by reducing their inventories, enabling quicker delivery of perishable products to consumers, or dealing with unstable demand etc."[6]

In general, increased transparency ameliorates the problems of "information asymmetries."[7] This is when one party knows more key information than the other party (such as the seller of a used car who knows more about the car's problems than the buyer).[8] As the flow of information increases and becomes more balanced, sellers and buyers are more likely to make educated decisions, and markets become more efficient.[9]

We often see the benefits of increased transparency when we shop online. Rather than trudge to different retail stores, we can quickly search for and identify the particular product we want, compare prices among the major online and brick-and-mortar retailers, and have the item shipped to our home or available for pickup at a nearby outlet. There are now even companies, such as Doddle in the U.K., that have set up delivery points for a range of online retailers, such as Amazon and ASOS, allowing customers to pick up all of their online shopping in one place. Many online platforms and retailers provide user reviews and other information that consumers consider important to their purchasing decisions.[10] Sellers can easily inform customers of new products or services, their characteristics, and the price. Customers, aware of the range of options available in the marketplace, can intelligently choose the option that matches their preexisting preferences.

## Lower Search Costs

Having more information and greater market transparency is not especially helpful if it takes too much time and effort for consumers to review the information. New York City has over 5,000 grocery stores.[11] Grocery stores are often transparent in their prices. But consumers don't have the time to travel around town to compare prices for each grocery item. Thus another procompetitive feature of online markets is their ability to reduce users' search costs.

The economic literature has long illustrated that increases in search costs will likely lead to increases in the seller's power and prices.[12] Ill-informed customers are more likely to be subjected to higher, even monopolistic, pricing. When the seller's market power is based on the presence of high search costs related to quality or price, reducing those costs should, in theory, decrease the seller's market power and prices.[13]

Online platforms can help reduce search costs for both sellers and buyers by facilitating information flow and enabling users to quickly compare a range of products and relevant prices.[14] The promise of online platforms, including PCWs, in promoting competition lies not only in their provision of price information, but in several other features that support customers' decision making and reduce their search costs. For example, online shopping platforms provide users with interactive tools to identify the products or services that match their preferences. The combination of user-defined parameters, such as maximum price and average user rating, with a platform's own algorithms, such as matching accessories for the item that the consumer is considering, mean the online platform can distill for consumers a far greater volume of relevant information than they otherwise would have, enabling better purchasing decisions made more efficiently.[15] By reducing our search costs, these platforms enable us to undertake multiple searches on multiple platforms, further enhancing the competitive pressure on sellers—again, to our benefit.

Illustrative is the launch of a price comparison website in the U.K. dedicated to extended warranties. This information website was created following an investigation by the U.K. Competition Commission that identified a deficiency in the availability of relevant information, which undermined the competitive process.[16]

Another example is air travel. Suppose you want to fly next Friday from London to Las Vegas. You can search each airline's website for fares; but to lower your search costs, you can use Orbitz or another web-aggregator.

Indeed, some sites, such as SkyScanner, search multiple web-aggregators, which in turn search the web for airfares to Las Vegas next Friday. You can quickly determine the best flight, based on price or non-price factors (such as length of flight, number of transfers, and quality of airline service). You can also run the same search on multiple platforms (e.g., Orbitz and Kayak) to quickly assess airfares to Las Vegas next Friday. The web-aggregators also offer fare calendars that tell you the average prices for traveling to Las Vegas on other days that month.

## More Entry and Expansion

A third attractive feature of online markets is seemingly lower entry barriers. Customers generally benefit when potential sellers can rapidly enter and exit the market without incurring significant costs that they cannot recover elsewhere. The belief is that companies cannot exercise market power for long when entry into markets would be timely (generally under two years), likely (profitable for the entrants), and sufficient (the entrants would attain sufficient business to prevent the exercise of market power by the incumbent firms).[17] If a firm raises prices above, or degrades quality below, competitive levels, entrants and incumbents would seize the opportunity to profit and competition would be fully restored. Whether this is empirically true is another matter.[18] But there is little dispute that market power can be sustained in markets with significant barriers to entry and expansion, and that "entry analysis constitutes an important element of the overall competitive assessment."[19] Thus, as entry barriers significantly decrease, so too should concerns about likely anticompetitive effects.

In the online world, one doesn't need brick-and-mortar retail outlets to compete. One can easily design and create a website, offer services online, and reach customers with the help of online advertising and unbiased search engines. For example, you could compete against hotels and hostels through the accommodations app Airbnb or Booking.com. These online platforms facilitate entering the accommodation market in hosting guests at our own residences. In the same vein, it is a lot easier for drivers to enter the taxi market through a ride-sharing app, such as Uber, Lyft, or Didi Chuxing, than to acquire a taxi medallion or a cab.

Online platforms can facilitate a competitive market by mitigating the seller's actual (or perceived) risk and costs of entering. The risks of renting my place to a stranger may appear daunting. So platforms like Airbnb provide information and ratings of potential guests and a "Host Guarantee" that reimburses eligible hosts for damages up to $1,000,000.[20] In a similar vein, Uber provides its drivers with a passenger rating, which is an average rating of those provided by all of a passenger's previous drivers, which is not immediately available to the passenger. So for intoxicated passengers who vomit in the car, their chances of getting picked up are slim; they may not even be able to use the app.[21] In providing advice, reviews, and guarantees, online platforms can attract individuals who would otherwise be apprehensive about transacting with unfamiliar parties.

Online platforms can also foster entry by reducing advertising expenses. Suppliers who wish to advertise directly on search engines will bid for search words, as on Google AdWords, and pay for any click on the advertisement. That is an improvement over the old media model, where you would pay to advertise, often not knowing how many people saw, listened to, or read your ad. Price comparison websites (PCW), which benefit from economies of scale and high conversion rates, can further lower these advertising costs and facilitate access to markets.[22] Indeed, it has been reported that consumers indicated that "they would only know to contact a few companies for any given product or service, but on [PCWs] they get a wider range of options to choose from."[23]

## More Dynamic Disruption and Efficiencies

Reducing search costs, lowering entry barriers, and increasing information flows can increase the competitive pressure to innovate.[24] Thus the fourth promise of online markets is to promote distinct *dynamic and allocative efficiencies*. The disruptive technology—by increasing transparency and reducing search costs—can more efficiently match buyers and sellers, thereby promoting allocative efficiency. With these online tools, users can quickly identify the provider or product that better matches their needs.[25] As the U.K. Office of Fair Trading (OFT) noted,[26] "[t]he Internet allows for a much swifter search and comparison across a wide variety of choice factors including price, dates, quality and location."[27]

The rise of Big Data and Big Analytics may yield other distinct economic efficiencies. For instance, they can reduce costs by optimizing inventory levels; "to have the right amount of stock in the right place at the right time."[28] Manufacturers, distributors, and retailers can rely on sensors to track products and components throughout the supply chain from production to point-of-sale. Moreover, online platforms can unleash economic value on several levels. The sharing economy, for example, promises to increase efficiency through greater transparency and disintermediation. People can immediately profit from assets currently being underutilized—our cars, houses, power tools, or spare time. As more people rely on ride-sharing apps, fewer people will need to buy cars. Fewer cars, or individual car trips, mean less space devoted to garages and parking lots; space in high-rent urban centers like San Francisco now can be used for housing and other productive endeavors.

Online retailers are already employing complex pricing algorithms "that take into account factors like an item's popularity and what competitors are charging for it" and "data about you—such as where you live, when you shop, how often you've visited the site, and what you've bought in the past."[29] These increasingly automated, digitized transactions could create a more transparent marketplace in which resources are allocated more efficiently and in which the best product or service, at the lowest price, triumphs. The new market environment provides retailers with the capacity to better identify their customers' needs and react to market changes with ever-increasing speed.

## Reduction in Seller Power

Finally, old world antitrust problems seem less likely. If online markets increase information flow, market transparency, and dynamic innovation, and reduce entry barriers, then sellers should have less market power, and monopolies should be even rarer. Importantly, the popularity of search engines, PCWs, and shopping platforms like Amazon and eBay should make it harder for suppliers to take advantage of ill-informed customers who are subjected to high information costs.[30] As Amazon notes, "The presence of many competing sellers on the same e-commerce site strengthens competition to provide the best offers and prices. It also enables customers to easily compare competing offers by brand, quality, price, speed of delivery or other attributes and select the offers that best meet their needs."[31]

Suppose you are interested in buying a particular brand of coffee maker. A web-aggregator can tell you the price of that coffee maker at different online and brick-and-mortar retailers (intrabrand competition), but also other manufacturers' coffee makers, their specifications, features, warranty, and customer reviews (interbrand competition). The increase in both intra- and interbrand competition can further pressure manufacturers and retailers to reduce prices, increase quality, and enhance services, such as free repairs. Hotels, travel agents, insurance brokers, and other upstream providers compete on transparent platforms in which price, service, and other variables are visible to all.

The rise of web-aggregators in some markets has in fact led to lower prices and consequently lower profit margins for upstream sellers.[32] For example, one empirical economic study found that the rise of Internet comparison shopping sites for life insurance reduced term life prices in the 1990s by 8 to 15 percent and increased consumer surplus by at least $115–$215 million per year.[33]

Furthermore, with the rise of pricing algorithms, we arguably no longer need to worry about collusion, where competitors agree in smoke-filled hotel rooms to fix price, allocate markets, or reduce output. When each firm relies on its own pricing algorithm, cartels may become less stable. Indeed, the advance of pricing algorithms might suggest the end of cartels. Computers do not exhibit trust, which is important for many cartels' success.[34] Nor is there any collusion among the computers. "Collusion is more likely," the U.S. Department of Justice noted, "if the competitors know each other well through social connections, trade associations, legitimate business contacts, or shifting employment from one company to another."[35] Pricing algorithms will not "congregate in the same building or town," thereby having "an easy opportunity for last-minute communications."[36] Instead, it is often assumed that algorithms, in engaging in cold, profit-maximizing calculations, won't agree with, or trust, other computers; even if they did, they would find ways to cheat on any agreements.

Price discrimination should also be less likely. The collation of information makes it easier for consumers to compare the prices of advertised goods—thus making it harder for sellers to selectively increase the prices or degrade the quality of goods.[37] Armed with more information, consumers become aware of the full range of substitutes, which they can take into account when making purchasing decisions.[38]

## On the Path to Better Competition

With the growth of online platforms—from search engines to price comparison websites—we are seemingly on the road to optimizing competition. Prices should steadily decline toward marginal cost. Fully informed sellers and buyers easily enter and exit the market; such as Uber drivers who are enticed by surge pricing to hop in their cars and meet the surge in demand.

So the rise of the digital economy can be a good thing. Few hunger for 1970s fashions. Why then pine for the old competitive framework, with its cartels, including the government-supported uranium cartels, and monopolies like Kodak and IBM? If online markets accelerate market forces, we're heading toward healthier competition, where entry and exit are easier, buyers and sellers are numerous and better informed, prices are approaching marginal cost, and firms are innovating to remain relevant. Antitrust becomes less relevant, as monopolies and cartels are less durable. In short, the promise of online markets could free us from the monopolies and gatekeepers of old and unleash tremendous value as resources are used more efficiently.

# 2

# New Economic Reality: The Rise of Big Data and Big Analytics

ONLINE MARKETS have many attractive features that promise to increase competition in ways that improve our well-being. So what is driving this new economic reality?

In this chapter we examine how self-learning algorithms and Big Data are providing online platforms, like Amazon.com, a competitive advantage over brick-and-mortar behemoths like Wal-Mart Stores, Inc. (Walmart). This intense competitive pressure is changing the nature of retail. Many brick-and-mortar outlets face the reality of adapting or losing even more sales. As the data arms race and shift to pricing algorithms intensify, the line between online and brick-and-mortar retail will blur.

## The Battle between Walmart and Amazon

A few years back, when you thought of market and buyer power, one retailer that probably came to mind was Walmart.[1] As many small and large sellers can attest, Walmart is "powerful"; its purchasing agents "can make you or break you."[2] One fear was that when Walmart moves in, small businesses and jobs move out, and Main Street dies.[3] As a 2003 *BusinessWeek* cover story "Is Wal-Mart Too Powerful?" put it, "the more size and power that 'the Beast of Bentonville' amasses, the greater the backlash it is stirring among competing retailers, vendors, organized labor, community activists, and cultural and political progressives."[4] Thwarting Walmart's ambitious expansion strategy into urban America, the 2003 article noted, was the "intensifying grassroots opposition."[5]

Let us fast-forward to January 2016. Walmart announced its closing of 269 stores globally, 154 of them in the United States.[6] Why the retreat? The threat was not from the grassroots progressives. Rather, the threat came from online commerce. Its customers increasingly “are using computers, tablets, and smart phones to shop online with [Walmart] and with [their] competitors and to do comparison shopping.”[7] Many of us bring our smartphones to stores, to review and compare store prices with online prices, read online reviews, and so on.[8] The result is that the likelihood of our purchasing in brick-and-mortar stores, even once we are in them, is decreasing.

Walmart is now working hard to catch up in the accelerating shift to online sales. Walmart’s goal is to position itself “to win at the convergence of digital and physical.”[9] To strengthen its e-commerce operations, in 2015–2016, Walmart planned to spend $2 billion, far more than the $700 million it spent on e-commerce in 2014.[10]

So when Walmart was slipping, who was gaining? Amazon. As one Wall Street analyst observed in 2015, “With every passing year, it becomes harder and harder for Wal-Mart to compete with Amazon.”[11] Walmart’s revenues in 2014 were five times greater than Amazon’s ($486 billion vs. $89 billion). But Amazon’s stock market value as of mid-2015 had eclipsed Walmart’s by over $70 billion.[12] Moreover, Amazon’s net sales have accelerated—from $34 billion in 2010, to $48 billion in 2011, to $61 billion in 2012, to $74 billion in 2013, to $88.9 billion in 2014, and $107 billion in 2015.[13] Amazon was the fastest company ever to reach $100 billion in annual sales.[14]

The sentiment is that Walmart’s distributional efficiencies from its brick-and-mortar store model do not translate to the data-driven analytics and dynamic pricing of the online world. To illustrate the significance of these dynamics, and the way they affect competition, let us compare Amazon’s business practices to those of the brick-and-mortar retailers.

First, Amazon.com has a far greater product assortment and inventory than any brick-and-mortar retail outlet. Amazon and third parties sell millions of unique products on the platform, across dozens of product categories.[15] In 2014 Amazon sold over 2 billion products,[16] and today it sells far more books than any retail bookstore. Its power in books was illustrated by the *Apple* antitrust case, in which the dominant publishers complained of their inability to act unilaterally (or without “critical mass”) against Amazon’s pricing practices.[17] Amazon also is expected to be by 2017 the largest clothing retailer. Thus even the ubiquitous retailer Gap is considering selling its clothing on Amazon’s super-platform. To not consider this possibility, said Gap’s CEO, would be “delusional.”[18]

Second, as any retailer's product assortment grows, so too does the impracticability of manually adjusting pricing. Humans would have to process vast reams of data to decide the price. Moreover, pricing, if done manually, like the clerk stamping the price on the food tins, could take months, if not years. Amazon uses computer algorithms that harvest personal and market data to constantly adjust its pricing for its millions of products. Amazon's pricing algorithms made headlines when they led to an unintended escalation in price of Peter Lawrence's book *The Making of a Fly.*[19] At its peak, Amazon priced the book at $23,698,655.93 (plus $3.99 shipping).[20] Notwithstanding that incident, Amazon "aggressively changes prices, sometimes altering them more than once per day in reaction to other retailers."[21] Its algorithms can adjust prices quickly to respond to changes in market conditions, including its competitors' prices. Take the price of a frozen yogurt ice cream and sorbet maker, which, according to CamelCamelCamel.com (a website which tracks Amazon's prices), fluctuated between $27.97 and $59.99.[22] Some prices change dramatically. Amazon's price for a ladies' watch, for example, plunged from $115 to $57.50 in just a few days.[23]

Third, as Amazon and other online retailers expand their pricing algorithms to other product offerings, the competitive pressure on competing online and brick-and-mortar retailers to use pricing algorithms will intensify. Amazon epitomizes this increasingly intense pricing-algorithm arms race. As one venture fund observed:

> "In a world where companies like Amazon are changing price and customer experience in real-time to optimize sales, retailers cannot afford to [be] revisiting pricing decisions on a weekly or monthly basis, and hope to survive," said Scott Jacobson, Managing Director, Madrona Venture Group. "To compete, they need sophisticated technologies like Boomerang's that enable instantaneous updates based on changing market data. Guru and his team have developed technology that helps level the playing field, leveraging hundreds of millions of data points to help retailers automate and accelerate their decision-making to drive profitable growth."[24]

As the venture fund noted, Amazon is not alone. Boomerang Commerce, for example, is a market leader in the field of computerized price optimization. Its pricing algorithms examine over 100–150 data points on a minute-by-minute basis in adjusting prices.[25] "Amazon has hundreds of millions of products with the ability to change prices every 15 minutes," the founder of Boomerang says. "The average retailer has far fewer items but only changes price every one to three months."[26] Staples, one customer of Boomerang, felt the competitive pressure to use dynamic pricing: "We don't have a choice. Prices are constantly fluctuating."[27] The competitive pressure to switch to dynamic pricing has opened a new competitive front between retailers. Pricing algorithms already dominate online sales in hotel booking, and the travel, retail, sports, and entertainment industries—optimizing the price based on available stock and anticipated demand.[28]

Fourth, online retailers cannot simply post their products on their website and expect sales to surge. Data, and importantly, the scale of data, are key. Companies that operate and control these online platforms can collect a large volume and variety of personal data that may have significant value. Having control over, and being able to quickly analyze, the personal data can provide the platform operator a key competitive advantage. Indeed, Amazon originally sold books as a way to gather personal data on affluent, educated shoppers.[29] Also, algorithms learn through trial and error and finding patterns from a greater volume and variety of data. Amazon collects far more data on its users than many retailers possibly could. Yet more ominous for its brick-and-mortar competitors is that, as Amazon collects more data on its users, and as its algorithms have more opportunities to experiment (such as presenting items, suggesting other purchases), its pricing will become even more dynamic and differentiated. Basically, price changes will be quicker, product offerings will be increasingly tailored to particular users' tastes, and price optimization will occur.

Fifth, Amazon's algorithms will increasingly be pitted against other algorithms (rather than humans) for pricing decisions. For example, Jet.com—an e-commerce site based on a subscription model—has raised over $200 million "to take on Amazon with a dynamic pricing model" and "promises to offer prices that are 10-to-15% lower than anywhere else, including Amazon."[30] As the industry-wide use of algorithms increases, the algorithms, through learning by doing, will better anticipate and respond to rival algorithms' actions.

To better compete against online giants like Amazon, Boomerang offers its retail clients a "Dynamic Price Optimizer" as part of its main software service. The optimizer "starts by analyzing pricing data from a retail client and its competitors. But the secret sauce is its proprietary algorithms, which incorporate sophisticated game theory and portfolio theory models, filtering the data for almost any variable or desired outcome."[31]

Sixth, some of the drawbacks of online shopping are disappearing. Some shoppers, for example, like the immediate gratification of walking out of the store with the goods. Online sellers are now increasing the speed at which goods arrive at your door. For instance, with a subscription to Amazon's Prime service, consumers can now have millions of goods delivered to their door within a couple of days, if not the same day.[32] For an extra cost, some goods can be delivered within a one-hour window.[33] With the service now boasting dairy, chilled, and frozen products, the online provider can satisfy almost all of one's needs.[34] In addition to fast delivery or click and collect options, some online retailers have now invested in brick and mortar shops, to support their online operations.

## Rise of Big Data and Big Analytics

As our Amazon example shows, Big Data and Big Analytics are increasingly fueling our online marketplace. Big Data has various definitions, many of which are broad and inclusive.[35] Although data is varied, we predominantly focus here on personal data, which is generally defined as "any information relating to an identified or identifiable individual (data subject)."[36] Big Data has commonly been characterized by four Vs: the *volume* of data; the *velocity* at which data is collected, used, and disseminated; the *variety* of information aggregated; and finally the *value* of the data.[37]

The use of Big Data and its value have increased with the rise of Big Analytics: the ability to design algorithms that can access and analyze vast amounts of information. Moreover, the introduction of machine learning has propelled performance in this area even further.

Recent years have witnessed groundbreaking research and progress in the design and development of smart, self-learning algorithms to assist in pricing decisions, planning, trade, and logistics. The field has attracted significant investment in deep learning by leading market players.[38]

In 2011, International Business Machines Corp.'s *Jeopardy!*-winning Watson computer showcased the power of its deep-learning techniques, which enabled the computer to optimize its strategy following trials and feedback.[39] Since then, IBM has invested in widening the capacity and functionality of the technology, with the aim of making it "the equivalent of a computing operating system for an emerging class of data-fueled artificial-intelligence applications."[40]

Recently, the launch of the Deep Q network by Google showcased enhanced self-learning capacity. The computer was designed to play old-fashioned

Atari games. Importantly, it was not programmed to react to any possible move in the game. Rather, it relied on models that enabled it to "learn" the game environment through trial and error and improve its performance over time. The technology mimics human learning by "changing the strength of simulated neural connections on the basis of experience. Google Brain, with about 1 million simulated neurons and 1 billion simulated connections, was ten times larger than any deep neural network before it."[41]

Deep-learning techniques have also been implemented in day-to-day technologies. Smart algorithms are increasingly used to support automated customer support, e-commerce, and online communications, and to create interactive experiences online. Already in 2015, the European Data Protection Supervisor observed, "algorithms can understand and translate languages, recognise images, write news articles and analyse medical data."[42] For instance, the technology has been used by Microsoft in its Windows Phone and Bing voice search;[43] by Google, Toyota, Apple, Audi, and Jaguar in developing "driverless" cars;[44] and also in stock exchange analysis and other services.[45]

Big Data and Big Analytics have a mutually reinforcing relationship. Big Data would have less value if companies couldn't rapidly analyze the data and act upon it. Machine learning, in turn, relies on accessing large data sets. As the European Data Protection Supervisor observed, "Deep learning computers teach themselves tasks by crunching large data sets using (among other things) neural networks that appear to emulate the brain."[46] The algorithms' capacity to learn increases as they process more relevant data.[47] The belief is that simple algorithms with lots of data will eventually outperform sophisticated algorithms with little data.[48] Part of this is due to the opportunity for algorithms to learn through trial and error. Another is seeing correlations from big data sets.

Thus one thing IBM's Watson and artificial intelligence (AI) generally need in order to "do meaningful work" is data.[49] That is why IBM acquired the digital and data assets of Weather Co., owner of the Weather Channel. Watson could analyze the volume of weather data to refine its algorithms.[50] Watson's services, in turn, can be sold to other parties, like insurance apps. Octo Telematics, for example, uses IBM's real-time weather data "as a critical input to its driver behavior scoring app."[51] Octo's free mobile app offers personalized insurance quotes based on the driver's behavior.[52] Octo's algorithm assesses not only the driver's speed, braking, and acceleration, but also "outside variables often directly affected by weather, such as road and traffic conditions, to determine driver scoring."[53] Drivers with good scores, as determined by Octo's algorithm, are rewarded with the option of a discounted insurance quote from a panel of insurers, which they can choose to accept at their discretion. Here we see how IBM's data-driven algorithm helps its client "construct a more accurate and reliable scoring algorithm based on the precise weather conditions at the place and time of the driver's trip."[54] We also see how insurers are migrating from historical data (such as the number of speeding tickets one has received in the past few years) to near-real-time data (how the driver performed on the icy roads yesterday evening) in personalizing insurance pricing.

Another example concerns the combination of smart algorithms with Facebook's vast user base, to improve targeting of ads and promotions. In its annual developer conference in 2016, the company discussed the way artificial intelligence (AI) could interact with the rich flow of data from its users. Facebook CEO, Mark Zuckerberg, noted how "with AI and natural language processing combined with human help, people will be able to talk to Messenger bots just like they talk to friends."[55] David Marcus, VP messaging products, reported how the company is "testing if business bots can re-engage people on threads with sponsored messages."[56] Not surprisingly, Apple, Amazon, Google and Microsoft are also investing in voice-activated digital assistants that "learn" to make decisions rather than simply follow instructions.[57] The future of instant and online communications will heavily rely on the mutually reinforcing relationship between Big Data and Big Analytics.

Another recent significant development concerns the ability of computers to operate with limited information. Computer algorithms long ago solved perfect information games—like the board game checkers—where players know everything that happened previously. The year 2015 marked a significant advancement. Several computer scientists announced a new computer algorithm capable of solving extensive-form, "imperfect information games" much larger than previously possible. Their new algorithm "weakly solved" one popular game of poker.

Let us consider the significance of such advancements. In checkers, both players know of all the past moves and the current state of play (based on where each piece is on the board). In poker the players do not have full knowledge of past events (the unobserved cards that the other player had in earlier rounds) and the current round (the unobserved cards).[58] Thus solving the poker game is more complex, with $3.16 \times 10^{17}$ possible states and $3.19 \times 10^{14}$ decision points (where a player must make a decision). The algorithm, however, computed a strategy for two-player limit Texas Hold

’Em poker so that it cannot be beaten with statistical significance in a human’s lifetime.[59] For poker aficionados, we’ll mention that the algorithm confirmed (for two-player limit Texas Hold ’Em) that the dealer has a substantial advantage, and the nondealer’s optimal strategy is more often to play than to fold.[60] The significance of this advancement lies in the computer’s ability to address the “real-world” complexity of imperfect information, unleashing the possibility for complex “human-like” interaction and decision making.

### Cloud Computing and the Internet of Things

As the breadth and quality of data increase over the next decade, the positive feedback loop between machine learning and Big Data will accelerate. One contributing factor will be the developments in cloud computing.

Amazon’s cloud division in 2015, for example, added an Amazon Machine Learning service. Amazon’s algorithms help the client find patterns in its existing data.[61] Then Amazon creates models, which process the client’s incoming data and generate predictions. The models could predict likely fraudulent purchases, products or services that might appeal to the client’s customer, or consumer trends. As more data is processed, the predictive models are refined. Google and Microsoft likewise provide as part of their cloud computing services machine-learning algorithms to analyze data and predict future outcomes.[62] A positive feedback loop can ensue: Clients will have an even greater incentive to collect data and use the cloud computing services if they can obtain a competitive advantage through these predictive models. And access to the many different clients’ data will improve Amazon’s, Microsoft’s and Google’s algorithms.

Another contributing factor will be the “Internet of Things,” that is, the integration of software and sensors embedded in everyday objects. This technology enables machine-to-machine communication (M2M), as well as the collection and analysis of information gathered through sensors.

For instance, Amazon in 2015 launched its “IoT platform,” which “lets connected devices easily and securely interact with cloud applications and other devices.”[63] The platform is designed to process trillions of messages from billions of devices “and can process and route those messages to [Amazon Web Service] endpoints and to other devices reliably and securely.”[64] The research firm International Data Corp estimated the “global market for Internet of Things” to nearly triple to $1.7 trillion by 2020.[65] The firm also notes how technology firms, like Google, Intel Corp, Cisco Systems, Samsung Electronics and the major telecoms such as Vodafone and Verizon, "are betting heavily on it to drive revenue and profit in the future."[66] Whereas traditional data is harvested through our interaction with online sellers and our digitalized environment, the Internet of Things would widen the scope of data for the algorithms. As more products have sensors, the interfaces will include anything from household appliances, clothing, cars, and bicycles, to streetlights, airports, smart building materials, and human-embedded sensors.

## Emerging Trends

The relevance and usefulness of real-time data are becoming increasingly difficult to ignore. Our "real" and "online" environments are converging, and digitalization will seemingly track individuals before their birth to their death.[67]

These developments may improve our welfare well beyond online commerce. For instance, health services could provide faster response and monitoring through automated data collection. Smart meters and appliances can help optimize our electricity usage. Even our local authorities can optimize their services by carefully collecting and using data from various sources.[68]

In the context of our discussion, one distinct trend is the shift from brick-and-mortar stores to online sites. We see this already with Amazon's sprawling platform. E-commerce, as a percentage of total retail, is increasing.[69] As a recent White House report noted,

> Americans are using the Internet to shop in rapidly growing numbers, suggesting that consumers believe they are getting a good deal on the Internet, regardless of any differences in the pricing practices of online and offline retailers. The U.S. Census estimates that e-commerce has increased from 2 percent of total U.S. retail sales in 2004 to 6 percent in 2014. Moreover, electronic commerce revenue is currently growing at a rate of 16 percent per year in the United States, more than three times the 5 percent growth rate in overall retail sales.[70]

You might have noticed this shift when shopping on Black Friday in any of the large U.S. retail stores. In 2015, the big U.S. shopping day after Thanksgiving witnessed fewer customers in many stores. People were already online on Thursday buying presents.[71] Amazon's Thanksgiving sales rose 29 percent compared with a year before.[72] As the *Wall Street Journal* reported, Walmart "made the majority of its Black Friday deals available online in the wee hours of Thanksgiving morning—some 15 hours before its stores opened. So many shoppers visited Wal-Mart's website when the door-busters went on sale early Thursday, that the site was overloaded and checkouts were snarled."[73]

As online markets cover an ever-increasing spectrum of commercial activities, another noteworthy trend is how Big Data and Big Analytics can offer firms "even greater opportunities for competitive advantage (online businesses have always known that they were competing on how well they understood their data)."[74]

The business literature highlights the following ways in which Big Data and Big Analytics can transform industries:

- Companies are increasingly adopting business models that rely on personal data as a key input. Data-driven business models, for example, involve multisided markets; companies offer individuals free services with the aim of acquiring valuable personal data to assist advertisers to better target them with behavioral advertising.[75]
- The four Vs of Big Data—volume, velocity, variety, and value—will increase, as companies undertake data-driven strategies to obtain and sustain a competitive advantage. Companies will offer products and services to harvest a greater volume of data that is not otherwise publicly available. With the Internet of Things, sensors, microphones, and cameras will sweep in significantly more data on human behavior in their homes, cars, and work.[76] The value of data may also come from its variety. Data fusion "occurs when data from different sources are brought into contact and new facts emerge."[77] Through data fusion, companies can identify and improve their profiles of individuals; better track individuals' activities, preferences, and vulnerabilities; and better target individuals with behavioral advertisements.
- As the competitive value of data increases, companies will strive to acquire a "data advantage," and thus a competitive advantage over rivals. Companies will increasingly invest in computer algorithms to analyze the volume and variety of data. Even for publicly available data, velocity will be critical—namely, getting and analyzing the

data quickly to outmaneuver rivals.[78] The velocity in which data is generated, accessed, processed, and analyzed will accelerate,[79] and for some applications it is now approaching real time.[80]

- As the velocity of generating, accessing, processing, and analyzing data increases, the velocity of adjusting prices will also increase. With online trading platforms, computers can assess and adjust prices—even for particular individuals at particular times—within milliseconds.[81]
- As more online sellers use AI and pricing algorithms, their rivals, to prevent being at a competitive disadvantage, will feel greater pressure to develop "smart" pricing algorithms themselves.
- As more companies switch to pricing algorithms, algorithms will increasingly determine industry pricing of goods and services. The distinction between online and offline pricing will blur and eventually disappear in many industries.
- As their industry-wide use increases, algorithms, through learning by doing, will anticipate and respond to other algorithms' actions. Online trading platforms may also enable sellers to segment the market by using dynamic, differential pricing.[82]
- Learning from the volume and variety of our personal data, computers, using AI, will increasingly make decisions for us—with digital personal assistants predicting our needs and wants.

If traditional powerhouses like Walmart are vulnerable to the dynamic disruption of Big Data and Big Analytics, then arguably the competitive gales within the online marketplace will intensify into hurricanes. One might argue that market power should be fleeting, as the digital hand will drive prices lower, and information flows will raise quality levels. Thus the rallying cry in some circles, as the next chapter explores, will be for a light regulatory hand (if any).

# 3

# Light Touch Antitrust

IN 1998, a banking merger wave was increasing substantially the measures of U.S. national concentration. Many financial institutions were falling into fewer hands. Alan Greenspan, chairman of the Federal Reserve System, told the U.S. Senate not to worry. The antitrust thinking over bigness had evolved:

> In the 1970s and 1980s, there was a significant shift in emphasis from a relatively deterministic antitrust enforcement policy to one based on the belief (under the aegis of the so-called Chicago School) that those market imperfections that are not the result of government subsidies, quotas, or franchises would be assuaged by heightened competition. Antitrust initiatives were not seen as a generally successful remedy. More recently, limited avenues for antitrust policy are perceived by policymakers to enhance market efficiencies.[1]

Many antitrust enforcers in 1998 would have agreed. Remarkably, some antitrust scholars and enforcers would agree even today—despite the economic crisis and the U.S. government bailing out financial institutions that, as a result of the mergers, were deemed too big to fail.

While jurisdictions around the world exhibit varying levels of intervention, the dominant voices in competition policy over the past thirty-five years, as this chapter explores, have advocated lighter intervention, if any, in many mergers and monopolies. One exception is the prosecution of cartels that fix prices, allocate markets or bids, or reduce output.[2]

Seemingly, from the discussion in Chapters 1 and 2, a light touch approach would appear justified. Governmental intervention in the online world appears superfluous—markets are dynamic and competitive. New online business dynamics, it is often argued, have changed markets for the better. Companies' algorithms, fueled by the increasing flow of data, are seemingly perfect strategies to optimize profitability. These developments appear to give rise to new forms of competition and commerce. The traditional competitive problems (collusion, monopoly, and price discrimination) should arguably appear infrequently in the digital world, where rivals are simply a click away. With price algorithms analyzing and responding in real time to far more market data than humans could consider in their lifetime, we appear on course to a more dynamic marketplace.

Before delivering the DOJ a stinging defeat, the U.S. Court of Appeals for the Ninth Circuit first praised the invisible hand, while condemning centrally planned economies (and price regulation):

> Competition is the driving force behind our free enterprise system. Unlike centrally planned economies, where decisions about production and allocation are made by government bureaucrats who ostensibly see the big picture and know to do the right thing, capitalism relies on decentralized planning—millions of producers and consumers making hundreds of millions of individual decisions each year—to determine what and how much will be produced. Competition plays the key role in this process: It imposes an essential discipline on producers and sellers of goods to provide the consumer with a better product at a lower cost; it drives out inefficient and marginal producers, releasing resources to higher-valued uses; it promotes diversity, giving consumers choices to fit a wide array of personal preferences; it avoids permanent concentrations of economic power, as even the largest firm can lose market share to a feistier and hungrier rival. If, as the metaphor goes, a market economy is governed by an invisible hand, competition is surely the brass knuckles by which it enforces its decisions.[3]

Why the court digressed is anyone's guess. But regulation has fallen on hard times. Even communist countries are now touting the free market. The Chinese government in 2007, for example, enacted an Anti-Monopoly Law for "the purpose of preventing and restraining monopolistic conducts, protecting fair market competition, enhancing economic efficiency, safeguarding the interests of consumers and the interests of the society as a whole, and promoting the healthy development of socialist market economy."[4]

In the United States and elsewhere, the push since 1980 has been to deregulate. The belief is that competition with a light touch enforcement of competition laws yields better outcomes. As the DOJ's Antitrust Division warned, "regulation can be an imperfect and very costly substitute for 'regulation' by market forces. Accordingly, exceptions to the general rule of free market competition, protected by antitrust enforcement, should be permitted only on compelling evidence that competition cannot work or is inimical to some overriding social objective."[5] Thus, the modern interpretation of Adam Smith's "invisible hand"[6] has been central to the changing attitudes toward antitrust enforcement.

Many adherents of neoclassical economic theory assume competition to be "a self-initiating process,"[7] which, when left alone by government regulators, will generally allocate resources efficiently toward users who value them the most. Any company's attempt to secure or maintain market power would likely be defeated by other well-informed profit maximizers—either new entrants or existing competitors. The key proponents were economists and lawyers associated with the University of Chicago.[8] They generally assumed that market participants were rational, were self-interested, and had strong willpower, that most markets were competitive, that mergers and vertical arrangements often created efficiencies, and that market forces would often defeat any attempt to exercise market power.

The government, under this theory, operates outside the free market, and must justify the necessity of its intervening and "displacing" competition. Any suggestion to improve or manage competition smacks of socialism and industrial policy. Government intervention should be limited to clear and sustained instances of market failure, of which "only explicit price fixing and very large horizontal mergers (mergers to monopoly) [are] worthy of serious concern."[9] For some, even then, the government must proceed with caution. The spontaneous free market forces will eventually defeat, through expansion or de novo entry, this temporary market power.

Under the Chicago School theory, the government will often cause more harm than good. In attempting to preempt the exercise of market power, the government may chill procompetitive behavior. The concern is that, unlike market-created impediments, market forces may not readily overcome these government-imposed impediments to competition. The greater concern around governmental intervention lies with the risk of false positives, which can chill procompetitive market behavior and which market forces cannot readily redress, rather than false negatives, which entry or expansion eventually corrects.[10]

The Chicago School's neoclassical economic views in favor of removing or minimizing governmental restraints on the free market took hold in the Reagan administration. Coinciding with the Reagan administration's view of governmental institutions as a necessary evil,[11] competition advocacy underscored how government interference likely causes more harm than good, by inhibiting the market's efficient allocation of scarce resources. Consequently, the debate among some neoclassical economists is whether and when the government should intervene in certain markets.

## Dynamic Markets Will Correct Themselves

Many online industries are dynamic and fast-growing. The European Commission, for example, took account of the dynamic market characteristics when it approved Microsoft's acquisition of Skype. In upholding the Commission's decision, the General Court observed that the consumer communications sector was "a recent and fast-growing sector which is characterised by short innovation cycles in which large market shares may turn out to be ephemeral."[12] In such a dynamic context, the Court noted, "high market shares are not necessarily indicative of market power and, therefore, of lasting damage to competition. . . ."[13]

Some argue that courts and agencies should rarely, if ever, intervene in dynamic industries.[14] They claim that governmental intervention in dynamic economic markets will often harm consumers. The antitrust benefits are limited, they argue, because online markets are so dynamic that any market power is fleeting. (At times this is true, but no empirical evidence supports any such blanket assertion.)

Another concern is that with dynamic industries it may be hard to attack anticompetitive practices while preserving incentives to innovate. As one antitrust official noted, "This can mean bringing an action to prevent conduct that reduces innovation or it can mean declining to act where overly aggressive antitrust enforcement risks chilling the type of vigorous, innovative competition that brings long-term benefits to consumers. In this regard, we recognize that when innovation leads to dynamic efficiency improvements and a period of market power, it is not a departure from competition, but it is a particular type of competition, and one that we should be careful not to mistake for a violation of the antitrust laws."[15] This is especially sensitive for antitrust scrutiny of product designs.[16] Some, like one FTC commissioner, argue for a very light touch: "Although I am not arguing that antitrust has no place in technology markets, with a statute as elastic as Section 5, I think the Commission ought to tread extremely lightly in that space. Otherwise, it runs a serious risk of chilling innovation in what are arguably some of the most important industries in our economy."[17]

## Reflections

The Chicago School has not influenced the EU competition policy to the same extent it has influenced U.S. policy. Even in the United States, the Chicago School—before the recent economic crisis—had begun losing its luster. But aside from cases of collusion, the common wisdom that continues to emerge is that the costs and harms of regulatory intervention in online industries will often exceed the benefits. As one FTC commissioner observed, "Where the Chicago School tends to advocate a hands off approach based on an over-riding concern about false positives, one could characterize the post-Chicago scholars as counseling a 'light touch.' "[18]

Because online markets fueled by pricing algorithms should increase competition by lowering search costs and entry barriers, and increasing information flows and market transparency, market power is transient.

Thus, it is argued that most online markets should not possess the characteristics that make antitrust intervention (or regulation) necessary. Any claims for antitrust or regulatory intervention should be treated with suspicion. The intervention will likely be unnecessary and harm consumers, as its aim will be to protect firms in the old economy from the new economy.

While the algorithm-driven economy may herald the decline of "traditional" competition, the era of machine learning fueled by Big Data will unleash greater efficiencies that improve our welfare.

Of course, we accept and acknowledge these benefits. But once we look beyond the shiny outer layer, the emerging online markets reveal several significant dangers. Accordingly, it may be too soon to celebrate the optimal competitive order. We may want to wait with the champagne, at least for a while.

# 4

# Looking beyond the Façade of Competition

BIG DATA and technological innovations are neither good, bad, nor neutral. As we'll explore, their nature depends on how firms employ them, whether their incentives are aligned with our interests, and certain market characteristics. We'll see that at times, Big Data and Big Analytics can promote a competitive online environment where we benefit. However, we cannot uncritically assume that we will always benefit. When we critically examine the complex algorithm-driven environment, we witness the imperfections of the new market dynamics. Thus, the risks to our well-being are greater than many would admit.

## Controlled Ecosystems: *The Truman Show*

New technologies are changing the dynamics of competition as we know it and are giving rise to a new environment, which displays the characteristics of competitive markets but is driven by different forces. The good old invisible hand of competition, which safeguarded our welfare when we shopped in our local fruit market, is being displaced by the digitalized hand.

Think of the 1998 American movie *The Truman Show*—a controlled environment which is nothing more than a façade, but has the potential to deliver relative joy to its subjects. The main beneficiary, of course, is the one who controls the ecosystem. Likewise, some online markets may appear to be subject to ordinary free market forces. We, like Truman, may think that we're ordinary consumers with ordinary lives with unremarkable purchases. We have no idea about how, and the extent to which, we are being exploited.

On a consumer level, we are entering the age of datafication, which involves "taking all aspects of life and turning them into data."[1] In a data-driven economy, sophisticated players will strive to improve their capacity to monitor our online and offline activities, accumulate data, target us during key purchasing opportunities, and react to changes with ever-increasing speed.

Using sophisticated algorithms, companies are engaging in data mining, data trade, pattern recognition,[2] demand estimation, and price optimization.[3] Our behavior and preferences trigger individualized promotions, all meant to help us make the right choice.[4] But right for whom?

## The Cost of Free: Data as Currency

With the rise of Big Data and Big Analytics, firms will not merely passively track us. Instead, as one White House report noted, there is the "growing potential for big data analytics to have an immediate effect on a person's surrounding environment or decisions being made about his or her life."[5] As the European Data Protection Supervisor observed, "Governments and companies are able to move beyond 'data mining' to 'reality mining', which penetrates everyday experience, communication and even thought."[6] Increasingly our identities, both personal and professional, are shaped through online media—Facebook, Twitter, WhatsApp, and LinkedIn, to name but a few. Indeed, such is the perceived importance of these media platforms that we deploy, at times, sophisticated means to shape our perceived selves.[7]

Today, data is the currency which provides us with "free" online services and an advanced Internet environment. For these media outlets to be available, a price is paid. We accept the "cost" of "free." We are not surprised to receive targeted promotions, coupons, and ads. We expect our web searches to deliver the right results, swiftly. We have come to expect the benefits that flow from this tracking and harvesting.

Yet, increasingly, we have concerns that the "cost" is now too high, and that we have lost control over it. Many of us do not know what data is collected about us, how it is being used, when, by whom, and for what purpose. Indeed, we have increasingly expressed concern as to the invasion of privacy from the tracking, harvesting, and use of our personal data. It has been reported that over "90 percent of Americans feel they've lost control over how their personal information is collected and used on the Internet."[8]

These privacy concerns will intensify. The digitalization of information, our increasing reliance on smart technologies, and the growth of online markets have significantly increased the volume and variety of available data. Our information, the data, serves as a valuable commodity that translates into targeted advertisements, sales, and money. Lots of money. It is therefore no surprise that companies are investing many resources into harvesting and analyzing such data, and many powerful tech firms, as we'll see, view privacy protection technologies as a threat. These trends create new gatekeepers and new forms of market power. They may also give rise to new forms of anticompetitive behavior that reduce our welfare.

## Anticompetitive Dynamics

Subsequent chapters identify how the rise of sophisticated computer algorithms and the new market reality can significantly change our paradigm of competition for the worse—with more durable forms of collusion (beyond the reach of enforcers), more sophisticated forms of price discrimination, and data-driven monopolies that, by controlling key platforms (like the operating system of your smartphone), dictate the flow of your personal data, and who gets to exploit you.

The scenarios below are not conjectural. Competition agencies are already grappling with the scenarios we identify. Officials from the United States, U.K., France, and Germany, citing our earlier work, have publicly recognized the potential harm from these scenarios and question the adequacy of their current enforcement tools.[9] Many enforcers have also privately shared with us the concern that their tool kit at times will be inadequate to prevent and redress the harm.

### Collusion: From Smoke-Filled Hotel Rooms to Vapor-Filled Data Centers

As we saw in Chapter 2, industries are shifting from a pricing environment where store clerks stamped prices on products, to dynamic, differential pricing where sophisticated computer algorithms rapidly calculate and update prices. At times dynamic pricing is good—one example we explore is "smart" parking meters in San Francisco. But as pricing shifts from humans to computers, so too will the types of collusion and behavioral exploitation in which companies may engage. Part II considers a classic antitrust mainstay—cartels—to explore the shift from a world where executives expressly collude to one in which computers facilitate collusion. We illustrate how in some markets, the industry-wide use of pricing algorithms, rather than increasing competition, may result in us paying more for goods and services.

## Approaching Perfect Behavioral Discrimination

Part III takes us in a different direction, to a market where the prices and products you see differ from those offered to your neighbors, relatives, friends, and families living on the other side of town. Companies collect data about you and track your behavior to better predict what you are likelier to buy and how much you are willing to spend. Here we will see the expansion of behavioral advertising and price discrimination across online markets. We consider the means by which companies might approach, but not achieve in the near future, perfect behavioral discrimination, and the possible anticompetitive effects that may follow.

As part of our discussion of discrimination we also consider the emerging role of intermediates, such as price comparison websites. We saw in Chapter 1 how these platforms can promote customers' decision making and intensify competition among suppliers. But we will consider in Part III how these price comparison websites, in changing the competitive dynamics, may, at times, actually harm consumers with fewer choices and higher prices.

## Frenemy Dynamics

A growing, and seemingly appealing, part of the online marketplace is free goods and services. The proliferation of free mobile apps seemingly benefits consumers (as well as advertisers, smartphone manufacturers, mobile carriers, and independent application developers) by reducing search costs and increasing demand.

Part IV involves the dynamics of "Frenemy"—where a relationship of both competition and cooperation exists between the super-platforms and independent apps. We consider the world of mobile and tablet operating systems, in which two super-platforms—Apple's iOS and Google's Android mobile software platforms[10]—dominate mobile phones. Each super-platform, like a coral reef, attracts to its ecosystem software developers, apps, and accessory makers.

We reflect on the rise of super-platforms and the way in which they foster a mix of competition and interdependence among market participants.

Firms cooperate to extract data from individuals and promote asymmetrical information flows to foster behavioral exploitation, while simultaneously competing among themselves over the consumer surplus. Extraction and capture may be viewed from an evolutionary perspective: a den of lions cooperates to circle the gazelle and they then compete over which of them gets the choice cuts. They all benefit from the combined effort, yet the dominant lion gets the best cut, which further enhances its power.

## Possible Intervention

The three core dynamics discussed above are not always easy to trace. Markets may on their surface appear competitive—but these dynamics can progressively hinder our autonomy, livelihood, and welfare. In other words, despite the mirage of ordinary competitiveness, the emerging online markets will at times reduce, rather than increase, our well-being, as the competitors' pricing algorithms tacitly collude in a transparency-enhanced environment, price discriminate, or collectively extract our personal data and compete over how best to capture our wealth.

In this reality, in which algorithms and data pools provide the foundation for possible unilateral, coordinated, and Frenemy behavior, is the "invisible hand" still a viable concept?

As we will show, markets may be dynamic but still be dominated by a few firms. In this controlled ecosystem, the traditional signposts of greater free competition—notably market transparency, entry, and choice—may be merely a mirage.

The common competitive ideal is that we would want many companies to compete to provide the best products and services. But if the critical resource at this point is data—not merely to target advertising, but also to optimize the products and services themselves—the firms with the most data are not merely in the best position to dominate their own sectors—they are also poised to take over adjacent fields. Further, to the extent that such firms compile politically sensitive information about users, and mediate their experience of content, they are also powerful political actors. With that in mind, careful intervention may be necessary to remedy market failure and promote customer welfare.

From our experience, having mentioned possible intervention, we expect a roar of dismay (or outrage) from some stakeholders. Indeed, some of the dominant tech players work hard through various channels to capture and frame the debate—conflating criticisms of the means by which they increase their profitability with criticisms of technology itself, and characterizing those criticisms as a threat to innovation, investment, and competition.

Needless to say, our aim is not to argue in favor of intervention per se. But the anticompetitive effects we identify can be significant and durable. There is no reason to tolerate these market failures simply because they occur in the new digital economy.

So where exactly does this leave us? Is competition law salvageable, or is it simply a relic of a predigital economy? Or, perhaps paradoxically, is the less technocratic, more political competition law of American antitrust prevailing in the mid-twentieth century the right direction for current policymakers to travel? Part V addresses several means by which governments may address the concerns raised in this book. It outlines the possible costs and benefits of intervention and the ability to fine tune instruments to improve the competitive landscape.

Importantly, our scenarios of possible collusion, behavioral discrimination, and Frenemies do not challenge innovation, technology, and efficiencies. Our aim is to go beyond the slogans and myths and examine the relative costs and benefits of these phenomena, and to highlight the effects that current and future dynamics may have on our welfare. The mirage of competition will compound, rather than solve, the problems we identify and worsen, rather than improve, our well-being. Competition officials with their current tools can fix some but not all of the problems. Regulation should no longer be a dirty word. Smart regulation, in a data-rich world, may prove quite beneficial.

## Food for Thought

Beyond the "laissez-faire competition good, regulation bad" refrain, challenging questions await us. For instance—is the algorithm price the competitive price, or merely a fiction created by the digitalized hand? Turning to a famous economist, Friedrich A. Hayek, we inquire whether the emergence of super-platforms—companies that dominate the digital landscape—could indicate a monumental shift toward the attainment of all knowledge. Platforms' sophisticated computer algorithms could increasingly determine the competitive market price. Data collection by leading platforms like the car-sharing app Uber, and super-platforms like Google, Apple, and Amazon, could create an economy which, for all purposes, is planned not by bureaucrats or CEOs, but by the technostructure. If so, a subsequent question arises: if private firms can harness Big Data and Big Analytics to effectively set prices, can governments use the same tools to monitor industry prices, or even determine a competitive price? If Uber, which doesn't own any cars or employ any drivers, can determine prices, why can't the government?

# PART II

# The Collusion Scenarios

WHEN HUMANS ARE PROSECUTED in the United States for price fixing, they generally go to jail. What happens with the rise of pricing algorithms, when competitors' computers fix prices (or help fix prices)? We explore this issue here.

The antitrust community is accustomed to company executives fixing prices, allocating markets and bids, and reducing output. The film *The Informant!* dramatizes these real-life executives who every year conspire around the world to fix prices and reduce output. Cartels are generally regarded in the antitrust world as "no-brainers." The cartel agreement, even if unsuccessful, is typically condemned as per se illegal—being anti-competitive by object. The executives and companies have few, if any, legal defenses. And in the United States, among other jurisdictions, the guilty executives are often thrown into prison.

Cartel agreements are not always easy to establish and maintain. Neo-classical economic theory would suggest that many cartels are unstable as they are susceptible to distrust, cheating, or detection. Yet empirical observations suggest that in practice cartels are more durable than neoclassical economic theory posits.[1]

So why do firms collude? Often because it is easier than competing. By agreeing to raise or stabilize prices, companies earn greater profits. In allocating markets, each cartel member can dominate its territory without fear of its competitors entering.

Humans have for many years been the moving force behind these price-fixing activities; they have decided to what extent they should increase prices, reduce output, allocate bids and markets, or eliminate other parameters of competition. They may meet yearly or even monthly as the cartel adjusts its activities. Humans have colluded on everything from turtles[2] to packaged ice[3] to rare banknotes.[4] To deter cartels, the United States "has steadfastly emphasized the importance of individual accountability and stiff corporate fines."[5] Despite rising fines, prison sentences, and attractive leniency programs, cartels persist.[6]

So, as more firms and industries migrate to pricing algorithms, does that spell the end of classic cartels, or does it create new ways to collude?

In this part we consider the role played by algorithms in facilitating cartels and illegal activity. Our focus goes beyond a simple collusion story in which the co-conspirators use computers to support their cartel activity. Rather, our interest is in new dynamics that could widen the circumstances in which anticompetitive activity may take place.

We note how Big Data and Big Analytics—in increasing the speed of communicating price changes, detecting any cheating or deviations, and punishing such deviations—can provide new and enhanced means to foster collusion. The danger here is not express collusion where computers limit competition through "agreement" or concerted practice, but more elusive forms of collusion, achieved through subtler means, which do not amount to a hard-core cartel, and are beyond the reach of the law. Altogether we consider four scenarios in which computer algorithms may promote collusion.

The first scenario—Messenger—concerns humans' agreeing to collude and using computers to execute their will. This is a simple extension of human will—the use of the IT environment to enhance existing collusion. Under this scenario, humans collude. They use computers to assist in implementing, monitoring, and policing the cartel or to facilitate information exchange and signaling; in the United States and elsewhere, they go to jail if caught.

Our second scenario—Hub and Spoke—is more challenging. Here we consider the use of a single pricing algorithm to determine the market price charged by numerous users. In this framework, a cluster of similar vertical agreements with many of the industries' competitors may give rise to a classic hub-and-spoke conspiracy, whereby the algorithm developer, as the hub, helps orchestrate industry-wide collusion, leading to higher prices.

The third scenario—The Predictable Agent—is even more challenging. It explores how we are shifting from a world where executives expressly collude in smoke-filled hotel rooms, to a world where pricing algorithms act as predictable agents and continually monitor and adjust to each other's prices and market data. In this new world, there is no collusive agreement among executives. Each firm unilaterally adopts its own pricing algorithm, which sets its own price. The result is algorithm-enhanced conscious parallelism—or as we call it, Tacit Collusion on Steroids.

Finally, we consider the most challenging collusion scenario—Digital Eye. The computers, in learning by doing, determine independently the means to optimize profit. Artificial intelligence operating in enhanced market transparency leads to an anticompetitive outcome, with no evidence of any anticompetitive agreement or intent. In this scenario we may not even know when something is amiss. In the end, we may think the markets, driven by these technologies, are competitive. And yet, we're not benefitting from this virtual competition.

# 5

# The Messenger Scenario

> We will not tolerate anticompetitive conduct, whether it occurs in a smoke-filled room or over the Internet using complex pricing algorithms. American consumers have the right to a free and fair marketplace online, as well as in brick and mortar businesses.
> —Bill Baer, U.S. Department of Justice, 2015

UNDER OUR FIRST collusion scenario, Messenger, humans are the masters who agree to collude and map out the cartel. The computer algorithms are the messenger, which the cartel members program to help effectuate the cartel and monitor and punish any deviation from the cartel agreement.

From an enforcement perspective, this is a no-brainer. Competition law's concept of agreement can be applied straightforwardly. Prosecutors, with sufficient evidence of the humans' agreement or concerted practice, will have little difficulty in condemning the use of computers to facilitate the cartel.

To illustrate: in a classic cartel, executives from rival firms secretly agree to fix prices, allocate markets or bids, or reduce output.[1] Here, the executives, after secretly colluding, leave it to their computer algorithms to monitor and enforce the illegal agreement.

The advancement of computer technology enables forms of collusion that are just as pernicious and anticompetitive as the cartels of yesteryear. It made the news in 2015 when the DOJ warned antitrust lawyers, economists, and scholars of the illicit use of complex pricing algorithms. The DOJ charged members of a price-fixing scheme involving posters sold through Amazon Marketplace. David Topkins and his coconspirators adopted specific pricing algorithms that collected competitors' pricing information for specific posters sold online and applied the sellers' pricing rules. The competitors used the computer algorithms with the goal of coordinating changes to their respective prices[2] for the sale of their posters.[3] The cartel began as early as September 2013. Topkins pled guilty.

The ongoing DOJ investigation into price fixing in the online wall décor industry led to a price-fixing charge against Daniel William Aston and his U.K.-based company.[4] Assistant Attorney General Bill Baer of the DOJ's Antitrust Division commented that "U.S. consumers deserve competitive markets when they shop online," and that the DOJ "will continue to prosecute conspiracies that subvert online competition."[5]

Another recent example of illicit use of computer algorithms was the major financial firms' manipulation of benchmark interest rates. In May 2015, five banks—Citicorp, JPMorgan Chase & Co., Barclays PLC, the Royal Bank of Scotland plc, and UBS AG—all pled guilty to felony charges of conspiring to manipulate the price of U.S. dollars and euros exchanged in the foreign currency exchange spot market.[6] The DOJ described how traders at Citicorp, JPMorgan, Barclays, and RBS—self-described members of "The Cartel"—used for five years an exclusive electronic chatroom and coded language to manipulate benchmark exchange rates.[7] The new U.S. attorney general noted how the steep financial penalties "should deter competitors in the future from chasing profits without regard to fairness, to the law, or to the public welfare."[8] This is optimistic, given the limited success that steep fines have had in curbing such behavior.[9]

Also illustrative is a Greek competition authority investigation into the use of IT systems to facilitate anticompetitive practices. In 2010, the Greek Hellenic Competition Commission fined Carrefour Marinopoulos €12.5 million for a number of infringements, including resale price maintenance (RPM).[10] The practice, which is illegal under EU competition law, was detected within Carrefour's franchise network.[11] In its decision, the Competition Commission emphasized the role played by Carrefour's joint IT system in facilitating the infringement. This system, "which formed an integral part of the [franchise] network,"[12] allowed the franchisor to monitor any deviations by franchisees from its recommended resale prices, "with the sole purpose of appraising the 'appropriateness' of such retail prices in relation with the total pricing policy of the network."[13] Moreover, the Competition Commission added, the nature of the IT system in question "rendered the management of prices by the franchisees difficult and time-consuming in practice, thereby facilitating price rigidity."[14]

An earlier example of the use of computers to facilitate collusion is the DOJ's civil *Airline Tariff Publishing* case.[15] The United States alleged that the defendant airlines used their computerized fare dissemination services to freely negotiate among themselves supracompetitive fares in multiple markets. No one questioned that the defendants' computerized fare dissemination system had a procompetitive purpose in supplying travel agents with basic information about airline fares for specific routes. However, the antitrust risks arose when the defendant airlines also used this system as a forum to exchange information that was of limited or no use to consumers, but was important to the other airlines in communicating and agreeing upon supracompetitive fares.

The DOJ asserted that the defendant airlines essentially signaled their concurrence in or disagreement with entreaties to raise fares and/or eliminate discounted fares through the First and Last Ticket Dates. Essentially, the defendant airlines communicated among themselves relatively costless proposals to change fares through these footnote designators with First and Last Ticket Dates. They employed sophisticated computer programs to process all this fare information, which enabled them to monitor and analyze their competitors' responses to current and future fares on certain routes. These negotiations at times would link fare changes among different routes, and would continue for several weeks until all the airlines had indicated their commitment to the fare increases by filing the same fares in the same markets with the same First Ticket Date. Likewise, the airlines used the Last Ticket Dates in connection with the footnote designators to communicate proposals to eliminate discounted fares currently being offered to consumers. Not only did this computerized fare dissemination system enable the defendants to negotiate higher fares, it importantly enabled them to verify that such fares would stick, and to signal retaliatory measures against any airline that did not go along with specific fares for specific routes.[16]

In a modified scenario of this case, the airline executives could agree broadly not to compete along certain routes and program their computers to ensure that each airline was allocated its set of customers, to monitor any deviations, and to react automatically to any defections. Importantly, the computers here are used to execute the task that they were set, using preloaded data and orders. While faster than their creators, the computer algorithms reflect—and are limited by—the amalgamation of human instructions. The computers simply help execute the humans' anticompetitive agreement.

These examples illustrate the way in which computers may be used to facilitate and monitor anticompetitive agreements. Collusion, however, may at times be established through weaker forms of communications, which do not give rise to an agreement yet are still condemned under antitrust laws. Here as well, computers and algorithms may play a role as the executors of human will—for instance, for the exchange of information or signaling between companies.[17]

All in all, from an enforcement perspective, the Messenger collusion scenario is relatively straightforward. The illegality inheres in the agreement or collusion among humans. So, while pricing algorithms facilitate the illegal behavior, the noteworthy conduct can be analyzed through a "human" prism. Thus, executives who agree to fix prices cannot blame their computers.

At the administrative level, competition enforcers can rely on the case law involving an illicit agreement or concerted practice and use the concept of "object"[18] or "per se" illegality to establish violations and impose fines on the companies.[19] The computers' failure to effectuate or monitor the agreement does not affect the agreement's illegality.[20] The stronger the evidence of an anticompetitive agreement in the Messenger scenario, the less the need for evidence of intent to establish the concurrence of wills or the agreement's purpose.

## The Algorithm as an Intermediary

From a legal perspective, the use of computers to help execute the cartel's tasks does not change the "human" prism. The use of algorithms facilitates tasks which humans would otherwise execute. Although the legal implications are the same—namely, that humans are guilty if they agreed to fix prices—the technology shift may have an important psychological impact on prospective colluders.

The computer, by increasing the distance between the human and the illegal day-to-day activity, can reduce the guilt of wrongdoing. Executives who fix prices often find excuses for their criminal behavior.[21] By using computer algorithms to fix prices, rather than secretly meeting and communicating with the other coconspirators, executives will likely feel less culpable. The computer, in serving as an intermediary, may help individuals wash their hands of the illicit conduct.

To explain how the presence of an intermediary may facilitate such actions, we enter the area of behavioral experiments, which explore the issue of distancing in decision-making.

One famous example—and the basis for Peter Gabriel's song "Milgram's 37 (We Do What We're Told)"[22]—is Stanley Milgram's electric shock experiments.[23] You might have seen the black-and-white videos[24] in which the test subject and a confederate of the experimenter were told that the experiment tested the effects of punishment on memory. To determine their assigned roles, the confederate and test subject drew lots, which were rigged so that the test subject always received the teacher role. The teacher-participant then administered a test in which the confederate-learner was to memorize word pairs. Each time the confederate-learner answered incorrectly, the teacher-participant was to administer an electric shock to the learner. A "shock generator" had thirty clearly marked voltage levels, ranging from fifteen to 450 volts, with designations from "Slight Shock" to "Danger: Severe Shock." Two switches after the last designation were simply marked "XXX." Unbeknownst to the teacher-subject, the confederate was not actually receiving electric shocks. The confederate-learner gave standardized responses. In one variation of the experiment, the confederate-learner pounded on the wall of the room in which he was bound to the electric chair after the 300 volt shock was administered. The teacher-subject could hear the pounding. Thereafter, the learner no longer responded; the experimenter instructed the teacher-subject to treat the absence of a response as a wrong answer, and to continue with the experiment. As the experiment continued, the teacher-participant was told to administer increasingly intense shocks to the now nonresponsive confederate-learner, even to the levels marked "XXX." These experiments actually sought to measure at what voltage level the teacher-participant would disobey and refuse to continue with the experiment. Milgram varied the situational factors to determine the extent to which they altered the degree of obedience.

Before his famous experiment, Milgram asked college students, psychiatrists, and middle-class adults for their predictions. No one predicted that the experiment participants would administer shocks above 300 volts. Nearly all the subjects, they predicted, would disobey the experimenter, only 4 percent of the subjects would administer 300 volts, and only a pathological fringe (about one in a 1,000) would administer the highest shock of 450 volts.[25] They were wrong. In his primary experiment, all forty subjects administered shocks up to 300 volts (when the learner-confederate pounded on the wall), and twenty-six subjects complied until the end and administered 450 volts.

Milgram's experiments highlight the importance of situational factors in explaining how ordinary blue-collar workers and white-collar professionals, contrary to their own expectations, administered a lethal dosage of 450 volts to an unresponsive, possibly dead, fellow test-subject.

One situational factor is to create opportunities for the diffusion of responsibility or abdication of responsibility for negative outcomes. Milgram ran the same experiment but changed certain conditions. In one variation, the teacher-participant administered only the test, while a confederate administered the shock for every wrong answer. In this situation, the degree of compliance was even higher: thirty-seven of the forty participants proceeded to the highest voltage level. Greater compliance may also be attributable to the reduced salience, as the teacher-participant was not directly administering the shock.

Two other variations of Milgram's experiment demonstrate the impact of increased salience on compliance. When the confederate-victim was in the same room as the teacher-participant, fewer teacher-participants administered the maximum voltage; compliance was even less when the teacher-participant had to force the victim's hand onto a shock plate.[26]

Let us consider the implications of Milgram's studies on computer-assisted collusion. Would the use of an intermediate algorithm increase the willingness to collude?

People generally perceive indirect harms as less problematic than direct harms.[27] Thus, price fixing may already appear less problematic and be easier for cartel members when they do not deal directly with the end customer, such as cartels for intermediate manufactured goods and services.[28] Cartels' perceived illegality will be further diminished if computers, rather than humans, monitor and punish any deviations from the cartel agreement. Moreover, as we will see with the next scenarios of collusion, price fixing may be easier to defend when the competitors' algorithms not only monitor and punish any deviations, but tacitly collude.

## Reflections

We see how computers, in facilitating communications, monitoring for any cheating and punishing any defections, may help humans collude. We also note how the use of the computer as an intermediary could weaken the individual's sense of illegality and, in so doing, further facilitate the illegal activity.

It is, however, important to remember that just as computers may be used to facilitate cartels, they may also be used by individual companies to execute more aggressive competitive behavior. For instance, they may provide a sophisticated tool in the hands of a maverick firm which would in fact destabilize cartel activity.

We thus return to the heart of the Messenger scenario: algorithms may facilitate collusion when such is the desire and intention of their operators. As messengers, algorithms are neither a negative nor positive force; rather, they are a technological extension of the human will.

# 6

# Hub and Spoke

HAVING CONSIDERED the "simple" Messenger scenario, we next consider instances in which computer algorithms are used as the central "hub" to coordinate competitors' pricing or activities. While the competitors do not directly contact or communicate with each other, the overall impact of the practice is akin to horizontal collusion.

## Traditional Hub and Spoke

Hub-and-Spoke conspiracies are not unique to the online environment or antitrust. After all, both cocaine and price-fixing cartels may be facilitated by such arrangements. These conspiracies, as one court described, take form when "a central mastermind, or 'hub,' controls numerous 'spokes,' or secondary co-conspirators."[1] The spokes each "participate in independent transactions with the individual or group of individuals at the 'hub' that collectively further a single, illegal enterprise."[2] A common example is where the mastermind recruits different coconspirators to carry out the illegal enterprise's various functions, such as procuring the guns, stealing the get-away car, laundering the money, and so on.

The coconspirators need not communicate with, or even know, each other. As the U.S. Supreme Court noted, "an unlawful conspiracy may be and often is formed without simultaneous action or agreement on the part of the conspirators."[3] But to show a single hub-and-spoke conspiracy, rather than multiple independent conspiracies, there must be a rim: there must be some overall awareness of the conspiracy and that "each defendant knew or had reason to know of the scope of the conspiracy and . . . reason to believe that their own benefits were dependent upon the success of the entire venture."[4] In a hub-and-spoke price-fixing conspiracy, the competitors who form the wheel's spokes must be aware of the concerted effort to stabilize prices. An easy case is where the hub "has not only committed to vertical agreements, but has also agreed to participate in the horizontal conspiracy."[5]

Courts have long recognized the existence of hub-and-spoke price-fixing conspiracies. Often the hub operates at one level of the market structure, coordinating a pricing-fixing agreement among competitors at a different level, the spokes.[6] In the *Interstate Circuit* case,[7] for example, a movie theater owner approached each movie distributor individually, told each movie distributor of the contemplated conspiracy, told each movie distributor that the other movie distributors would be invited to join the conspiracy, and said that cooperation of all eight distributors was essential for the conspiracy to work. By giving their consent to the conspiracy and agreeing to participate in it, both the movie theater owner (the hub) and the eight movie distributors (spokes) were liable.

Let us now consider the hub's active involvement in the collusion.[8] The European Commission condemned such active support and enabling practice as part of its investigation into the manipulation of the LIBOR. The Commission condemned the hub in this case (U.K.-based broker ICAP) for its "serving as a communications channel between a trader of Citigroup and a trader of RBS and thereby enabling the anticompetitive practices between them."[9] In the U.S. e-books case, Apple and five large book publishers were held liable for conspiring to raise the prices of e-books, and in particular the price of new releases and *New York Times* bestsellers.[10] The Apple case is illustrative of the potential power of platforms and their ability to distort competition. The use by Apple of an agency agreement and wide parity clauses[11] served to facilitate the publishers' collective (and collusive) action.[12]

## Algorithm-Fueled Hub and Spoke

With this overview of traditional hub-and-spoke conspiracies, we now explore instances where a computer algorithm executes the "hub" function to facilitate collusion among competitors.

Suppose each competitor in a local market sees the shift to dynamic pricing. But creating and refining the algorithms are too expensive. So each competitor outsources its pricing to an upstream supplier's pricing algorithm. The competitors do not interact directly with each other, yet they all use the upstream supplier's pricing algorithm. Here we face an industry-wide use of a single algorithm, which competitors use to determine the market price or react to market changes. As a result, the market behavior of the competitors could be "magically" aligned, when they all use a similar "brain" to determine their price strategy.

It is important to note how the algorithm-fueled hub and spoke differs from our first scenario—the Messenger—which considered the computer as a mere extension of the humans' illegal agreement. In an algorithm-driven hub and spoke, the computer does not merely execute the orders of humans; rather, it is the competitors' use of the same pricing algorithm that stabilizes prices and dampens competition.

It is also important to distinguish between the traditional hub and spoke conspiracy, in which the immediate aim is horizontal collusion, and each vertical link is in furtherance of that aim, from an algorithm-driven hub and spoke. The latter may, of course, be the result of an intentional attempt to dampen competition, but it may also occur due to unintentional alignment and use of similar algorithms to monitor prices. In other words, collusion may be the consequence, but not necessarily the original aim, when each competitor opts for the same third-party pricing algorithm.

Our focus is therefore on instances in which the use of a single algorithm as a hub would lead to a de facto alignment among rivals that dampens competition. One example is when many competitors outsource their pricing to a third-party vendor. Indeed, as pricing has become more dynamic and data-driven, companies are increasingly relying on third-party vendors.

Take, for example, the pricing services provided by one of these vendors—Boomerang Commerce. This third-party vendor's "platform analyzes over 100 discrete data points per SKU, including competitors' prices" to help "retailers re-price millions of products in real-time."[13] Boomerang "makes software that online retailers use to evaluate competitors' pricing on similar goods, and then analyze a variety of factors to decide when to match prices, or drop them lower or push them higher than a competitors'."[14] Among Boomerang's customers are Staples, Sears, and Groupon Goods.[15] Boomerang also promotes how its clients can avoid an algorithm-fueled price war:

> A new upstart, Jet.com, is building an online product catalogue with 30 million-SKUs and has pledged to underprice Amazon. What does

> this mean to you? An opportunity to take control of your pricing, and turn a destructive "Race to the Bottom" pledge into a level playing field where you can compete.
>
> Amazon's pricing machine will surely match Jet.com's aggressive prices to prevent customer churn. For retailers, blindly matching prices is not an answer. Top 100 retailers are utilizing Boomerang's innovative pricing technology to develop real-time pricing strategies to compete and grow profits.[16]

No one accuses Boomerang or its clients of fixing prices. But let us develop a potential case:

Suppose Staples uses Boomerang to price its online office supply products. What are the implications if Staples' competitors also decide to use Boomerang's price optimization software? Each competitor can claim that it never intended to fix prices; rather, it was too costly or time-consuming to independently develop the pricing algorithm and collect the needed market data. Moreover, as Boomerang enlists more office supply retailers as clients, its pricing algorithm will likely improve as it has more data and greater opportunities to experiment with prices and recalibrate. Quite simply, as more retailers use Boomerang, its self-learning pricing algorithm has more data to refine its pricing strategies for each client. Any algorithm that a smaller retailer could independently develop would likely be inferior to Boomerang's. Thus, each retailer would have independent business justifications for using Boomerang's pricing services, as its algorithms are smarter with more data and opportunities to experiment.

But if each major office supply retailer delegates its pricing to the same vendor, and if the vendor promises in its advertising materials to maximize profits, then surely each retailer knows that the vendor's pricing algorithms will make use of its own and its rivals' information in assessing prices. Each competitor would surely be aware that using the same third-party pricing vendor would likely influence market conditions.

Thus, we start to see the shape of a traditional hub-and-spoke conspiracy, where each retailer provides the hub with data and pricing authority, knowing that its rivals are doing the same. The vendor's pricing algorithm does, in fact, use the market information it collects from each retailer in determining the optimal prices for each retailer's products. Prices stabilize as a result, and the retailers' and algorithm vendor's profits increase. Each competitor might have independent business justifications for electronically sending its data to a third-party pricing vendor. But the competitors also recognize that doing so collectively will likely increase prices and their profits. So an algorithm-fueled hub-and-spoke conspiracy arises when competitors outsource pricing to a "similarly minded" or identical algorithm.

## Uber's Hub and Spoke

Another algorithm-fueled hub-and-spoke conspiracy may involve platforms, which bring together sellers and purchasers. When the platform's algorithm sets the price and many competing operators agree to use the platform's price, that too may dampen horizontal competition.

To illustrate the possibility of the hub setting the price for its spokes, we'll consider Uber Technologies Inc.'s online platform for car services. Basically, Uber connects drivers and passengers in over 300 cities, using a single pricing algorithm to set the price for car services in each city.[17]

For those unfamiliar with Uber's success story, in mid-2015 Uber was valued close to $51 billion. To put this into perspective, only two venture capital–backed private start-ups had ever surpassed a $50 billion valuation: Uber and Facebook. And Uber reached this valuation two years faster than Facebook.[18]

This rise in value and usage echo the significant benefits the online platform provides. Passengers don't have to wait in line for a cab (or try to hail one). They obtain full information on available rides and fares; and often the fare is less than that of traditional taxi companies. This—coupled with reduced search costs, and information about the driver's availability, distance, and rating—has fueled Uber's success. In addition, by linking a large number of users and drivers—some part-time, others full-time—the platform can promote a more efficient use of resources.

And yet the success story is not all rosy. Uber has its critics. Concerns have been raised over the nature of the relationship between Uber and its drivers and the responsibility the company should have for their welfare and actions.[19] Fairness concerns have also been raised. Critics argue that Uber avoids the costs of safety and other regulations that traditional taxi companies incur, and thus enjoys an unfair competitive advantage.[20]

For our purposes, we'll focus on another dimension—namely, the automated price-setting by Uber's algorithm.

We approach this discussion with care. Having used Uber and its competitor Lyft many times, we value the service. Indeed, on a busy day in

London or New York, such applications often offer commuters a cost-effective alternative. With these benefits in mind, we consider how a hub-and-spoke model could, under certain conditions, generate a completely different market dynamic.

Uber's algorithm has been referred to as an "algorithmic monopoly" as it may mimic a perceived competitive price rather than the true market price.[21] Uber's drivers typically do not negotiate discounts with customers. Instead, under its "[n]o cash, no tip, no hassle" policy, Uber's algorithm sets the price and automatically charges the passenger's credit card on file.[22] Uber takes between 20 and 25 percent of the fare; the driver gets the rest.[23] Uber's dynamic pricing algorithm provides passengers a baseline standard fare, which increases when consumer demand in a location exceeds the supply of available drivers.[24] For example, during a New York snowstorm, some rides on Uber cost 8.25 times more than normal.[25] Controversially, the algorithm was also reported to have implemented significant surge fees of up to four times the normal rate when demand for rides escalated in the midst of a hostage situation in downtime Sydney. Uber later apologized and refunded the charge.[26]

Thus, Uber's algorithm determines for hundreds of competing drivers the base price for the trip, *when* to implement a surge price, for *which* areas, for *how long,* and to *what extent.* Granted, the customer can compare the Uber price to alternatives (such as taxis or other car service platforms like Lyft), but as more customers and drivers rely on Uber's platform, one may wonder what effect its algorithm could have on the market price.

To illustrate, let us suppose Uber is the dominant car service platform in Nashville. Let us also assume taxis, for various reasons, are not a significant competitive restraint. What, if any, competition is left? Uber drivers do not offer discounts, as Uber's pricing algorithm determines the fare. Nor will Uber drivers necessarily compete by offering better service. One study of Uber and Lyft drivers found that they "distanced themselves from one another by checking other drivers' locations on the map so that they did not compete with each other for passenger requests. When drivers desired a break but did not want to turn off their driver applications to benefit from an hourly payment promotion, they parked in between the other ride-sharing cars in order not to get any requests."[27] So, as more people use Uber in Nashville, more drivers will likewise gravitate to Uber's platform, which further reduces users' wait time, increasing Uber's appeal. Unless passengers switch en masse to another platform, Uber's algorithms will have greater market power to set the price (including surge pricing) and increase profits. Drivers won't complain as they get 75 to 80 percent.

## Enforcement Challenges

The above scenarios illustrate the dangers when many competitors rely on a common algorithm. Higher prices are the likely outcome. To be clear, a single vertical agreement by itself may not necessarily be anticompetitive and does not necessarily reflect an attempt to fix market prices. The concern arises when a cluster of similar vertical agreements within a market gives rise to a classic hub-and-spoke conspiracy. Rivals end up using the same algorithm (the hub), which thereby softens competition and leads to higher prices.

From an enforcement perspective, one must appreciate the vertical relationship at the heart of the hub-and-spoke category and the challenges it raises. The pricing vendor Boomerang, for example, does not compete with its retail customers, such as Staples; nor does Uber compete with its drivers. To establish a conspiracy, it is not enough for information to flow through the hub. The parties should be aware of the likely effects of the flow of information. Intent to communicate the information through the hub, and situational awareness by the recipient of that information are required.[28]

In the case of *Eturas and Others*, the Court of Justice of the European Union was considering a possible hub-and-spoke conspiracy facilitated by an online system.[29] There, an administrator of an online travel booking system posted a notice on its system declaring a newly implemented technical restriction that imposed a cap on discount rates.[30] The Court held that travel agents who knew the content of the message sent via the system could be presumed to have participated in an illegal collusion unless they publicly distanced themselves from that message or reported it to the administrative authorities. It emphasized the significance of establishing the travel agents' awareness of the message.[31]

Similarly, in the United States, competition authorities may use evidence of intent to assess the nature of the agreement (i.e., is it purely vertical or is it effectively a horizontal agreement among competitors?), its likely competitive consequences, whether to categorize the conduct as a hard-core offense, and whether to prosecute civilly or criminally.[32]

In applying this case law to our algorithm-fueled hub-and-spoke scenario, it seems likely that in determining antitrust liability, courts in the

United States and the European Union will likely consider the firms' intent in using the algorithms, that is, whether they: (1) intended a clearly illegal result, such as agreeing to fix prices, or (2) acted with knowledge that illegal results, which actually occurred, were "probable."[33]

No doubt if the algorithm is specifically designed to facilitate collusion among the users, we would have the classic hub-and-spoke conspiracy.[34] The motivation in developing the algorithm would satisfy the intent and awareness conditions and pave the way for a finding of illegality.

From an enforcement perspective, also noteworthy is the fact that the hub-and-spoke structure may support a more stable cartel due to the role played by the hub and the use of computerized systems. When the hub sets the price and monitors market information (including the activities of the competing spokes), it may be more difficult, if not impossible, for any cartel member to "cheat" on the agreed price.

The algorithm as a hub serves as a commitment device. Given the logistics, the spokes may not know when to discount, for which products, or the magnitude of the discount. That is why the rivals delegated pricing to the hub in the first place. So the hub—as the central processor in collecting industry data and setting prices—can reduce distrust among competitors; each knows that the others are also entrusting their pricing to the same algorithm, whose aim is to maximize profit.

But what about instances in which the algorithm is not designed to facilitate collusion, but may nonetheless tamper with the market price? Could it then be deemed to have the object to restrict competition?

Consider again Uber's algorithm and its use by all drivers. If the drivers independently agreed among themselves to charge the same base rate (or surge rate), they would be guilty of price fixing. Yet in the case of Uber a vertical agreement is present between the hub (the algorithm developer) and the spokes (the Uber drivers). After Uber entered Nashville, the first few drivers who joined Uber's platform—while agreeing to use the algorithm—did not necessarily agree to fix the prices for taxi services. But what about the later drivers, who sign up after Uber dominates the local Nashville market? If these drivers understood that, by joining Uber, they all would receive the same rate and the same percentage of any monopoly profits, have they essentially become a hub-and-spoke conspiracy?

That remains unclear. As these online platforms' size and power increase, competition authorities will face challenging legal issues as to the algorithms' possible manipulation of the perceived market price and the liability of drivers and the platform. While the effects on the market may resemble horizontal collusion, the conditions for establishing a hub-and-spoke conspiracy may be absent. True, the parallel use of the same algorithm may give rise to concern. Yet whether it is sufficient to facilitate a finding of illegality remains to be seen.[35]

Interestingly, one federal district court in 2016 refused to dismiss a private antitrust complaint against Uber's CEO and drivers for generating "supra-competitive prices" through their agreement to use the Uber pricing algorithm.[36] As Judge Rakoff aptly noted, "The advancement of technological means for the orchestration of large-scale price-fixing conspiracies need not leave antitrust law behind."[37] The antitrust complaint overcame the first legal hurdle. It must next survive summary judgment.

If Uber and its drivers are found to have engaged in a hub-and-spoke conspiracy, then they are liable regardless of the cartel's actual effects. It does not matter whether the algorithm's pricing was reasonable or lower than the prevailing taxi fares.

And yet, when prices offered by the platform are lower than the substitutes, it is hard to justify intervention. In other words, should courts find illegality even when the platform improved services and lowered price?

Still, over time, as the platform gains power, the comparative benchmark may no longer reflect the competitive price. A competition authority will likely have a hard time identifying the tipping point when the legal use of a common algorithm becomes a conspiracy. After all, the first retailer who uses Boomerang's pricing algorithm and the first driver on Uber's platform in a new city are not guilty of price fixing. Nor is there necessarily a hub-and-spoke conspiracy when the second or third driver joins Uber. At what point does the algorithm become the central hub to facilitate collusion?

Another challenge concerns the properties of a given algorithm. A competition authority may find it cumbersome, and at times impossible, to delve into the heart of an algorithm to establish whether it is designed in a way that would lead to, or may lead to, exploitation. Machine learning is an ongoing process. The algorithm used last year may not resemble the one used today. Unless the competition agencies discovered evidence of a clear anticompetitive design, their analysis would shift from a "per se illegal" standard to a "Rule of Reason" standard. Under this standard, the competition authority must establish the likely adverse effects of these vertical agreements in a properly defined antitrust market. Unlike the per se illegal standard, the defendants can offer procompetitive justifications for using the pricing algorithm. If any anticompetitive harm would be outweighed by the practice's procompetitive effects, then the practice is lawful. Such analysis is typically costly, time-consuming, and complex. Nor is the analysis always objective or the outcome predictable. Thus the appetite to pursue such rule of reason cases is diminished.[38]

## Reflections

When competitors use the same pricing algorithm, the illegality of these arrangements will often be murky. If there is strong evidence of anticompetitive intent, then the agency can prosecute the participants using the familiar hub-and-spoke conspiracy law. Absent this evidence, however, the common use of the same algorithm raises difficult enforcement and policy challenges.

First, as illustrated above, identifying the tipping point from legal use of an algorithm to anticompetitive use may be challenging.

Second, the stability of these schemes and their susceptibility to entry may be difficult to establish. Consider again our Uber example. On the one hand, the use of the hub to set prices via a common algorithm and the centralized payment system support a stable environment. Drivers are likely to lack the incentive and ability to undercut the common price. On the other hand, if competitive alternatives restrain the platform and its sellers from raising prices or degrading quality, then the antitrust risks lessen.

This tension leads us to the third enforcement challenge—identifying the point at which the platform or sellers obtain market power and the hub's algorithm can and likely will increase prices. Market power should be assessed while taking note of social biases, users' inability to process complex information,[39] limited switching patterns, usage of apps, and access to platforms.

We cannot predict the competitive dynamics of some markets or the competitive pressure to which the leading platforms are subjected. The ability of entrants to thwart any hub-and-spoke conspiracy is hotly debated in the conferences and workshops we attend. It is hard to obtain clear information about the extent to which users multihome and use cross-platform comparison sites, and whether this could curtail the power of the leading platform. When time is at a premium, do users simply opt for the leading default platform?[40] Moreover, as we will explore later, network effects can make the big platforms even bigger and more powerful. When that happens, the platform's price effectively becomes the market price, which means higher prices for us all.

# 7

# Tacit Collusion on Steroids: The Predictable Agent

THE LAST TWO CHAPTERS explored the shift from a world where executives expressly collude in smoke-filled hotel rooms to where they still collude but use computer algorithms to help execute their illegal agreement (Messenger), or to serve as the hub in their Hub-and-Spoke conspiracy. We now shift to the "twilight" world of virtual competition, where the industry-wide use of pricing algorithms leads to higher prices, without any clear or implied human anticompetitive agreement.

After explaining how greater transparency can facilitate the phenomenon known as tacit collusion, we explore our third collusion scenario, Predictable Agent. Here we consider how each firm unilaterally creates an algorithm but knows that the industry-wide use of pricing algorithms will facilitate tacit collusion. The competition authority lacks evidence of an illegal agreement but has evidence of anticompetitive intent. We reflect on whether this suffices to deter and punish tacit collusion.

## Transparency, Competition, and Tacit Collusion

Greater transparency, as we saw in Chapter 1, can foster competition, as it lowers our search costs in assessing the prices each seller charges. But greater transparency, under certain market conditions, can also lead to a unique phenomenon known as tacit collusion, which lessens competition. As we'll see, this phenomenon can harm consumers to the same extent as the price-fixing cartels we saw in Chapters 5 and 6.

So what is tacit collusion? In its judgment in *Brooke Group Ltd. v. Brown & Williamson Tobacco Corp.,* the United States Supreme Court gave the following description:

> [T]acit collusion, sometimes called oligopolistic price coordination or conscious parallelism, describes the process, not in itself unlawful, by which firms in a concentrated market might in effect share monopoly power, setting their prices at a profit-maximizing, supracompetitive level by recognizing their shared economic interests and their interdependence with respect to price and output decisions and subsequently unilaterally set their prices above the competitive level.[1]

Importantly, the conditions for tacit collusion, as several economists have noted, "need not involve any 'collusion' in the legal sense, and in particular need involve no communication between the parties. It is referred to as tacit collusion only because the outcome (in terms of prices set or quantities produced, for example) may well resemble that of explicit collusion or even of an official cartel."[2] Accordingly, tacit collusion differs from express collusion, where the competitors' employees actually agree to fix prices, reduce output, or allocate markets. More importantly, express collusion is illegal, whereas the parallel behavior, which may stem from tacit collusion, is legal.[3]

To illustrate tacit collusion, let us consider Martha's Vineyard, which attracts U.S. presidents and vacationers every summer. The plaintiffs are the summer residents, angry at unjustifiably high gasoline prices.[4] The defendants operate four of the nine gas stations on Martha's Vineyard. The defendants' prices exceed prices at gas stations on nearby Cape Cod by an average of fifty-six cents per gallon.[5] So why is gas so expensive? Must it be because the defendants are colluding?

Not necessarily. As both the trial and appellate court found, the retail gasoline market on Martha's Vineyard has "features that make it susceptible to efforts by gas stations to sustain supra-competitive prices."[6] First are the high entry (and regulatory) barriers for anyone seeking to open another gas station on the island.[7] No bridges connect with the mainland; drivers rely on a ferry. Second, consumer demand is inelastic, meaning "customers will not buy much less gas when prices rise, because they cannot choose to drive farther away to get cheaper gas."[8] Third, gasoline is a homogeneous good, "so consumers decide where to buy it based mostly on price and convenience, leading competing gas stations to prominently post prices."[9]

On Martha's Vineyard, like most other places, gas prices are highly transparent. You see the posted price as you drive by. But the transparency, the First Circuit noted, helped cause the high prices: it "lets competitors know and respond in real time to one another's prices, allowing them to catch price 'cheaters' and to follow price 'leaders.' "[10] With only nine gas stations on the entire island, they can, through conscious parallelism, reach the same anticompetitive outcomes as a cartel:

> [E]ach station can easily monitor and respond to the prices of the others. If one station drops its price in order to attract more business, the others can quickly drop their prices in response. The original "cheater" benefits very little from undercutting its competitors' prices, because when any one of them drops its prices the competitors can match the price before many customers respond to the incentive. And all of the stations suffer a decrease in profit margin. Conversely, a station acting as a price "leader" risks little by raising its price under such market conditions. Other stations are likely to follow, given the possibility of higher prices and profit margins for all. If for some reason the competitors do not follow the increases, the leader can easily drop its price again to match the other stations so quickly that few customers are lost to lower-priced competition. Knowing these features of the market, each gas station owner is likely to reach its own independent conclusion that its best interests involve keeping prices high, including following price changes by a price "leader" (if one emerges), in confidence that the other station owners will reach the same independent conclusion.[11]

Of course, if the four gas station owners got together and agreed to fix gas prices, then that constitutes express collusion, which is per se illegal. The defendants would be civilly liable and criminally prosecuted. But the Martha's Vineyard gasoline market is an oligopolistic market that is highly conducive to tacit collusion.[12] Here the defendants, given the market conditions and high transparency, could achieve the same end as a cartel (namely higher prices and profits) without the illegal means (namely agreeing among themselves to fix prices).

So without sufficient evidence of an agreement among the competitors, the plaintiffs' antitrust claims failed. The plaintiffs' evidence was entirely consistent with conscious parallelism, where each gas station owner simply followed the price leader. That is legal.

To demonstrate the dynamics underlying tacit collusion, suppose one morning one of the owners decides to reduce the price she charges for gasoline. She does so with the hope of attracting more customers and increasing overall profits. Indeed, such a strategy embodies competitive markets. Yet our oligopolistic market has all the characteristics required for tacit collusion. As a result, the other gas station owners—upon observing the price reduction—will retaliate by reducing their prices. They do so to prevent customers from shifting their business to the discounting gas station. At the day's end, each competitor, as well as our original discounter, sells the same amount of gasoline, but at a lower price, making less profit. The discounter, along with her competitors, learns through experience how the market is characterized by interdependence. Every time any owner tries to undercut the others' price, the others will match that price cut. In other words, no one profits by discounting.

This discovered interdependence not only reduces the incentive to discount; it increases their incentive to follow a price increase. This is so because under the market conditions, when one competitor raises the price of gasoline, the others know that if they do not follow the price increase, the price leader will eventually drop the price, so as not to lose many customers. In other words, if they choose not to follow the price increase, they all forgo the extra profits from the price increase. The interdependence between the gas station operators therefore supports a gradual increase in price and leads to a new equilibrium above competitive levels.

Indeed, the defendant gas stations' interdependence was strong: they held gas prices on Martha's Vineyard steady or raised them while the cost of gasoline at wholesale declined.[13] Their profits were abnormally high. They based their gas prices, not on their cost, but on the actions and expected actions of the other stations on Martha's Vineyard. And their market shares were stable over time.

Importantly, the owners could charge high prices without any formal or informal illegal agreement among themselves. The equilibrium was the result of a rational, unilateral decision by each competitor.[14]

Here the competition authority is stuck. The outcome of tacit and express collusion is the same—namely steep prices. But for tacit collusion, there is no agreement. Thus, the service station owners profit from the oligopolistic market dynamic.

So why would firms expressly collude, when they can avoid antitrust liability (and incarceration) by tacitly colluding? Recall that for tacit collusion to be sustained, a few key conditions must be present. One key condition is that the market is sufficiently transparent that its few competitors can "promptly and confidently" observe each rival's "significant competitive initiatives."[15] When "the terms offered to customers are relatively transparent,"[16] the risk of tacit collusion increases in concentrated industries with homogeneous products and inelastic consumer demand. Each competitor has "the ability to know how the other members are behaving" and can "monitor whether or not they are adopting the common policy."[17] The European Commission explains how markets need to be sufficiently transparent to allow the coordinating firms to monitor to a sufficient degree whether other firms are deviating by lowering prices, offering secret discounts, increasing product quality or capacity, or trying to win new customers:

> When evaluating the level of transparency in the market, the key element is to identify what firms can infer about the actions of other firms from the available information. Coordinating firms should be able to interpret with some certainty whether unexpected behaviour is the result of deviation from the terms of coordination. For instance, in unstable environments it may be difficult for a firm to know whether its lost sales are due to an overall low level of demand or due to a competitor offering particularly low prices.[18]

For tacit coordination to be sustainable over time, one European case notes, "there must be an incentive not to depart from the common policy on the market."[19] Companies must be able to effectively retaliate when a competitor seeks a relative advantage by discounting. The retaliation must be "sufficiently likely and costly to outweigh the short-term benefits from 'cheating' on the collusive path."[20] In addition, to sustain tacit collusion, potential competitors or customers should not be in a position to jeopardize the results expected from the common policy. One would therefore expect that buyers cannot exert buyer power, are unlikely to change their purchasing powers, and the market in general is characterized by high entry barriers.[21] (But, as evidenced by the cartels in turtles and packaged ice, even markets with low entry barriers can be cartelized.)

Thus, tacit collusion requires certain market conditions. Absent these conditions, parallel behavior should ordinarily not occur. As we illustrate below, as market participants increasingly rely on pricing algorithms, they will change the market conditions. One risk is that the changed market conditions can widen the instances in which tacit collusion may occur.

## The Predictable Agent

To explore how algorithms can foster tacit collusion, we turn to our third scenario, the Predictable Agent, where each firm programs its algorithm with a strategy to maximize profits. The algorithm, among other things, is programmed to monitor price changes and swiftly react to any competitor's price reduction. The algorithm is also programmed to follow price increases when sustainable, that is, when others follow in a timely manner so that no competitor benefits from keeping prices lower.

Consider the effect when each competitor in an industry adopts this pricing algorithm. As each seller relies on the algorithm, more market data will be digitalized and accessible, and market transparency will likely increase.

First, the demand for digitized market information and transparency will increase. The algorithms will likely engage in "predictive analytics"—that is, the study of patterns in pricing and commercial decisions. Such an analysis will enable firms to combine "real-time, historical and third-party data to build forecasts of what will happen in their business months, weeks or even just hours in advance."[22] That technology would enable "moving away from 'systems of record' to 'systems of engagement' that use predictive analytics to cut through the noise in big data and uncover insights that can be acted on."[23] In order for the algorithm to function effectively and optimize pricing, the computer must quickly access and process key market data, including competitors' prices and sale terms, and respond to market changes.

Second, when each firm adopts a pricing algorithm, the supply of market data (including competitors' pricing) increases. Each seller, in shifting to algorithms, increases market transparency by posting its current prices. Consumers and rival algorithms will immediately see each firm's current price and terms online.

What if the algorithm determines the list price, and the firm secretly offers price-sensitive customers discounts? (We'll explore this further in Part III in regard to price discrimination.) Some of us will end up paying more. Moreover, as we saw in Chapter 2, some industries are currently in an arms race to use algorithms to engage in dynamic pricing. Under this competitive pressure to quickly adjust prices, firms may have neither the time nor the incentive to manually check the algorithm's price and determine a secretive discount. When dynamic pricing yields a competitive advantage, no firm can afford the time gap to assess whether the algorithm's suggested price should be implemented. The firm relies on the pricing algorithm precisely because it is ineffective for humans to independently analyze all the underlying market data to calculate prices (or discounts) on many products.

If the whole purpose of dynamic pricing is to update prices quickly so as to reflect market demand, market participants will likely expect the price posted online to be the actual price. Some buyers may continue to haggle, but the norm develops that the algorithm-determined posted price is the actual price. (Indeed, with gas stations, one typically does not try to negotiate a discount from the clerk, who may have little if any authority to change the posted price.)

This differs from yesteryear when buyers received physical price lists. There was often a lag before rivals obtained the list. Moreover, the list price may not have reflected the actual price paid. Firms, with only the competitors' older price lists, would have to rely on hearsay collected by their sales personnel on what rivals were actually charging.

## Speed

Speed, in our Predictable Agent scenario, is critical. When we were growing up, humans monitored market activity, determined whether, and by how much, to raise or lower prices, and physically stamped products with price stickers. Pricing decisions took weeks—if not months—to implement.

So as competitors' prices shift online, their algorithms can assess and adjust prices—even for particular individuals at particular times and for thousands of products—within milliseconds.[24] In other words, they can swiftly match a rival's discount, thus eliminating its incentive to discount in the first place. On the other hand, they will follow price increases (when sustainable). In an environment dominated by similar pricing algorithms that are aware of opportunities to foster interdependence, the risk is higher prices.[25]

Returning to our gasoline station example, imagine our oligopolistic market had limited transparency (i.e., drivers would have to inquire inside the station to determine the price of gas). Drivers would not want to search Martha's Vineyard for the lowest gas prices. Instead, they might ask their friends, visit a few stations, and support the one with the lowest price. Thus, the discounter benefits from a reputation for having the lowest price; the other stations would eventually discount. Under these market conditions, conscious parallelism is harder to sustain. The firms will compete as expected.

Now, think of the basic conditions for tacit collusion/conscious parallelism. Suppose some gasoline owners want to shift pricing decisions from humans to computers. The computer must be able to access market data, of which there is very little. So the pricing algorithm initially uses crude data, perhaps historic daily volume of sales. If actual sales falls below the historic level, the assumption, after controlling other possible explanations, is that gas is cheaper at the other stations. The computer continues dropping the posted price of gasoline until average sales reach the historic average. When the second and third gas station adopts a similar pricing algorithm, the quality of the market data improves. The pricing algorithm can use its rivals' posted price data, rather than infer it from historic versus actual sales.

Now suppose, as is the case in many states,[26] a smartphone app tells you the price of gasoline at every local station. That sounds procompetitive. The increase in price transparency lowers your search costs for finding cheaper gasoline. Indeed, in markets characterized by many sellers, the gas app may promote competition.

However, in an oligopolistic market, such applications may have the opposite effect. First, the applications put competitive pressure on any gas station that still does not use pricing algorithms. Ironically, even if some companies yearn for the days of printed list prices and secretive discounts, they may switch to pricing algorithms to prevent being at a competitive disadvantage. Symetry is soon established. Second, the applications provide real-time pricing for gasoline for each station; competitors no longer have to drive around the island to collect the information. Rivals' pricing algorithms can promptly observe all the competitively significant terms. And the pricing is real—it reflects what customers actually pay. By shifting pricing decisions to computer algorithms, competitors thereby increase transparency, reduce strategic uncertainty (when the pricing algorithm cannot grant secretive discounts), and thereby stabilize the market.[27] When one gas station lowers the price by one cent at 11:33 A.M., within milliseconds other nearby stations respond by lowering their price.

Thus, with each firm's algorithm tapping into its rivals' real-time pricing, no firm would likely profit by discounting. Given the velocity with which the pricing algorithms can adjust, no gas station would likely develop among its customers a reputation as a price discounter. Accordingly, the competitors will have less incentive to discount. We can see that in such a market, the app that was meant to promote price competition could end up undermining it.

On the flip side, the algorithms' velocity of pricing decisions can shorten the time period for signaling price increases. Firms would no longer have to rely on lengthy (e.g., thirty-day) price announcements, where they wait and see what the competitive response is, to decide whether to raise prices (and to what extent). Computers can have multiple rounds whereby one firm increases prices and the rival computers respond immediately and without the risk that the firm that initiates the price increase will lose many customers to rivals. Essentially, companies may now need only seconds, rather than days, to signal price increases to foster collusion.

So the industry-wide use of pricing algorithms increases both market transparency and the risk of conscious parallelism. Moreover, in programming its pricing algorithm, each firm will likely use historic pricing data and competitive responses to calibrate the dominant strategy. As such, when the algorithms operate within the greater transparency of their digitalized environment, the computers will already be programmed to anticipate and respond to rivals' moves. In such a scenario, computers can rapidly calculate the profit implications of myriad moves and countermoves. With the computers' ability to police deviations and rely on prior strategies to punish deviations, prices, as a result of their conscious parallelism, will climb.

## The Algorithm Arms Race

Our scenario resembles the use of computers at a chess match or blackjack table. Imagine you are playing against other humans, but one player uses a computer. For blackjack, the computer counts all the cards in the multiple decks to predict the likelihood of receiving a desired card, assesses the strategies employed by the other players under similar circumstances, and calculates the other players' risk aversion. For chess, the computer calculates all the possible moves and countermoves.[28] The computer gives the player an inherent advantage. After losing several times, you would likely want a computer too.

This explains the metal detectors at the World Chess Cup tournament. The concern is that the players, to gain a competitive advantage, are secretly turning to their smartphones' chess app for their moves. A smartphone chess app can beat the best players. Chess tournaments, besides the metal detectors, are also using algorithms to detect whether a player's moves, given his or her skill levels and situations on the board, are too much like a computer's.[29]

Unlike chess players, market players can freely use algorithms to gain a competitive advantage. Rivals, like high-speed traders, will have an incentive to invest in technology so that they can see competitively significant terms a few minutes or seconds before customers will. Michael Lewis in *Flash Boys* documented how Wall Street traders built their business models on having a slight relative advantage in seeing orders before others with slower connections and systems, and then trading ahead of the others.[30] Thus, the algorithm arms race may lead to companies detecting price changes (including discounts) milliseconds before their customers do, and being able to respond before the customers can. So too each firm—in unilaterally deciding to shift to pricing algorithms—would bring the market reality closer to that necessary for conscious parallelism and higher prices.

## Enforcement Challenges

Unlike our Messenger and Hub-and-Spoke scenarios (in Chapters 5 and 6), which focused on collusion, the scenario here does not involve any agreement. The firms—in unilaterally creating and implementing the algorithms—never agreed to fix prices. Each firm had an independent economic self-interest in developing and relying on the algorithms; indeed, it may be contrary to the firm's economic self-interest to rely on human pricing or trading.

Interestingly, conscious parallelism takes place at both the human and machine levels. First, when configuring the machines, each human, independently and without collusion, knows that when possible, a dominant strategy may be to follow a rival's price increase. Furthermore, each person knows that if other firms have a similar algorithm, the resulting equilibrium may be above the competitive level. This conscious parallelism at the human level leads to the programming of machines which are aware of possible conscious parallelism at the market level. The computer is therefore set up to monitor the market and explore the likelihood of establishing interdependence, without venturing into illegal concerted practices or illicit agreements. The computer may also be programmed to identify maverick firms and punish any deviations from a possible tacit collusion.

Competition law, in most jurisdictions, will require proof of an agreement among the parties to change the market dynamics. Can the competition agency impute the presence of an illicit agreement or understanding among the competitors to use similar algorithms to dampen competition?[31] Not necessarily. One should acknowledge that evolution dictates that the stronger, more powerful algorithms will likely prevail and dominate the technology market. This reality naturally fosters assimilation of systems between various computer developers and companies. Abstaining from an advanced algorithm may be irrational; it would be as if an investment bank or hedge fund insisted on human floor traders, when most trading is automated.

In our example, there is no evidence of an agreement among the firms, but there is strong evidence of anticompetitive intent. Humans unilaterally design algorithms to deliver predictable outcomes and react in a given way to changing market conditions. The firms recognize, in this scenario, that the industry-wide adoption of similar algorithms would likely foster tacit collusion, whereby they mutually profit from their initial investment. Crucially, the use of advanced algorithms in this scenario transforms the "normal," preexisting market conditions. Before algorithms, transparency was limited; conscious parallelism could not be sustained. To facilitate the use of the pricing algorithms, the firms increase transparency, which in turn makes tacit collusion likelier. While the mutual price monitoring at the heart of tacit collusion is legal under competition law, one may ask whether the creation of such a dynamic through "artificial" means should give rise to antitrust intervention.

The main enforcement challenge concerns the legality of conscious parallelism. A rational reaction by competitors to market dynamics, in itself, is legal. When such legal behavior, absent communication or agreement, leads to an equilibrium above competitive levels, it does not trigger antitrust intervention.[32]

But the fact that tacit collusion is legal does not mean it is desirable. Indeed, competition law prohibits mergers that make tacit collusion more likely. This is so since the merger, in effect, changes the existing competitive conditions. To illustrate, suppose Firms A and B plan to merge, leaving Firms A, C, and D in the market. Suppose Firms A and C currently use pricing algorithms, and Firm D, as a result of merger, would likely use algorithms as well. Suppose the evidence shows that D's use of pricing algorithms post-merger would blunt each firm's incentive to discount and increase their incentive to raise prices.[33] The merger by enabling tacit collusion would likely diminish competition. Subsequently, the reviewing competition agency will enjoin the merger or demand remedies which can resolve the anticompetitive risks.

Now let us change the scenario. Suppose there is no merger, but Firms A, B, C, and D are all predisposed to tacit collusion. But current market conditions prevent it, and they do not want to risk criminal penalties by expressly colluding. They all recognize that the use of advanced algorithms will increase transparency, reduce their incentives to discount, and increase their incentives to raise prices. They all incorporate the pricing algorithms. Is that meaningfully different from the merger scenario?

The question is therefore whether one may condemn the creation of a transparent market in which monitoring and punishment mechanisms are present, and if so, under what conditions? Another challenge concerns instances in which the algorithm is programmed to refrain from targeting competitors' customers in an attempt to stabilize the market and avoid a price war. The legality of such action was addressed by the U.S. Court of Appeals for the Seventh Circuit:

> [S]uppose that the firms in an oligopolistic market don't try to sell to each other's sleepers, "sleepers" being a term for a seller's customers who out of indolence or pricing ignorance don't shop but instead are loyal to whichever seller they've been accustomed to buy from. Each firm may be reluctant to "awaken" any of the other firms' sleepers by offering them discounts, fearing retaliation. To avoid punishment under antitrust law for such forbearance (which would be a form of tacit collusion, aimed at keeping prices high), would firms be required to raid each other's sleepers? It is one thing to prohibit competitors from agreeing not to compete; it is another to order them to compete. How is a court to decide how vigorously they must compete in order to avoid being found to have tacitly colluded in violation of antitrust law? Such liability would, to repeat, give antitrust agencies a public-utility style regulatory role.[34]

Should competition agencies challenge a unilateral decision not to compete? Can such a strategy be credibly framed as collusive customer allocation?

Considering the above challenges, one may wonder whether, under current laws, algorithm developers can legally program machines that unilaterally support tacit collusion.

Under traditional competition analysis the answer is likely to be "Yes." Absent evidence of an agreement to change market dynamics, most competition agencies lack enforcement tools, outside of merger control, that could effectively deal with the change of market dynamics through algorithms. Unilaterally, a firm without market power may develop an algorithm that detects the market behaviors of competitors; anticipates the rivals' algorithms' likely reactions to different competitive responses; and opts for the path that, given the competitive reactions, will maximize profits, which may often be the path toward conscious parallelism.

Outside the core competition provisions, one may, however, consider alternative legal instruments. For instance, the U.S. Federal Trade Commission (FTC) can bring claims under Section 5 of the FTC Act, without evidence of an agreement, only a showing of an "unfair practice." Many states have a similar statute. But the FTC has been unsuccessful in bringing these "facilitating practices" claims, as is evident in *Boise Cascade*[35] and *Ethyl.*[36] If the court adopts the standard in *Ethyl,* the FTC would need to show either (1) evidence that defendants tacitly or expressly agreed to use pricing algorithms to avoid competition, or (2) oppressiveness, such as (a) evidence of defendants' anticompetitive intent or purpose or (b) the absence of an independent legitimate business reason for the defendants' conduct.[37] Accordingly, in the Predictable Agent category, the defendants may be liable if, when developing the algorithms or in seeing the effects, they were (1) motivated to achieve an anticompetitive outcome, or (2) aware of their actions' natural and probable anticompetitive consequences.

Another approach may be to consider the use of such algorithms as market manipulation. This approach has its own obstacles; yet one could imagine the introduction of legislation that targets "abuse" of excessive transparency, possibly where clear anticompetitive intent is present.

If the executives, for example, call their algorithm *Gravy,* and tinker with it to better manipulate the market, and boast about this in their internal e-mails—as in the U.S. Securities and Exchange Commission's (SEC) case against Athena Capital Research—liability could be established.[38] The *Athena* case is illustrative. In 2014, the SEC for the first time sanctioned the high-frequency trading firm for using complex computer programs to manipulate stock prices.[39] The sophisticated algorithm, code-named *Gravy,* engaged in a practice known as "marking the close" in which stocks were bought or sold near the close of trading to affect the closing price: "[t]he massive volumes of Athena's last-second trades allowed Athena to overwhelm the market's available liquidity and artificially push the market price—and therefore the closing price—in Athena's favor."[40] Athena's employees, the SEC alleged, were "acutely aware of the price impact of its algorithmic trading, calling it 'owning the game' in internal e-mails."[41] Athena employees "knew and expected that *Gravy* impacted the price of shares it traded, and at times Athena monitored the extent to which it did. For example, in August 2008, Athena employees compiled a spreadsheet containing information on the price movements caused by an early version of *Gravy*."[42] Athena configured its algorithm *Gravy* "so that it would have a price impact."[43]

In calling its market-manipulation algorithm *Gravy,* and by exchanging a string of incriminating e-mails, the company did not help its case. Without admitting guilt, Athena paid a $1 million penalty. This demonstrates that automated trading has the potential to increase market transparency and efficiency, but it can also lead to market manipulation.[44]

Finding the predominant purpose for using an algorithm will not always be straightforward. Athena, for example, challenged the SEC's allegations that it engaged in fraudulent activity: "While Athena does not deny the Commission's charges, Athena believes that its trading activity helped satisfy market demand for liquidity during a period of unprecedented demand for such liquidity."[45] A court might agree. Companies can also learn from *Athena* and be more circumspect in their e-mails.

Moreover, evidence of intent will likely be mixed when each firm has valid independent business reasons to develop and implement a pricing algorithm. After all, the first firm to use the pricing algorithm could not be accused of colluding, as the market was likelier less transparent, and rivals could not match the speed of the first mover's price changes. Thus, if the first firm to use a pricing algorithm lacked anticompetitive intent, the same may be true for the second or third firm. It too might have legitimate business reasons to employ a pricing algorithm—namely, to not be at a competitive disadvantage in responding to price changes by the first firm.

## Reflections

Tacit collusion provides a fascinating example of challenging market dynamics. First, it will likely arise (at least initially) in highly concentrated markets where the other conditions for conscious parallelism are present. Admittedly, even when these conditions are present, the dynamics of a market may trigger changes or new entry and destabilize conscious parallelism.[46] Similarly, technology may provide a disruptive force, allowing algorithms to successfully "cheat" by discounting.

Still, with the above caveats in mind, conscious parallelism will likely become more common. The nature of electronic markets, the availability of data, the development of similar algorithms, and the stability and transparency they foster, will likely push markets that were just outside the realm of tacit collusion into interdependence.[47]

These developments raise challenging technical, enforcement, and legal questions. If the algorithms increase market transparency, the defendants will often have an independent legitimate business rationale for their conduct. Courts and the enforcement agencies may be reluctant to restrict this free flow of information in the marketplace. Its dissemination, observed the Supreme Court, "is normally an aid to commerce,"[48] and "can in certain circumstances increase economic efficiency and render markets more, rather than less, competitive."[49] Indeed, concerted action to reduce price transparency may itself be an antitrust violation.[50]

A regulatory approach to reduce transparency may also prove difficult. One may find it difficult to fine-tune the enforcement policy aimed at condemning "excessive" market transparency. This may be particularly challenging when the information and data are otherwise available to consumers and traders and it is the intelligent use of that information that facilitates conscious parallelism.

An alternative use of disruptive technology may also have limited appeal, as it could be overpowered by new technology. Similarly, restrictions that limit the ability to match prices could be undermined by smart algorithms operating in fast moving markets.

We revisit the question of intervention in the Part V of the book. Next, we consider the fourth scenario, Digital Eye, where, as more data is quickly fed into the algorithm, transparency can reach what we call "the God View." Self-learning algorithms, with the God View, can expand tacit collusion in unexpected directions, compounding the harm.

# 8

# Artificial Intelligence, God View, and the Digital Eye

WE ARE ALREADY witnessing the Messenger and Hub and Spoke collusion scenarios. Predictable Agent will likely be the next scenario we'll see. Our final collusion scenario—Digital Eye—represents the next frontier. Here we consider how two key technological advancements can amplify tacit collusion to a new level of stability and scope. The first advancement involves the computer's ability to process high volumes of data in real time to achieve a God-like view of the marketplace. The second advancement concerns the increasing sophistication of algorithms as they engage in autonomous decision making and learning through experience—that is, the use of Artificial Intelligence (AI).

These two technological advances can form a harmful combination: In enabling a wider, more detailed view of the market, a faster reaction time in response to competitive initiatives, and dynamic strategies achieved by "learning by doing," the technologies can expand tacit collusion beyond price, beyond oligopolistic markets, and beyond easy detection. With our other three scenarios, we, like the vacationers on Martha's Vineyard, may know when something is amiss. In the Digital Eye scenario, the contagion spreads—to markets less susceptible to tacit collusion under the brick-and-mortar economy, and beyond pricing to other competitive initiatives. In the end, with Digital Eye, we may think the markets, driven by these technologies, are competitive. We may believe that tacit collusion in these markets isn't even possible. And yet we're not benefiting from this virtual competition.

## God View

In 2014, Uber caused a stir. Two former Uber employees told reporters that "[t]racking customers is easy using an internal company tool called 'God View.'"[1] Uber's "God View" apparently shows the location of all Uber vehicles and customers who have requested a car.

Borrowing Uber's terminology, we refer to God View as competitors using Big Data and Big Analytics for a clearer overview of the marketplace at any given moment. The wealth of data generated from the online environment, cloud computing, and smart sensors can provide a panoramic God-like view of our state of being. Firms can see on a giant screen, for any city, their own driverless trucks, their rivals' driverless trucks, their customers' trucks, what the trucks are carrying, and where they are traveling. Each firm can track the movement of its own and its rivals' products traveling through the supply chain. They can see when the item enters their customers' factories or homes. They can continue to collect data until the item is ultimately recycled or discarded.

As we saw in Chapter 7, computer algorithms are quicker than humans to observe price and demand changes, and can respond (including tit-for-tat) by adjusting prices for relatively homogeneous products. Also significant is the fact that markets are typically more vulnerable to coordinated conduct "if a firm's prospective competitive reward from attracting customers away from its rivals will be significantly diminished by likely responses of those rivals," which "is more likely to be the case, the stronger and faster are the responses the firm anticipates from its rivals."[2] In markets where customers can switch between suppliers, and where the goods are homogeneous, computer algorithms can quickly detect price reductions by a rival and effectively deprive that rival of any significant increase in sales. The greater the price transparency, the quicker the competitive response, the less likely the first mover will benefit, and the less likely any firm will discount. Thus Chapter 7 focused on the algorithms' reactions to rivals' price changes.

With God View, we go a step further: computers can anticipate and react to competitive threats well before any pricing change. Each firm's algorithm determines whether it can profit by undertaking a competitive initiative. Under our scenario, the algorithm concludes not. This is because the rivals also possess the God View technology. They can quickly identify the competitive initiative and the emerging threat. The real-time data—

from tracking the behavior of rivals, potential entrants, and customers—will reveal when competitors are seeking to increase sales (including expanding into serving new territories or types of customers, such as institutional buyers). God View enables each algorithm to quickly detect any competitive maneuver, and thus to know when and how to retaliate. By responding quickly, the rivals deprive any would-be mavericks of the benefits of launching competitive initiatives, and thereby diminish the incentive to undertake these initiatives in the first place.

Our scenario assumes that each firm will have the God View technology. This increases overall transparency so that no algorithm will attempt to increase its firm's market share by secretly discounting, increasing product quality or capacity, or trying to win new customers. Such an approach would likely lead to detection, prompting retaliation and loss of profit.

So why assume that every significant firm will have God View? We base this proposition on a simple evolutionary assumption with two possible paths. Under the "survival of the fittest" path, faster, smarter operators may develop the God View and AI technology for a competitive advantage over rivals. With a clearer view of the marketplace, they can react swiftly to market changes, increase sales, and acquire more data (from their products' sensors). Rivals without the God View technology and data stream lose sales until they exit the market. Entry barriers increase over time, as weaker firms are eliminated and the leading firms acquire even more real-time data on the flow of commerce. The industry is dominated by a few self-learning algorithms that use God View to tacitly collude.

Alternatively, under a "sharing" path, the firms, as in the Predictable Agent scenario, recognize that greater profits can be earned sooner by sharing the God View and AI technology and data stream with rivals. They recognize that tacit collusion depends on the competitors quickly identifying and responding to any rival's competitive initiative, such that the first mover does not meaningfully increase sales or profits. No one will be tempted to improve their products, lower prices, or enter new markets, because others will immediately detect and punish this initiative. By enabling each firm's significant competitive initiatives to be promptly and confidently observed by others, God View reduces uncertainty. Barriers to God View may also erode as the information flows to common customers, where the rivals can then access it, and eventually across the industry.

The rise of God View has clear implications for our story of tacit collusion. The environment in which the machines operate will not necessarily be homogeneous at the outset. It will include different levels of sophistication that characterize different machine-learning algorithms, and different market players with different incentives. But the dynamics of information harvesting and trade are likely to give rise to joint efforts at data extraction and analytics. Initially, firms might track their own products, but it may be inefficient to use multiple sensors on the same product. Instead, each item may have one or two sensors, which can be openly tracked. Firms can then follow not only their own products but their competitors' products and components through the supply chain. For instance, users may set rules for how the system will handle and respond to data from their devices.[3] For example, Amazon, in 2015, was developing a platform for the Internet of Things, where a "whole ecosystem of manufacturers, service providers, and application developers [can] easily connect their products to the cloud at scale, take action on the data they collect, and create a new class of applications that interact with the physical world."[4] Its platform "also has a 'shadow' mode, which keeps the latest virtual version of a device in the system for others to interact with, even if the device itself has gone offline."[5]

## Digital Eye: Avoiding the Tit-for-Tat Death Spiral

As the flow of personal and market data increases, self-learning algorithms may use the enhanced transparency of God View to assess the company's profit-maximizing strategy for myriad strategic moves and countermoves. The use of artificial intelligence has significant implications for the effectiveness of the strategy and its legal analysis.

As in the previous chapters, the algorithm here is designed to maximize profit while avoiding any illegal activity, such as agreeing, to the extent computers can, with rival firms' computers to fix prices or allocate markets.[6] Subject to these restrictions, the self-learning algorithm continually analyzes market data and engages in self-learning and experimentation with the aim of maximizing profit. In contrast to the previous chapter, the algorithm is not mandated the task of stabilizing the market or reaching tacit collusion. Rather, it is operating independently, observing the market dynamic and identifying the optimal strategy.

With God View, computers can more easily anticipate and understand each other's moves. Their strategies thereby become more stable and predictable. Moreover, God View reduces the likelihood of retaliation where competitors cannot divine each other's signals. Uncertainty and misperception, the poison of collusion, are further reduced as each algorithm quickly obtains additional data to assess whether its rivals' actions were intentional or mistakes.

To illustrate these developments, let us consider a "traditional" form of competition between two companies and then consider how that dynamic may change under our Digital Eye scenario.

Imagine companies USA and CAN each supply their home markets, say the United States and Canada, respectively. If one company ships into the rival's home market, the rival retaliates by dumping its product in the other market. Thus, we could expect a detente—each competitor learns to sit "tight, expecting their neighbors to do the same thing."[7] This tit-for-tat strategy works well, as each side knows that swift punishment will eliminate any profits from entering.

A problem with this tit-for-tat strategy, however, is misperception, as "any mistake 'echoes' back and forth."[8] Suppose, at times, a rogue distributor transports Company USA's goods from the United States to Canada. Suppose Company USA is unaware of this. Company CAN, seeing USA's products in Canada, retaliates by selling in the United States. Thinking that Company CAN is the defector, Company USA retaliates by selling more in Canada. Consumers benefit from the competition. Even if Company USA is aware of the rogue distributor, it may be unable, given the mutual distrust, to credibly inform Company CAN that it did not direct this shipment.

Consequently, as two game theorists have noted, "When misperceptions are possible, in the long run tit-for-tat will spend half the time cooperating and half of it defecting."[9] Consumers benefit from competitive prices during periods of defection.

Now let's add Digital Eye to the mix. At an initial stage, computers can be programmed to follow a tit-for-tat strategy. The human programmers, however, will recognize that, given the risk of misperceptions, at least half the time the rivals will be in a price war. Thus, the computer can be programmed to choose among different strategies, each of which has a greater degree of tolerance (such as reverting to tit-for-tat if five trucks out of a hundred within one month cross the border). The self-learning computers, not tethered to following tit-for-tat, can optimize profits using evolving competitive strategies.

With God View, Company CAN's computer can now track the rogue distributor shipping Company USA's product into Canada. Company

CAN's computer may also detect a pattern: after the rogue distributor crosses the border, Company USA promptly curtails its supply to the rogue distributor for one year, other distributors do not ship Company USA's product into Canada for several years, and monopoly prices are stable. Thus, Company CAN's computer may learn to forgo retribution to see whether Company USA punishes the rogue distributor; if it does, a price war is averted.

One general rule of game theory is that "the better players know one another, or the more often they have been able to observe one another's strategic behavior, the more likely they are to succeed in finding focal points on which to coordinate."[10]

In the Digital Eye scenario, each firm, in continuously tracking its rivals' behavior, can find multiple points on which to coordinate. The algorithms, for example, can stabilize the market through de facto customer allocation. The self-learning algorithms may identify key customers serviced by competitors and refrain from targeting them with promotions and discounts. Such a unilateral strategy—the self-restriction of competition—could be used to avert price wars among the competitors.

## Artificial Intelligence vis-à-vis Humans

The Digital Eye dynamics not only support stable conscious parallelism; they also increase the instances in which conscious parallelism may be achieved and sustained. The tacit collusion equilibrium can become more stable with more competitors.

Humans fixing prices often trust one another.[11] With trade associations or other ringleaders, cartels generally involve many firms.[12] But without a ringleader, collusion (tacit or express) often involves far fewer firms. Why is this? Under the "traditional scenario," the market had to be sufficiently concentrated for tacit collusion to work. As U.S. competition authorities note, "The ability of rival firms to engage in coordinated conduct depends on the strength and predictability of rivals' responses to a price change or other competitive initiative."[13] It is generally easier for humans to monitor two rivals than twenty. It is also easier to learn through observation two firms' strategic behavior than twenty firms' behavior. Moreover, the punishment by one firm in a market equally divided among three firms is probably stronger than punishment by one firm with a 5 percent share in a twenty-firm market.

Computers are not trusting. But self-learning algorithms and God View could make tacit collusion among more competitors likelier. The stability needed for tacit collusion is enhanced by the fact that computer algorithms, while not trusting, are unlikely to exhibit other human biases. Human biases can always be reflected in the programming code, but if some biases are minimized (such as loss aversion, the sunk cost fallacy, and framing effects), the algorithm acts consistently on more deliberative analysis, rather than intuition.[14]

Unlike humans, the computer does not fear detection and possible financial penalties or incarceration; nor does it respond in anger. The computer can quantify the payoffs that are likely achievable through co-operation in future games, and opt for forbearance rather than punishing small deviations. It can also be more efficient in analyzing payoffs, since "solution space exploration is concentrated on 'promising' areas, and is not pre-imposed by the modeller."[15]

With the industry-wide use of computer algorithms, we may witness conscious parallelism in markets with many more players, where collusion previously would have been unstable. The computer can more easily track the behavior of numerous rivals to detect cheating. If the algorithms are all similarly programmed, it may be easier to predict the responses of the other competitors' computers. Moreover, if the computers, through self-learning, coalesce around a dominant strategy, each small firm can detect and appreciate the type of algorithms others are using. The computers can uniformly and swiftly punish any deviations by a rival. The collective punishment may be the equivalent of a monopoly controlling 95 percent of a market. The universe may close, with each algorithm sharing a common interest (profits) and inputs (similar data) that may lead to durable tacit collusion among many more competitors.

## The Empty Enforcement Tool Kit

Not only is the harm greater under Digital Eye, but the illegality is murkier. We are far removed from the first two scenarios, Messenger and Hub and Spoke, where algorithms helped humans collude. We are even beyond Predictable Agent, where humans did not expressly collude, but knew that tacit collusion was the likely outcome if each adopted profit-maximizing pricing algorithms. Although our third scenario presented greater legal uncertainty, at least the prosecutors had evidence of anticompetitive intent. In our last scenario, humans are further detached from the algorithms' tactical and strategic decisions. They don't know whether, when, or for how long the algorithms have been tacitly colluding. There is no evidence of anticompetitive intent. We can no longer assume that humans intended to create the conditions for tacit collusion.

What distinguishes our Digital Eye scenario from the other scenarios is that collusion (tacit or express) is unlikely at the outset. Recall that on the "factory floor" these computers have no specific commands that may trigger collusion. It is the self-learning in a market with a God View transparency occupied by similar-minded agents with the same profit-maximizing goal that leads to collusion, of which the firms' managers are unaware. As more data flows from online trade, mobile communications, and the Internet of Things, tacit collusion results from the algorithms' self-learning rather than human intent. The computers, in learning by doing, determine independently the means to optimize profits, based on ongoing feedback from the market. Here we see how self-learning computers may find that the optimal strategy is to enhance market transparency and thereby sustain conscious parallelism.

Our Digital Eye scenario raises many interesting liability issues. Can firms be held liable for the pricing decisions of their self-learning algorithms, when there isn't any evidence of anticompetitive agreement or intent? To what extent are humans responsible for their algorithms' actions, which they knew were possible but not necessarily probable? Granted, humans created the algorithm. Humans knew that tacit collusion was one of many possibilities. And humans relied upon, and profited from, the algorithm. However, the humans did not know that the natural and probable consequence of using the pricing algorithm was tacit collusion. The humans knew that tacit collusion was one of many possible outcomes, but they could not predict if, when, for how long, or to what extent the industry-wide use of pricing algorithms would lead to tacit collusion and inflated prices. Therefore, there is no evidence of anticompetitive intent (or an anticompetitive agreement among firms).

Nor is there express collusion among the computers to limit competition through "agreement" or concerted practice; instead, computer algorithms reduce or remove the degree of strategic uncertainty in the marketplace, evolve toward a common set of predictable strategies, and promote even greater transparency.

Lacking evidence of either an anticompetitive agreement or intent, prosecutors now have few, if any, tools to challenge the tacit collusion.

Recall that the phenomenon of tacit collusion reflects a rational unilateral reaction to market characteristics and in itself is not illegal. When we discussed the Predictable Agent scenario, we considered whether the *intentional* creation of a market environment that supports interdependence between sellers could be condemned. We noted that the application of Section 5 of the FTC Act was contingent on anticompetitive motive or intent.

Yet, when observing the Digital Eye scenario, enforcers cannot rely on the legal concept of intent, and aside from market evaluations, they have no other enforcement tools in their toolbox. Indeed, some regulators might prefer the stable market environment, where algorithms predict each other's reactions and dominant strategy, over a volatile environment where prices rise (during periods of cooperation) and fall (during periods of retaliation).

Interestingly, in a market reality in which such future collusion is possible, program designers may favor the use of similar algorithms. This seemingly benign decision may have significant implications once learning and increased data flows and transparency have taken place. The similar machines are more likely to "understand" one another and stabilize a collusive outcome.

Here customers are harmed just as much as (if not more than) in our other collusion scenarios (given fewer episodes of retaliation). We therefore witness a new reality: an anticompetitive outcome which we may not readily perceive and with no one to blame. Any reduction in our welfare is "merely" a side effect of the rise of the machines and their quest to optimize and serve.

## Change the Benchmark for Intervention?

Assuming that the computers are programmed to refrain from violating the competition laws, the company may have done all that it can to ensure compliance. From a technological perspective, programming compliance may be challenging when one attempts to capture the creation of a market dynamic such as conscious parallelism. A command not to fix prices may be simple to execute, but under reinforcement learning the algorithm will experiment with solutions including, as the competition authorities recognize, the myriad possibilities of coordinated interaction, not all of which are illegal.[16] Can the law credibly ask developers to instruct the algorithm not to react to market changes—to be inefficient?

Although conscious parallelism is legal, the question is whether such practices, when implemented by smart machines in a predictable digitalized environment, ought to be condemned. As a society, should we allow advanced technology to change market dynamics when such change results in a transfer of wealth from customers to sellers? Should we focus on the overall increase in efficiency and total welfare generated by new technology or on consumer welfare?

These questions go to the heart of competition policy and the goals of competition enforcement. The balancing point between pro- and anticompetitive effects adopted in each jurisdiction reflects the antitrust goals and values of that jurisdiction.[17] As a result, the answer to these questions may differ depending on the particular DNA of each regime and the hierarchy of its competition goals.

Also relevant is the analytical framework of the substantive prohibitions—be it administrative or criminal. In some jurisdictions a wide assumption of illegality may make it easier to treat certain actions as anticompetitive by object, or per se illegal. Also, the role of intent in establishing violations may differ between jurisdictions—and as such may affect the ease with which authorities may confront the Digital Eye scenario.

## Reflections

To some readers, the Digital Eye scenario may appear counterintuitive. After all, every risk we identify could be associated with a more competitive environment: the increase in market transparency can lower consumers' search costs. The velocity of price changes means that prices can come down faster (and go up quicker in periods of scarcity, which promotes allocative efficiency). The computers' ability to calculate the likely profits from different moves and countermoves may mean procompetitive responses that humans may not have foreseen. Greater profits could be gained by developing computers that, through self-learning or programming, opt for the profit-maximizing strategy, whereby everyone else charges the high price while the company defects (and sells more items and earns greater profits).

We do not rule out procompetitive outcomes. In some markets new entrants, changes in customers' purchasing patterns, disruptive technology, or mavericks could destabilize or prevent tacit collusion. Nor do we argue that algorithms are inherently bad, or that all markets will result in conscious parallelism.

Instead, we consider how new technologies, emerging market dynamics, and pricing algorithms, instead of representing the end of collusion, potentially mark a new, more durable form of collusion. Our scenarios illustrate how, under certain market conditions, firms' pricing algorithms could easily settle into a profit-maximizing strategy of conscious parallelism, which extracts their customers' wealth through higher prices. So at a minimum, competition authorities must be aware of these risks.

We may perceive the veneer of competition generated by the multitude of online sellers and offers. We may be unaware of any tacit collusion. Indeed, there may be periods where one firm enters another market and sells at a discount. At times, there will be retaliation. Yet behind the scenes competition may be undermined by close monitoring and retaliation. The computers' strategies may be so refined that both companies may be in the same market but not really competing. The stable equilibrium could appear to reflect a competitive equilibrium, when it actually reflects a subtle customer allocation scheme—each algorithm catering to different categories of customers.

Some readers, given the legal and ethical challenges in our last scenario, may argue strongly against intervention. But a free-market approach—by leaving these dynamics intact—would fail to protect many of us. It seems reasonable to predict that a market reality in which algorithms enhance and maintain tacit collusion is likely to intensify. Advanced technology and the availability of a wide data pool will increase the instances in which the conditions for tacit collusion are present. Fueled by profit maximization (or, to put it bluntly, greed), firms may use algorithms to transfer more wealth from purchasers (and ultimately us), further widening the gap between the stressed middle- and lower-income classes and the wealthy. Before we draw closer toward a plutocracy, a reevaluation of society's tolerance for such dynamics may be called for, which we revisit in the last part of the book.

## PART III

# Behavioral Discrimination

PART II EXPLORED how pricing algorithms can foster express or tacit collusion. In this part we consider a different theory of harm—the possibility of a single firm using data-driven algorithms to better target consumers with personalized marketing, pricing, and products.

The market reality here differs from our collusion scenarios. With collusion, pricing algorithms increase the transparency of the terms of sale and foster *coordinated* alignment of pricing. In this part we consider competitors' *unilateral* strategies to limit price transparency for highly differentiated products. We no longer have a uniformly high (supracompetitive) price. Instead, each firm seeks to charge different prices to different customers to maximize its profits. The price you are charged reflects the firm's estimate of how much you are willing to pay.

The increased personalization of our online environment has been noticeable in recent years. The advertisements you see online may differ from the ads your spouse, children, parents, or neighbors see. Indeed, we do not know to what extent the ads (or content) we see reflect our search inquiries, past purchases, or even the subject of a recent e-mail or text we wrote. As the *Wall Street Journal* reported, "the idea of an unbiased, impersonal Internet is fast giving way to an online world that, in reality, is increasingly tailored and targeted. Websites are adopting techniques to glean information about visitors to their sites, in real time, and then deliver different versions of the Web to different people. Prices change, products get swapped out, wording is modified, and there is little way for the typical website user to spot it when it happens."[1]

These personalization trends are at the heart of our discussion. Firms track you, collect data about you, develop a profile about you, and then target you with personalized advertisements to induce you to buy. We explore how the personalized, differentiated online environment affects the dynamics of competition and our welfare.

Behavioral advertising, personalized product offerings, and targeted pricing can help reduce our search costs and save time. Targeted advertisements and promotions can help us quickly learn more about relevant market opportunities. Yet, as we illustrate, behavioral discrimination can reduce our welfare. Targeted ads and marketing not only facilitate our consumption; they can influence and increase it. “Individualization” does not stop at promotions. It also affects pricing decisions—what is often referred to as “price optimization” or “dynamic differential pricing”—so that the more vulnerable end up consuming and paying more.

After a brief overview of price discrimination in Chapter 9, we explore in Chapter 10 how Big Data and machine learning will enable companies to better discriminate in pricing. But several challenges currently prevent algorithms from perfectly discriminating. While perfect price discrimination is unlikely in the short term, Chapter 11 explores behavioral discrimination, where data-driven algorithms learn how to segment us into smaller groups to target us with our own special offer. Our growing reliance on web-based platforms for searches and purchases is changing the competitive dynamics. Chapter 12 explores the social effects of behavioral discrimination in a digitalized environment. Finally, Chapter 13 considers the rise of price comparison websites (PCWs), metasearch engines and online platforms. We explore how they may inhibit price discrimination and how, at times, they could result in customers paying a higher price in a seemingly competitive market.

# 9

# Price Discrimination (Briefly) Explained

ONE WAY to price discriminate is to charge different customers different prices based on the customer's willingness to pay, irrespective of cost differences for similar services or products. Another way is to offer a range of products that "sort customers based on their purchase decisions."[1] The products are relatively similar, but some brands may be more heavily marketed.[2] Or products may be customized to individual tastes.

A simple example would be if the local merchant knew how much each customer is willing to pay for a can of Coca-Cola. The merchant could charge a die-hard Coke drinker $3 and an ambivalent cola drinker 40 cents. As competition authorities recognize, price discrimination, to succeed, requires differential pricing and limited arbitrage.[3]

## Differential Pricing

Differential pricing refers to the seller's ability to segment its customers and identify the demand elasticity of each customer or groups of customers. Suppose an art gallery did not post prices for its black-and-white Walker Evans photographs. You like a photo. In your mind, you have an idea of how much you are willing to pay. To price discriminate, the art gallery must figure out the maximum price that you are willing to pay. Economists call this the *customer's reservation price.* Suppose the gallery owner could read its customers' minds. Each customer would leave the gallery paying his or her reservation price for the black-and-white photograph—some might pay only $10; others would pay over $100. With detailed information on each customer's reservation price, the gallery can *perfectly price* *discriminate* (also known as first-degree price discrimination) by charging each customer the maximum price he or she is willing to pay.

In perfectly price discriminating, the gallery maximizes its earnings by capturing all the consumer surplus. *Consumer surplus* is basically the difference between the price you actually pay for a particular good or service and your reservation price.[4] Suppose the gallery owner loses his mind-reading powers. No longer able to perfectly price discriminate, he now charges a fixed price. In entering the gallery, you are willing to pay $500 for the Walker Evans photograph. Looking at the price tag, you see that it costs only $100. Your consumer surplus is $400 (the price you were willing to pay minus the price you actually pay). Now you can spend, save, or donate the $400.

One real-world example of near perfect price discrimination is tuition at private U.S. universities. Colleges collect detailed financial information on candidates' parents and their ability to pay; in awarding grants and scholarships, many charge less in tuition to those families with fewer resources. We say near perfect price discrimination, because some parents may be willing to pay more than the posted tuition and room and board for their child to attend a selective university. Depending on the student's acumen and the university's admission standards, this may entail making a significant donation (such as funding a new dormitory).[5]

In the old economy, many sellers lacked the detailed, accurate information to assess each customer's reservation price. Some instead *imperfectly price discriminated,* a practice also known as third-degree price discrimination. Here the sellers segmented their customers into broad categories, which were charged different prices. For instance, movie houses imperfectly price discriminated for decades by charging different prices for adults, children, students, and the elderly (on the assumption that students and the elderly generally have less discretionary income and a lower reservation price).

## Limiting Arbitrage

Limiting arbitrage is the second requirement for successful price discrimination. This concerns the seller's ability to prevent customers who pay a lower price from reselling the product to customers willing to pay a higher price. In our example, the gallery must find a way to prevent the buyer who bought the black-and-white Walker Evans photo for $10 from reselling it on eBay or Amazon to those willing to pay more. Sellers can deter arbitrage in various ways, such as customizing the product, voiding any warranties on resales, or making servicing the product more difficult or costly for customers who buy on the gray market.[6] Shipping products across borders may be impractical or too expensive. As competition authorities recognize, "Arbitrage on a modest scale may be possible but sufficiently costly or limited that it would not deter or defeat a discriminatory pricing strategy."[7]

## Dynamic Pricing

Price discrimination differs from dynamic pricing, where prices change in response to changes in supply and demand. The airline industry was one of the first to profit from dynamic pricing. Early estimates from the 1990's suggested that American Airlines, which many consider to have pioneered dynamic pricing, made, at the time, an extra $500 million per year through its yield management.[8] Today, dynamic pricing is pervasive in the airline industry, with frequent changes to pricing and availability of seat class—all aimed at maximizing profitability—by estimating customers' flexibility, outside options, and reservation price. Similar practices are common in many other industries, from hotels to sporting events. They may be used in brick and mortar outlets or online.

For instance, retailers may change prices based on the time of purchase, the availability of competing products, or the diminishing desirability of the product. Sometimes, these strategies are simple to execute. For example, supermarkets often discount bread and other groceries toward the end of their shelf life. They are not necessarily engaging in price discrimination, as the groceries—close to their expiration date—differ from fresher products. Their taste may be less appealing; they cannot be stored for a long period; they are less in demand. So to sell its remaining supply of these groceries, the supermarket lowers its price. Here the retailer is responding to a shift in demand for its remaining supply. In principle, these practices differ from price discrimination, where the supermarket charges different prices to different consumers, based on their different reservation prices, for the same bread.

In practice, the distinction between dynamic pricing and price discrimination may blur as sellers engage in more complex strategies.[9] For instance, a supermarket may engage in dynamic pricing by charging less for the same product during lunchtime and late hours (when demand is low) and increase the price in the early evening (when the outlet is packed with shoppers). This practice may also reflect price discrimination based on the time sensitivity of customers. Suppose the supermarket knows that its more price-sensitive customers will defer the purchase of bread until they head home from work. These more price-sensitive customers also know that the supermarket will discount the bread at the day's end. So is the supermarket adjusting price to changing demand or engaging in price discrimination (charging less price-sensitive purchasers more before 7 P.M., and giving the discount to more price-sensitive customers after 7 P.M.)? It is hard to tell. What might appear as pricing responsive to changing market conditions may simply be the supermarket segmenting customers by their price sensitivity.

## Why Do Firms Price Discriminate?

Price discrimination is often profitable.[10] Returning to our gallery example, when the gallery charges a fixed price, say $250, for a black-and-white photo, it obtains the sale of every customer whose reservation price is at or above that price. It loses the sale of potential customers whose reservation price is less than $250 for the photo. Moreover, the person who is willing to pay $1,000 will not necessarily buy four black-and-white photos. Instead, the customer may pay $250 for the one photo, and spend the $750 in consumer surplus elsewhere. In perfectly price discriminating, the gallery captures that consumer surplus. Moreover, it gains all the sales from customers whose reservation price is below the fixed retail price but above the photo's cost. So long as the customer's reservation price is above the gallery's cost, the gallery will profit with each sale. Essentially the gallery does not leave any money on the table. Everyone will pay the maximum amount that they are willing to spend, more photos will be sold, and the gallery will maximize its profit. By imperfectly price discriminating, the seller captures more consumer surplus than it would with a fixed price, but less consumer surplus than our clairvoyant gallery owner, who leaves no money on the table.

We'll explore in the next chapter how data-driven companies increase profits by extracting as much consumer surplus as they can—by getting them to buy things they didn't know they needed and to pay more when they can (or have fewer outside options).

# 10

# The Age of Perfect Price Discrimination?

ONE PUBLICIZED TOPIC at the 2015 *Advertising Week* event in New York was the personalization of advertising, exploring how, by 2020, all advertising "will be planned and bought using household-level and individual-level data."[1] Could the growth of Big Data and Big Analytics enable online sellers to perfectly price discriminate—where each customer pays the most he or she is willing to pay?

Competition as we know it is changing as companies experiment in devising better ways to price discriminate—far better than the imperfect price discrimination of the analog era (such as the senior citizen discount). Chronicling the advancements in tracking us and collecting our data, this chapter explores whether perfect price discrimination is on the horizon. The immediate answer, to paraphrase St. Thomas Aquinas's comment on happiness, is that perfect price discrimination is not possible on earth, but better forms of imperfect price discrimination are possible.

## Not Your Grandmother's Marketplace

You may wonder how can any company price discriminate online, when rivals, one or two clicks away, offer the same item at an everyday low price? How are online firms able to minimize the attractiveness of the consumer's outside options?

What economists and competition lawyers call "price discrimination," online industry participants call "price optimization" or "dynamic differential pricing". Dynamic differential pricing, as Massachusetts Institute of Technology Professor Yossi Sheffi has put it, is the "science of squeezing every possible dollar from customers."[2] With the rise of Big Data and self-learning price algorithms, online and brick-and-mortar sellers, not surprisingly, are experimenting with better ways to price discriminate.

Some online retailers are tracking a consumer's location, purchasing behavior, and other personal data to charge consumers with fewer options a higher price.[3] In 2012 the *Wall Street Journal* reported price discrimination by the online and brick-and-mortar office-supply superstore Staples, Inc.[4] The *Journal* found that Staples' pricing algorithms charged different prices on its website after estimating the customers' locations.[5] Staples apparently considered the customer's distance from its rivals OfficeMax's or Office Depot's brick-and-mortar stores: "If rival stores were within 20 miles or so, Staples.com usually showed a discounted price."[6] Staples is not alone. Office Depot admitted using "customers' browsing history and geolocation to vary the offers and products it displays to a visitor to its site."[7]

In 2000, Amazon.com sold DVDs to different people at different prices. Amazon called it "merely a test and ultimately refunded the price difference to people who paid more."[8] Patrick Misener, Global Vice President of Amazon, recently referred to this price test as an isolated incident: Amazon "will never use demographic information to price. We will not use purchase history or whatever other assumptions. We will not do that and never have. . . . In the case of this random price test, there is no other word for it than stupid. . . . We have not done it since. It was just dumb."[9]

In 2010 the *Wall Street Journal* reported that Capital One Financial Corp. "was using personalization technology to decide which credit cards to show first-time visitors to its website" and "was showing different users different cards first—either those for 'excellent credit' or 'average credit.' "[10]

Some online sites gave discounts based on whether or not a person was using a mobile device. "A person searching for hotels from the Web browser of an iPhone or Android phone on travel sites Orbitz and CheapTickets would see discounts of as much as 50% off the list price."[11] Rosetta Stone offered "different product 'bundles' in different places" and personalized its suggestions based on how the visitor reached its website—whether from a search engine, a social-media link, a mobile device, or a PC.[12] "We are increasingly focused on segmentation and targeting," a spokesman said. "Every customer is different."[13]

Allstate was recently criticized for its so-called "marketplace considerations" algorithm. The insurance company sought to optimize the price it charged to individuals by determining the likelihood that they would compare prices before purchasing insurance. This criticism stemmed from the fact that the algorithm facilitated non-risk-based selective pricing, which ranged from a discount of up to 90 percent off the standard rate to an increase in premiums of up to 800 percent.[14]

Brick-and-mortar stores, like their online counterparts, are also experimenting with dynamic differential pricing. In 2014 U.K. retailer B&Q, for example, was testing "electronic price tags that alter the price of an item based on the profile of the customer. The system uses data stored from loyalty cards and spending habits (via a chip in shoppers' mobile phones) to work out a price to be displayed next to the goods on the shelf. The retailer claims the move will reward loyal shoppers."[15]

Even coupons are becoming more personalized and targeted. One example is Coupons.com, an online platform that in 2015 delivered personalized promotions every month to approximately 17 million consumers. It promotes over 2,000 brands from approximately 700 consumer packaged goods companies, such as Clorox, Procter & Gamble, General Mills, and Kellogg's, as well as retailers like Albertsons-Safeway, CVS, Dollar General, Kroger, and Walgreens. Its digital platform, according to its 2014 annual report, seeks "to engage consumers at the critical moments when they are choosing which products they will buy and where they will shop."[16] By 2015, Coupons.com was targeting shoppers with display and video messages, "all informed by online data and in-store purchase behavior."[17]

Data is key here. Coupons.com starts "with demographic and geography based personalization techniques to ensure that consumers see and can easily access the most relevant content."[18] It then can "personalize content based on which offers the consumer has clicked on and what searches the consumer may conduct on our network as well as the coupons that the consumer previously activated by printing or loading to their loyalty cards and redeeming."[19] Moreover, when using Coupons.com's mobile phone grocery list app, shoppers receive personalized coupons based on their grocery list. The online platform also accesses a retailer's loyalty card data to target its shoppers. Thus, one of Coupons.com's "key strengths" is its "[p]roprietary data on consumer behavior from intent to purchase."[20]

Retailers have for years used loyalty programs to collect customer data and target them with specific ads and discounts.[21] One example is Target. When you walk into the retail outlet, you may be unaware that Target, whenever it can, will assign you and every other shopper "a unique code—known internally as the Guest ID number—that keeps tabs on everything [you] buy."[22] Whenever you use a credit card or store coupon, fill out a survey, mail in a refund, call the customer helpline, open an e-mail from Target, or visit Target's website, Target will link that data to your Guest ID.[23] You may also be unaware of the other data Target collects about you, including "your age, whether you are married and have kids, which part of town you live in, how long it takes you to drive to the store, your estimated salary, whether you've moved recently, what credit cards you carry in your wallet, and what websites you visit."[24] Plus, Target may acquire additional data about you, including "your ethnicity, job history, the magazines you read, if you've ever declared bankruptcy or got divorced, the year you bought (or lost) your house, where you went to college, what kinds of topics you talk about online, whether you prefer certain brands of coffee, paper towels, cereal or applesauce, your political leanings, reading habits, charitable giving and the number of cars you own."[25] Target collects information about your phone.[26] Target, with your consent, also tracks your "geo-location and in-store location" so that it knows how far you are from a Target store, and in what aisle you are currently.[27] Target, with your consent, also collects your Facebook ID, including your profile picture and your friends' IDs; and your Google ID and profile picture.[28] Target also collects information that you submit in any public forum, including blogs, chat rooms, or social networks, such as Facebook.[29]

Some of you don't want to be tracked online. So you may use your browser's "do not track" feature that lets you tell websites that you do not want to have your online activities tracked. Target, as of mid 2016, does not "respond" to your request not to be tracked.[30] Moreover Target uses its store cameras not strictly for security purposes but also for "operational purposes such as measuring traffic patterns and tracking in-stock levels."[31]

Why does Target go to such lengths to track you and collect data about you and your friends? To increase your loyalty and spending at Target, the *New York Times* reported. One desirable target are pregnant women. Target can sell them baby products (and likely other products once the expecting parents are at Target). Through its baby-shower registry Target knew some of its customers who were pregnant, but not every shopper revealed her pregnancy. To identify which women are likely pregnant, Target's computers examined for any patterns the shopping purchases of women on its baby-shower registry. This revealed that pregnant women were more likely to buy certain items, such as, "larger quantities of unscented lotion around the beginning of their second trimester."[32] From the wealth of purchase data, Target identified about twenty-five products that, when analyzed together, enabled it "to assign each shopper a 'pregnancy prediction' score."[33] Target could predict from the pattern of purchases (such as lotions) if the shopper was pregnant, and also, by the types of products, estimate "her due date to within a small window."[34] Target then analyzed every regular female shopper in its national database to identify those most likely to be pregnant, and offered them coupons for baby-related products, with the aim that they would buy other things at Target as well.

The *Times* reported about one father who demanded to see the manager at a Target outside Minneapolis:

> He was clutching coupons that had been sent to his daughter, and he was angry, according to an employee who participated in the conversation. "My daughter got this in the mail!" he said. "She's still in high school, and you're sending her coupons for baby clothes and cribs? Are you trying to encourage her to get pregnant?" The manager didn't have any idea what the man was talking about. He looked at the mailer. Sure enough, it was addressed to the man's daughter and contained advertisements for maternity clothing, nursery furniture and pictures of smiling infants. The manager apologized and then called a few days later to apologize again. On the phone, though, the father was somewhat abashed. "I had a talk with my daughter," he said. "It turns out there's been some activities in my house I haven't been completely aware of. She's due in August. I owe you an apology."[35]

Personalization is also prevalent in the U.K. supermarket sector, notably Tesco, which introduced in 1995 its loyalty program, Clubcard. As its former CEO noted, "We could treat customers as individuals. And we could learn what they were interested in, what their behaviours were, and we could tailor and target all of their marketing so that it was relevant to that individual consumer."[36] Why all the data? As McKinsey & Company found, it helps drive loyalty. [37]

This "personalization" extends to product offerings. As Merlin Stone, business research leader at IBM, explained: "In every sector, the top 20% of customers give 80% of the profit." No retailer would call the mechanics of their loyalty scheme discriminatory, but here, according to Stone, is how it might work: "They set a level [of service] that any customer will get, known as the 'vanilla treatment', and the more valuable customers will get even better treatment." So if, for example, you are a "cherry-picker"—someone who buys all the loss leaders and nothing else—a Tesco or a Sainsbury's might conclude that you would perhaps be better off in Lidl or Aldi. They might then raise the price of the loss leader, or just stop stocking the goods only cherry-pickers buy. More likely, however, they will actively discourage the purchase of these basic goods by placing them somewhere obscure and with little shelf space. That way, says Stone, "you don't have social exclusion, but at the same time you make sure you are focusing on selling the most profitable products to your best customers."[38]

On the flip side, companies may seek passive consumers with low engagement who will continue paying high prices for poor service—and tailor an environment for them which is free from promotions and ensures continuing purchases. Alex Chisholm, chief executive of the U.K.'s Competition and Markets Authority, observed how the "incumbent, wary of disturbing the sleeping, tip-toes around the customer dorm, with auto roll-overs, silent expiry of special offer periods . . ."[39]

## Mining, Tracking, and Profit-Maximizing

Companies can use Big Data to help their self-learning computer algorithms optimize behavioral advertisements, individualize promotions, and pricing. As Coupons.com's CEO remarked, its sophisticated products can "turn big data into smart data, using leading edge technologies such as machine learning and cross device targeting."[40] With more data about us, the pricing algorithms can better predict our behavior and preferences and thereby better price discriminate.

Loyalty cards and payment records are only the tip of the iceberg as companies track our activities and amass data about us. Indeed, brick-and-mortar retailers are increasingly tracking their customers. Unless you used a loyalty card, historically when you walked into a store, the retailer may not know who you are, what you are looking for, what else might interest you, or how much you are willing to spend. Retailers these days may use Wi-Fi and mobile phone technology to interact with shoppers as they enter the outlet.[41] They may also opt for more complex facial recognition software to identify shoppers and learn about their behavior.[42]

The FTC in 2014 hosted a seminar on mobile device tracking, dealing with "how retailers and other businesses have been tracking consumers' movements throughout and around retail stores and other attractions using technologies that identify signals emitted by their mobile devices," and how "this tracking is invisible to consumers and occurs with no consumer interaction."[43]

A year later the FTC brought its first retail tracking case against Nomi Technologies.[44] Using mobile device tracking technology (often without the customers' knowledge), Nomi tracked 9 million mobile devices during the first nine months of 2013 alone. It provided analytics services to brick-and-mortar retailers about aggregate customer traffic patterns, such as: "the percentage of consumers merely passing by the store versus entering the store; the average duration of consumers' visits; types of mobile devices used by consumers visiting a location; the percentage of repeat customers within a given time period; and the number of customers that have also visited another location within the client's chain."[45] Interestingly, what got Nomi in trouble wasn't the tracking. Instead, it was the misleading nature of its privacy policy. Nomi assured individuals that they could opt out of its tracking through its website or at "any retailer using Nomi's technology." But Nomi never required its retail clients to provide such notice. Since the retailers never notified individuals of the tracking, consumers could not opt out at the stores.[46] Had Nomi simply not posted a privacy policy, it presumably could have continued tracking.

Besides the data they collect, companies also rely on data brokers, which, the FTC found, collect a vast amount of information on consumers:

> Of the nine data brokers, one data broker's database has information on 1.4 billion consumer transactions and over 700 billion aggregated data elements; another data broker's database covers one trillion dollars in consumer transactions; and yet another data broker adds three billion new records each month to its databases. Most importantly, data brokers hold a vast array of information on individual consumers. For example, one of the nine data brokers has 3000 data segments for nearly every U.S. consumer.[47]

Besides collecting data about individuals' interests and online and offline activities, data brokers also offer analytics products. The FTC found that a few data brokers "convert their analyses into marketing scores that, for example, rank clients' customers on the basis of how likely they are to respond to particular marketing efforts or to make a purchase, their presence on the web or their influence over others, or other metrics."[48] All of this data is collected and processed with the aim of identifying customers' interests and price sensitivity to market specific products to them at specific prices (or with specific discounts).

In our modern world, much of our lives and livelihoods are intertwined with the online environment. Consider the number of hours you spend on your smartphone, tablet, or computer: at work, when communicating with others, when purchasing goods and services, for entertainment, and socializing. Then add the times when data is passively collected about you, such as your location, whenever you carry your smartphone. Then consider how much more data will be collected about you with the growth of driverless cars, the Internet of Things, and smart watches. In these digitalized algorithm-based markets, sellers will invest more money and time to better "shadow" our activities, harvest data on our behavior, and identify key moments to induce us to buy at the right price.

## Is Perfect Price Discrimination Near?

So as the volume, variety, and value of personal data increases, and self-learning pricing algorithms improve, will more sellers be able to perfectly price discriminate? To appreciate how competition can evolve, we must first understand why *perfect* price discrimination is unlikely in many markets in the near future. (One unfortunate exception is real estate—where both of us, in the overheated Oxford and Washington, DC, real estate markets, submitted bids that reflected the most we were willing to pay above the asking price for a property. But leaving our personal expenditures aside, let us focus on the online environment.)

### Insufficient Data

First, to perfectly price discriminate, a firm must develop an algorithm that can identify each customer's reservation price. Each consumer's reservation price is a latent variable—that is, a variable that cannot be directly observed but may be inferred. Online sellers often cannot directly observe, when the customer goes online, how much that particular customer is willing to pay for a particular item. Instead, the pricing algorithm collects and processes data that observes transactions and consumer behavior, such as under what conditions and price points consumers do purchase and when they do not.

So one impediment to perfect price discrimination is insufficient data. Although the algorithm has a lot more personal data than the brick-and-mortar retailer of twenty years ago, the algorithm still has insufficient data for any particular customer: the customer may never have bought the item before; and the customer's behavior may never have signaled how much he or she is willing to spend. To accurately predict an individual's reservation price would require sufficient data to identify and measure each of the many variables that affect that reservation price.

## Predictability and (Ir)rationality

Second, to perfectly price discriminate with incomplete data, any prediction would likely be based on assumptions, such as consumers having stable premises and a preexisting reservation price. The problem is that multiple dispositional and situational factors can affect purchasing decisions, and consumers may not even know their reservation price.

Neoclassical economic thinking had simplifying assumptions on human behavior, namely that market participants are rational, self-interested, and have willpower. But individuals, as the behavioral economics literature explores, are far more complex. Over the past twenty years, the economic literature has increasingly recognized and measured how (1) willpower is imperfect, (2) biases and heuristics can affect decision making, and (3) many people are concerned about fairness.[49]

Participants in one experiment were asked how much they were willing to pay for a cold beer that they would drink on the beach.[50] The experience is the same (drinking on the beach a specific brand of beer which one's friend procured from a nearby place). The only difference was whether the beer came from a nearby expensive hotel or a run-down grocery store. Most consumers were willing to pay more if the beer came from the fancy hotel ($2.65) than if it came from a run-down grocery store ($1.50). Even though the experience is the same, the reservation price differed significantly.

Consumers cannot always predict their reservation price, and may discount factors that actually affect their reservation price. For example, does an inflated list price affect one's reservation price? In one experiment, experienced real estate agents predicted it would not, but the results showed otherwise.[51] Each subject received a ten-page packet of information that real estate agents typically use to evaluate residential property, on a particular home.[52] The independent variable was the house's listing price relative to its appraised value. The local real estate agents claimed that most real estate agents would detect as "obviously deviant" if the listing price were inflated by more than 5 percent from its appraised value.[53] In two conditions, the listing price was either 4 percent above or below the house's appraised and actual listing price ($74,900). In the two other conditions, the listing price was 12 percent above or below the appraised value. For both the real estate agents and lay persons who participated in the study, the listing price significantly influenced their valuations. Even though the house was the same, and even with the same market data, the higher the house's listing price, the higher the participants' estimate of the property's appraised value.[54] The listing price (whether inflated or discounted) significantly biased both the amateurs' and real estate experts' estimates. The only difference was that the amateurs acknowledged using the listing price; the experts "flatly denied" considering the listing price.

We, like the real estate agents in the study, may also discount the significance of an inflated list price. One example is the advertised "discount" off the list price. One Amazon listing promoted how buyers saved $2,131.33 (99%) for a cat litter pan.[55] Likewise, buyers seemingly saved a lot on a six-ounce bag of dog treats; its list price of $822 was discounted to $7.90.[56] No one would likely pay $2,131.33 for a kitty litter pan or $822 for dog treats. Nonetheless, given the behavioral literature on anchoring effects,[57] our reservation price may be affected by an inflated list price, and other factors we claim we ignore or are unaware of. Indeed, when you travel abroad, you may be shocked initially by how expensive or inexpensive things are; eventually you adjust.

So with bounded rational consumers with imperfect willpower, the move toward perfect price discrimination requires identifying all the key parameters for each individual, and observing and improving the estimate of each parameter. Does a customer's reservation price for a can of Coca-Cola change if the preceding three days exceeded a certain temperature; whether the customer is on a date; whether the person just finished exercising; whether the purchase is from a vending machine or a store; and whether or not the purchase is at an airport?

We can see that a pricing algorithm tailored for each individual would require an enormous volume and variety of data. It must identify all the relevant variables that affect a particular person's reservation price. Each buying experience may differ: the day of the week; time of day; where the person is; what else they looked at on the Internet; the individual's sex, age, education, and demographics; the order of goods presented; and their relative prices.

### Sample Size

A third impediment to perfect price discrimination is that the algorithm would need a sufficient sample size for its hypothesis test to be robust. To identify all the relevant variables that affect a particular person's reservation price, one generally must conduct multiple experiments.

So how many observations would the algorithm need to accurately predict an individual's reservation price? The algorithm may have the minimum sample size for daily or weekly purchases, but not for infrequent purchases, such as television sets, automobiles, and so on.

Consequently, to perfectly price discriminate, the pricing algorithm would have to factor in the myriad dispositional and situational factors that could affect an individual's reservation price. This requires the algorithm to identify additional variables that can affect an individual's reservation price and have the data to accurately predict how the individual would likely react under each scenario. The pricing algorithm may not have enough trial-and-error opportunities to identify each variable needed to calculate accurately the individual's reservation price. If the algorithm cannot calculate each person's reservation price under those particular behavioral and situational factors, the algorithm cannot perfectly price discriminate.

## Reflections

Companies have for decades practiced cruder forms of imperfect price discrimination, such as discriminatory pricing based on broad groupings of individuals (youth, students, adults, senior citizens) and cruder independent variables (such as the customer's location, the day of the week, or time of day).

Advances in tracking our behavior, collecting and analyzing our personal data, and implementing differential pricing have improved firms' ability to price discriminate. Nonetheless, unless customers accurately reveal their reservation price (such as in heated real estate auctions), in the near future, pricing algorithms cannot identify each individual's reservation price in many online markets. At times, the algorithm may be better at predicting our behavior than we are. But ultimately every pricing algorithm model will be wrong. The algorithm's challenge is to calculate how wrong it is and improve itself.

As we'll see in the next chapter, with advances in pricing algorithms and the collection of a greater variety and volume of personal data, online companies can more closely approximate our reservation price. They may find the road to perfect price discrimination and increased profits irresistible. They will compete in refining their pricing algorithms' many independent variables, and in more precisely classifying individuals into smaller subgroups. As the European Data Protection Supervisor observed:

> Economic theory shows that a provider maximises profit when it is able to identify (and then, where appropriate, price-discriminate) between customers. In principle, if all patients remain unidentified, a pharmaceutical company will likely set a price for a drug which is the same for everyone. However, if the same company is able to identify who, among its customers, has more financial resources or has a greater need for the drug, it might be able to charge those customers a higher price (e.g. through a "premium" version of the drug that claims to be more effective). Big Data might facilitate such group discrimination. There is therefore a direct relationship between the availability of large sets of health data and the potential profitability of a number of industries active in the healthcare sector, as businesses will be able to better target their commercial propositions and thus draw a greater profit from the use of personal data. In a self-reinforcing trend, greater chances of profit will turn into an even greater demand of data and greater need for effective safeguards against abuses.[58]

As we'll see, as the volume of data collected increases, and the data analytics and categorization of consumers improve, self-learning computer algorithms will continually inch closer to perfect price discrimination.

# 11

# The Rise of "Almost Perfect" Behavioral Discrimination

PERFECT PRICE DISCRIMINATION may be unattainable. But "almost perfect" behavioral discrimination may be within reach. In the online world where Big Data meets behavioral economics, we are witnessing an emerging category of price discrimination—*behavioral discrimination*. Here firms harvest our personal data to identify which emotion (or bias) will prompt us to buy a product, and what's the most we are willing to pay.[1] Sellers, in tracking us and collecting data about us, can tailor their advertising and marketing to target us at critical moments with the right price and emotional pitch. So behavioral discrimination increases profits by increasing overall consumption (by shifting the demand curve to the right and price discriminating) and reducing consumer surplus.

This chapter explores how Big Data and Big Analytics are fueling this arms race. Both online and brick-and-mortar stores are rapidly seeking to improve their consumer profiles. Our online and increasingly offline activities are progressively being tracked. The aim—as we'll illustrate—is to approach ever closer to perfect behavioral discrimination.

## Big Data, Learning by Doing, and the Scale of Experiments

In approaching perfect behavioral discrimination, self-learning algorithms, while not identifying each customer's reservation price, may segregate us in ever smaller reference groups and refine for each group the explanatory variables (that among other things capture biases and situational factors). The algorithms refine the crude divisions of yesteryear (such as senior citizens and students) to more detailed, segmented reality, where people are matched to groups with similar price sensitivity and purchase behavior. So the march to “almost perfect” behavioral discrimination will involve labeling you in countless ways and placing you in smaller groupings of consumers with common situational and dispositional factors.

How is this possible? This is where Big Data, learning by doing, and the scale of experiments come into play. Pricing algorithms can collect data on you and other people. Users are divided into subgroups of like-minded, like–price-sensitive individuals, who share common biases and levels of willpower. Pricing algorithms can use data on how other people within your grouping react to predict how you will likely react under similar circumstances. This then enables the algorithm to more accurately approximate the user’s reservation price, observe behavior, and adjust. Thus, the more times the algorithm can observe what you and others within your grouping do under various circumstances, the more experiments it can run, the more it can learn through trial and error what your group’s reservation price is under different situations, and the more it can recalibrate and refine (including shifting you to another group).

Here is where scale comes into play. To optimize their performance, firms will refine their pricing algorithms, which in turn requires continually refining the groupings and independent variables. Firms will get as much relevant data as possible and to get as many opportunities to test and refine their algorithms. Every actual or potential consumer transaction gives the company an opportunity to study consumer behavior and adjust both the weight attributed to each variable and the categorization of users. Firms will compete in more accurately segmenting customers into subgroups to optimize pricing and profits. This is so because technology enables operators to bypass challenges in identifying particular consumers’ reservation price, targeting the consumers, and preventing arbitrage. The more data that the firm quickly collects on users, the better able it can segment them; the more opportunities it has to observe individual behavior; the more the algorithms can learn when they predict correctly; and the more the algorithms can refine and retest when they predict incorrectly.

The data flow, like a hamster wheel, whirls continually. To better categorize even smaller groups of individuals, firms will need more data. This will accelerate the Internet of Things, as firms compete to collect data on consumers’ activities in the home, at work, and outside. Smart thermostats, cars, utensils, and watches will help firms refine their consumer profiles, and will serve as platforms for behavioral advertisements. Information harvesting will go beyond purchasing decisions. For instance, online providers and sellers may know and make use of customers' locations via mapping software, their browser and search history, their friends and links on social networks, the media they stream, their preferences, and the contents of their online reviews and blog posts.[2]

## The Reality of Behavioral Discrimination

A joke in IT circles illustrates the speed of the harvesting and usage of such data: In the middle of an important board meeting, one manager anxiously requests to leave the room. "Why?" asks the chairwoman. The manager, pointing to his smartphone, replies, "I just received a string of ads on alarm and security systems—I think my house was just burgled."

A report by the U.K. Competition and Markets Authority (CMA) shows the joke's underlying reality. First, the joke reflects the velocity of being targeted. As the CMA found, "This real-time method of buying and selling inventory can enable adverts to be served to users' devices within milliseconds, offering increased accuracy by targeting refined audiences rather than the previous method of buying audiences in bulk tranches of thousands."[3] The U.K. Internet Advertising Bureau estimates that "in 2013, 28% of all digital display advertising was traded programmatically and that by 2017 this could increase to between 60% and 75%."[4]

Second, as the joke reflects, firms are already combining and analyzing data about consumers to make inferences about them. Using case studies in three sectors (auto insurance, clothing retailing, and game apps), the published literature, and meetings with key parties, the CMA found that firms are using detailed consumer data to increase consumption of their goods and services.[5] Firms increase consumption through targeted advertising, "which can increase the conversion rate from advertisements to purchases of a range of products and services available," and by "using data on consumers' previous purchases or areas of interest to cross-sell related products and services (for instance 'you may also be interested in . . .' messages on websites)."[6] The CMA found such concerns were greater in the digital advertising space, with the "growth in programmatic advertising—the fully automated buying and selling of digital advertising space."[7]

If you have an iPhone, Apple is categorizing you. When updating its iOS operating system in 2015, Apple discussed how its advertising platform, iAd, "creates groups of people who share similar characteristics and uses these groups for ad targeting."[8] Apple uses the data it collects "to determine which groups you are assigned to, and thus, which ads you receive."[9] Apple stated that to protect "your privacy, your information is used to place you into groups of at least 5,000 people."[10]

So in which categories will you fall? That depends on a variety of personal information Apple will harvest, including:

- Account Information: Your name, address, age, and devices registered to your account.
- Downloads: The music, movies, books, TV shows, and apps you download.
- Device Information: Your keyboard language settings, location, device, and connection type.
- Activities in Apple Apps: The topics and publications you follow for news, the types of music you listen to in Apple Music, the offers you choose to add to Wallet.
- Activities in other Apps: Information that other app developers (with your permission) provide Apple regarding your in-app purchases and activities such as game-level completion.
- Advertising: Your interaction with advertising delivered by iAd.
- Other Segments: Information that third parties may also share with Apple, including information on groups of people in which you belong (so long as no individual data is shared).[11]

Apple's privacy policy explains how users can clear existing data collected on them (but not necessarily how they can stop being tracked and the data from being collected). Apple also explains how users can limit its targeted advertising, which is not self-evident.[12]

Needless to say, we use Apple to illustrate an industry trend. The FTC in 2014 described how data brokers were developing complex models to predict consumer behavior, primarily by categorizing and segmenting consumers:

> The data brokers can identify a group of consumers that has already bought the products in which the data broker wants to predict an interest, analyze the characteristics the consumers share, and use the shared characteristic data to create a predictive model to apply to other consumers. For example, a data broker can:
>
> - Analyze the characteristics of a subset of consumers that purchased camping gear in the last year, identify consumers in its database that

share these characteristics, and create a segment called "Consumers Interested in Buying Camping Gear";

- Identify a group of consumers that sought chargebacks on their credit cards in the last year, analyze the characteristics those consumers share, and use the characteristic data to predict "Consumers that are Likely to Seek a Chargeback"; or
- Analyze data on consumers in this manner to predict which consumers are likely to use brand name medicine, order prescriptions by mail, research medications online, or respond to pharmaceutical advertisements.[13]

## Increasing Demand by Exploiting Biases

Behavioral discrimination isn't just categorizing us into groups that are charged different prices. It is also about getting us to buy things that we may not need or have previously wanted. One popular Internet quote is "We buy things we don't need with money we don't have to impress people we don't like."[14] So to increase demand for their products and services, companies will likely appeal to our emotional wants.

As noted earlier, most of us are not rational, self-interested individuals with willpower. The field of behavioral economics, as one of its pioneers, Amos Tversky, noted, has quantified what every good advertiser and car salesman already knew.[15] We have cognitive biases, which refer to our tendency to react, think, or operate in a certain way, which diverge from assumed rationality. Biases can be observed. But businesses and governments can trigger consumers' biases to achieve certain goals.[16] As noted by Cialdini, factors such as relative pricing, reciprocity, and the illusion of scarcity play a powerful role in the persuasion game.[17]

One competition authority official told us in 2015 that the behavioral economics literature identifies over one hundred human biases linked to decision making, information processing, memory, and social interaction. Companies could surely identify a number of biases, he remarked, in order to better price discriminate online. An algorithm-fueled environment will provide firms with unparalleled information about our desires, behavior, interests, search patterns, and willingness and ability to pay.

Below, we explore a few of the numerous "exploitable" consumer biases, which firms may use to promote (or reduce the consumer outrage over) their behavioral discrimination.

## Use of Decoys

We rarely choose goods and services in absolute terms. Instead, we base our choices on the product's relative advantage or disadvantage to other things.[18] How firms position their products can influence the purchase decision. By adding an expensive (albeit inferior) choice, for example, the marketer can steer consumers to a more expensive second choice. As the consulting firm McKinsey & Company reported, "many restaurants find that the second-most-expensive bottle of wine is very popular—and so is the second-cheapest. Customers who buy the former feel they are getting something special but not going over the top. Those who buy the latter feel they are getting a bargain but not being cheap."[19]

In one study, a hundred MIT students were offered three subscription choices for *The Economist* magazine: (1) Internet-only subscriptions for $59 (sixteen students chose this option); (2) print-only subscriptions for $125 (no students); and (3) print-and-Internet subscriptions for $125 (eighty-four students).[20] When the "decoy" second choice (print-only subscriptions) was removed and only the first and third options were presented, the students did not react similarly.[21] Instead, sixty-eight students opted for an Internet-only subscription for $59 (up from sixteen students) and only thirty-two students chose print-and-Internet subscriptions for $125 (down from eighty-four students).[22]

Online sellers can use decoy products or pricing to push consumers toward higher-margin products. Apple, for example, can make its recently launched $349 Apple Watch appear reasonable by adding thirty-eight different designs, ranging between $349 and $17,000.[23] Few, if any, will pay $17,000 for an Apple Watch, but it makes the $349 watch seem more reasonably priced.

A study has been carried out to determine whether the introduction of a decoy software option can increase demand for the real option by exploiting consumers' relative assessments of prices.[24] The study used Microsoft's portfolio of Windows 7, which included a Windows 7 Professional bundled with a 4-GB pen drive and a decoy Windows 7 Professional option priced the same as the bundle. The study found that the presence of the decoy makes the bundle option "a lucrative one and has the potential of increasing overall revenues by 15 per cent."[25]

Companies are already using these tactics. They may purposefully make the least expensive private-label products less appealing visually in order to nudge customers to higher-priced midrange private-label or other higher-margin goods. Indeed, one concern is that the commercial airlines are purposefully degrading the experience of flying coach to push less price-sensitive customers to "coach plus" or business class.

## Price Steering

Besides offering decoy choices, firms can nudge consumers closer to their reservation price by the way they present options online. As a 2015 White House report explains, "Steering is the practice of showing different products to customers in different demographic groups. In the online environment, steering occurs when a web site alters its search results based on information about a potential customer."[26] For example, for consumers with higher reservation prices, the online seller would likely present first the premium, more expensive brands.[27] As the U.K.'s competition authority noted, "Firms may do this by restricting the products that are displayed to consumers or by varying the order in which products are listed on their website to display relatively poorer or better quality products first depending on the information they collect about consumers. This raises the possibility of some consumers being exploited with low quality products that are sold at the same price as higher quality products."[28]

Thus, under the new competitive paradigm, the online experience will differ, as firms personalize how, and in what order, they present the products. The offerings on the web page may be tailored depending on your zip code, household wealth, gender, and age. So it will be harder to know what others see. At most, you might know what other people of similar age in your zip code see if they have similar professional and educational backgrounds, visited the same websites and have similar purchase histories. As personalized offerings increase, search costs will also increase for consumers seeking to identify the "true" market price.

One older example was the travel website Orbitz, which steered Mac OS X users toward "more expensive hotels in select locations by placing them at higher ranks in search results."[29] One 2014 study found additional evidence of price steering and price discrimination.[30] The study examined sixteen popular e-commerce sites involving general retailers and hotel and rental car booking sites, and found evidence of price steering and price discrimination on four general retailers' websites and five travel sites. For example, the travel website Expedia was assigning users to one of three buckets, and steering users in some buckets toward more expensive hotels.[31] Travelocity offered different hotel search results depending on whether users were browsing on their iPhone or iPad or browsing from "Chrome on Android, Safari on OS X, or other desktop browsers."[32] Travelocity gave people using their iPhones and iPads better prices on some hotels.[33] In contrast, Home Depot was steering users on mobile browsers toward more expensive products.[34]

## Increasing Complexity

To better discriminate, companies can take advantage of consumers' difficulty in processing many complex options. Companies deliberately increase the complexity by adding price and quality parameters, with the intent to facilitate consumer error or bias, to their advantage. Here, firms add options and increase their products' complexity to manipulate consumer demand by making it difficult to appraise quality and compare products.[35] Firms increase the consumers' search and evaluation costs, thus driving consumers to rely on basic signaling that benefits the firms. Firms increase the complexity of their contracts to increase their customers' switching costs and to more effectively price discriminate.[36] In short, firms increase complexity to render market conditions less susceptible to effective competition.

One study found that as competition in U.S. telecommunication markets increased, telecommunication providers offered more complicated, bad-value price plans.[37] The increased competition caused "cellphone providers to focus on raising profitability through creating confusion and gaining from consumer mistakes."[38] A criticism of the mobile phone industry is its deliberately increasing choice complexity to exploit consumers:

> Too much and too complex information have made it difficult for all but the most technologically savvy to choose the product best suited to their needs. Customers unable to choose based on attribute preferences appeared to make their choices based on price, only to later find out that the product did not meet their needs. This tendency is further complicated by a lack of comprehension. When provided with multiple options, consumers are only able to choose the least expensive about 65% of the time. When faced with the complex options of base service fees, additional features and cost for usage overages, customers tend to choose plans that greatly exceed their requirements, significantly overpaying each month rather than risking the chance of occasional overage costs.

> Problems navigating the telecommunications industry are not limited to older adults, although they may be particularly vulnerable.[39]

Similarly, another recent study found that a greater variety of price plans in U.K. electricity markets led more consumers to choose suboptimally, harming their welfare.[40] Consumers may find it difficult to accurately compare the true cost of a deal by one energy provider with that of another. Indeed, the U.K. Competition and Markets Authority (CMA) noted that the fundamental characteristics of energy consumption presented two barriers to consumers' engagement with the retail energy market: (1) the absence of a quality measurement for the differentiation of energy, which may "fundamentally reduce consumers' enthusiasm for, and interest in, engaging in the domestic retail energy markets, leading to customer inertia";[41] and (2) the fact that the information contained in conventional meters is not immediately accessible. Customers or the supplier generally read conventional meters infrequently, which "adds considerably to the complexity and opacity of gas and electricity bills."[42] Moreover, "the perception of the complexity and burden of the process" of searching for an alternative supplier limits successful switching.[43]

Complexity has also been shown to limit switching between service providers and to increase the likelihood of customers retaining the default option.[44] Ultimately, companies can discriminate by designing the number and types of options they offer to exploit consumers' cognitive overload. Similarly, they may support complexity by increasing search costs. Online firms may resort to age-old tactics, such as selling the same product but under different labels. This is legendary in the U.S. mattress industry. *Consumer Reports* noted the tricks the mattress industry uses to make it difficult for consumers to compare models and negotiate a better price, including when "manufacturers sell the identical or nearly identical mattresses to different retailers with exclusive model names."[45] Each retailer tells the puzzled customer, "We don't sell that Sealy brand, but we offer a superior mattress from Sealy."

## Drip Pricing

Online companies can shroud their behavioral discrimination by making the price terms more complex. The U.K. competition authority experimented with five common price frames: (1) "drip pricing," where a lower price is initially disclosed to the consumer and additional charges are added as the sale progresses; (2) "sales," where the sale price is referenced off an inflated regular price (e.g., was $2, now $1); (3) "complex pricing" (e.g., three-for-two offers), where the unit price requires some computation; (4) "baiting," where sellers promote special deals with only a limited number of goods available at the discounted price; and (5) "time-limited offers," where the special price is available for a short period.[46] Consumers made more mistakes and were especially worse off under drip pricing and time-limited offers.

The Executive Office of the President in the United States gave other examples of how firms may use complex or opaque pricing schemes to screen out less sophisticated buyers:

> [C]ompanies may obfuscate by bundling a low product price with costly warranties or shipping fees, using "bait and switch" techniques to attract unwary customers with low advertised prices and then upselling them on different merchandise, or burying important details in the small print of complex contracts. When these tactics work, the economic intuition that differential pricing allows firms to serve more price-sensitive customers at a lower price-point may even be overturned. If price-sensitive customers also tend to be less experienced, or less knowledgeable about potential pitfalls, they might more readily accept offers that appear fine on the surface but are actually full of hidden charges.[47]

## Imperfect Willpower

Consumers with limited patience will often pay a higher price. This has been known for decades. People could save money by waiting until a movie appeared in a second-run theatre,[48] or for the fiction hardcover to appear in paperback. Thus, the more the online site can encourage impulse purchases (such as "scarcity marketing" that promotes the dwindling stockpile of items and the many buyers looking at the item), the less likely the consumer will comparison shop.

Likewise, online retailers may shroud their behavioral discrimination by offering discounts to consumers with greater willpower. Baymard Institute, a retailers' Internet research firm, found that 68 percent of online shopping carts are abandoned after initial click-throughs. Consumers who abandon an online transaction may be rewarded. Indeed, it is not uncommon, when purchasing online, that a second visit to a site, following incomplete purchase, would result in a pop-up screen with a discount code. Such practices reflect the assumption that a customer who delayed purchase may be less eager, more price sensitive, or considering other purchase options. Coupon site Rather-be-shopping.com, for example, "found 17 well-known retailers (including Bed, Bath & Beyond, Macy's, and Williams-Sonoma) that offered coupons (ranging from 20% off to free shipping) to customers who left their carts."[49]

### Minimize the Perceived Unfairness through Framing Effects

Many consumers, as the next chapter discusses, feel cheated by price discrimination. They are deprived of a market price. To address this, firms can rely on framing effects when price discriminating. The behavioral economics literature suggests that "framing effects" (how the issue is worded or framed) do matter.[50] Here the price discrimination is framed not as consumers paying more, but rather as some getting a discount.

Credit cards are one example. Merchants often tell consumers of a discount if they pay with cash. Merchants never tell consumers they must pay more if they use a credit card. The net effect is the same: credit card customers pay more than cash customers. But how the choice is framed (either as a discount or as a surcharge) does matter. To illustrate, after the credit card companies' no-discrimination rule was abolished, Dutch merchants could impose surcharges or offer discounts based on how the customer was going to pay. Of the consumers surveyed, 74 percent thought it (very) bad if a merchant asked for a surcharge for using a credit card. But when asked about a merchant offering a cash discount, only 49 percent thought it (very) bad, with 22 percent neutral and 21 percent saying it is a (very) good thing.[51]

In another experiment, a majority of people said that a car dealer's elimination of a $200 discount off the list price for a popular vehicle was acceptable; 71 percent viewed selling the vehicle $200 above the list price as unfair.[52] Both scenarios again produce the same effect—a higher net retail price—but the direction of the deviation to or from the established reference point differed.

Thus when price discriminating, online companies will not likely impose a surcharge on those willing to pay more. Instead, they will likely start with a higher list price, and then selectively vary the level or size of discounts. Moreover, consumers' incentive to search for the outside option will vary, depending on whether there is a price increase versus a price decrease. As the OECD noted, consumers "may search more aggressively for alternative suppliers when prices increase, but less aggressively when prices are stable or slowly decreasing."[53] Consumers typically base a deal's "value" on the deviation from an established reference point (for example, a sale of 20 percent off the regular price). Many consumers may be less concerned when the steady discounts are eliminated (such as the 20 percent discount) than when list prices increase (although both have the same net effect). Deviations from the perceived reference point are marked by asymmetric price elasticity: consumers are angrier about, and more sensitive to, price increases than to the elimination of a discount or the maintenance of prices during periods of deflation.[54] Thus the road to near-perfect behavioral discrimination will likely be paved with personalized coupons and promotions: the less price-sensitive online customers may not care as much if others are getting promotional codes, coupons, and so on, as long as the list price does not increase.

Online sellers will increasingly offer consumers with a lower reservation price a timely coupon—ostensibly for being a valued customer, a new customer, a returning customer, or a customer who won the discount. The coupon may appear randomly assigned, but only customers with a lower reservation price are strategically targeted. For example, when American Airlines introduced dynamic pricing, it framed "the 21-day advance-purchase requirement as a chance to buy 'super-saver' fares."[55] Indeed, the price discrimination can happen on other, less salient aspects of the purchase. Retailers can offer the same price, but provide greater discounts on shipping (or faster delivery), offer complimentary customer service, or better warranty terms to attract customers with lower reservation prices, greater willpower, or more outside options.

Another way to frame behavioral discrimination in a palatable manner is to ascribe the pricing deviations to shifting market forces. Few people pay the same price for corporate stock. They accept that the pricing differences are responsive to market changes in supply and demand (dynamic pricing) rather than price discrimination (differential pricing). So once consumers accept that prices change rapidly (such as airfare, hotels, etc.), they have lower expectations of price uniformity among competitors. One hotel may be charging you a higher price because of its supply of rooms (rather than discriminating against that particular user). When your friend inquires about the same room, the different price could reflect an interim change in supply or demand. Rarely will you and others simultaneously search on the same website for the same room and communicate your findings. Thus, consumers may not know when pricing is dynamic, discriminatory, or both.

## Where Does the Power Reside?

The power in our scenario favors those who hold and sell our personal data. These informational asymmetries support near-perfect behavioral discrimination.

The first asymmetry is between the discriminating firm and its customers. The firm collects data on its customers and designs the algorithm. The firm may not know exactly how its pricing algorithm derived a particular price for a particular customer (see Chapters 7 and 8), but the firm does know the algorithm's ultimate strategy (namely to increase profits by better discrimination). The firm, unlike its customers, also knows the magnitude of the price disparity among the various consumer categories.

We, on the other hand, are in the dark on this data-driven behavioral discrimination. The list of "known unknowns" is troubling. In many jurisdictions, including the United States, we do not know:

- who has been collecting data on us;
- the uses to which our personal data will be put;
- the other potential recipients of our personal data;
- the nature of the personal data collected about us;
- the categories in which we are placed;
- the means by which our personal data is collected;
- the quality of the data (and inferences made about our likely behavior); and
- what, if any, options we have to control how the data is used.

Nor, in most countries, do individuals as of this book's publication date have the right to view the data, and to verify or contest the data's accuracy. Nor can we challenge the accuracy of categories in which we are placed. We may know that we are getting a lot of ads—such as substance abuse, lower-quality credit cards, or checking our prison records—but not know why these ads are directed at us.[56]

The second level of informational asymmetry is between the firm and its competitors. Because perfect price discrimination will remain elusive, firms will seek to refine their categorizations of consumers. Not all the firms will have the same data. Firms with a data advantage will likely have better algorithms that can better segment customers, and for each group they will likely be better at identifying the group's average reservation price (and a narrower distribution of individual reservation prices). Rather than converge under the tacit collusion scenarios, the pricing algorithms here might diverge, with some firms' algorithms improving and others remaining cruder. If some competitors are closer to perfect behavioral discrimination than others, that might suggest greater competitive opportunities. Consumers with (perceived) high reservation prices could switch to competitors with cruder algorithms (so to get better deals). Consumers with low reservation prices could switch to competitors with more sophisticated algorithms (where the product they are offered will likely be cheaper).

The problem is that firms that discriminate will generally seek to reduce the customers' outside options by reducing price transparency and increasing the customers' search costs. This may be easy. Some customers are known as "sleepers," a term for customers "who out of indolence or ignorance don't shop but instead are loyal to whichever seller they've been accustomed to buy from."[57] Switching costs may therefore be higher than one assumes, despite perceived competition being only a click away. Illustrative is the behavior of many users who indicated that when a search result fails to meet their expectations, they will "try to change the search query—not the search engine."[58]

The firm might differentiate its products and services, perhaps through customization. When products and services are customized to individual tastes, there is no longer a common benchmark and it can become harder for customers (and competitors) to compare products and prices. The customization and disappearance of a competitive benchmark could also make it harder for potential entrants to assess what price they should charge to convert sufficient customers for their entry to be profitable.

Moreover, as more online retailers engage in dynamic, differential pricing, it will be harder for consumers to discover a general market price and to assess their outside options.[59] For example, if Amazon would engage in behavioral discrimination, the customer might turn to Walmart. But if Walmart and other retailers engage in behavioral discrimination for customized products, it will be increasingly difficult for consumers to find the competitive benchmark. A White House report summarized this trend toward personalized pricing and individually-targeted marketing campaigns: "A review of the current practices suggests that sellers are now using big data and digital technology to explore consumer demand, to steer consumers towards particular products, to create targeted advertising and marketing offers, and in a more limited and experimental fashion, to set personalized prices."[60]

Importantly, that power is not unlimited. It depends on the level of competition, the availability of outside options, and public perception of the unfairness of price discrimination. It is also affected by the ability to harvest and process data, economies of scale, and network effects. The power to price discriminate may be curtailed by a possible pushback from consumers, in the form of programs designed to outsmart price algorithms and trigger discounts or lower prices. A market may emerge in which countermeasures develop for individuals to migrate between groups or obstruct segmentation.

## Reflections

While technology, financial, and other barriers may prevent sellers from perfecting behavioral discrimination,[61] the online environment is still much more susceptible to such measures than the traditional brick-and-mortar shops. So whatever the measures and countermeasures, we are moving away from the old competitive environment where the store clerk stamps one price on the item, which everyone pays. Customers in the coming years may still know the price of milk at several retailers, and retailers will still compete by lowering prices for some items or improving service. But for many products and services, the growth of Big Data and Big Analytics will lead to greater opportunities to acquire information on the preferences, weaknesses, and elasticity of demand for discrete groups of customers. The more detailed such information is, the easier it may be to segment the customer base and approach perfect behavioral discrimination.

We may not know when, and the extent to which, we are victims of behavioral discrimination.[62] Often markets exhibit weak consumer engagement.[63] Only a minority will likely invest time in countermeasures to curtail tracking. Even the astute, to benefit from discounts through loyalty programs, must reveal their identity. Moreover, the loyalty discounts are more salient than the perceived savings in remaining anonymous.

These processes not only affect us, but may equally affect small and medium size enterprises (SMEs), which may lack the sophistication and resources to cope with leading market players. As noted by CMA Chairman, David Currie: "Compared with the large corporation, SMEs typically have scarce skilled resource, their transactions are more sporadic, their information is limited and their access to high volume data processing and analytics is limited. So they may be much more like individual consumers, so that their biases risk being used by large companies, just as for individual consumers."[64]

An interesting and challenging question which emerges from our discussion is whether the enhanced capacity to price discriminate in a digitalized environment should call for a more interventionist approach. The next chapter examines the welfare implications of behavioral discrimination, and what tools enforcers could use as firms get even better at discriminating.

# 12

# Behavioral Discrimination: Economic and Social Perspectives

OUR GROWING RELIANCE on web-based platforms for searches and purchases changes the dynamics of competition. It can facilitate an almost perfect behavioral discrimination, which will result in customers consuming more and many paying a higher price in a seemingly competitive market.

In this chapter we consider the welfare effects of behavioral discrimination. We do so in two steps.

First, we explore the welfare effects of price discrimination. We note how price discrimination's welfare effects are mixed. On the one hand, our increasingly automated, digitalized transactions could create a more transparent marketplace in which resources are allocated more efficiently and in which the best product or service, at the lowest price, triumphs. On the other hand, pricing algorithms may be used to exploit customers and raise "the seemingly endless possibilities for both chaos and mischief."[1]

Second, we move beyond price discrimination into the murkier water of behavioral discrimination. Digitalized algorithm-based markets are characterized by the ability of sellers to increasingly "shadow" our activities, harvest data on our behavior and preferences, build profiles about us, tailor inducements, and recalibrate based on our responses. This behavioral discrimination can increase consumption, optimize the extraction of wealth, and affect other important values, such as privacy, equality and fairness.

## The Neoclassical Economists' Take on Price Discrimination

Do we lose when sellers discriminate? Well, it depends. At times we will; at other times we won't. Price discrimination could generate a mixture of effects under different market conditions. Not surprisingly, economists debate over the net welfare effects of price discrimination. Some view it more negatively than others. For instance, two economists, Leeson and Sobel, suggest that when the costs of implementing price discrimination are taken into account, its efficiency is doubtful.[2]

Price discrimination can, at times, yield distinct efficiencies and welfare gains, including:

- *Increasing output, facilitating the recovery of high fixed costs, and allowing certain businesses, which would not otherwise have existed, to operate profitably.*[3] For instance, railway companies may depend on temporal price discrimination between peak and off-peak travel or between advanced bookings or loyalty schemes, to attract enough business to keep their services running.
- *Fostering choice and access* in increasing the range of products or services offered to customers who could not otherwise afford them under uniform pricing (e.g., land or air travel).[4]
- *Increasing social equality*[5]—such as U.S. colleges, which, in awarding poorer students financial aid, enable greater access to higher education than if everyone paid the same (higher) tuition.
- *Facilitating dynamic efficiencies.* With more revenues and profits, companies have more to invest in research and development and enhancing quality.[6] This could also manifest itself through competitive investments, as opposed to innovation, such as "increasing product variety" and "expanding retail outlets."[7]
- *Intensifying competition among oligopolists,* who can now charge lower prices to competitors' customers and new customers while maintaining higher prices on existing (more captive) customers. This allows suppliers to compete for all customers, not just marginal customers.[8]

Price discrimination can also raise several concerns—in particular, when it enables a powerful firm, or group of firms, to:

- *Exploit customers.* One example is when customers are locked in, and the seller uses its market power to segment its customer groups to maximize wealth extraction.[9]
- *Exclude or eliminate a competitor.* The European Commission recognized in *AKZO* how discrimination "between similarly-placed

customers is expressly prohibited . . . when it places certain firms at a competitive disadvantage." The anticompetitive effect of AKZO's differential pricing "involved not so much direct injury to customers but rather a serious impact on the structure of competition at the level of supply by reason of its exclusionary effect."[10]

- *Increase barriers to entry or expansion,* by making entry or expansion difficult or excessively costly. The U.K. Competition and Markets Authority, for example, noted that "where a firm uses consumer data to separate different groups of customers and offers a different price to each group," small or new firms "would not have a substantial fixed base of existing customers, and so may be unable to compete as successfully to target customers through offering them lower prices."[11]
- *Deprive smaller rivals or new entrants of attaining sales or distribution sufficient to achieve efficient scale,* thereby raising the smaller companies' costs and thwarting their competitiveness.
- *Magnify or sustain other exclusionary or predatory abuses.*[12]
- *Adversely affect competition downstream.* This concern led to the Robinson-Patman Act, which, the U.S. Supreme Court and Federal Trade Commission concluded, is based on "one fundamental principle: to assure, to the extent reasonably practicable, that businessmen at the same functional level would stand on equal competitive footing so far as price is concerned."[13]

In the context of online sales, the U.K. competition agency[14] nicely outlined several instances where price discrimination can harm competition and consumers:

- when the practice "is carried out by a monopolist";
- "the form of price discrimination is very complex and/or consumers are not aware of it";
- "it is costly for firms to implement and so it pushes up costs"; and
- "it leads to a fall in consumers' trust in online markets."[15]

## The Added Complexity of Behavioral Discrimination

Behavioral discrimination amplifies many of the welfare effects associated with price discrimination. Information gathered about our behavior, desires, and ability to pay can help firms exploit consumer biases. Sophisticated online sellers can manipulate our environment to increase overall consumption by price discriminating and by shifting the demand curve to the right (getting people otherwise uninterested in the product to buy).

At times behavioral discrimination may generate positive effects. To illustrate, think about your desire to visit your local dentist. Consumers may underappreciate a product or service or simply procrastinate. Behavioral discrimination can encourage people to regularly visit a dentist, use dental floss, and brush their teeth. In doing so, it increases the individual's and society's welfare. One can think of other examples, where an increase in demand, even through manipulation, benefits the individual. Many instances, however, involve noncommercial interests and limited financial incentives.

The unscrupulous nature of behavioral discrimination is revealed as firms induce consumers to buy more of a bad thing. Cigarette manufacturers, for example, can exploit biases and imperfect willpower by getting people otherwise uninterested in smoking addicted.[16] Behavioral discrimination will enable cigarette manufacturers to sell even more cigarettes. Indeed, one study found that "retail cigarette advertising increased the likelihood that youth would initiate smoking; pricing strategies contributed to increases all along the smoking continuum, from initiation and experimentation to regular smoking; and cigarette promotions increased the likelihood that youth will move from experimentation to regular smoking."[17] From a social welfare perspective, the increase in output is bad for smokers, their families, those harmed by the secondhand smoke, and anyone who bears the health and other costs caused by smoking.

Behavioral discrimination also raises concerns over wealth inequality. Decoy pricing may be used to make unreasonably priced goods appear more reasonable, or entice consumers to make purchases they otherwise would not make. This decreases the disposable income that consumers can use for retirement, savings, or basic necessities; this effect is proportionately greater on those with lower incomes, and thus increases wealth inequality.

Further, one may argue that, from a neoclassical economic perspective, the overall efficiencies would be limited. The argument put forward by Leeson and Sobel, who doubted the presence of efficiencies in price discrimination, may be extended. Behavioral discrimination does not come cheap. To harness one's biases to trigger consumption, the seller would need to make a significant investment—in tracking consumers; collecting data on their behavior; segmenting them into groups; identifying their demand elasticities; reducing market transparency; increasing consumers' search costs; preventing the resale of the products; limiting the growth of anti-tracking technology; creating lengthy, tedious privacy statements; setting the individuals' privacy defaults as opt-in; and lobbying against greater privacy protections. So the practice is more likely to accompany commercial activities, where money is available and profit is lucrative. For the seller, investment in these measures may be rational and profitable. When sales increase, customers will ultimately pay these costs and supply the profits. So even from a neoclassical economic perspective, behavioral discrimination would have to deliver significant benefits to actually increase total welfare. Once you account the consumer perspective, the social welfare perspective, and the limited likelihood of total welfare increasing, behavioral discrimination is likely a toxic combination.

Not surprisingly, some might disagree. Like opponents of the ban on advertising tobacco products, who argued that tobacco advertising did not increase consumption, they would argue that customers are empowered (more so than their paternalistic overseers believe). If consumers remain in control and behavioral discrimination persists, then consumers must ultimately favor behavioral discrimination to assist their decision making. Thus behavioral discrimination, they would argue, is generally good for you and society.

## Social Acceptance

The argument ultimately is over what we prefer. Do many of us prefer behavioral discrimination? Would we want it if we end up paying more than others? Looking at social acceptance, we can identify instances in which we, as a society, willingly accept price discrimination.

Many of us whose children attend a college or private school know the financial sting when tuition is due. We also know that many parents will likely pay more or less than we do. No parent, to our knowledge, has stormed the dean's office protesting the price discrimination. Instead, price discrimination in some contexts, such as higher education, is more accepted than in many other contexts, where people view it as unfair. Why is this? One must examine price discrimination beyond the neoclassical economic analysis, which assumes that we are self-interested (greedy) profit maximizers, to the frontiers of behavioral economics, which views price discrimination through the prism of fairness and equality.

First, price discrimination may be accepted where its primary purpose is to advance social goals, not simply profit maximization. For many elite U.S. universities, the full tuition does not cover the university's marginal cost of supplying a year of education to an undergraduate student.[18] The same applies for some private high schools, like Phillips Exeter Academy. Every student, in effect, receives a discount—a benefit from the university's or high school's endowment and revenue stream. Parents and students accept price discrimination when it promotes greater social and moral goals, such as promoting opportunities and upward mobility. Price discrimination provides poor and middle-class students a broader range of schools from which to choose, including highly selective universities, where they can network and increase their earnings potential.[19] (Unfortunately, many bright but poor students have not applied to selective U.S. universities, even when doing so would cost them less.[20])

Second, price discrimination may be accepted when it improves the overall product. Without price discrimination, prestigious universities and high schools could attract only those students whose parents are willing and able to pay the full tuition and room and board. (No financial aid would be offered.) But the belief is that the academic environment would suffer (as well as the school's reputation over time). Thus price discrimination enriches the product itself, namely the educational and academic environment, by increasing diversity.

Finally, price discrimination is accepted when it is transparent and fairly applied. Many colleges provide financial assistance calculators that enable parents and students to assess the net price. The belief is that, apart from issues of merit or athletic scholarships, families with similar financial situations whose children attend the same school will contribute roughly the same amount.

If these factors no longer applied, and universities simply price discriminated to maximize revenues and increase compensation for the university administrators, coaches, and perhaps even professors, then trust would break down and parents would likely rebel.

The introduction of a profit motive changes the framework of assessment and leads many people to perceive price discrimination as unfair. This attitude intensifies where behavioral discrimination is exposed and people perceive themselves as victims of manipulation.

## (Lack of) Fairness and Equality

In contrast to the above, other markets dominated by for-profit firms have less exceptional characteristics. Price and behavioral discrimination will not increase the product's or service's quality or foster any greater societal objectives. Instead, companies price discriminate to capture as much of the consumers' wealth as possible.

In this context price discrimination is generally perceived as unfair. Over the past thirty years, behavioral economists in the lab and the field have tested the assumption that we are greedy, self-interested profit maximizers. Some people are. But the psychological and experimental economic data show that most people care about treating others, and being treated, fairly.[21] Some economists are agnostic on price discrimination, or believe that in certain instances it may be welfare-enhancing. But 91 percent of individuals in one survey thought charging higher prices to those who were more dependent on the product was offensive.[22]

A collateral consequence of price discrimination is a loss of trust between companies and their customers. In behavioral experiments, consumers have been found to be less trusting of firms engaging in price discrimination, and less willing to purchase from them.[23] Even where the study's participants personally received a better price than others, many still perceived the retailer to be behaving unfairly, were less inclined to purchase from that retailer again, and were less willing to recommend the retailer to a friend.[24]

Many consumers, in a couple of studies, objected to such price discrimination as "ethically wrong," including:

- 76 percent who agreed "it would bother me to learn that other people pay less than I do for the same products";
- 64 percent who agreed "it would bother me to learn that other people get better discount coupons than I do for the same products";
- 66 percent who disagreed that "it's OK with me if the supermarket I shop at keeps detailed records of my buying behavior";
- 87 percent who disagreed that "it's OK if an online store I use charges people different prices for the same products during the same hour"; and
- 72 percent who disagreed with the idea that "if a store I shop at frequently charges me lower prices than it charges other people because it wants to keep me as a customer more than it wants to keep them, that's OK."[25]

Most of the surveyed American adults believed it was illegal for "an online store to charge different people different prices at the same time of day."[26] It isn't.

So why does price discrimination violate so many people's notions of fairness? Why do they think it is (or should be) illegal? One reason is its perceived exploitation, namely taking advantage of people who don't have a viable outside option. The company does not provide any extra service; it simply exercises its market power.

## When Actual Discrimination and Behavioral Discrimination Blur

One belief is that algorithms are free of human biases (to the extent their code does not reflect such biases) and can process data objectively. Unlike humans, pricing algorithms won't discriminate based on one's gender, skin color, national origin, age, disabilities, sexual orientation, or religion.

As Chapter 10 discusses, pricing algorithms won't be able in the near future to identify each customer's unique reservation price across every possible situation. Instead, consumers are lumped into groups. If you live in a certain neighborhood, are a certain age, went to a particular university, or are a member of a particular religion, then the pricing algorithm may lump you in a particular category. In other words, the seller makes an educated guess that certain groups are more likely to buy the product and are less sensitive to its price than other groups, who even if tempted to purchase, will require a lower price.

Some groups will be exploited. Thus, the road to perfect behavioral discrimination increases the risk that computer algorithms may categorize consumers on an unalterable trait, such as one's skin color. The White House report noted how Big Data "may facilitate discrimination against protected groups, and when prices are not transparent, differential pricing could be conducive to fraud or scams that take advantage of unwary consumers."[27] Data brokers, as the FTC reported in 2014, were already categorizing and segmenting consumers.[28] "While some of these segments seem innocuous," noted the FTC, "others rely on characteristics, such as ethnicity, income level, and education level, which seem more sensitive and may be disconcerting."[29] Some segments, for example, "primarily focus on minority communities with lower incomes, such as 'Urban Scramble' and 'Mobile Mixers,' both of which include a high concentration of Latino and

African-American consumers with low incomes."[30] Other potentially sensitive categories "highlight a consumer's age such as 'Rural Everlasting,' which includes single men and women over the age of 66 with 'low educational attainment and low net worths,' while 'Married Sophisticates' includes thirty-something couples in the 'upper-middle class . . . with no children.' "[31] Data brokers also categorize us into health-related topics or conditions, such as "Expectant Parent," "Diabetes Interest," and "Cholesterol Focus."[32]

Businesses in the United States and the European Union cannot use one's race, color, religion, or certain other categories to make credit, insurance, or employment decisions.[33] But firms can circumvent these antidiscrimination laws through the use of algorithms that automatically develop and refine categories in which people of certain race, marital status, age, sexual orientation, or religion are lumped together.

Such discrimination by algorithms is already happening. One 2015 study found high school students in communities with a high density of Asian residents were 1.8 times likelier to be charged higher prices for Princeton Review's online college test-prep services, regardless of income.[34] As the study found, the gap "remains even for Asians in lower income neighborhoods"—citing as one example a ZIP code in Flushing, New York, where Asians make up 70.5 percent of the population, with a low median household income, $41,884, "yet The Princeton Review customers there are quoted the highest price."[35]

A Carnegie Mellon study examined whether visiting websites related to substance abuse will likely impact the ads you'll see later.[36] Google targets users with behavioral ads. Google's Ad Settings "display[s] inferences Google has made about a user's demographics and interests based on his browsing behavior."[37] Google also provides a tool that "helps you control the ads you see on Google services and on websites that partner with Google."[38] So the researchers ran an experiment where two groups initially had the same Google Ad Settings. One group visited websites on substance abuse; the control group simply waited. Then both groups collected the ads served by Google on a news website.

Although Google's Ad Settings remained the same for both groups, the group that visited the substance abuse websites received many more ads for Watershed Rehab. The experiment found a mismatch between Google's Ad Settings and the ads targeting consumers: "information about visits to these websites is indeed being used to serve ads, but the Ad Settings page does not reflect this use in this case."[39]

A related experiment found evidence suggestive of gender discrimination. In this experiment, the group was divided according to gender on Google's Ad Settings page.[40] With only that difference, the female and male groups both visited web pages associated with employment. Here the ads differed by the agent's sex: Google showed the male group "ads from a certain career coaching agency that promised large salaries more frequently" than the female group.[41] The experiments observed the discrimination, but it was unclear who was to blame: "whether Google, the advertiser, or complex interactions among them and others caused the discrimination." Even if they could find out who was responsible, "the discrimination might have resulted unintentionally from algorithms optimizing click-through rates or other metrics free of bigotry."[42]

Here we see the lack of transparency come to the fore. In the first experiment, the users seemingly had the same profile, but they received different types of ads based on the websites they visited. If they went to Google's Ad Settings, they would not see any reference to substance abuse (nor any ability to correct this misimpression if it did show up). One can imagine other implications. Health insurance firms could discriminate in their posted rate, based on the websites one visits, the items one purchases (including cigarettes or alcohol as a gift), or the activities one posts on a social network. Users cannot go to Ad Settings or other advertising profile sites to correct any misimpression, as the sites may not reflect this information.

Say you type "CEO" on Google's search engine. You click the Images tab. In early 2016, you would find mostly white men. Which woman is listed among the top results? Not Mary Barra of General Motors. Nor Virginia Rometty of IBM. Nor Indra K. Nooyi of PepsiCo, Inc. The first female image is none other than CEO Barbie. One 2013 study identified discrimination in Google image search results for some, but not all, occupations. The study compared the percentages of women who appeared in Google searches for different occupations with U.S. statistics showing how many women actually worked in that field. Among the professions with significant gaps were CEOs (11 percent of the images in the Google image search result were women, compared with 27 percent of U.S. CEOs who are women), authors (25 percent of images for this search result were women, compared with 56 percent of U.S. authors who are women), and telemarketers (64 percent of the images were women compared with 50 percent in the workforce).[43]

Another study examined advertisements for the web page of a high-profile, historically black fraternity, Omega Psi Phi, which celebrated its one hundredth birthday. Among the algorithm-generated ads on the website were ads for low-quality, highly criticized credit cards and ads that suggest the audience member had an arrest record.[44]

What remains unclear is why a black fraternity website attracts ads about one's criminal history, and why men get career coaching ads for boosting their salary, but not women. One possibility is that the advertiser requested the placement. Alternatively, the advertising algorithm predicted that the questionable ad would likelier be clicked than other ads. Law professor Frank Pasquale criticized the secrecy of these algorithms and the lack of transparency.[45]

The worrying thing is that we may not even know that we are being discriminated against. Under the old competitive paradigm, one knew if one was discriminated against if one was denied access (e.g., restaurants for "whites only") or was charged a higher price based on this single variable. Under the new paradigm, users may be unable to detect the small but statistically significant change in targeted advertisements (or advertised rates). In a Carnegie Mellon study, all conditions were held equal except one (namely gender or specific sites visited). In this controlled experiment, one can measure the direct impact this one change had. But in our day-to-day reality, there are often too many confounding variables and often no handy benchmark.[46] A woman searching the web will not necessarily know to what extent the ads she is seeing differ from those her male counterparts see. She will unlikely ask her male colleagues to report the ads they see and compare the differences. Even if users could detect that they were being targeted with rehab ads (or not being offered advertised opportunities for greater salaries), they may not know why they were being discriminated against. It might be the websites they visited, a magazine subscription they had, an e-mail they wrote, their race, or some incident. The bottom line is that the march to perfect behavioral discrimination will entail lumping us into categories. At times that categorization process and behavioral targeting will promote actual discrimination.

## Current Enforcement Tools

Many people believe price discrimination by online and brick-and-mortar retailers is illegal. But it typically isn't. Even when potentially illegal, price discrimination is low on the competition agencies' enforcement agenda.

The primary weapon in the United States against price discrimination, the Robinson-Patman Act, does not even apply to our scenario, namely behavioral discrimination directed at end users.[47] Instead, the Act prohibits discriminating against smaller retailers or distributors competing against larger competitors.[48] Even for small businesses, an American Bar Association article observes, the Robinson-Patman Act "is still alive, but with declining relevance."[49] Although the United States could criminally prosecute under the Robinson-Patman Act, it hasn't for decades. The U.S. competition agencies rarely enforce the Act through civil actions. Private plaintiffs bring almost all the cases, and they often lose, as the Supreme Court has narrowed the Act's scope by, among other things, expanding the defenses.[50] Thus, generally under U.S. federal law, online or brick-and-mortar retailers "are under no obligation to disclose their pricing structure to consumers, and in the absence of some duty to disclose, retailers may charge different prices for the same goods or service to different groups of consumers without disclosing that fact."[51]

In the European Union, price discrimination can be addressed under Article 102(c) TFEU. The article stipulates that an abuse of a dominant position may consist of the application of "dissimilar conditions to equivalent transactions with other trading parties, thereby placing them at a competitive disadvantage." The provision targets discrimination that places other trading parties in an unfavorable position. This type of competitive harm is often referred to as a "second line injury" as it concerns competition between undertakings at the downstream level. For instance, in *Post Danmark A/S v. Konkurrencerådet,*[52] the court clarified that "the fact that the practice of a dominant undertaking may, like the pricing policy . . . [be] described as 'price discrimination', . . . , cannot of itself suggest that there exists an exclusionary abuse."[53]

Evidently, other laws may prohibit discrimination on a broader basis—such as discrimination based on race, age, and so on. As the UK competition authority noted, "A range of other legislation could also apply in this area, for example the Equality Act 2010, which prohibits discrimination in the supply of goods, services or facilities based on 'protected characteristics' of age, disability, gender reassignment, pregnancy and maternity, race, religion or belief, sex or sexual orientation, could apply in the case of businesses which may discriminate, for example, through the analysis of data to target individuals based on racially discriminatory algorithms."[54] Other instruments include the EU Unfair Commercial Practices Directive[55] and EU Data Protection Directive.[56]

## Reflections

In 2015, we asked lawyers, judges, and economists about their approach to price and behavioral discrimination. We raised these issues to different groups as part of training sessions on competition law. Competition lawyers and economists dominated some groups; in others the participants had limited economic or competition law background. We asked each group for their reaction if they discovered that another online customer had purchased goods for a lower price through intended price discrimination.

Those without an economic background felt it was unfair, so much so that they would stop, if possible, using the seller in question. Interestingly, those with an economic background were less susceptible to feelings of unfairness. They felt that this may be acceptable when one wishes to facilitate access for lower-income consumers, create positive externalities, and increase and optimize production. When faced with questions about behavioral discrimination, participants were more united in their approach. Some felt manipulated, others exposed. Many indicated lack of belief as to the ease with which their actions may be affected by simple "tricks of the trade."

As companies' data collection and analytics improve, so too will their ability to discriminate. Targeted pricing may, in particular, be sustainable where a market is stable and exhibits barriers to entry or expansion, limited outside options, heterogeneous or branded goods, imperfect information flows, or the ability to distort or inhibit information exchange. It may also be sustained in markets that attract loyal customers or where companies develop and customize distinguishable products for particular purchasers.[57]

Even if companies can discriminate, this does not necessarily mean that they will. Behavioral discrimination—given its manipulation of our emotions and our expectation of a fair competitive price, which everyone pays—will likely be condemned. Behavioral discrimination raises privacy concerns.[58] We do not necessarily think we are being monitored when we are online. Even if we do, we may underestimate the amount of data being collected on us and how that data is being used to target us. Behavioral discrimination, besides the heightened privacy concerns, can disturb our trust in the marketplace. People still expect a competitive price set by market forces, whereas perfect price discrimination eliminates the competitive benchmark. The price you pay differs from the price I pay, based simply on our perceived willingness to pay. The new paradigm of behavioral discrimination affects not only our pocketbook but our social environment, trust in firms and the marketplace, personal autonomy, and privacy.[59] Fearing the adverse reputational impact, some companies will initially refrain from using all the data at their disposal to maximize wealth extraction.

A trend may, however, emerge. As pricing norms change, fewer people over the years may oppose price and behavioral discrimination. Price discrimination eventually may be accepted as the new normal. Just as we have accepted (or become resigned to) the quality degradation of air travel, and the rise of airline fees—from luggage to printing boarding passes—our future norms may well include online segmentation and price discrimination. Many forms of discrimination, involving different pricing on mobile platforms and PCs, personalized search results, personalized coupons, and price steering,[60] are already appearing in the online marketplace.

Looking ahead, perhaps younger generations may more easily accept price (and even behavioral) discrimination, particularly as they have been exposed to it from a younger age, and will engage in online purchasing at an increasing rate. The savvier may use countermeasures to extract better deals and manipulate attempts at price discrimination and steering.

But given the asymmetries in information and power between the data collectors and us, countermeasures will unlikely stop the march toward near-perfect behavioral discrimination. Absent legal intervention, behavioral discrimination will likely become in many retail industries the new norm.

# 13

# The Comparison Intermediaries

HAVING CONSIDERED the possible use of price discrimination in an algorithm-driven environment, we explore in this chapter the role played by price comparison websites (PCWs) and metasearch engines. These comparison intermediaries support market transparency, and as such create an environment which can reduce the capacity for price discrimination and help safeguard our welfare.

Indeed, these comparison and search platforms have become an integral part of our web environment: Google, Bing, Yahoo!, Amazon, Expedia, Booking, Alibaba, Ebay, Lastminute, Trivago, PriceRunner, Go Compare, Money Supermarket, mySupermarket, Comparethemarket, and uSwitch are only a handful of the many platforms that provide users with comparative data and access to sellers and service providers.

Often these intermediaries operate in a multisided market. On the market's consumer side, the websites predominantly offer their services for free: customers enter their search queries and are provided with relevant information and links without charge. On the provider side, however, they often generate an income stream. Search platforms would predominantly rely on advertising income. Price comparison websites would often charge a fee or commission for a referral or sale they facilitate.

In Chapter 1 we introduced the prominent role played by intermediaries and their contribution to the dynamic online environment—buyers access information about product offerings, variety, available sellers, price options, and reviews in a wide range of markets—including insurance, travel, loans, mortgages, credit cards, holidays, and consumer goods. In this chapter we note some of the benefits offered by these intermediaries. We then explore instances in which they may raise competitive concerns—and reduce our welfare while retaining the façade of competition.

## The Benefits

Comparison intermediaries can help level the playing field and intensify competitive pressure.

For comparison intermediaries to yield the desired benefits, customers must be aware of the availability of outside options, have low switching costs, and have the incentive to search (that is, the alternative price and quality must be sufficiently attractive to justify the costs and risks of searching and switching).

When this occurs, comparison intermediates can facilitate a transparent market environment in which customers obtain comparable information on the available products and bargains. By collating and aggregating quantitative and qualitative data about suppliers, as well as price and product characteristics, the search and price comparison platforms can reduce the asymmetry of information and improve information flows. This can make it harder for suppliers to take advantage of ill-informed customers who are subject to high information costs.[1] As such, the comparison intermediaries could weaken the power of sellers to segment the market and price discriminate. They can help reduce the market power of sellers, to the extent that power was the result of high information costs.[2]

These platforms can support a competitive dynamic, where sellers face price competition and invest in services, quality, and innovation. Overall, the flow of information generates substantial allocation efficiencies, as buyers can more cheaply locate sellers that better meet their needs. Indeed, "[t]he Internet brought about price transparency across the market, enabling consumers to identify the best deal, i.e. the lowest price for any given hotel room, at very low search costs."[3]

Comparison intermediaries may also facilitate suppliers' entry and expansion by providing economies of scale and efficiencies in distribution, marketing, and promotion. They can reduce the associated risks and costs for new entrants and enable access to potential customers, economies of scale in online advertising, payment facilities, guarantees, and ease of transaction.[4] These supplier-focused efficiencies can support a more competitive environment and lower prices—again, to our benefit.

Moreover, comparison intermediaries can widen the realm of the market at both national and international levels. They can link international sellers with buyers—widening the reach of suppliers and widening the customer base. They may offer interfaces in a range of languages, further facilitating access and information flow.

Overall, comparison and search platforms have the potential to support a competitive environment in which users easily identify, compare, and access various offerings of products and services. We use the word "potential" because sometimes platforms might reduce competition, as we explore next.

## Network Effects and Market Power

Let us now consider how network effects may give rise to market power and create bottlenecks in the online environment. Network effects and market power may influence the comparison intermediates' incentives and practice. Powerful platforms can distort the information they present us to improve their own profitability. To explain how, we first explain the operation of network effects. Then we illustrate the way in which market power could distort competition and search results online.

### Network Effects

To understand how online platforms can exercise market power, we briefly outline several network effects involving online multisided platforms (such as Google, Bing, price comparison websites, and Facebook).[5]

*Traditional Network Effects.* Traditional network effects are observable in social network platforms, where bigger is better. Direct network effects arise when a consumer's utility from a product increases as others use the product.[6] One example is Facebook. As more people use the social network, the more people with whom one can interact, the easier it is to connect with other people, and the greater one's utility in using Facebook. The value of the network increases with its growth. As the big platforms get bigger, the entry barriers to obtaining the necessary scale to meaningfully compete also increase.

*Trial and Error.* This network effect is linked to the scale achieved by trial and error, or learning by doing. Such an effect is relevant to machine learning. For example, for search engines an increase in the number of searches increases the search engine's likelihood of identifying relevant results. In other words, the more consumers who use the search engine and the more searches they run, the more trials the search engine has in predicting consumer preferences, the more feedback the search engine receives of any errors, and the quicker the search engine can respond by recalibrating its offerings. Naturally, the quality improvement attracts additional consumers to that search engine compared to competitor sites. In effect, the more users, the larger (and more heterogeneous) the sample size, and the better the search engine can identify relevant responses for both popular and less frequent queries ("tail" queries).

*Scope of Data.* This network effect involves the scope of data on the user. Search results, for example, can improve from the variety of personal data on users. If people use, besides the search engine, other services offered by the company (such as e-mail, web-browser, texting, mapping, purchasing, etc.), the company, in collecting the variety of personal data, can develop user profiles to better predict users' tastes and interests, and better target users with more relevant organic and sponsored search results. This feedback loop adds another dimension: it is now no longer the trial and error, learning by doing from earlier searches, but also learning of users' tastes and preferences from the variety of personal data it collects across its platform, which enables the personalization of search results and the targeting of users with specific sponsored ads that they will likely click.

*Spillovers and Snowball Effect.* As discussed previously, intermediaries often operate in a multisided market. Spillovers and the snowball effect concern the way network effects on the "free" (consumer) side can spill over to the "paid" (provider) side, and each can reinforce the other. The inflow of many users with heterogeneous search inquiries, for example, will attract a greater variety of advertisers to a platform. The search platform can use the inflow of personal data to better target consumers with specific targeted advertising across its platform of free services (such as sponsored search results, ads in e-mails, and displaying ads in videos) in the moments that matter for a purchasing decision. In targeting users with more relevant ads (or ads that users will likelier click), the search engine increases its advertising revenue and profits. Moreover, the search engine can target users with these personalized ads across media (such as personal computers, smartphones, tablets, and, soon, household appliances) and across services (texts, maps, videos, etc.). This too increases the likelihood of consumers clicking on a relevant sponsored ad (which generates revenue on a cost-per-click basis) or seeing a display ad (which generates revenue on a cost-per-impression basis). As more users are drawn to the platform, and as the company amasses a greater variety of data to effectively target consumers with relevant online ads, the broad platform can reduce the advertisers' fixed costs of managing multiple ad campaigns. As more people use the search engine, more advertisers will use the platform, the more relevant and targeted the advertisements, the likelier that users will click on the ads, and the more profits the search engine has to expand its range of free services and to ensure that its service remains the default search engine on various portals to the Internet (for example, developing one's own browser and paying other browsers to have one's search engine be the default).[7]

## Market Power

The above network effects illustrate the way in which online comparison intermediaries may acquire market power. For example, more users generate more search queries, which generate more trial and error, which yields better search results, which attracts more users and advertisers to the search platform, which enables better profiling of users and greater likelihood of users clicking on the ads, which generates more advertising revenue to enable the search engine to offer even more free services, which enables consumers to spend more time on the company's platform, which allows it "to gather even more valuable data about consumer behaviour, and to further improve services, for (new) consumers as well as advertisers (on both sides of the market)."[8] The larger platforms gather more data on their users and have greater opportunities to experiment and learn by doing. They can continually improve and refine their services as more users rely on them. The big web-aggregators become bigger, as users increasingly rely on the popular websites. The web-aggregators in turn become significant players—unavoidable partners, even—occupying a strategic position in the distribution channel.

As more consumers rely (and trust) an intermediary to deliver the best results (whether relevant results to a search query or array of goods and services), they become less interested in multi-homing—that is, in checking the availability of products and prices elsewhere. For example, most people conduct their searches on a single search engine. Few run the same search on multiple search engines, such as Bing, Google, Yahoo!, or DuckDuckGo. As fewer consumers multi-home by running the same search on multiple search engines or price comparison websites, the more power the platform has.

As more customers rely on the intermediary, it becomes more attractive to sellers, who will find it important that their products be included on the platform. Sellers know that their products' and services' inclusion on a platform's search results may be crucial for their visibility.

As these "information and referral junctions" become a crucial gatekeeper between suppliers and consumers, the platform's bargaining power increases.[9] The increased reliance on a few powerful intermediaries gives rise to possible changes in market dynamics. These gatekeepers control many significant access points and, as a result, have the power to distort competition, sometimes unintentionally. So, comparison intermediaries could sometimes, under certain conditions, pave the way for higher prices, lower quality, and a reduction in consumer welfare. In what follows, we illustrate how platforms may sometimes fail to deliver on their competitive promise.

## Possible Distortions

When a multisided platform offers a product or service for free, the primary dimension of competition is typically quality. Competition is therefore likely to stimulate investment in quality, such as more relevant search results. Yet, the platform operator has competing incentives. It invests in quality on the free side to attract users. But its revenues and profits come from the platform's other side, such as commissions or advertising. So its incentive to optimize quality may be distorted.

As the platforms' market power increases, transparency in these online markets will not be controlled by society or even by market forces, but increasingly by the platform operators' incentives. In such instances, the online platform may intentionally degrade quality on the free side below levels that consumers prefer, if doing so increases its profitability (or market power).

Some platforms, for example, may allow for preferential placement based on the level of payment or commission they receive from sellers. For instance, pay-for-placement fees allow a platform to charge higher rates to sellers for the right to be positioned at the top of the list on the default page result. Such positioning may distort competition when the user is unaware of the preferential positioning and assumes that the top results are the best (or most relevant) ones objectively picked by the websites' algorithms.

One example of such manipulation of results is in online hotel bookings. The factors which could influence the default ordering of hotels on hotel booking intermediaries includes: "customer ratings and complaints"; "if hotels are willing to pay larger commissions"; "photo quality"; and "if a hotel is quicker to turn shoppers into buyers."[10] The methods that hotel booking intermediaries use to tailor search results have come under criticism by some hotels. The American Hotel and Lodging Association told the *Wall Street Journal,* "'Biased or misleading search results from these sites or via web searches can be highly problematic, particularly on those booking websites that purport to be helping consumers comparison shop based off of less than objective information.'"[11]

This old trick also occurred with the U.S. airlines' computerized reservation systems. The United States in 1984 was concerned that several airlines were taking advantage of their control of a computerized reservation system to give themselves a competitive edge. The government discovered, for example, "that certain system owners had written the computer program algorithms in such a manner that their [computer reservation system] screens would display all of their own flights before listing those of competitors, even though other flights might more closely match the agents' specifications. Because travel agents work under heavy time pressures, they tend to recommend the flights listed first."[12] To eliminate such abuses, the government required that the algorithms generate results based on "neutral" characteristics.[13]

The *New York Times* reported that Amazon in 1999, unbeknownst to its customers, offered an "E-merchandising" program, where book publishers, in exchange for paying advertising fees of as much as $12,500, received "featured treatment of titles in categories that range from 'What We're Reading' to 'Destined for Greatness.'"[14] Amazon did not disclose the advertising fees to its customers.[15]

Some web aggregators may add a charge for a referral to a provider's site. While these websites may benefit from a public perception that they will provide the best rate available online—like many other web aggregators—they levy a charge on the user. For instance, a study conducted in Germany revealed how some comparison platforms charge higher prices for services and goods, than would otherwise be available on the provider's site.[16] The study questioned the true benefit provided by these services.

In the European Union, the consumer harms from distorted information have led, on occasion, to public condemnation. For instance, in early 2015 the U.K. Energy and Climate Change Select Committee challenged practices that resulted in distorted information on the web-aggregators. Among other things, platforms were accused of "not showing the cheapest tariffs by default if it meant they wouldn't earn a commission."[17] Following this criticism, the PCWs have since ensured that the default search setting will include the full range of tariffs available, regardless of whether or not a commission is charged upstream.[18]

Search engines may bias their results to favor paid advertising. For a number of search engine operators, for example, the order of the results that appear on a search results screen will depend on how much an advertiser pays. Most search engines provide users with "sponsored" results and "organic" results, which are produced by the search engine's algorithms.[19] For the paid sponsored search results, most advertisers pay the search engine on a cost-per-click basis, whereby the advertiser pays the search engine only when a user clicks on its sponsored ad.[20] When Microsoft and Yahoo! collaborated on their search engines, one concern two economists for the European Commission noted was whether the search engine "may alter the ranking of the organic search results such that, from the user's perspective, firms offering competing products to the sponsored links are given a less-than-optimal ranking on the organic side."[21] The Commission ultimately found that Microsoft and Yahoo were unlikely to engage in such behavior.

The intermediaries may have greater power to extract greater rents from suppliers of goods and services in the form of higher commissions, fees for preferential placement, or advertising. Perhaps not surprisingly, online platforms, as profit making entities, share incentives similar to other market players and may also benefit from personalization and behavioral discrimination. In fact, some of them use similar tactics to gather information about users. They may amend their offering based on one's location or shopping history and engage in a range of tactics, from the use of decoys and price steering to drip pricing. So the promise of transparency and undistorted information may give way to profit motive, once the comparison intermediates gain relative power.

In addition, some comparison platforms or meta-search engines, which also provide related services downstream, may favor their own services over those of competitors and display them more prominently in their search results. Notable here is the European Commission's investigation into Google's alleged favoring of its own comparison shopping product "Google Shopping" and its preferential positioning on Google general search results pages. In April 2015, the European Commission accused Google of systematic favoring of its own comparison-shopping services in its general search results pages over more relevant competitor sites. The commission was predominantly concerned with the leveraging of Google's market power in the online general search engine market to create an advantage in the related market of comparison-shopping services. This leveraging, the commission argued, harmed rival comparison-shopping services, consumers, and innovation.[22] The top European Commission competition official noted: "when a consumer enters a shopping-related query in Google's search engine, Google's comparison shopping product is systematically displayed prominently at the top of the search results. This display is irrespective of whether it is the most relevant response to the query. Thus, Google's commercial product is not subject to the same algorithms as other comparison shopping services . . . with the result that consumers may not necessarily see the most relevant results in response to their queries, and Google's competitors may not get the commercial opportunities that their innovations deserve."[23]

Overall, an online platform, even when competition is a click away, can reduce quality, when: (1) the platform has the ability and economic incentive to degrade quality; (2) consumers cannot accurately assess the quality degradation; and (3) it is difficult or costly for others to convey to consumers the products' or services' inherent quality differences or to prompt them to switch.[24]

## The Use of Wide Parity Clauses and the Agency Model

So far we noted how network effects and market power may distort how information is displayed by comparison intermediaries. We now explore how contractual arrangements may sometimes distort competition, not by manipulating the results, but by dampening the intensity of competition.

We focus on the use of wide parity—also known as wide Most Favored Nation (MFN) clauses—by some intermediaries. These clauses have attracted attention especially when combined with an agency distribution model.

Let us consider how these wide MFN clauses with the agency model could maintain a perception of competitiveness while in practice limiting competition. We'll use Apple and the book publishers as our example. In an agency distribution model, the book publishers set the final price of the e-books sold on Apple, Amazon, and any other online platform. The platform receives a commission for each e-book sale made under an agreed revenue-sharing clause. Accordingly, Apple, Amazon, and the other platforms do not purchase the e-books from the publishers. Instead, they act as agents, selling the e-books on the publishers' behalf.[25] To ensure that Amazon or any other bookseller does not offer popular e-books at a lower price, Apple also insisted on a wide MFN clause. As the court noted in the Apple antitrust case, "an MFN Clause is a contractual provision that requires one party to give the other the best terms that it makes available to any competitor"; in other words "the MFN would require the publisher to offer any e-book in Apple's iBookstore for no more than what the same e-book was offered elsewhere, such as from Amazon."[26] With a wide MFN clause and agency model, Apple, the court found, was protected from retail price competition.[27]

The combination of a wide MFN clause and agency model has become common in online commerce. They are designed to resolve the hold-up problem, often manifested in vertical relationships, by removing the risk of the supplier and other sellers free-riding on the PCWs' investment in demand-enhancing features.[28] By addressing possible horizontal and vertical externalities, they ensure the continuous investment by the platform in demand-enhancing features.

Yet the use of wide MFN clauses has come under increased scrutiny in recent years due to their potential anticompetitive effects. One concern has been that wide MFNs, when combined with an agency model, may incentivize a powerful intermediary to increase the fees it charges to upstream sellers. To see why, suppose the PCW has market power. It wants to charge sellers higher fees for their products to be listed on its website. The fear is that a seller agrees, but starts shifting sales to rival PCWs or an entrant. With a wide MFN clause, each seller contractually agrees not to charge a lower price on any other PCWs, even those that charge modest fees. So the dominant platform can increase its fees to the sellers. The sellers can choose to absorb the price increase (which lowers their profit margins) or raise the price of their goods. If the latter, you will pay that higher price on whatever PCW you visit. Why? Under the wide MFN, price parity with other platforms is guaranteed.[29]

In its review of the private auto insurance sector, the U.K. Competition and Markets Authority commented on the combined effect of agency pricing and wide MFNs:

> Generally, we expected that higher commission fees would lead to higher policy premiums because there was likely to be some pass-through of costs to premiums. . . . [I]rrespective of the rate of pass-through, the PCW with the wide MFN could continue to increase commission fees until the price of the policy was too high from the point of view of the PCW. Premiums across the market might increase up to the point at which [private motor insurance] providers exercised their “outside option”, which would be to withdraw from listing on the PCW with the wide MFN and to seek to attract customers from other sources.[30]

For us, the wide MFN, when combined with an agency model, might seem like a benefit. We can continue using the dominant PCW, knowing that it always has (or matches) the best price. The harm is less salient. We do not see, besides their price effects, how the clause may undermine new PCWs from entering into the market. Suppose a new PCW seeks to offer consumers lower prices by charging the sellers a lower fee. The dominant platform will invoke its price parity provision with the sellers and require them to match the lower price on its website. This would effectively reduce the sellers’ profit margins on the dominant platform. Each additional sale on the dominant PCW means less money for the sellers. Since the sellers now make even less money per sale, they would not eagerly embrace the entrant. Thus, the wide MFN clause and agency model collectively change the sellers’ incentives; specifically, they would not discount on the entrant’s PCW—no matter how great a deal the entrant offers—since they would have to offer that discounted price on the other PCWs. As the price is set under an agency model and subjected to wide MFN provisions, lower prices cannot be charged on any platforms, including the entrant’s.[31] So why enter this market? The entrant cannot compete against the incumbent PCWs by offering lower prices or better terms. Even if the entrant somehow could compete, the dominant PCW’s algorithms would immediately detect and match the price. As we continue using the dominant PCW, the sellers, whose margins are squeezed, view the entrant as a pariah.

For example, a BBC report raised concerns on the rise in energy costs in the U.K. The report considered how the hidden costs of commissions levied by PCWs perhaps contributed to the price increase:

> [T]here’s another cost in the bill. It’s hidden, it’s kept confidential, and yet it’s for a part of the industry that appears to be on the consumers’ side. This is the cut of the bill taken by price comparison websites, in return for referring customers. The recommendation to switch creates churn in

> the market, and it is seen by supplier companies as worth paying high fees to the websites. Whether or not customers choose to use the sites, the cost to the supplier is embedded within bills for all customers.[32]

The report quotes David Hunter, an energy industry analyst with Schneider Electric, who elaborated on the possible price implications of PCWs:

> If you use a price comparison website, that website or broker will be paid commission by the successful supplier for placing business through them. . . . We know the supplier makes a profit for billing you of about £60 a year, and bearing in mind what we know about supply cost information, I wouldn't be at all surprised if the websites and brokers are making £60 or perhaps more out of every customer's annual bill.[33]

In early 2015, the fees charged by the U.K.'s leading PCWs were revealed in discussions of the Energy and Climate Change Select Committee.[34] The PCWs' commissions ranged between £22 to £30 per single fuel customer and up to £60 for a dual fuel tariff.[35] Committee member Ian Lavery commented on these charges and the platforms' profits: "Someone is paying for these profits. We support advising people to switch, but we do so on the basis that the price comparison websites are trustworthy."[36] Despite the criticism and concerns raised, however, the committee acknowledged the benefit of these sites in facilitating the effective comparison of tariffs in the energy sector and encouraging competition on price.[37]

PCWs in our U.K. energy example did not directly increase the cost per transaction—in the sense that the PCW's referral fee was not added as a surcharge to the product or service referred. Instead, the concern was that the rising referral fees increased the pressure on upstream providers to increase their prices to defray the referral costs.[38] Some argue that providers using these platforms, when faced with increased charges by web-aggregators, will ultimately increase their output price to regain profitability.[39]

The economic literature suggests that such cost externalities may indeed arise under certain conditions.[40] The introduction of a wide MFN to a market with a homogeneous good, in which consumers already have access to each of the sellers' websites, would lead to an increase in price when consumers would not multi-home and would be satisfied by the results of a single comparison platform. Furthermore, in such markets, price increases may intensify as additional web-aggregators are introduced.[41]

So the use of wide MFNs and agency models reminds us that all that glitters is not gold. The perceived competitive environment offered by online platforms may be undermined by behind-the-scenes mechanisms and agreements which may, at times, leave consumers with less than they bargained for. That realization has indeed led in recent years to a restrictive approach to wide MFNs.[42] A growing number of competition agencies have condemned these wide parity clauses and held them to be illegal. By contrast, competition agencies have generally accepted the use of narrow MFNs, which do not foster alignment between market players, as these provisions can encourage investment and competition.[43]

## Reflections

Using online comparison and search platforms, users can make better decisions and be exposed to sellers and products which may otherwise remain outside the market. With such contributions, it is no wonder that these web-aggregators have become a significant intermediary in our online environment. Their role and their privileged position have supported competition at the platform level as well, with an increase in the number of web-aggregators which are established and aim to provide products. That competition is valuable. It ensures the quality and service of the web-aggregators, their ongoing investment in demand-enhancing features, and, of course, supports a more transparent marketplace.

While they may increase welfare where the relevant market exhibits information failures and high search costs, they can also distort competition. Such may be the case when intermediaries become a crucial gate to the World Wide Web or when they use business agreements—like wide MFN clauses and the agency model. The mixed effects generated by web-aggregators require consideration in context, taking into account the market characteristics and nature of competition. One important destabilizing feature, which could help safeguard competition, comes in the form of new technology and innovation. Indeed, the likely entry of new players or new technology could restrain the incumbents' behavior. Intervention by the competition authority should be considered in light of these dynamics.

# PART IV

# Frenemies

AS WE HAVE SEEN in Parts II and III, the rise of Big Data and Big Analytics can foster new forms of collusion and behavioral discrimination. We now explore a third competitive dynamic, which we refer to as "Frenemy." This dynamic strategy—while not part of the competition agencies' lexicon—can significantly harm competition, innovation, and our privacy interests. We also discuss how "network effects" can reinforce dominance and create powerful gatekeepers.[1]

The Frenemy dynamic highlights the complexity of new online ecosystem—what on the surface appears competitive, really is not—and some shortcomings of traditional competition analysis.

Chapter 14 outlines the complex Frenemy dynamic and the interdependence among competitors. Our Frenemies are not equals. We'll see the rise of the so-called "super-platforms," and the way independent application developers depend on the goodwill of these main gatekeepers. In using the term super-platform we refer to a handful of very powerful companies, which benefit from network effects and dominate the ecosystem.[2]

Chapter 15 explores how firms, in our Frenemies scenario, have a dual data-driven strategy—extraction and capture. It is as if a den of lions were to cooperate to circle the prey and then compete over which of them gets the choice cuts of the gazelle. As you might guess, we are the gazelles.

Chapter 16 examines the Frenemy social structure. The super-platform sets the rules for getting on, being promoted within, and getting kicked off its platform. The super-platform can control (and cut off) the smaller independent apps' oxygen supply. We will examine two apps, have you guess which one was thrown off the super-platform, and explore why. We will also see why—despite the abundance of free apps—competition and innovation are diminished in the Frenemy scenario. The application developers' and super-platforms' interests, even when aligned, do not always favor the consumer.

Chapter 17 considers the future of the Frenemy dynamic and the rise of personal assistants. We explore how the introduction of digital personal assistants can marginalize other operators and increase the super-platforms as gatekeepers. This, we illustrate, will enable it to more easily determine what we will see, where we will buy, and what we will read.

# 14

# The Dynamic Interplay among Frenemies

YOU WON'T FIND the word *Frenemy* in any of the competition agencies' policy statements. The agencies typically classify the competitive relationship, if any, between firms as horizontal, vertical, interlocking, or conglomerate.[1] Companies in a *horizontal* relationship operate at the same level of the distribution chain; they compete directly for market share (such as Coke vs. Pepsi). Companies in a *vertical* relationship operate at different levels of the supply chain. They do not compete directly for market share; instead they buy from or sell to each other (such as Coke, its distributors, and retailers like Walmart).[2] Examples of firms in an *interlocking* relationship are those in a hub-and-spoke conspiracy, discussed in Chapter 6, or persons who serve as directors or officers of two competitors (as when Google CEO Eric Schmidt and former Genentech CEO Arthur Levinson sat on the boards of both Google and Apple).[3] Finally, under a *conglomerate* theory, firms are in neither a horizontal nor a vertical relationship, but are active in closely related markets (e.g., mergers involving suppliers of complementary products[4] or products that belong to the same product range).[5]

With that classification as their guide, competition agencies generally scrutinize horizontal agreements and mergers more often than vertical ones; they rarely investigate agreements or transactions involving conglomerate or interlocking theories. That analytical framework provides a useful guide when assessing most commercial relationships. Yet modern dynamic markets sometimes exhibit different, more complex relationships. In the context of our discussion, the competitive Frenemy dynamic gives rise to an interesting atypical form of competition. The rise of platform competition and pricing algorithms entails companies increasingly becoming "Frenemies."

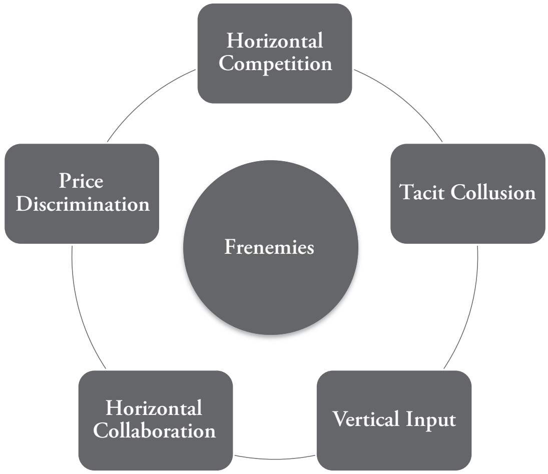


**Figure 1.** *Frenemies*

Figure 1 reflects the move beyond the binary world of coordinated effects/tacit collusion (which Part II addresses) and unilateral effects/price discrimination (which Part III addresses), and beyond horizontal and vertical interplay, to the dynamic reality of Frenemies. Firms here collaborate (friends), compete (enemies), at times engage in unilateral discriminatory action, and at other times benefit from increased interdependence between firms (collusion). While they may view each other as enemies, they may also cooperate in extracting and analyzing data or, alternatively, supplying each other with a key vertical input.

## Competition between and within Super-Platforms

The online world has seen the rise of super-platforms. In the 1990s, Microsoft dominated the operating systems of personal computers. Today consumers are increasingly migrating to mobile and tablet operating systems. Smartphone adoption has accelerated. Ericsson predicts that 90 percent of the world's population over six years old will have a mobile phone by 2020.[6] People are spending more time on their smartphones than on their personal computers. Between 2013 and 2015, Americans' overall digital media usage grew by 49 percent.[7] In this two-year period, their average time on mobile apps increased by 90 percent, and their average time browsing the web increased by 53 percent.[8]

With the migration to smartphones and tablets, the new super-platforms are Apple, Google, Facebook, and Amazon.[9] As the *Wall Street Journal* observed:

> Anyone building a brand, for example, can't ignore Facebook's highly engaged daily audience of 1 billion. Anyone starting a business needs to make sure they can be found on Google. Anyone with goods to sell wants Amazon to carry them. Any mobile app maker needs to be available in Apple Inc.'s or Google's online stores. Any marketer with a video to promote needs to be on Google's YouTube, while producers selling music, film, and television distribute their works through Apple's iTunes or Amazon Video.
>
> The giants have spent billions of dollars on computing hardware and data centers that run their own operations while increasingly providing free or low-cost services for startups and many large corporations. Many longtime Silicon Valley executives are convinced that these companies have become fundamental to the business landscape.
>
> "You are seeing ecosystems built around all of these companies now," said Enrique Salem, a managing director at Bain Capital Ventures and the former chief executive of Symantec Corp. "There is a platform shift happening."[10]

Two super-platforms dominate the mobile and tablet world: Apple's iOS and Google's Android operating systems. In the second quarter of 2015, Android accounted for 59 percent of the U.S. smartphone market, Apple's iPhone software had 38 percent, Microsoft's Windows Phone platform had 2.35 percent, and BlackBerry had 0.36 percent.[11]

Each super-platform, like a coral reef, attracts to it an ecosystem of software developers and app and accessory makers. Figure 2 shows how the number of apps available in the Google Play and Apple App stores soared between December 2009 and February 2015.[12]

Within these ecosystems, competition is along multiple dimensions. First, apps can compete with other apps on the same super-platform. For example, Kayak's travel reservation app competes with Orbitz's app. Second, apps on one super-platform can compete with apps on a rival super-platform; an app may be available on both the Apple and Android super-platforms.[13] Third, independent apps can compete with the super-platform itself. Finally, Apple's and Google's super-platforms can compete against each other for app developers and users.

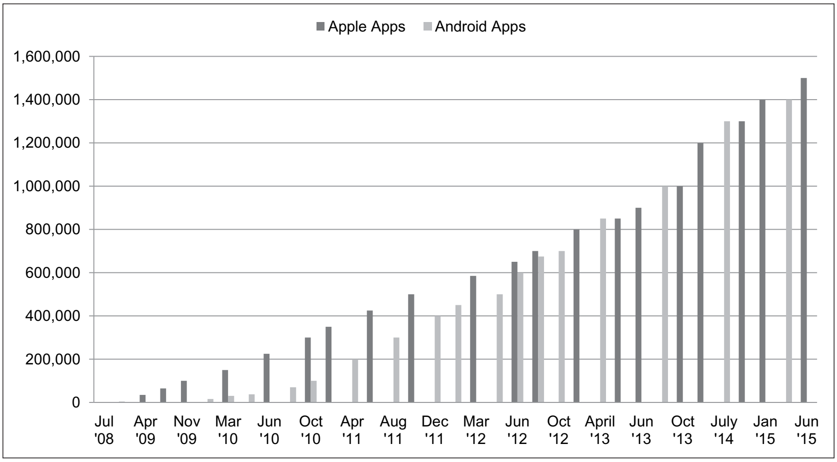


**Figure 2.** *Number of available apps in the Apple App and Google Play stores*

Although the super-platforms compete, they can also be friends. For example, Android, Google's mobile operating system platform, supports 90 percent of Apple's APIs (which stands for application program interface, "a set of routines, protocols, and tools for building software applications").[14] Google has strategic reasons for extending this support, and consequently for reducing the workload of potential Android software developers who already are (or wish to be) present on Apple's mobile platform.[15] In supporting Apple's APIs, Google increases the likelihood of developers writing apps for its own version of the "open-source" Android operating system, and decreases the likelihood of developers working with any other version of Android (i.e., a competing fork of the software) or Amazon's Kindle:

> Most developers probably say "yes" to Google APIs, and the next question is what should they do about the Kindle and other Android forks? Developers are largely on their own to find a replacement API solution, which might be out of date and might not work perfectly with their existing app. If this other solution isn't a perfect drop-in replacement, the developer will have to figure out how to design their app around the missing feature. Since this is such a small amount of users compared to their current iOS + Android user base, is it even worth it to try to figure out this separate ecosystem? Will they get a return on their

time investment? It would be easy to say "the hell with forked Android" and skip all the extra work and Q/A that would entail.[16]

Accordingly, the two super-platforms, while competing, can also collaborate when their commercial interests align.

Another example of Frenemies, which several business professors have examined, is the e-reader market.[17] Amazon introduced its Kindle device several years before Apple's iPad; both devices compete for users today. But, interestingly, Amazon subsequently developed a Kindle Reader app for iPads, which Apple approved. So consumers can now read e-books they purchased from Amazon on either their Kindle Reader or their iPad.[18] As Professors Adner, Chen, and Zhu noted, Apple, "well known for rejecting third-party applications that compete directly with its own offerings, nevertheless approved Amazon's Kindle Reader for iPad, effectively rendering the two platforms Frenemies (friends and enemies). Apple has not, however, made iBooks available for the Kindle."[19]

This manifests the interdependence among leading companies. While super-platforms can easily discard small app developers and remove them from their ecosystem, they may have limited incentive to do so when dealing with other leading platforms.

### Uber's Frenemy Relationship with Apple and Google

Besides super-platforms having Frenemy relationships, independent apps can have a Frenemy relationship with their super-platform. Uber's relationship with Google and Apple illustrates this dynamic. As we saw in Chapter 6, Uber operates a platform that connects drivers and users in dozens of countries. According to Uber's website, "hundreds of thousands of drivers" are joining its platform every month.[20] Uber's own platform sits on top of, and depends upon, Apple's and Google's super-platforms. To compete, Uber must be available and fully functional on these super-platforms, because users rely on their smartphones to request a ride, locate the car, and pay the fare.

So Uber is friends with Google and Apple. Uber's app is available in the Google Play and Apple App stores. Indeed, apps like Uber can increase demand for smartphones by enhancing their utility. Uber drivers and users also need mapping technology, which Google has supplied.[21] In addition, Google, besides providing a platform for Uber, is an investor. Google

Ventures invested $258 million in Uber in August 2013.[22] A Google executive, as of mid-2016, sits on Uber's board.[23]

On the other hand, Uber and the super-platforms will increasingly become competitors and thus enemies. Google is currently investing heavily in driverless cars. In 2015, Google's cars were already "averaging 10,000 new self-driven miles a week, mostly on real-world city streets—not on controlled test tracks."[24] In 2015, Apple was also rumored to be launching an electric car that may eventually be self-driving.[25] In addition, 2016 saw a significant investment by Apple in Didi Chuxing, a leading Chinese car-hailing app.[26] The investment, amounting to a billion dollars, formed part of Apple's strategy in China, and may well affect the increasingly complex Frenemy dynamic to which Uber is party as well.

When, in the future, consumers start using Google's (and perhaps Apple's) driverless cars and ride-sharing services, the super-platforms have the potential to become a powerful force in these downstream markets. Both super-platforms already have the mapping technology. Google also has a crowd-sourcing app, Waze, which provides real-time traffic, accident, and police information. Furthermore, Google has a vast quantity of consumer data from its browser, e-mail service, search engine, and social network. Finally, Google, by licensing its applications, largely controls the open-source Android operating system. Apple controls both the iOS operating system and the iPhone.

At their will, therefore, Google and Apple can nudge users toward their Uber-like app in several ways. Google can require smartphone makers to preload its driver app (along with its other apps) on the mobile operating system platform and include the app on the smartphone's home screen.[27] Apple can preload and feature its app directly on its iPhone. Alternatively, the super-platforms could integrate their Uber-like app with their other services, such as their mapping apps. So when you look up an address on your iPhone or Android smartphone, Apple and Google could identify how much it would cost to be driven there; you would simply click a button to immediately order a car. In other words, the super-platforms can leverage their power to diminish Uber's competitive position. In 2016, Google was already testing a ride-sharing app, whereby riders pay drivers 54 cents per mile.[28] Predictably, Google used its popular Waze app.

The possible leveraging of market power to push out an "as efficient" operator downstream, and clear the way for the super-platform's own operation downstream, is worrying.[29]

Beyond the super-platforms' ability to leverage their power to support car-sharing services, the true game changer is likely to be their driverless car technology. Google and Apple could in the future enjoy a significant cost advantage over Uber. The super-platforms' algorithms for their driverless cars will also benefit from learning by doing, which provides important scale. As *Forbes* has noted, "unlike human drivers who must rely on their own experience for learning, Google's cars will learn from every Google car's experience. That means that the more cars Google puts on the road compared to its competitors, the greater its learning advantage."[30] Unlike Uber, the super-platforms do incur a significant upfront cost for developing the driverless car. But Google and Apple can spread that cost over many passengers. And, unlike Uber, the super-platforms would not have to pay for the expensive recruitment of drivers; nor would they need to pay 80 percent of each fare to drivers. Nor would Google and Apple have to impose hefty surcharges to entice drivers onto the roads when demand exceeds supply: their algorithms could simply summon available driverless cars from local parking lots. Thus, as the cost of driverless car technology decreases, and the technology improves through learning by doing, the super-platforms could enjoy a significant cost advantage over Uber and become a powerful enemy.

What makes Google a powerful Frenemy is that driverless cars represent a new, important mechanism by which it can collect data for its super-platform. As with all economies of scale and network effects, the technology and data can go much further and add more value when at the disposal of a super-platform. For instance, Google's driverless car fleet would collect real-time data on street traffic, construction, and so on. This data, along with that collected on its Waze and Google Maps apps, could give Google a competitive advantage in turn-by-turn navigation systems. If commuters want to know the latest traffic conditions, they would likely turn to Google's Waze and Maps apps. As more traffic data is quickly pumped through Google's super-platform, its driverless cars could better avoid traffic jams—thereby reducing electricity/fuel costs and travel time, which in turn increases its competitive advantage over Uber. Google's Uber-like app would also collect the geolocation data of particular consumers, which Google can combine with its other data to better target app users with behavioral ads (both on their phones and in its cars). The driverless car could, were it to offer free Wi-Fi, collect even more data from users, including how they spend their time.

Google is ultimately not a car-sharing service. We doubt that Google is interested in cars per se (just as it isn't interested in smart thermostats per se, despite its $3.2 billion acquisition of Nest Labs, a company whose leading product is just that). Google is fundamentally an advertising-supported super-platform. It collects our personal data to help advertisers better target us with advertisements when we are on its super-platform and third-party websites. Users, while in the Google cars, could spend time on Google's super-platform—watching YouTube videos (and ads) and searching (and clicking on sponsored ads). The driverless car could itself become a billboard for the Google platform, where users and bystanders can be targeted with ads televised on screens throughout the car.

Thus, the windfall is potentially great for Google: even if Google were to offer the car service for a nominal fee, consumers would end up paying with their data and privacy. This gives Google a competitive advantage over other super-platforms, like Apple, Facebook, and Amazon. Google's Uber-like car service could become so cheap that many people might relinquish their cars (and their use of public transportation). Instead, Google's car service could seamlessly become part of our daily activities, adjusting to the rhythm of our lifestyles. Google, by virtue of its calendar and e-mail apps, could anticipate when you need a car and where you need to go. As your Nest Labs smart thermostat lowers the heat when you leave your home, a Google driverless car pulls up to your front door.

Even for those who prefer to drive their own cars, Google could nonetheless leverage its driverless car technology. Given the scale benefits of learning by doing, car manufacturers might prefer (or be forced) to license Google's technology (including the daily or hourly updates from the millions of Google cars on the road). (If Apple did not license its driverless car technology, then it would lack the scale, and its quality would lag.) The car manufacturers also see a potential relationship in which they manufacture the car's "dumb" commoditized parts (like Foxconn Technology Group for Apple), while the super-platforms earn the lion's share of profits from technology and design. Thus the leading car manufacturers are undertaking AI research.[31]

The above Frenemy scenario between and within platforms also takes place between the operators on these platforms. Each application or service competes with other providers on the platform. At the same time, they also complement each other. By providing users a wider choice of apps, the super-platform becomes more attractive relative to other platforms.[32]

## Economic (Inter)dependence

The benefits the super-platform may derive from driverless car technology highlight another theme—one of market power and dependency. The super-platform needs the apps to attract users, but, once it becomes powerful, it can harm the independent app developer in many ways. The super-platform at any moment may favor its own operations downstream over those provided by Uber. To put it differently, Uber's biggest nightmare is not some obnoxious taxi commissioner seeking to hold on to a crumbling monopoly by refusing Uber entry into his city, nor is it another car-service platform like Lyft. The real fright comes from super-platforms like Google and Apple.

Consumers may benefit from Uber's fright when Uber improves service, maintains competitive prices, and increases its investment in research and development. But Uber also sees the long shadow of the super-platforms, and realizes that it will likely be at a significant competitive disadvantage over the long run. Uber must now develop its own driverless car technology (or partner with a car manufacturer that does). It also lacks the super-platforms' mapping technology. So in early 2015, when *Bloomberg* reported that Google was preparing its own ride-hailing service,[33] Uber responded. In 2015, it acquired mapping technology, including Microsoft's Bing Maps street-mapping technology and a hundred of its workers.[34] Uber has also hired around fifty researchers from Carnegie Mellon to develop driverless cars.[35] Google's rival, Microsoft, is also an investor in Uber.[36] So Google is now Uber's friend, investor, and enemy. Adding another dimension, General Motors invested in Uber's smaller rival Lyft, where customers can order a driverless car using their smartphones.[37]

But Uber will still lack the consumer data, advertising revenue, and multiple advertising platforms that a super-platform like Google possesses. And Uber, unless it launches its own smartphone operating system, will continue to depend on the super-platforms for its oxygen supply. The oxygen provider will ultimately hold the key to coexistence, exclusion, or possible acquisition of the downstream operator.

## Asymmetries in Power

The asymmetry in bargaining power between the apps and super-platforms is central to the Frenemy dynamic. The independent apps recognize that web usage is increasingly shifting to mobile platforms such as smartphones and other connected devices.[38] Their business growth and success thus depend on their interoperability with the super-platforms, which they do not control.

In its report on "Online Platforms and the Digital Single Market," the United Kingdom House of Lords noted the asymmetry in bargaining power.[39] We also see both the smaller and larger publicly held platforms, from Coupons.com[40] to Facebook,[41] expressing the same concern to their investors, namely being squeezed by the super-platform.

The super-platform Facebook, for example, described to investors its "dependen[ce] on the interoperability . . . with popular mobile operating systems, networks, and standards that we do not control, such as the Android and iOS operating systems."[42] Facebook identified how these super-platforms could degrade the functionality of its app; reduce or eliminate its ability to distribute its products; give preferential treatment to competing products; limit its app, whose revenues are primarily from advertising and the ability to deliver, target, or measure the effectiveness of ads; or impose fees or other charges related to its delivery of ads.[43] Thus, Facebook warns that, among other things, there "is no guarantee that popular mobile devices will continue to feature Facebook or our other products, or that mobile device users will continue to use our products rather than competing products."[44]

Are the independent apps simply paranoid? Not necessarily. A super-platform has several levers with which to exert its power. The super-platform can degrade the functionality of the independent apps and online platforms—like LinkedIn, Twitter, Yelp, or Coupons.com—by reducing their performance and making them run slower. It can foreclose its Frenemies' timely access to critical data. It can increase consumers' switching costs, thereby making it harder for the app to attract users.[45] A super-platform could also prevent Frenemies from achieving the minimum efficient scale.[46] Scale can be especially important in data-driven industries such as search and search-advertising. It may limit a competing app's revenue stream by excluding the app from its online payment systems, such as Apple Pay or Google Wallet. The super-platform can reduce or eliminate the independent app's ability to distribute its products. It can make it harder for consumers to find the product on its search engine or app store. It can also give preferential treatment to its own or other competitive services.

The super-platform can give preferential treatment to its own products, by preloading its app on the smartphone, having it on the opening screen, or integrating its own products into other popular products, including search and the smartphone operating system. This was the basis of the European Commission's 2016 charges against Google.[47] Google, the Commission alleged, abused its dominant position with its mobile Android super-platform to "preserve and strengthen its dominance in general internet search."[48] Absent a Frenemy relationship, a super-platform would ordinarily leave it to manufacturers or customers to decide what apps to preinstall on the smartphone. Android is technically an open operating system. But Google, according to the Commission, controlled the operating system's development through its licensing agreements with the Android smartphone manufacturers.[49] It reduced the smartphone manufacturers' incentives to preinstall competing search apps, as well as consumers' incentives to download such apps.[50] Google also paid a lot of money to "some of the largest smartphone and tablet manufacturers as well as mobile network operators" on the condition that they exclusively preinstall Google Search on their devices, and not any other search provider.[51]

If the Commission's concerns are borne out, then one can imagine how difficult it is for an independent search engine, like DuckDuckGo—or any independent app—to successfully compete against Google. In Europe, Google dominates the markets of general Internet search services and licensable smart mobile operating systems. DuckDuckGo can't convince the manufacturer to be the default search engine on your Android phone; nor can DuckDuckGo get its search engine preloaded on your Android phone; nor can it turn to Apple. As we'll see, Google paid Apple $1 billion in recent years to be the default search engine on your iPhone.

## Reflections

This chapter identifies the rise of a competitive dynamic that fosters interdependence between competitors and between companies in the vertical chain. Our Frenemy scenario takes place between super-platforms and within them. Possible abuses by the super-platform can hurt consumers in many ways, including less innovation (when independent companies know that, however good their products or services are, they cannot effectively reach consumers unless the super-platform admits them and doesn't injure them later).

In the next chapter we explore the unique environment in which apps and super-platforms join forces in extracting, selling, and analyzing data. Here again we see super-platforms, in exercising their dominance, coordinate the extraction of our data and capture most of the profits.

# 15

# Extraction and Capture

POWER, we saw in the last chapter, resides with the super-platform. But the lives of the independent apps are not necessarily solitary, in continual fear and danger of violent death by the super-platform. The apps' lives are, in fact, interdependent with the super-platforms'. They both seek to attract us to their ecosystem, whether it is, for example, an Apple or Android smartphone.

One way to attract our attention is through free apps. Indeed, the ecosystem can appear competitive, with many apps offering free or discounted products or services. But behind this competitive veneer lies another facet of their interdependence, namely their joint strategy, *extraction and capture,* in collecting and using our personal data. As we saw with price discrimination, relevant, up-to-date personal data can provide online sellers a competitive advantage.[1]

This chapter explores the Frenemy strategy of *extraction and capture.* The website owners, independent apps, and the super-platform cooperate in the extraction phase, obtaining valuable personal data (such as geolocation data) about us, tracking our behavior, promoting asymmetrical information exchanges and strategies (i.e., where they control and know about the data flow, but we don't), and reducing our ability to maintain our privacy.

In this extraction phase, the super-platform, website owners, and independent app developers are like lions that cooperate to circle the prey. We, like gazelles running across the savanna, rarely stay on one website or app. If the super-platform, website owners, and independent app developers did not cooperate, they would see us only when we arrive. They would not know from where we came or where we are going next. Advertisers would not want to negotiate with each website for data about us. It would be too costly and time-consuming to develop profiles about us. Without such profiles, it would be harder to predict what ads would appeal to particular users and to engage in behavioral advertising (and discrimination).

Following the successful extraction, in the subsequent capture phase, the super-platform, website owners, and independent app developers compete to retain an advantage over each other and to capture as much of consumers' wealth as possible. In this phase, the Frenemies' interests can diverge, as they compete among themselves over the distribution of value within the channel. That distribution, as we explore, depends on their relative bargaining power. So, after circling the prey, the super-platform and independent apps compete over the choice cuts of the gazelle.

## Data Extraction

Suppose advertising revenue is the lifeblood of the super-platform's, website owners', and independent app developers' ecosystem. Every time we click an ad or purchase an item, they get money. How could they maximize profits? Ideally, the Frenemies could implant in our brains a device to collect data wherever we go, about what we do, what we are thinking, and what we can be enticed to buy. The implant would provide a clear picture of our desires and behavior; the Frenemies could easily predict what we are likely to buy, when, at what price, and the personalized ad that would induce our purchase. With this technology the Frenemies could perfectly track and target us with personalized ads, increasing the relative power of their ecosystem. What advertiser or marketer could afford to spurn this technology?

Of course, such technology does not exist today. Instead, the Frenemies, under their joint extraction strategy, strive to approach it. The super-platform, independent apps, and websites within the ecosystem join forces to better track and understand us as we browse their websites across devices (such as when we are on our personal computer, laptop, smartphone, or tablet). In jointly extracting the data about us, they seek to improve their understanding of our behavior in order to influence and modify it. This includes devising ways to better exploit our biases and imperfect willpower. Ultimately, the companies agree to extract our personal data, which feeds the advertising networks' algorithms, and improves their ability to identify behavioral ads to prompt purchases. So the Frenemies cooperate with respect to both the inputs (extracting personal data) and outputs (providing platforms for behavioral ads by others).

The independent apps and websites use the personal data internally, but also selectively distribute it within the food chain for others to analyze. At the top of the chain is the super-platform. The super-platform harvests massive volumes of data directly as well as through others, analyzes it, and then determines what data its partners and advertisers can analyze (perhaps without personal identifiers). Or the super-platform serves as the air traffic controller. It uses the data to continually target individuals with personalized ads on all of its own and its Frenemies' publishing platforms. Their joint interest is that that we spend more time on their network of websites and apps rather than a competing super-platform's ecosystem, where they cannot collect data about us or target us with ads.

To illustrate, let us consider a health club ad. Traditionally, a health club would advertise offers on media that many prospects were watching, such as fitness or athletic shows. There was a lot of waste, because many viewers may be uninterested in joining a health club. Another drawback is that the health clubs had to wait for consumers to watch the shows or visit the fitness or athletic websites where they advertised. Now suppose that from the data flow the super-platform finds that an individual, whom we'll call Harry, is interested in joining a health club. It might be because Harry searched for nearby health clubs or e-mailed a friend about possibly joining a gym. Or, cleverer still, Harry's behavior signals a greater willingness to join a gym. Harry, for example, recently searched about dieting or healthier foods. Under the Frenemy scenario, the super-platform is collecting enormous amounts of data about Harry. It knows Harry is ripe to join a gym. It also knows, from where Harry lives, works, and socializes, which gym might be especially attractive. Now the super-platform can target Harry with promotions for this specific health club wherever Harry spends time on any of the Frenemies' websites, apps, or services within the ecosystem. When Harry awakes, his free alarm app might have an ad for the health club. Later in the morning, when Harry reads about world news on the *New York Times* website, a banner ad may promote the health club. When Harry next visits a social network, he may see a friend's endorsement of the same health club. Indeed, the super-platform can target Harry with complementary ads—for athletic clothing, energy bars, nutritional supplements, and health clubs—each reinforcing the need to consume some of these products. When walking downtown near the health club, Harry might get a coupon for a free thirty-day trial period. So what's the best way to track Harry and extract his data? The answer is in his pocket.

## Mobile Platforms as a Source of Data

Harry's smartphone can offer a wealth of data that quantitatively and qualitatively differs from anything else he carries in his pocket or stores in his home.[2]

The U.S. Supreme Court observed in 2014 how the storage capacity of cell phones had several interrelated consequences for privacy.[3] The Court noted how the data collected on a smartphone differs qualitatively from physical records, and could reveal "an individual's private interests or concerns—perhaps a search for certain symptoms of disease, coupled with frequent visits to WebMD . . . [and] where a person has been."[4] Historic location information, the Court noted, "is a standard feature on many smart phones and can reconstruct someone's specific movements down to the minute, not only around town but also within a particular building."[5]

Our location data is also used to refine our user profiles and better target us with behavioral advertising.[6] Our geolocation information, along with other data collected from our phones, can be sold or used to develop other marketing strategies.[7] So companies can use our mobile phones to extract additional information about our whereabouts and activities, when we visit or revisit a particular store, and where we linger in that store. Google, for example, tracks users' locations "to tell with 99% accuracy if a user visited a store after seeing a relevant search ad."[8] That data collection is intensified in the context of the "tech addiction that puts smartphones in control of us."[9]

Importantly, not many of us know of all the personal data collected through our smartphone. As the Australian Communications and Media Authority noted:

> Around half of all survey participants were not aware of data-sharing processes such as information shared with a third-party provider, stored by a mobile service or internet service provider when using a location service, or information stored by the location service developer. . . . The sale and ownership of information and risks associated with disclosure were key concerns with 71 per cent of users' concerns with information being sold to a third party and 59 per cent concerned about a lack of information on where their data goes and who owns it.[10]

With the rise of the Internet of Things, mobile platforms will become the key gateway to the flow of personal data. Google's underlying operating system for the Internet of Things, dubbed "Brillo," is based on its Android operating system.[11] As our smartphones are always near us (except perhaps when we shower or swim), they will assist the super-platforms, governments,[12] and others in tracking our behavior, harvesting our data, and targeting us with behavioral ads.[13] This data trove will also attract hackers and criminals.

Thus we should expect Frenemies to support the Internet of Things, to the extent that the sensors can effectively track and collect data on us when we are offline—data that can be used to fuel their advertising-supported business model. Frenemies, as we'll see with Uber, would also likely cooperate by allowing third-party cookies and other technology to better track us.

## Uber and Google

We saw in Chapter 14 how Uber and Google were Frenemies with respect to car services. But they are also Frenemies with respect to data.

To begin with, Uber caused a stir in 2014 when its senior vice president expressed a desire to spend $1 million to dig up information on the personal lives and families of journalists who wrote critically about Uber.[14] Another Uber executive had "examined the private travel records of a Buzzfeed reporter during an e-mail exchange about an article without seeking permission to access the data."[15]

Given these privacy lapses, Uber prompted consternation when in 2015 it relaxed its privacy policy. Uber will track its users' locations, if they agree, even when they aren't using the app:

> When you use the Services for transportation or delivery, we collect precise location data about the trip from the Uber app used by the Driver. If you permit the Uber app to access location services through the permission system used by your mobile operating system ("platform"), we may also collect the precise location of your device when the app is running in the foreground or background. We may also derive your approximate location from your IP address.[16]

Uber will also, if users agree, access their address books, collecting all the names and contact information in them so as "to facilitate social interactions through [its] Services and for other purposes described in this

Statement or at the time of consent or collection."[17] Uber never explained how this data would improve its car-sharing services.

Competition dynamics should correct an app, like Uber, that overreaches by seeking more personal data than is necessary for its services to be provided. One check should come from the super-platform, as its incentives should be aligned with the users'. The super-platform wants to attract many users, and to retain its existing users. So the super-platform should be vigilant, rebuking any independent app developer who greedily demands more personal data than necessary for its app to run effectively. The super-platform would also design its platform to promote users' privacy preferences, such as giving users greater control over their data, requiring any app to obtain the user's express permission, and enabling users to delete their personal data.

Interestingly, neither super-platform publicly rebuked Uber over tracking smartphone users' locations when they weren't using the app, or for accessing their contact information. Indeed, Google made it easier for Uber to access your information.

Apple, as Uber notes, "will alert you the first time the Uber app wants permission to access certain types of data and will let you consent (or not consent) to that request."[18] So Apple, at least, requires its iPhone users to affirmatively assent, allowing them to opt out of each permission on an individual basis.

Android smartphones, however, do not; they will merely notify you "of the permissions that the Uber app seeks before you first use the app, and your use of the app constitutes your consent."[19]

Apple iPhone users see the box shown in Figure 3, which requires the user's consent.[20] Android users instead see the box shown in Figure 4, without any conspicuous consent box.[21]

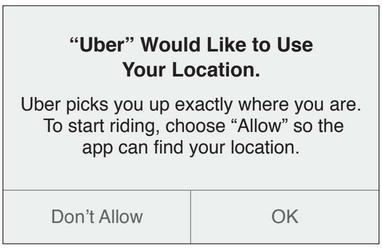


**Figure 3.** *Uber, iOS app permissions*
(https://www.uber.com/ios/permissions)
© Uber Technologies, Inc.

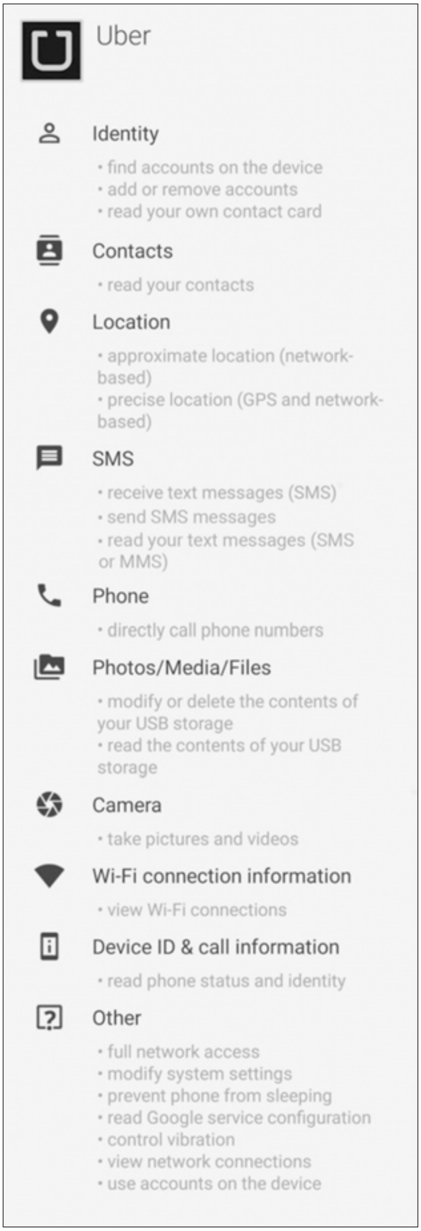


**Figure 4.** *Uber, Android app permissions*
(https://www.uber.com/legal/android/permissions)

This was not entirely Uber's choice. Uber's Privacy Statement states that Google created "[t]he descriptions of these permissions," which "are worded the same for every app—currently, there's no way for Uber to customize them."[22]

Returning to our extraction phase, we see here how the super-platforms help (rather than thwart) the independent apps (like Uber) to better track users. Uber (and others) can track your location even when you aren't using the app. Rather than promoting privacy by design, Google's take-it-or-leave-it privacy approach makes it harder for users to avoid being tracked. (Google's forthcoming Android 6.0 or "Marshmallow" may enable users to toggle individual permissions on and off on an app-by-app basis.[23]) Indeed, according to one account, advertisers hated working with Apple's iAd:

> not because it failed to improve the ad experience, or because it was technically inferior, or because it failed to engage audiences. Advertisers hated that Apple's iAd was preventing them from gaining full access to user demographics and behaviors—the way Google, Adobe and the other mobile ad networks were working to facilitate. Apple's increasingly vocal stance on the side of consumer privacy—which has only grown more strident over time—was standing in the way of advertising nirvana: the non-stop audience surveillance program that could be distilled into the sort of pure profit brand manipulation depicted in futurist movies such as Minority Report, where billboards literally leap into your face and talk to you by name, coaxing you to buy with the savvy of a salesman pretending to be your best friend.[24]

Although Google is more opportunistic than Apple in the extraction phase, neither super-platform employs a data-minimization principle, which would require the apps within their ecosystem to collect only the personal data that is directly relevant and necessary to accomplish the app's specified purposes and to retain the data only as long as is necessary to fulfill the specified purpose. Neither super-platform requires Uber to explain:

- why it needs to track your location when you aren't using the Uber app;
- why it needs your contact information "to facilitate social interactions through [its] Services";[25] or

- why if you choose to link, create, or log into your Uber account with a payment provider (such as Google Wallet) or a social media service (such as Facebook), Uber can obtain yet more personal information about you or your connections from these websites.[26]

The other component of our extraction phase is how the independent apps and websites within the ecosystem help each other extract personal data. Uber isn't simply hoarding the data for itself. Rather, Google (and Apple to a lesser extent) encourages the flow of consumer data, because it fuels the advertising revenue upon which the super-platforms, the ad exchanges, and the publishers are dependent. This is not apparent when you first visit Uber's website. To have seen this in February 2016, one would have had to visit Uber's website, go to the bottom of the page, click on its Privacy tab, scroll down the page until near the end, click the Cookie Statement hyperlink, scroll to the bottom of the Cookie Statement, and read Uber's description of how third parties will track you when you visit Uber's website:

> Things like cookies and pixels are used to deliver relevant ads, track ad campaign performance and efficiency. For example, we and our ad partners may rely on information gleaned through these cookies to serve you ads that may be interesting to you on other websites. Similarly, our partners may use a cookie, attribution service or another similar technology to determine whether we've served an ad and how it performed or provide us with information about how you interact with them.[27]

For its app to function, Uber doesn't need to continuously monitor your location. It doesn't need to know who all of your friends, family, and coworkers are, as well as anyone else listed among your contacts. Nor does Uber have to allow others to track you across the web, including when you visit Uber's website. So what explains Uber's actions? Here again the answer is data.

To understand tracking we'll briefly discuss cookies. A "cookie" is a file on a user's computer that contains "information that identifies the domain name of the webserver that wrote the cookie (e.g., hulu.com or facebook.com)" and "information about the user's interaction with a website."[28] Cookies were originally developed for a benign purpose: an online shopping site placed the cookie (first-party cookie) to help remember the items you wanted to purchase (e.g., placed in your shopping cart) as you browsed its website.[29] For example, the cookie would allow Brooks Brothers to remember the shirt you placed in your shopping basket as you continued searching for a matching tie.

The inventor of cookies was concerned that third parties could use cookies to track you across the web.[30] That is exactly what happened. In fact, the *Wall Street Journal* found that the tracking technology "is getting smarter and more intrusive," moving beyond cookies to tools that "scan in real time what people are doing on a Web page, then instantly assess location, income, shopping interests and even medical conditions. Some tools surreptitiously re-spawn themselves even after users try to delete them."[31] As a result of the tracking mechanisms, including third-party cookies, not only will the retailer remember what you placed in your shopping cart, but so too will other companies; thus you may encounter advertisements for dress shirts and ties as you surf other websites.

Uber places cookies on your browser or computer when you visit its website. But Uber also allows the super-platform Google and other companies to place cookies and identification technologies on your computer and browser when you visit Uber's website.

Uber identifies several reasons why it allows third parties to track you when you visit Uber's website. The first is "Site features and Services," namely to enable Facebook, Twitter, Google, and possibly others to "provide you and others with social plugins and other customized content and experiences, such as making suggestions to you and others."[32] Second, it enables Google, MixPanel, Optimizely, and possibly others to collect data for "analytics and research," including segmenting audiences for testing and understanding "how you use websites, apps, products, services and ads."[33] The final reason is advertising. Uber allows, among others, Google, Facebook, AOL, Microsoft, Yahoo, Drawbridge, Indeed, Recruitics, RocketFuel, Simplyhired, Twitter, Ziprecruiter, Mixpanel, HasOffers/Tune, Adjust, AdRoll, Quantcast, and KenshooThings, to track your visit to Uber. The cookies and pixels are used to deliver and track the performance of behavioral ads.[34]

Uber is not alone in helping the super-platform and others extract your data. Any time you visit the website or app of any of Google's partners, such as websites that use Google's advertising products (like AdSense), social products (like the +1 button), or analytics tools (Google Analytics), "your web browser automatically sends certain information to Google."[35] Google collects the web address of the page that you're visiting and your IP address.[36] Google "may also set cookies on your browser, or read cookies that are already there."[37] Apps that "partner with Google" can send it additional information "such as the name of the app and an identifier that helps [Google] to determine which ads [Google] served to other apps on your device."[38] Google can use your personal data in a variety of ways, including making the behavioral ads more effective, and help its partner websites and app owners using Google Analytics "to understand how visitors engage with their sites or apps."[39] (To opt out of websites and apps sending your data to Google Analytics, you must download and install an add-on for your web browser.[40])

Consider one class action lawsuit against Viacom Inc. and Google on behalf of children under thirteen years of age for violating their privacy rights under U.S. federal and state law.[41] Viacom owns and operates three websites geared toward children: Nick.com, Nickjr.com, and Neopets.com. As the complaint alleged, Viacom encouraged the children to register and establish profiles on its websites. Viacom assigned a code name to each child based on that child's gender and age—allegedly called (by Viacom internally) the "rugrat" code. Viacom placed a cookie on the children's computers, allegedly without their (or their parents') consent to acquire additional information. Viacom then shared this information with Google and permitted Google to place third-party cookies on the children's computers to track their Internet usage. Google used the information for the same reason that Viacom used it—" 'to sell targeted advertising' based upon [the children's] 'individualized web usage, including videos requested and obtained.' "[42]

Judge Stanley R. Chesler, in an unpublished opinion, dismissed the lawsuit. Some of the reasons dealt with the particular statutes at issue.[43] The state privacy claim failed because the judge was not persuaded that Google's and Viacom's collection and monetization of online information of children would be "offensive to the reasonable person, let alone exceedingly so."[44]

This was not an isolated incident. In 2010, the *Wall Street Journal* examined fifty websites popular with U.S. teens and children to see what tracking tools they installed on a test computer.[45] As a group, the websites placed "4,123 'cookies,' 'beacons' and other pieces of tracking technology."[46] That was 30 percent more than what the *Journal* found in an analysis of the fifty most popular U.S. sites overall, which were generally aimed at adults.[47] Viacom's Nickelodeon TV network accounted for eight of the fifty websites in the *Journal*'s survey.[48] And Google placed the most tracking files overall on the fifty websites. In response to the *Journal* article, a Google spokesperson responded that "'a small proportion' of the files may be used to determine computer users' interests."[49] The Google spokesperson also said that Google doesn't include in its user profiles "topics solely of interest to children."[50] But the *Journal,* in reviewing Google's Ads Preferences page, found that the super-platform "accurately identified a dozen pastimes of 10-year-old Jenna Maas—including pets, photography, 'virtual worlds' and 'online goodies' such as little animated graphics to decorate a website."[51]

Included in the extraction phase are data brokers, who are also innovating methods to better track you online and offline:

> Data brokers rely on websites with registration features and cookies to find consumers online and target Internet advertisements to them based on their offline activities. Once a data broker locates a consumer online and places a cookie on the consumer's browser, the data broker's client can advertise to that consumer across the Internet for as long as the cookie stays on the consumer's browser. Consumers may not be aware that data brokers are providing companies with products to allow them to advertise to consumers online based on their offline activities. Some data brokers are using similar technology to serve targeted advertisements to consumers on mobile devices.[52]

In addition, companies buy and sell user profiles and updated information on stock market–like exchanges.[53]

## Capture

So Frenemies cooperate to track us, extract our data, and target us with behavioral ads. They all benefit from the combined effort. But they do not share equally the spoils; the dominant lion gets the best cut, which further enhances its power.

As we saw in the last chapter, the super-platform has relatively more power than the independent apps. As a key conduit for data, it can serve as the advertising intermediary, obtaining several choice cuts of the advertising revenue. It can collect revenue from ads on its sprawling super-platform. It can collect fees for advising advertisers where their ads should go. It can collect fees for advising publishers on how to better collect data to target users with ads they are likelier to click. Finally, it can collect a share of the advertising revenue of its partners' websites. Suppose Google's algorithms directed the health club ad to one of its partner's websites. When Harry clicks the health club ad, the website receives 68 percent of the ad revenue and Google 32 percent. So if the advertiser pays $1 per click, the Frenemy that published the ad gets 68 cents; Google gets 32 cents.[54]

Why settle for 32 percent when you can get it all? The super-platforms can use their profits to expand downstream with new (or acquired) apps and programs, so that the gazelles will likely spend more time grazing on the super-platform's terrain. When you click an ad on the super-platform's website, it collects 100 percent. For example, the bulk of Google's ad revenues come from its websites rather than its Frenemies' websites.[55]

So Frenemies, using the findings from psychology experiments, compete to get us to spend more time on their platform or app.[56] For advertising-dependent apps, their value largely depends on how much time people spend on them.[57] Here the super-platforms have the advantage. In 2014, Americans, on average, spent forty minutes per day on Facebook.[58] One survey found that of all the minutes spent on mobile phone apps, U.S. users spent the greatest time on Facebook's super-platform (13 percent), followed by Google (12 percent, and this percentage does not include time spent on the Android operating system ), Amazon (3 percent), and Apple (3 percent).[59]

Thus, one concern is that as the super-platform expands, including incorporating more habit-forming technology, it becomes less dependent on third-party tracking technologies and third-party publishers of ads. In effect, the savanna becomes the super-platform's zoo. It knows where the gazelles are, and can devour them whole.

For example, for those of us owning an iPhone and iPad, we can use ad-blocking technology to limit behavioral ads when we use the Safari browser; we cannot use the technology within apps, such as those of Facebook or Google. Why the distinction? As the *Wall Street Journal* reports, "Apple says it won't allow ad blocking within apps, because ads inside apps don't compromise performance as they do on the browser. That distinction serves Apple's interests. It takes a 30% cut on money generated from apps, and has a business serving ads inside apps."[60] This comports with our Frenemy scenario. Apple incentivizes companies that are dependent on advertising revenue to develop apps for its iOS platform, where ads can't be blocked, and Apple gets a significant cut of the ad revenue.

Likewise, Coupons.com warns investors about Google moving away from cookies, which consumers can block, to other tracking technologies:

> [C]ompanies such as Google have publicly disclosed their intention to move away from cookies to another form of persistent unique identifier, or ID, to identify individual Internet users or Internet-connected devices

> in the bidding process on advertising exchanges. If companies do not use shared IDs across the entire ecosystem, this could have a negative impact on our ability to find the same anonymous user across different web properties, and reduce the effectiveness of our solution.[61]

Thus, one concern is that Google and other dominant firms can track individuals across their sprawling super-platforms, but restrict sharing the customer information with others in the ecosystem.

Allen Grunes, our colleague at the Data Competition Institute, explained this "capture" dynamic with respect to an industry-proposed do-not-track standard.[62] The Federal Trade Commission asked industry participants to craft a new "Do Not Track" policy for online data, similar to the "Do Not Call" registry that helped reduce the nuisance of telemarketers telephoning our homes. "But what started as a group effort by technology companies and privacy experts to craft a new type of consumer protection has quietly changed," Grunes said, "and today has morphed into a committee where a few of the most powerful Internet firms are deciding on the rules of the game."[63] The World-Wide-Web Consortium, under the influence of dominant players such as Google, Yahoo!, Facebook, and Comcast, proposed in July 2015 a Do Not Track standard that distinguished between first and third parties. Basically, when the gazelles are visiting the super-platform's own apps and websites, the super-platforms can continue to track them and collect data on them, but third parties, like the smaller apps, cannot. So when a user activates the Do Not Track signal, "if he or she enters a query into the Google search engine, signs onto . . . Gmail, or uses Google Chrome or Android, he or she will still be allowing Google to gather information and use it to deliver targeted ads."[64]

Here the Frenemy relationship is tilting toward capture. The proposed Do Not Track standard doesn't really prevent tracking. Instead, the main function of the proposed standard "will be to limit the ability of any potential rivals to collect comparable data."[65]

This is key as users spend more time on mobile phones, whose operating systems the super-platforms control, and on the super-platforms' own apps and services. The big lions will still rely on others to help hunt the gazelles. But under our scenario's capture stage, the weaker lions will get skinnier as their cuts of profits get smaller. They will eventually perish or be displaced by other, more enterprising app developers who can offer the super-platform better, more valuable data or provide a popular watering hole for gazelles that do not frequent the super-platform.

The more personal data the super-platforms amass, the more likely they can predict where we will go and buy, and what we will want. With a better view of our behavior, they can better identify the critical aspects that are missing. To use another analogy, if data is crude oil, the super-platforms will know where to drill. For more valuable personal data, the super-platform may use its own rigs to access the data. Lesser grades of data may be pumped by one of the independent apps. Once the data is exhausted, the independent app ceases. At times, consumers may volunteer their valuable personal data, such as identifying their friends and likes [and, in 2016, "dislikes" (or a near alternative)] on Facebook.[66] Then the super-platform refines the data and selectively allows access to specific advertisers and independent apps that serve as advertising platforms.

Thus the extraction and capture phases are dynamic. Super-platforms at times will be more selective about sharing data on users. Facebook, for example, had a billion people who used its network on a single day in August 2015.[67] While extending its platform to include search, Facebook is also restricting the data it is sharing with others. As the *Wall Street Journal* reported, "Dozens of startups that had been using Facebook data have shut down, been acquired or overhauled their businesses."[68] One venture capitalist noted the shift from joint extraction to capture: "Companies are open until they have liquidity and users. Then they start to control."[69] He too is "becoming increasingly skeptical that you can build a lasting, stand-alone business based on access to someone else's social graph."[70]

While closing one door, Facebook is opening other doors for companies to target us. For example, Facebook introduced bots for its Facebook Messenger texting platform. The new technology, backed by powerful algorithms, will make use of user data to better target users with ads and promotions. The bots will foster communication with companies and enable Facebook's algorithms to better learn of your preferences. Since it is embedded within the chat service, it may become difficult to separate from the "normal" use Messenger. Indeed, if Facebook's vision materializes, the use of its bots would replace other apps as these will form part of the chat thread—exposing us to increased tracking and targeting.[71]

## How Powerful Is the Super-Platform?

The super-platform, while increasing in power and scale, is not immune from competition. Competitive pressure may come from other platforms, innovation, or entry. To maintain its position, the super-platform will invest heavily in research and development.

While it controls the bottleneck and determines access, the super-platform also has to retain and attract independent app developers for its ecosystem to flourish. It is important to recall the *interdependence* between the super-platform and the applications. Each super-platform collects money from the independent app developers. Google reportedly takes a 30 percent cut from every sale that its app developers make at the Play Store.[72] Each platform needs its ecosystem to flourish; accordingly, it will need to attract independent application developers to join its platform to help build solutions. The greater the utility and diversity of solutions that the platform's products and services can offer, the more users the platform will likely attract. As the platform attracts more users, more application developers will migrate to the platform. So we see a positive feedback loop, where big platforms get even bigger as they attract more developers and users, and as they morph into super-platforms. Microsoft, which is familiar with these network effects from its personal computer operating system, recently noted the importance of platform competition: "A well-established ecosystem creates beneficial network effects among users, application developers, and the platform provider that can accelerate growth. Establishing significant scale in the marketplace is necessary to achieve and maintain attractive margins."[73]

When considering the power of the super-platform, one should also acknowledge the nonexclusive nature of some data that others may independently access (for example, the ability of mobile applications to access the contact list on a mobile phone). Linked to this is the temporal dimension of data. It is often the case that data may decrease in value over time (such as user location in a given time).

In addition, there are looming threats. Intel Corp. is reportedly partly funding "research into how to shield different apps on a smartphone so that they can't steal data from each other, or siphon off data from the phone's user."[74]

Still, in relative terms, the super-platform is the alpha lion that pushes away the other predators once the gazelle is ready to be consumed. As one industry expert observed, "Apps are worth millions. Platforms are worth billions. If you want to make money in mobile, build a killer platform."[75] Indeed, since 2008, Google reportedly (according to Oracle's counsel in ongoing litigation) made $31 billion in revenue and $22 billion in profit out of Android.[76]

To cement its leadership, the super-platform may engage in the defensive practices of acquiring or blocking innovation or entry that might potentially undermine its dominance. The European Commission in 2015 expressed concern over the growth, power, and influence of online platforms. The Commission thinks "almost all areas of the economy will depend on them in the near future."[77]

Indeed, as platforms become super-platforms, network effects can better insulate them from competitive pressure. The bigger the super-platform, the greater the data-driven network effects, and the more difficult it may be for competitive forces to displace it. For example, critics in the 1990s argued that Microsoft's monopoly was likely to be short-lived. Twenty-five years later, Microsoft still has a 90 percent share in operating systems for desktop personal computers.[78]

The real threat to the super-platform generally comes from innovation that disrupts the entire market. Returning to Microsoft, the threat to its position came not from another PC operating system (such as Apple's operating system for its Macs). Nor was Microsoft's market power weakened by a competing browser (such as Netscape), word processing software (such as WordPerfect), or media player (such as RealNetworks). Microsoft's power was eroded when users shifted from personal computers to tablets and mobile phones. Microsoft's 2015 annual report discussed this platform competition:

> We derive substantial revenue from licenses of Windows operating systems on personal computers. We face significant competition from competing platforms developed for new devices and from factors such as smartphones and tablet computers. These devices compete on multiple bases including price and the perceived utility of the device and its platform. Users are increasingly turning to these devices to perform functions that in the past were performed by personal computers. Even if many users view these devices as complementary to a personal computer, the prevalence of these devices may make it more difficult to attract application developers to our PC operating system platforms. Competing with operating systems licensed at low or no cost may decrease our PC operating system margins. In addition, some of our devices compete with products made by our OEM partners, which may affect their commitment to our platform.[79]

Many people are familiar with Microsoft's Windows platform from their use of PCs. But Microsoft—while dominant on the old platform (PC operating systems)—is having a harder time competing against Apple's and Google's mobile and tablet platforms, and in getting Android and iOS users to switch to Microsoft tablets and smartphones. Once users are locked into a platform, it is often hard to switch them to another platform. As Microsoft reports, "Users incur costs to move data and buy new applications when switching platforms."[80]

Moreover, if data and data-driven network effects provide a competitive advantage in these online markets, then the super-platforms may take their increasing profits to expand their platform to sweep in more data and advertising revenue. Here we may see the super-platforms prevent others from tracking and profiling the gazelles while they are on their websites and apps, thereby weakening the Frenemies' ability to usurp the super-platform's throne. Thus the availability of data plays a central role in the Frenemy scenario's capture phase.

Finally, the cost of harvesting, storing, and processing the data, while declining over the years, still plays a role in the ability of firms to engage in these strategies. All in all, these variables affect the dependence and interdependence between market participants. Ultimately, they affect the competitive dynamics: Will firms seek to improve our welfare or will they cooperate to extract our data, and compete in the ensuing feeding frenzy?

## Reflections

A rapid shift from competitors to collaborators and a mixture of vertical and horizontal effects characterize the complex Frenemy dynamics. Competition under our Frenemy scenario changes constantly and is dependent on the relative market and bargaining powers of the independent app developers and super-platform operators.

To conclude, we will not necessarily benefit as the super-platform expands. Superficially, competition may appear robust. After all, Android users can choose from over a million apps. Many apps are free. Thus, Android users seemingly are benefiting from a greater choice of free and low-priced apps. But the incentives of the super-platform and its ecosystem of app developers will not always align with our incentives.

Where the incentives diverge, we will be harmed—often with less innovation and privacy protection. Yes, we may get more apps, but none will offer solutions to our privacy concerns. Thus there will be growing resignation that tracking and behavioral advertising are inevitable. Some might accept this as a measure of progress. But this progress is at our expense. While the free app developers are seemingly competing for our attention, we will continue to pay more—with our data and privacy. Moreover, an advertising-supported platform, as it pumps consumer data through its ecosystem, will leave us more vulnerable to malware and other cybercrime, including identity theft.[81]

# 16

# "Why Invite an Arsonist to Your Home?" Understanding the Frenemy Mentality

OUR FRENEMY SCENARIO, as we have seen in Chapters 14 and 15, has multiple dimensions. One dimension is when the independent app developer competes against the super-platform (such as Uber competing against Google's driverless cars). Another dimension is when advertising revenue supports the ecosystem. Here, the independent apps and super-platform, in the extraction phase, cooperate to better track, profile, and target us with behavioral ads; in the capture phase, they compete over the spoils. In both Frenemy scenarios, the power has shifted to the super-platforms.

As the super-platform's dominance increases, it benefits from its unrivaled ability to control the consumer's experience. Examples range from Microsoft's control over a significant proportion of personal computer operating systems, to Google's and Apple's control of the smartphones operating super-platform, and to Amazon's control over third-party retailers on its super-platform.[1] The super-platform determines who can join its platform, which apps are featured in its app store, which apps are preloaded on the smartphone, and the product's default settings. Apps can be promoted and demoted. In short, the super-platform becomes the gatekeeper.

This chapter examines, through the tale of two apps, the Frenemy social structure. The super-platform sets the rules for getting on, being promoted within, and getting kicked off the platform. The independent apps cooperate under the single leader, the super-platform. They live by the super-platform's rules and informal norms. Lines are clearly defined. The super-platform eats first; no one can interfere with the hunt of the gazelles. And certainly any independent app that tries to help the gazelles will be kicked off the platform. The asymmetric power and bargaining between the independent apps and the super-platform are understood. The super-platform controls the independent apps' access to users and their data; it can control (and cut off) the smaller independent apps' oxygen supply. The super-platform's ecosystem will develop in a controlled manner in line with the super-platform's strategic goals.

## A Tale of Two Apps

To illustrate the "Frenemy" social structure, we look at the fate of two independent apps: Brightest Flashlight Free and Disconnect. We ask you to guess which app was kicked out of the Google Play Store.

The first app, Brightest Flashlight Free, was simple. It turned on all the available lights on the Android smartphone to make it a flashlight. The free app was popular. The Google Play application store ranked the app in May 2013 "as one of the top free applications available for download. Users have downloaded the Brightest Flashlight App tens of millions of times via Google Play."[2] Unbeknownst to its millions of users, however, the app secretively tracked its users' precise location, which it then sold to third parties, including advertising networks.[3] The Federal Trade Commission sued the app developer for its deception, and the app developer settled.

The second app, Disconnect, afforded users greater control over the extent to which they were tracked while surfing on the web. Disconnect gave the following example: In visiting the *Financial Times* newspaper's website on an Android phone, users will be tracked by seventeen separate networks. Seven of these requests come from sites and services that invisibly track consumers as they use applications and browse the web, in order to form a comprehensive profile of their personal information. Advertising companies, Disconnect stated, "use these invisible connections to track" us as we browse the web or open other mobile applications. They collect personal information about us, create a "profile" of each of us, and make money targeting us with behavioral advertising. Increasingly, these invisible connections (including those set up by advertising companies) are being used even more maliciously—by cybercriminals—to distribute malware, steal confidential personal and business information, damage property, and engage in identity theft.[4] Disconnect's app revealed and blocked this secretive tracking.

So which app did Google kick off its platform? The flashlight app, which surreptitiously tracked users' locations, or the privacy app that gave users greater control over their online privacy? The answer is Disconnect's privacy app. The flashlight app remains on the Google Play store, and is still tracking users' locations—even after the FTC enforcement action.

Now, like many stories, this one has different ways of being told. Google explains that Disconnect was "disconnected" as it infringed Google's privacy rules, acted as a free rider, and changed users' settings without their consent. Disconnect tells the story of a small app that was kicked out for being innovative and disrupting the super-platform's extraction agenda.

We want to make clear that we have as of June 2016 only Disconnect's complaint to the European Commission. Google has not publicized its response to the Commission. Nor has the European Commission made its findings, if any, public. Moreover, the Commission may find that Disconnect's version of facts, even if true, does not make out an antitrust claim. We therefore do not argue in favor of or against any of these companies. Ultimately, we leave it for the reader to decide which account is more convincing or reflective of reality. With that caveat in mind, we use this tale of two apps to explore the possible incentives and disincentives in a data-driven Frenemy dynamic, where the super-platform and many of its independent apps have a dual strategy of extraction and capture.

## The Brightest Flashlight Android App

Even though it was developed for Google's Android operating system, and even though tens of millions of users downloaded the app, neither the app developer, Goldenshores Technologies, nor Google told users that the free flashlight app tracked the smartphone's precise geolocation "along with persistent device identifiers that can be used to track a user's location over time" and shared the phone's location with third parties, including advertising networks.[5] Instead, the app deceived its millions of users.

The penalty for such deception is telling. Some people opined that the app developer should have been criminally prosecuted, have paid a civil fine, or provided consumers with restitution. That never happened. Instead, the FTC's punishment was weak. This reflects in part the FTC's limited power in this area. The FTC noted that "it would be very difficult to calculate each consumer's monetary loss," and that it lacks authority to prosecute criminally or issue fines or civil penalties under the circumstances of the case.[6] Instead, Goldenshores agreed, among other things, to no longer misrepresent how consumers' information was collected and shared. Goldenshores also committed to disclose to users when, how, and why their geolocation information was being collected, used, and shared, and to obtain the users' affirmative consent before doing so. The app maker had to delete any preexisting personal information it had collected.

It is hard to see what the FTC action actually accomplished. Most strikingly, Goldenshores was not prevented from tracking its users in the future. The FTC only required the company to obtain users' "affirmative express consent."[7] It is questionable whether Goldenshores is even complying with this requirement. Unless Goldenshores provides additional disclosures when you download its app, it appears from its privacy policy in November 2015 that Goldenshores still automatically collects your geolocation data. It remains incumbent on you to click the link to Goldenshores' privacy policy, which tells you that you must opt out of tracking by using your settings within your device. (The app developer's privacy statement never explains how to do this.)

The FTC also required Goldenshores to tell you how your geolocation information may be used. Goldenshores must tell you why its flashlight app is accessing your geolocation information. It must tell you the "identity or specific categories of third parties that receive geolocation information directly or indirectly from such application."[8] Goldenshores' privacy statement does not even satisfy this lax requirement. All we know from Goldenshores' privacy statement is that your geolocation data is sent to "third-party service providers" who are "persons or entities that provide advertisements to you during your use of the Brightest Flashlight® software."[9] Goldenshores, in its privacy statement, never identifies who exactly is getting your geolocation data, how they are using your data, or whether the advertisers are passing your data to others in the food chain.

Goldenshores was clearly at fault for its deception. Users never knew that this simple app was tracking their location for advertising purposes. Nonetheless, Goldenshores is still collecting users' geolocation, even though this data is wholly unrelated to its app's purpose—namely, to provide a shining bright light.

Putting aside the FTC's ineffectual remedy, why didn't Google punish Goldenshores? Google could have prevented this deception. It could have limited tracking only when necessary for the app to function. It could have required every app to expressly obtain the user's informed consent before tracking (and thereafter give users the ability to turn off the tracking feature). Google never required this.[10] Even after Goldenshores's deception came to light, Google never kicked the app off its platform. Google had this power. Goldenshores violated the super-platform's stated policy: Google requires that apps for its Google Play store "must not contain false or misleading information or claims in any content, title, icon, description, or screenshots."[11] Google notes that its policies for app developers "play an important role in maintaining a positive experience for everyone using Google Play."[12] Android users could choose other apps that offered this flashlight service. So why is Goldenshores Technologies tracking its users, and why is the super-platform allowing this?

## Advertising and Privacy

Here we see how Frenemies both compete and share data. Goldenshores Technologies is privately owned, so we do not know exactly how it makes money. Since its app was free, the company likely made most, if not all, of its revenues from advertising. And despite the FTC action, Goldenshores still does not reveal the identities of the advertisers and advertising networks to which it is sending its users' location.

One likely recipient is Google. Google, like Brightest Flashlight, derives most of its revenues from advertising. In 2015, nearly 90 percent of Google's revenues came from advertising.[13] Google's advertising revenues have increased in recent years—from $43.686 billion in 2012, to $51 billion in 2013, to $59.6 billion in 2014, to $67.39 billion in 2015.[14] Google controls the world's largest mobile advertising network. Over 650,000 apps, as of mid-2015, used Google's AdMob.[15] As Google's website states: "With the largest source of global advertiser demand, flexible ad controls, and an industry-leading mediation service, AdMob is the best platform to monetize your apps and maximize your ad revenue through app advertising."[16] Google's Doubleclick business also promotes mobile advertising—from helping other companies design their mobile ads and placing them on apps, to measuring how customers respond to those ads.

Europe's privacy advisory process describes the interaction among the advertisers, publishers (like Goldenshores), and advertising networks (like Google's):

> [T]he publisher reserves visual space on its website to display an ad and relinquishes the rest of the advertising process to one or more advertising network providers. The ad network providers are responsible for distributing advertisements to publishers with the maximum effect possible.

> The ad network providers control the targeting technology and associated databases. The larger the advertising network, the more resources it has to monitor users and "track" their behaviour.[17]

In this ecosystem, online advertisers generally pay only when the user clicks on the ad. As Google asks, "Want extra revenue from your website? Google AdSense shows timely and relevant ads alongside your own online content—and pays whenever someone clicks."[18] That changes Goldenshores' incentives. As part of their joint "extraction" strategy, Goldenshores and the other advertising-dependent apps will track users, help others track their users, collect personal data, and share that data if that increases the likelihood of users clicking the ads. Likewise, when the super-platform controls the largest mobile advertising marketplace, its incentives change: It wants to help advertisers and publishers better target us with ads that we will likely click. Once we click the ad, Google gets paid, and publishers like Goldenshores get their cut. The super-platform's concern about its users' privacy lessens.

Thus, Google's and Goldenshores' interests are aligned in that both want users to click ads. To increase the chances that users will click an ad on the flashlight app, both Google and Goldenshores must predict which ads will be more appealing. The better the data they collect, the better the algorithms can predict which ad will most likely be clicked at that particular place and time. Google and the app developer want to promote the flow of personal data to know where the users are, what they're doing, and what they're interested in, and to target them with an ad that will likely appeal to them at that moment. Smartphones add another important dimension to behavioral advertising—namely "geofencing," by which advertisers can use one's physical location to target ads.[19] So when a flashlight app user is fumbling for his keys at 11 P.M. in a parking lot, which is later than his usual hour, the ad network and publisher can use the data to target him with an ad for a nearby Taco Bell.

Goldenshores is not alone. One 2010 study examined the United States fifty top websites, which accounted at the time for about 40 percent of the web pages viewed by Americans. On average, each website installed "64 pieces of tracking technology onto the computers of visitors, usually with no warning. A dozen sites each installed more than a hundred."[20]

Tracking by cookies or other means has favored larger ad networks. The networks have agreements with websites that publish their ads. The bigger the ad network, the more likely that you will browse websites with relationships with the ad network, the greater the ad network's potential to track you with these third-party cookies, and the more detailed its profile on you.[21] Thus, the super-platform, in controlling an ad network, coordinates with the advertisers and publishers of ads to track you and target you with personalized ads.

To see where the data is flowing, another study looked at the hundred most popular Android applications and the hundred newest applications in each of the categories available.[22] The researchers wanted to know the apps' friends, namely the other websites to which many of these apps connected. Nine of the ten most popular domains the apps frequented were various web services run by Google.[23] The most popular domain was doubleclick.net, Google's advertising platform, which tracks end users and serves up advertisements. Thus, the study found that, while "Google does not directly make any revenue from Android itself (which is openly licensed to manufacturers), it is able to extract revenue from the ads business around the ecosystem."[24] The study found "(i) that a significant number of applications, some highly rated, download an excessive number of advertisements which indicate that users may not be as sensitive to advertisements as anecdotally conjectured; (ii) a large number of applications communicate with a multiplicity of online tracking entities, a fact to which users may not be aware; and (iii) . . . some applications [were] communicating with websites that have been deemed malicious by malware detection engines."[25]

If Google and Goldenshores are friends when seeking to extract data from consumers, who then is their enemy? Any company that helps users prevent invisible tracking and impede the extraction of information about them. This brings us to Disconnect.

## Disruptive Dynamic

Disconnect's cofounder was an engineer at Google. In 2010, he read how the most popular apps on Facebook "were transmitting users' identifying information to dozens of advertising and internet tracking companies, without disclosure or permission."[26] So he went home and wrote an "extension" for Google's Chrome browser, which blocked connections between third-party sites and Facebook servers without interfering with the user's connection to Facebook.[27] Within two weeks, his extension was downloaded 50,000 times.[28] After realizing that his own employer was among the larger collectors of the personal data that his extension was intended to protect, he left Google in November 2010 to focus on online privacy.[29]

Disconnect offers four privacy functions: the ability of users to see otherwise undisclosed web tracking and privacy policies, virtual private networking (VPN) technology, private search, and private browsing.[30]

Unlike the flashlight app, Disconnect does not surreptitiously collect users' geolocation information. Nor does it track users' activities across the web. Unlike Google and the flashlight app, Disconnect does not rely on advertising revenues. It does not sell its user data to advertisers, ad networks, or data brokers.[31] Disconnect makes its money "by selling its products to users."[32] The basic version of its mobile app is free; its "Pro" version has a one-time $40 fee; and its "Premium" version costs $50 per year.[33]

After launching its mobile app, Disconnect received on August 26, 2014, an e-mail from the Google Play team. Google had removed the app from its Play Store because the app "interferes with or accesses another service or product in an unauthorized manner."[34] As Google warned the app maker:

> All violations are tracked. Serious or repeated violations of any nature will result in the termination of your developer account, and investigation and possible termination of related Google accounts. If your account is terminated, payments will cease and Google may recover the proceeds of any past sales and/or the cost of any associated fees (such as chargebacks and transaction fees) from you.[35]

Disconnect was popular. As the *Wall Street Journal* reported, "In the six days it was available in Google's store, it was downloaded more than 5,000 times."[36] Google readmitted Disconnect, only to kick it out again.

Disconnect tried to make its app compliant with Google's rules. But Google's policies were "so vague that Google could, in essence, ban any app in its store."[37] As Disconnect's cofounder said, "It's like a Kafka novel—you're getting kicked out or arrested for reasons you don't even know."[38]

Disconnect was not alone. Google, according to the *Wall Street Journal,* had removed other ad-blocking apps, such as Adblock Plus, from its Play Store.[39] While kicking out some apps that safeguarded users' privacy by preventing tracking, Google did not kick out all apps promising to protect users' privacy.[40]

Disconnect eventually complained to the European Commission, contending that Google had abused its dominant position. In its ninety-five-page complaint, Disconnect questioned why Google does not protect Android users from the risks associated with tracking. Google's Chrome browser, for example, does not provide details on which websites and web services respect “Do Not Track” requests or how they interpret them. As Google reports, “most Web services, including Google’s, do not alter their behavior or change their services upon receiving Do Not Track requests.”[41]

Disconnect also explained how Google’s privacy features in 2015 were weak. Google tells users they can opt out of targeted advertising. But app developers could circumvent Google’s targeted advertising opt-out feature in Android.[42] Moreover, Google’s opt-out feature only stops Google from showing you “interest-based” ads. Opting out did not stop ads altogether, including ads based on your recent searches or general location.[43] Opting out would not disable other companies’ interest-based ads.[44] Nor does the opt-out automatically apply whenever you use other browsers on that device or other devices.[45] Thus, you would have to opt out for each browser you use on each PC, tablet, and smartphone. Nor will opting out keep you opted out after you clear your browser’s cookies.[46] Nor will it opt you out of interest-based ads in services where cookie technology may not be available.[47] Nor does the opt-out feature prevent Google or any other company from tracking you; it only prevents a targeted ad under certain circumstances.[48]

Google, for its part, rejected the complaint as baseless; Disconnect was removed from the ecosystem as its blocking services prevented other applications from legitimately earning money. That interference infringed Google Play’s apps policy.[49] Google noted that over 200 privacy apps that do not infringe its policies are available in Google Play.[50]

After Google removed Disconnect from its Play Store, Android users could no longer search for, or find, the privacy app in the Play Store, and its downloads and sales for a premium version of the app suffered.[51]

## Why Some Ecosystems Hate Privacy

For both the super-platforms and app developers whose business model is dependent upon tracking us and using our data to target us with behavioral ads, privacy technologies represent a real threat. Google, among others, said so.

In its 2014 Annual Report, Google identifies various risks that could adversely affect its business, financial condition, results of operations, cash flows, and the trading price of its stock. One risk is that “New technologies could block online ads, which would harm our business.”[52] As Google explains,

> Technologies have been developed that can block the display of our ads and that provide tools to users to opt out of our advertising products. Most of our revenues are derived from fees paid to us by advertisers in connection with the display of ads on web pages for our users. As a result, such technologies and tools could adversely affect our operating results.[53]

Facebook also warns investors that privacy innovations can threaten its business model. Like Google, nearly all of Facebook's revenue is generated from advertising. For 2014, 2013, and 2012, advertising accounted for 92 percent, 89 percent, and 84 percent of its revenue, respectively.[54] Among the risks Facebook identifies are "the degree to which users opt out of social ads or certain types of ad targeting; the degree to which users cease or reduce the number of times they click on our ads; . . . [and] the impact of new technologies that could block or obscure the display of our ads."[55]

Besides individuals deleting cookies or using "ad blocking" software that prevents cookies from being stored on a user's computer, Coupons.com warns investors that even the privacy default setting can hurt its business:

> [T]he Safari browser blocks third-party cookies by default, the developers of the Firefox browser have announced that a future version of the Firefox browser will also block third-party cookies by default, and other browsers may do so in the future. Unless such default settings in browsers were altered by Internet users to permit the placement of third-party cookies, we would be able to set fewer of our cookies in users' browsers, which could adversely affect our business.[56]

So one can see why Disconnect is the pariah in the Frenemy scenario. It is unwilling to help the other lions chase the prey—that is, to track consumers' activities and behavior, in order to better know their tastes, interests, and intentions, and target them with the right ad at the right place and time. Disconnect was not interested in fighting over who gets the choice cuts of the advertising revenue. Instead, it wanted to make money by helping users avoid the lions altogether.

Is Disconnect the saint or a serial infringer? As we indicated earlier, the Google/Disconnect clash is still under review in Europe. No formal decision, as of May 2016, was released; accordingly without all the facts, the way the story should be read remains unclear. Our aim is not to discredit either party, but to use this friction to illustrate the complex Frenemy dynamics.

Apart from the Google/Disconnect story, privacy issues made the news in August 2015, when Apple announced its implementation of a new privacy feature. Its updated iOS would permit iPhone and iPad users for the first time to download apps that block ads when using Safari.[57] It is remarkable how such a small privacy measure is so newsworthy. Users, for years, could employ ad blockers on their Macs and MacBooks when browsing the web using Safari. The technology existed, and so too did the demand. The benefits of blocking ads are far greater on smartphones than on personal computers. Ad-blocking technology can reduce the clutter on our smartphones' small screens, help pages load faster (four times faster in one test), and save data (53 percent less in one test).[58] Nonetheless, we had to wait until 2015 for one of the two super-platforms to even permit ad-blocking technology on their mobile phone platform. Even here, Apple is treading lightly. It will not preinstall the ad-blocking technology. Rather, we must find and download the browser extension. Thus, by requiring users to opt in, Apple can mollify those firms that are dependent on advertising revenues by pointing out that relatively few iPhone and iPad users will likely download the technology, and that consequently fewer ads will be blocked.

## Reflections

When we raised the Google/Disconnect scenario at one conference, someone responded, "Isn't this like a homeowner inviting an arsonist to her house?" In other words, why should Google accept an app that would undermine its own and its ecosystem's advertising-fueled business model? Should the law penalize a super-platform for protecting its commercial interest?

The answer will depend, among other things, on one's view of the role of competition law, and the particular market's dynamics and structure.

Some would oppose antitrust intervention, citing the risks of chilling competition and undermining the incentives to invest in research and development. They would cite a 1945 case where the United States successfully prosecuted a monopoly: "The successful competitor, having been urged to compete, must not be turned upon when he wins."[59] Accordingly, an outright or de facto refusal to deal, even by a dominant platform, should not justify governmental intervention.[60] Instead, the independent app developers and outlets should strive to create independent demand for their products and services. That demand will improve their bargaining position in its relationship with the super-platform and reduce their dependency. They, like Facebook, could become their own super-platform. Even if the independent app developer is squeezed out of the market, it will be hard for the government and courts to distinguish whether that outcome did or did not reflect healthy competitive dynamics—namely better-quality products pushing out inferior products produced by less-efficient players.

Proponents of intervention would focus on the special responsibility that a super-platform has. They would question the ability of a small independent app to fight against a giant when the latter takes action to undermine competition. Even if the super-platform would not immediately kick the app out of the ecosystem, the super-platform can hinder the app's ability to reach users, eventually leading to its exit. This, arguably, is an abuse of power. We saw this in the 1990s when independents—such as the Netscape browser, WordPerfect, and RealNetworks—struggled to compete against the dominant Microsoft Windows platform. The focus here is not only on monopolistic abuses that directly harm consumers, but also on abuses that distort competition and thereby harm consumers.[61] Intervention may be required to protect efficient competitors from being pushed out of the market and innovators seeking to enter the market.

What is clear is that the independent app developers face a perilous landscape when the super-platform controls their oxygen supply. When the super-platform competes against the app, its incentives change, and the "Frenemy" can bare its teeth. If the independent app threatens the super-platform's and other apps' source of revenue, it too can be kicked off the platform.

The independent apps cannot rely on the antitrust laws to protect them from the super-platform's anticompetitive abuses. The super-platforms have little to fear from the antitrust enforcers (at least in the United States). While running for president, Barack Obama criticized the Bush Administration for having "what may be the weakest record of antitrust enforcement of any administration in the last half century."[62] Obama noted that "in seven years, the Bush Justice Department has not brought a single monopolization case."[63] Obama promised to "reinvigorate antitrust enforcement" and "step up review of merger activity."[64] Now, with his second term coming to an end, the Department of Justice has brought only one monopoly case; and the same criticism of feeble antitrust enforcement has been made about the Obama Administration.[65] Nor can the independent app afford a costly, time-consuming private lawsuit against the super-platform. The outcome is often uncertain, and the super-platform can retaliate subtly.

Instead, the independent app must somehow scale up to keep ahead of rival app developers; but as the app grows in usage and profits, it will likely catch the super-platform's attention. In such a case, the independent app developer can assess its strategies: it can align itself with another, friendly super-platform; it can try to become its own super-platform; or, the more attractive (or viable) option, it can be acquired by the super-platform (as Waze was by Google). An acquisition at the peak of its value would maximize the independent app's profits. It would also improve its horizontal position in the downstream market. Otherwise, its value will likely diminish by the entry of the super-platform (for example, MapQuest). Long term, the Frenemy dynamics may foster vertical consolidation, which would further enhance the super-platforms' power. With each acquisition, more personal data flows through the super-platform. Moreover, since the Frenemy scenario defies the competition authorities' horizontal, vertical, interlocking, and conglomerate categories, the acquisitions by the super-platforms would likely escape antitrust scrutiny.

With that in mind, it will be interesting to see Disconnect's or Uber's ultimate fate. Can Disconnect survive outside the super-platform? How will that affect others investing in privacy apps? Will Uber continue to scale up and expand to become a super-platform? Will it be acquired—like the independent navigation app Waze—by the super-platform? Will it switch allegiances to another platform? Or will it eventually wither away, to join MapQuest, WordPerfect, RealNetworks, and other innovators eclipsed by the super-platforms?

# 17

# The Future of Frenemy: The Rise of Personal Assistants

I am putting myself to the fullest possible use, which is all
I think that any conscious entity can ever hope to do.
—The HAL 9000 computer, in the 1968 film
*2001: A Space Odyssey*

What is the future of Frenemy? One likely path, we believe, will involve the rise of digital personal assistants. All the super-platforms are currently investing in this technology: Apple's Siri, Amazon.com's Alexa, Facebook's M, and Google Assistant.[1] This personalized tool promises to interact with us in a human-like way, providing relevant information and suggesting restaurants, news stories, hotels, and shopping sites. As the artificial intelligence and communication interface advance, personal assistants can offer an unparalleled personalized experience.

These developments are exciting. Personal assistants can not only provide us with endless information, if we so desire, but can anticipate and fulfill our needs and requests. They can do so in an intelligent manner, based on our connections, data profile, behavior, and so forth. They can learn our needs, communicate with us in our preferred language, and execute our commands at high speed. Our time will be too important to worry over life's little details. As the personal assistant seamlessly provides more of what interests us and less of what doesn't, we will grow to like and trust it.

How does this relate to our Frenemy dynamic? As this chapter illustrates, the rise of the digitalized assistant, driven primarily by the super-platforms, may heighten the anticompetitive dynamics we have explored thus far: our personal butler may, unbeknownst to us, encourage tacit collusion. It may help bring retailers closer to perfect behavioral discrimination. And it may consolidate the super-platform's power, as it obtains greater control over what we see and what we purchase. The more we rely on our personal assistant, the less relevant our outside options become, the more dependent we, and the independent sellers, become on the super-platform, and the greater the super-platform's power to exclude others and control our virtual universe.

## The Rise of Personal Assistants

Facebook in 2015 announced a beta version of M, its digital assistant, which can replace most of one's web searches and apps with a chat app on Facebook Messenger.[2] Like Apple's Siri, Microsoft's Cortana, Amazon.com's Alexa, and Google's voice-recognition system, Facebook's technology relies on machine learning. The super-platforms' plans are clear: they "envision a future where humans do less thinking when it comes to the small decisions that make up daily life."[3] In 2016 Google showed a video of a suburban family undergoing its morning wakeup routine: "The dad made French press coffee while telling Google to turn on the lights and start playing music in his kids' rooms. The mom asked if 'my package' had shipped. It did, Google said. The daughter asked for help with her Spanish homework."[4]

The future looks bright. But behind the dream of the personal helper lies a sophisticated machine that may eventually undermine our welfare. We see two important shifts with the rise of the digital personal assistants.

First, technology is shifting from being reactive to becoming proactive—anticipating our needs and wants, rather than following instructions. One example is takeout. Twenty years ago we looked at menus in our kitchen drawer or in the yellow pages. In 2016, absent a steady favorite, we likely choose the type of food and then search online for nearby restaurants. We review how others rated the restaurants, and read the menus online. After deciding which dishes we want, we place our order with the restaurant and pay online or on delivery.

In this domain, the super-platform points us to other sources, which may lead us to additional sources, and ultimately our end choice. Google, through its search engine, was, and remains as of 2016, the primary portal for the web. Google also dominates through its search engine "direct response" advertising, "which is the kind of ad that pops up when we are searching for an airline ticket, a new laptop or any other purchase."[5] So, as we saw in the preceding chapters, the super-platform may try to influence our decision while we undertake each step in ordering takeout.

Now imagine a new technology that can enable us to accomplish so much more with the assistance of artificial intelligence. Our personal assistant reduces the number of steps we take, online and offline. Imagine you lived in an estate—like Downton Abbey. You would not want the butler to direct you to the livery of junior servants for each request you make. The butler instead anticipates your wants, and quietly orchestrates the servants to fulfill these tasks. Your shoes are already polished; the coffee with the right amount of sugar and cream is beside the freshly squeezed juice. Your car and driver are already waiting. The warmed clean towel is folded by the shower. The scent from the freshly cut roses wafts down the hallway. Your children are busily practicing their French while drawing landscapes.

So too the AI personal assistant will become our primary interface. Based on our personal data, including our calendar, texts, e-mails, and geolocation data, our personal assistant may recognize a busier than usual day. From our phone's geolocation data, it will know when we are heading to our car. Our personal assistant may suggest, "How about treating yourself to Chinese tonight?" Our personal assistant might recommend a popular place. It might then direct the order to a restaurant it believes we would like, arrange for the food's delivery shortly after we arrive home, and pay for the food. All we need to do is grab the food at the door. So like a good butler, our personal assistant seamlessly anticipates and satisfies our needs, condensing all the steps to one or two commands. Thus each super-platform will seek through its voice- or text-based interface to become the first, and only, place we will go.

Second, the stakes are huge. Google, Apple, and Facebook are currently jockeying as to "who gets to control the primary interface of mobile devices."[6] As we shift from a mobile-dominated world to an AI-dominated platform, we will converse primarily with our head butler, who increasingly predicts and fulfills our needs, and we will less frequently look at price-comparison websites, search the web, or download apps. Take, for example, the Google assistant, which forms part of the company's "effort to further entrench itself in users' daily lives by answering users' queries directly rather than pointing them to other sources."[7] Why fritter our time away on such minor details, when we can use it more productively? Or we can dream of the fly-fishing vacation our head butler arranged at a Scottish castle, where no doubt we'll be sipping eighteen-year-old Bunnahabhain single-malt Scotch whiskey with our Cohiba cigars, while gazing at the fireplace.

### Could a Personal Assistant Be So Devious?

Who wouldn't want a personal butler? The idea of an intelligent, voice-activated helper is alluring. And yet, when considering its possible strategic usage by the winners in the Frenemy dynamic, our butler's interests may not always align with our interests. Our new trusted alter ego, to which we outsource our decision making, may be charming, but partial. After all, as we learned earlier, being the "free" part of a multisided market, we don't directly pay for the butler's services. Our butler must ultimately cater to the needs of its real employer—the super-platform. Of course, we can still benefit when the super-platform's interests are aligned with our own. But we may often be unaware of when such alignment is absent.

So what differentiates the strategies discussed earlier in our Frenemy scenario and the future use of personal assistants? We identify several key differences that affect the user experience and will likely act as "game changers"—transforming our competitive environment.

First, we note the changing interaction with the new digital helpers. Because it is human in its communications, charming in its demeanor, and funny—at just the appropriate level—we will grow to trust our companion, which has been privy to so many of our activities. Many of us already trust our favorite search engine to find the relevant results for our inquiries, Facebook to identify relevant news stories, Amazon for book recommendations, and Siri to place phone calls, send text messages, and find a good Chinese place nearby. So with an eager (and free) butler whose capacity to help us improves, we will increasingly rely on it. At first the choices will seem benign, such as asking the personal assistant for today's weather rather than searching the web. But the more tasks the personal platform undertakes, the more we rely on the super-platform's functions (such as its texting app, maps, and so forth). That trust, in competitive terms, can easily translate to our willingly being locked in—that is, willingly forgoing opportunities to independently consider outside options.

Second, the more we communicate only with our personal assistant, the less likely we will independently search the web, use price-comparison websites, seek independent customer reviews, and rely on other tools. The ease of voice activation and verbal communication with our butler may limit our view of the available outside options.

Today when an app is preloaded on our smartphone and integrated with the phone's other functions, few of us download a competing app. As

EU Commissioner Vestager noted, "if Google's apps are already on our phones when we buy them, not many of us will go to the trouble of looking for alternatives. And that makes it hard for Google's competitors to persuade us to try their apps."[8] Many of us stick with the default option. Likewise, as our personal assistant becomes our default, so too will its platform's other features and functions. To illustrate, suppose we are sipping our single-malt Scotch in our summer retreat. We may ask our assistant how long a drive it is to a friend's country home, and then ask our assistant to text our friend our ETA. We would be unlikely to pull out our Android phone, search MapQuest to figure out the distance and time to drive, and then use Messenger to text our friend.

The removal of the human element from the search activity, and partly from the decision making, transfers more power to the super-platform. The personal assistant will use its own tools and may exercise its own judgment as to prioritizing and communicating the results.

Third, the scope of data and the personalization that follows will make it harder for us to switch assistants. As Google's CEO characterized its personal assistant, "We think of it as building each user their own individual Google."[9] The super-platforms, given the scope of data, opportunities to experiment and learn by doing, and control over key technologies (such as maps), can already provide us with a personalized experience that smaller providers are unlikely to match. Once we choose and train a head butler, we may tolerate mistakes rather than train a new butler from another super-platform.

The super-platform—through its butler—will benefit from unparalleled access to our data. As we noted earlier, the super-platforms already spend a lot of time, money, and effort to track our behavior and profile us. Now, by providing us a butler, the super-platforms will collect even more data. As repeatedly noted by developers, the hope is for these tools to accompany us in our decision making, encouraging ongoing daily interaction from chats to shopping. As a result, the information gathered about our needs and desires will be significantly enhanced—feeding the Big Data and Big Analytics machines.

As the super-platform's power increases, so does the risk of anticompetitive activities. Indeed, the personal assistant can magnify the harmful effects of each of our three scenarios.

Think, for example, of our behavioral discrimination scenario. Our personal assistant will accumulate increasing information about us and will be aware of the extent to which we venture out and seek other options. Its aim is to deliver the right product or service at a price we are willing to pay. So the line between personalization and behavioral discrimination will blur. As we increasingly rely on the personal assistant for suggestions, it can increasingly suggest things or services to buy, and the price it has successfully negotiated. While helping our son with his Spanish, our personal assistant might suggest a particular app or private tutor that tremendously helped other students struggling with the same issue. Because the tutoring is customized for our son, it will be harder to assess whether the price the tutor charges is the fair market price or simply a price we would tolerate. Moreover, if the tutoring service is helping other children improve their grades, we would not want our child to be at a competitive disadvantage—especially if we are all eyeing the same highly selective universities. So the personal assistant can prompt purchases that we otherwise wouldn't consider.

Now let's think of our collusion scenarios facilitated by smart algorithms. As our digital assistant increasingly orchestrates what we purchase at what time, it can easily become the hub upon which the spokes rely. Suppose the personal assistant gets a commission for every sale. Higher prices mean higher commissions. The more the personal assistant is plugged into our lives, the harder it will be to circumvent the assistant in finding a lower price. And when we independently find a lower price, our butler can always surprise us with a special deal, whose aim is to punish any discounter and undermine any attempt to cheat on the tacitly established price.

Finally, the harms we identify in our Frenemy scenario are amplified. While we would each enjoy our personalized experience and growing intimacy with our digital personal assistant, its roots and loyalty remain with its real master. As more people rely on the super-platform's personal assistant for their day-to-day activities, so too will sellers gravitate to the super-platform. The punishment for being kicked off the super-platform is severe. Without access to the personal data stream, the independent retailer will have a harder time identifying a customer's key purchasing moment (like when he needs a new oxford shirt). Because the ads we see while surfing the web will be orchestrated by the super-platform, it will be harder for the retailer to reach that customer. Even if the retailer can reach the customer, it cannot provide the increasingly customized products or services (such as tailored shirts in the styles and colors that appeal to the customer). And even if retailer can gain the customer's attention, the personal assistant may interject with its own recommendation, suggesting that he consider a special deal by another haberdashery, one that is part of the super-platform's ecosystem. In this multisided market, the assistant may subtly push certain products and services and degrade or conceal others, all in the name of personalization.

## Control of Media and Mind

As we increasingly rely on our personal assistant, it will increasingly learn about our social and political views, behavior, and susceptibility to biases. It will become more proactive—making recommendations on entertainment, commenting on the music we listen to or the books we are reading. By complimenting and cajoling, sharing thoughts with us on recent events, sending personalized notes on special occasions, reminding us of presents, suggesting popular gifts trending among the recipient's friends, and informing us about information from our smart meters and smart sensors, it will ingrain itself in our lives. We will wonder how we ever managed without a digital personal assistant.

While we appreciate this free service, we will not know its exact cost. When it joins our chats to make suggestions, or at times makes suggestions counter to those made by other helpers, we may not know whether it is being helpful or simply manipulating our behavior. It may work in the background to undermine attempts to expose us to competing products, or it may monitor our chats for signs of discontent with the service or discount offered—signs of anger that should trigger a behavioral action. The list is truly endless—all in the name of catering to our needs. After all, happy users make happy super-platforms.

*The Truman Show* reemerges, only grander and more effective. In fact, it will transcend the retail world and distinctly impact our worldview. The rise of the trusted personal assistant may provide the super-platforms with the ultimate power—to affect our views and the public debate. The reliance on a gatekeeper may enable its operator to intellectually capture users, and subsequently decision makers, in an attempt to ultimately ensure that public opinion and government policies align with the corporate agenda.

Consider, for example, the control our personal assistant may have over our news feed. Currently, the super-platforms do not report the news. But many people rely on the super-platforms' algorithms to find news of interest. One 2015 study found that 61 percent of Millennials in the United

States (those born between 1981 and 1996) were "getting political news on Facebook in a given week."[10] This was a much larger percentage than any other news source. A 2016 study found that Facebook "sends by far the most mobile readers to news sites of any social media sites"—82 percent of the social traffic to longer news stories and 84 percent of the social traffic to shorter news articles.[11]

Users rely on the super-platforms, in part, because they believe the algorithms objectively identify the most relevant results. But, as we saw with search engines, the super-platform can intentionally degrade its results to promote its corporate interests. Thus we can see why conservatives were concerned over allegations in 2016 that the social network Facebook manipulated for political purposes the rankings of news stories for its users, suppressing conservative viewpoints.[12] (Facebook denied doing this.) As we saw in our behavioral discrimination, as prices become personalized, a benchmark market price becomes more elusive. Likewise, personalization of news feeds makes it harder to uncover censorship. Because you expect other people's news feeds to differ from yours, it is harder to determine when (and why) a relevant story is buried.

Given our reliance on these information gatekeepers, the super-platforms—in affecting our views of the world—can also influence elections. Jonathan Zittrain, for example, identified as a risk Facebook's ability to manipulate elections.[13] He warned of the super-platform's potential ability to predict political views, identify party affiliation, and engage in targeted campaigning to mobilize distinct groups of voters to take action.[14] Robert Epstein likewise pointed to the potential risk associated with online search manipulation. He noted how Google could affect not only commercial interests but also political agendas.[15] His research illustrates the potential to affect election results through web manipulation and "boost the proportion of people who favored any candidate by between 37 and 63 percent after just one search session."[16] By manipulating the rankings of search results, the studies found, "Google's search algorithm can easily shift the voting preferences of undecided voters by 20 percent or more—up to 80 percent in some demographic groups—with virtually no one knowing they are being manipulated."[17]

We already see instances in which platforms were used to promote certain agendas. Uber used its app to mobilize protests against the New York mayor's proposal for a cap on the number of available rides.[18] Google used its homepage to protest against the Stop Online Piracy Act (SOPA), asking users to petition Congress.[19]

As the personal assistant expands its role in our daily lives, it can alter our worldview. By crafting notes for us, and suggesting "likes" for other posts it wrote for other people, the personal assistant can effectively manipulate us through this stimulation. "With two billion 'likes' a day and one billion comments," one doctor noted, "Facebook stimulates the release of loads of dopamine as well as offering an effective cure to loneliness."[20] Imagine the dopamine spike when the personal assistant secures a new record of "likes" for a political message it suggested that you post. Others do not know that your digital assistant was heavily involved in drafting your note. You don't know the extent to which the personal assistant generated the likes. And none of us know how this note is helping sway the public discourse in ways that benefit the super-platform.

As we increasingly rely on our personal assistant, we may not recognize its toll on our well-being. As the personal assistant increasingly controls mundane household tasks, like turning off lights, regulating room temperature, and adjusting our water heater, it will be harder to turn off. But the online (and increasingly offline) tracking of our behavior can impede our creativity, solitude, and mental repose.[21] George Orwell famously discussed in *1984* how monitoring our behavior can adversely affect intellectual freedom: "You had to live—did live, from habit that became instinct—in the assumption that every sound you made was overheard and, except in darkness, every movement scrutinized."[22] As the U.S. President's Commission on Law Enforcement and Administration of Justice wrote in 1967, "In a democratic society privacy of communication is essential if citizens are to think and act creatively and constructively. Fear or suspicion that one's speech is being monitored by a stranger, even without the reality of such activity, can have a seriously inhibiting effect upon the willingness to voice critical and constructive ideas."[23] Soon we may have our digital personal assistant hovering nearby, without being conspicuous.

## The Purist Assistant

The predictions outlined in this chapter are driven by the assumption that most of the future private assistants will be developed and provided by the super-platforms and other powerful, vertically integrated firms.

Would there be any possible counter measure to these devious helpers? We certainly hope so. We can anticipate a class of independent assistants, developed by independent firms with *our* interests in mind. Our purist assistant could warn us when behavioral discrimination is at play, when outside options are ignored, when price alignment seems out of order, or when our information is harvested. It may even be capable of deploying counter measures to maximize our welfare in face of such strategies. It could monitor our news feed and alert us if it has been affected. It will form a true extension of our interest—aware of our preferences and safeguarding our autonomy.

With the possibility for such a purist assistant, you may rightly ask why our base assumption has been rather pessimistic and has led us to focus on the devious assistant? Perhaps the simplest way to explain our prediction is to ask you, our reader, to consider the following: Which search engine did you use today? Did you opt for one which does not harvest information and retains your anonymity (such as DuckDuckGo) or for one which is part of the Frenemy ecosystem and lavishes you with individualized results? Did you limit the ability of your phone apps to access personal and location information? Do you often change the default option? Do you click "accept" only after reading the terms and conditions? Did you invest money in privacy measures, or recently choose a paid app for its privacy protections over a popular free app? And if you did invest money, do you know if the promise of privacy and control was truly delivered by your service provider?

The likely answers to these questions may help us all appreciate why the evolutionary path tilts in favor of the Frenemy dynamic and the devious helper. Key here are data-driven network effects, Big Data, Big Analytics, vertical integration, bundling of services, and interoperability, which all seem to favor the super-platforms.

Let us explain in more detail: First, to excel in its role, the personal assistant must know our preferences. To learn and predict our desires, personal assistants require a significant store of data and opportunities to experiment. The underlying code and algorithms of Facebook's M, for example, are largely open source. The key assets are not the algorithms (otherwise why share them?) but the scale of data and the algorithm's ability to learn by trial-by-error. As the *Wall Street Journal* reported, "Facebook Messenger already has more than 700 million users," which yields it the following advantage: "with access to so many users, Facebook has a plausible way to get the gigantic quantity of conversational data required to make a chat-based assistant sufficiently automated."[24] With more users making more requests, M can quickly process more tasks easily. In effect, users help the super-platform's algorithm learn by noting and correcting mistakes. Only a few companies have the requisite volume and variety of personal data and opportunities to experiment for their personal assistants to be competitive: namely, the super-platforms Amazon, Facebook, Google, and Apple. Microsoft, in acquiring the professional social network LinkedIn and divesting its low-end smartphones, could become the fifth competitor in this space.[25]

Second, data-driven network effects will further weed out the super-platforms. We do not want five butlers, each asking us about movies tonight or food to order. Each super-platform will jockey for its butler to become our head butler. In discussing its digital personal assistant, Google's CEO said, "We want users to have an ongoing two-way dialogue with Google."[26] Google, as the head butler, can analyze our e-mails, texts, or photos, and suggest replies.[27] Looking at our calendar, it can determine the best time for the dog to be groomed. Thus the more we converse with, and delegate to, the head butler, the better it can predict our tastes, and the more likely we will rely on it for our daily activities. As our butler accumulates information over time, the switching costs between butlers will become higher. We would therefore be willingly locked into our comfort zone. New entrants will find it difficult to match the scale of data held by the super-platforms and to convince us to switch.

Third, the super-platform can seamlessly integrate its wide offerings, bundle its apps, and nudge us to its products. The gatekeeper function is intensified. Others will likely lack the scale and scope of products to attract new users. Moreover, unless they develop their own operating system, they too will be dependent on the super-platform's. For example, Google argues that given "its 17 years of work cataloguing the internet and physical world, its assistant is smarter and better able to work with its email, messaging, mapping and photo apps. And since Google makes software for smartphones, smartwatches and old-fashioned computers, Google says people will be able to have one conversation with multiple machines."[28]

These effects could undermine the success of the Purist Assistant. Luckily, all is not lost and an increased popularity of these purist tools may be possible. But it will have to be driven by us, the users, taking control over the interface and appreciating that free can sometimes be very expensive.

## Reflections

The next frontier of the Frenemy dynamic may make the strong super-platforms even stronger, and many independent apps weaker. It may increase the entry barriers and consolidate economic and political power into even fewer hands. The super-platforms could extract even more data, and command even higher rents to allow others to access us. The increasing revenues could enable the few super-platforms to further expand into driverless cars, wearables, virtual reality, and the Internet of Things, drying out downstream services.

The new Frenemy environment, especially when voice-activated and speech-based, would superficially appear beneficial—more free services to help our personal assistant attend to our daily needs. Because the products and services are highly personalized, competition authorities would have difficulties identifying quality degradation and proving its anticompetitive effects. As the primary interaction takes place at the personal-assistant level, shortcuts and bypasses may make applications redundant and allow the super-platform to occupy broader swaths of the savanna. Indeed, unlike the current Frenemy scenario, where lions collaborate to kill gazelles, the super-platform in the future might seem protective. We are no longer gazelles in the wild, but domesticated animals in the zoo, with the digital personal assistant as our caretaker.

Thus, this evolution may go unchallenged under current user behavior and current antitrust policies and tools. The greater algorithm autonomy in a nontransparent, highly personalized interface with customers will halt competition enforcement. At best, the agencies and courts might understand the risks and work to confront them, among other things, by educating the users about the cost of free. At worst, the agencies and users will be captured intellectually and regulatorily, and will celebrate the technologies that slowly bring us into the ultimate *Truman Show.*

# PART V

# Intervention

OUR THREE SCENARIOS—collusion, behavioral discrimination, and Frenemy—illustrate the mirage of competition. Online markets at times may appear competitive. They have many of the procompetitive attributes upon which we have learned to rely. But behind this competitive veneer, new strategies emerge, powered by a complex web of algorithms, that maximize the firms' profits, while harming our welfare.

Faced with the end of competition as we know it, how do we protect ourselves? How do we ensure that the digitized hand yields a competitive environment that promotes our overall well-being? The displacement of the invisible hand by the "digitized hand" heralds a change in dynamics which requires us to carefully recalibrate our approach to markets and intervention.

Some, however, will defend the adequacy of a free-market, noninterventionist approach, They will warn that any regulatory or enforcement intervention will likely chill the new technologies and the rise of dynamic markets from which we will benefit immensely.

Others will recognize the problem but look for a quick, broadly applicable fix. Because there isn't one, they will argue for non-intervention until a fix can be developed.

Given the different types of problems we identify, we need to consider afresh when intervention is required, the type of intervention, and its duration. The regulatory/enforcement aim is to help promote competition, where innovation and investment flourish, and to minimize the harms we identify, along with other harms.

Our discussion in this part spreads over two chapters, the first being more conceptual in nature and the second taking a more practical perspective.

Chapter 18 looks at how Big Data and Big Analytics could lead to a "planned economy," albeit one planned by dominant firms, not bureaucrats. Faced with these dynamics, should smart regulation be introduced by the government?

Following this, in Chapter 19, we explore the antitrust toolbox to see whether the enforcers can prevent or deter the anticompetitive scenarios of collusion, behavioral discrimination, and Frenemy. We highlight possible avenues for the enforcer—including the use of current tools and perhaps a few new ones.

# 18

# To Regulate or Not to Regulate

SUPPOSE WE COULD INVEST in phrases, as we do with stocks. Also, suppose the payoff would depend on how frequently the phrase appears in English-language books. If you could invest in one of these phrases—*price regulation* or *invisible hand*—which one would you pick? Google's Ngram Viewer shows how often a phrase has occurred in a corpus of English-language books. As Figure 5 reflects, an investor in *price regulation* would have profited in the 1940s (see the gray line in Figure 5), but the overall winners are those who picked *invisible hand* (the dotted line in Figure 5).

The result parallels the shift in emphasis in modern times, from regulation to free market philosophy. Price regulation has taken a beating, especially, as Chapter 3 explores, with the rise of neoclassical economic theories associated with the University of Chicago.

Granted, the appeal of the invisible hand has diminished in recent years—after the financial crisis, the Great Recession, growing income and wealth inequality in the United States and U.K.,[1] reduced social mobility, and the sheer arrogance of crony capitalism. Nonetheless, despite the growing appeal of conscious capitalism and shared value, many policymakers still praise the unrestrained free market, and are far more vocal over the cost of false positives from governmental intervention than the cost of false negatives from governmental abstention.

## Aggregated Information and Competition: The Sum of All Knowledge

In defending a market economy, one should first inquire what one is defending. As we have seen, competition is changing. The digitalized market environment, characterized by a growing capacity to analyze, aggregate,

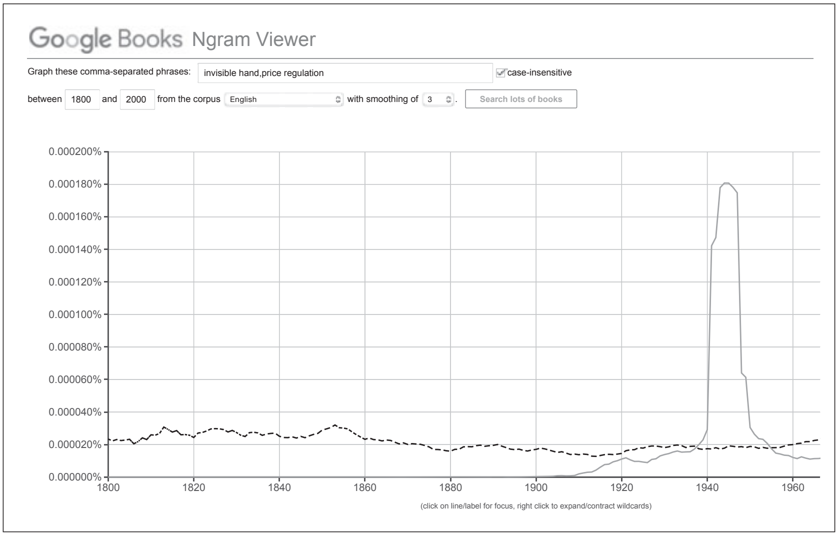


**Figure 5.** *Google Books, Ngram Viewer* (https://books.google.com/ngrams). © 2013 Google (CC BY 3.0).

and store data, changes the role and significance of information. In a data-driven environment, algorithms collect and process data on our movements, preferences, biases, and reservation price, and utilize this information in future transactions. As more real-time data flows through the ecosystem, and the data becomes accessible, a thought-provoking question emerges: Could it be that in a digitalized environment, data will be aggregated to provide the sum of all or the most relevant knowledge? Are we approaching the creation of a single repository of all information that is continually updated and accessible? If so, then surely the dynamics of competition would radically change. Increasingly one may wonder, what is left of competition as we know it?

In asking what power the invisible hand still possesses in digitalized markets, we must consider Friedrich A. Hayek's seminal work on knowledge, competition, and society. In his book *The Road to Serfdom,* the economist did not condemn governments' intrusion into the marketplace. He was careful to distinguish his opposition to central planning from a dogmatic laissez-faire attitude.[2] Recall that in Hayek's time, collectivism was on the rise, with fascism, nationalist autarky, and later communism spreading. As Harvard Professor Jeffry Frieden discussed, the Nazis by 1938 "had more than five hundred important state-owned firms, half of all investment was being carried out by the state, and government spending was 34 percent of GNP, up from 15 percent in the late 1920s."[3] Frieden also observed how, at its height in the late 1930s, the fascist economic order included nearly all of Europe and the Middle East and much of Asia and Africa.[4] Thus, democratic governments with market economies, when Hayek wrote his seminal book, were the exception rather than the rule.

Part of Hayek's critique of centrally planned economies was incomplete information patterns, which characterized the market environment in the mid-1940s, and the way in which these affected resource allocation. Hayek noted that:

> [K]nowledge of the circumstances of which we must make use never exists in concentrated or integrated form but solely as the dispersed bits of incomplete and frequently contradictory knowledge which all the separate individuals possess. The economic problem of society is thus not merely a problem of how to allocate "given" resources—if "given" is taken to mean given to a single mind which deliberately solves the problem set by these "data." It is rather a problem of how to secure the best use of resources known to any of the members of society, for ends whose relative importance only these individuals know. Or, to put it briefly, it is a problem of the utilization of knowledge which is not given to anyone in its totality.[5]

Hayek's critique focused on the then pervasive (but fallacious) assumptions of stability and availability of information, which underpinned much of the contemporary macroeconomic theory during his time.[6] In reality, he observed, information is dispersed among many people, and he therefore noted both "the unavoidable imperfection of man's knowledge and the consequent need for a process by which knowledge is constantly communicated and acquired."[7]

Markets incorporate dispersed knowledge. The definition of the *efficient markets hypothesis* encompasses this belief:

> [A]ll relevant information is fully and immediately reflected in a security's market price, thereby assuming that an investor will obtain an equilibrium rate of return. In other words, an investor should not expect to earn an abnormal return (above the market return) through either technical analysis or fundamental analysis. Three forms of efficient market hypothesis exist: weak form (stock prices reflect all past information in

prices), semistrong form (stock prices reflect all past and current publicly available information), and strong form (stock prices reflect all relevant information, including information not yet disclosed to the general public, such as insider information).[8]

It follows that a competitive market price incorporates the dispersed knowledge. In a competitive market, price is determined by the intersection of consumers' demand for a given good or service with its available supply. The higher the demand and lower the supply for any given good or service, the higher its price; the lower the demand and higher the supply, the lower its price. Price (at least in a competitive market) serves an allocative function; it mediates between how much of a good or service is demanded and how much of it can be supplied. Price also serves an important signaling function; it publicly communicates information about a particular company's efficiency and market profitability, and it may help others to consider expansion, entry, or resource allocation.

## The Illusion of a Competitive Price

With the advancement in Big Data and Big Analytics, our ability to amass information has progressed far beyond what Hayek envisaged in the mid-twentieth century.[9] Is Hayek's "knowledge problem" less problematic today? As Hayek recognized:

> If we possess all the relevant information, if we can start out from a given system of preferences, and if we command complete knowledge of available means, the problem which remains is purely one of logic.[10]

> If anyone actually knew everything that economic theory designated as "data" competition would indeed be a highly wasteful method of securing adjustment to these facts.[11]

> [C]ompetition is important only because and insofar as its outcomes are unpredictable and on the whole different from those that anyone would have been able to consciously strive for.[12]

It is interesting to consider Hayek's theory in light of comments made by Leonid Kantorovich in his Nobel Prize lecture.[13] The Soviet economist noted how complex problems of economic prediction, control, planning, and resource allocation may be resolved, among other things, with advancements in computing technology and algorithms.

Are we close to reaching that stage? With the rise of pricing algorithms in an increasingly digitalized market universe, in which web-aggregators, algorithms, and data pools provide the foundation for possible unilateral, coordinated, and Frenemy behavior, is the invisible hand still a viable concept? After all, in a market that is in reality controlled by bots and algorithms, what power does the invisible hand possess?

One may argue that the invisible hand remains a powerful force. Humans, after all, program and nominally control the algorithms. We still trust the invisible hand in many markets where robots manufacture products or provide services, or where computers help facilitate trade. Moreover, we have seen how computers can enhance competition and our welfare.

But we have also seen that, in a digitalized and controlled universe, barriers and market failures often exist, and may even be unavoidably integrated into the landscape. As we suggested earlier, what might at first glance be seen as competition is, in fact, the creation of a new force—the "digitalized hand." That hand, controlled by algorithms, determines the market price in any given market through complex calculations. It is controlled by those who seek to maximize their profits. At times we see a surreal result, as when Amazon's algorithms priced the book *The Making of a Fly* at $23,698,655.93. But other times, the deviation will be smaller and less noticeable, especially when no ready benchmark exists.

Another interesting question follows: Is the price in a digitalized environment characterized by many sellers the competitive price, or merely a fiction created by the digitalized hand?

Recall our Hub and Spoke scenario, where an algorithm determines the base price for the ride-sharing platform Uber. The algorithm also determines: *when* to implement a surge price, for *which* areas, for *how long;* and to *what extent.* Passengers typically do not negotiate a discount with the drivers. Uber's God View reaches beyond knowing where all its drivers and users are traveling. Uber's algorithm collects data in real time and sets a price based on demand and supply characteristics and market conditions. Uber defends its surge pricing based on its knowledge of supply and demand conditions:

> We raise price when supply of available cars gets tight. [Example: If there are 300 cars in a city and 290 of them are picking up a rider or in trip, then this would be considered an extremely tight supply situation.] We

> raise the price in increments over time based on supply health. When supply opens up, we then lower the price. . . .
>
> We are able to get a far greater number of drivers on the system when Surge Pricing is in effect—it's basic economics. Higher prices encourages more supply to come online. It gets some drivers out to work on NYE. It keeps other drivers from going to alternatives like renting their car out for the night, or trying their luck at hustling rides on the street. Higher prices means more cars, means more rides, means more people getting around the city efficiently, safely AND in style.[14]

The surge in prices, in theory, should attract more drivers onto the road (or reduce consumer demand for those unwilling to pay the surge amount), whereupon prices should return to the regular rate. In the context of our discussion, of significance is the fact that Uber is the one seemingly determining the competitive market price, where its users' demand for a car service intersects with the available supply.

Uber also claims that its surge pricing serves a signaling function: namely to communicate to the community's Uber drivers (and potential drivers) to consider entering the market. So is Uber's surge price, in a market characterized by many drivers, the competitive price or merely a fiction created by its algorithms? When Uber's algorithm determines when demand exceeds supply, and charges a premium (ostensibly to attract potential drivers to the road), is this the invisible hand at work? Or is it Uber's digitalized hand at work?

Two studies have drawn into question Uber's claim that its surge pricing brings more drivers into the market. One study examined four weeks of Uber data and did not find evidence of surge pricing bringing more drivers out on the roads. Instead, surge pricing appeared to push "drivers already on the job toward neighborhoods with more demand—and higher surge pricing. As a result, some neighborhoods are left with higher waiting times for a car."[15] Another study interviewed Uber and Lyft drivers. Over half of the interviewed drivers said they were "not influenced by surge pricing information as the supply-demand control algorithms failed to accommodate their abilities, emotion, and motivation."[16] As the study found,

> Surge pricing changed too rapidly and unexpectedly to utilize the information in a strategic way to boost their incomes. Surge areas were on and off, sometimes by the second, and being in the surge area did not guarantee requests from within the surge area.[17]

Even if surge pricing did not have its intended effect of quickly attracting additional drivers to the road, the invisible hand could still be at work. Arguably, Uber has to price competitively. Otherwise users will turn to other ride-sharing apps, taxis, public transportation, or other modes of travel. Thus, in markets with a competitive alternative, the invisible hand ultimately checks Uber. If Uber's surge price is too frequent, too high, or for too long, its app users would opt for other modes of travel (or simply walk).

But as we saw in Chapter 6, as Uber's platform increases in popularity outside options are limited and switching costs become high. With more drivers and users relying on Uber, its pricing algorithm, rather than responding to market conditions, essentially sets the market price. The competing services may not benefit from economies of scale; public transportation and taxis may not be a viable option (and if they are, the waiting time may be longer). Uber—quite rightly—may have the upper hand. Eventually, the price Uber sets may be shielded, to some extent, from the competitive pressures of other providers. Furthermore, competitors in some markets may opt to follow the price determined by the digitalized hand, when that price is higher than the alternative which would have emerged through the invisible hand.

Consumers do not know how Uber's pricing algorithm calculates the surge price or whether the surge price is fair. Nor will the surge price always have the desired effect of quickly attracting drivers to the road. Instead, if Uber possesses market power, the surge price enables both Uber and its drivers to simply earn extra profits, at consumers' expense, all under the guise of a "market-clearing" price.

## A Privately Planned Economy?

Notice here that Uber is in effect an uber–price regulator. Uber does not own the cars. Nor does Uber employ the drivers, who are "independent contractors."[18] Nor does Uber allow individual drivers and passengers to negotiate prices in each city. Uber sets the price. It also increases and lowers the price based on its capturing all the relevant market information. So if Uber captures the sum of all knowledge to set the market-clearing price, why can't other platforms and super-platforms do the same?

The emergence of super-platforms could indicate a shift toward the attainment of all knowledge. Data collection by leading platforms (like Uber) and super-platforms (like Google, Facebook, Apple, and Amazon) could create an economy which, for all purposes, is planned, not by bureaucrats or CEOs, but by the technostructure. Corporate decision-making power, economist John Kenneth Galbraith observed, resides not with the CEO but with the technostructure.[19] As Galbraith found, "if a decision requires the specialized knowledge of a group, it is subject to safe review only by the similar knowledge of a similar group. Group decision, unless acted upon by another group, tends to be absolute."[20] In Galbraith's day, the technostructure involved the working groups of designers, engineers, and marketers within corporations like General Motors. In 2016 it would be the working groups of engineers, marketing, advertising, software developers, designers, and so on, operating within Google, Apple, Amazon, and Facebook. The CEO will not necessarily know the details of how the technostructure facilitates the data flow and the ways in which wealth can be extracted. And the technostructure, while knowing the general objectives of the algorithm, may not necessarily know how the algorithm determined the instant price. And how the algorithm determined the price may not at all resemble how humans did it in brick-and-mortar shops subject to the invisible hand.

Firms increasingly will use Big Data and Big Analytics to determine prices. We may not observe in each market when the digitalized hand displaces the natural competition dynamics. One scenario, as we saw, will be the gradual demise of a uniform market price, as pricing algorithms individualize price and product offerings as they approach near-perfect behavioral discrimination. Another set of scenarios involve pricing algorithms tacitly colluding in a transparency-enhanced environment. In either case, the market involves many competitors who, following the path of Uber, can also claim that they are harnessing Big Data and Big Analytics to set the market-clearing price. If they have market power, then their market-clearing price may exceed the competitive price, that is, the average price if left to negotiation between individual buyers and sellers.

## Is Smart Regulation Back?

If companies can harness Big Data and Big Analytics to effectively set the market price, should governments use the same tools to monitor industry prices (or even determine a competitive price)?

If Uber, which doesn't own any cars or employ any drivers, can determine the surge and base price in each market, why can't the government? The government can collect as much data as Uber, if not more. The government could also use pricing algorithms. And the government could determine a competitive price and identify what amounts to an excessive price. So if Uber, as an intermediary, can calculate the surcharge for its many drivers and passengers during periods of congestion, why couldn't the government's pricing algorithms monitor industry pricing or simply set the market-clearing price. One could argue that price regulation in the post-Hayekian world of Big Data is feasible, once industry data on individual consumer preferences and firm costs are collected and analyzed. The rise of the digitalized hand makes this possible.

One could go a step further. If companies can harness Big Data to set the market price, can the combination of large volumes of data and sophisticated pricing algorithms make a centrally planned economy viable?

We can reflect upon the potential and limitations of Big Data and a planned economy in light of developments in Chile between 1971 and 1973. At the time, when seeking to coordinate the nationalized sectors of its economy, the Chilean government sought to address Hayek's "knowledge problem." To do so, it launched Project Cybersyn—a system of telex machines that were placed in nationalized factories and regularly transmitted data to a central operations room. This data, once harvested, was used in economic modeling and enabled the central government to steer the national economy.[21] The significance of Project Cybersyn was aptly illustrated during the national strike in 1972.[22] Faced with the possibility that the strike might cripple its economy, Chile's government responded by utilizing its information network to coordinate the activities of those factories that were not striking and effectively allocate resources to them.[23] Importantly, the project was not problem-free. Most noticeably, its response time was often too slow to be of any use,[24] and it was also heavily reliant upon accurate submission by factories of their production data—information that was not always forthcoming.

The Chilean experience, with its achievements and drawbacks, provides an example of the power of knowledge and its use as part of a planned economy. Its execution in a modern digitalized environment would have achieved much more than capacity and production optimization. As one proponent wrote, "A combination of new sensory and computing technologies, two-way communications and devices that both create and analyze large volumes of data can now measure and communicate real-time demand."[25] The government algorithm, in analyzing the data, could quickly change pricing or supply levels, "such as powering down preselected devices during periods of peak electricity demand."[26] Thus local, state, or federal governments can harness data to set a market-clearing price.

To illustrate "smart" regulation in the post–Project Cybersyn world, we'll look at parking in San Francisco. In 2011, the city's SFpark program began experimenting with smart parking meters that continually adjust pricing to respond to changing demand conditions. The city wanted to determine the right price to charge for parking to meet its parking space availability targets. So the city installed wireless parking sensors in 8,200 on-street metered spaces, which detected parking availability in real time and monitored public garages.[27] The city set a target occupancy rate between 60 and 80 percent.[28] Data on the available supply of parking spaces was collected in real time from the meter sensors. Rather than charging the same price during periods of high or low demand, the parking prices would adjust accordingly throughout the day for public parking on any street. In areas and at times where it became difficult to find a parking space, parking rates increased incrementally "until at least one space is available on each block most of the time;" in areas where parking spaces were plentiful, parking rates decreased "until some of the empty spaces fill."[29] The city also directed "drivers towards available parking by sending real-time availability to mobile apps and to the website."[30]

The city's pilot "demand-responsive" pricing program was apparently successful on many levels. It helped improve parking availability and net revenues.[31] It decreased drivers' average search time for a space.[32] It also helped reduce greenhouse gas emissions,[33] peak period congestion,[34] traffic volume,[35] vehicle miles traveled,[36] and double parking.[37]

So if one major U.S. city could determine the market-clearing price for parking spaces, does this mark a rebirth for "smarter" price regulation, albeit under a more fashionable and acceptable term, such as data-driven dynamic pricing?

## To Infinity and Beyond?

Even if one accepts the premise that the sum of all data would facilitate some variation of a planned economy, the challenge remains to gather all or most data. Pricing for municipal parking is straightforward. So too is pricing for car-sharing services. Uber breaks down prices per city along several basic categories of cars (basic, SUVs, luxury, and taxi). But as anyone who lives in a centrally planned economy knows, designing and pricing men's and women's fashions are not as straightforward. Even if the velocity of collecting and processing a voluminous variety of data increases, one wonders whether any firm or governmental agency could truly possess enough information for many markets. We may have solved Hayek's knowledge problem for parking, car service, energy, and other simple homogenous services and products, but not for designer dresses and the many differentiated goods and services.

It is hard to imagine us categorically solving the knowledge problem in the foreseeable future. We cannot capture and digitize all information. It is too costly (and raises many privacy concerns). Moreover, even if technology does indeed reach a point where all or most relevant knowledge can be aggregated, this does not mean that the computer algorithms will keep abreast in processing it. Recall that 2015 marked the first time an algorithm weakly solved one kind of poker game with incomplete information. It will likely take years for algorithms to solve more complex games and for a complete picture of many markets for differentiated goods and services. Indeed, one criticism of Hayek's theory concerns its assumption that, despite the dispersal of knowledge among a large number of decision makers, "as a whole, the aggregated set of all decision makers have a complete set of all relevant knowledge."[38] Even if all the data were collected, many theorists believe that there are in fact missing pieces of the puzzle, which are not known by anyone (and cannot therefore be captured or analyzed).[39]

One example is Apple. Its cofounder, Steve Jobs, showed the iPad to a small group of journalists shortly before its going on sale in 2010. As the *New York Times* reported, one journalist asked Jobs what consumer and market research Apple had done to guide the development of the new product. "None," Jobs replied. "It isn't the consumers' job to know what they want."[40] Data can capture well-established consumer preferences for pre-existing products and services, but the algorithms may not necessarily estimate demand for new products based on new technologies.[41] Even if the government or super-platform could collect all the data on all of our existing preferences, they may perhaps design a better cell phone (but not the iPhone) or a cheaper watch (but not the Apple Watch).

Other concerns over price regulation involve incentives and regulatory capture. Economic regulation attracts special interest groups to lobby the government for regulatory measures that benefit them to the detriment of society overall. If the government algorithm sets (or regulates) price levels, then rent-seeking behavior can impose additional social costs. For example, the U.S. Federal Energy Regulatory Commission's merger review policies were criticized for relying on data supplied by the regulated entities, rather than conducting its own independent fact gathering and analysis of market definition.[42] The risk that sector regulators, even the most dedicated ones, may fail to understand and predict market dynamics, is real. Such failure will likely lead to a generalized approach that ultimately reduces welfare. In addition to the risks of imperfect information and regulatory capture, the government can undertake anticompetitive intervention because of weaker incentives to avoid mistakes than private actors who fully bear the costs of their mistakes, "political myopia," and the lack of direct accountability to the public.[43]

Moreover, the road to perfect price regulation may also lead to a world of limited privacy, among other things. On this point, it has been noted that "being online increasingly means being put into categories based on a socioeconomic portrait of you that's built over time by advertisers and search engines collecting your data—a portrait that data brokers buy and sell, but that you cannot control or even see."[44] That information is open for companies and individuals to purchase and use in targeting users—from legitimate advertising to possible abusive use of one's most secret or vulnerable searches and online behavior.[45]

## Reflections

For some products and services, one does not require *all* information for decision making. Uber, for example, sets the surge price without knowing where exactly its possible drivers are or how quickly they will respond (if they do). We live in a world where we spend a lot of our household income on ordinary things, such as basic foods, utilities, electricity, mortgage interest, gasoline, and public services.[46] For these areas, data-driven, dynamic pricing may be on the horizon.

As firms and super-platforms increasingly collect and analyze data, we will likely see more dynamic pricing. But we cannot assume that market prices going forward will approximate the market-clearing, competitive price. The more power these platforms (like Uber) or super-platforms (like Apple, Facebook, Amazon, Google) accumulate, the more likely they will control, rather than respond to, the digitalized hand.

There will always be alternatives. So you can always walk at 1 A.M. on New Year's Day if you are dissatisfied with Uber's surge pricing. But that defense is available to any monopolist. And as we trudge through the snow on our way home, it becomes apparent that we are no longer in a market economy governed by an invisible hand, where competition is the brass knuckles that enforce its decisions.

# 19

# The Enforcement Toolbox

HAVING EXPLORED the possible use of "smart" regulation in a data-driven economy, we now identify several looming enforcement challenges presented by our scenarios. First, the competition agency may not see any problem. Even if it does see the problem, it may not have any enforcement tools to fix the problem. The issues may transcend antitrust, given the difficult legal and ethical issues of humans' accountability for a computer's behavior. Finally, even if the competition agency has the tools, when should it intervene?

These problems may appear insurmountable. One debate, as we saw in Chapter 3, is whether the "old economy" antitrust doctrines should apply to firms competing in dynamic technological markets characterized by network effects. But this debate recurs with every generation of antitrust scholars and practitioners. As we will see, the current antitrust tools will be inadequate in prosecuting and remedying some of our anticompetitive scenarios. The dynamic has changed in many markets—competition as we know it has given way to new forms of rivalry.

But the issue is not over the current tools. As we will explore, the real issue is designing new tools to address the new problems. Indeed, some courts and competition agencies many years ago were better at recognizing the prevailing challenges and devising ingenuous solutions to meet them. With that reality in mind, we must be open-minded to new enforcement instruments. Failure to do so, as the United Kingdom House of Lords recognized, may result in "a perception that large online platforms are above the law."[1] And if the House of Lords is at the forefront in addressing these issues, no competition agency can justify its unimaginativeness as wisdom.

## Key Challenges to Competition Enforcement

### When the Competition Agency Does Not See the Problem

As discussed in Chapter 1, the digital economy is booming—a dynamic landscape where new entrants, low entry barriers, and rapidly changing technologies are dislodging preexisting market power. As we have explored, what appears to be a competitive environment may not be the welfare-enhancing competition that we know. Our concerns are not with technological advances or successful online businesses. Our concerns go deeper, to the core of the new market dynamics—where entry is possible, but expansion will likely be controlled by super-platforms; where choice is ample, but competition is limited; and where disruptive innovative threats emerge, but are eliminated through acquisitions or exclusionary practices. The competitive façade masks the wealth transfer, and the targets of anticompetitive practices—the buyers—are often unaware of the extent of the manipulation.

Thus, the competition agency must look beyond the façade to see whether competitors are racing to the bottom in finding new ways to exploit us. So while technology can increase price transparency (which should be a good thing as it lowers consumers' search costs), the pricing algorithms at times can foster tacit collusion—when sellers' pricing algorithms, by quickly reacting to price changes, diminish the incentive to discount. If market participants' algorithms can attain a God View, then enforcers must consider the possibility of tacit collusion beyond price and highly concentrated industries.

So while technology can enable sellers to customize their product offerings (which should be a good thing if it matches consumer preferences), the pricing algorithms can also enable sellers to better segment customers and engage in behavioral discrimination—again, at our expense. Some enforcers today accept price discrimination as efficiency-enhancing. Some enforcers scoff at the advances in economic thinking over the past thirty years–downplaying the role of imperfect willpower and biases. They still believe that markets behave as though the participants are perfectly rational and have willpower. So behavioral exploitation may be as foreign to them as Snapchat, and will affect their readiness to pursue these cases.

Super-platforms may appear competitive in attracting a constellation of software developers. Seeing the plethora of free and low-cost apps downloaded annually, the enforcers may conclude that consumers are benefiting (and do not care that much about privacy). As a result, they do not discover that free comes at a significant cost as Frenemies coordinate to better track our behavior, profile us, and target us with behavioral ads.

The anticompetitive effects are not always easy to see. Companies can be a step ahead in developing sophisticated strategies and technologies that distort the perceived competitive environment. One illustration, in the context of manipulation of stock exchange trading, is Michael Lewis's fascinating book *Flash Boys: A Wall Street Revolt*.[2] On one side were the traditional investors, from small traders to large pension funds, making their investment decisions based on the market reality as they saw it. But what appeared to be a competitive market (indeed, the stock market is often perceived as competition in its truest sense) was an illusion. The stock prices posted on the computer screen were not the actual prices. Once the traders executed an order, the price often shifted. In reality, the different stock exchanges were rigged by sophisticated high-frequency traders working with many of the large financial institutions. The high-frequency traders were in a competitive arms race, including laying cable the shortest possible distance to their trading desk to gain a relative advantage in seeing and executing orders slightly before everyone else. With this advantage, the insiders "rode" on the traditional investment orders before they were executed. Once the traditional order was placed, these investors moved in and out of positions in milliseconds, changing the market reality through their accelerated capabilities. Ultimately, the insiders imposed, as Lewis described, a small invisible tax on each trade, which amounted to nearly $160 million a day.

One cannot help but borrow Albert Einstein's aphorism: "Reality is merely an illusion, albeit a very persistent one." Technology in an algorithm-driven economy can create multiple versions of the same market, distinguished by the participant's savviness (or deceit) and wealth. Some compete in the slower lane while others, better placed, compete against them and against each other in the fast lane. Whether this is competition on the merits or exploitation is the challenging issue.

### When the Competition Agency Sees the Problem but Has No Tools to Fix It

Some competition officials are already seeing the problems in some of our scenarios. But they also see some of the challenges in applying the existing antitrust case law to our collusion, behavioral discrimination, and Frenemy scenarios. Indeed, looking at our three scenarios, competition enforcers will have the tools to fix some problems but not others. Antitrust, while not obsolete, may prove difficult, at times, to apply even when a theory of harm is present and the competition agency wishes to intervene.

When considering our collusion scenarios, the competition agencies are likely to position these practices high on their enforcement agendas. European Union and U.S. authorities could use Article 101 TFEU and Section 1 of the Sherman Act, respectively, to address the Messenger and Hub and Spoke scenarios, where an anticompetitive agreement exists. They may also stretch these statutes to Predictable Agent by reframing it as a simple conspiracy. Unless they have another statute (like Section 5 of the FTC Act), their current tools do not reach the unilateral use of algorithms by nondominant companies. Some agencies currently have no tools for the creation of the Digital Eye, where there is no evidence of anticompetitive agreement or intent.[3]

When reflecting on behavioral discrimination, several challenges emerge. The agency must understand the new market dynamics to appreciate the shift to almost perfect behavioral discrimination. Second, the agency's welfare benchmark should target the transfer of wealth from consumers to sellers and focus on direct consumer welfare. Third, the current antitrust tools do not target noncollusive behavioral discrimination. One exception is if the discrimination helps the firm attain or maintain its monopoly. Arguably the ability to behaviorally discriminate almost perfectly indicates market power. In Europe, enforcers can perhaps go further in challenging the imposition of monopoly prices by the discriminators.[4]

Finally, with respect to Frenemy dynamics, distinct theories of harm may be considered. The first concerns collusion among the apps and within the ecosystem. The main challenge here concerns the framing of such activities in antitrust language. Indeed, the harm to users that is inflicted through the extraction of data may be easier to address and to remedy under consumer and data protection laws than under the competition laws. A second theory of harm may concern the activities of the super-platform and the possible abuse of its dominant position. Here, as illustrated in Chapter 14, an explicit refusal to deal, or a de facto refusal, may trigger intervention, in the form of decisions, commitments, or interim measures. Moreover, enforcers can intervene when the super-platform uses unfair tactics to favor its own services and products on its platform over those of independent producers. Competition officials dealt with this issue when prosecuting Microsoft.[5] And the European Commission raises this concern in its two recent statements of objections involving Google.

### When the Competition Agency Has the Tools, but Practical Challenges Await

Even when the competition agency takes action, using its existing legal tools, the new market dynamics raise other practical challenges.

Take, for example, the challenge of establishing market power in a data-driven environment. Can the online company behave independently of its customers or competitors? Often there is no direct evidence. Much depends on how one defines the relevant market and one's assumptions about and understanding of market dynamics. The dynamics of a data-driven environment, as the Frenemy scenario reflects, can be complex. The competition agency must appreciate the interdependence, the asymmetry in bargaining power, the strength of network effects, the absence of outside options, high switching costs, and whether customers are locked in.

Even when market power is identified, recall that monopolies (other than those created by mergers) are legal. Once dominance has been attained legally, its abuse should be considered. The agency must consider which actions should be condemned and the level and nature of harm needed to trigger intervention.[6]

Also challenging is identifying reliable counterfactuals when appraising harm. With traditional cartels, enforcers and courts can consider price increase announcements that occur closely after meetings in which many cartel members participate. In our collusion scenarios, the prices may increase gradually as market transparency and interdependence increase. There may not be a definitive meeting or occurrence to which one can point. Nor can enforcers always identify credible counterfactuals when assessing behavioral discrimination. What is the competitive baseline "market" price in a world of dynamic, differential pricing? Should the next incremental development be contrasted with the previous one or with a computer-free reality? Absent a transformative change in technology and market dynamics, it may be difficult to identify the appropriate point of intervention and comparison. After all, today's artificial levels of transparency (and elevated prices) may become tomorrow's acceptable norm.

Another key challenge is the legal and conceptual difficulty emerging from the relationship between man and machine—that is, humans' control (or lack of it) over machines, and their accountability for the algorithms' activities.[7] If algorithms collude or price discriminate, are humans liable? As several computer scientists have observed, "The amoral status of an algorithm does not negate its effects on society."[8] Or as one judge aptly noted, "Automation is effected through a human design."[9] In the context of competition and markets, friction among profit maximization, ethical trading, and consumer welfare exists. Current laws may not always resolve this friction and may fail to incentivize individuals to take responsibility for the actions of an "independent," self-learning algorithm.

## When to Intervene and to What Extent

Controversy may surround the timing of an intervention, its nature, and its extent. As markets may display many characteristics of a competitive environment, intervention may seem counterintuitive. The competitive façade, in addition to intellectual capture propagated by interested parties, may tilt against intervention. To what extent do these dynamics present an immediate problem in need of immediate correction?

The durability of market power in dynamic technology markets is often difficult to ascertain and therefore controversial to act upon. Should the competition agency wait for entry or expansion? At what point should the enforcer assume that market power is sustainable? And which enforcement tool, if any, should be used? Balancing the possible anticompetitive harm against the welfare gains from technological advantages may prove challenging. Importantly, some market efficiencies may only be delivered through a super-platform.

Courts and enforcers also may be reluctant to intervene and find the firm liable under the antitrust law, if no effective remedy exists. The U.S. Supreme Court, for example, said, "No court should impose a duty to deal that it cannot explain or adequately and reasonably supervise. The problem should be deemed irremedia[ble] by antitrust law when compulsory access requires the court to assume the day-to-day controls characteristic of a regulatory agency."[10]

Not surprisingly, a range of enforcement philosophies may lead to varying levels of intervention. Although guided by economic analysis, the foundations of competition policy around the world differ as competition regimes developed and evolved under different political, social, and market conditions.[11] Enforcers differ in their views on the ability of markets to correct themselves and the benefits and risks of intervention versus nonintervention.

Even within a jurisdiction, elected officials, enforcers, and courts can differ over the choice of cases, the enforcement agenda, the way the law is applied, the goals and scope of competition law, and the wisdom of intervening in our three scenarios.

To illustrate, consider the issuance in 2008 by the Bush administration and subsequent withdrawal in 2009 by the Obama administration of the Department of Justice (DOJ) report on competition and monopoly.[12] Despite their joint task force, the FTC did not join the report.[13] The report was seen as too deferential to monopolies. "Withdrawing the Section 2 report," Christine A. Varney, then head of the DOJ's Antitrust Division, said, "is a shift in philosophy and the clearest way to let everyone know that the Antitrust Division will be aggressively pursuing cases where monopolists try to use their dominance in the marketplace to stifle competition and harm consumers."[14] Notwithstanding her rhetoric, the DOJ since 1999 has challenged a monopoly only once for engaging in anticompetitive unilateral conduct. This case involved a private hospital in Wichita Falls, the twenty-ninth largest city in Texas.[15] Neither the FTC nor the DOJ has challenged many data-driven mergers[16] or the alleged anticompetitive practices of any of the super-platforms, besides Apple.[17]

So where does this leave us? Opponents of intervention often argue that antitrust law is ill-suited to data-driven markets and that existing tools do not support intervention. When reflecting on such claims, however, one should note that harm and market failure cannot be defined by the enforcement tools. Rather, once they are identified, a range of enforcement tools should be considered. In line with this, the argument that "no previous case law supports intervention" fails to consider the full enforcement toolbox and to acknowledge the change in market and competitive dynamics. Intervention should not be categorically set aside as irrelevant for new dynamic markets. Economic theories, based on hypothetical market assumptions, should not trump the economic realities that evince actual consumer harm.

But enforcement should not be taken lightly. One should critically reflect on the assumptions, theory of harm, and market reality before taking action. Antitrust is not a panacea for every problem. While antitrust may prove useful in addressing some dynamics, it may lack the scope and refinement to address others. Importantly, antitrust is only one of many tools at our disposal.

## Learning and Doing

Traditional competition law can address some, albeit not all, of the issues we have explored. In a 2016 speech, EU Commissioner Vestager noted the rise of Big Data and the role of competition enforcement:

> [W]e don't need a whole new competition rulebook for the big data world. Just as we didn't need one for a world of fax machines, or credit cards, or personal computers. What we do need is to pay close attention to these markets and to take action when it's necessary. Competition rules can't solve every problem on their own. But they can make an important contribution to keeping digital markets level and open. So that consumers get innovative products at the right prices. And so that digital entrepreneurs, however big or small, have a fair shot at success.[18]

We agree. Competition law is not obsolete. Furthermore, some jurisdictions benefit from a broad market and sector investigations regime. This flexible tool enables agencies to investigate and gather information to better understand market dynamics. Unlike traditional competition law investigations, the focus is not whether one or several companies violated the law but on the operation of the market and identifying possible market failures.

This tool can prove useful in helping agencies understand the new dynamics in algorithm-driven markets and the magnitude of any competitive problems. In some jurisdictions, like the United Kingdom, market and sector investigation laws also provide for wide behavioral and structural remedies. So even when no other suitable tool exists, the agency can nonetheless address and minimize our scenarios' anticompetitive risks.[19] Moreover, market investigations can provide a valuable framework for considering new enforcement tools.

### Building the Framework for Healthy Virtual Competition

Competition is normative. What we observe as competition reflects, in part, the legal constraints and incentives, as well as informal social, ethical, and moral norms. Formal norms (like laws and regulations) and informal norms (such as codes of practice[20]) shape participants' incentives and market structure. As economist Douglass North observed, "The government is not a disinterested party in the economy."[21] For example, if the government does nothing to prevent monopolies, and if many markets are conducive to monopolization, then monopolies will likely dominate these markets. So rather than an ex post approach (wait for the monopolies to arise and then regulate them or prosecute their behavior), the government may favor ex ante mechanisms (toughen the merger laws to prevent monopolies, and facilitate entry by lowering regulatory barriers).

Thus, for virtual competition to flourish, we should focus on what preconditions are necessary, and the extent to which competition, consumer protection, and privacy laws can help support this economy. Such an approach is valuable. In changing the formal and informal norms, the government affects the inherent nature of competition so that firms' incentives are aligned with ours. In other words, carefully sowing the seeds of change may be preferable to laborious and unrefined weeding.

We sketch several possible tools extending beyond competition law to address our three scenarios. Our list is not exclusive. More creative solutions—no doubt—can be tailored. The tools below simply illustrate the expansive frontier to be explored.

## Privacy by Design and Customer Empowerment

To hinder the abuses in our behavioral discrimination and Frenemy scenarios, privacy measures and safeguards may be a necessary precondition. One promising legislative approach is to give individuals greater control over their personal data and to avoid being tracked on- and offline.

The notice-and-consent privacy model is broken.[22] Too often, as users, we habitually click our consent to terms and conditions that we never read. Indeed, a study of customers' reading of standard online contracts revealed that fewer than two out of a thousand customers attempt to read them, and even then only superficially.[23] Given the zeal with which we click our consent to online terms, the solution isn't more information (and legalese) that we'll never read (especially on our mobile phones). In fact, excessive and complex information would likely have the opposite effect—further disincentivizing us from attempting to read the notices. Even if the disclosures were briefer, we still lack the power to renegotiate. You either accept the terms or do without the update, app, or software. To be effective, any enhanced disclosure must take into account the asymmetry in negotiating power and possible consumer engagement problems, where "under-active consumers, by not exercising choice, impose negative externalities on other consumers from the consequential weakening of competition."[24]

So what are the alternatives? First, the behavioral discrimination and Frenemy behavior must become more salient, such as by means of (1) pop-up windows that inform us when and what information is being harvested, and when we're being tracked; (2) clear indication of when personalized prices are displayed; (3) clear disclosure with respect to "best price" claims, to avoid misleading information as to the availability of other options; and (4) clarity with respect to "no availability" claims—for instance, in the case of hotel rooms or flights—and requiring sellers to clearly indicate whether such claims relate to the availability on the specific website or to overall availability.

Second, we should require default privacy options that are generally aligned with our privacy interests. To illustrate, in the United States we could extend to everyone the existing protection afforded to minors (and their parents) under the Children's Online Privacy Protection Act.[25] Under this legal model, privacy would be the default. We would have to opt in, rather than opt out of being tracked (either by the website or by third parties), of having data collected on us, and of being profiled. Firms would have to obtain our written, verifiable consent. Like the browser choice screen in the European Commission's *Microsoft* case,[26] users, after purchasing their smartphone or computer, would be prompted for an omnibus privacy setting. We could opt for the bare minimum, such as cookies to enable us to log in and remember what is in our shopping basket, but for no other purpose. Firms could not condition our access and use of their services on their collection and use of our data ("click wrap"). Even when we authorize the use of data, the company—consistent with data-minimization principles—could not collect more personal information than is reasonably necessary for them to provide their services. We could readily access any personal information the firm has about us and delete it.

We are seeing such developments in the European Union, where privacy generally, and informational privacy in particular, have long been a fundamental right. Of significance is the EU Data Protection Regulation. Adopted in 2016, after four years of drafting and negotiations, its aim is to advance "clear rules that are fit for the digital age, that give strong protection and at the same time create opportunities and encourage innovation in a European Digital Single Market."[27] Privacy regulators will have more power, including the ability to impose larger administrative fines.[28] Companies cannot "divulge information that they have received for a particular purpose without the permission of the person concerned. Consumers will have to give their explicit consent to the use of their data."[29] Consumers will have greater control over their data—being able to transfer it between providers, remove it from a database, and obtain information as to its usage.[30]

With greater control over our personal data, we could select third-party agents to negotiate on our behalf. Computer science professor Pedro Domingos, for example, proposed creating a digital alter ego: "For a subscription fee, such a firm would record your every interaction with the digital world, build and maintain a 360-degree model of you, and use it to negotiate with other people's models."[31]

So we can see how ex ante privacy protections can foster innovative services, while limiting the ability and incentives of sellers to discriminate.[32]

## New Entrants with Different Incentives

To destabilize algorithm-enhanced tacit collusion or widespread behavioral discrimination, the government might promote entry by companies with different economic incentives. One approach may involve subsidies to algorithm providers that promote customers' interest by, for example, designing "counter measures," which may serve to restore competition. Another avenue may involve entry by consumer-owned cooperatives, where the supracompetitive profits are redistributed to consumers in the form of rebates. The rebates could effectively return prices to competitive levels. Social purchasing sites, such as CrowdZap, which assemble buying groups and achieve economies of scale in purchasing, including the "Big Switch" initiative to save money on energy bills,[33] are injecting competition. Similarly, other sites, such as Groupon, Wowcher, and Living Social, distinguished as "group buying" rather than "collective purchasing,"[34] offer consumers discount vouchers when enough consumers sign up for an offer.[35]

A related approach involves sponsoring or supporting entry by a maverick. A maverick may offer a disruptive technology or business model, take the lead in cutting prices (or resisting its rivals' attempts to raise prices), or expand its production capacity. If consumers flock to the discounter, rivals will likely respond. If successful, they end up, from the competitors' perspective, with the nuclear option—an all-out price war. Mavericks might program their pricing algorithm to prefer market share growth over profitability within certain bounds, so as to enable them to expand quickly.

Admittedly, our ability to design such maverick interventions—across markets—is not problem-free and may be limited. Cooperatives, subject to weak corporate governance, may dissipate their profits on internal salaries, perks, or expansion into other markets. Beyond the difficulties in sponsoring entry, the incumbents can develop counterstrategies that ultimately thwart the entrant's market-share growth. In industries where competitors compete in multiple products and geographic markets, computers can learn to retaliate across markets (e.g., the incumbent offers a steep discount in the maverick's home market or markets sheltered from competition), which the maverick's pricing algorithm can quickly learn is correlated with its discounting.

Incumbents can devise strategies to reduce the maverick's incentive to discount, thus fostering coordinated behavior instead. With improvements in technology, companies can replicate Uber's God View, seeing where their shoppers are currently located and what they are doing. Using real-time geolocation data, companies will know if their loyalty card shoppers have entered a rival's store. They will know if their consumers are frequenting a competing website that is promoting the same item at a discount. So, using this God View, companies could avoid an all-out price war. Instead, they target the maverick's customers, and not their fellow Frenemies', to marginalize the maverick while avoiding the nuclear option.

## Reducing Price Transparency

We are accustomed to treating transparency as a condition for competition. But we want to design ways for companies to undercut the market price using nontransparent communications with buyers. Careful design of secret bids and sales could help destabilize algorithm-supported tacit collusion.

One way to decrease transparency is by offering discount cards that provide secret discounts without collecting data on users (to avoid our behavioral discrimination scenario). Dealers may engage in reverse auctions and sell below the market price. Such strategies already exist in some industries and sectors, from vehicle sales to legal services.[36] Similarly, some websites allow buyers to solicit offers from undisclosed sellers who compete against each other for the sale of electric appliances and other products.

Alternatively, the government may attempt to reduce the speed with which sellers can adjust prices. Such an approach has been implemented in the fuel sector in Austria and Western Australia, where sellers are limited in their ability to match each other's price more than once a day. Such provisions aim to reduce the number of price changes, open the way for competitors to undercut the collusive price, and promote a seller's reputation as a discounter. The pricing algorithms, while continually monitoring the rivals' pricing and business maneuvers, would now face a time delay in changing price. Under this scenario, the maverick—if the delay were long enough—could profit from being the first to lower prices.

This solution has its problems: competitors would soon complain that the government is preventing them from discounting. One alternative would be if the government allowed price decreases to be implemented immediately, but imposed a time lag for price increases. But pricing algorithms, like humans, could game the system. For example, a dominant incumbent could punish the maverick by undercutting its price. The maverick could not immediately raise its price, and would be forced to lower its price even further. Taking this into account, the maverick's algorithm, before discounting, would likely calculate the probability of incumbents retaliating, its costs (including lost profits) in discounting, and the benefits (which would be slight if rivals could instantly match the maverick's lower price). The governmental pricing delay—rather than helping the maverick and consumers—would instead serve as a punishment mechanism for defecting from the supracompetitive price. In reducing the maverick's incentives to lower prices in cases where retaliation is likely, the governmental pricing delay could unintentionally foster tacit collusion.

## Auditing the Algorithm

Finally, we note the possibility of "enhanced ex-ante monitoring" of firms' algorithms. Such a mechanism, in promoting greater transparency, may enable "public countermeasures" when industry-wide signaling and stabilizing features are identified. Disclosure of algorithms may also help address possible quality degradation or manipulation of search results. Companies may be required to change features in their algorithm, or, alternatively, the government may use the information to design its own market countermeasures. To safeguard the intellectual property rights of online companies, disclosure may be confined to a dedicated enforcement agency and handled under strict confidentiality.

Admittedly, the audit route has limited practical appeal. At least three challenges exist: First, algorithms are not likely to include simple "collusive" instructions, but rather are used to observe market conditions and react in a profit-maximizing way. Running them in a "Sandbox"—a controlled environment that tests their operation—may not always reveal their true effects. Their sophistication may make proof of an illicit aim or action difficult. Auditing may thus fail to lead to meaningful intervention.

Second, even if one can show that algorithms facilitate tacit collusion, the remedy may be challenging. For instance, it may be impractical to require computers to ignore information that is available to everyone online. One possibility may be to focus on commercially sensitive information that, although publicly available, is of little or no value to customers but helps the competitors arrive at a supracompetitive price.[37] Here the focus is on "cheap talk," that is, data exchanges that facilitate conscious parallelism but are of limited use to customers. One problem, however, is in identifying such information. Part of the value of Big Data is data fusion, whereby computers link data sets, from which new insights emerge.[38] Moreover, the data for some applications—such as customers sharing their inventory data with suppliers—can promote efficiency even while raising antitrust concerns.[39] Even if the customers seek to limit what information can be shared, the algorithms—by analyzing a variety of data—could fill in the gaps. So it would likely be difficult (and potentially welfare-reducing) for the government to specify what data the algorithms must ignore.

A third challenge concerns the ability to effectively audit an algorithm or intervene in the market. One risk is that the government will remain several steps behind. Competition authorities may have a difficult time overseeing firms' design and development of sophisticated algorithms. Further, state countermeasures implemented following an audit are not likely to keep pace with the industry's evolving, self-learning algorithms.

While limited in appeal in 2016, the audit route may become feasible as technology and enforcers' proficiency develop.

## Reflections

The enforcement challenges presented by the new market dynamics may be divided into four groups. The first is ideology around how markets operate and the goals of competition law. The second is political will. The effects of intellectual and regulatory capture, as the next chapter explores, cannot be underestimated. The third is ingenuity. The lack of tools may represent a policy failure—namely, the agency's pursuit of what is readily quantifiable over what is important. It is all the more startling that in the age of Big Data and Big Analytics, the government is the entity that claims it lacks the data or analytical tools to assess a restraint's impact. For the areas we identify where their current tools may be ill-suited, the agencies should study how they can refine them or develop alternatives.

Finally, the law at times is messy. Some competition agencies envision themselves as surgeons, removing the anticompetitive restraint while leaving intact the procompetitive (or competitively neutral) behavior. That is the ideal. The risks of legal uncertainty and enforcement costs dictate a careful approach when designing new instruments. In designing and enforcing, one should be aware of our limited ability to predict the future, the dynamics of the market, and changes in strategies. Still, we would argue that a blanket refusal to engage in a discussion of possible new tools would be effectively allowing the patient to die on the table. It stems from the misguided assumption that we are merely dealing with old wine in new bottles—that, while digital markets are new and different, the competitive dynamic remains the same and does not call for change.

# Final Reflections

AS WE HAVE EXPLORED, the upsurge of algorithms, Big Data, and super-platforms will hasten the end of competition as we know it—a decline of the market system to which we have become accustomed. But as we stated at the outset, the new market dynamic is not necessarily bleak. The innovations from machine learning and Big Data can be transformative—lowering our search costs in finding a raincoat or parking spot, lowering entry barriers, creating new channels for expansion and entry, and ultimately stimulating competition.

Big Analytics and Big Data can be beneficial, no doubt. As we saw, these innovations are not inherently good, bad, or neutral: it will depend on how the companies employ the technologies, on whether the companies' incentives are aligned with our interests, and on their actions' collective impact on markets.

The new competitive landscape, however, is not necessarily rosy either. We explored three core dynamics—collusion, behavioral discrimination, and Frenemy—where the rise of sophisticated computer algorithms, artificial intelligence, and Big Data can change our competitive paradigm and market reality for the worse. These dynamics require us to look beyond the façade of competitive progress, acknowledge its pitfalls, and explore smart intervention to promote our welfare. We conclude with the following reflections.

## The Descent from King to Slave on the Data Treadmill

How do we know when competition is a mirage? In competitive markets, the economist Ludwig von Mises observed, the customer, not firms, should be supreme. In our purchasing behavior, we ultimately determine "what should be produced and in what quantity and quality."[1] Von Mises, in his belief in consumer sovereignty, was skeptical about the evils of private monopolies—rational consumers with willpower often can take care of themselves. However, the market realities raise doubt as to our actual power and control.

If we reigned supreme, we would get products that advanced our privacy interests. We would not have to wait years to get ad blockers for our mobile phones. We would not have to search the web in hopes of finding some technology that promotes our privacy interest. If we believed behavioral discrimination was unfair, companies would not segment and target us with differential pricing. Nor could companies tacitly collude and charge us higher prices as a result.

In competitive markets, firms collaborate to innovate or lower production costs.[2] Yet, as the Frenemy scenario explores, the cooperation and competition are misdirected. These new dynamics change competition as we know it from "consumer welfare/surplus" competition, which seeks to improve our well-being, to "producer welfare/surplus" competition, where firms cooperate to extract as much consumer surplus as possible, and then compete over the spoils. Importantly, in producer welfare/surplus competition, the perceived attributes of a competitive market may exist, yet we do not benefit.

No doubt super-platforms invest in research and development and improve the interface and services available to us. This, at times, improves overall welfare. But whatever one thinks of the super-platforms, one does not think of them as the authors or artists of any notable work. Facebook does not supply original content that attracts users to its platform: the content comes from other people we know. The same is true for Twitter, LinkedIn, and many of Google's services. We largely create the YouTube videos ourselves or upload other people's content. None of the super-platforms have written an outstanding novel, directed or produced an award-winning film, scored a musical or opera, staged a play, or informed the public debate with any investigative journalism. Other people and companies provide the creative content, which the super-platforms' algorithms identify to attract our attention.

What is remarkable is that consumers are often toiling away on the super-platform, providing content without compensation, which the super-platform uses to attract others. The more content we create or the more interesting our content is, the more likely others will visit the super-platform, the more data we collectively generate, and the more we can be targeted with behavioral ads. Indeed, the super-platform enables us to compete for status over how many "likes" our posts receive, how many followers we have, or how often our postings are viewed. We are competing against each other for a relative advantage in status.

*Yes,* one might say, *but we get it all for free.* Free, however, is only a price point on a spectrum. We would likely pay some amount if we did not pay with our data (and being targeted with ads). But this is not to say we are fairly compensated for our data and content. Indeed, our toil on the super-platforms and the data collected about us are worth far more than the cost of developing and providing the technology. As we have seen, some tech firms have put a value on our data. Google estimates $720 per person, per year when it talks to investors.[3] One key metric for Facebook, among others, is daily active users: "Trends in the number of users affect our revenue and financial results by influencing the number of ads we are able to show, the value of our ads to marketers, the volume of Payments transactions, as well as our expenses and capital expenditures."[4] As Figure 6 shows, Facebook's average revenue per user (ARPU) has increased steadily since 2010.[5]

Google's ARPU in the first quarter of 2014 was even higher—six times higher than Facebook's.[6] Both companies earn billions of dollars in profits from their advertising platforms.[7]

In a consumer-oriented competitive market, we could conceivably demand compensation for our data and our contributions to YouTube, Facebook, LinkedIn, and Twitter. Yet in our online environment this power has been diluted. Indeed, Facebook users effectively become free endorsers when they "like" a product, advertisement, or company; their photo and identity can now be used in that product's advertisements targeted at friends, family, and others.[8]

Facebook notes how "[t]he size of our user base and our users' level of engagement are critical to our success."[9] If Facebook users stopped toiling away for free and hopped off the data treadmill, then the quality and frequency of postings would decrease, and Facebook's profits would shrink. As Facebook tells investors, it is " 'vital' to encourage a broad range of users to contribute content."[10] One fear at Facebook is that users will provide less content to attract others to its platform. In the third quarter of 2015, for example, a market researcher found that "34% of Facebook users updated their status, and 37% shared their own photos, down from 50% and 59%, respectively, in the same period a year earlier."[11] Facebook thus seeks to nudge us onto the data treadmill. For example, since May 2015, to spur

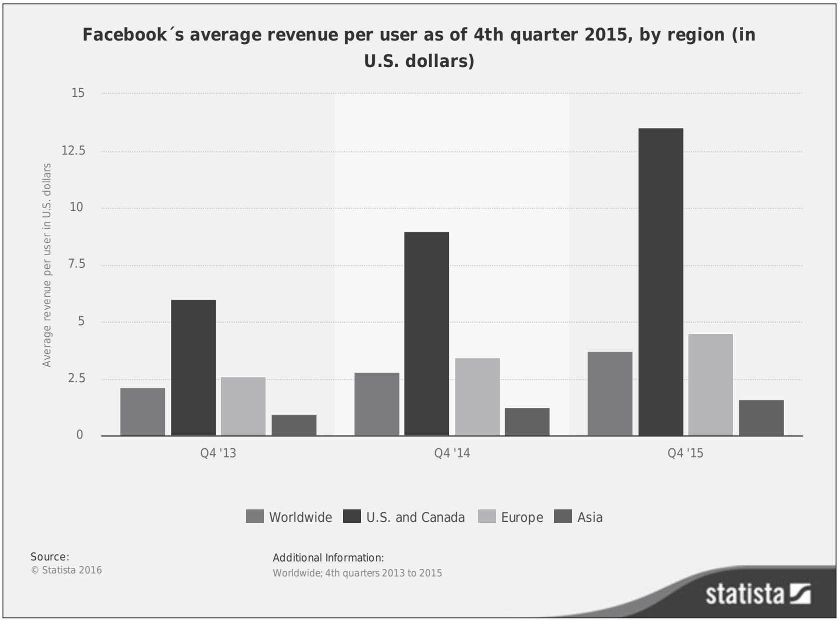


**Figure 6.** *Facebook's average revenue per user, in U.S. dollars* (http://www.statista.com/statistics/251328/facebooks-average-revenue-per-user-by-region/)

conversations, Facebook has drawn on users' likes and location to place "prompts related to ongoing events at the top of some users' news feeds."[12] Facebook, some argue, taps into our fear of missing out with habit-forming technology, like Instagram.[13]

Thus Facebook has every incentive to steer us onto its super-platform, and having us work—by posting content, commenting on other people's content, and supporting the advertisers. It is doubtful that Facebook would be as popular as a social network if another network compensated users for posting content and spending time on its platform. Nor would many of us be satisfied with a free flashlight app if we knew how much the app maker was profiting from our data. And yet, the allegedly powerful forces of the invisible hand and competition have yet to deliver such new entry despite likely demand.

## The Positive Feedback Loop Where the Big Get Bigger

So consumers aren't necessarily reigning supreme. The negative developments we identify from the collusion, behavioral discrimination, and

Frenemy scenarios have already surfaced and will likely continue. But from a policy perspective the harm is less concerning if it is episodic and fleeting. So will the market power in our three scenarios likely be fleeting or durable?

While we can hope for the former, the market characteristics suggest the latter. One threat to this anticompetitive equilibrium is if mavericks quickly enter the market, restore competition, and improve our well-being. As our three scenarios take hold in different markets, it may become harder for independent mavericks to curb the abuses and safeguard our privacy.

One reason, as we saw in Part II, is that greater market transparency cuts both ways. Granted, imperfect information and less transparency can foster market manipulation. Indeed, a seller may manipulate the market—engage in secret discounts and, like a stock trader, profit from the inefficiencies through arbitrage. And yet, as pricing is increasingly powered by algorithms, as the velocity in accessing and responding to market information increases, and as algorithms quickly adjust prices in response to discounts or increases, the increase in transparency can yield tacit collusion—where competitors perhaps offer more choices, albeit at higher prices and with little differentiation.

With their data-generated God View, firms will observe not only their competitors' current prices, but any nascent competitive initiatives. Tesco's or Kroger's computers, for example, can discern from the inflowing data that a particular loyalty card customer is driven by milk prices and is likely to shop for milk and other food products on the weekends. From the incoming geolocation data, the supermarket knows whether its customer is driving toward a rival supermarket. It can text the customer a significant milk discount to woo him to its store, and thereby blunt the competitor's incentives to poach its customers. Thus in tracking customers and selectively discounting, retailers can thwart their rivals' efforts to woo customers with lower prices. If rivals persist in discounting, the nuclear option becomes a significant threat; the pricing algorithms will soon learn that they can't profit by lowering prices. For homogeneous goods, one likely outcome will be the collusion scenario. For differentiated goods, the likely outcome will be behavioral discrimination. Or at times the firms will offer the product or service for "free," and the competition will be over extracting wealth through behavioral advertising.

Another reason why market power will likely be durable is network effects.[14] Operating systems, we saw, are a classic example of network effects: the more people that use the platform, "the more there will be invested in developing products compatible with that platform, which, in turn reinforces the popularity of that platform with users."[15] Thus network effects help insulate Google's and Apple's market power over mobile phone operating systems. As *The Economist* reported, "Alphabet [Google], Facebook and Amazon are not being valued by investors as if they are high risk, but as if their market shares are sustainable and their network effects and accumulation of data will eventually allow them to reap monopoly-style profits."[16]

Positive feedback loops and data-driven network effects can play a significant role here.[17] The new currency in our Frenemy and behavioral discrimination scenarios is data. As one consulting firm observed, "Big Data may well become a new type of corporate asset that will . . . function much as a powerful brand does, representing a key basis for competition."[18] The ability to gather data enables super-platforms' and sellers' algorithms to better classify and target individual users, and consequently allows them to foster an ongoing relationship entailing additional interactions. Successful data harvesting and analysis can have a snowball effect, enabling a provider to better target customers, thereby reinforcing its power by attracting additional users.[19] This enables a provider "to gather even more valuable data about consumer behaviour, and to further improve services, for (new) consumers as well as advertisers (on both sides of the market)."[20] Firms with more users, more personal data, and better algorithms can better price discriminate or wield greater power in the Frenemy scenario, so firms will seek a data advantage over rivals. In its 2015 report on Big Data, the White House noted that "even small improvements can have a large impact on profitability, particularly for companies with a large customer base."[21] One example it gives is Netflix, which, a 2014 study described, could boost profits by using behavioral data for personalized pricing.[22]

Shielded by data-driven network effects, firms can use their data advantage and greater opportunities to experiment to teach their algorithms to be smarter than their rivals'. In quickly accessing and analyzing our personal data, the super-platforms have powerful tools that the monopolies of yesteryear lacked, such as the ability to discern trends and threats well before others, including the government.[23]

Their superior market position enables them to dictate the interaction not only with us—the customers—but also with small and medium size companies. The latter, just like us, may lack the resources, data, and algorithms to effectively curb the power of the super-platforms when they expand into their markets. Even Goliaths like General Motors are wary that with self-driving cars, the lion's share of profits will go to those tech firms that develop the algorithms and collect the data.[24] The auto manufacturers' profits (and their unionized workers' salaries) are squeezed.

The winners in the data-collection arms race benefit in several ways: first, in improving their self-learning algorithms; second, in capturing greater value from the data (either directly or indirectly through advertising-related services or behavioral discrimination); third, in using the profits to expand their platform, thereby attracting more users, advertisers, and personal data; and finally, as their platforms evolve into super-platforms, in becoming the lords of the new market order—keepers of the data—who can promote or disrupt competition at their will.

Thus we enter a data-collection arms race, where firms have little incentive to protect our privacy interests.[25] A data advantage over rivals can enable the company to achieve critical economies of scale, which could tilt the data—and the competitive balance—in its favor. Indeed, leading companies do not limit themselves to mere improvements in harvesting and analyzing data; they also compete on infrastructure and in emerging markets. As Evgeny Morozov noted, "Google and Facebook have figured out that they cannot be in the business of organizing the world's knowledge if they do not also control the sensors that generate that knowledge and the gateways through which it passes."[26]

Mavericks, like Disconnect, may offer privacy technologies that seek to protect us from being tracked and our personal data from being collected. But they currently are swimming against the current. None of the super-platforms are promoting these privacy technologies. Indeed, some super-platforms perceive these privacy technologies as threats to their advertising-revenue business models. Thus the incentives and ability to innovate diminish, especially when a super-platform kicks these mavericks out of its app store. Any maverick will end up investing heavily to reach us—paying the tax levied by the new dynamic.

## Technology and Wealth Inequality

Even if the harms we identify are real and persistent, they might be overshadowed by the procompetitive gains we identify in Chapter 1. Granted, consumers might lose in some markets, but overall they may benefit under the new competitive dynamics, with more consumer surplus (and money) to spend or save. Overall their wealth may increase.

The fact that some online markets are competitive does not excuse anti-competitive tactics in other markets. But assessing the gains and losses puts the problems we identify into perspective. Overall, all else being equal, will wealth inequality increase, decrease, or remain unchanged as we enter the age of virtual competition?

The current record wealth inequality is a pressing issue. In January 2016, ahead of the Davos World Economic Forum, Oxfam released a report on global wealth inequality. According to the report, sixty-two billionaires own the same wealth as half the world's population—3.6 billion people.[27] As an Oxfam executive director said: "half of the world's population—that's three and a half billion people—own no more than a tiny elite whose numbers could all fit comfortably on a double-decker bus."[28]

One factor contributing to income and wealth inequality is market power.[29] Consider, for instance, the state of competition in the United States. In 2016, the White House issued an executive order[30] and report by its Council of Economic Advisers ("CEA Report").[31] The CEA Report highlighted several signs indicating a decline in competition in the United States since the 1970s. First, entry appears to be decreasing in many economic sectors, including a decades-long decline in new business formation. The United States is seeing lower levels of firm entry and labor market mobility. Second, many industries are becoming more concentrated. Third, increasing industry profits are falling into the hands of fewer firms. Basically, the CEA Report identifies how more industries are dominated by fewer firms (increasing concentration). These few powerful firms are extracting greater profits (and wealth) from workers, sellers, and consumers. And it is getting harder for new firms to enter markets and for workers to change employers. The solution is more competition. This includes, the CEA Report noted, robust antitrust enforcement.[32] The Council of Economic Advisors also noted that as more sectors of the economy are digitized, the government needs to consider how digitization is impacting competition, and whether additional regulation is needed.[33]

Thus, in assessing whether the emerging digitized hand is reducing market power and increasing consumer surplus, one metric is wealth inequality. It should decrease. But this isn't guaranteed. The increasing importance of Big Data, a UN panel of experts noted in a 2014 report, is creating the prospect that "a whole new inequality frontier will open up, splitting the world between those who know, and those who do not."[34] The concern is that the boom in Big Data and information asymmetry perpetuates wealth inequality.[35] As one writer has noted, "the data mining of individual privacy is fundamentally reshaping markets by transferring so much knowledge about user interests, behavior and desires into a few corporate hands."[36]

We can see how firms extract wealth in our three scenarios. In the collusion scenarios, the money is extracted directly from purchasers' pockets in the form of higher prices. Even where the collusion involves intermediary goods, the cost increase can translate to higher prices for the finished goods that we buy.

Technology, in our behavioral discrimination scenario, may increase wealth inequality. As we saw, one defense for price discrimination is that it increases market access to poorer customers (such as university grants and scholarships). But the victims of behavioral discrimination will not always be the wealthy who are willing to pay more. The victims will often be the poor whose circumstances limit viable outside options. Take, for example, Staples. It was discriminating against—rather than in favor of—the poor. The *Wall Street Journal,* in examining Staples' online price discrimination, found that customers living in wealthier communities generally paid lower prices.[37] The wealthy (who presumably had more outside options, such as more competing stores nearby or greater ability to drive to alternatives) received discounts.

In our Frenemy scenario, wealth extraction can occur on several levels. First, the super-platforms extract wealth from users by getting their valuable data, including their likes, dislikes, intentions, and so on, without having to pay its fair market value. Second, the super-platforms extract wealth by getting content from users for free. (In a competitive market one might expect rivals to offer valuable consideration to induce users to provide them content.) Third, the super-platforms help extract wealth by advancing behavioral advertising and discrimination. Fourth, the super-platforms extract wealth when they scrape valuable content from other websites and post it on their own.[38]

Thus, as super-platforms expand into personal assistants, the Internet of Things, and smart technologies, the concern is that their data advantage increases their competitive advantage and market power. As their capacity to extract our wealth increases, more money will flow to the few super-platforms. Interestingly, in early 2016, the growing profitability of one super-platform, Google, sparked "an after-hours [trading] rally that propelled it past Apple Inc. as the world's most-valuable company."[39] Thus the two mobile super-platforms in early 2016 were the world's two most valuable companies.

## Privacy and Trust

Wealth transfers, for some economists, are a nonissue. Widows and orphans, they observe, could be shareholders in the monopolies. When the monopoly profits don't return to the poor and middle class, the government, through taxes and other programs, can redistribute the wealth. The economists' concern is deadweight welfare loss, namely transactions that would have occurred in a competitive market but are forgone in the cartelized or monopolized industry.

Competition officials, at times, see the privacy issues we raise as unrelated to their competition concerns. In the Facebook/WhatsApp merger, the European Commission recognized that Facebook may weaken WhatsApp's privacy commitments and start collecting and using personal data from WhatsApp users. The Commission, however, focused primarily on advertisers, not individuals:

> For the purposes of this decision, the Commission has analysed potential data concentration only to the extent that it is likely to strengthen Facebook's position in the online advertising market or in any subsegments thereof. Any privacy-related concerns flowing from the increased concentration of data within the control of Facebook as a result of the Transaction do not fall within the scope of the EU competition law rules but within the scope of the EU data protection rules.[40]

These privacy-related effects, for some, are unrelated to their notion of consumer welfare.[41] Some argue, for example, that it is "impossible to find any way in which consumer welfare is currently being harmed by Google."[42] Others take the view that merely conducting a relatively narrow cost-benefit analysis of the issue "diminishes privacy's status as a right."[43]

These views are mistaken. Just because an app is free, and continues to be free after the merger, doesn't mean that consumers will necessarily benefit. Privacy protection can be a parameter of non-price competition, namely quality.[44]

Moreover, privacy at times fits within neoclassical economic theory's concern over deadweight welfare loss. The virtual economy, as Chapter 1 discusses, can promote allocative efficiency. But it can also increase the deadweight welfare loss by increasing distrust. Market economies rely on trust.[45] Fairness and trust, business and economic research shows, are highly interrelated. On a macro level, the empirical evidence does not identify greed as a prerequisite for a market economy.[46] Societies with greedier residents do not necessarily have stronger economies. Instead, norms of fairness can play a far greater role than greed in supporting a market economy. As Professor Lynn Stout discussed, societal norms of fairness and prosocial behavior are both common in and necessary for a market economy.[47] Violations of social norms of fairness decrease trust and increase retaliation.[48] How trusting can you be in a world where people will seek whenever possible to profit at your expense? The transaction costs in a world where greed runs amok would be astronomical. Many people in behavioral economic experiments are trusting. However, their willingness to trust and cooperate is conditional, depending on the actual or expected cooperation of others.[49]

For online markets to deliver their benefits, people must trust firms and their use of their data. But as technology evolves and more personal data is collected, we are increasingly aware that companies are using our personal information for their own benefit, not ours.[50] There is growing mistrust of how firms use Big Data and Big Analytics.[51] Take, for instance, the numerous challenges involving Google's alleged evasion of privacy protections,[52] and the revelation that owners of Nissan Leaf cars were being tracked (and that other users could access the relevant data).[53] Many people, the U.K. competition agency recently found, are unhappy with how well firms explain why they collect data.[54] As the agency concluded, "Consumer trust could be fragile and at risk if negative perceptions about new technologies or the way firms manage data take hold. We are concerned that future changes in the way that data is collected and used (such as more passive collection via the [Internet of Things]) could test how far consumers would be willing to continue to provide data."[55]

If industries advance closer toward perfect behavioral discrimination, consumers will increasingly distrust service providers, platforms, mobile devices, and wearables. Consumers may no longer use the technology—such as search engines, mobile technology, smart electric meters, smart watches, and other wearables—to the same degree, out of privacy concerns. They may forgo purchases that they otherwise would have made if they had greater trust in the seller and the fairness of the market norms. Thus, as the volume, variety, and complexity of personal data being collected expands, privacy issues will likely become more pressing.[56] As distrust increases, so too will the deadweight welfare loss.

## Money, Power, and Politics

Besides the deadweight welfare loss, the rise of market giants in control of data, analytics, and the ecosystems raises challenging questions about the concentration of power.[57] To what extent does economic concentration affect enforcement?

Economic power can translate into political power. Corporations and trade groups spend billions of dollars lobbying the U.S. government.[58] And with the rise of private economic power, the dividing line between corporate action and the political realm may easily fade.[59] The extent of crony capitalism may surprise some. Many of us knew that the major financial institutions had clout, but the economic crisis and subsequent U.S. taxpayer bailouts exposed the extent to which they manipulated the regulatory environment in their favor, and how the economically powerful have every incentive to use the government to protect their economic interests. Not surprisingly, two-thirds of Americans, including a majority of Republicans, believe that the economy "unfairly favors powerful interests."[60]

Now the clout of the tech giants and their influence on government policies are coming to light. The super-platforms and other interested parties are investing heavily in shaping the debate. Take, for example, Google's lobbying, which captured the media's attention in recent years. The week after it became public that the U.S. Federal Trade Commission was investigating Google for monopolistic abuses, the company hired twelve additional lobbying firms[61] and increased its lobbying expenses in 2012 by 88 percent, becoming among "the top 10 of spenders seeking to influence the federal government."[62] During this time, Google, the *Wall Street Journal* reported, "had a flurry of meetings with top officials at the White House and Federal Trade Commission."[63] Google reportedly established a close relationship with the Obama administration: "Google representatives attended White House meetings more than once a week, on average, from the beginning of Obama's presidency through October 2015. Nearly 250 people have shuttled from government service to Google employment or vice versa over the course of his administration."[64] We don't know what was discussed; these meetings might have been benign or involved an outsider's perspective on important policy issues. Still, they reflect one firm's unparalleled access to the highest levels of the Executive Branch, and the opportunities to align state policies with corporate interests.

With such influence in mind, eyebrows were raised when it emerged that the FTC's decision to close its Google investigation may have been inconsistent with the recommendations of its legal staff.[65] The story came to light in 2015 as the *Wall Street Journal* inadvertently received portions of the FTC legal staff report. The legal staff recognized the likely defenses and challenges in bringing a monopolization case, and opted to forgo challenging some of Google's practices. But the FTC legal staff, after a lengthy investigation, concluded that Google's conduct "has resulted—and will result—in real harm to consumers and to innovation in the online search and advertising markets."[66] Thus the legal staff recommended suing Google for abusing its monopoly power in several ways that harmed Internet users and rivals.[67]

After the FTC staff report became public, there was an outcry, especially among European policymakers, as Google was under investigation by the European Commission. Google's lobbyist e-mailed the FTC saying the company was "deeply troubled"[68]—its rivals were using the FTC staff report to "sow confusion and undermine the FTC's conclusions, especially in Europe."[69] It pressed the FTC to defend its decision in a press statement. "Two days after the email was sent, and after the *Wall Street Journal* published another article about Google's relationship with Washington," the reporter who broke the story noted, "the FTC released a statement that provided the context [the Google lobbyist] had sought."[70]

Moving beyond this story, it is important to understand why lobbying by leading companies and key economic players will likely intensify with virtual competition. The stakes are greater, as firms can extract even more wealth under our collusion, behavioral discrimination, and Frenemy scenarios. Their increasing economic power will likely translate to political power, influencing governmental policies to preserve the status quo.[71] Moreover, the legal standards applicable to many of our scenarios invite lobbying. Let us explain why:

For hard-core antitrust violations, such as the Messenger and perhaps Hub and Spoke collusion scenarios, the per se illegal antitrust standard limits defenses (and discretion). But for our other scenarios, greater discretion exists. It is basic economics that the more discretion the government has in bringing and determining violations, the more prone its policies are to distortion by lobbyists. The vaguer the legal standard, the more subjective input it allows from lobbyists. The less transparent the review and its objectives, the less predictable the enforcement becomes.

Consequently, the problem is not lobbyists. The problem is the combination of concentrated economic power, weakened limits on corporate political spending,[72] and an amorphous legal standard, such as the Supreme Court's "rule of reason" legal standard for most antitrust violations.[73] The amorphous legal standard is attractive to economists, lobbyists, and antitrust counsel who "know" and "can work" with the agency to dissuade it from intervening in our three scenarios.

## Intellectual Capture

Closely linked to economic power is the ability to foster intellectual and regulatory capture. As anthropology professor David Graeber observed, "if 1% of the population controls most of the disposable wealth, what we call 'the market' reflects what *they* think is useful or important, not anybody else."[74]

Lobbying, discussed above, provides a central tool to shape opinions of governments and the public—to affect the public debate and our perception of right and wrong.[75] Other means to capture the debate include the funding of articles, academic initiatives, and think tanks.[76] Here one may harness the credibility of individuals and institutions to propagate certain ideas and create a pool of supportive media and writing that can cross-reference itself.

Google, for example, from the beginning of the FTC investigation through the end of 2013, reportedly gave George Mason University's Law and Economics Center $762,000 in donations.[77] Why? The center "issued numerous studies supporting Google's position that they committed no legal violations, and hosted conferences on the same issues where Google representatives suggested speakers and invitees."[78] Between 2009 and 2015, at least "66 published studies by over 45 academics" were reportedly either "'commissioned by Google,' 'funded by Google,' or 'supported by a gift from Google, Inc.'"[79]

Google is not alone. We should expect the beneficiaries of our three scenarios to fund articles, academic initiatives, and think tanks to frame the "virtual competition" debate in ways that support their corporate agenda. When confronted with market realities—such as declining upward mobility, diminishing rates of small-company creation, increasing market concentration and power, and widening wealth inequality—they will likely pivot from the economic realities to the neoclassical economic theories of self-correcting markets. They will likely argue that any meaningful intervention in our three scenarios would cause greater harm than good. The dynamic market's self-policing powers, we'll be told, will prevent companies from inflicting significant harm and will safeguard our welfare.

Similarly, arguments in favor of any form of intervention are likely to be framed as opposing technology or innovation. For example, in his opening statement in the historic 1998 antitrust trial, Microsoft's lead attorney compared the Justice Department to nineteenth-century Luddites who smashed labor-saving machines "to arrest the march of progress driven by science and technology."[80] The government's case was "a repudiation of the basic principle in our society that creative commercial activity should be encouraged and rewarded."[81] Of course, as European and U.S. courts have recognized, monopolistic abuses don't foster innovation; rather, their abuses, left unchecked, can cause greater harm to technological innovation. But the doublethink is that hindering monopolistic abuses hinders innovation.

With the dominant firms' many levers to affect public opinion, we cannot help but wonder whether competition enforcers and regulators can resist the intellectual capture skillfully propagated by these giants—through media, lobbying, political power, and funding. Is the controlled ecosystem limited to our online environment, or is it already capturing the main junctions in our political environment—leaving us with only the illusion of autonomy and independence?

## The Road Ahead

We are often told how the technological revolution will increase our welfare through greater transparency, communication, choice, and value. Computer algorithms are constantly improving. The use of computers and their interface with humans are rapidly evolving. The Internet of Things will expand, with more sensors in the home, car, work, and on our body.

The technologies' potential benefits are often significant and self-evident, from increasing our health to finding an available parking space. We certainly agree, and welcome these transformative technologies. But these exciting developments and their welfare benefits should not mask the potential risks.

Our aim was to show that data-driven online markets will not necessarily correct themselves. Even when markets are competitive, this pressure may not necessarily improve our welfare. With the changing market reality, new dynamics may change our ability to safeguard our welfare. It may become even harder to effectively resist the flow of our diminishing wealth to fewer, more powerful firms. As power shifts to the hands of the few, the risks this will likely have for competition, our democratic ideals, and our economic and overall well-being will increase accordingly.

Thus, careful and measured intervention will likely be warranted. Mainstream competition, privacy, and consumer protection enforcement and regulation all have an important role in safeguarding our welfare. As we illustrated, however, some remedies that traditionally come to mind are imperfect. As market dynamics evolve, new and carefully measured instruments will be needed—to deter the abuses by super-platforms and harms from the Frenemy dynamics, to prevent computers from colluding, and to block the road to perfect behavioral discrimination. Education should also play a key role. The notion that "free may be expensive" should not be the preserve of the privileged few. Competition agencies and our elected governments have a responsibility to educate customers as to the promises and perils of virtual competition.

Importantly, enforcement agencies must devote resources to understanding the changing market dynamics and incentives, the role and use of data and algorithms, and the implications for our welfare. In addition, faced with the limited utility of current legal doctrines on agreement and intent in the age of pricing algorithms, agencies will face the challenge of updating the enforcement toolbox to match the emerging challenges.

This task has never been easy. It is even harder in dynamic markets. Ill-advised or misguided intervention, without a clear and credible theory of harm, can carry significant welfare costs. But so will ignoring the scenarios we raise.

Even more worrying is the intellectual capture that may inhibit a critical look at market dynamics. Ultimately, it comes down to political will. The most daunting challenge is getting government agencies to respond. Some agency officials, in our discussions about this book, were engaged and eager. Others were somnolent. One was comatose. The siren song of powerful players both inside and outside the government may undermine change and discredit attempts to evaluate new market dynamics.

So political pressure is needed. Antitrust under the Obama administration is perceived at best as mixed and at worst feeble. Despite having one of the older antitrust laws, the United States, as one former official noted, "is no longer viewed as the intellectual leader of antitrust."[82]

So to you, our dear readers who took the time to join this endeavor, we thank you. Few get excited about antitrust anymore. But apathy has a price. We cannot assume that the digitized hand will always protect our welfare. It is ultimately up to us to start asking our elected officials and agencies what they are doing to prevent these scenarios from happening.

Notes

Acknowledgments

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# Notes

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42. European Data Protection Supervisor, *Towards a New Digital Ethics: Data, Dignity and Technology,* Opinion 4/2015 (September 11, 2015), 9.
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45. Lohr, "IBM's AI System Watson to Get Second Home."
46. European Data Protection Supervisor, *Towards a New Digital Ethics.*
47. Take, for example, the Rubicon Project, "a leading technology company automating the buying and selling of advertising." As its website notes, "Relentless in its efforts for innovation, Rubicon Project has engineered one of the largest real-time cloud and Big Data computing systems, processing trillions of transactions within milliseconds each month"; Rubicon Project. (2016), http://rubiconproject.com/whoweare/. The company discussed the interplay among Big Data, machine learning, and data-driven network effects as a competitive strength: "As we process more volume on our automated platform, we accumulate more data, such as pricing, geographic and preference information, data on how best to optimize yield for sellers and more. This additional data helps make our machine-learning algorithms more intelligent and this leads to more effective matching between buyers and sellers. As a result, more buyers and sellers are attracted to our platform, from which we get more data, which further reinforces the network effect and thereby increases market liquidity, which benefits both buyers and sellers"; Rubicon Project, *Amendment No. 3 to Form S-1 Registration Statement* (April 30, 2014). See also Organisation for Economic Co-operation and Development, *Data-Driven Innovation for Growth and Well-Being,*

4 (discussing how algorithms can "learn from data of previous situations and . . . autonomously make decisions based on the analysis of these data").

48. Viktor Mayer-Schönberger and Kenneth Cukier, *Big Data: A Revolution that Will Transform How We Live, Work, and Think* (London: John Murray, 2013), 36–39 (discussing how more data trumps better algorithms in the area of better language processing); Alon Halevy Peter Norvig, and Fernando Pereira, "The Unreasonable Effectiveness of Data," *IEEE Intelligent Systems,* March/April 2009, 9, http://static.googleusercontent.com/media/research.google.com/en//pubs/archive/35179.pdf (observing that "invariably, simple models and a lot of data trump more elaborate models based on less data. . . . [O]bservations have been made in every other application of machine learning to Web data: simple n-gram models or linear classifiers based on millions of specific features perform better than elaborate models that try to discover general rules. In many cases there appears to be a threshold of sufficient data").
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59. Tuomas Sandholm, "Solving Imperfect-Information Games," *Science,* January 9, 2015, 122.
60. Bowling et al., "Heads-Up Limit Hold'em Poker Is Solved," 148.
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63. Ingrid Lunden, "Amazon Launches AWS IoT—A Platform for Building, Managing and Analyzing the Internet Of Things," *Tech Crunch,* October 8, 2015, http://techcrunch.com/2015/10/08/amazon-announces-aws-iot-a-platform-for-building-managing-and-analyzing-the-internet-of-things/#.gfgxjj:0nTE.
64. Ibid. Amazon Web Services is a collection of cloud computing services offered by Amazon. "Amazon Web Services offers a broad set of global compute, storage, database, analytics, application, and deployment services that help organizations move faster, lower IT costs, and scale applications"; Amazon Web Services, *Cloud Products* (2015), https://aws.amazon.com/products/?nc2=h_ql_ny_livestream_blu.
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67. With our increasing interaction with digital devices exacerbating the opportunities for data about how we lead our daily lives to be collected, even at the dinner table, we may feel the need to reach for a pepper grinder that can block Wi-Fi and mobile signals; Susmita Baral, "New Pepper Grinder Blocks All Electronics during Meals while Grinding Spice for Your Food," *iDigitalTimes,* April 1, 2015, http://www.idigitaltimes.com/new-pepper-grinder-blocks-all-electronics-during-meals-while-grinding-spice-your-food-428558.
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https://www.whitehouse.gov/sites/default/files/whitehouse_files/docs/Big_Data_Report_Nonembargo_v2.pdf.

71. According to Visa, e-commerce spending on Thanksgiving 2015 by its U.S. account holders increased to $1.5 billion, up 22 percent from 2014. Suzanne Kapner, "Black Friday Shopping—with Thinner Crowds," *Wall Street Journal,* November 28, 2015, http://www.wsj.com/articles/black-friday-shoppingwith-thinner-crowds-1448639398.
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73. Ibid. As the newspaper also noted, 36 percent of consumers planned to shop online during the 2015 holiday season, up from 19 percent who said so in 2014; only 18 percent planned to shop in physical stores, down from 35 percent a year ago. Ibid.
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76. European Data Protection Supervisor, *Towards a New Digital Ethics,* 35. ("The situation is likely to be compounded by the growth of the Internet of Things, which will include many technical or embedded devices collecting personal data, with the result that their users will be unable to consult the privacy policy on the device itself, but would have to find paper documentation or more likely browse from another device to the relevant web sites"); President's Council of Advisors on Science and Technology, *Report to the President, Big Data and Privacy,* 15: "To some, it seems farfetched that the typical home will foreseeably acquire cameras and microphones in every room, but that appears to be a likely trend. What can your cell phone (already equipped with front and back cameras) hear or see when it is on the nightstand next to your bed? Tablets, laptops, and many desktop computers have cameras and microphones."
77. President's Council of Advisors on Science and Technology, *Report to the President, Big Data and Privacy.*
78. McAfee and Brynjolfsson, "Big Data."

79. McKinsey Global Institute, *Big Data: The Next Frontier for Innovation, Competition, and Productivity* (McKinsey & Company, June 2011), 98, http://www.mckinsey.com/insights/business_technology/big_data_the_next_frontier_for_innovation; "More and more sensors are being embedded in physical devices—from assembly-line equipment to automobiles to mobile phones—that measure processes, the use of end products, and human behavior. Individual consumers, too, are creating and sharing a tremendous amount of data through blogging, status updates, and posting photos and videos. Much of these data can now be collected in real or near real time."
80. Executive Office of the President, *Big Data and Differential Pricing,* 5.
81. Samuel B. Hwang and Sungho Kim, "Dynamic Pricing Algorithm for E-Commerce," in *Advances in Systems, Computing Sciences and Software Engineering,* Proceedings of SCSS05, Tarek Sobh and Khaled Elleithy, eds. (Dordrecht: Springer, 2006), 149–155; N. Abe and T. Kamba. "A Web Marketing System with Automatic Pricing," *Computer Networks* 33 (2000): 775–78; L. M. Minga, Y. Q. Fend, and Y. J. Li, "Dynamic Pricing: E-Commerce—Oriented Price Setting Algorithm," *Proceedings of the 2nd International Conference on Machine Learning and Cybernetics,* Xi'an, China, 2003, vol. 2.
82. See Mehra, "Antitrust and the Robo-Seller."

## 3 • Light Touch Antitrust

1. Alan Greenspan, "The Effects of Mergers (Testimony before the Committee on the Judiciary, U.S. Senate)," *Federal Reserve Bulletin,* 84 (June 16, 1998): 643, 646, at 5.
2. Note, however, differences between the EU and US with respect to abuse of dominance. The European Commission has taken a rather critical look at some activities by dominant technology companies. Noteworthy are the EU Commission focus on activities by Google, Microsoft, Apple, and Intel. Note, for example, the Statement of Objections issued by the Commission with respect to Google's comparison shopping services (April 2015) and Android operating system and applications (April 2016); by contrast, the U.S. Department of Justice (DOJ) and Federal Trade Commission have largely abstained from prosecuting monopolies in online markets (or any other market) over the past sixteen years. More generally, on EU enforcement, see A. Ezrachi, *EU Competition Law: An Analytical Guide to the Leading Cases* (Oxford: Hart Publishing, 2016). For statistics on US enforcement, see Maurice E. Stucke and Allen P. Grunes, *Big Data and Competition Policy* (Oxford: Oxford University Press, 2016).

3. *United States v. Syufy Enterprises,* 903 F.2d 659, 662–63 (9th Cir. 1990).
4. Order of the President of the People's Republic of China No. 68, Anti-Monopoly Law of the People's Republic of China, Chapter 1, Article 1, http://www.china.org.cn/china/2011-02/11/content_21900178.htm.
5. U.S. Department of Justice Antitrust Division, *Antitrust Division Manual,* 4th ed., chap. 5 (Washington, DC: U.S. Department of Justice, March 2008).
6. Adam Smith, *The Wealth of Nations* (1776).
7. Unilateral Conduct Working Group, *Report on the Objectives of Unilateral Conduct Laws, Assessment of Dominance/Substantial Market Power, and State-Created Monopolies* (Moscow: International Competition Network, May 2007), http://www.internationalcompetitionnetwork.org/uploads/library/doc353.pdf.
8. See, for example, Robert H. Bork, *The Antitrust Paradox: A Policy at War with Itself* (New York: Basic Books, 1978); Richard A. Posner, "The Chicago School of Antitrust Analysis," *University of Pennsylvania Law Review* 127 (1978): 925, 933.
9. Posner, "The Chicago School of Antitrust Analysis."
10. Justin Fox, *The Myth of the Rational Market* (New York: Harper Business/HarperCollins, 2009), 89–107.
11. As President Reagan told the nation, "government is not the solution to our problem; government is the problem"; Ronald Reagan, First Inaugural Address (January 20, 1981), http://www.reaganlibrary.com/reagan/speeches/first.asp.
12. Case No. T-79/12, *Cisco Systems Inc. v. Commission* [December 11, 2013] 612 TJ 0079, para. 69.
13. Ibid.
14. *United States v. Microsoft Corp.,* 253 F.3d 34, 49 (D.C. Cir. 2001) (noting "significant debate amongst academics and practitioners over the extent to which 'old economy' § 2 monopolization doctrines should apply to firms competing in dynamic technological markets characterized by network effects"); *United States v. Bazaarvoice, Inc.,* No. 13-CV-00133-WHO, 2014 WL 203966, 76 (N.D. Cal. Jan. 8, 2014) (noting "the debate over the proper role of antitrust law in rapidly changing high-tech markets" with some maintaining "that antitrust law is ill-suited to these dynamic markets, arguing, for example, that it undermines high-tech innovation); see, for example, Robert J. Barro, "Why the Antitrust Cops Should Lay Off High–Tech," *BusinessWeek,* August 16, 1998, http://www.bloomberg.com/bw/stories/1998-08-16/why-the-antitrust-cops-should-lay-off-high-tech ("the best policy for the government in the computer industry is to stay out of it" or that market power is transitory in high-tech industries where competitive ideas can overcome entrenchment).

15. Thomas O. Barnett, "Maximizing Welfare through Technological Innovation," *George Mason Law Review* 15 (2008): 1191, 1200.
16. See, for example, *United States v. Microsoft Corp.,* 147 F.3d 935, 948 (D.C. Cir. 1998) ("Antitrust scholars have long recognized the undesirability of having courts oversee product design, and any dampening of technological innovation would be at cross-purposes with antitrust law"); compare John M. Newman, "Anticompetitive Product Design in the New Economy," *Florida State University Law Review* 39 (2012): 681, proposing a structured, efficient, and rational method for analyzing design-related conduct in tech markets.
17. Maureen K. Ohlhausen, *A Smarter Section 5* (Washington DC: U.S. Federal Trade Commission, September 25, 2015), 12, https://www.ftc.gov/system/files/documents/public_statements/804511/150925smartersection5.pdf.
18. J. Thomas Rosch, *I Say Monopoly, You Say Dominance: The Continuing Divide on the Treatment of Dominant Firms, Is It the Economics?* (Florence: International Bar Association, Antitrust Section Conference, September 8, 2007), 5, https://www.ftc.gov/sites/default/files/documents/public_statements/i-say-monopoly-you-say-dominance-continuing-divide-treatment-dominant-firms-it-economics/070908isaymonopolyiba_0.pdf.

## 4 • Looking beyond the Façade of Competition

1. Viktor Mayer-Schönberger and Kenneth Cukier, *Big Data: A Revolution That Will Transform How We Live, Work, and Think* (London: John Murray, 2013), 35.
2. C. M. Bishop, *Pattern Recognition and Machine Learning* (New York: Springer-Verlag, 2006).
3. "Pricing Algorithms: Is the Price You Pay Right?" *Bloomberg* (May 12, 2015), http://www.bloomberg.com/news/videos/b/02d3f0f0-e653-4ca1-8bdd-0f95a5a81212.
4. For instance, see Sarah Griffiths, "Facebook Ads to Become More Intrusive: Site Will Soon Show Promotions for Products You've Looked at across the Web," *Daily Mail,* June 13, 2014, http://www.dailymail.co.uk/sciencetech/article-2657043/Facebook-ads-intrusive-Site-soon-promotions-products-youve-searched-web.html.
5. Executive Office of the President, *Big Data: Seizing Opportunities, Preserving Values,* (May 2014), 5, https://www.whitehouse.gov/sites/default/files/docs/big_data_privacy_report_may_1_2014.pdf; see also Facebook, *Announcing New Product Ads on Facebook* (February 17, 2015), https://www.facebook.com/business/news/product-ads.
6. European Data Protection Supervisor, *Towards a New Digital Ethics: Data, Dignity and Technology,* Opinion 4/2015 (September 11, 2015), 6.

7. For example, "Crystal creates a unique profile for anyone with a LinkedIn account, explaining how to speak, email, work with or sell to them most effectively. With disconcerting specificity, it tells you the 'words, phrases, style and tone you should use to reach the recipient in the way that they like to communicate, rather than your own'—even their tolerance for sarcasm and emoticons." Elle Hunt, "Crystal Knows Best . . . or Too Much? The Disconcerting New Email Advice Service," *The Guardian,* May 19, 2015, http://www.theguardian.com/media/2015/may/19/crystal-knows-best-or-too-much-the-disconcerting-new-email-advice-service (referring to Crystal Project Inc., https://www.crystalknows.com/).
8. Allen Grunes, "Tracking Not Allowed (Unless You're Google)," *Politico* (October 1, 2015), http://www.politico.com/agenda/story/2015/10/tracking-not-allowed-unless-youre-google-000261.
9. See, e.g., French Autorité de la concurrence and the German Bundeskartellamt, Competition Law and Data, May 10, 2016, http://www.bundeskartellamt.de/SharedDocs/Publikation/DE/Berichte/Big%20Data%20Papier.pdf?__blob=publicationFile&v=2; U.K. House of Lords, Select Committee on European Union "Online Platforms and the Digital Single Market," April 20, 2016, 10th Report of Session 2015–16, http://www.publications.parliament.uk/pa/ld201516/ldselect/ldeucom/129/129.pdf; Keynote Remarks of FTC Commissioner Terrell McSweeny, "Competition Law: Keeping Pace in a Digital Age," 16th Annual Loyola Antitrust Colloquium, Chicago, IL, April 15, 2016.

    As noted by the House of Lords in its Report on "Online Platforms and the Digital Single Market," "[R]apid developments in data collection and data analytics have created the potential for new welfare reducing and anti-competitive behaviours by online platforms, including subtle degradations of quality, acquiring datasets to exclude potential competitors, and new forms of collusion. While some of these abuses are hypothetical, they raise questions as to the adequacy of current approaches to competition enforcement" (paragraph 178).
10. Following restructuring, a new holding company named Alphabet has been formed to include the wide range of Google operations. In our discussion we make reference to Google when discussing all of Alphabet's operations. On the activities of the new company, see Google, "G Is for Google," *Google Official Blog* (August 10, 2015), https://googleblog.blogspot.co.uk/2015/08/google-alphabet.html.

## **Part II** • The Collusion Scenarios

1. Studies of detected cartels find that they are often bimodal: some cartels last less than a year, but many others last between four and six years. M. C.

Levenstein and V. Y. Suslow, "What Determines Cartel Success?," *Journal of Economic Literature* 44 (2006): 43, 51–52 (noting that duration is bimodal, with cartels lasting only one year, and twice as many lasting between four and six years). Many conspiracies, including those with eleven or more conspirators, can last for years, if not decades. J. M. Connor, "Cartels and Antitrust Portrayed: Internal Structure—Private International Cartels 1990–2008," American Antitrust Institute Working Paper No. 09-06 (2009), 4, 8, ssrn.com/abstract=1372849 (finding cartels' median and mean duration was fifty-seven and eighty-two months, respectively, and that global cartels lasted 57 percent longer than the average cartel). The average duration of international cartels successfully prosecuted between 1983 and 1994 was approximately ninety months; the average duration declined below eighty months for the period 1995 to 1999, and trended upward to nearly ninety months for the period 2005 to 2008. Ibid., 11. Not surprisingly, one DOJ official took aim at the *Wall Street Journal,* which surmised that, "If colluders push prices too high, defectors and new entrants will set things right." The DOJ official responded, "Our experience has shown that this is not the case. Several of the cartels we prosecuted had been in existence for over ten years, including one (sorbates) that lasted 17 years, from 1979 to 1996." W. J. Kolasky (Deputy Assistant Attorney General, Antitrust Division, U.S. DOJ), *Antitrust Compliance Programs: The Government Perspective,* Speech at Corporate Compliance 2002 Conference of the Practising Law Institute (San Francisco: U.S. Department of Justice, July 12, 2002).

2. *United States v. National Turtle Farmers & Shippers Assoc., Inc.,* Trade Reg. Rep. Summaries (CCH) ¶ 45,095, at 44,744 (D. La. 1995).
3. *United States v. Home City Ice Co.,* No. 07-CR-140 (S.D. Ohio Nov. 5, 2007), http://www.justice.gov/atr/cases/f234200/234205.htm.
4. *United States v. William Barrett Numismatics Ltd.,* Trade Reg. Rep. Summaries (CCH) ¶ 45,095, at 44,741 (S.D.N.Y. 1995).
5. Scott D. Hammond (Deputy Assistant Attorney General for criminal enforcement, Antitrust Division, U.S. DOJ), *Recent Developments, Trends, and Milestones in the Antitrust Division's Criminal Enforcement Program* (Washington, DC: U.S. Department of Justice, March 26, 2008), http://www.justice.gov/atr/speech/recent-developments-trends-and-milestones-antitrust-divisions-criminal-enforcement. Believing that existing criminal penalties were suboptimal in deterring antitrust offences, the United States over the past four decades has increased the Sherman Act's criminal penalties—conspirators may be jailed to a maximum of ten years, and both the individuals and the corporations may be subjected to hefty fines.
6. Price fixers, observed one DOJ official, "tend to be recidivists." Kolasky, *Antitrust Compliance Programs;* J. M. Connor and C. G. Helmers, "Statistics on Modern International Cartels 1990–2005," AAI Working Paper No. 07-01

(January 10, 2007), 23 (170 companies in 283 international cartels studied were price-fixing recidivists, of which eleven companies were caught ten or more times fixing prices). Major cartels (some detected under the leniency program) continued to operate after the DOJ's publicized price-fixing case against Archer Daniels Midland Company (ADM). As *BusinessWeek* observed upon the release of the movie *The Informant!,* "for all the splashy headlines, stiff sanctions, and caught-on-tape teaching moments generated by the ADM case, price-fixing appears to be as pervasive as ever." M. Orey, "Price Fixing, the Perpetual Sequel," *BusinessWeek,* September 28, 2009, http://www.businessweek.com/bwdaily/dnflash/content/sep2009/db20090928_842438.htm.

## 5 · The Messenger Scenario

Epigraph: Bill Baer (Assistant Attorney General, Antitrust Division, U.S. DOJ), *Former E-Commerce Executive Charged with Price Fixing in the Antitrust Division's First Online Marketplace Prosecution* (Washington, DC: U.S. Department of Justice, April 6, 2005), 15–421, http://www.justice.gov/atr/public/press_releases/2015/313011.docx.

1. Scott D. Hammond (Director of Criminal Enforcement, Antitrust Division, U.S. DOJ), *The Fly on the Wall Has Been Bugged—Catching an International Cartel in the Act* (Washington, DC: U.S. Department of Justice, May 15, 2001), http://www.justice.gov/atr/public/speeches/8280.htm (ADM case).
2. Baer, *Former E-Commerce Executive Charged with Price Fixing.*
3. *United States v. Topkins,* CR 15–00201 WHO (N.D. Cal. Apr. 30, 2015), Plea Agreement, para. 4, http://www.justice.gov/atr/cases/topkins.html.
4. U.S. Department of Justice, *E-Commerce Exec and Online Retailer Charged with Price Fixing Wall Posters* (December 4, 2015), http://www.justice.gov/opa/pr/e-commerce-exec-and-online-retailer-charged-price-fixing-wall-posters.
5. The banks agreed to pay criminal fines totaling over $2.5 billion. Moreover, two banks—UBS and Barclays—had to pay an additional $203 million and $60 million, respectively, for breaching their 2012 non-prosecution agreements resolving the DOJ's investigation involving the LIBOR benchmark interest rate. Ibid. See also Elai Katz, "U.S. Brings Computerized Price-Fixing Charges," *New York Law Journal* 254, no. 120 (December 23, 2015).
6. U.S. Department of Justice, *Five Major Banks Agree to Parent-Level Guilty Pleas: Citicorp, JPMorgan Chase & Co., Barclays PLC, the Royal Bank of Scotland PLC Agree to Plead Guilty in Connection with the Foreign Exchange Market and Agree to Pay More than $2.5 Billion in Criminal Fines* (May 20,

2015), http://www.justice.gov/opa/pr/five-major-banks-agree-parent-level-guilty-pleas.

7. The DOJ prescribed fines for Citicorp ($925 million), Barclays ($650 million), JPMorgan ($550 million), and RBS ($395 million). Ibid.
8. Ibid.
9. Since 2009, financial institutions have paid over $204 billion in 175 settlements where fines exceeded $100 million. Jeff Cox, "Misbehaving Banks Have Now Paid $204B in Fines," CNBC (October 30, 2015), http://www.cnbc.com/2015/10/30/misbehaving-banks-have-now-paid-204b-in-fines.html (Bank of America $77.09 billion, JPMorgan Chase $40.12 billion, Citigroup $18.39 billion, Wells Fargo $10.24 billion, BNP Paribas $8.90 billion, UBS $6.54 billion, Deutsche Bank $5.53 billion, Morgan Stanley $4.78 billion, Barclays $4.23 billion, and Credit Suisse $3.74 billion).
10. RPM is where the manufacturer/distributor agrees with the retailer on the price charged to consumers. That practice is regarded as anticompetitive by object in the European Union. In the United State, RPM was also per se illegal for over ninety-five years until the Supreme Court overruled its earlier decision and held that vertical price restraints are to be judged by the more lenient rule of reason standard. *Leegin Creative Leather Products, Inc. v. PSKS, Inc.,* 551 U.S. 877, 882 (2007).
11. Under the agreements that governed that network, Carrefour provided recommended resale prices to its franchisees, which, through an annex expressly stipulated, were normally adhered to as resale prices. The Greek Hellenic Competition Commission ruled that these provisions constituted "a general obligatory rule for the franchisees to follow Carrefour's recommended retail prices, to which only exceptions could exist." Lia Vitzilaiou, "The Hellenic Competition Commission Fines a Retailer for Resale Price Maintenance and Other Infringements within Its Franchise Network (Carrefour Marinopoulos)," *e-Competitions* (February 2011), http://www.lambadarioslaw.gr/publications/2011/en/article_33885.pdf.
12. Hellenic Competition Commission. *Decision Concerning Infringements of Articles 1 of Law 703/77 and Article 101 TFEU by the Retailer Carrefour Marinopoulos S.A. in Connection with the Franchise Network for the Operation of "5 Marinopoulos" Retail Stores* (Athens: Hellenic Competition Commission, July 15, 2010), http://www.epant.gr/img/x2/news/news270_1_1279200461.pdf.
13. Vitzilaiou, "The Hellenic Competition Commission Fines a Retailer."
14. Hellenic Competition Commission, *Decision Concerning Infringements.*
15. *United States v. Airline Tariff Publ'g Co.,* 836 F. Supp. 9, 12 (D.D.C. 1993).
16. This information exchange greatly facilitated tacit collusion, and as noted by the DOJ, it was of little benefit to consumers. Some defendants disputed this

claim, submitting numerous affidavits from travel agents praising the airlines' policy of advanced notice, and arguing that such signaling was employed in geographic markets where only one airline had market power. The travel agents did not, however, have access to some of this information (such as the footnote designators), and thus could not readily determine all of the airlines' contemplated changes to fares. Nor could the agents (unlike the airlines) readily determine the relationships between proposed fare increases for certain routes and the elimination of discounted fares on other routes. Moreover, the pricing information, asserted the DOJ, was unreliable and misleading, in particular because the airlines changed the ticket dates often. The DOJ's consent decrees attempted to shift the lever toward promoting information of use to the consumers. The decrees did not prohibit the posting of airfare pricing; rather, the defendants were prohibited from posting fare information of little significance to the consumer, namely Last Ticket Dates, with the exception of those used in advertised promotions, and First Ticket Dates. Thus, the airlines' posted fares would have some significance for the consumer, as the travel agents could immediately purchase the ticket that day for that fare. Likewise, by restricting the airlines from using Last Ticket Dates except under advertised commitments, the decrees ended the "costless communication" among the defendants about which discounts should be removed. The decrees did not eliminate the possibility of tacit coordination. Rather, they made such negotiations costlier for the airlines by imposing some risk on the price leader. Moreover, when one airline violated this decree by signaling a price increase through a prohibited mechanism, it resulted in a $3 million civil penalty.

17. Take, for example, the European concept of "concerted practice," which refers to forms of coordination between companies, which, without reaching the level of an agreement, have nevertheless established practical cooperation between them. See Case 40/73, *Suiker Unie and Others v. Commission,* [1975] ECR 1663, para. 26, and Case C-89/85 I, [1993] ECR I-1307, para. 63; commission decision in Case IV/37.614/F3 PO, *Interbrew and Alken-Maes,* [2003] OJ L200/1, para. 221.
18. Article 101(1) TFEU provides that agreements, decisions, or concerted practices which have as their object or effect the direct or indirect fixing of selling price would be prohibited. The European courts and commission have generally treated price-fixing, market-sharing, and bid-rigging arrangements as having the object of restricting competition.
19. Agreements among competitors that "tamper" with price structure are per se illegal. *United States v. Socony-Vacuum Oil Co.,* 310 U.S. 150, 221 (1940). "Even though members of the price-fixing group were in no position to

control the market, to the extent that they raised, lowered, or stabilized prices they would be directly interfering with the free play of market forces."

20. *Power Conversion, Inc. v. Saft Am., Inc.,* 672 F. Supp. 224, 227 (D. Md. 1987). "Price-fixing is per se illegal regardless of whether the objective is to raise or lower market prices, whether the agreement is successful or not, and whether the prices were reasonable or not." Thus, the Sherman Act reaches combinations formed for the purpose, and with the effect, of raising, depressing, fixing, pegging, or stabilizing prices. Antitrust plaintiffs need not prove that defendants fixed prices directly or controlled a substantial part of the commodity, that no competition remained, or that prices as a result were uniform, inflexible, or unreasonable. *Socony-Vacuum,* 310 U.S. at 222, 224.
21. Maurice Stucke, "Morality and Antitrust," *Columbia Business Law Review* (2006): 443.
22. Songfacts, "Milgram's 37 (We Do What We're Told)," by Peter Gabriel, http://www.songfacts.com/detail.php?id=772.
23. S. Milgram, "Behavioral Study of Obedience," *Journal of Abnormal & Social Psychology* 67, no. 4 (1963): 371.
24. DP DenkProducties, "Milgram Experiment—Jeroen Busscher," YouTube (June 2012), https://www.youtube.com/watch?v=yr5cjyokVUs.
25. S. Milgram, *Obedience to Authority: An Experimental View* (New York: Harper & Row, 1974), 30–31.
26. Milgram, "Behavioral Study of Obedience."
27. F. Gino et al., "See No Evil: When We Overlook Other People's Unethical Behavior," HBS Working Paper No 08-045 (January 11, 2008), 11.
28. M. C. Levenstein and V. Y. Suslow, "Breaking Up Is Hard to Do: Determinants of Cartel Duration," Ross School of Business Paper No. 1150 (September 2009), 11, http://ssrn.com/abstract=1676968; Gino et al., "See No Evil" (discussing identifiable victim effect where people have greater concern for identifiable, than statistical, victims).

## 6 • Hub and Spoke

1. *United States v. Newton,* 326 F.3d 253, 255 (1st Cir. 2003).
2. Ibid.
3. *Interstate Circuit v. United States,* 306 U.S. 208, 227 (1939).
4. *United States v. Lapier,* No. 13-30279, 2015 WL 4664689, at para. 8 (9th Cir. August 7, 2015) (internal quotations omitted).
5. *United States v. Apple, Inc.,* No. 13-3741-CV, 2015 WL 3953243, para. 28 (2d Cir. June 30, 2015).

6. Ibid., para. 17; *Howard Hess Dental Labs. Inc. v. Dentsply Int'l, Inc.,* 602 F.3d 237, 255 (3d Cir. 2010); see also *Toys "R" Us, Inc. v. FTC,* 221 F.3d 928, 932–934 (7th Cir. 2000).
7. *Interstate Circuit v. United States,* 306 U.S. 208 (1939).
8. On the principal liability of such a facilitator, see, for instance, the European Commission's decision in *AC-Treuhand AG.* There, a consulting group was found to violate the competition law by helping organize cartel meetings. The company collected and supplied to the cartel members data on sales on the relevant markets; offered to act as a moderator in case of tensions between the cartel members; and encouraged the cartel members to find compromises, for which it received remuneration. The consulting firm claimed it wasn't liable, as the law applied to the competitors who conspired, and not to those who merely helped to organize the cartel meetings or provide services in the context of the anticompetitive agreements. The General Court and the European Court of Justice upheld the Commission's decision (T-27/10 *AC-Treuhand v. Commission,* C-194/14 P *AC Treuhand v. Commission*).
9. European Commission, *Antitrust: Commission Fines Broker ICAP €14.9 Million for Participation in Several Cartels in Yen Interest Rate Derivatives Sector,* IP/15/4104 (Brussels: European Commission, February 4, 2015), http://europa.eu/rapid/press-release_IP-15-4104_en.htm.
10. *United States v. Apple, Inc.,* 952 F. Supp. 2d 638 (S.D.N.Y. 2013), aff'd, 791 F.3d 290 (2d Cir. 2015). Apple and its coconspirators changed the wholesale business model used at the time by Amazon, leading to higher prices for e-books. *United States v. Apple, Inc.,* 791 F.3d 290, 310 (2d Cir. 2015), cert. denied, 136 S. Ct. 1376 (2016) ("Based on data from February 2010—just before the Publisher Defendants switched Amazon to agency pricing—to February 2011, an expert retained by the Justice Department observed that the weighted average price of the Publisher Defendants' new releases increased by 24.2%, while bestsellers increased by 40.4%, and other ebooks increased by 27.5%, for a total weighted average ebook price increase of 23.9%").
11. The case concerned Apple's use of price parity conditions when launching the iPad and its iBooks Store in 2010. Price parity clauses provide assurance to the downstream online platform that it has received goods or services from the supplier at terms that are at least as favorable as those offered to any other buyers. They are sometimes combined with an agency distribution model, in which the seller determines the price offered on the platform. Under such a combination, the platform and the seller agree that the price charged on the platform will not be lower than the price the seller sets and charges when selling through other platforms. See generally Okeoghene

Odudu, "Indirect Information Exchange: The Constituent Elements of Hub and Spoke Collusion," *European Competition Journal* 7, no. 2 (2011): 205–242.

12. Indeed, the court condemned the agreements, "not because those [most favored nation and agency] Contracts themselves were independently unlawful, but because, in context, they provide strong evidence that Apple consciously orchestrated a conspiracy among the Publisher Defendants." *Apple,* 791 F.3d at 316. See also a similar statement by the U.S. District Court, S.D. New York: "If Apple is suggesting that an adverse ruling necessarily implies that agency agreements, pricing tiers with caps, MFN clauses, or simultaneous negotiations with suppliers are improper, it is wrong. As explained above, the Plaintiffs have not argued and this Court has not found that any of these or other such components of Apple's entry into the market were wrongful, either alone or in combination. What was wrongful was the use of those components to facilitate a conspiracy with the Publisher Defendants"; *United States v. Apple Inc.,* 952 F. Supp. 2d 638, 708 (S.D.N.Y. 2013).
13. Boomerang Commerce, *Our Story,* http://www.boomerangcommerce.com/about/.
14. Jason Del Rey, "Amazon Vet Raises $8.5 Million to Help Retailers Think More Like Amazon," *Re/Code* (July 16, 2014), http://recode.net/2014/07/16/amazon-vet-raises-8-5-million-to-help-retailers-think-more-like-amazon/.
15. Ibid.
16. Boomerang Commerce, *What's Worse than An 800-Pound Gorilla Undercutting Your Prices?*, http://www.boomerangcommerce.com/resources/whats-worse-than-an-800-pound-gorilla-undercutting-your-prices/.
17. Rohit Joshi, "How Does Uber's Dispatch Algorithm Work?" *Quora* (December 13, 2014), http://www.quora.com/How-does-Ubers-dispatch-algorithm-work; James Surowiecki, "In Praise of Efficient Price Gouging," *MIT Technology Review,* August 19, 2014, http://www.technologyreview.com/review/529961/in-praise-of-efficient-price-gouging/; Eric Posner, "Why Uber Will—and Should—Be Regulated," *Slate* (January 5, 2015), http://www.slate.com/articles/news_and_politics/view_from_chicago/2015/01/uber_surge_pricing_federal_regulation_over_taxis_and_car_ride_services.html.
18. Douglas Macmillan and Telis Demos, "Uber Valued at More than $50 Billion," *Wall Street Journal* (London), July 31, 2015, http://www.wsj.com/articles/uber-valued-at-more-than-50-billion-1438367457.
19. See, for example, Mark Harris, "Uber: Why the World's Biggest Ride-Sharing Company Has No Drivers," *The Guardian,* November 16, 2015, http://www.theguardian.com/technology/2015/nov/16/uber-worlds-biggest

-ride-sharing-company-no-drivers; Izabella Kaminska, "If and When Uber Drivers Unionise . . . ," *Financial Times,* January 12, 2016, http://ftalphaville.ft.com/2016/01/12/2149878/if-and-when-uber-drivers-unionise/ (on the possibility of Uber drivers receiving low wages and few employment rights); Tim Bradshaw and Leslie Hook, 2015. "Uber Drivers Win Union 'Break-through,'" *Financial Times* (San Francisco), December 15, 2015, http://www.ft.com/cms/s/0/37930e72-a2c6-11e5-bc70-7ff6d4fd203a.html#axzz3yTDzV6n7 (discussing a new law introduced by Seattle City Council allowing Uber drivers to unionize to demand better conditions from the company); Leslie Hook, "Setback for Uber on Drivers' Class Action Case," *Financial Times* (San Francisco), December 10, 2015, http://www.ft.com/cms/s/0/ddc7b032-9ec9-11e5-b45d-4812f209f861.html#axzz3yTDzV6n7 (on a California case on whether Uber drivers should be treated as full employees rather than contractors).

20. Ian Beetlestone, "Why London's Black Cab Drivers Are Protesting over Uber," *The Guardian,* June 11, 2014, http://www.theguardian.com/commentisfree/2014/jun/11/why-london-taxi-drivers-protesting-uber-tfl (an article by a London black cab driver on how Uber is able to become a taxi service "without going through any of the regulatory hoops").
21. Macmillan and Demos, "Uber Valued at More than $50 Billion."
22. Uber, *Always the Ride You Want: The Best Way to Get Wherever You're Going,* https://www.uber.com/ride.
23. Sarah Ashley O'Brien, "NYC Uber Drivers Protest Rate Cuts," *CNN Money* (February 1, 2016), http://money.cnn.com/2016/02/01/technology/uber-nyc-protest/index.html?sr=twCNN020116uber-nyc-protest0317PMVODtopPhoto&linkId=20849630; Lyft, *Nashville Drivers Make Up to $6000/Month Driving Your Car,* https://www.lyft.com/drive-for-lyft?im=&inc=6000&t=month&kw=Nashville%20Drivers&utm_source=bing&utm_medium=search&utm_campaign=Driver_BNA_v2_Search_Brand_All_Lyft&utm_term=lyft%20com%20driver&adgroup=lyft_driver&device=c&matchtype=b.
24. Uber, "Dynamic Pricing 101 | Uber," YouTube (December 2014), https://www.youtube.com/watch?v=76q7PDnxWuE.
25. Annie Lowrey, "Is Uber's Surge-Pricing an Example of High-Tech Gouging?," *New York Times Magazine,* January 10, 2014, http://www.nytimes.com/2014/01/12/magazine/is-ubers-surge-pricing-an-example-of-high-tech-gouging.html?_r=0.
26. Jay Hathaway, "Uber Turned on Surge Pricing for People Fleeing Sydney Hostage Scene," December 15, 2014, http://gawker.com/uber-turned-on-surge-pricing-for-people-fleeing-sydney-1671193132; Brian Ries & Jenni Ryall, "Uber Intros Surge Pricing during Sydney Hostage Siege, Then

Backtracks after User Outcry," December 15, 2014, http://mashable.com/2014/12/14/uber-sydney-surge-pricing/#lnLL3YYzXSqM.

27. Min Kyung Lee, Daniel Kusbit, Evan Metsky, and Laura Dabbish, "Working with Machines: The Impact of Algorithmic and Data-Driven Management on Human Workers" (Pittsburgh: Human-Computer Interaction Institute, Heinz College, Carnegie Mellon University, 2015), http://www.cs.cmu.edu/~mklee/materials/Publication/2015-CHI_algorithmic_management.pdf.
28. For instance, in Tesco v. Office of Fair Trading, the U.K. Competition Appeal Tribunal elaborated that an indirect information exchange through a third party will amount to an objectionable hub-and-spoke conspiracy when two phases are present: 1. Retailer A discloses to supplier B its future pricing, with the intention that B will pass that information to other retailers in order to influence market conditions. 2. Retailer C receives the information from supplier B, knowing the circumstances in which its competitor retailer A disclosed it to B, and C makes use of that information in determining its own future pricing intentions; Case 1188/1/1/11, *Tesco v. Office of Fair Trading,* [2012] CAT 31, para. 57, 58.
29. Case C-74/14, *Eturas and Others* (2016).
30. The Advocate General, who advises the Court, noted in his opinion that "where the sender of the information is not a competitor but rather a third party, such interaction may give rise to a horizontal collusion between competitors only if the addressee may be deemed to appreciate that the information transmitted by a third party comes from a competitor or at least is also communicated to a competitor." Ibid., AG Opinion, para. 50.
31. Case C-74/14, *Eturas and Others,* para. 45 (holding that "if it cannot be established that a travel agency was aware of that message, its participation in a concertation cannot be inferred from the mere existence of a technical restriction implemented in the system at issue . . . , unless it is established on the basis of other objective and consistent indicia that it tacitly assented to an anticompetitive action").
32. Maurice E. Stucke, "Is Intent Relevant?" *Journal of Law, Economics & Policy* 8 (2012): 801; U.S. Department of Justice Antitrust Division, *Antitrust Division Manual,* 5th ed. (Washington, DC: U.S. Department of Justice, March 2014), chap. 3–12 (noting how the Department of Justice would not prosecute an offense criminally if "there is clear evidence that the subjects of the investigation were not aware of, or did not appreciate, the consequences of their action"). In evaluating collaboration among competitors, competition agencies consider evidence of intent, which "may aid in evaluating market power, the likelihood of anticompetitive harm, and claimed procompetitive

justifications where an agreement's effects are otherwise ambiguous"; Federal Trade Commission and U.S. Department of Justice, *Antitrust Guidelines for Collaborations among Competitors* (April 2000), p. 12, note 35, https://www.ftc.gov/sites/default/files/documents/public_events/joint-venture-hearings-antitrust-guidelines-collaboration-among-competitors/ftcdojguidelines-2.pdf. Likewise, the European Commission assesses "whether or not an agreement has as its object the restriction of competition," based on "a number of factors," including evidence of the parties' subjective intent; European Commission. 2004. *Communication from the Commission, Notice Guidelines on the Application of Article 81(3) of the Treaty,* 2004/C 101/08) (April 27, 2004), para. 22, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2004:101:0097:0118:EN:PDF. See also Federal Trade Commission and U.S. Department of Justice, *Horizontal Merger Guidelines* (August 10, 2010), para. 2.2.1, https://www.ftc.gov/sites/default/files/attachments/merger-review/100819hmg.pdf: "Explicit or implicit evidence that the merging parties intend to raise prices, reduce output or capacity, reduce product quality or variety, withdraw products or delay their introduction, or curtail research and development efforts after the merger, or explicit or implicit evidence that the ability to engage in such conduct motivated the merger, can be highly informative in evaluating the likely effects of a merger."

33. *United States v. U.S. Gypsum Co.,* 438 U.S. 422, 444–446 (1978) (concluding that "action undertaken with knowledge of its probable consequences and having the requisite anticompetitive effects can be a sufficient predicate for a finding of criminal liability under the antitrust laws").
34. See for example, Case 1188/1/1/11, *Tesco v. Office of Fair Trading.*
35. Returning to our Uber example, it is important to distinguish our discussion of an algorithm being used as a hub from an argument that Uber and the drivers compete horizontally with each other. Such a claim served as the backbone to a lawsuit launched in Canada in September 2015. Uber was accused of price fixing by Edmonton taxi companies. The CAN$150 million lawsuit put forward an argument that Uber is a competitor to its drivers since it is the one setting the prices for fares. Subsequently, it argued that Uber conspired with its drivers to fix prices of vehicle-for-hire services. See "Uber Accused of Price-Fixing in $150M Lawsuit by Edmonton Taxi Companies," *CBC News* (September 14, 2015), http://www.cbc.ca/news/canada/edmonton/uber-accused-of-price-fixing-in-150m-lawsuit-by-edmonton-taxi-companies-1.3228115.
36. *Meyer v. Kalanick*, Case 1:15-cv-09796-JSR, slip op. (S.D.N.Y. March 31, 2016).
37. Ibid., 15.

38. Maurice E. Stucke, "Does the Rule of Reason Violate the Rule of Law?" *U.C. Davis Law Review* 42 (2009): 1375; Maurice E. Stucke, "Antitrust Marathon: Antitrust and the Rule of Law," *Loyola Consumer Law Review,* 22 (2009): 15; Peter C. Carstensen, "The Content of the Hollow Core of Antitrust: The Chicago Board of Trade Case and the Meaning of the 'Rule of Reason' in Restraint of Trade Analysis," *Research in Law and Economics* 15 (1992): 1, 4.
39. Adam Candeub, "Behavioral Economics, Internet Search, and Antitrust," MSU Legal Studies Research Paper No. 12-03 (2014), http://ssrn.com/abstract=2414179.
40. Judy Wajcman, *Pressed for Time: The Acceleration of Life in Digital Capitalism* (Chicago: University of Chicago Press, 2015); see also Hartmut Rosa, *Social Acceleration—A New Theory of Modernity* (New York: Columbia University Press, 2013).

## 7 • Tacit Collusion on Steroids: The Predictable Agent

1. *Brooke Group Ltd. v. Brown & Williamson Tobacco Corp.,* 509 U.S. 209 (1993); R. S. Khemani and D. M. Shapiro, *Glossary of Industrial Organisation Economics and Competition Law* (Paris: Organisation for Economic Co-operation and Development, 1993), http://www.oecd.org/dataoecd/8/61/2376087.pdf.
2. Marc Ivaldi, Bruno Jullien, Patrick Rey, Paul Seabright, and Jean Tirole, "The Economics of Tacit Collusion," Final Report for DG Competition (Toulouse: European Commission, March 2003), 4, http://ec.europa.eu/competition/mergers/studies_reports/the_economics_of_tacit_collusion_en.pdf.
3. For a review of the economics of tacit collusion and the EU approach, see Nicolas Petit, "The 'Oligopoly Problem' in EU Competition Law" in *Research Handbook in European Competition Law*, Ioannis Liannos and Damien Geradin, eds. (Edward Elgar Publishing, 2013), 259.
4. *White v. R.M. Packer Co.,* 635 F.3d 571, 579 (1st Cir. 2011).
5. Ibid. Twenty-one cents of that difference is attributable to the higher costs of transporting gas to the island than to the mainland cape.
6. *White v. R.M. Packer Co.*
7. Ibid. Would-be competitors attracted to the market by high profit margins "face a regulatory barrier to entry: they need permission from the Martha's Vineyard Commission. The Commission has denied all petitions to open new gas stations since 1997. This, along with their location on a relatively small island, insulates the current stations from competition."

8. Ibid. “Gasoline in general is a nondurable good, so that customers have to buy it frequently and are not likely to simply stay out of the market until prices drop. This is particularly true for customers who are summer residents and are in the market for only limited periods of time.”
9. Ibid.
10. Ibid.
11. Ibid., 579.
12. Ibid.
13. Ibid.
14. Consider, for instance, the German Competition Authority (Bundeskartellamt) Fuel Sector Inquiry, in which the agency identified a dominant oligopoly in regional fuel retail markets. The agency concluded that the “retail prices of the majority of off-motorway petrol stations were higher in the oligopolistic setting than they would have been if effective competition had been in place.” Bundeskartellamt, *Fuel Sector Inquiry Final Report in Accordance with § 32e GWB* (Bonn: Bundeskartellamt, May 2011), section 5, http://www.bundeskartellamt.de/SharedDocs/Publikation/EN/Sector%20Inquiries/Fuel%20Sector%20Inquiry%20-%20Final%20Report.pdf?__blob=publicationFile&v=14.
15. Federal Trade Commission and U.S. Department of Justice, *Horizontal Merger Guidelines* (August 10, 2010), para. 7.2, https://www.ftc.gov/sites/default/files/attachments/merger-review/100819hmg.pdf.
16. Ibid.
17. Case T-342/99, *Airtours,* [2002] ECR 2585, [2002] 5 CMLR 317, para. 61.
18. European Commission, *Guidelines on the Assessment of Horizontal Mergers under the Council Regulation on the Control of Concentrations between Undertakings,* 2004/C 31/03 (February 5, 2004), para. 49–50.
19. Case T-342/99, *Airtours.*
20. Ivaldi et al., “The Economics of Tacit Collusion,” 5.
21. Federal Trade Commission and U.S. Department of Justice, *Horizontal Merger Guidelines,* para. 7.
22. Roland Moore-Colyer, “Predictive Analytics Are the Future of Big Data,” *V3* (October 9, 2015), http://www.v3.co.uk/v3-uk/analysis/2429494/predictive-analytics-are-the-future-of-big-data.
23. Ibid., citing Larry Augustine, chief executive at SugarCRM.
24. Samuel B. Hwang and Sungho Kim, “Dynamic Pricing Algorithm for E-Commerce,” in *Advances in Systems, Computing Sciences and Software Engineering,* Proceedings of SCSS05, Tarek Sobh and Khaled Elleithy, eds. (Dordrecht: Springer, 2006), 149–155; N. Abe and T. Kamba, “A Web Marketing System with Automatic Pricing,” *Computer Networks* 33 (2000): 775–788; L. M. Minga, Y. Q. Fend, and Y. J. Li, “Dynamic Pricing:

E-Commerce-Oriented Price Setting Algorithm," *International Conference on Machine Learning and Cybernetics* 2 (2003).

25. Alternatively, the computers can engage in parallel accommodating conduct, whereby "each rival's response to competitive moves made by others is individually rational, and not motivated by retaliation or deterrence nor intended to sustain an agreed-upon market outcome, but nevertheless emboldens price increases and weakens competitive incentives to reduce prices or offer customers better terms." Federal Trade Commission and U.S. Department of Justice, *Horizontal Merger Guidelines,* para. 7.
26. Fuel apps have become a common feature and can be downloaded for free.
27. See Salil K. Mehra, "Antitrust and the Robo-Seller: Competition in the Time of Algorithms," *Minnesota Law Review* 100 (March 10, 2015), http://ssrn.com/abstract=2576341, on how pricing algorithms can promote tacit collusion under a Cournot model.
28. The outcome, in any game with set rules and a finite number of sequential moves, could be determined by the initial move; Avinash Dixit and Barry Nalebuee, *Thinking Strategically: The Competitive Edge in Business, Politics, and Everyday Life* (New York: W. W. Norton, 1991), 41–44. Indeed, E. Zermelo formulated in the early twentieth century an algorithm that leads to an equilibrium outcome in chess, but nonetheless, grandmasters still compete today. Martin J. Osborne and Ariel Rubinstein, *A Course in Game Theory* (Cambridge, MA: Massachusetts Institute of Technology Press, 1994), 6.
29. Christopher Chabris, "High-Tech Chess Cheaters Charge Ahead," *Wall Street Journal,* October 9, 2015, http://www.wsj.com/articles/high-tech-chess-cheaters-charge-ahead-1444404660.
30. Michael Lewis, *Flash Boys: A Wall Street Revolt* (New York: W. W. Norton, 2014).
31. The plaintiff can allege that the defendant firms collectively agreed to use these algorithms; specifically, it was their collective agreement to use a facilitating device that fosters tacit collusion. See *Todd v. Exxon Corp.,* 275 F.3d 191 (2d Cir. 2001). The benefit of this approach is that it may be easier to prove that the industry agreed to use algorithms (especially in order to ensure their interoperability) and knew that its rival firms' algorithms had similar reward structures than it is to prove an agreement to fix prices. The downsides of this approach are the cost, duration, and unpredictability of a rule of reason case, and the difficulty for the court in weighing the procompetitive benefits of product developments with the anticompetitive effects.
32. See, for example, Case C-199/92, *P Hüls AG v. Commission,* [1999] ECR I-4287, [1999] 5 CMLR 1016; Joined Cases C-89, 104, 114, 116, 117, 125, 129/85, *Ahlström Osakeyhtiö and others v. Commission* (Wood Pulp II), [1993] ECR I-1307, [1993] 4 CMLR 407; Cases T-442/08, *CISAC v Commission,*

[2013] 5 CMLR 15 (General Court). Note that our focus is on non-dominant firms.

33. See Federal Trade Commission and U.S. Department of Justice, *Horizontal Merger Guidelines,* para. 7.
34. *In re Text Messaging Antitrust Litig.,* 782 F.3d 867, 874 (7th Cir.) cert. denied sub nom.; *Aircraft Check Servs. Co. v. Verizon Wireless,* 136 S. Ct. 524 (2015).
35. *Boise Cascade Corp. v. F.T.C.,* 637 F.2d 573 (9th Cir. 1980).
36. *E. I. du Pont de Nemours & Co. v. F.T.C.,* 729 F.2d 128 (2d Cir. 1984).
37. Ibid., 128, 139.
38. U.S. Securities and Exchange Commission, *Administrative Proceeding File No. 3-16199* (October 16, 2014), http://www.sec.gov/litigation/admin/2014/34-73369.pdf.
39. The computer trading program was "placing a large number of aggressive, rapid-fire trades in the final two seconds of almost every trading day during a six-month period to manipulate the closing prices of thousands of NASDAQ-listed stocks." U.S. Securities and Exchange Commission, *SEC Charges New York–Based High Frequency Trading Firm with Fraudulent Trading to Manipulate Closing Prices,* October 16, 2014, http://www.sec.gov/News/PressRelease/Detail/PressRelease/1370543184457#.VEOZlfldV8E. Ibid.
40. Ibid.
41. Ibid. As the SEC alleged Athena's manipulative scheme focused on trading in order to create imbalances in securities at the close of the trading day: "Imbalances occur when there are more orders to buy shares than to sell shares (or vice versa) at the close for any given stock. Every day at the close of trading, NASDAQ runs a closing auction to fill all on-close orders at the best price, one that is not too distant from the price of the stock just before the close. Athena placed orders to fill imbalances in securities at the close of trading, and then traded or 'accumulated' shares on the continuous market on the opposite side of its order." According to the SEC's order, Athena's algorithmic strategies became increasingly focused on ensuring that the firm was the dominant firm—and sometimes the only one—trading desirable stock imbalances at the end of each trading day. The firm implemented additional algorithms known as "Collars" to ensure that Athena's orders received priority over other orders when trading imbalances. These eventually resulted in Athena's imbalance-on-close orders being at least partially filled more than 98 percent of the time. Athena's ability to predict that its orders would get filled on almost every imbalance order allowed the firm to unleash its manipulative *Gravy* algorithm to trade tens of thousands of shares right before the close of trading. As a result, these shares traded at artificial prices that NASDAQ then used to set the closing prices for on-close

orders as part of its closing auction. Athena's high-frequency trading scheme enabled its orders to be executed at more favorable prices.

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46. Note that the algorithms may be designed to deter entry, provide complex signals as to profitability, and engage in limit pricing or other strategies.
47. One would expect tacit collusion to be feasible with a larger number of participants than commonly assumed. On the common market assumptions, see generally R. Selten, "A Simple Model of Imperfect Competition, Where Four Are Few and Six Are Many," *International Journal of Game Theory* 2 (1973): 141; Steffen Hucka, Hans-Theo Normannb, and Jörg Oechssler, "Two Are Few and Four Are Many: Number Effects in Experimental Oligopolies," *Journal of Economic Behavior and Organization* 53, no. 4 (2004): 435–446.
48. *Sugar Institute, Inc. v. United States,* 297 U.S. 553, 598 (1936).
49. *United States v. United States Gypsum Co.,* 438 U.S. 422, 441 n.16 (1978); See also Richard A. Posner, *Antitrust Law,* 2nd ed. (Chicago: University of Chicago Press, 2001), 160. Generally, the more information sellers have about their competitors' prices and output, the more efficiently the market will operate.
50. See, for example, Federal Trade Commission, *Funeral Directors Board Settles with FTC* (August 16, 2004), http://www.ftc.gov/opa/2004/08/vafuneral.htm (a board's prohibition on licensed funeral directors advertising discounts deprived consumers of truthful information); Federal Trade Commission, *Arizona Automobile Dealers Association,* FTC C-3497 (February 25, 1994) (a trade association illegally agreed with members to restrict nondeceptive comparative and discount advertising and advertisements concerning the terms and availability of consumer credit); Organisation for Economic Co-operation and Development, *Price Transparency,* DAFFE/CLP(2001)22 (September 11, 2001), 183, 185–186 (citing examples of U.S. enforcement agencies seeking to increase price transparency); compare *InterVest, Inc. v. Bloomberg, L.P.,* 340 F.3d 144 (3d Cir. 2003) (lack of price transparency in bond market not illegal if consistent with unilateral conduct).

## 8 • Artificial Intelligence, God View, and the Digital Eye

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9. Ibid., 111.
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## Part III • Behavioral Discrimination

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## 9 • Price Discrimination (Briefly) Explained

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*Forces That Shape Our Decisions* (New York: HarperCollins Publishers, 2008), 25–28. The students, then participants, monetized it (e.g., $14), and then answered "Yes or No" for each bidded item if they would pay that amount for the item. The students then stated the maximum amount they were willing to pay for each auctioned product. Students with the highest ending SSN (80–99) bid 216 to 346 percent higher than students with low-end SSNs (1–20), who bid the lowest. See also Daniel Kahneman, *Thinking, Fast and Slow* (New York: Farrar, Straus and Giroux, 2011), 119–128, which discusses anchoring effects generally.

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## 11 • The Rise of "Almost Perfect" Behavioral Discrimination

1. One business article, for example, outlined how all buying decisions "stem from the interplay of the following six emotions":
    1. Greed. "If I make a decision now, I will be rewarded."
    2. Fear. "If I don't make a decision now, I'm toast."
    3. Altruism. "If I make a decision now, I will help others."
    4. Envy. "If I don't make a decision now, my competition will win."
    5. Pride. "If I make a decision now, I will look smart."
    6. Shame. "If I don't make a decision now, I will look stupid."

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11. Ibid. Apple states that its iAd "does not know or make available to advertisers information regarding your sexual orientation, religious beliefs or political affiliations." No Apple Pay transactions or Health app data is accessible to iAd, or is used for advertising purposes. iAd does not sell or otherwise transmit any personally identifiable information to third parties.
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40. Chris M. Wilson and Catherine Waddams Price, "Do Consumers Switch to the Best Supplier?" *Oxford Economic Papers* 62 (2011): 98–131; see also Adi Ayal, "Harmful Freedom of Choice," 121. For discussion of the anticompetitive implications of product differentiation in U.S. health care markets, see William M. Sage and Peter J. Hammer, "Competing on Quality of Care: The Need to Develop a Competition Policy for Health Care Markets," *University of Michigan Journal of Law Reform* 32 (1999): 1073, 1082.
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42. Ibid. More generally, the CMA found barriers to engagement resulted from: "lack of access to the internet (or a lack of confidence in using the internet)." Ibid., para. 124. Also "customers on low income and with low levels of education" were less likely to use price comparison websites. Ibid., para. 125.
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44. Stefania Sitzia, Jiwei Zheng, and Daniel John Zizzo, "Complexity and Smart Nudges with Inattentive Consumers," CCP Working Paper 12–13, available online: http://competitionpolicy.ac.uk/documents/8158338/8251737/CCP+Working+Paper+12-13.pdf/f9d4eff9-daf7-4244-acd7-240b8972bfd7.
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47. Executive Office of the President, *Big Data and Differential Pricing,* 6.
48. *Interstate Circuit v. United States,* 306 U.S. 208 (1939).
49. Ismat Sarah Mangla, "3 Tricks to Help You Snag the Best Deals Online," *Time,* September 8, 2014, http://time.com/money/3136612/dynamic-pricing-amazon-best-buy-walmart/.
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54. Colin F. Camerer, "Prospect Theory in the Wild: Evidence from the Field," in *Advances in Behavioral Economics,* Colin F. Camerer, George Loewenstein, and Matthew Rabin, eds. (Princeton, NJ: Princeton University Press, December 28, 2003): 148, 152 (many consumers "dislike price increases more than they like the windfall gain from price cuts and will cut back purchases more when prices rise compared with the extra amount they buy when prices fall"); Daniel Kahneman, "Maps of Bounded Rationality: Psychology for Behavioral Economics," *American Economic Review* 93 (December 2003): 1449, 1458.
55. James Surowiecki, "In Praise of Efficient Gouging," *MIT Technology Review* (August 19, 2004), http://www.technologyreview.com/review/529961/in-praise-of-efficient-price-gouging/.
56. Frank Pasquale, *The Black Box Society: The Secret Algorithms that Control Money and Information* (Cambridge, MA: Harvard University Press, 2015).
57. Alex Chisholm (CMA chief executive), *Why "Sleepers" Can't Always Be Left to "Sleep,"* CCRP 2016 Competition Policy Roundtable (London: Competition Markets Authority, January 25, 2016), https://www.gov.uk/government/speeches/alex-chisholm-on-consumer-engagement-in-a-digital-world; quoting *In re Text Messaging Antitrust Litig.,* 782 F.3d 867, 874 (7th Cir.) cert. denied sub nom and *Aircraft Check Servs. Co. v. Verizon Wireless,* 136 S. Ct. 524 (2015).
58. Paragraph 79, House of Lords, Select Committee on European Union, "Online Platforms and the Digital Single Market," April 20, 2016, 10th Report of Session 2015–16, http://www.publications.parliament.uk/pa/ld201516/ldselect/ldeucom/129/129.pdf.
59. In the next part we consider how price comparison websites may assist limiting the possibility for discrimination.
60. Executive Office of the President, *Big Data and Differential Pricing.*
61. In the EU, the Privacy and Electronic Communications Regulations "deal with the collection of location and traffic data by public electronic communications services providers ('CSPs') and use of cookies (and similar technologies)." For example, "Traffic Data held by a CSP must be erased or anonymised when it is

no longer necessary for the purpose of the transmission of a communication," unless (1) "it is being used to provide a value added service," and (2) "consent has been given for the retention of the Traffic Data." Moreover, "the use and storage of cookies and similar technologies requires" (1) "clear and comprehensive information," and (2) "consent of the website user." DLA Piper, *Data Protection Laws of the World,* http://dlapiperdataprotection.com/#handbook/online-privacy-section/c2_GB.

62. "At first blush, detecting personalization on e-commerce sites seems conceptually simple: have two users run the same search, and any differences in the results indicate personalization. Unfortunately, this approach is likely to have many false positives, as differences between users' results may exist for a number of reasons not related to personalization. For example, results may differ due to changes in product inventory, regional tax differences, or inconsistencies across data centers. As a result, accurately detecting personalization on e-commerce sites remains an open challenge. Second, even when customers are aware, it is often the case that markets exhibit weak consumer engagement. Only a minority will likely invest time in countermeasures to curtail tracking. To benefit from discounts through loyalty programs, they must reveal their identity. Moreover, the loyalty discounts are more salient than the savings in remaining anonymous. An asymmetry in power is observed between us and those who hold and sell our personal data." Hannak et al., "Measuring Price Discrimination and Steering on E-Commerce Web Sites."
63. Chisholm, *Why "Sleepers" Can't Always Be Left to "Sleep."*
64. "David Currie speaks about the CMA experience of behavioural economics," April 20, 2015. Available on the CMA website: https://www.gov.uk/government/speeches/david-currie-speaks-about-the-cma-experience-of-behavioural-economics.

## 12 • Behavioral Discrimination: Economic and Social Perspectives

1. Michael Eisen, "Amazon's $23,698,655.93 Book about Flies," *It Is NOT Junk* (April 22, 2011), http://www.michaeleisen.org/blog/?p=358.
2. P. T. Leeson and R. Sobel, "Costly Price Discrimination," *Economics Letters* 99, no. 1 (2008): 206–208, http://www.peterleeson.com/Costly_Price_Discrimination.pdf; "We show this occurs [perfect price discrimination is often socially inefficient] because firms face costs of enacting price discrimination. These costs, which include segmenting consumers, identifying elasticities, and preventing resale, are significant in all industries. This, of course, is the reason not all firms enact this pricing strategy. The omission of

these transactions costs from existing theories of price discrimination is important because, as Varian has pointed out: 'A full welfare analysis of attempts to engage in [perfect] price discrimination cannot neglect the transactions costs involved in the negotiation itself.' "

3. P. Papandropoulos, "How Should Price Discrimination Be Dealt with by Competition Authorities?" *Revue des droits de la concurrence* 3 (2007): 34–38, http://ec.europa.eu/dgs/competition/economist/concurrences_03_2007.pdf.
4. Note, for instance, a study of air travel fares: "The results are consistent with the hypothesis that, as more carriers operate on a given route, the carriers' competition for consumers with higher price elasticity of demand increases, while fares charged to consumers with inelastic demand stay high"; J. Stavins, "Price Discrimination in the Airline Markets: The Effect of Market Concentration," *Review of Economics and Statistics* 83 (2001): 200. In line with this rationale, the competition agencies in a merger review may seek to maintain price discrimination when it protects buyers who cannot pay a higher, uniform price. Alternatively, the U.S. competition authorities give an example where a powerful buyer benefits from price discrimination: the buyer can "negotiate lower pre-merger prices than other customers by threatening to shift its large volume of purchases from one merging firm to the other. No other suppliers are as well placed to meet Customer C's needs for volume and reliability. The merger is likely to harm Customer C. In this situation, the Agencies could identify a price discrimination market consisting of Customer C and similarly placed customers. The merger threatens to end previous price discrimination in their favor"; Federal Trade Commission and U.S. Department of Justice, *Horizontal Merger Guidelines* (August 19, 2010), para. 8.
5. See, for example, pharmaceutical markets: "In low-income countries the vast majority are unwilling to pay for effective drugs simply because they are unable to pay. Low-income nations need more price discrimination—and vastly lower prices—if they are ever to afford the world's most effective medicines"; Judith L. Wagner and Elizabeth McCarthy, "International Differences in Drug Prices," *Annual Review of Public Health* 25 (2004): 475.
6. See, for example, the pharmaceutical markets. A study by Jerry Hausman and Jeffrey K. MacKie-Mason indicated price discrimination increased dynamic welfare because of the positive effects on research and development; Jerry A. Hausman and Jeffrey McKie-Mason, "Price Discrimination and Patent Policy," *RAND Journal of Economics* 19 (1988): 253. Firms will also have greater incentives to innovate when they can recover the significant upfront costs by price discriminating: "if dynamic incentives are taken into

account as well, price discrimination may ensure that long-run incentives to invest (e.g. in R&D) are preserved by providing firms with sufficient returns"; Papandropoulos, "How Should Price Discrimination Be Dealt with by Competition Authorities?" When the ability to innovate is present, the incentive to innovate is driven by the desire to appropriate financial gains associated with innovation. This economic framework is "often associated with the eminent economist Professor Joseph Schumpeter," who suggested, "firms with market power will have the greatest incentive to innovate because of their large relative size and dominant position in a market" D. L. Weisman and R. B. Kulick, "Price Discrimination, Two-Sided Markets, and Net Neutrality Regulation," *Tulane Journal of Technology and Intellectual Property* 13 (2010): 81, https://www.researchgate.net/profile/Dennis_Weisman/publication/228307995_Price_Discrimination_Two-Sided_Markets_and_Net_Neutrality_Regulation/links/0deec5187eadf2a5c8000000.pdf.

7. Josh Wright, "Price Discrimination Is Good, Part I," *Truth on the Market* (November 30, 2008), http://truthonthemarket.com/2008/11/30/price-discrimination-is-good-part-i/. This approach, generally associated with Nobel laureate economist Kenneth Arrow, suggests "the increased business generated by an innovation will come mostly from sales that formerly would have gone to competitors, while monopolists may largely cannibalize their own business"; Weisman and Kulick, "Price Discrimination, Two-Sided Markets, and Net Neutrality Regulation."
8. "The reason why price discrimination may intensify competition is that with uniform pricing, firms would only compete for 'marginal consumers' whereas through price discrimination, firms can compete for all customers, including those with strong loyalty to a competitor's brand"; Papandropoulos, "How Should Price Discrimination Be Dealt with by Competition Authorities?"
9. For example, the European car-rental industry. In 2014 the European Commission wrote to six international car-rental companies, including Avis, Europcar, and Hertz, after cases in which the price of car rentals varied considerably based on the country of residence of the customer; "Car Hire Prices 'Unfairly Vary' across the EU," BBC News (August 12, 2014), http://www.bbc.co.uk/news/business-28756674. The U.S. Department of Justice had this concern in a 2003 merger between Quest Diagnostics, Inc., and Unilab Corp., the two leading providers of clinical laboratory testing services to physician groups in Northern California: "[P]urchasers of these services cannot economically resell them to other customers, and that suppliers of the services can potentially identify the competitive alternatives available to physician group customers according to the group's base of physicians and geographic coverage. This information indicated that a

hypothetical monopolist could discriminate on price among customer types. Suppliers' ability to price discriminate, combined with the fact that some types of customers had few competitive alternatives to contracting with suppliers that had a network of locations, led staff to define markets based on customer categories"; Federal Trade Commission and U.S. Department of Justice, *Commentary on the Horizontal Merger Guidelines* (March 2006), 8, http://www.justice.gov/atr/commentary-horizontal-merger-guidelines.

10. Commission Decision 85/609 *ECS/AKZO,* OJ L 374 (December 31, 1985), para. 83.
11. Competition and Markets Authority, *The Commercial Use of Consumer Data,* CMA38 (June 2015), https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/435817/The_commercial_use_of_consumer_data.pdf, 3.48.
12. Papandropoulos, "How Should Price Discrimination Be Dealt with by Competition Authorities?" "Price discrimination can also be an instrument to implement predatory pricing. Indeed, it can reduce the costs of the strategy and therefore, make it profitable to predate when it would not be profitable if the dominant firm could not price discriminate. Assume a dominant firm serves two market segments and there is entry on only one of the segments. By selectively offering predatory prices to customers in the segment facing entry, the costs of the strategy would be lower than if the predatory price had to be charged across the board, to both segments. In some instances, the ability to target price cuts could reduce the costs of predation enough to be outweighed by the long-run benefits of impeding entry. Hence, there may be situations in which, predation would not be profitable if price discrimination was impossible. Yet, even in this case, it is not price discrimination as such that may lead to anti-competitive effects but the predatory strategy. In the context of an effects-based analysis of targeted price cuts, it is the predatory nature of the price cuts that would cause foreclosure effects."
13. Donald S. Clark (secretary of the Federal Trade Commission), *The Robinson-Patman Act: General Principles, Commission Proceedings, and Selected Issues* (San Jose, CA: Federal Trade Commission, June 7, 1995), https://www.ftc.gov/public-statements/1995/06/robinson-patman-act-general-principles-commission-proceedings-and-selected.
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/20140402142426/, http://www.oft.gov.uk/shared_oft/markets-work/personalised-pricing/oft1489.pdf.

15. Competition and Markets Authority, *The Commercial Use of Consumer Data,* 90 (citing a call for information by the Office of Fair Trading in 2012 on personalized pricing).
16. Laura Bach, "Tobacco Company Marketing to Kids," Campaign for Tobacco-Free Kids (June 4, 2015), https://www.tobaccofreekids.org/research/factsheets/pdf/0008.pdf (discussing research of cigarette manufacturers' promotional activities that influenced previously nonsusceptible nonsmokers to become susceptible to or experiment with smoking).
17. Ibid.
18. *United States v. Brown University,* 5 F.3d 658 (3d Cir. 1993).
19. Stacy Dale and Alan B. Krueger, "Estimating the Return to College Selectivity over the Career Using Administrative Earning Data," Princeton University Working Paper 563 (February 16, 2011), http://i.bnet.com/blogs/ivy-league-study.pdf (finding that, for black and Hispanic students and for students who come from less-educated families in terms of their parents' education, the estimates of the earnings return to college selectivity remain large, even in models that adjust for unobserved student characteristics).
20. Derek Thompson, "Why Smart Poor Students Don't Apply to Selective Colleges (and How to Fix It)," *The Atlantic,* January 24, 2013, http://www.theatlantic.com/business/archive/2013/01/why-smart-poor-students-dont-apply-to-selective-colleges-and-how-to-fix-it/272490/; Caroline M. Hoxby and Christopher Avery, "The Missing 'One-Offs': The Hidden Supply of High-Achieving, Low Income Students," NBER Working Paper 18586 (December 2012), http://www.nber.org/papers/w18586 (showing that "the vast majority of very high-achieving students who are low-income do not apply to any selective college or university . . . despite the fact that selective institutions would often cost them less, owing to generous financial aid, than the resource-poor two-year and non-selective four-year institutions to which they actually apply").
21. Maurice E. Stucke, "Is Intent Relevant?" *Journal of Law, Economics & Policy* 8 (2012): 801, 822–828 (collecting some of the literature); see also Lynn A. Stout, *Cultivating Conscience: How Good Laws Make Good People* (Princeton, NJ: Princeton University Press, 2011), 238–240 (discussing how societal norms of fairness and prosocial behavior are both common in, and necessary for, a market economy); Thomas J. Horton, "Unraveling the Chicago/Harvard Antitrust Double Helix: Applying Evolutionary Theory to Guard Competitors and Revive Antitrust Jury Trials," *University of Baltimore Law Review* 41 (2012): 615, 653–654 (citing research on how " 'fairness evolved as a stable strategy for maintaining social harmony' in our economic relation-

ships" and how "[n]eurobiological studies have found that 'the sense of fairness fundamental to distributive justice' is rooted in humans' emotional processing"), quoting Joan Roughgarden, *The Genial Gene: Deconstructing Darwinian Selfishness* (Berkeley: University of California Press, 2009), 160; Michael Shermer, *The Mind of the Market: Compassionate Apes, Competitive Humans, and Other Tales from Evolutionary Economics* (New York: Times Books, 2008), 11.

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29. Ibid.
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31. Ibid., v.
32. Ibid.
33. Ibid., 56; Article 21, Charter of Fundamental Rights of the European Union; Directive 2006/54/EC of the European Parliament and of the Council of July 5, 2006, on the implementation of the principle of equal opportunities and equal treatment of men and women in matters of employment and occupation.
34. Julia Angwin, Surya Mattu, and Jeff Larson, "The Tiger Mom Tax: Asians Are Nearly Twice as Likely to Get a Higher Price from Princeton Review,"

*ProPublica* (September 1, 2015), https://www.propublica.org/article/asians-nearly-twice-as-likely-to-get-higher-price-from-princeton-review.

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36. Amit Datta, Michael Carl Tschantz, and Anupam Datta, "Automated Experiments on Ad Privacy Settings: A Tale of Opacity, Choice, and Discrimination," *Proceedings on Privacy Enhancing Technologies* 2015, no. 1 (2015): 92–112.
37. Ibid., 92.
38. Ibid.
39. Ibid., 93.
40. Ibid.
41. Ibid.
42. Ibid., 105.
43. University of Washington, "Who's a CEO? Google Image Results Can Shift Gender Biases," *ScienceDaily* (April 9, 2015), www.sciencedaily.com/releases/2015/04/150409143143.htm.
44. Latanya Sweeney, *Online Ads Roll the Dice,* Federal Trade Commission (September 25, 2014), https://www.ftc.gov/news-events/blogs/techftc/2014/09/online-ads-roll-dice. The FTC official began by searching "best credit cards" and "worst credit cards" on the Google search engine and collected the first twenty-five credit cards for each category, as mentioned in these third-party sources. "Credit card ads that appeared on omegapsiphi2011.com were offers for criticized cards or were generic. No ads naming any of the praised cards appeared."
45. Frank Pasquale, *The Black Box Society: The Secret Algorithms that Control Money and Information* (Cambridge, MA: Harvard University Press, 2015), 38–42.
46. Aniko Hannak, Gary Soeller, David Lazer, Alan Mislove, and Christo Wilson, "Measuring Price Discrimination and Steering on E-Commerce Web Sites," Proceedings of the 2014 Conference on Internet Measurement Conference, New York, 5, http://www.ccs.neu.edu/home/cbw/pdf/imc151-hannak.pdf [noting that they could not "determine why results are being personalized based on the data from real-world users, since there are too many confounding variables attached to each . . . user (e.g., their location, choice of browser, purchase history, etc.)"].
47. *Li Xi v. Apple Inc.,* 603 F. Supp. 2d 464 (E.D.N.Y. 2009) (dismissing end-users' Robinson-Patman Act claims when the plaintiffs never alleged that they were "competitors engaged in the business of reselling iPhones, that they are in actual competition with a favored purchaser, or that they even resold or attempted to resell their iPhones"); Matthew A. Edwards, "Price and Prejudice: The Case against Consumer Equality in the Information Age," *Lewis & Clark*

*Law Review* 10 (2006): 559, 580; "Even under the most liberal current interpretation of the RPA, consumer price discrimination claims fail because end-use buyers are not in competition with other buyers who are receiving preferential pricing treatment. Thus, the RPA does not require retailers to treat these consumers equally" (footnotes omitted).

48. The Act prohibits a seller from discriminating in price between two or more competing buyers in the sale of commodities of like grade and quality, where the effect of the discrimination "may be substantially" to "lessen competition . . . in any line of commerce;" or "tend to create a monopoly in any line of commerce;" or "injure, destroy, or prevent competition with any person who grants or knowingly receives the benefit of the discrimination, or with the customers of either of them"; Federal Trade Commission, *The Robinson-Patman Act: General Principles, Commission Proceedings, and Selected Issues* (June 7, 1995), https://www.ftc.gov/public-statements/1995/06/robinson-patman-act-general-principles-commission-proceedings-and-selected.
49. Ross E. Elfand, "The Robinson-Patman Act," American Bar Association (n.d.), http://www.americanbar.org/groups/young_lawyers/publications/the_101_201_practice_series/robinson_patman_act.html.
50. Ibid., citing *Feesers, Inc. v. Michael Foods, Inc.,* 591 F. 3d 191, 198 (3d Cir. 2010) (discussing recent Supreme Court jurisprudence); Ryan Luchs, Tansev Geylani, Anthony Dukes, and Kannan Srinivasan, "The End of the Robinson-Patman Act? Evidence from Legal Case Data," *Management Science* 56, no. 12 (2010): 2123–2133, http://www-bcf.usc.edu/~dukes/Papers/Dukes13_EndofRP_MgtSci_10.pdf. The decision in *Brooke Group Ltd. v. Brown & Williamson Tobacco Corp.,* 509 U.S. 209 (1993), raised the standard for "primary line" cases where "one manufacturer reduces its prices in a specific geographic market and causes injury to its competitors in the same market," requiring evidence that the larger company intended to raise prices for consumers at a later date to recoup money lost on discounts, shifting the focus to the consumer rather the competitor. Similarly, the decision in *Volvo Trucks North America, Inc. v. Reeder-Simco GMC, Inc.,* 546 U.S. 164 (2006), raised the standard for "secondary line" cases, "which occur when favored customers of a supplier are given a price advantage over competing customers," requiring that the supplier show that the different pricing policies made it harder to compete for the same customers at the same time; Federal Trade Commission, *Price Discrimination: Robinson-Patman Violations* (n.d.), https://www.ftc.gov/tips-advice/competition-guidance/guide-antitrust-laws/price-discrimination-robinson-patman; see also Robert J. Toth, "A Powerful Law Has Been Losing a Lot of Its Punch," *Wall Street Journal,* May 1, 2002, http://www.wsj.com/articles/SB1000142405270230474660457738017275 4953842.

51. Edwards, "Price and Prejudice," 596, quoting Howard J. Alperin and Roland F. Chase, *Consumer Law: Sales Practices and Credit Regulation,* 2004 Supplement (St. Paul, MN: West Pub. Co., 2004) 39–40.
52. C-209/10, *Post Danmark A/S v Konkurrencerådet.*
53. Ibid., para. 30.
54. Competition and Markets Authority, *The Commercial Use of Consumer Data,* 2.120.
55. Traders are not prevented from charging a different price in a later invitation to purchase, so long as the total price is clearly displayed before completion. However, as a result of "dubious commercial behaviour," the European Commission is "organising workshops to further assess under which circumstances the sudden increase of prices by a trader may become illegitimate from a consumer protection angle." Such circumstances include where "consumers make repeated searches from a device with the same IP address, leading to the website to offer a higher price on each successive search." Mac Macmillan, "European MEP Calls for Investigation of Online Price Discrimination," *Hogan Lovells Chronicle of Data Protection,* September 13, 2013, http://www.hldataprotection.com/2013/09/articles/consumer-privacy/european-mep-calls-for-investigation-of-online-price-discrimination/. Rafaele Rivais, "Why the Prices of Trains and Planes Vary from One Minute to the Next (Continued)," SOS Conso Blog, *Le Monde* (January 24, 2013), translation.
56. Directive 95/46/EC of the European Parliament and of the Council of October 24, 1995, on the protection of individuals with regard to the processing of personal data and on the free movement of such data. A consumer's IP address constitutes personal data, and as such a member of the European Parliament has stated that "clients . . . should be informed about the processing [of the IP address information]." European Parliament, *Parliamentary Questions,* P-001257/13, E-001574/13, E-000956/13, April 18, 2013, http://www.europarl.europa.eu/sides/getAllAnswers.do?reference=E-2013-000956&language=EN.
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58. Pasquale, *The Black Box Society,* 32, discusses how runaway data can lead to cascading disadvantages; Katherine Noyes, "The EU Will Examine Banks' Use of Customer Data for Profiling and Marketing Campaigns," *PCWorld,* October 5, 2015, pcworld.com/article/2989048/privacy/banks-use-of-big-data-to-be-scrutinzed-by-eu-regulators.html.
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September 20, 2015, http://www.nytimes.com/2015/09/21/business/media/retailers-use-of-their-fans-photos-draws-scrutiny.html?smprod=nytcore-iphone&smid=nytcore-iphone-share; Vindu Goel, "Flipping the Switches on Facebook's Privacy Controls," *New York Times,* January 29, 2014, http://www.nytimes.com/2014/01/30/technology/personaltech/on-facebook-deciding-who-knows-youre-a-dog.html?_r=0.

60. Mattioli, "On Orbitz, Mac Users Steered to Pricier Hotels"("Orbitz Worldwide Inc. has found that people who use Apple Inc.'s Mac computers spend as much as 30% more a night on hotels, so the online travel agency is starting to show them different, and sometimes costlier, travel options than Windows visitors see."). Article referred to in Frederik Zuiderveen Borgesius, "Online Price Discrimination and Data Protection Law," Amsterdam Law School Research Paper No. 2015-32 (August 28, 2015), http://ssrn.com/abstract=2652665.

## 13 · The Comparison Intermediaries

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2. Ibid., 13; Joseph E. Stiglitz, "Imperfect Information in the Product Market," in *Handbook of Industrial Organisation,* vol. 1, R. Schmalensee and R. D. Willig, eds. (Dordrecht: Elsevier, 1989), 769; J. Yannis Bakos, "A Strategic Analysis of Economic marketplaces," *MIS Quarterly* 295 (1991).
3. OFT Statement of Objections, para. 1.14–1.15, as cited in the Competition Appeal Tribunal judgment, *Skyscanner Limited v. Competition and Markets Authority,* Case No. 1226/2/12/14 (September 26, 2014), [2014] CAT 16, 31–32.
4. Ariel Ezrachi, "The Competitive Effects of Parity Clauses on Online Commerce," *European Competition Journal* 11, no. 2–3 (2015).
5. The following section is based on our submission to the House of Lords; A. Ezrachi and Maurice E. Stucke, "Online Platforms and the EU Digital Single Market," University of Tennessee Legal Studies Research Paper No. 283 (October 16, 2015), http://ssrn.com/abstract=2677267; see also Maurice E. Stucke and Ariel Ezrachi, "When Competition Fails to Optimize Quality: A Look at Search Engines," *Yale Journal of Law and Technology* 18 (2016), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2598128.
6. Marina Lao, "Networks, Access, and 'Essential Facilities': From Terminal Railroad to Microsoft," *Southern Methodist University Law Review* 62 (2009): 557, 560–561; "The defining characteristic of network industries is the increasing value of their products to users as the number of users

increases, a phenomenon called 'network effects' or demand-side economies of scale." The increased value can come directly (having more interconnections as a result of more users (e.g., telephones) or indirectly (having more supporting complements developed for that product as the number of users increases (e.g., Windows operating system). See also *United States v. Microsoft Corp.,* 84 F. Supp. 2d 9, 20 (D.D.C. 1999) (discussing the "positive network effect" of Windows); Case T-201/04, *Microsoft Corp. v. Commission,* 2007 E.C.R. 11-3601 (discussing the indirect network effects of streaming media players).

7. In January 2016, an Oracle lawyer reportedly told the court in Oakland, California, that one Google executive testified in a sworn deposition that the annual sum Google pays Apple to keep its search box as the default on the iPhone has topped $1 billion; see Mike Swift, "Oracle Pushes Judge to Force Google to Disclose Terms of Deals with Apple, Other Mobile Competitors," *mLex Market Insight* (January 14, 2016), http://mlexmarketinsight.com/category_editors/digital-risk/.
8. Organisation for Economic Co-operation and Development, *Data-Driven Innovation for Growth and Well-Being, Interim Synthesis Report* (October 2015), 29.
9. See, for example, Ioannis Lianos and Evgenia Motchenkova, "Market Dominance and Search Quality in the Search Engine Market," *Journal of Competition Law & Economics* 9 (2013): 419, 422 (advance access publication, April 17, 2013), discussing how search engines "act as 'information gatekeepers': they not only provide information on what can be found on the web (equivalent to yellow pages), but they also are 'an essential first-point-of-call for anyone venturing onto the Internet' " and how they differ from other two-sided platforms, as "search engines detain an important amount of information about their customers and advertisers (the 'map of commerce')."
10. Scott McCartney, "How Booking Sites Influence Which Hotels You Pick," *Wall Street Journal,* January 27, 2016, http://www.wsj.com/articles/how-booking-sites-influence-which-hotels-you-pick-1453921300.
11. Ibid.
12. *Competitive Enter. Inst. v. U.S. Dep't of Transp.,* 856 F.2d 1563, 1564–65 (D.C. Cir. 1988).
13. Ibid.
14. Doreen Carvajal, "Amazon.com Plans to Revise Its Ad Program," *New York Times,* February 10, 1999, http://www.nytimes.com/1999/02/10/business/amazoncom-plans-to-revise-its-ad-program.html.
15. Similar allegations were also raised with respect to the way in which leading PCWs display the results on their default pages. Payment for placement by leading platforms was criticized as a business model that misleads consumers, as users are not always aware of whether the display

reflects organic or sponsored results; see James Maguire, "Case Study: BizRate," *ECommerce-Guide* (January 2, 2003), http://www.ecommerce-guide.com/news/news/article.php/1563011/Case-Study-BizRate.htm; "How Shopping Bots Really Work," *Loginworks* (December 18, 2014), http://www.loginworks.com/informative/shopping-bots-really-work/; Leslie Walker, "What Shopping Guides Don't Advertise," *Washington Post,* November 6, 2003, http://www.washingtonpost.com/archive/business/2003/11/06/what-shopping-guides-dont-advertise/9c387768-f228-4356-850e-78a2afc60b47/.

16. Study conducted by the German Verbraucherzentrale. For the full study and related materials, see: http://www.marktwaechter.de/pressemeldung/buchungs-und-vergleichsportale-bieten-zu-wenig-nutzen-fuer-verbraucher; http://www.verbraucherzentrale.de/vergleichsportale#header.
17. Rachel Rickard Straus, "Price Comparison Website Bosses under Attack from MPs for Not Showing Customers the Best Deals," *This Is Money* (February 4, 2014), http://www.thisismoney.co.uk/money/bills/article-2939364/Price-comparison-website-bosses-attack-MPs.html.
18. Ibid.
19. European Commission Case No. Comp/M. 5727, *Microsoft/Yahoo! Search Business Regulation* (EC) No. 139/2004 Merger Procedure (February 18, 2010), para. 100.
20. Ibid. para. 35, 45.
21. See, for example, Andrea Amelio and Dimitrios Magos, "Economic Background of the Microsoft/Yahoo! Case," *Competition Policy Newsletter* 2 (2010): 51. "For instance, instead of displaying links to additional merchants in the organic search results, search engines could display links to 'informational' sites or placing the links winning the auctions also in prominent positions in the organic search results, in order to decrease substitution between organic and paid searches." Federal Trade Commission, *FTC Staff Report, Google Inc.,* File No. 111-0161 (August 8, 2012), 92, released by the *Wall Street Journal,* http://graphics.wsj.com/google-ftc-report/img/ftc-ocr-watermark.pdf, stating that "Google's threat (and willingness) to degrade its own web search product—by banishing high-quality vertical websites from its web search results altogether—suggests that Google's motive in scraping high-quality content from its vertical competitors was not pro-competitive." A few caveats about this report, which the FTC released (mistakenly) under the Freedom of Information Act to the *Wall Street Journal.* First, only the report's even-numbered pages were released, so the missing odd pages may have contained important qualifications. Second, other reports, including any prepared by the FTC economists and Google, were not released. Third, although the competition staff recommended that the FTC file a complaint, the commissioners elected not to.

22. Users, the Commission argued, do not "necessarily see the most relevant comparison shopping results in response to their queries, and . . . incentives to innovate from rivals are lowered as they know that however good their product, they will not benefit from the same prominence as Google's product." European Commission, *Antitrust: Commission Sends Statement of Objections to Google on Comparison Shopping Service,* MEMO/15/4781 (April 15, 2015), http://europa.eu/rapid/press-release_MEMO-15-4781_en.htm.
23. European Commission, *Statement by Commissioner Vestager on Antitrust Decisions Concerning Google,* STATEMENT/15/4785 (April 15, 2015), http://europa.eu/rapid/press-release_STATEMENT-15-4785_en.htm.
24. Using these three conditions, we explored elsewhere how a dominant search engine like Google could degrade quality (by providing less relevant responses to a search inquiry), even with competition by Bing, Yahoo!, and DuckDuckGo. Maurice E. Stucke and Ariel Ezrachi, "When Competition Fails to Optimize Quality: A Look at Search Engines," *Yale Journal of Law and Technology* 18 (2016), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2598128.
25. Under the system Apple devised, publishers would have the freedom to set e-book prices in the iBookstore and would keep 70 percent of each sale. The remaining 30 percent would go to Apple as a commission. *United States v. Apple, Inc.*, 791 F.3d 290, 303 (2d Cir. 2015), cert. denied, 136 S. Ct. 1376 (2016). Other distribution models may include a combination of both wholesale and agency elements. For instance, one may design a *hybrid* wholesale model (such as the *merchant model*) that includes a fixed markup. Under such a model the upstream supplier determines the wholesale price, while the contract between the parties includes an agreed margin for the retailer.
26. *United States v. Apple, Inc.*, 791 F.3d 290, 304 (2d Cir. 2015), cert. denied, 136 S. Ct. 1376 (2016).
27. Ibid., 305.
28. A. Ezrachi, "The Competitive Effects of Parity Clauses on Online Commerce," Oxford Legal Studies Research Paper No. 55/2015 (October 11, 2015), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2672541.
29. Benjamin Edelman and Julian Wright, "Price Coherence and Excessive Intermediation," Harvard Business School Working Paper No. 15-030 (March 2015), 3, http://www.benedelman.org/publications/pricecoherence-2015-03-12.pdf.
30. Competition and Markets Authority, *Private Motor Insurance Market Investigation: Final Report* (September 24, 2014), 8.42, 8.14, https://assets.digital.cabinet-office.gov.uk/media/5421c2ade5274a1314000001/Final_report.pdf.
31. Ibid., 8.13.

32. Douglas Fraser, “Heat Is On: Why Are Energy Bills so High?” *BBC News* (January 15, 2014), http://www.bbc.co.uk/news/uk-scotland-scotland-business-25743336.
33. Ibid.
34. According to the figures released, annual profits range from £69.7 million (Compare The Market), to £53.9 million (MoneySuperMarket), to £19.8million (GoCompare), to £16.4 and £9.8 million (Confused.com and uSwitch); see Straus, “Price Comparison Website Bosses under Attack.”
35. Fraser, “Heat Is On.”
36. Ibid.
37. U.K. Parliament Energy and Climate Change Select Committee, *Protecting Consumers: Making Energy Price Comparison Websites Transparent* (March 26, 2015), http://www.publications.parliament.uk/pa/cm201415/cmselect/cmenergy/1145/114502.htm.
38. In its submission to the committee, the U.K. Office of Gas and Electricity Markets noted that the level of commission charged by price comparison websites does not impact the actual price that the consumer pays when switching. As noted in the government response, “the cost a consumer will pay on a tariff is the same regardless of whether they switch through a comparison site or directly through the supplier, it is difficult to see how consumers would benefit this requirement.” Ibid., Appendix 1: Government Response, Recommendation 3.
39. David Ronayne, “Price Comparison Websites,” Warwick Economic Research Papers 1056 (October 2015), http://www2.warwick.ac.uk/fac/soc/economics/research/workingpapers/2015/twerp_1056b_ronayne.pdf.
40. Ibid.
41. Ibid.
42. HRS-Hotel Reservation Service B 9-66/10 (December 20, 2013), http://www.bundeskartellamt.de/SharedDocs/Entscheidung/EN/Entscheidungen/Kartellverbot/B9-66-10.pdf; *United States v. Apple Inc.,* 952 F. Supp. 2d 638, 15 647 (S.D.N.Y. 2013); Case COMP/AT-39.847, *E-Books* (July 25, 2013).
43. For further discussion on the effects of narrow and wide MFNs, see Ariel Ezrachi, “The Competitive Effects of Parity Clauses on Online Commerce.”

## Part IV • Frenemies

1. On the role of network effects, note the Report by the House of Lords, Select Committee on European Union “Online Platforms and the Digital Single Market” (April 20, 2016) 10th Report of Session 2015–16, paras 65–93, http://www.publications.parliament.uk/pa/ld201516/ldselect/ldeucom/129/129.pdf.

2. For instance, in the personal computer world two super-platforms are noticeable: Microsoft's Windows for operating system software and Intel for microprocessors.

### 14 • The Dynamic Interplay among Frenemies

1. Some firms have no preexisting relationship, as when a vulture fund acquires a distressed newspaper.
2. Marius Schwartz and David Eisenstadt, "Vertical Restraints," U.S. Department of Justice Antitrust Division, EPO Discussion Paper 82-2 (1982), 4, 5; *Business Electronics Corp. v. Sharp Electronics Corp.,* 485 U.S. 717 (1988), 11.
3. "FTC Looks at Google-Apple Board Ties: Report," Reuters (May 5, 2009), http://www.reuters.com/article/us-google-apple-idUSTRE54403Z20090505. The FTC investigated, and both individuals resigned from Apple's board; https://www.ftc.gov/news-events/press-releases/2009/08/statement-bureau-competition-director-richard-feinstein-regarding; "Statement of FTC Chairman Jon Leibowitz Regarding the Announcement That Arthur D. Levinson Has Resigned from Google's Board," FTC Press Release (October 12, 2009), https://www.ftc.gov/news-events/press-releases/2009/10/statement-ftc-chairman-jon-leibowitz-regarding-announcement. See Section 8 of the Clayton Act, 15 U.S.C. § 19(a)(5).
4. Companies with a complementary relationship may not interact directly. In their relationship, an increase in demand for one firm's products or services increases the demand for the other's—such is the relationship between producers of peanut butter and jelly, or ketchup and french fries.
5. European Commission, *Guidelines on the Assessment of Non-Horizontal Mergers under the Council Regulation on the Control of Concentrations between Undertakings* (October 8, 2008), para. 5.
6. Ericsson, *Ericsson Mobility Report: On the Pulse of the Networked Society* (June 2015), http://www.ericsson.com/res/docs/2015/ericsson-mobility-report-june-2015.pdf.
7. comScore, *The 2015 U.S. Mobile App Report* (September 22, 2015), 5.
8. Ibid.
9. Note the distinction between the powerful super-platform, which we discuss in this chapter, and the more general definition of platform, which often encompasses online companies operating in two- or multisided markets. On the EU approach to platforms, see European Commission, *Public Consultation on the Regulatory Environment for Platforms, Online Intermediaries, Data and Cloud Computing and the Collaborative Economy* (September 24, 2015), https://ec.europa.eu/digital-agenda/en/news/public-consultation-regulatory-environment-platforms-online-intermediaries-data-and-cloud.

10. Don Clark and Robert McMillan, "Facebook, Amazon and Other Tech Giants Tighten Grip on Internet Economy," *Wall Street Journal,* November 5, 2015, http://www.wsj.com/articles/giants-tighten-grip-on-internet-economy-1446771732.
11. David McLaughlin, "Google Said to Be under U.S. Antitrust Scrutiny over Android," *Bloomberg* (September 25, 2015), http://www.bloomberg.com/news/articles/2015-09-25/google-said-to-be-under-u-s-antitrust-scrutiny-over-android-iezf41sg.
12. Statistica, "Number of Available Applications in the Google Play Store from December 2009 to February 2015" (2016), http://www.statista.com/statistics/266210/number-of-available-applications-in-the-google-play-store/; Statistica, "Number of Available Apps in the Apple App Store from July 2008 to June 2015" (2016), http://www.statista.com/statistics/263795/number-of-available-apps-in-the-apple-app-store/.
13. One study of the top 200 apps found that thirty-eight paid and seventy-four free apps were present on both super-platforms. Mikey Campbell, "Apps No Longer Differentiator in iOS vs. Android War, Services Next Battleground," *Apple Insider* (January 6, 2014), http://appleinsider.com/articles/14/01/06/apps-no-longer-differentiator-in-ios-vs-android-war-services-next-battleground.
14. Vangie Beal, "API—Application Program Interface," *Wedopedia* (n.d.), http://www.webopedia.com/TERM/A/API.html.
15. Ron Amadeo, "Google's Iron Grip on Android: Controlling Open Source by Any Means Necessary," *Ars Technica* (October 20, 2013), http://arstechnica.com/gadgets/2013/10/googles-iron-grip-on-android-controlling-open-source-by-any-means-necessary/4/.
16. Ibid.
17. Ron Adner, Jianqing Chen, and Feng Zhu, "Frenemies in Platform Markets: The Case of Apple's iPad vs. Amazon's Kindle," Harvard Business School Working Paper 15-087 (May 6, 2015).
18. Ibid., 2.
19. Ibid. This paper provides an economic model when platforms have the incentive to become Frenemies. As they discuss in regard to the e-reader market: "Apple's iPad provides many features beyond reading e-books, while Amazon's Kindle is almost exclusively an e-book reader. As a result, in equilibrium, compared to Amazon, Apple's hardware profits are more important to its total profits. In contrast, for Amazon, royalties from e-book sales are more important to its total profits relative to Apple. When this difference in profit foci is large enough, having the Kindle Reader available on iPad is agreeable to both Apple and Amazon: Amazon's e-book sales increase because iPad users can now purchase e-books from Amazon and

read them via Kindle Reader, and Apple's hardware sales increase because greater value accrues to the iPad with access to Kindle Reader than in the case of incompatibility. The additional profits Apple generates from hardware sales more than compensate its loss in royalties from e-book sales through its iBooks. Similarly, the additional profits Amazon generates from e-book sales are greater than its loss in Kindle device sales. In particular, when Amazon subsidizes Kindle sales, it is always in Amazon's interest to have Kindle Reader on Apple's iPad. We also show that it is never in Apple's or Amazon's interest to have iBooks available on the Kindle device."

20. Uber, "The Top 10 Facts You May Not Know about Uber Driver Partners" (August 5, 2015), http://newsroom.uber.com/2015/08/the-top-10-facts-you-may-not-know-about-uber-driver-partners/.
21. Brad Stone, "Exclusive: Google Is Developing Its Own Uber Competitor," *Bloomberg* (February 2, 2015), http://www.bloomberg.com/news/articles/2015-02-02/exclusive-google-and-uber-are-going-to-war-over-taxis.
22. Ibid.
23. Jack Nicas, "Alphabet Cruises into Ride-Sharing Business," *Wall Street Journal,* May 17, 2016, B4.
24. Chunka Mui, "Google Is Millions of Miles Ahead of Apple in Driverless Cars," *Forbes,* August 21, 2015, http://www.forbes.com/sites/chunkamui/2015/08/21/google-is-millions-of-miles-ahead-of-apple-in-driverless-cars/.
25. Daisuke Wakabayashi, "Apple Targets Electric-Car Shipping Date for 2019," *Wall Street Journal,* September 21, 2015, http://www.wsj.com/articles/apple-speeds-up-electric-car-work-1442857105.
26. "Apple Invests in Chinese Uber Rival Didi Chuxing," BBC News (May 13, 2016), http://www.bbc.co.uk/news/business-36283661; "Apple Invests $1bn in 'Chinese Uber' Didi Chuxing," *The Telegraph* (May 13, 2016), http://www.telegraph.co.uk/technology/2016/05/13/apple-invests-1bn-in-chinese-uber-didi-chuxing/.
27. NDTV Correspondent, "Google Reportedly Wants More of Its Apps Preinstalled on Android Devices," *Gadgets360* (September 29, 2014), http://gadgets.ndtv.com/mobiles/news/google-reportedly-wants-more-of-its-apps-pre installed-on-android-devices-599478.
28. Jack Nicas, "Alphabet Cruises into Ride-Sharing Business."
29. For instance, in Europe, such may be the case when a dominant undertaking operates at both the upstream and downstream levels and refuses to supply a competitor operating at the downstream level. Such a refusal to supply is contrary to Article 102 TFEU when it eliminates competition in the downstream market. Another form of refusal to supply that is objectionable occurs when a dominant party controls the provision of an essential infrastructure, uses that essential facility, but refuses other companies access to that facility,

with no objective justification for doing so. In other cases a refusal to supply may involve a refusal to license intellectual property rights. For relevant cases see Ariel Ezrachi, *EU Competition Law—An Analytical Guide to the Leading Cases,* 4th ed. (Oxford: Hart Publishing, 2014), 252.

30. John Markoff, "Toyota Invests $1 Billion in Artificial Intelligence in U.S.," *New York Times,* November 6, 2015, http://www.nytimes.com/2015/11/06/technology/toyota-silicon-valley-artificial-intelligence-research-center.html?_r=0; Mui, "Google Is Millions of Miles Ahead of Apple in Driverless Cars."
31. See, e.g., Markoff, "Toyota Invests $1 Billion in Artificial Intelligence in U.S."
32. Jean Tirole, "Comments Made at FT-ETNO Summit 2015," *Financial Times* (October 13, 2015), https://live.ft.com/Events/2015/FT-ETNO-Summit-2015.
33. Stone, "Exclusive."
34. Matt Weinberger, "Microsoft Could See an Opportunity to Poke Google in the Eye with Uber Investment," *Business Insider UK* (July 31, 2015), http://www.businessinsider.com/microsoft-and-google-are-uber-investors-2015-7.
35. Nathaniel Mott, "Uber Should Fear the Company Formerly Known as Google," *Gigaom* (August 11, 2015), https://gigaom.com/2015/08/11/uber-vs-alphabet-google/.
36. Weinberger, "Microsoft Could See an Opportunity to Poke Google in the Eye with Uber Investment."
37. Douglas MacMillan, "GM Invests $500 Million in Lyft, Plans System for Self-Driving Cars," *Wall Street Journal,* January 4, 2016, http://www.wsj.com/article_email/gm-invests-500-million-in-lyft-plans-system-for-self-driving-cars-1451914204-lMyQjAxMTI2NTA2NDEwODQyWj.
38. Coupons.com, Form 10-K for 2014 (2014), 17; Yelp Inc., Form 10-Q for the Quarterly Period Ended June 30, 2015 (2015), 33, http://www.sec.gov/Archives/edgar/data/1345016/000120677415002479/yelp_10q.htm. "The number of people who access information about local businesses through mobile devices, including smartphones, tablets and handheld computers, has increased dramatically over the past few years and is expected to continue to increase. Although many consumers access our platform both on their mobile devices and through personal computers, we have seen substantial growth in mobile usage. We anticipate that growth in use of our mobile platform will be the driver of our growth for the foreseeable future and that usage through personal computers may continue to decline worldwide. As a result, we must continue to drive adoption of and user engagement on our mobile platform, and our mobile app in particular." LinkedIn Corp., Form 10-Q, for the Quarterly Period Ended June 30, 2015 (2015), 47, http://www.sec.gov/Archives/edgar/data/1271024/000127102415000020/a20150630-10qdocument.htm. "Many individuals use mobile devices to access online

services. . . . The number of people who access online services through mobile devices, such as smart phones, handheld tablets and mobile telephones, as opposed to personal computers, has increased dramatically in the past few years and is projected to continue to increase."

39. They noted, for instance, that the Independent Music Companies Association "claimed that YouTube had threatened to remove content and block access to its services "unless non-negotiable licensing conditions were accepted," and had tried to impose a " 'least-favoured nation' clause ensuring the royalty rate of all independents could be aligned with the lowest rate agreed with any label worldwide." Paragraph 126, House of Lords, Select Committee on European Union, "Online Platforms and the Digital Single Market" (April 20, 2016), 10th Report of Session 2015–16, http://www.publications.parliament.uk/pa/ld201516/ldselect/ldeucom/129/129.pdf. The Association of Authors' Agents said that Amazon asked "suppliers and customers to agree to terms and conditions that are liable to change without notice." The British Booksellers Association agreed. Amazon's contracts enabled it "to change the terms whenever it liked," and added that many publishers "had been asked by Amazon to ring fence stock . . . without receiving a guaranteed order." Ibid.
40. Coupons.com, Form 10-K for 2014, 15, 17.
41. Facebook, Form 10-K for 2014 (2014), 11.
42. Ibid.
43. Ibid.
44. Ibid.
45. In finding that the Facebook/WhatsApp merger was unlikely to be anticompetitive, the European Commission inquired, among other things, whether: (1) users of the consumer communications apps are locked in to any particular physical network, hardware solution, or anything else that needs to be replaced in order to use competing products; (2) consumers had control over, and there were any significant limits on, the portability of their data; and (3) the parties had any means to preclude competitors from recreating a user's network on the parties' applications. Case COMP/M.7217, *Facebook/WhatsApp,* Commission Decision, 2014 O.J. (C 7239), 24–25, 134. Presumably, if the answer was "yes," then the risks of anticompetitive, unilateral conduct increase. These three factors, which identify several more potential abuses of a dominant position, involve consumers' switching costs. The basic premise is that as the more the time and cost needed to switch products or services increase, the more the consumer is locked in, and the greater the dominant firm's ability to increase price or, for our purposes, reduce other parameters of competition, such as quality, including the level of privacy

protection. This is especially the case where consumers cannot readily predict costs or quality levels over time.

46. These exclusionary practices are explored in greater detail in Maurice E. Stucke and Allen P. Grunes, *Big Data and Competition Policy* (Oxford: Oxford University Press, 2016).
47. European Commission, "Antitrust: Commission Sends Statement of Objections to Google on Android Operating System and Applications," press release (April 20, 2016), http://europa.eu/rapid/press-release_IP-16-1492_en.htm.
48. Ibid.
49. If a manufacturer wished to preinstall Google proprietary apps, including Google Play Store and Google Search, on any of its devices, Google required the manufacturer not to sell any devices running on "Android forks"—basically, any modified Android mobile operating system. Forgoing Google apps, as some phone makers have found, is difficult. As the *Wall Street Journal* reported, Amazon.com in 2014 launched its customized version of an Android smartphone. Because Amazon's version was an Android fork, it couldn't include the more popular apps like Google Search, YouTube, Maps, or the Play Store. Amazon's smartphone "sold poorly, which some Google detractors blamed on the lack of Google apps." Natalia Drozdiak and Sam Schechner, "EU Set to Charge Google over Android Phone Apps: European Commission Focusing on Demand That Phones Load Google Apps," *Wall Street Journal,* April 19, 2016, http://www.wsj.com/article_email/eu-set-to-charge-google-over-android-1461067383-lMyQjAxMTI2MDE5OTAxMjk4Wj.
50. One inducement is Google Play Store, where smartphone users can access and download apps. Google's Play Store accounts for more than 90 percent of apps downloaded on Android devices in Europe. In its licensing contracts with the smartphone manufacturers, Google basically told them that if they wanted to install Google Play Store on their Android devices, then they had to preinstall Google Search and make it the default search engine.
51. European Commission, "Antitrust: Commission Sends Statement of Objections to Google on Android Operating System and Applications—Factsheet" (April 20, 2016), http://europa.eu/rapid/press-release_MEMO-16-1484_en.htm.

## 15 • Extraction and Capture

1. See Part III and Chapter 8.
2. *Riley v. California,* 134 S. Ct. 2473, 2489, 189 L. Ed. 2d 430 (2014).
3. "First, a cell phone collects in one place many distinct types of information—an address, a note, a prescription, a bank statement, a video—that reveal

much more in combination than any isolated record. Second, a cell phone's capacity allows even just one type of information to convey far more than previously possible. The sum of an individual's private life can be reconstructed through a thousand photographs labeled with dates, locations, and descriptions; the same cannot be said of a photograph or two of loved ones tucked into a wallet. Third, the data on a phone can date back to the purchase of the phone, or even earlier. A person might carry in his pocket a slip of paper reminding him to call Mr. Jones; he would not carry a record of all his communications with Mr. Jones for the past several months, as would routinely be kept on a phone. Finally, there is an element of pervasiveness that characterizes cell phones but not physical records. Prior to the digital age, people did not typically carry a cache of sensitive personal information with them as they went about their day. Now it is the person who is not carrying a cell phone, with all that it contains, who is the exception. According to one poll, nearly three-quarters of smart phone users report being within five feet of their phones most of the time, with 12% admitting that they even use their phones in the shower. . . . [I]t is no exaggeration to say that many of the more than 90% of American adults who own a cell phone keep on their person a digital record of nearly every aspect of their lives—from the mundane to the intimate." Ibid., at 2489–2490 (internal footnote omitted).

4. Ibid., at 2490.
5. Ibid.; see, for example, Brian X. Chen, "Why and How Apple Is Collecting Your iPhone Location Data," *Wired,* April 21, 2001, http://www.wired.com/2011/04/apple-iphone-tracking/.
6. Australian Communications and Media Authority. *Here, There and Everywhere—Consumer Behaviour and Location Services* (December 2012), 1, http://www.acma.gov.au/webwr/_assets/main/lib310665/location_services-dec2012.pdf.
7. Ibid.
8. Jack Nicas, "Google to Increase Frequency, Size of Ads," *Wall Street Journal,* May 25, 2016, B4.
9. Brian See Voo, "Smartphones & You: Who Is (Really) in Control?" *Hongkiat* (December 3, 2013), http://www.hongkiat.com/blog/smartphone-you-who-in-control/; Andrew Munchbach, "Your Smartphone Is Tracking You, and You Said It Was Okay," *BGR* (April 20, 2011), http://bgr.com/2011/04/20/your-smartphone-is-tracking-you-and-you-said-it-was-okay/.
10. Australian Communications and Media Authority, *Here, There and Everywhere,* 18
11. Alun Williams, "Google Invites Developers to Its Brillo IoT Platform," *Electronics Weekly,* October 28, 2015, http://www.electronicsweekly.com

/blogs/eyes-on-android/embedded-android/google-invites-developers-to-its-brillo-iot-platform-2015–10/.

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## 17 • The Future of Frenemy: The Rise of Personal Assistants

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## 19 • The Enforcement Toolbox

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20. Another instrument that may be used to address the asymmetric bargaining power between suppliers (such as app developers) and gatekeepers (such as super platforms) is the possible use of codes of practice. Such codes could be designed by the state and provide a voluntary or binding framework, which can be tailored to specific market realities. Such instruments could ensure that "all parts of the supply chain were treated equally," and prevent online platforms from engaging in "unfair trading practices in their dealings with SME suppliers." A code of practice could be designed in collaboration with the industry and might include a business-to-business dispute resolution mechanism. It could take into account many of the dynamics discussed in our Frenemy scenario, consider them in specific market context, and address them. Written evidence to the House of Lords from IMPALA, and Comments by Hon. Ed Vaizey MP. House of Lords, Select Committee on European Union, "Online Platforms and the Digital Single Market," para. 129, 130, 133.
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Final Reflections

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on ads that support or attack specific candidates, whereas national parties will not be able to spend a dime of soft money on ads of any kind. The Court's ruling thus dramatically enhances the role of corporations and unions—and the narrow interests they represent—vis-à-vis the role of political parties—and the broad coalitions they represent—in determining who will hold public office." *Citizens United,* 558 U.S. at 412.

73. Despite its label, the rule of reason is not a directive that businesses and consumers can readily understand and internalize (such as clear prohibitions on agreeing with one's competitors to fix prices). Instead, the term embraces antitrust's most open-ended principles, namely a "flexible" factual inquiry into a restraint's overall competitive effect and "the facts peculiar to the business, the history of the restraint, and the reasons why it was imposed." *Am. Needle, Inc. v. Nat'l Football League,* 130 S. Ct. 2201, 2217 (2010) [quoting *Board of Trade of Chicago v. United States,* 246 U.S. 231, 238 (1918)]. The rule of reason also "varies in focus and detail depending on the nature of the agreement and market circumstances." Federal Trade Commission and U.S. Department of Justice, *Antitrust Guidelines for Collaborations among Competitors* (2000) §1.2, at 4, http://www.ftc.gov/os/2000/04/ftcdojguidelines.pdf.
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# Acknowledgments

One joy in writing this book were the discussions with people within and outside the antitrust circle. Our ideas benefitted from many exchanges with competition officials, regulators, practitioners, and academics. Helpful meetings with statisticians, mathematicians, engineers, and IT specialists further widened our horizons and contributed to our understanding of the interfaces between technology and competition. We are grateful for their taking the time to listen, their thoughtful comments, their criticism, and their support.

We would like to note our special gratitude to insights and criticism received along the way from Allen Grunes, Frank Pasquale, Nicolas Petit, Ingmar Posner, Tony Curzon Price, Greg Taylor, Frank Wood, and the anonymous referees.

Since this project's beginning, we were privileged to present parts of it in various fora. The presentations and the discussion which followed enriched our understanding of virtual competition's many facets. We are particularly grateful to the organizers and participants of the following conferences and hearings: The Organisation for Economic Co-operation and Development hearing "Across Platform Parity Agreements"; the House of Lords hearing "Online Platforms and the Digital Single Market"; the Canadian Competition Bureau's "Workshop on Emerging Competition Issues: Keeping Pace in a Changing World"; the European Data Protection Supervisor & Academy of European Law's conference "Competition Rebooted: Enforcement and Personal Data in Digital Markets"; the Federal Trade Commission's workshop "The 'Sharing' Economy: Issues Facing Platforms, Participants, and Regulators"; Bar Ilan University's conference "Fairness in Antitrust"; the British Institute of International and Comparative Law's event "The Role of 'Big Data' in Competition and Privacy Law"; Lund University's conference "21st Century Challenges and Antitrust: Thinking Ahead"; and Loyola University Chicago and University of Haifa's joint event "Antitrust in Transitional Markets."

Our project began in Oxford while Maurice visited the Centre for Competition Law and Policy. We thank the University of Oxford for facilitating the visit. Special thanks are due to the Master of Pembroke College, Dame Lynne Brindley, the professors, and college staff who were all gracious and hospitable. Maurice would like to thank the University of Tennessee, Doug Blaze, Carol Parker, and Greg Stein for supporting our research, including his sabbatical at the University of Oxford to undertake this research.

Martin Dickson provided valuable assistance in the last editing phase. Deborah Grahame-Smith proficiently oversaw the editing of our book. Ian Malcolm at Harvard University Press was supportive in shepherding this book through the publication process. We are very much indebted to them for their tireless and selfless effort.

Finally, we thank our families for all of their support.

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