

MARKET DEFINITION AND UNILATERAL COMPETITIVE EFFECTS IN ONLINE RETAIL MARKETS

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ABSTRACT

Although the basic principles used to define a relevant market or to analyze unilateral competitive effects in traditional retail settings also apply in online retail markets, several features of the online environment add complexities to the analysis. This paper examines some of the results in the economics and marketing literatures that can influence market definition and competitive effects analysis in online retail settings. I argue that a failure to account properly for certain aspects of online markets can lead to erroneous definitions of the relevant market and, more importantly, erroneous conclusions regarding the unilateral competitive effects of horizontal mergers.

JEL: K21; L81

I. INTRODUCTION

Online retail markets are often portrayed as textbook examples of perfect competition. A 1999 article published in *The Economist*, for instance, promised that the Internet would bring “a new age of perfectly competitive markets.”¹ The thinking was that the Internet would permit consumers to obtain perfect information about prices, which in turn would force firms to set prices at marginal cost.

Nearly a decade of economic research, however, reveals that the prices that online retailers charge for products ranging from books and CDs to more expensive consumer electronics such as printers, personal digital assistants, and TVs are hardly consistent with the perfectly competitive paradigm.² Different online sellers tend to charge significantly different prices

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¹ *The Economist*, November 20, 1999, p. 112.

² For instance, there is evidence that the prices that Internet retailers charge for the same item differ by 33 percent for books and 25 percent for CDs; see Eric Erik Brynjolfsson & Michael D. Smith, *Frictionless Commerce? A Comparison of Internet and Conventional Retailers*, 46 *MANAGEMENT SCIENCE* 563–85 (2000). There is evidence that the average range in prices for consumer electronics products is even larger, about 40 percent; see Michael R. Baye, John

for the same item.³ Even at the most transparent of all online retail markets—a price comparison site—price dispersion is the rule rather than the exception and the “law of one price” is routinely violated. Unlike many offline markets, the identity of the firm offering the best deal tends to change very frequently. Frequent changes in the number of firms that sell a given product also contribute to the dynamics of many online markets. Furthermore, some online consumers tend to exhibit a degree of “loyalty” to branded e-retailers, and buy from their preferred e-retailer even when they are aware that a competitor is offering what would appear to be the same physical product at a lower price.⁴ Other shoppers view a product sold by different sellers to be homogenous, and always buy at the lowest price that they find online.

In light of these observations, how does one go about defining a relevant market in online settings? Conceptually, the same principles articulated in the *Guidelines* also apply to online retail markets:

A market is defined as a product or group of products and a geographic area in which it is produced or sold such that a hypothetical profit-maximizing firm, not subject to price regulation, that was the only present and future producer or seller of those products in that area likely would impose at least a “small but significant and nontransitory” increase in price [SSNIP], assuming the terms of sale of all other products are held constant. A relevant market is a group of products and a geographic area that is no bigger than necessary to satisfy this test.⁵

But, as we shall see, the nature of online competition affects a number of the fundamental ingredients required for defining a relevant market and in analyzing the unilateral competitive effect of a horizontal merger.

For instance, one of the distinguishing features of online markets is the ease with which online buyers can search for sellers offering the same

Morgan & Patrick Scholten, *Price Dispersion in the Small and in the Large: Evidence from an Internet Price Comparison Site*, 52 *JOURNAL OF INDUSTRIAL ECONOMICS* 463–96 (2004).

³ For a review of additional empirical studies that document significant online price dispersion, and a synthesis of a variety of theoretical models that rationalize price dispersion in online as well as traditional markets, see MICHAEL R. BAYE, JOHN MORGAN & PATRICK SCHOLTEN, *Information, Search, and Price Dispersion*, in *HANDBOOK IN ECONOMICS AND INFORMATION SYSTEMS* (Amsterdam: Elsevier 2006).

⁴ See, for instance, Erik Brynjolfsson & Michael D. Smith, *The Great Equalizer? Consumer Choice Behavior at Internet Shopbots* (MIT Sloan Working Paper No. 4208-01, October 2001).

⁵ Section 1.0 of the *Horizontal Merger Guidelines* at <http://www.ftc.gov/bc/docs/horizmer.htm>. Market definition is an analytical framework for analyzing consumer responses and demand substitution. However, the ultimate objective of merger analysis is to determine whether the acquisition is likely to lessen competition substantially. Not infrequently, particularly in cases that entail unilateral effects theories, there is evidence that can more directly test for the likelihood of competitive effects. In such cases, this information is also used simultaneously to define the relevant market. Indeed, some view the process as backing into a definition of the relevant market after determining competitive effects.

physical item (such as a specific model and brand of camera), and these search costs are virtually “free” within the confines of a price comparison site that lists the prices that many different sellers charge for the same physical product. On the surface, this opens a Pandora’s box of potentially relevant substitutes that could lead to a more broadly defined relevant market and potentially mitigate the competitive effects of horizontal mergers. But the reality is that this is not necessarily the case, and in any event formal economic models suggest that certain features of online markets greatly complicate estimation of relevant demand elasticities and other “fundamentals” that are central to market definition and/or competitive effects analysis.

As in traditional market environments, the underlying nature of competition can also have an effect on market definition and competitive effects analysis in online retail markets. But unlike traditional markets, where the implications of different economic models (for example, Hotelling, Cournot, or Bertrand oligopoly)⁶ for market definition or competitive effects are reasonably well understood, it is not widely recognized that different models of online competition (for example, Varian, Rosenthal, and Baye-Morgan)⁷ have dramatically different implications for market definition and competitive effects analysis. For this reason, I also provide an overview of recent models that have been used to analyze competition in online retail markets, and show that subtle differences in these formal models can influence market definition and competitive effects analysis.

II. AN OVERVIEW OF COMPETITION AT RETAIL PRICE COMPARISON SITES

With this background, I now turn to online markets. Let me emphasize at the outset that there are many flavors of online markets ranging from auctions to markets for diverse types of advertising to a plethora of different types of e-retail markets. My focus here is on retail competition at price comparison sites—not because I view these markets to be more important than other online markets, but because these markets accentuate the informational features and low consumer search costs that are present in online markets more generally. My approach is stylized and designed to highlight

⁶ Harold Hotelling, *Stability in Competition*, *ECONOMIC JOURNAL* 41–57 (1929); Antoine Cournot, *RECHERCHES SUR LES PRINCIPES MATHÉMATIQUES DE LA THÉORIE DES RICHESSES* (Paris: Hachette, 1838); Joseph Bertrand, *Review of Théorie Mathématique de la Richesse Sociale par Léon Walras: Recherches sur les Principes Mathématiques de la Théorie des Richesses par Augustin Cournot*, 67 *JOURNAL DES SAVANTS* 499–508 (1983).

⁷ Hal R. Varian, *A Model of Sales*, 70 *AMERICAN ECONOMIC REVIEW* 651–59 (1980); Robert W. Rosenthal, *A Model in Which an Increase in the Number of Sellers Leads to a Higher Price*, 48 *ECONOMETRICA* 1575–80 (1980); Michael R. Baye & John Morgan, *Information Gatekeepers on the Internet and the Competitiveness of Homogeneous Product Markets*, 91 *AMERICAN ECONOMIC REVIEW* 454–74 (2001).

the relation between formal economic models of online competition and market definition/competitive effects analysis.

A price comparison site is an online marketplace where sellers—located in different physical locations that might range from Maine to California—compete in the same virtual location (the price comparison site’s website) for consumers wishing to purchase a given product. Consumers or potential buyers also may be domiciled in different physical locations, but can visit the same virtual location (either in lieu of, or in addition to, visiting physical businesses in their locales) to purchase a specific item. Although items may be physically identical, retailers’ services may differ and thus induce a degree of product differentiation in the eyes of some consumers. To the extent that different online consumers live in different locations (be they cities, states, or potentially even different countries), they may enjoy different offline options. They may also face different effective online prices due to differential shipping costs or sales taxes based on their domiciles. Thus, substitution possibilities may vary across consumers, and hence the degree of competition may vary across different retailers.

To illustrate the information available to consumers at price comparison sites, the results of a search for a Canon PowerShot SD900 digital camera at Shopper.com are displayed in Figure 1. At this “virtual” piece of real estate, six online retailers sell the same camera at six different prices ranging from a low of \$309.00 to a high of \$499.00.⁸ It took only a few keystrokes and less than four seconds to obtain this comparative price information, which illustrates the virtually frictionless manner in which online buyers can find the best deals online. And despite the ease with which consumers can comparison shop, the prices exhibit significant price dispersion—competition has not driven all firms to charge the same price.

Importantly, and as discussed in the introduction, price dispersion is not unique to this particular item, website, or point in time; over the past decade, a host of studies in economics and marketing have documented ubiquitous price dispersion for thousands of other consumer products sold online. These studies also document that firms’ prices tend to vary unpredictably, that the identity of the firm charging the lowest price tends to vary over time, and that there is little evidence that dispersion has declined over the past decade.⁹

With this background, I now highlight some of the issues and complications that can arise in defining a relevant market or evaluating competitive effects in an online setting.

⁸ These prices include shipping and taxes (based on my zip code).

⁹ See, for instance, Baye et al., *supra* note 2.

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Store	Certified rating	Inventory	Price	Total price
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 WILSONSBYS.COM 800-378-1898 Est. 1898, NYC's Oldest Photographic Emporium	★★★★★ Rate this store See store profile	In stock FAST FREE SHIPPING!	Price: \$312.00 Tax: \$0.00 Shipping: Free	\$312.00
 amazon.com	★★★★★ Rate this store See store profile	In stock	Price: \$319.00 Tax: \$0.00 Shipping: Free	\$319.00
 Vanns	★★★★★ Rate this store See store profile	In stock	Price: \$359.98 Tax: \$0.00 Shipping: Free	\$359.98
 DELL	★★★★★ Rate this store See store profile	In stock	Price: \$379.99 Tax: \$22.80 Shipping: Free	\$402.79
	★★★★★ Rate this store See store profile	In stock	Price: \$499.00 Tax: \$0.00 Shipping: Free	\$499.00

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-  Canon PowerShot SD1000 Digital ELPH (Silver)
\$167.19 - \$200.45
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-  Canon PowerShot SD870 IS (Black)
\$289.00 - \$399.99
-  Canon PowerShot SD950 IS
\$319.00 - \$434.97

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Figure 1. A screenshot from a price comparison site.

III. ISSUES THAT POTENTIALLY INFLUENCE MARKET DEFINITION AND COMPETITIVE EFFECTS “ONLINE”

Consider the issue of identifying the relevant geographic market. In the context of the example in Figure 1, one possibility is that the virtual real estate represented by the screenshot is the relevant geographic area. But there are certainly other online and offline locations where consumers might identify alternative sellers of this particular item. These alternatives include other price comparison sites (such as Nextag.com, Shopping.com, Kelkoo.com, and Pricerabber.com), the websites of firms that eschew comparison sites altogether in favor of direct online sales through their own websites, and retailers who are purely brick-and-mortar operations. Some firms may use several of these channels, and either charge a uniform price

across all of these channels or price discriminate across them.¹⁰ All of these factors can affect the definition of a relevant market.

Of course, even if there are options other than those displayed in Figure 1, some of these options may be attractive to some consumers but not others. For instance, U.S. consumers may find the transaction costs associated with purchasing the item from a seller that uses the European price comparison site, Kelkoo.com, prohibitive. Some consumers may prefer getting the item immediately at their local brick-and-mortar store, whereas consumers in rural areas may view online shopping as the only viable option given their location and transaction costs of using offline markets.

Even in traditional markets, a relevant market may exclude some sellers that offer the exact same physical item.¹¹ The same is true in online markets. Thus, even if other retailers sell the same item “outside” of the virtual real estate displayed in Figure 1, or sell closely related models of cameras, this need not be a deal-breaker for defining a relevant market that excludes these alternatives. It all boils down to whether the presence of these alternatives would significantly discipline the pricing decision of a hypothetical monopolist e-retailer at this particular virtual location.

To illustrate some of the complications that can arise in defining a relevant market in an online setting, I begin with a highly stylized hypothetical that ignores potential substitutes outside of the “virtual” market displayed in Figure 1. As will soon become apparent, even in this highly simplified environment—one that exclusively focuses on competition for this particular item sold within the confines of this specific comparison site (and thus ignores potential competition with retailers selling related products elsewhere)—it is hardly a trivial task to define a relevant market or to analyze competitive effects.

A. Establishing Market Fundamentals

Formal economic models indicate that market fundamentals—firms’ marginal costs, demand elasticities, numbers of competitors, initial constellations of prices, and so on—can play a critical role in defining a relevant market and/or analyzing competitive effects. I next discuss features of online competition that can potentially distort perceptions of market fundamentals.

¹⁰ Market definition differs in the case of price discrimination; see Section 1.12 of the *Guidelines*.

¹¹ Using the *Guidelines* definition, it is straightforward to construct a theoretical example of homogeneous product Cournot oligopoly such that a firm controlling only a subset of the identical products could profitably impose a small but significant and nontransitory increase in price, regardless of whether one permits rivals to adjust their prices and outputs. In practice, the *Guidelines* are rarely pushed this far, but it is not uncommon to exclude from the relevant market *some* firms that sell identical *physical* products (for example, paper or pens in the Staples–Office Depot case).

1. *Relevant Costs of Competing at Comparison Sites*

One of the striking features of price comparison sites is that they permit entrepreneurs domiciled in distant and even obscure locations to compete for consumers located in different cities around the world. The costs of establishing an online presence are typically perceived to be lower than those of establishing a brick-and-mortar presence because online sellers do not incur many of the costs that traditional brick-and-mortar establishments incur in opening and operating their businesses. However, it can be costly and take time for a new online seller to establish the reputation required to compete effectively against established retailers. Although these and other entry costs are potentially important in analyzing competitive effects in online markets, they are not relevant for market definition because that exercise presumes that a hypothetical profit-maximizing firm is “the only present and future producer or seller of those products in that area.” However, there are other costs that are somewhat unique to online markets, and it is important to take them into account when estimating an online seller’s relevant unit costs.

For instance, shipping costs can affect an online seller’s marginal cost, and accounting for such costs is important because online sellers sometimes quote prices that include “free” shipping and handling. Additionally, some online sellers may enjoy tax advantages over their competitors (stemming from their physical locations) that permit them to sell products to consumers located in other states without directly collecting sales taxes. Significantly, one of the more important, and sometimes overlooked, components of an online seller’s marginal cost is the click-through fees that it pays to the price comparison site for directing potential buyers to its own website to consummate a transaction.

More specifically, price comparison sites typically charge firms a fee each time that a consumer clicks on a link at the comparison site that directs the consumer to a particular retailer’s website. This fee is paid regardless of whether the consumer ultimately makes a purchase. Click-through fees generally vary for different types of products but often range from 40 cents to \$1 per click.¹²

Of course, not all consumers who click through to a retailer’s website ultimately decide to make a purchase. Conversion rates—the fraction of those consumers clicking through to a given firm’s website that ultimately makes a purchase—tend to vary across products. One source estimates that a typical online retailer must receive 20–30 clicks to generate a single sale.¹³ At a cost

¹² See Michael R. Baye, J. Rupert J. Gatti, Paul Kattuman & John Morgan, *A Dashboard for Online Pricing*, 50 CALIFORNIA MANAGEMENT REVIEW (2007). Some price comparison sites set *minimum* fees that range from \$.05 for books to \$1.00 for consumer electronics products, but merchants pay more than these minimums to obtain more favorable screen locations. See, for instance, <https://merchant.shopping.com/enroll/app?service=page/RateCard>.

¹³ See <http://www.marketingexperiments.com/ppc-seo-optimization/comparison-search-engines-tested-analysis.html>.

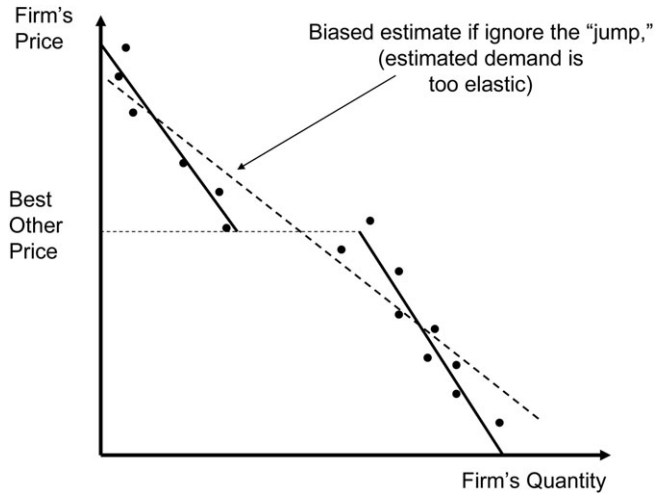


Figure 2. The presence of “shoppers” and “loyals” in online markets can result in biased estimates of the elasticity of demand.

of \$1 per click, this would imply that click-through fees add \$20–\$30 to an e-retailer’s marginal cost because, on average, it takes \$20–\$30 in clicks to sell a single item. Even abstracting from labor and other variable costs, this means that an online seller’s marginal cost of selling an item online can be significantly higher than the e-retailer’s wholesale cost of the item.

Failure to account for click-through fees, shipping costs, and other relevant components of online sellers’ marginal costs tends to bias downwards estimates of online retailers’ marginal costs. Other things equal, this biases upwards estimates of a hypothetical monopolist’s profits from a given SSNIP and may lead to distortions in market definition and/or the analysis of competitive effects.

2. Demand Elasticities

Although e-retailers sell physically identical items at price comparison sites, economic and marketing research indicates that some online consumers view the same item sold by different sellers as differentiated products. As a consequence, some consumers are loyal to a particular seller up to a reservation price.¹⁴ But there is also evidence that other consumers—as many as 13 percent—do not view online retailers as differentiated and buy purely on the basis of price.¹⁵ As illustrated by the solid demand curve displayed in Figure 2, the presence of these two types of consumers leads to a

¹⁴ Erik Brynjolfsson & Michael D. Smith, *The Great Equalizer? Consumer Choice Behavior at Internet Shopbots* (MIT Sloan Working Paper No. 4208-01, October 2001).

¹⁵ Michael R. Baye, J. Rupert J. Gatti, Paul Kattuman & John Morgan, *Clicks, Discontinuities, and Firm Demand Online* (Cambridge University Working Paper, July 2007).

discontinuity in a retailer's demand when its price moves from the second lowest price to the lowest price at the site: As a retailer lowers its price, its quantity demanded increases continuously as it enjoys more sales from its loyal base of customers. But once it lowers price slightly below the best other price at the site, it enjoys a discontinuous jump in demand because it attracts all of the price-sensitive shoppers, who always purchase from the firm charging the lowest price at the comparison site.

Even if both types of consumers have the same underlying elasticity of demand for the item (observe that this common elasticity corresponds to the one facing a hypothetical monopolist serving the entire virtual market), a firm that lowers its price below the "best other price" charged in the market enjoys a rightward jump in its demand. For prices higher than the best other price at the comparison site, the firm's demand consists purely of its base of loyal customers, who view purchasing the product from this firm as sufficiently different to justify paying a price premium. But once its price falls below the best price charged by its rivals, the firm not only sells to its loyal customers but also attracts *all* of the price-sensitive shoppers.¹⁶

Given data on the firms' prices and quantities (represented by the black dots in Figure 2), econometric analysis that does not account for a firm's jump in demand when it succeeds in charging the lowest price at the comparison site will yield an estimated demand function corresponding to the dashed line in Figure 2. Econometric analysis that recognizes that there are two types of consumers, and that a firm's demand jumps when it happens to charge the lowest price, will properly estimate the demands of both shoppers and loyal consumers. The proper estimate is represented by the solid black lines. As shown in the figure, ignoring the jump in demand due to the presence of shoppers and loyal consumers tends to result in biased estimates of both types of consumers' elasticity of demand for the underlying product.

In short, failure to account for the mix of shoppers and loyal results in a biased estimate of the hypothetical monopolist's elasticity of demand. This is not merely a theoretical possibility; recent empirical evidence suggests that failure to account for the jump in demand caused by the mix of shoppers and loyal consumers can lead to econometric estimates of the elasticity of *market* demand in a virtual market that is about twice as elastic as that obtained by accounting for the jump properly.¹⁷

¹⁶ Such a jump in demand when a firm offers the lowest price is also consistent with empirical evidence by Aninyda Ghose, Michael Smith & Rahul Telang, *Internet Exchanges for Used Books: An Empirical Analysis of Product Cannibalization and Welfare Impact*, 17 INFORMATION SYSTEMS RESEARCH 3–19 (2006).

¹⁷ Baye et al., *supra* note 15. The empirical evidence in this paper is based on clicks data rather than final sales data, but their Proposition 1 reveals that a demand elasticity may be inferred from a clicks elasticity.

In the context of market definition, this suggests that failure to account for discontinuities in demand that stem from low search costs in online markets tends to result in definitions of relevant markets that are too broad. For a given SSNIP, an upward bias in the estimated market elasticity of demand generally results in a downward bias in a hypothetical monopolist's change in profits.

3. Number of Competitors

Formal economic models of traditional markets indicate that competitive effects depend on the number of competitors. Intuitively, demand tends to be more elastic when there are more available substitutes.¹⁸ At a purely theoretical level, the same principle applies in virtual markets: The more rivals selling a given product at a comparison site, the more elastic any given e-retailers' demand. Recent empirical evidence by Baye, Gatti, Kattuman, and Morgan corroborates this empirically—at least for a select set of products sold at a particular price comparison site.¹⁹ Their results are illustrated in Figure 3, where the vertical axis indicates a representative retailer's elasticity of demand (in absolute value) and the horizontal axis indicates the number of rivals selling the same item at the comparison site. The estimates reveal that a representative retailer at the comparison site faces a more elastic demand when it competes against more rivals at that particular site. For instance, for products where only a single firm listed the product at the comparison site, a representative retailer's demand elasticity was about 2.5. Notice that this corresponds to the elasticity of demand of a hypothetical monopolist selling at the site. For products where six firms sold the same item, the estimated elasticity was about 10. Interestingly, these estimates imply that a firm's elasticity of demand in this virtual market is not as sensitive to the number of rivals as would be the case if firms were competing in a classical homogenous product Cournot fashion.²⁰ Moreover, these results represent empirical evidence that an individual firm's elasticity of demand in this virtual market depends on its number of rivals, and that a firm's demand is *not* perfectly elastic (as would be the case under perfect competition).

Importantly, the number of online competitors does not only have a bearing on market definition and competitive effects analysis through its potential impact on estimates of the elasticity of demand. The number of competitors can also directly have an effect on levels of price dispersion and

¹⁸ See, for instance, Chapter 3 in MICHAEL R. BAYE, *MANAGERIAL ECONOMICS AND BUSINESS STRATEGY* (McGraw Hill 6th ed. 2009).

¹⁹ Baye et al., *supra* note 15.

²⁰ In a symmetric Cournot model with homogenous products, an individual firm's elasticity of demand is n times the market elasticity (the elasticity faced by a monopolist), where n denotes the number of Cournot firms (see Chapter 11 in Baye, *supra* note 18). The dotted line in Figure 3 shows this implied elasticity.

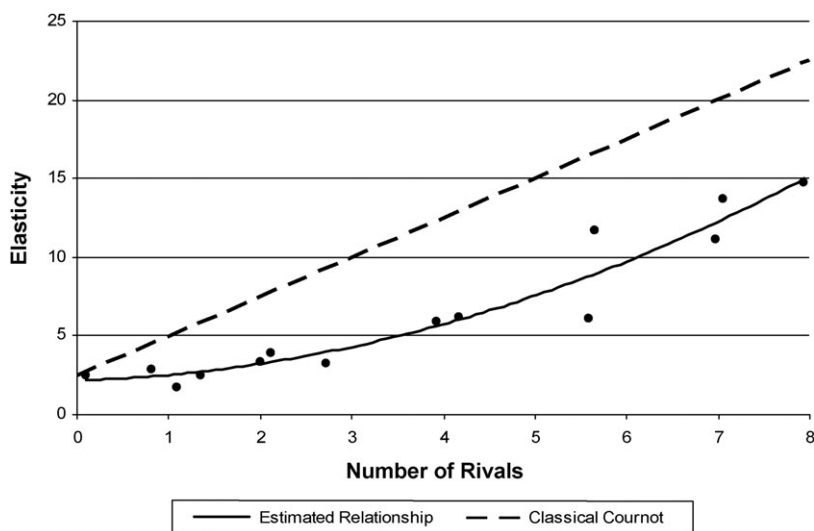


Figure 3. Estimates of a firm's actual elasticity of demand in an online market compared with that predicted under the classical Cournot model (source for data: Michael R. Baye, J. Rupert J. Gatti, Paul Kattuman, and John Morgan, *Clicks, Discontinuities, and Firm Demand Online* (Cambridge University Working Paper, July 2007)).

the average price that a firm charges at a comparison site. Additionally, as a result of day-to-day variation in an online retailer's decision to post its price at a comparison site, the actual number of firms that directly compete at a particular price comparison site generally exceeds the number of firms that might list their prices for a particular item on any given date. To understand these and other subtleties that arise in online markets better, it is necessary to take a brief journey into alternative models of competition at price comparison sites.

B. The Model Matters: Competitive Effects on Whom?

As in traditional markets, market definition and competitive effects in an online context depend on the underlying model of competition that reflects the behavior of consumers and firms. Consider, for instance, the models of Varian and Rosenthal, which have been used to analyze competition at price comparison sites.²¹ These models presume that there are two types of consumers, which one may think of as shoppers and loyal consumers. Both types of consumers have no alternative but to shop at the comparison site, and have a common reservation price for the product, which is assumed to be the monopoly price. Shoppers always purchase from the firm offering the

²¹ For a more detailed discussion of these and other models of online price competition, see Baye et al. (*supra* note 2) as well as Baye et al. (*supra* note 3).

lowest price, whereas loyal consumers always purchase from their preferred retailer because they have a preference for its differentiated characteristics. Because a retailer cannot identify which type of consumer is clicking and therefore cannot price discriminate across consumers, it charges a single price.

The presence of these two types of consumers creates a tension for retailers. On the one hand, if all consumers were loyal consumers, each firm would price at the reservation price, which corresponds to the firm's monopoly price based on its private stock of loyal consumers. In this case, each firm fully exploits its market power over captive loyal consumers (it cannot attract consumers who are loyal to the characteristics of other firms by cutting price). On the other hand, if all consumers were shoppers, homogeneous product Bertrand competition would ensue and firms would price at marginal cost in a symmetric equilibrium.²² But with a mix of both shoppers and loyal consumers, the only equilibrium is for each firm to randomize its price to prevent its rivals from being able to predict its price systematically and undercut that price to capture all of the price-sensitive shoppers. The equilibrium has the property that prices are dispersed—a phenomenon that Varian calls “temporal price dispersion.” Similarly, a retailer's position in the distribution of prices changes randomly over time. Because retailers' prices vary randomly over time, it is appropriate to base competitive effects analysis on each firm's average price rather than a particular price that is realized on any given date.

The equilibrium distribution of prices (and hence the average price charged by each retailer) in these models depends on all of the market fundamentals discussed earlier, including the number of retailers. Because a change in the number of retailers competing at the site changes the equilibrium distribution of prices, one could in principle define a relevant market or examine competitive effects based on an analysis of the impact of changes in the set of competitors on the average prices paid by consumers who use the comparison site. Rather than work through the rather tedious arithmetic required for such calculations, it is instructive to discuss more broadly some of the conceptual issues that can arise in these and other online markets.

First, subtle differences in formal economic models can lead to profoundly different competitive effects. In the Rosenthal model, for instance, each firm is assumed to bring its own base of loyal customers into the market. Consequently, as the number of firms shrinks, any one firm's base of loyal customers remains unchanged.²³ Other things being equal, the

²² More generally, two firms would price at marginal cost and the other firms would set prices at or above this level, but in any event all transactions would occur at marginal cost.

²³ This modeling convention may be appropriate in situations where traditional branded retailers entering or exiting an online market bring their own stock of loyal consumers with them.

fewer firms that compete at a comparison site, the more likely it is that any one of them will succeed in charging the lowest price. As a consequence, a reduction in the number of firms in the Rosenthal model causes them to price more aggressively, and this alters the equilibrium distribution of prices such that the average prices paid by both shoppers and loyal consumers actually *declines* as the number of retailers using the comparison site decreases. This feature of the Rosenthal model turns the usual intuition regarding unilateral competitive effects on its head.

In contrast, the Varian model essentially assumes a fixed overall number of loyal consumers, and any one firm's share of loyal consumers increases as the number of firms selling at a comparison site declines. A reduction in the number of competitors thus changes the equilibrium distribution of prices in a manner that harms shoppers but benefits loyal consumers. In particular, shoppers always purchase at the lowest price at the comparison site, and the expected minimum price rises as the number of retailers at the site declines. But on average, loyal consumers pay the average price listed at the comparison site, and the average price declines as the number of retailers at the site decreases. In short, a reduction in the number of retailers in the Varian model increases the average prices paid by shoppers but decreases the average price paid by loyal consumers. As a consequence, the competitive effects of a merger differ in this instance depending on whether one analyzes the impact of the competitive effects on loyal consumers, shoppers, or some weighted average of the two.

Further complicating an analysis of competitive effects is the fact that a reduction in the number of competing retailers in these models also depends on whether loyal consumers "reposition" themselves such that each retailer maintains a symmetric number of loyal consumers. Equilibrium analysis (and the analysis of competitive effects) in related models with asymmetries is even more complex.²⁴

Finally, it is important to note that all of the models described thus far assume that the number of competitors "inside" the virtual market—that is, the number of firms that list on the site at any point in time—is the competitively relevant number of firms. Thus, in our simple hypothetical, there are six retailers listing prices at the comparison site so there are at most six retailers in the relevant market. Whether one can further narrow the market to a subset of these retailers depends not only on which model is used and whether one evaluates the impact on shoppers, loyal consumers, or some weighted average of the two, but also on whether loyal customers reposition themselves.

The Baye-Morgan model generalizes the above models of competition in two respects. First, the model explicitly accounts for the price comparison

²⁴ For an analysis of the asymmetric case, see Michael R. Baye, Dan Kovenock & Casper G. de Vries, *It Takes Two to Tango: Equilibria in a Model of Sales*, 4 GAMES AND ECONOMIC BEHAVIOR 493–510 (1992).

site's incentive to price the use of its "virtual" real estate optimally. The authors show that comparison sites have incentives to charge low (often free) fees to consumers who access the site to attract as many consumers as possible to their site. This creates a virtuous circle: A large number of consumers visiting the site makes it advantageous for retailers to use the site to attract online shoppers from more distant locales. Comparison sites earn their profits through the fees charged to retailers who sell products through their sites.

Secondly, retailers in the Baye-Morgan model can opt out of using the comparison site by simply listing their prices at their own website or (if they have a physical presence) their brick-and-mortar operation. Likewise, consumers have the option of purchasing the product directly from a retailer's own website or its physical brick-and-mortar store.

Accounting for the fees that retailers pay to use the comparison site, as well as both firms' and consumers' ability to transact outside of the "virtual" market located at the comparison site, has potentially important implications for market definition and competitive effects analysis. First, as in the Varian and Rosenthal models of online price competition, the prices observed at the comparison site are dispersed, and firms' positions in the distribution of prices change over time. As before, this implies that it is appropriate to base the hypothetical monopolist test or competitive effects analysis on appropriately determined average prices, and that the results may depend on whether one focuses on shoppers, loyal consumers, or a weighted average of the two.

Secondly, retailers in the Baye-Morgan model also randomize the timing of their listings at the site to prevent rivals from being able to predict the intensity of online competition systematically. Consequently, the Baye-Morgan model implies that the number of retailers that actually list their prices at a comparison site on any given date is a random variable, and thus can vary randomly over time. Furthermore, the average number of retailers listing prices at a comparison site on any given date is *less* than the total number of relevant competitors in the market. In the context of the screenshot in Figure 1, the Baye-Morgan model implies that there are likely to be significantly more than six relevant competitors at this particular site—even when one abstracts from potential competition created by the presence of other price comparison sites or retailers that sell other varieties of cameras.

IV. CONCLUSIONS

This paper has highlighted a few aspects of online markets that complicate market definition and competitive effects analysis. In concluding, it is important to stress two points. First, market definition is merely a methodological tool and not an end in itself. Although debates regarding market definition should not sidetrack an evaluation of unilateral competitive effects—the heart of horizontal merger analysis—the reality is that

complexities and misperceptions regarding the competitiveness of online markets may heighten disagreements about market definition and/or competitive effects analysis in horizontal merger cases.

Secondly, I stress that the issues discussed here are not exhaustive. Nor do they necessarily apply to all online markets. A variety of other factors can affect market definition and competitive effects analysis in online markets, such as cost heterogeneities, firms' screen locations at a price comparison site, or locations of banner ads, reputation, certification, product depth, whether an online seller also has an offline presence, and so on.²⁵ And as in traditional markets, potential entry and efficiency considerations can affect bottom-line assessments of likely competitive effects.

²⁵ See, for instance, Paul Resnick & Richard Zeckhauser, *Trust Among Strangers in Internet Transactions: Empirical Analysis of eBay's Reputation System*, 11 *ADVANCES IN APPLIED MICROECONOMICS* 127–58 (2002); Pei-Yu Sharon Chen & Lorin M. Hitt, *Measuring Switching Costs and the Determinants of Customer Retention in Internet-Enabled Business: A Study of the Online Brokerage Industry*, 13 *INFORMATION SYSTEMS RESEARCH* 255–74 (2002), and Baye et al., *supra* note 15.