Chapter XX

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ENTRY AND EXIT EVENT ANALYSIS

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Economists have analyzed incumbent responses to entry and exit by competitors as probative of competitive effects in several recent high profile mergers. This chapter argues that an incumbent's response to entry or exit may be probative of competitive effects of merger because these responses reveal whether premerger pricing is competitive and, therefore, whether the elimination of one competitive constraint through merger is likely to change competitive outcomes. This interpretation contrasts with the more common interpretation that simulates postmerger prices by equating the effects of entry and exit with merger. Such simulation may either overstate or understate the effects of merger, depending on the circumstances. This chapter also considers two types of issues that may arise in entry and exit event analysis. The first is in the interpretation of the estimated causal effects of entry and exit on incumbents. The second is in the estimation of these effects.

1. Introduction

In recent years, antitrust merger analysis has increasingly sought to employ empirical techniques to assess competitive effects. One empirical tool that has gained popularity is the analysis of "natural experiments."[1] In a merger context, a natural experiment is an historical event beyond the control of the merging parties for which market reactions may be informative about prospective merger effects. This chapter focuses on a particular kind of natural experiment: incumbent responses to entry and exit of competitors.

Systematic analysis of entry and exit of competitors was first used in court to assess prospective merger effects in *Staples,*[2] a proposed merger of office superstores. The critical issue in that case was whether office superstores were significantly constrained only by other office superstores and not by a broader range of stores selling office supplies. Both the Federal Trade Commission (FTC) and the merging parties relied heavily on econometric analyses of store pricing to buttress their respective theories of competitive effect in court. Among other things, both sides analyzed how office superstore prices changed subsequent to entry or exit of

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[1] *See* U.S. DEP'T OF JUSTICE & FEDERAL TRADE COMM'N, COMMENTARY ON THE HORIZONTAL MERGER GUIDELINES (2006) ("Evidence pointing directly toward competitive effects may arise from statistical analysis of price and quantity data related to, among other things, incumbent responses to prior events (sometimes called 'natural experiments') such as entry or exit by rivals.") [hereinafter 2006 MERGER GUIDELINES COMMENTARY], *available at* http://www.usdoj.gov/atr/ public/guidelines/ 215247.pdf.

[2] FTC v. Staples, Inc., 970 F. Supp. 1066 (D.D.C. 1997).

nearby competing office superstores. Since both sides believed it to be informative about prospective merger effects under the *1992 Merger Guidelines*,[3] their dispute was over the econometric details of the analysis and not whether the analysis had probative value in the first place. Based in part on its entry and exit event analysis, the FTC concluded that the presence of a competing office store *caused* lower prices at nearby office superstores and concluded that a merger between Stapes and Office Depot would have an anticompetitive effect. The district court agreed.[4]

But in what sense is an incumbent's response to entry or exit of a nearby competitor probative of prospective merger effects? While *Staples*-inspired analyses have gained popularity,[5] there has been little rigorous examination of their relevance to merger analysis. This lack of examination is troubling because the interpretation of entry and exit event analysis is not as straightforward as the interpretation of other natural experiments, such as prior mergers in similar markets. This chapter's main conclusion is that an incumbent's reactions to historical entry or exit by competitors can be probative of the likely effects of merger not because the competitive effects of exit are identical to that of merger, but rather because reactions to entry and exit reflect the extent of premerger competition. The existence of vigorous premerger competition implies that the elimination of one competitor, and hence one source of premerger competitive constraint, will not result in any substantial lessening of competition postmerger.

The chapter proceeds as follows. Section 2 defines entry and exit event analysis and offers an interpretation that allows this analysis to be informative about a merger's likely competitive effects. In particular, Section 2 argues that entry and exit event analysis reveals whether premerger pricing is competitive and, therefore, whether the elimination of one competitive constraint through the merger is likely to change competitive outcomes. Section 3 outlines how a common interpretation of entry and exit event analysis allows for the direct prediction of postmerger prices. It lays out the necessary assumptions for this interpretation and concludes that they are generally unlikely to be valid. Section 4 considers issues in the interpretation of the estimated causal effects of entry or exit on measures of an incumbent's prices.

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3   *See* U.S. DEP'T OF JUSTICE & FEDERAL TRADE COMM'N, HORIZONTAL MERGER GUIDELINES § 2 (1992) (with Apr. 8, 1997 revisions to Section 4 on efficiencies) [hereinafter 1992 MERGER GUIDELINES], *reprinted in* 4 TRADE REG. REP. (CCH) ¶ 13,104.

4.   For a detailed review of the econometric analysis in *Staples*, see, e.g., Orley Ashenfelter, David Ashmore, Jonathan B. Baker, Suzanne Gleason & Daniel S. Hosken, *Empirical Methods in Merger Analysis: Econometric Methods in FTC v. Staples*, 13 INT'L J. ECON. BUS. 265 (2006); and Jonathan B. Baker, *Econometric Analysis in FTC v. Staples,* 18 J. PUB. POL'Y & MARKETING 11 (1999).

5.   *See, e.g.*, FTC v. Whole Foods Market, 502 F. Supp. 2d 1 (D.D.C. 2007), and the associated Expert Report of Kevin M. Murphy, *available at* http://www.ftc.gov/os/caselist/0710114/ 070823murphy.pdf. While public information is limited, similar analysis was also carried out in The Great Atlantic & Pacific Tea Company's acquisition of Pathmark Stores. The author provided expert analysis for The Great Atlantic & Pacific Tea Company in connection with this acquisition. *Cf.* Great Atl. & Pac. Tea Co., Docket No. C-4209 (FTC 2007) (final consent decree), *available at* http://www.ftc.gov/os/caselist/0710120/080104do.pdf.

Section 5 proposes some "best practices" for the econometric estimation of these effects. Section 6 briefly concludes.

2. Entry and exit event analysis and its relation to merger effects

Entry and exit event analysis systematically studies how incumbents respond to nearby entry and exit of competitors. Typically, the analysis econometrically estimates changes in some measure of incumbent prices charged to consumers due to entry or exit of nearby competitors. Used this way, the principal benefit of the application of econometric techniques is that it permits for a causal interpretation to be attached to the response: an entry or exit *causes* an incumbent to respond.

A measure of how entry and exit of competitors causes incumbent firms to change prices reveals the degree of competition in markets. For example, a significant decrease in price following entry indicates that the entrant constrains the incumbent's pricing and that the incumbent exercised market power pre-entry. By contrast, lack of a price response to entry of a competitor implies that the incumbent had no market power prior to entry and, therefore, was already constrained to price at competitive levels. These responses may be useful in studying how a merger—which eliminates one competitor and hence one source of premerger competitive constraint—is likely to affect postmerger prices paid by consumers.

In this sense, entry and exit event analysis is probative of likely prospective merger effects. Suppose that firms A and B are proposing to merge and that the analysis indicates that B's entry or exit does not affect A's pricing. In many cases, the only explanation for lack of a pricing response is that firm A exercised no market power prior to entry so its prices were already at competitive levels. Moreover, firm B's presence is not necessary to constrain firm A to competitive pricing so that the elimination of this competitive constraint through merger is unlikely to result in market power. The analysis may also measure incumbent responses to entry and exit of firms not involved in the merger, that is, while firms A and B are proposing to merge, the analysis might measure A's response to entry of a third firm, C. Two additional steps, however, should be taken before equating lack of incumbent response with lack of anticompetitive merger effects. First, independent evidence should verify that the entrant's product is at least as close a substitute to the incumbent's product as is the other merging party's product, since incumbent responses to entry by firms in another market will not be informative about the effects of merger between firms in the same market. Second, there should be verification that the incumbent's lack of response is not caused by competition from the other merging party, perhaps by checking for lack of incumbent responses in areas where the other merging party is not present.

Conversely, suppose that the entry and exit event analysis indicates that entry caused a decrease in the incumbent's pricing. Since there was room for the incumbent to drop its prices, the analysis now suggests that the incumbent's prices were not at competitive levels pre-entry. But even in this case, a merger will not necessarily result in higher prices. The observed reduction in price subsequent to entry, for example, may have been driven by the close substitutability of the products

sold by the entrant and incumbent, while the merger may involve much more distant competitors. On the other hand, a merger involving closer competitors could very well result in higher prices. This is not to say that one can, or should, equate merger and entry effects. As explained in the next section, postmerger pricing and pre-entry pricing will, in general, not be equal.

At first glance, it may be surprising that entry or exit of close competitors may not necessarily cause a significant incumbent response. In fact, economists have formulated models of competitive interaction whose implications vary from large to no effects of entry on price. For instance, in the contestable markets literature, the mere threat of entry forces price to competitive levels, so that actual entry should have no effect on prices.[6] On the other hand, in some entry barrier models, only actual entry has an effect on price.[7] However, most economists would agree that if there are sufficiently many non-colluding firms selling sufficiently close substitutes in the relevant market, then price effects from entry or exit should be minimal. The difficulty is in determining this threshold level—or at least determining whether one is above it or below it—in a particular market in which a merger will occur, especially since the threshold number may differ significantly from market to market depending on a wide variety of factors, including the nature of the products, the precise locations of the products in a differentiated product space, the demand characteristics of consumers in the market, and behavioral peculiarities of the incumbent firms, to name just a few.

The idea that there is a threshold number of firms sufficient to ensure competition in a given market is argued eloquently and tested empirically by Bresnahan and Reiss,[8] who studied how the total size of the market divided by the number of firms (i.e., the average quantity per firm) varies as the number of firms changes. They argue that when average quantity sold per firm is constant beyond a certain threshold number of firms, then pricing must be at competitive levels when there are more incumbents than this threshold number. The reason is that entry will occur whenever fixed costs can be just covered by variable profits. If each additional entrant serves the same number of consumers and pays the same fixed costs, then each additional entrant must have the same markup of price over marginal cost. Moreover, this markup must be competitive because it is the lowest that permits firms to cover fixed costs.[9] Bresnahan and Reiss study five industries (druggists, tire dealers, doctors,

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6. *See generally* WILLIAM J. BAUMOL, JOHN C. PANZAR & ROBERT D. WILLIG, CONTESTABLE MARKETS AND THE THEORY OF INDUSTRY STRUCTURE (1982).

7. For example, whereas older models of limit pricing argued that entry decisions may be affected by incumbents' pre-entry prices, more recent models stress that entry decisions should be affected by expected postentry prices. Thus, the mere threat of entry need not affect industry prices. *See* Paul Milgrom & John Roberts, *Limit Pricing and Entry under Incomplete Information: An Equilibrium Analysis*, 50 ECONOMETRICA 443 (1982).

8. Timothy F. Bresnahan & Peter C. Reiss, *Entry and Competition in Concentrated Markets*, 99 J. POL. ECON. 977 (1991).

9. As an example, consider a monopolist with marginal cost of $2, fixed costs of $100, and a profit-maximizing price of $12. Variable profit is $10 per unit so, in order to at least break even the monopolist must sell 10 units to cover its fixed cost. Suppose demand increases just enough to allow for entry by another (symmetric) competitor and the new competition leads to a lower price,

dentists, and plumbers) in a set of small towns and find, perhaps surprisingly, that price is at competitive levels whenever there are three or more firms within a particular town. This suggests that at least some markets may operate competitively when concentration levels are outside the safe harbors of the *1992 Merger Guidelines*. In such cases, an entry and exit event analysis may be useful to assess whether markets were operating competitively.

To see more formally how entry effects are related to the nature of competition, consider a simple model of symmetric Cournot competition where the inverse demand function is given by $p = a - q$ and marginal costs are constant and denoted by c. Here, q represents total quantity produced, p represents price, and a is a parameter that indicates strength of demand. Denoting the number of competitors by n, the Cournot equilibrium price is given by:

$$p = \frac{a}{n+1} + \frac{nc}{n+1} \tag{1}$$

As Equation (1) shows, in equilibrium, as the number of competitors n grows, price p decreases, at a decreasing rate, towards marginal cost c. Thus, if entry—that is, an increase in the number of competitors from n to $n + 1$—is estimated to cause only a small decrease in price, then one may conclude that incumbent pricing was constrained by a substantial number of competitors pre-entry. In such markets, a merger of two competitors is unlikely to have substantial effects on price.

3. Interpreting entry and exit effects as merger effects

The interpretation of entry and exit analysis as revealing the degree of premerger competition does not equate entry or exit with merger. Indeed, neither entry nor exit should generally be equated to merger. Nevertheless, applications of entry and exit event analysis in some recent merger investigations have used an interpretation that implicitly equates entry or exit effects with merger effects.

In *Staples*, both sides used estimates of the effect of exit to predict, or simulate, postmerger prices.[10] Simulated postmerger prices were constructed by estimating the effect of exit by a single store and multiplying this effect by the number of surrounding acquired stores. For example, suppose the exit effect on a firm is estimated to be negative five percent, that is, the exit of a nearby store increases price at the incumbent store by five percent. If the firm then merges with another firm, which has two stores in the surrounding area, then the simulated postmerger price will be ten percent higher than the premerger price (two times five percent). This approach necessarily equates changes in prices due to merger to changes due to exit. While perhaps the analysis in *Staples* was motivated by a desire to estimate effects

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say $7. Each firm now earns $5 per unit so that demand must be such that per firm quantity is 20 units in order to cover fixed costs. Thus, when additional firms are associated with an increase in per firm output, entry must decrease prices and margins. However, if output per firm is observed to be unchanged as the number of firms increases (and demand increases), then prices must be just at the competitive, zero-profit level (i.e., sufficient to cover fixed costs).

10. *See* Ashenfelter et al., *supra* note 4, at 270.

that appear precise, the parties appear to have interpreted price effects stemming from exit and merger synonymously.

In *Whole Foods*, the government expert conducted an entry and exit event analysis and found that entry by Whole Foods had a substantial effect on Wild Oats' prices, margins, and sales. He also reported that entry by no other competitor had similar effects. Instead of simulating postmerger prices on the basis of this analysis, he interpreted his analysis as demonstrating that Whole Foods and Wild Oats were each other's "most significant individual competitors."[11] An implication of the analysis (that was not explicitly made) is that the existence of other supermarkets was insufficient to constrain Wild Oats' pricing to competitive levels. In contrast with the government expert's interpretation of his entry and exit event analysis, a reading of the *Whole Foods* decision reveals the merging parties implicitly did equate entry and exit effects to merger effects. For instance, the merging parties criticized the government expert because he did not estimate the effect of Wild Oats' exits on Whole Foods' prices, ignoring something "more relevant" than the effects of Whole Foods entry on Wild Oats.[12] That the merging parties argued that these former events were "more relevant" was likely the result of their viewing the analysis as a way of simulating postmerger prices because Whole Foods was the acquiring firm and had planned to close some (but not all) Wild Oats stores postmerger. In other words, the effect of Wild Oats' exits on Whole Foods' prices was "more relevant" because the merger and Wild Oats' exits would both affect Whole Foods' prices identically. The judge agreed with this criticism: "The Court is unwilling to accept the assumption that the effects on Wild Oats from Whole Foods' entries provide a mirror from which predictions can reliably be made about the effects on Whole Foods from Wild Oats' future exits if this transaction occurs."[13] That the court viewed it necessary to interpret the government expert's analysis with a "mirror" implies that it also interpreted entry and exit event analysis as only useful when it permits the simulation of postmerger prices.

Can an entry and exit event analysis be used to simulate postmerger prices? In general, the answer is that postmerger prices simulated on the basis of entry and exit events are biased. Moreover, the bias may either understate or overstate postmerger prices. Critically, however, the existence of this unknown bias does not undermine the logic of why entry and exit event analysis is probative of likely merger competitive effects that were described in Section 2.

Two simple models illustrate the bias and the different directions it can take. To begin, define the pre-entry, postentry, and postmerger cases as follows.

- *Pre-entry*: a single firm sells a single product (firm A sells product 1).

- *Postentry*: two independent firms sell two differentiated products (firm A sells product 1 and firm B sells product 2).

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11.   Murphy report, s*upra* note 5, at 2.

12.   FTC v. Whole Foods Market, 502 F. Supp. 2d 1, 20 (D.D.C. 2007).

13.   *Id*. at 35.

- *Postmerger*: a single firm sells two differentiated products (firm A sells products 1 and 2).

An "entry effect" is the difference between the postentry and pre-entry prices of product 1, while a "merger effect" is the difference between the postmerger and postentry price of product 1. These two effects coincide if and only if the prices of product 1 are equal in the postmerger and pre-entry cases. If the postmerger price is greater than the pre-entry price (i.e., the merger effect is greater than the entry effect), then using entry effects to simulate postmerger prices will *understate* the effect of merger. Conversely, if the postmerger price is smaller than the pre-entry price (i.e., the merger effect is smaller than the entry effect), then using entry effects to simulate postmerger prices will *overstate* the effect of merger.

An obvious and important difference between pre-entry and postmerger can be that product 2 is not sold pre-entry but is sold postmerger, that is, the set of products postmerger is larger than the set of products pre-entry. This, of course, assumes that the merged firm does not eliminate one of the overlapping products, which it sometimes does. Where the merged firm keeps both products, some customers who purchased product 1 pre-entry may purchase product 2 postmerger. The postmerger firm internalizes lost sales of product 1 that accrue to product 2 because it captures profits from the sale of both products. This internalization generally causes the firm's pricing to differ postmerger and pre-entry. Whether this internalization causes postmerger price to be higher or lower than pre-entry price depends on whether product 2 attracts proportionally more customers with a higher or lower valuation for product 1. In the case where product 2 attracts customers with a lower valuation for product 1, the customers that continue to purchase product 1 will be less price sensitive. Faced with less price sensitive customers, the firm will price product 1 higher in the postmerger case than in the pre-entry case. Drug pricing is a convenient illustration: the prices of branded drugs often increase subsequent to generic entry.[14] Using the entry effect to simulate the effect of a branded-generic merger on branded prices would predict that postmerger branded prices would be *lower* than premerger prices. This contrasts with economic models that predict *higher* postmerger branded prices given substitution between the two drugs and the branded drug's having some market power. Thus, simulated postmerger prices calculated via an entry and exit event analysis will *understate* the effect of merger. In the opposite case (product 2 attracts customers with a higher valuation for product 1), the firm will price product 1 lower in the postmerger case than in the pre-entry case. Thus, simulated postmerger prices calculated via an entry and exit event analysis will *overstate* the effect of merger. As an illustration, suppose the incumbent sells a low quality good and the entrant sells a high quality good. Entry will cause a change in price of the low quality incumbent that is greater than the price change brought about by merger. Thus, simulated postmerger prices overstate actual effects.

Two simple economic models illustrate this logic and show how postmerger prices may differ from pre-entry pricing depending on whether product 2 captures

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14. *See* FEDERAL TRADE COMM'N, GENERIC DRUG ENTRY PRIOR TO PATENT EXPIRATION: AN FTC STUDY (July 2002), *available at* http://www.ftc.gov/os/2002/07/genericdrugstudy.pdf.

consumers with high or low valuation for product 1. Product differentiation is essential to all these models because, without product differentiation, the set of products sold postmerger will not be larger than the set of products sold pre-entry.[15] And, following the logic above, the firm will charge identical prices to the pre-entry firm because its pricing trade-off remains unchanged.

The first model is a simple model of vertical, or quality, differentiation.[16] In this model, the postmerger price of product 1 may be *lower* than the pre-entry price of product 1. The intuition for this result is that the second product is a sufficiently high quality product that will be sold to consumers who value quality relatively more than those consumers who purchase product 1. The purchasers of product 1 are relatively more price sensitive in the postmerger case than in the pre-entry case, so the firm lowers the price of product 1. In this model, firms produce the products with constant zero marginal costs. Customers, when purchasing product 1, have utility given by:

$$U = v - p_1 \tag{2}$$

where v is a customer's taste for quality (large v means customers value quality more) and p_1 is the price of product 1. The measure of quality of product 1 is normalized to equal one. Assume that v is distributed uniformly on the unit interval. In the pre-entry (i.e., one good is sold) case, it can be shown that firms will maximize profits when $p_1 = \frac{1}{2}$. Now consider the postmerger case where product 2 is sold by the same firm. Customers, when purchasing product 2, have utility given by:

$$U = av - p_2 \tag{3}$$

where a is a parameter that represents the quality of the second good. Assume $a > 1$, so that this is a higher quality good than the first. Under these conditions, it can be shown that the following prices maximize the firm's profits:

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\begin{aligned}
p_1 &= (a-1)/(4a-5) \\
p_2 &= 2a(a^2-1)/(4a-5)
\end{aligned}
\tag{4}
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15. In undifferentiated Cournot (quantity) competition with constant marginal costs, pre-entry and postmerger prices are identical. Such a model is probably inappropriate to study merger, however, because merger is equivalent to exit of a firm, by construction (i.e., both merger and exit reduce the number of firms from n to $n - 1$). Several authors have recognized this shortcoming and, in response, have formulated models of Cournot competition with non-constant marginal costs and merger-specific efficiencies. For example, costs may differ across firms and merger may result in cost synergies. *See, e.g.*, Martin K. Perry & Robert H. Porter, *Oligopoly and the Incentive for Horizontal Merger,* 75 AM. ECON. REV. 219 (1985); Joseph Farrell & Carl Shapiro, *Horizontal Mergers: An Equilibrium Analysis,* 80 AM. ECON. REV. 107 (1990). In an auction context, Waehrer and Perry present a model with capacity constraints where the pre-entry price is higher than the postmerger price. *See* Keith Waehrer & Martin K. Perry, *The Effects of Mergers in Open-Auction Markets*, 34 RAND J. OF ECON. 287 (2003). An important implication of these models is that where merger synergies are present, postmerger prices may be lower than pre-entry prices for reasons unrelated to strategic interaction.

16. This model is taken from JEAN TIROLE, THE THEORY OF INDUSTRIAL ORGANIZATION 96 (1998) (discussing vertical differentiation).

To see that pre-entry prices for product 1 are higher than post-merger prices for product 1, it suffices to check the inequality $1/2 > (a-1)(4a-5)$. This inequality reduces to $a > 3/2$. Under this condition, postmerger prices will be lower than pre-entry prices. Thus, using the entry effect to simulate postmerger prices will *overstate* the effects of merger.

The second model is a model of horizontal differentiation.[17] In this model, the postmerger price of product 1 will be *greater* than the pre-entry price of product 1. The intuition for this result is that the second product is purchased by customers who value product 1 relatively less than those consumers who purchase product 1. Thus, the purchasers of product 1 are relatively less price sensitive in the postmerger case than in the pre-entry case, so the firm raises price. In this model, customers are located uniformly around a circle. A customer who purchases product 1 and travels a distance *d* has utility given by:

$$U = V - d - p_1 \qquad\qquad (5)$$

where *V* is the customer's willingness to pay (constant across all customers), and p_1 is the price of product 1. Intuitively, the customer suffers increasing disutility with the distance to travel. Suppose, the pre-entry case has a single shop located at 0 degrees. In the postmerger case, a single firm operates two shops located at 0 degrees and *x* degrees. Ignore the trivial case where *x* = 0, and also suppose that there is some competitive interaction between the shops (i.e., the transportation cost is not too high compared to the customer's willingness to pay). In the postmerger case, the firm will choose identical prices at both shops. Under these assumptions, postmerger prices must be greater than pre-entry prices. To see why, consider the limiting case where a firm has an increasing number of stores located uniformly around the circle. At the limit, the merged firm will charge the customer's willingness to pay. Thus, for each new store the firm adds, it will raise price to capture the rents associated with lowered customer transportation costs. It will do so because some customers that would not have purchased at all due to higher prices can purchase from a closer store owned by the same firm subsequent to the addition of a new shop. Thus, using the entry effect to estimate postmerger prices will *understate* the effects of merger.

As the preceding discussion has indicated, conducting an entry and exit event analysis in a way to simulate unbiased postmerger prices is a challenge. An interesting subject for future research might be to outline a feasible methodology that uses simulated postmerger prices to bound actual postmerger prices. But, as Section 2 argued, the probative value of entry and exit event analysis need not rely on such a methodology. Therefore, the rest of this chapter focuses on the interpretation of entry and exit event analysis as revealing the extent of premerger competition and discusses issues in interpreting the causal effects of entry or exit, and the estimation of these effects.

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17.   *See* Steven C. Salop, *Monopolistic Competition with Outside Goods*, 10 BELL J. ECON. 141 (1979).

4. Interpreting the causal effect of entry and exit

The proper interpretation of an incumbent's response to entry and exit by competitors as indicative of the level of competition in the market can be nuanced and complex. This section examines four such complications, without pretending to be exhaustive: (1) how assumptions about the symmetry of incumbent responses affect the probative value of the analysis; (2) choosing between prices and margins, which are complementary measures of incumbent responses to entry and exit; (3) the possibility of price increases as a profit-maximizing response to entry by a competitive product; and (4) interpreting an incumbent's response to entry and exit when pricing is not specific to a given store.

4.1. Asymmetric incumbent responses

Entry and exit need not have identical (but opposite) effects on measures of an incumbent's price. Additionally, firm A's response to firm B's entry need not be identical to B's response to A's entry. Nonetheless, most entry and exit event analyses assume some kind of "symmetric" incumbent response, and so it is useful to consider how the presence of asymmetric incumbent responses affect the probative value of the analysis as an antitrust merger tool. The presence of such asymmetric responses may be problematic if one uses entry and exit event analysis to simulate postmerger prices. However, if entry and exit event analysis is interpreted to reveal the extent of premerger competition, then interpretation of even asymmetric incumbent responses is straightforward.

Asymmetric incumbent responses were at issue in *Whole Foods* when the merging parties criticized the government expert for estimating the effects of Whole Foods' entry on Wild Oats rather than the effects of exit by Wild Oats on Whole Foods (since Whole Foods would be the surviving company).[18] The merging parties claimed that the government expert's econometric analysis was not probative of merger effects for two reasons. First, exit was "more relevant" than entry, presumably because it more closely mimicked the effect of a merger. Second, the effects of Wild Oats on Whole Foods was "more relevant" than the effects of Whole Foods on Wild Oats.

Consider an entry and exit event analysis that only measures incumbent responses to entry and does not measure responses to exit. Obviously, the probative value of the analysis is unaffected if entry and exit elicit identical (but opposite) incumbent responses. As a first point, it would seem surprising to expect nonidentical (but opposite) effects from entry and exit. In particular, for entry and exit effects to differ, current market outcomes must somehow be affected by past market conditions. For example, one reason for entry and exit effects to differ is that pricing in an economy is not only a function of the current number of firms in a market, but also a function of the past number of firms in the market. Without this dependence, pricing with n firms currently in the market would be unaffected whether $n+1$ firms operated in the past (exit) or $n-1$ firms operated in the past (entry). Perhaps for this

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18.   *Whole Foods*, 502 F. Supp. 2d at 13.

reason, economists usually formulate models that imply symmetric entry and exit effects.[19]   Assuming that entry and exit effects do differ, a second point is that significant effect of *either* entry or exit on a measure of incumbent prices is evidence that the incumbent exercised market power pre-entry (or post-exit). In *Whole Foods*, the fact that exit effects were not estimated should not have affected the probative value of the analysis. To the extent that the entry effects were estimated reliably, the analysis showed that Wild Oats reduced margins in response to Whole Foods' entry and so was not already constrained to price competitively by traditional supermarkets—a fact at odds with the merging parties' claims that traditional supermarkets constrained each of the merging parties to price competitively.

Next consider the probative value of an entry and exit event analysis that only measures firm A's response to firm B's entry or exit, and does not measure B's response to A. Such a limitation can be a serious shortcoming if postmerger prices were simulated based on how the acquiring firm's price changes subsequent to the acquired firm's exit. But as argued in prior sections, the probative value of entry and exit event analysis does not rest on its ability to simulate postmerger prices. And to the extent that the merging parties' criticism in *Whole Foods* was predicated on this understanding, it should not have changed the fact that the key insight should have been that Wild Oats exercised some degree of market power and priced above competitive levels prior to Whole Foods' entry.

4.2. *Choice of variable to be analyzed by entry and exit event analysis*

An entry and exit event analysis must identify variables that reflect how an incumbent responds to entry and exit. These variables should be indicative of market power if the analysis is taken to reveal the extent of premerger competition. Additionally, these variables should also be constructed in a reliable and transparent fashion. Two obvious and popular choices of such variables are price and margin. In practice, "price" is typically some price index of a market basket of goods. Margin is the difference between revenues less marginal cost divided by revenues— that is, the percentage markup over cost of goods sold. This subsection discusses generally the relative merits of each. In any particular application, however, either measure may have substantial advantages over the other. But in the absence of clear evidence to the contrary, an entry and exit event analysis can benefit from studying the effect of entry and exit on both of these measures.

The relative merits of prices compared to margins were at issue in *Whole Foods* since the government expert relied on margins instead of prices. The merging parties argued that this reliance was not based on sound economics, accounting, or financial

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19.   For example, the simple models of competition discussed earlier in this chapter (Cournot, quality differentiation, and the Salop circle) all have the characteristic that entry and exit cause an identical (but opposite) change in price. Other types of symmetry assumptions are also fairly common. For example, in demand estimation, standard econometric models imply an identical (but opposite) effect on quantity resulting from a 1% increase or decrease in price.

methodology and that any inferred effects would be relevant only if they would permit an inference about price.[20]

First, consider how well-constructed measures of price or margins can reveal the extent of premerger competition in an entry and exit event analysis. Certainly, prices are a direct measure of how consumers are affected so that if entry *causes* decreases in prices then this is indicative that pre-entry pricing was not competitive. However, it may be difficult to determine causality of this effect because prices may change in response to (unobserved) changes in input costs, beyond the control of the incumbent, that are coincidental to entry or exit events. Margins, of course, do account for such changes in input costs. Moreover, while the *level* of margins may be uninformative as to the degree of competition, *changes* in margins subsequent to entry or exit can be extremely informative about changes in the degree of competition.[21] In fact, margins are almost universally used by economists as a fundamental measure of the degree of competition. For example, the notion of differentiated Bertrand competition is widely used in merger analysis and this equilibrium concept implies that margins are related to demand elasticity. Along these lines, a useful and intuitive interpretation of margins is that they proxy for the price of retailing services. More specifically, retailers mark up the wholesale price of products they sell. Thus, in a merger of retailers that are not integrated into production, this markup may be viewed as the more relevant "price" affected by the merger.

Second, how reliably and transparently may margins and prices be constructed? Certainly, any economic variable can be unreliable if poorly constructed or measured, and margins and prices are by no means unique in this respect. In some cases, construction of margins may be much less fraught with difficulties than construction of prices. For instance, firms may fastidiously maintain a series of profit and loss statements in order to monitor performance, while "price" may actually be prices of a (very) large number of SKUs.[22] When confronted with such a scenario, economists commonly will construct a price index that is meant to capture overall pricing at a store, or a subset of products suspected of being impacted by the merger. In such a case, construction of price indices is a challenging (but not impossible) task for at least three reasons. First, an analyst must construct a price index based on a market basket of SKUs that reflects pricing of a large set of products. Such a requirement may require the selection of thousands of SKUs because an analysis of price based on a handful of products may miss the very competitive responses that are the goal of the study. Second, an analyst will likely

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20. *Whole Foods*, 502 F. Supp. 2d, at 13.
21. Models of competition predict that absolute gross margins (i.e., price less marginal cost) will be sufficient to cover fixed costs in equilibrium. Entry lowers these margins and occurs to the point when it is no longer profitable, that is, when an additional entrant would no longer be able to cover fixed costs, or net margins are low. Thus, if gross margins are "large" while net margins are "low," then pricing may be at competitive levels.
22. For example, Whole Foods stores featured over 30,000 natural and organic SKUs. This numerosity is independent of other complicating factors such as how store promotions affect actual price paid by consumers.

confront a significant amount of missing data. Typically, this occurs when an SKU is not sold at a given store in a given period. If the item is not sold, the analyst must somehow impute a price in a justifiable way. For example, if stores use zone pricing,[23] then it might be reasonable to impute prices at other stores within the same zone to missing observations. More troubling, however, is whether the observation is missing due to a high price. In this instance, any imputation might bias the price index away from accurately reflecting competitive responses. Third, the data required to construct price indices may contain errors significant enough to substantially affect any price index. In such instances, extensive "data cleaning" is necessary to construct meaningful indices.

In other cases, construction of margins may be problematic. For example, margins constructed from profit and loss statements typically do not hold constant the product mix so that changes in product mix may affect margins. Thus, the resulting estimation of effects will be unreliable to the extent that these changes are coincidental with entry and exit events. As another example, margins may only be available for certain sets of products. And to the extent that these sets do not coincide with the sets of products suspected of being impacted by the merger, estimation of entry and exit effects using margins may not be probative. In both of these examples, a price index may be constructed to focus in on a specific mix of products that can be held constant over time.

4.3. Incumbents may not lower price subsequent to entry even if they are pricing above competitive levels

Typical models of competition used in merger antitrust analysis have the property that a merger of two competitors necessarily raises price so long as the merger does not generate efficiencies.[24] These models imply that a price increase is a profit-maximizing response to a price increase by competitors. However, economic theory does not rule out that a price decrease, or no price response at all, is a best response to a price increase by competitors. The same economics imply that entry need not induce an incumbent to lower price and exit need not induce an incumbent to raise price.[25] Indeed, a price increase (or no price change) may be an incumbent's best response to entry, even when the incumbent is not constrained to price competitively pre-entry.

The economic theory as to why incumbents need not lower price subsequent to entry has been well understood since at least the mid-1980s.[26] The intuition is that the entrant may sell to a nonrepresentative cross-section of the incumbent's customers. Thus, if the entrant captures those customers that are particularly price

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23.   *See infra* Section 4.4.

24.   *See* Carl Shapiro, *Mergers with Differentiated Products,* ANTITRUST, Spring 1996, at 23; *Interview with Economist Robert D. Willig,* ANTITRUST, Spring 1997, at 11.

25.   An example of such behavior is drug pricing: a branded drug's price often increases subsequent to generic entry. *See supra* note 14.

26.   *See, e.g.*, Jeremy I. Bulow, John D. Geanakoplos & Paul D. Klemperer, *Multimarket Oligopoly: Strategic Substitutes and Complements*, 93 J. POL. ECON. 488 (1985).

sensitive (i.e., customers with more elastic demand), the incumbent will be left with customers who are price insensitive (i.e., customers with inelastic demand). When firms face more inelastic demand, they choose higher prices.

Consequently, in interpreting an incumbent's response to entry, it is important to understand whether the entrant attracts primarily price-sensitive customers, primarily price-insensitive customers, or a representative cross-section of customers. In the case where the entrant attracts primarily price-sensitive customers, the lack of an incumbent price response to entry may not imply that pre-entry pricing was at competitive levels. Higher prices could result if the incumbent's remaining customers become more price insensitive on average—the effects of the entrant's substantial additional competitive constraint might be offset by the change in the mix of the remaining customers. On the other hand, when the entrant attracts primarily price-insensitive customers or a representative cross-section of customers, a change in composition of customers cannot explain a lack of an incumbent price response.

To illustrate, consider the supermarkets relevant in *Whole Foods*. Both merging parties targeted customers who valued high levels of customer service and, thus, were likely less price sensitive than those targeted by traditional supermarkets.[27] There is no publicly available evidence indicating that one of the merging parties targeted particularly more price sensitive customers than the other merging party, and casually at least, there is no reason to believe that was the case. Therefore, it seems unlikely that the complication described in this subsection would be relevant for an estimate of Wild Oats' response to Whole Foods' entry. But now consider Wild Oats' response to entry by a traditional supermarket. Because the traditional supermarket likely captures price sensitive customers from Wild Oats, increased competition may be offset with Wild Oats facing less price sensitive customers postentry. Thus, lack of a price response need not imply lack of pre-entry market power. Conversely, because the merging parties likely capture few price sensitive customers from traditional supermarkets, a lack of a response by traditional supermarkets to entry by the merging parties does imply that traditional supermarkets were pricing competitively pre-entry.

4.4. Pricing may not be store specific

Firms may choose prices that are not uniquely tailored to each store they own. Instead, due to the costs involved in selecting prices for multiple objects in multiple stores, firms may use some variant of "zone pricing." The firm defines a zone as a set of stores with certain characteristics in common (such as geographic location or distance to the nearest competitor) and sets identical pricing at all stores within the zone.[28] To what degree does entry and exit event analysis retain its probative value

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27. *See* FTC v. Whole Foods Market, 502 F. Supp. 2d 1, 37 (D.D.C. 2007) ("Whole Foods and Wild Oats traditionally have offered a higher level of service than do the majority of conventional supermarkets.").

28. For a discussion of zone pricing in supermarkets, see Pradeep K. Chintagunta, Jean-Pierre Dubé & Vishal Singh, *Balancing Profitability and Customer Welfare in a Supermarket Chain*, 1 QUANTITATIVE MARKETING & ECON. 111 (2003). In *Staples*, the implications of zone pricing

when zone pricing exists, since the effect of a single entry or exit could be insufficient to change pricing throughout the entire zone?

Firms choose the strategies that determine the prices set at their stores. Antitrust analysis assumes that if a change in strategy is profitable, firms will pursue the change in strategy. Thus, if entry or exit caused a significant change in competitive conditions, then firms could change pricing throughout the zone, or, perhaps less dramatically, realign zone assignments to change prices. Such changes do not entail a wholesale reworking of pricing strategy, but rather entail a fairly commonplace reassignment of one store to a different zone.[29] That observed entry or exit has not been sufficient to elicit a response, in effect, simply implies that observed entry and exit did not change the competitive landscape. This indicates either that firms were pricing at competitive levels pre-entry or that that the data lack sufficient variability to make the analysis informative. If the latter explanation is plausible, then different data-driven methodologies, such as estimation of demand systems, may be useful in assessing likely merger effects.[30]

5. Reliable estimation of entry and exit effects

Even assuming away all complications in interpreting the effects of entry and exit, the analysis can be only as good as the reliability of the estimates of these effects. Three steps can generally increase the reliability of the econometric estimation of entry and exit effects: (1) cross-validation to help determine the "right" econometric model to estimate; (2) validation of the event data set by examining the effect of entry and exit on incumbent dollar sales, in addition to prices and margins; and (3) use of time series data over cross-sectional data in informing whether the presence of a competitor causes changes in incumbent prices or margins.

5.1. Econometric model selection via cross-validation

Entry and exit event analysis typically econometrically estimates the causal effect of entry and exit on an incumbent. A foundation of this estimation is an econometric model that specifies a mathematical function that permits a set of exogenous variables to affect an endogenous, or left hand side, variable. The application of econometric techniques in an entry and exit event analysis is no different than in other analyses in that the choice of econometric model all too often lacks a rigorous and objective justification. In other words, usually no justifiable methodology is proposed to choose a particular mathematical function that governs how the exogenous variables may affect the endogenous variables from among a potentially (very) large set of candidate mathematical functions. This is particularly problematic

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on incumbent responses to entry and exit were not a focus of either side's analysis despite the fact that office superstores were grouped into pricing zones based on geographic location.

29. Additionally, firms that use zone pricing often use a pricing strategy that allows for important exceptions. For example, firms may use store-specific specials on a subset of products to respond to competitive conditions. In this case, a response to this complication is to measure how pricing of these items is affected by entry and exit.

30. *See, e.g.*, 2006 MERGER GUIDELINES COMMENTARY, *supra* note 1, at 14, 30-31 (discussing *General Mills/Pillsbury* and *Maybelline/Cosmair* mergers).

when two opposing experts select different econometric models that generate qualitatively different results

A prominent example of such a "battle of experts" is in *Staples*. In that case, the two sides proposed different econometric models that reached rather dramatically different conclusions. The government expert selected an econometric model that implied that postmerger prices would be 8.6 percent higher than premerger prices. The merging parties' expert selected an econometric model that predicted postmerger prices would be 0.9 percent higher than premerger prices.[31] While the Court's decision did not rely explicitly on these econometric estimates, Baker argues that econometric analysis was influential.[32] In any case, the application of econometric techniques certainly becomes less useful to a court as the divergence in their predictions grows.

Fortunately, a statistical technique known as cross-validation can be of help in resolving questions of model selection. The intuition of cross-validation is appealing and easy to grasp.[33] Fundamentally, cross-validation uses out-of-sample prediction as the basis for model selection. Consider two competing econometric models, and define two types of mutually exclusive subsets of the data: an "estimation" set and a "validation" set. Cross-validation repeatedly estimates each model over different estimation sets and forecasts over different validation sets to capture a measure of "prediction error." The analyst then selects the model with the smallest prediction error. The statistical literature has explored the foundations of cross-validation and has shown that it dominates other model selection methods.[34]

There can be, literally, an infinite number of candidate econometric models from which to select. Hence, although cross-validation is valuable in selecting among a limited set of candidate econometric models, it cannot assess the performance of all possible candidate econometric models. The resolution to this problem is to apply economic theory to limit the set of candidate models.[35] One must first gain an understanding of the industry and then examine the implications of economic theory. For example, consider the problem of explaining the price of a finished good. An understanding of the industry may reveal that a certain raw material is not used in the production process nor is it relevant to those who consume the finished good. Economic theory may then be applied to eliminate the price of this raw material from candidate economic models because it is neither relevant to supply nor demand of the finished good. In another example, economic theory, informed by an understanding of the supermarket business, may imply that supermarkets and shoe stores do not

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31. *See* Ashenfelter et al., *supra* note 4, at 270. As this chapter has argued, while these "simulated price changes" lack a solid foundation, they do underscore the difference in the estimated effects of entry and exit.

32. *See* Baker, *supra* note 4.

33. For a brief introduction to the technique, see BRADLEY EFRON & ROBERT J. TIBSHIRANI, AN INTRODUCTION TO THE BOOTSTRAP ch. 17 (Monographs on Statistics and Applied Probability, No. 57 (1993).

34. *See* Jun Shao, *Linear Model Selection by Cross-Validation*, 88 J. AM. STAT. ASS'N 486 (1993).

35. *See* Halbert White, *Time-Series Estimation of the Effects of Natural Experiments*, 135 J. ECONOMETRICS 527 (2006).

compete. Thus, econometric models that include entry and exit of shoe stores should not be considered as candidate models in an entry and exit event analysis.

Cross-validation can be applied in entry and exit event analysis as well as other applications. For example, in *Staples*, one point of contention between the experts was the geographic area over which entry was permitted to affect an incumbent store's pricing. The merging parties' expert sponsored a model that estimated different entry effects based on the distance from the incumbent store, whereas the government expert sponsored a model that calculated a single effect over an entire metropolitan statistical area.[36] The two econometric models estimated different effects of entry. Cross-validation would have been an appropriate technique to select among these two competing econometric models. The usefulness of the technique is not limited to selecting among models that differ in the geographic area over which entry and exit are permitted to affect an incumbent store's pricing. One application may select the firms whose entry events are included in the econometric model. Another application may specify the dynamics of the effect of entry and exit on the incumbent's price. For example, cross-validation may distinguish between models that permit entry to cause an immediate and permanent change in the incumbent's price and models that permit an immediate but temporary price change followed by a permanent change in price of different magnitude.

5.2. *Validation of the event data set*

The foundation of an entry and exit event analysis is the event data set that catalogues entries and exits of competitors. Construction of an event data set can be a labor-intensive task that may require extensive cross-checking from publicly available sources even if a firm monitors entries and exits for competitive intelligence purposes. The process of constructing the event data set can be subject to error and an event data set with "too much" error cannot be probative of a merger's competitive effects. Fortunately, it is a fairly simple procedure to check if the event data set contains too much error by estimating the effect of entry and exit on dollar sales. This procedure is useful beyond checking the reliability of the data set, as it also may be informative about market definition.

A reliable event data set should result in significant effects of entry and exit by competitors on an incumbent's dollar sales even if it reveals insignificant effects of entry and exit on price. An incumbent should lose dollar sales subsequent to entry of a competitor even if it exercised no market power pre-entry. On the other hand, a data set that contains too many errors should yield insignificant effects of entry and exit on *both* dollar sales and price. For example, consider an event data set that catalogues entry and exit events in a way unrelated to when and where actual entry took place. Econometric theory tells us that such a data set will, in expectation, result in insignificant estimates of entry and exit on an incumbent's price or dollar sales. But despite the lack of incumbent price response, such a data set is entirely uninformative about the degree of competition in markets. Fortunately, the lack of

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36. The defendant expert's model estimated different entry effects for entry within 5 miles, 5-10 miles, and 10-20 miles from its stores. *See* Ashenfelter et al., *supra* note 4.

information in this data set will be revealed by the lack of effect of entry and exit on dollar sales.

Beyond the value of a test of the event data set, studying the effect of entry and exit on an incumbent's dollar sales may be informative about product and geographic market definition. Intuitively, entry by a firm in a different market should not affect the incumbent's dollar sales, whereas entry by a firm in the same market should affect dollar sales. One could, potentially, use these estimated effects to assess the set of entering and exiting firms that are in the same product and geographic market as the incumbent. As an illustration, consider *Whole Foods* where a key point of contention was whether traditional supermarkets were in the same market with "premium natural organic supermarkets" like the merging parties. A rigorous application of the *1992 Merger Guidelines* to define markets would have required substantial data in order to estimate the cross-price elasticities required by a hypothetical monopolist SSNIP test. If such data were not available, an alternative would have been to measure the effect of entry or exit of traditional supermarkets on Whole Foods and Wild Oats. The government expert indeed found that Whole Foods caused a larger decrease in Wild Oats' sales than did other supermarkets.[37] The Court, however, found this result to weigh in favor of the parties: "The problem is that what's going on in the marketplace, according to credible evidence before the court, is that . . . when Whole Foods does enter a new market where Wild Oats operates Whole Foods takes most of its business from other retailers, not from Wild Oats."[38]

5.3. Entry and exit event analysis versus cross-sectional analysis

This chapter has discussed entry and exit events in an explicitly time series context. This is the natural way to consider entry and exit, which have obvious dynamic connotations: one can speak of "prior to entry" and "subsequent to entry." It is possible, however, to mimic a dynamic entry and exit event analysis with a static (point-in-time) analysis by exploiting cross-sectional variation in the number of competitors and pricing. This latter type of analysis, for example, might aim to estimate the causal relationship between pricing and the number of competitors or the presence or absence of specific competitors. In general, an entry and exit event analysis has advantages over a cross-sectional analysis because the former analysis is required to control for fewer factors than the latter analysis.

In *Staples,* the government originally pursued a cross-sectional analysis of office superstore pricing. The merging parties argued that this approach was unreliable and argued that an entry and exit event analysis was more reliable.[39] Both parties eventually pursued an analysis of incumbent responses to changes in the numbers of competing office superstores, that is, an entry and exit event analysis. An entry and exit event analysis often uses "panel data"—that is data with both a cross-sectional and time dimension—and, through a technique known as "fixed effects," focused on

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37. *See* Murphy Report, *supra* note 4, at 19-20.
38. FTC v. Whole Foods Market, 502 F. Supp. 2d 1, 35 (D.D.C. 2007).
39. *See* Baker, *supra* note 4.

pre- and post-event *changes* in pricing at a given store.[40] By focusing on changes in pricing at a given store, fixed effects techniques control for all store-specific factors, observable or unobservable, that are constant through time. In contrast, a cross-sectional analysis needs to explain the *level* of price at a given store and, thus, control for many more factors than an entry and exit event analysis. That an entry and exit event analysis is required to control for fewer factors than a cross-sectional analysis is an advantage.

For example, consider an analysis that regresses stores' average prices over some time period on the number of stores within a certain driving time. Suppose that this cross-sectional analysis explains prices as a function of the number of nearby competitors, but fails to consider (or cannot measure or observe) an important factor that affects price, such as quality. If this unobserved factor is correlated with the number of nearby competitors, then the econometric estimation will yield unreliable estimates of the causal effects of the number of competitors on price. Intuitively, the econometric estimation will confound the effects of the number of competitors and the omitted factor. In econometric jargon, the analysis will not *identify* the effect of the number of competitors on price. On the other hand, to the extent that the unobserved factor affects price in the same way before and after entry, an entry and exit event analysis can effectively control for this factor by analyzing store-specific changes in price.

6. Conclusions

When properly performed, entry and exit event analysis can be a useful tool in assessing likely merger effects. In particular, entry and exit event analysis can reveal whether premerger pricing is competitive and, therefore, whether the elimination of one competitive constraint through merger is likely to change competitive outcomes. In highly competitive markets where competition from a single firm is not critical in preventing the exercise of market power, the elimination of a single constraint through merger is unlikely to lessen postmerger competition. On the other hand, in markets where competition from a single firm meaningfully constrains the exercise of market power, the elimination of a single competitive constraint through merger may significantly lessen postmerger competition.

This interpretation contrasts with previous applications, which have used entry and exit event analysis to simulate postmerger prices. Such simulation implicitly assumes that entry and exit are equivalent to merger. This assumption is generally not valid and will lead to biases that can either overstate or understate merger effects.

In conducting an entry and exit event analysis, two distinct types of issues can arise in assessing the antitrust implications of mergers. The first, which was prominent in *Whole Foods*, involves the interpretation of the estimated causal effects of entry or exit on a measure of an incumbent's prices. This chapter has considered a number of these issues. The second, which was prominent in *Staples*, involves the

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40. *See, e.g.*, CHENG HSIAO, ANALYSIS OF PANEL DATA, ECONOMETRIC SOCIETY MONOGRAPHS, NO. 11 (1986); JEFFREY WOOLDRIDGE, ECONOMETRIC ANALYSIS OF CROSS SECTION AND PANEL DATA (2002).

econometric estimation of these effects. This chapter has offered several suggestions on how to estimate these effects reliably.