Assessing the Competitive Effects of a Merger: Empirical Analysis of Price Differences Across Markets and Natural Experiments

BY GREGORY K. LEONARD AND LAWRENCE WU

The variety of empirical methods that can be applied to assess the competitive implications of proposed mergers has increased over time. This is due, in part, to the greater availability of data of all types, ranging from specific transaction level data collected at retail stores to aggregate product sales and profitability data. The range of alternative methodologies also reflects advances in theoretical economics, as well as econometric techniques, both of which have enabled economists to use and analyze data to answer difficult questions more easily and readily. Of course, the use of modern economic tools also reveals the degree to which merging parties put forward an analysis that now required to analyze the potential for post-merger price increases is correspondingly more rigorous.

The techniques used by the economist expert witnesses in FTC v. Whole Foods Market, Inc. illustrate two approaches that exemplify modern empirical merger analysis. One approach focuses on the relationship between price and the number and identities of competitors. The second approach analyzes historical events or “natural experiments” in the marketplace, such as the responses of incumbent firms to new entry. In our discussion of both approaches, we address three key issues: (1) What antitrust question does each technique address, specifically in the context of assessing the likely competitive effects of a merger? (2) What assumptions and data are needed to implement each technique? And (3) What key questions should counsel ask economists to evaluate the appropriateness of these types of studies?

Analyses of the Relationship Between Price and the Number of Competitors

To assess the competitive effects of a merger, it is natural to want to compare prices across markets. For example, one might want to compare prices in markets where both merging firms compete to prices in markets where only one of the merging parties is present. Alternatively, one might want to conduct a more general study of the effect of market structure by determining whether or by how much a company’s prices are lower when it faces, say, three competitors instead of two. If the third competitor “matters” competitively, one might intuitively expect that the company’s price would be lower in three-competitor situations than in two-competitor situations.

Consider, for example, the economic analysis that was conducted in Whole Foods. The economic expert for the merging parties put forward an analysis that compared Whole Foods’ prices in local markets where it faced competition from Wild Oats with its prices in local markets where it did not. Was Wild Oats an important competitive constraint on Whole Foods or was Whole Foods primarily constrained by traditional supermarkets with their organic food sections? If pricing at Whole Foods stores was constrained primarily by nearby traditional supermarkets, one might expect that Whole Foods stores would have similar prices regardless of whether there was a Wild Oats store nearby. If, on the other hand, Wild Oats had an important constraining influence beyond that provided by local traditional supermarkets, one might expect lower Whole Foods pricing at stores where there was a Wild Oats store nearby.

The econometric analysis of the merging parties’ experts apparently found no significant difference in the Whole Foods price whether or not there was a Wild Oats store nearby. The Court relied on this result to reach the conclusion that Wild Oats and Whole Foods were not close competitors and that the merger would not lead to an increase in Whole Foods’ prices in those local markets where Wild Oats was also present.

What can we learn from price comparisons of this type, and under what conditions do such comparisons provide useful information for assessing the competitive effects of a merger? If all other factors that affect Whole Foods’ prices were the same across local markets with and without Wild Oats, the comparison would identify the effect of the presence of Wild Oats on Whole Foods’ prices. In other words, if all other factors were the same across local markets, the presence of Wild Oats would be the only remaining possible explanation for any observed systematic price difference between the two types of local markets.

It is unlikely, however, that all other factors are the same across local markets. Nevertheless, some factors can be explic-
itly measured, and the effects of these local market factors on pricing can be accounted for using regression analysis. For example, we can specify and estimate a regression model that relates the price in a given market for each of the acquiring firm's stores to variables that account for the presence (or absence) of various potentially competing stores, as well as the cost of operating the store and other factors specific to the local market in which the store operates. The price would correspond to a “basket” of goods that reflect the mix of products sold by the acquir-
ing firm. The competitor variables could simply indicate the presence or absence of a particular competitor. They also could be variables that capture the number of competing stores owned by the competitor near each of the acquiring firm's stores or the distance or direction of the competing stores from each of the acquiring firm's stores. We abstract from those details here, although they are important for appropriate model specification.

At a minimum, the data required to run such an analysis would consist of (1) the prices for each product that is included in a relevant and well-defined basket of goods sold at each Whole Foods store (or a sample of Whole Foods stores) at a given point in time; (2) the location and other characteristics of each potentially competing store; and (3) characteristics of the local markets around each Whole Foods store, such as local cost conditions and demographics. Some of these data can be obtained from the merging parties (e.g., the merging parties' prices, costs, product mix, and location-specific data), but data from third parties are also needed (e.g., competitors' store information and location-specific data). In addition, the prices must reflect the actual amount paid by consumers (as opposed to shelf prices). In some circumstances, the percentage discount also can be used.

If the data for such an analysis are reliable and if an econometric model can be properly specified (an issue discussed in greater detail below), the regression results will provide measures of the extent to which the presence of nearby contender stores affects Whole Foods' pricing. For example, the regression model described above—and articulated in endnote 6—would yield an estimate of the effect of any particular competitor on the prices charged by another firm (e.g., the acquiring firm). If the competitor variable indicates the simple presence or absence of a particular competitor (e.g., the firm to be acquired), then the estimated regression coefficient on that variable would indicate the effect, if any, of that competitor on the acquiring firm's pricing. If the competitor variable counts the number of nearby stores owned by that competitor, then the estimated regression coefficient on that variable would indicate the effect, if any, on the acquiring firm's prices if that competitor were to open an additional store.

If the results of the econometric model are robust and reliable, what would they imply about the likely competitive effects of the proposed merger? The results could be used to estimate the average price that the acquiring firm would charge if the firm to be acquired was present as a local competitor and the average price that the acquiring firm did charge when the firm to be acquired was present. The difference would be the estimated price effect of the merger because it would reflect the change in prices that would result if the stores owned by the firm to be acquired no longer existed as a source of competition for the acquired firm.

There are several questions one might want to ask to determine the relevance and reliability of the analysis. First, one might ask whether this hypothetical world—a market in which the stores owned by the firm to be acquired did not exist any longer—is relevant for analyzing the merger. For example, in Whole Foods, some of the Wild Oats stores were going to be closed, but most would remain open. The difference would be that the stores would now be operated by Whole Foods instead of an independent Wild Oats.

Is this an important objection? Potentially. The difference between these two possible post-merger situations can be illustrated as follows. Suppose there are two competing stores in a local market and the acquiring firm continues to operate both stores. If the firms are allowed to merge, there still would be two stores in the market, but they would be priced so as to maximize their joint profits. In contrast, suppose the acquiring firm was planning to close one of the stores. That would leave a single store operating in the market. In general, an owner of a single store in a market would choose a price that is different from the price that it would choose if it operated multiple stores in the same market.

Second, one might want to assess the reliability of the econometric model. The analysis described above requires the specification of an appropriate regression model. Otherwise, it may not be possible to make any inferences at all about the competitive effects of the proposed merger. For example, a regression model like the one described above (and shown in note 6) will provide a reliable estimate of the model coefficients as long as the competitor variables (and the other explanatory variables) are uncorrelated with (unrelated to) the unobserved factors in the market (known as the error term of a regression). If, on the other hand, the competitor variables are correlated with market factors not captured in the model, the regression results may mistakenly attribute the effects of the missing factors to the competitor variables. As a consequence, the regression will provide unreliable estimates of the effects of the competitor variables (i.e., the estimates will mix the true effects of the competitor variables with the effects of the factors that are not explicitly accounted for in the data and model).

The potential for this type of model misspecification might arise if, for example, the presence of nearby competitors is driven by local cost, demand, and competitive conditions that are not fully accounted for by variables that capture the nature of the competition (i.e., the competitor variables) and local competitive conditions (i.e., the variables in X, in the model shown in endnote 6, which include local cost conditions). For example, markets that exhibit low prices also might be areas in which the cost of doing business is lower, which may lead to an increase in the number of competitor stores in those areas. In that case, the unobserved local economic conditions that may affect the cost of doing business will appear in both the error term (because
they will affect the prices that are charged by the stores in that area) and the competitor variables in the model (because these unobserved factors also directly determine the number of stores that are present in the area). Accordingly, the competitor variables and the error term will be correlated, leading to unreliable regression results.

So far, we have assumed that we have only “cross-sectional” data; that is, we have data on each of a set of stores at a single point in time. In this case, each store is called a cross-sectional unit. The existence of time series and cross-sectional data (also called “panel” data) where we have multiple observations over time for each cross-sectional unit (store) may provide a means to avoid the potential specification problems discussed above. We will return to this point in our discussion of natural experiments below.

Analyses of Historical Events and “Natural Experiments”

The term “natural experiment” is often used to refer to a historical market event, the outcome of which potentially allows us to distinguish between two alternative hypotheses about how the market operates. In the case of merger analysis, useful natural experiments center on changes in market structure—examples include the entry of a new product or competitor, a merger, or a shutdown of industry capacity. The reference to an “experiment” is meant to invoke the scientific gold standard of controlled experimental design, which ensures that the “treatment” is exogenous to the selection of subjects into the treatment and control groups. Despite this invocation, natural experiments in economics (generally) are not controlled experiments, and, as we will see below, whether the natural experiment is appropriate to study the question at hand and whether the event that defines the natural experiment is truly exogenous to market outcomes are crucial considerations in assessing the technique’s reliability in a given circumstance.

A variety of events could lead to a natural experiment relevant for an antitrust analysis, and below, we will focus on the particular natural experiment represented by the entry of a new product or competitor. This was the type of natural experiment that was analyzed by the experts in Whole Foods.9 The FTC’s economic expert analyzed the effects of entry of Whole Foods stores on the sales, margins, and prices at existing Wild Oats stores in several local markets.10 The merging parties’ expert analyzed the effects of Whole Foods’ entry on Wild Oats’ sales.11

The entry by one of the merging parties into a local market may provide an opportunity to assess the competitive effects of the proposed transaction. For instance, an analysis of the entry of, say, the acquiring firm into a market in which the firm to be acquired has existing stores may reveal the degree to which the new entrant changes the demand facing the firm to be acquired and other incumbents. The new entry also may have prompted a competitive response by the incumbent firms, which may create the opportunity to examine whether, by how much, and for how long existing firms altered their pricing in response to the new competition. The entry and the subsequent responses by the incumbent firms are potentially useful for assessing the competitive effects of a merger because, in general, the entry of a new product or competitor is a source of new competition that may lead to lower prices for existing products or competitors.12 Those sellers that compete most closely with the new entrant will often be expected to show the largest price effects from the entry. Thus, this type of natural experiment can be used to identify which firms (and products or services) compete most closely with the entrant.

When the entrant is one of the merging parties, this type of natural experiment helps answer the question of how closely the merging parties compete. It also potentially can answer the question of what the post-merger world would look like, since the hypothetical post-merger world would have similarities to the actual pre-entry world, particularly in terms of the number of competitors. Consider, for example, the empirical analysis of entry that was conducted by the FTC’s economic expert in Whole Foods. The starting point for the study was the observation that there were Wild Oats stores operating in local markets in which there were no Whole Foods stores. If the pricing at such a Wild Oats store was competitively constrained primarily by nearby traditional supermarkets, we would expect that the opening of a Whole Foods store nearby would have little or no effect on Wild Oats’ pricing (and thus on the store’s gross profit margins, properly measured)—the Wild Oats store would already have been pricing at the competitive level. If, on the other hand, the local traditional supermarkets had little or no constraining effect on Wild Oats’ pricing, then we would expect the opening of the new Whole Foods store to substantially reduce prices (and potentially profit margins) at Wild Oats. The analysis was therefore conducted to address the following question: Is Whole Foods a significant competitive constraint on Wild Oats or is Wild Oats primarily constrained by traditional supermarkets with their organic food sections?

The FTC’s expert’s econometric analysis apparently found that the entry of Whole Foods had an effect on Wild Oats’ pricing in certain local markets.13 The FTC used this result to argue that Wild Oats and Whole Foods were each other’s closest competitors and that the merger would cause a price increase in local markets where the two chains competed that was approximately equal to the observed Wild Oats price decrease that occurred in those local markets where Whole Foods had entered.

Again, it is useful to consider the types of questions that one might want to ask to determine the relevance of this analysis for analyzing the competitive effects of the merger. Evidence on post-entry price responses may be informative about the competitive interaction between the merging parties, but there are important distinctions that complicate the inferences that can be made from such data about the competitive effects of a proposed transaction involving those firms. Here are some of the questions that may be relevant.

First, is the pre-entry world a good analog for the post-merger world? Possibly, but not necessarily, because the post-merger world would have a product (i.e., the entrant’s product) that was not present in the pre-entry world.
Second, does the analysis focus on prices or margins, and does it matter? In Whole Foods, it was suggested that the FTC's expert's focus on Wild Oats' profit margins, rather than pricing, was incorrect. Above, we discussed the use of a price index for a bundle of products at a store as the dependent variable in the analysis. However, an alternative dependent variable might be the percentage gross profit margin for a store. This dependent variable has the advantage of summarizing all of the store's products in a single variable that has great intuitive appeal. However, if the costs used in defining the margins included some element of fixed cost, the store-level gross profit margin could possibly decline with a loss in sales even in the absence of a price effect and one might incorrectly infer a price effect where there was, in fact, none. To see this, consider the simplified case where Wild Oats sells a single product and, prior to Whole Foods entry, price is $1, the quantity sold is 100 units, the variable cost is $0.50 per unit, and there is a fixed cost element equal to $25 that is subtracted out when calculating the profit margin. In that case, prior to Whole Foods' entry, the profit margin would be equal to 25 percent (i.e., $1.00*100 – $0.50*100 – $25)/($1.00*100) = 25%). Now suppose that after there is entry by Whole Foods, Wild Oats does not change its price, yet it loses 10 units of its sales. In that case, despite the fact that prices did not change, the profit margin would nevertheless fall from 25 percent to 22 percent (because ($1.00*90 – $0.50*90 – $25)/($1.00*90) = 22%). It would be an error in this case to infer that prices fell as a result of the new entry based on the observation that there had been a decline in the profit margin. Note that if the profit margin were instead defined so as to exclude the fixed cost element, the profit margin would have remained at 50 percent in the scenario outlined and it would be appropriate to draw inferences about the effect of the new entry on the incumbent firm's prices.

Another potential shortcoming of analyzing store-level gross profit margins is that a store's gross profit margin can change as the store's product mix changes, even if there is no change in underlying prices. For example, if the new entry had no effect on the incumbent store's prices, but took away sales of the incumbent's high margin products, the incumbent's overall gross profit margin might fall (due to a greater proportion of low margin products in the mix) even though there was no change in prices.

Third, does it matter whether the natural experiment is focused on the entry of the acquirer or the target firm? In Whole Foods, it was suggested that, because Whole Foods would be the surviving entity making the pricing decisions, analyzing the effect of Whole Foods' entry on Wild Oats' pricing was studying the wrong question. This might matter if the results for Wild Oats' pricing were applied to determine the price effects at Whole Foods post-merger because there need not be symmetry in the price effects between the two firms. However, under the assumption that Wild Oats' and Whole Foods' managers both behave rationally, it may be reasonable to apply the results of the study to determine the price effects at Wild Oats post-merger even if such stores were run by Whole Foods' management at that point.

Fourth, is a natural experiment focused on entry the best analog for the merger or would a natural experiment focused on exit be a better analog? In Whole Foods, it was suggested that exit was a more relevant natural experiment than entry. The reason is that the merger would involve “removing” Wild Oats from the market (either by literally closing stores or by eliminating Wild Oats as an independent entity). Thus, a study of the effects of Wild Oats’ exit(s) would appear to be a more directly comparable analogy to the effects of the proposed merger. However, from the point of view of economic theory, entry and exit should have similar effects, but of opposite sign, holding all else equal. If Whole Foods entered a market, Wild Oats responded with a price decrease, and then Whole Foods subsequently exited the market, the profit-maximizing price for Wild Oats after the Whole Foods exit would be the same as the price it charged prior to the Whole Foods entry (assuming all other economic conditions remained the same). However, it is possible that, as a practical matter, prices are less likely to adjust upwards than downwards. For example, the exit of a Whole Foods store may not allow Wild Oats to increase its prices back to the level that existed before Whole Foods’ entry because Wild Oats may fear that such a price increase would alienate its customers. Empirical analysis would be needed to determine whether this was true.

Fifth, is it necessary to disentangle the direct effects of entry from the indirect effects of entry? In Whole Foods, it was suggested that the FTC's expert's analysis did not control for other firms' competitive behavior in response to Whole Foods' entry and that Wild Oats' price reaction might have been a response to these other competitors' behavior. However, even if the premise of this criticism is correct, the merger would nevertheless still have the potential for anticompetitive effects. Suppose that Whole Foods’ entry directly affected Safeway's pricing, and it was the change in Safeway's pricing (as opposed to a direct effect of Whole Foods’ entry) that led Wild Oats to change its pricing. Even in that scenario, if Whole Foods is likely to close certain Wild Oats stores post-merger, the closures could lead to higher prices because Safeway would face less competition without Wild Oats and thus have the incentive to charge higher prices. Consequently, Whole Foods would be less constrained by Safeway's pricing and have the incentive to charge higher prices as well.

Sixth, is the market event in question truly exogenous to market outcomes? For example, it is possible that Whole Foods chose to enter the local areas where it did precisely because it expected to have only a limited price effect on existing Wild Oats stores in those areas—a decision that might very well make economic and business sense for Whole Foods. If so, Whole Foods’ entry would not be exogenous to market outcomes and the entry analysis would fail to fully measure the extent of competition between Whole Foods and Wild Oats. On the other hand, perhaps Whole Foods’ entry decisions were driven by logistical supply chain concerns that might well be largely independent of market outcomes. Such entry could well be the basis for a natural experiment.

Seventh, does the analysis adequately account for geographic location, which affects the degree to which a new entrant
is, in fact, a competitor? For example, a Whole Foods store is unlikely to be a close competitor to a Wild Oats store 500 miles away. The analysis must distinguish somehow between a store one mile away and one 500 miles away.

Eighth, how does the analysis take into account how price responses might vary over time? In some markets, the incumbent firms may have lowered their prices before the entrant entered to maintain consumer loyalty; in other markets, the incumbent firms may not have lowered their prices until after entry occurred. Interpreting empirical analyses of the price response to new entry also must be done with care. For example, entry may be followed by a temporary price war that is not sustainable over time. A temporary price response by incumbent firms as they test the waters may therefore provide little information about the ultimate price effect of the entry in the long term.

Ninth, were there any confounding events occurring in the marketplace? For a natural experiment to yield useful observations, it is important to consider the influence of other concurrent events. This, of course, calls for the use of econometric analysis and a regression model that is similar in form to the model that can be used to assess the impact of one competitor on the pricing of another. The key addition to the model is that we must now add a dimension of time and a structure that allows the study to capture the possibility that the entry may affect each incumbent (or category of incumbent) in the local market differently.\(^{16}\)

We now turn to the question of data requirements, and show how this type of natural experiment can solve certain problems that might exist with the cross-sectional analysis we described above. Because this technique involves comparing prices before and after entry of a competing store, the analysis requires data from more than one time period for stores in the markets in which entry occurred. Thus, for this natural experiment, we require panel data as opposed to only cross-sectional data.

The econometric model (as described, for example, in the specification shown in note 16) is sophisticated in that it can be used to assess the effect of a competitor’s presence or entry on a store’s prices, even if the store is unique in some way (e.g., location, size of store, etc.).\(^{17}\) For example, a store located in a high cost area (due, for instance, to high labor costs or rent) might be expected to have higher prices over the entire time period covered by the data. The use of panel data in conjunction with a model that accounts for store-specific effects is a technique that can be used to control for unobserved time-invariant economic factors that potentially affect the competitor variables. In so doing, the technique can eliminate or reduce the correlation that may exist between the competitor variables and the unobserved factors that are contained in the error term.\(^{18}\) This means that, with panel data, we can avoid the problems for cross-sectional analysis caused by such correlation.\(^{19}\)

The possibility that prices may be affected by store-specific effects that do not change over time is realistic, but it also implies that the effect of a competitor on pricing can only be identified if there is a change over time (e.g., a change in capacity, new entry, etc.). That is, if a competitor variable does not change over the time period (so that it is time-invariant), its effects will be absorbed into the store-specific effect and cannot be separately identified (because the fixed effect accounts for all factors that do not change over time). Thus, we can isolate the effects of the competitor variables from the fixed effects only if there is a change in the competitor variables over time. Such changes include the opening or closing of nearby stores.

To see how an analysis of price effects using cross-market data at a single point in time differs from an analysis of panel data that would reveal the effect of a new entrant on prices over time, consider two Whole Foods stores (A and B) where pricing is observed for each of two years. In the first year, Store A had no Wild Oats competition whereas Store B had a Wild Oats store located nearby. Suppose that at the end of the first year, Wild Oats opened a new store near Store A so that in the second year, both stores faced competition from a Wild Oats store. A cross sectional analysis would involve the comparison of the pricing of Store A and Store B in the first year because one store faced competition from Wild Oats, while the other did not. Suppose Store A’s average price was $100, while Store B’s average price was $95. From this comparison, you might conclude that Wild Oats caused a 5 percent reduction in Whole Foods’ pricing. Suppose now, however, that you find that Store A’s price in year 2 was unchanged from year 1—it was still $100—even though the Wild Oats store had opened nearby (assuming that all other economic conditions were unchanged). This is the comparison that would be performed in a time-series/cross sectional analysis. From this result, one would conclude that Wild Oats had no competitive effect on Whole Foods. In other words, the reason that Store A’s prices were higher than Store B’s in the first year (and for that matter, in the second year, as well) must be due to some unobserved characteristic of the market in which Store A is located. For example, perhaps it is a small market with a correspondingly lower scale of operation so that prices had to be higher to cover the higher fixed costs of operating in that market.

For these reasons, attempts to relate prices to the number of competitors in the market or to an index of market concentration based on a cross-sectional analysis should be approached with some caution. Indeed, the economic literature has reached a similar conclusion with regard to price-concentration analyses that have been done at the level of the industry.\(^{20}\) If possible, a panel data analysis should be done, as well, with the appropriate econometric testing employed to determine whether the cross-sectional analysis is yielding reliable results.

### Conclusion

The techniques used in Whole Foods reflect the increasing importance of empirical work in assessing the likely competitive effects of a merger and the inferences that can be gleaned from analyses of localized pricing and the effects of natural experiments in the marketplace.\(^{21}\) These techniques vary in the data required, as well as in the relationship between the empirical question they respectively answer and the competitive
effects question that is central to merger analysis. Moreover, for the results to be informative about the likely competitive effects of a merger, the analysis must account for other key events and market dynamics that affect prices. An econometric model may appear abstract and theoretical, but in the end, its relevance and importance will be based on its ability to capture the dynamics that drive pricing in the real world.


2 The techniques we describe here typically involve the delineation of or an assumption about the boundaries of local geographic “markets,” either implicitly or explicitly. For example, the analysis might focus on the number of competitors within a certain sized radius around a store. The implied market definition is a key aspect of the empirical model, and it is often easy to test the sensitivity of the results to the chosen boundaries by performing the analysis with different radii to see whether the results are robust. Alternatively, one can choose wide boundaries, but allow the effect of a competitor to depend on its distance from the store in question.

3 Whole Foods, supra note 1, slip op. at 70–71.

4 Id. at 70.

5 See generally id. at 68–71.

6 Such a model might take the following mathematical form:

\[
\log P_i = \alpha + \beta_1 \text{COMP}_1 + \beta_2 \text{COMP}_2 + \ldots + \beta_n \text{COMP}_n + \chi_1 + \gamma + \nu_i
\]

where \(\log P_i\) is the log of the price of a “basket” of goods at a particular store that is owned by the acquiring firm (i.e., store i), the variables COMP_1, COMP_2, ..., COMP_n are “competitor variables,” each respectively representing the presence of a different competitor near store i, and \(\chi_1\) is a set of other explanatory variables that might be expected to affect the prices at store i such as local cost conditions or the demographics of the people who typically shop at store i.

7 Consider the model in endnote 6. The coefficient \(\beta_1\) indicates the percentage effect on Whole Foods’ pricing from increasing COMP1 by one unit. If COMP1 is defined as an indicator variable for the presence of competitor 1, then \(\beta_1\) would be equal to the percentage effect on Whole Foods’ prices of having competitor 1 present in the local market. If COMP1 is defined as the number of stores of competitor 1 in the local market, then \(\beta_1\) would capture the percentage effect on Whole Foods’ pricing if competitor 1 were to open a new store in the local market.

8 Suppose the model in endnote 6 was estimated using pricing data for the acquiring firm (e.g., Whole Foods) and that the competitor variable COMP1 corresponds to the firm to be acquired (e.g., Wild Oats). The effects of the merger for Whole Foods store i might be inferred by setting COMP1 = 0, i.e., removing Wild Oats from the local market around store i and calculating the predicted effect on the price of Whole Foods. The predicted effect in this case would be equal to \(\beta_1 \text{COMP}_1\), which is the regression coefficient on COMP1, multiplied by the value of COMP1.

9 Other types of natural experiments might include a relaxation in regulatory rules or a non-transitory increase in demand that led to higher prices and profits and, therefore, new entry. Such natural experiments may help assess questions about the likelihood and ease of new entry or, potentially, the identities of the participants in the relevant market.

10 Whole Foods, supra note 1, slip op. at 20.

11 Id. at 31–32.

12 Under certain circumstances, however, entry of a new competitor may be followed by no price change or even a price increase for existing products. An example is provided by the responses of branded pharmaceuticals following generic entry. It has been demonstrated that the price of a branded drug sometimes remains unchanged or even increases after the generic version of the drug is introduced and sold. See, e.g., Richard E. Caves et al., Patent Expiration, Entry, and Competition in the U.S. Pharmaceutical Industry, in 1991 BROOKINGS PAPERS ON ECONOMIC ACTIVITY: MICROEconomics 1, 66 (1991). Although this outcome may suggest a lack of competition between the branded drug and the generics, it is more likely that the observed price effect reflects a change in the demand curve facing the branded drug as the most price-sensitive customers switch away to the generic, leaving price-insensitive customers buying the branded drug.

13 Or, rather, the FTC’s expert found an effect of Whole Foods’ entry on Wild Oats’ profit margins. Based on this result, the expert inferred that the proposed acquisition would have an effect on prices. See Whole Foods, supra note 1, slip op. at 20.

14 Id. at 20–21.

15 There was an analysis of the effects of the exit of a Wild Oats store in at least one market. See id. at 11.

16 For example, a regression model that could be used to analyze a natural experiment can be written as follows:

\[
(2) \log P_{si} = \alpha + \beta_1 \text{COMP}_1 + \beta_2 \text{COMP}_2 + \ldots + \beta_n \text{COMP}_n + \chi_1 + \gamma + \nu_{si}
\]

where the variables are defined as previously in endnote 6 with one difference—each variable now has two subscripts: i to identify the store and t to identify the time period. One might include, among the variables in \(\chi\), a set of indicator variables for each of the time periods. These variables will capture any factors specific to a given time period that affect prices at each store (e.g., region-wide economic conditions).

17 As shown in equation (2), supra note 16, each Whole Foods store is allowed to have its own intercept for the regression line (\(\alpha_i\)). This parameter captures the unique aspects of each local store. This is called a “fixed effect” for store i, and it captures all time-invariant factors that might affect the price of store i.

18 Reliability of the panel data regression still requires zero correlation between the competitor variables and the unobserved factors that are captured in the error term in the regression, \(\nu_{si}\). This seems likely if entry decisions are based more on long-term, time-invariant factors than on short-term, highly variable factors.

19 With panel data, we can also econometrically test for whether the cross-sectional regression is reliable. See Jerry A. Hausman, Specification Tests in Econometrics, 46 ECONOMETRICA 1251 (1978).

20 For a summary of inter-industry studies of the relationships between market structure, conduct, and performance, see Richard Schmalensee, Inter-Industry Studies of Structure and Performance, in 2 HANDBOOK OF INDUSTRIAL ORGANIZATION 952 (Richard Schmalensee & Robert D. Willig eds., 1989). Schmalensee argues that “cross-section studies rarely if ever yield consistent estimates of structural parameters, but they can produce useful stylized facts to guide theory construction and analysis of particular industries.”

21 The methods we have described were used in Whole Foods because there were localized geographic markets, with variation within and across markets in the number and identity of competitors. However, depending on the market at issue, it may not be possible to conduct these types of studies. In that event, useful empirical analysis is likely to focus on other types of natural experiments involving changes in the marketplace over time, such as the effects of entry and exit, changes in imports from foreign countries, new product introductions, capacity changes, or changes in costs. Alternatively, empirical analysis might focus on the estimation of own- and cross-price elasticities of demand. A related analysis is the critical loss test. A critical loss test involves comparing the loss of sales necessary to make a hypothesized price increase unprofitable for the merged firm (the “critical loss”) to the actual loss that the merged firm would sustain from the price increase. If the analysis finds that the actual loss exceeds the critical loss, then it would suggest that the merged firm would not be able profitably to raise prices post-merger. In principle, the actual loss can be determined using estimates of the own- and cross-price elasticities of demand. However, in the absence of reliable estimates of the elasticities of demand, deriving a reliable quantitative estimate of the actual loss is often difficult.