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Market Definition in Antitrust Analysis: Comment*

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* The views expressed herein are those of the authors and do not necessarily represent the opinions of the Commission or any individual Commissioner.

MARKET DEFINITION IN ANTITRUST ANALYSIS: COMMENT 1/

Recently in this Journal, Horowitz [5] proposed an empirical method for delineating geographic and product markets to assist the courts in overcoming one of the most difficult aspects of antitrust proceedings. Using the Marshallian notion of price uniformity, Horowitz postulated a regression model to test whether several varieties of meat and a dozen U. S. cities comprise any product and/or geographic markets. Although Horowitz offered a potentially useful tool for market definition analysis--price comparisons over time--his application of the methodology ignores too many of the factors that determine relative prices to allow any consistent interpretation. Moreover, the data are suspect and the findings counterintuitive. In the final analysis, we remain unpersuaded that Horowitz' paper moves us much closer to establishing a practical means of defining markets.

The first section of our comment will consider some of the conceptual and practical problems in the use of price data as a means of identifying markets. In section two, we critique Horowitz' empirical contribution in light of the market analysis appropriate for antitrust purposes.

1/ We benefited from discussions with Alan Fisher, Mark Fratrik, Jim Langenfeld, Morris Morkre, Paul Pautler, John Peterman, and Ed Rifkin. We are responsible for any remaining errors.

I. The Market Definition Problem

Defining the market is the first and in many respects the most important question in antitrust. In many antitrust cases the outcome falls neatly from the resolution of the market definition issue. Depending on how the market is defined, a company is or is not a monopolist, or a merger does or does not go beyond the market shares required of a *prima facie* violation of the law. Economists have not been of much practical help since theory offers no consistently reliable criteria for determining what degree of substitutability amongst goods, distance, and time delineates a market for legal purposes. As a consequence, relevant markets are determined *ad hoc* in antitrust investigations.

Price is the ideal datum for measuring the extent of the market because it is the variable by which competition is most directly expressed and by which responses to competitive inroads are most directly made. Complex information about changing demand and supply conditions is transmitted through prices. Profit opportunities are revealed by widening price-cost margins and rivals, moving to take advantage of supra-normal returns, will drive the price and profit back to normal levels.

Hence the celebrated dicta of Marshall [10, 325] and, more recently, Stigler [14, 85] that a market is defined by "the tendency for the same price to be paid for the same thing at the same time in all parts of the market." In making this pedagogical point, however, both Marshall and Stigler were setting the framework of the perfectly competitive market with

all its simplifying assumptions. It is clear that this definition of the market is equivalent to a condition of truly homogeneous (as perceived by consumers) goods [8, 7]. While free of theoretical ambiguity, this definition has little use in antitrust analysis. Product differentiation, imperfect information, indivisibility of products, transactions costs, conjectural responses to rivals, technological innovations and entrepreneurial proclivities toward filling niches in the chain of substitutes cloud the pristine markets so diligently studied in theory.

Economics has not neglected the complexity of the real world, however. Jevons [6, 137] was aware that price differences for the same kind of article "arise from extraneous circumstances, such as the defective credit of the purchasers, their imperfect knowledge of the market and so on." The early work of Chamberlain [2], Robinson [11], and Kaldor [7] explored the competitive significance of imperfect substitutes and the "gaps in the chain of substitutes" that would identify distinct market boundaries. Kaldor refined the notion of substitutability to a scale of cross-elasticities across imperfect substitutes:

> Different producers are not selling either 'identical' of 'different' products, but 'more or less different' products--the demand confronting them being neither completely sensitive nor completely unsensitive to the prices charged by other producers.

Thus the gaps Robinson postulated to bound a market need not be felt equally by all producers within that market since

all producers need not be equally sensitive to price changes of imperfect substitutes. Gaps, as they appear, can appear in different places for different brands, during different phases of the business cycle, for different magnitudes of price changes of substitutes and for different conditions in the markets of the different consumers.

Clearly, economic theory does not conclude that the goods making up (or within) a relevant market must exhibit identical prices. Horowitz turns to--and later rejects--Jevons' law that the variation in price of any one commodity will tend to affect in the same direction the price of all commodities serving a similar use. Commodities need not be identical, nor would we expect their prices to be. But the prices will move together over time.2/ Hence Areeda and Turner's [1, 352] more recent

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2/ Jevons explains it, with some irony given Horowitz' illustrative sample [6, 166-7]:

> Whenever different commodities are thus applicable to the same purposes, their conditions of demand and exchange are not independent. Their mutual ratio of exchange cannot vary much, for it will be closely defined by the ratio of their utilities. Beef and mutton, for instance, differ so slightly that people eat them almost indifferently. But the wholesale price of mutton, on an average, exceeds that of beef in the ratio of 9 to 8, and we must therefore conclude that people generally esteem mutton more than beef in this proportion, otherwise they would not buy the dearer meat. It follows that the final degrees of utility of these meats are in this ratio, or that if ϕx be the degree of utility of mutton, and ψy that of beef, we have
>
> $$8\phi x = 9\psi y. \ . \ .$$

[footnote continues]

conclusion that "[c]lose price relationships among products over a substantial period of time are sufficient to establish a strong presumption that the products should be included in the same market."

This test deals more appropriately with demand-side substitutability than the uniform price test. However, supply-side substitutability is not captured, and an important element of market analysis is omitted. The price correlation test is restricted to the narrow instance of producers with identical cost functions. In the general case, where cost curves are not identical, the price ratio need not stay constant in the face of a change in the price of a third good. Consider good X, which competes with goods Y and Z. Y faces rising costs, Z has constant costs. The different supply elasticities will cause non-uniform price responses on the part of Y and Z to a change in the price of X. Horowitz, and it seems Areeda and Turner, would conclude that the goods were in separate markets when, in fact, the change in the price ratio is the result of competitive responses by producers with different cost structures.3/

2/ [continued]

> If the supply of beef falls off to a small extent, people will not pay a higher price for it, but will eat more mutton; and if the supply of mutton falls off, they will eat more beef. The conditions of supply will have no effect upon the ratio of exchange; we must, in fact, treat beef and mutton as one commodity of two different strengths, just as gold at eighteen and gold at twenty karats are hardly considered as two, but rather as one commodity, of which twenty parts of one is considered the equivalent of eighteen of the other.

3/ An own-price elasticity approach could capture the effects considered here. See Landes and Posner [9] and Schmalensee [12].

Horowitz rejects the correlated price disparity of imperfect substitutes over time in favor of the more narrow uniform price standard:

> The fine-line problem in all this is that a persistent price difference might obtain between two distinct products (areas) in both the long run and short, because at that price difference and no other the two products (areas) are perfect substitutes (one) in either production or consumption. Introducing the imperfections of the real world, the price in one market places a ceiling on the price that can be charged and over the long run maintained in the other. Rather than having a single market, we have two distinct markets, and for antitrust purposes they should be treated as such [5, 10].

Since it is to the ideal of uniform prices that he turns, price differentials suggest separate markets to Horowitz.

Before focusing on Horowitz' model, it is worthwhile to consider several more problems with using price data since his model relies on it so heavily. When Elzinga and Hogarty (E-H) [3] looked at the question of geographic market definition, the problems with using price data led them to propose shipments data as an alternative. They found it to be difficult in some instances to determine "the price" or "the transportation rate" of the products under investigation. The problem is easily seen in actual cases that can arise--containers, beer, wine, commercial banking, or general merchandise retailing.4/ E-H

4/ For example, E-H note the problems in interregional comparison of bank "prices" arising from the difficulties of compensating for different loan mixes, dissimilar risk factors due to varied regulatory statutes, monopoly elements, differences in costs per unit volume due to density differences, etc. [3, 70].

also suggest that two distinct geographic markets may exhibit the same price because of coincidental demand-supply equilibria. For instance, formidible transportation costs may create distinct markets on either side of the Rocky Mountains. Similar costs and competitive conditions might lead to similar price structures in each area, suggesting a single national market. But a disturbance, say successful cartel behavior in the western market, may not induce shipments form the east because production costs plus transportation costs over the Rockies equal or exceed the cartel price. In a similar vein, Areeda and Turner [1, 353] mention that equal prices might occur if explicit or tacit collusion exists among companies in two geographic markets significantly separated by high transportation costs where disparate prices would prevail if the markets were competitive. Consider also the case of the discriminating monopolist [4, 49]. By definition, the one supplier will be charging different prices within a single geographic or product market.

Other, more mundane, problems can arise with price data. Local tax and regulation differentials are likely to lead to disparate prices within the same geographic market. Transactions in many industries are at varying discounts from list prices. The discounts can occur periodically, can correspond to volume, or can be tied to purchases of multiple products from the same firm. Different prices may arise from differences in servicing agreements, or warranties as well as more obvious quality differences.

For custom-made products, "the price" is determined individually for each item produced.

Even a relatively homogeneous product like coal can have a disparate price structure in a small geographic area. E-H point out that the F.O.B. mine price for coal in Eastern Kentucky was $27.03 per ton in 1975, but $13.75 per ton in Western Kentucky [4, 6]. Comparable coal was $18 per ton in New York, but $38 in New Jersey; and $23 and $34 in Illinois and Wisconsin, respectively. Even sophisticated attempts to explain these differences have proved unsuccessful. As an example, Shrieves [13, 606-7] could only explain 64 percent of observed coal price differences with 25 independent variables.

Finally, prices in an imperfect world seldom, if ever, reach equilibrium. Exploring in more detail the workings of actual markets, Marshall [10, 333] discovered that "the price may be tossed hither and thither like a shuttle-cock, as one side or the other gets the better of the 'higgling and bargaining' of the market." The interaction of buyers and sellers will move the market toward equilibrium, but in an imperfect world it is seldom reached, and never held for long. To capture the dynamic disequilibrium in a time frame sufficient to measure trends toward price uniformity is a formidable task in model specification.

In view of the problems involved with price data in market definition, we now consider Horowitz' empirical work in more detail.

II. Horowitz' Model and Results

Horowitz' methodology is based on the idea that the pairwise prices of goods in the same market tend toward equality as long-run competitive equilibrium is approached. If there are no transportation or other transactions costs, goods in the same product and/or geographic market will trade at the same price. In order to test this proposition, Horowitz employs a relatively simple regression equation. In particular, he lets "$D_{i(j-k)t} = P_{ijt} - P_{ikt}$ and $D_{(h-i)jt} = P_{hjt} - P_{ijt}$ represent the price differences between product i in candidate areas j and k during period t, and between candidate products h and i in area j during period t, respectively" [5, 11]. Supressing all but the time subscripts, the adjustment to the long-run (unobservable) price difference, D_{tL}, is given by

$$D_{tL} - D_t = \lambda(D_{tL} - D_{t-1}), \tag{1}$$

where D_t is a particular price difference and λ is the constant adjustment coefficient ($-1 < \lambda > 1$). Substituting

$$D_{tL} = \gamma + \omega_t \tag{2}$$

into (1) results in the equation to be estimated:

$$D_t = (1 - \lambda)\gamma + \lambda D_{t-1} + (1 - \lambda)\omega_t. \tag{3}$$

The coefficient γ is the mean long-run price difference and ω_t is a randomly-distributed disturbance term. Ignoring the error term, the solution to (3) is of the form

$$D_t = \gamma + (D_0 - \gamma)\lambda^t, \qquad (4)$$

"where D_0, the price difference in period zero, is given as an initial condition" [5, 9].

The estimate of the regression constant term permits calculation of $\hat{\gamma}$--the mean price difference between goods in a postulated product or geographic market. In the absence of transactions costs, failure to reject the null hypothesis that $\gamma = 0$ leads to the inference that a market has been delineated. In addition, $\lambda = 0$ implies that long-run equilibrium has been attained. On the other hand, $\gamma \neq 0$ and $|\lambda| < 1$ indicate either that a single price is being approached or that the long-run equilibrium mean price difference is nonzero, reflecting the existence of, for example, transportation costs or product differentiation. "Values of $|\lambda| \geq 1$ would not obtain in a market" [5, 10].

Horowitz points out several dangers in utilizing this regression framework. Among these are the necessity to avoid "spuriously inferring causality from correlation" and that "the absence of any correlation will not necessarily imply that there is not a single market" [5, 8]. We are also advised that "the imperfections of the real world, as well as the imperfections in the data that we input [sic] into the estimation, will mean that the interpretation of the empirical results will not necessarily be unambiguous" [5, 10]. Ambiguity turns out to be the case.

Horowitz proceeds without heeding his own warnings. Indeed, he chooses the ideal example to refute his own methodology.

The data consist of annual average observations on retail prices in cents per pound for six meats in 12 cities from 1955 to 1977.5/6/ The products chosen were round steak, rib roast, hamburger, veal cutlets, pork chops, and ham. The geographic

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5/ Data of this complexity would be virtually impossible to obtain in a litigation setting.

6/ The retail price data were obtained from the Bureau of Labor Statistics publication entitled "Estimated Retail Food Prices by City." The BLS cautions against utilizing these data for making geographic comparisons. The front cover of a typical issue contains the following caveat:

> Quotations from each source are on a comparable basis from one period to the next as to brand, quality, and size, but quotations from different sources and different urban areas may reflect some variation in these factors. Therefore, differences in prices between areas may not represent true differentials.

More specifically, a footnote to the tables warns that "in making price comparisons, it must be borne in mind that the primary use of the Bureau's prices is for time-to-time rather than place-to-place comparisons" [emphasis in original].

We wish to thank James Hurdle for making this observation.

areas were: Baltimore, Boston, Chicago, Cleveland, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis, San Francisco, and Washington, D. C. Equation (3) was estimated 576 times, each run involving either a within-city price difference for two meats (product market test) or a cross-city price difference for a single meat (geographic market test). Horowitz reported product market results from a comparison of round steak prices with the five other meats and geographic market estimates which used Baltimore as the base city.

A typical entry in the tabulated results contained estimates of the mean price difference, $\hat{\gamma}$, the adjustment coefficient, $\hat{\lambda}$, their respective standard errors, and the coefficient of determination, R^2. Horowitz claimed that "the purpose of running these regressions and presenting the results is neither to test hypotheses nor propose specific markets. Rather, it is to illustrate the feasibility of the approach and the situations it might identify" [5, 11]. Even under this limited claim, the estimates are often so odd that it is difficult to conceive how this approach may ever provide consistent market definition criteria for the courts.

The estimates frequently display the classic symptoms of misspecification. For example, the price of hamburger is calculated to be $3.89 higher per pound in Philadelphia than in Baltimore, with a standard error of $2,710,219.15. The adjustment coefficient is significantly different from zero (but not from 1) and $R^2 = 0.80$. Given this data problem, the geographic

market tests offer a great deal of inconsistency. Using the criteria that $\gamma = 0$ and $|\lambda| < 1$ delineates a market, Baltimore and Washington, D. C. are determined to be in the same market for round steak, but not for any of the five other meats. Baltimore and San Francisco comprise the same market for round steak, veal cutlets, pork chops, and ham, but not for rib roast or hamburger. Given that the regression model is a reduced form equation, the estimated coefficients confound demand and supply factors. This may partially explain the inconsistencies since in deriving some price differences, one side of the market may be relatively more important than in other comparisons. For example, even if round steak were being given away in San Francisco, retail meat buyers in Baltimore would be unaffected.

The essential question in defining markets involves both demand and supply factors. Considering meat retailing in a certain geographic area, say Baltimore, it is logical to look at the area in which Baltimore's consumers can reasonably be expected to purchase meat. Washington, D. C. seems a logical candidate. San Francisco does not. To infer a geographic market from similar prices in two such distant cities is plausible on the supply side (major grocery chains can look nationwide for alternative wholesale sources), but certainly not on the demand side at the retail level. Horowitz' counter-intuitive results reflect the confusion that can occur by applying a statistical test without carefully developing a

theoretical and logical basis for the empirical work.

The product market estimates provide similarly counterintuitive findings. Hamburger is usually determined to be in a different market than round steak, despite the fact that ground round is a common variety of hamburger. "Veal cutlet . . . would in general neither be included in the same product market with any of the other five meats, nor would it serve as a serious potential competitor to any of the other five" [5, 11]. Yet the difference between veal and beef is generally based on whether a calf has reached one year of age. As a final example, "the hypothesis that pork chops and ham . . . constitute one market would clearly be rejected" [5, 11]. Horowitz' product market results ignore the fact that meat is generally shipped as refrigerated animal sides. The local butcher makes the marginal decision about the relative amounts of meat varieties to be obtained from a particular carcass.

The time element is a particularly disturbing feature of Horowitz' specification. By choosing a one-period lag structure, conditions of over two decades past are weighted equally with economic conditions (rivalry, structure, innovations, etc.) of the present. Yet if one focuses on a more recent period, say the last five years, relying on quarterly or monthly data to obtain enough observations, the incidence and influence of short-run fluctuations in supply and demand increases. A useful model must grapple with this tricky problem.

It is clear that Horowitz' model does not capture the many possible sources of systematic price disparity that have appeared in real antitrust cases. For example, from the model presented it is not clear that the long-standing price differential would not place Clorox bleach in a separate market from the many house brand bleaches [18]. The model would likely dispute the contention of the court that "premium" canned dog food competed with lower priced "economy" canned dog food [17]. It is not at all certain how the model would factor in dry dog food, to which canned dog food has been losing ground for the last decade. The model is also unable to address the product market question in a merger of department stores, where traditional department stores maintain a higher "price" in part because over time they have abandoned entire product lines to the encroaching discounters and specialty stores [16]. Horowitz' technique would have difficulty handling the question of substitutability of utility power generating systems, where the goods are made-to-order [15]. It is clear that a more complete understanding of the nature of competition is necessary to posit the boundaries of a relevant market for which price data can, in certain instances, provide useful information

The methodology Horowitz offers does not "whet one's appetite" for future application, nor does it represent a useful market screening device. Both Type I and Type II errors are "too large." The regression identifies geographic or product

pairs as being in the same market when common sense dictates that no market exists. Goods which the most cursory supply-side analysis would put in the same market are found not to compete. An examination of price correlations among substitutes over time is an important part of any relevant market analysis; but it is only a part. Restricting his analysis to the more narrow uniform price test, and completely ignoring supply-side substitutibility, Horowitz has failed to convince us that his model provides "antitrust with a model, understandable, and implementable means of delineating . . . markets." [5, 14]

REFERENCES

1. Areeda, P. and D. F. Turner. Antitrust Law. Boston: Little, Brown & Co., 1978.

2. Chamberlain, E. H. The Theory of Monopolistic Competition. Cambridge: Harvard University Press, 1962.

3. Elzinga, K. G. and T. F. Hogarty. "The Problem of Geographic Market Delineation in Antimerger Suits." The Antitrust Bulletin, Spring 1973, 45-81.

4. _____. "The Problem of Geographic Market Delineation Revisited: The Case of Coal." The Antitrust Bulletin, Spring 1978, 1-16.

5. Horowitz, I. "Market Definition in Antitrust Analysis: A Regression-Based Approach." Southern Economic Journal, July 1981, 1-16.

6. Jevons, W. S. The Theory of Political Economy. Baltimore: Penguin, 1970.

7. Kaldor, N. "Mrs. Robinson's 'Economics of Imperfect Competition.'" Economica, August 1934, 335-41.

8. Kwoka, J. "Product Space and Product Markets: A Suggested Approach." Unpublished paper, FTC, 1978.

9. Landes, W. M. and R. A. Posner. "Market Power in Antitrust Cases." Harvard Law Review, March 1981, 937-96.

10. Marshall, A. Principles of Economics. New York: Macmillan, 1930.

11. Robinson, J. The Economics of Imperfect Competition. New York: St. Martin's Press, 1969.

12. Schmalensee, R. "Another Look at Market Power in Antitrust." MIT Working Paper No. 1238-81, July 1981.

13. Shrieves, R. "Geographic Market Areas and Market Structure in the Bituminous Coal Industry." The Antitrust Bulletin, Fall 1978, 589-625.

14. Stigler, G. The Theory of Price. New York: Macmillan, 1966.

Legal Cases

15. Babcock and Wilcox v. United Technologies Corp. 435 F. Supp. 1249 (1977).

16. U. S. v. Gimbel Bros. 202 F. Supp. 779 (1962).

17. U. S. v. Liggett & Myers. 87 FTC 1074.

18. U. S. v. Proctor & Gamble. 386 U. S. 568 (1967).