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## Margin of Error: The Flawed Paradigm in the New Merger Guidelines

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## I. INTRODUCTION

The U.S. Department of Justice (“DOJ”) and the Federal Trade Commission (“FTC”), the two federal agencies that review mergers, recently issued new Horizontal Merger Guidelines, (“Guidelines”). The Guidelines, first issued in 1984 and revised in 1992 and 1997, comprise a formal statement of the agencies’ approach to merger analysis, an approach that has generally reflected the economic concepts of markets and market power. The effort to explain merger policy, and to have that policy reflect economic principles, is laudable regardless of what one thinks of the final product. But the new version of the Guidelines offers a distinct break from the past and a new paradigm for merger analysis. The analytical core of the new Guidelines, however, relies on an assumption that was long ago shown to be invalid. Here we revisit that history and demonstrate that the paradigm in the new Guidelines is not consistent with basic economic principles.<sup>2</sup>

## II. MARGINS AND MARKET POWER

The conceptual claim in the new Guidelines addressed here is that observed price-cost margins are correlated with market power. The new Guidelines are straightforward about this:

[I]f a firm sets price well above incremental cost, that normally indicates either that the firm believes its customers are not highly sensitive to price...or that the firm and its rivals are engaged in coordinated interaction.<sup>3</sup>

Unless the firms are engaging in coordinated interaction, high pre-merger margins normally indicate that each firm’s product individually faces demand that is not highly sensitive to price.<sup>4</sup>

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<sup>2</sup> The new Horizontal Merger Guidelines can be found at [ftc.gov/os/2010/08/100819hmg.pdf](http://ftc.gov/os/2010/08/100819hmg.pdf), (hereinafter “Guidelines”). The paradigm underlying the new Guidelines is presented in Carl Shapiro, *The 2010 Horizontal Merger Guidelines: From Hedgehog to Fox in Forty Years*, 77(1) ANTITRUST L.J., (2010) (hereinafter “Shapiro”); and in Joseph Farrell & Carl Shapiro, *Antitrust Evolution of Horizontal Mergers: An Economic Alternative to Market Definition*, 10(1) B.E.J. THEORETICAL ECON., (2010) (hereinafter “Farrell & Shapiro”). For other perspectives see the symposia published in ANTITRUST, (Fall 2010); THE ANTITRUST SOURCE, (October 2010); and CPI ANTITRUST CHRON., (October 2010). A comprehensive overview is provided in Dennis W. Carlton, *Revising the Horizontal Merger Guidelines*, J. COMPETITION L. & ECON., (September 2010) (hereinafter “Carlton”). Some of the issues here are also discussed in Michael G. Baumann & Paul E. Godek, *Reconciling the Opposing Views of Critical Elasticity*, 9(1) GLOBAL COMPETITION POL’Y, (September 2009) (hereinafter “Baumann & Godek”).

<sup>3</sup> Guidelines *supra* note 2, §2.2.1.

<sup>4</sup> *Id.* §4.1.3.

In other words, price above “incremental cost” indicates the presence of market power, through either a lack of competitive constraints on a single firm or tacit collusion in an industry. The margin of price over cost—as a supposed indicator of market power—becomes an essential input into the subsequent merger analysis.<sup>5</sup> The qualifying terms “well-above” and “high” are left vague, but vagueness is not the primary problem. The primary problem is that the difference between price and observable cost is not informative about market power.

A margin between price and cost is informative about market power only if it is based on the marginal cost of the firm, as economic theory defines marginal cost. In the Guidelines context, however, incremental cost is generally assumed to include only the additional materials, energy, and labor needed to make additional units of the product—which is how firms end up having “high margins.” As we have suggested before and will discuss in detail here, information derived from a firm’s financial statements and other business documents may allow for the estimation of short-run variable cost, but not of economic marginal cost.<sup>6</sup>

First, it is helpful to review the relationship between variable cost and marginal cost, which applies regardless of the degree of competition.<sup>7</sup> Variable cost and marginal cost are different but related functions.<sup>8</sup> Every standard price-theory textbook contains some version of the following diagram showing the relationship between the two. At any given level of output, the difference between price and variable cost ( $p_0 - vc_0$ ) multiplied by quantity is known as the “rent” being earned by the firm. Rent does not derive from market power; it is the uncertain but hoped-for return to durable and specialized assets of production. The amount of rent determines whether a firm is earning enough to justify its investment in those assets.<sup>9</sup>

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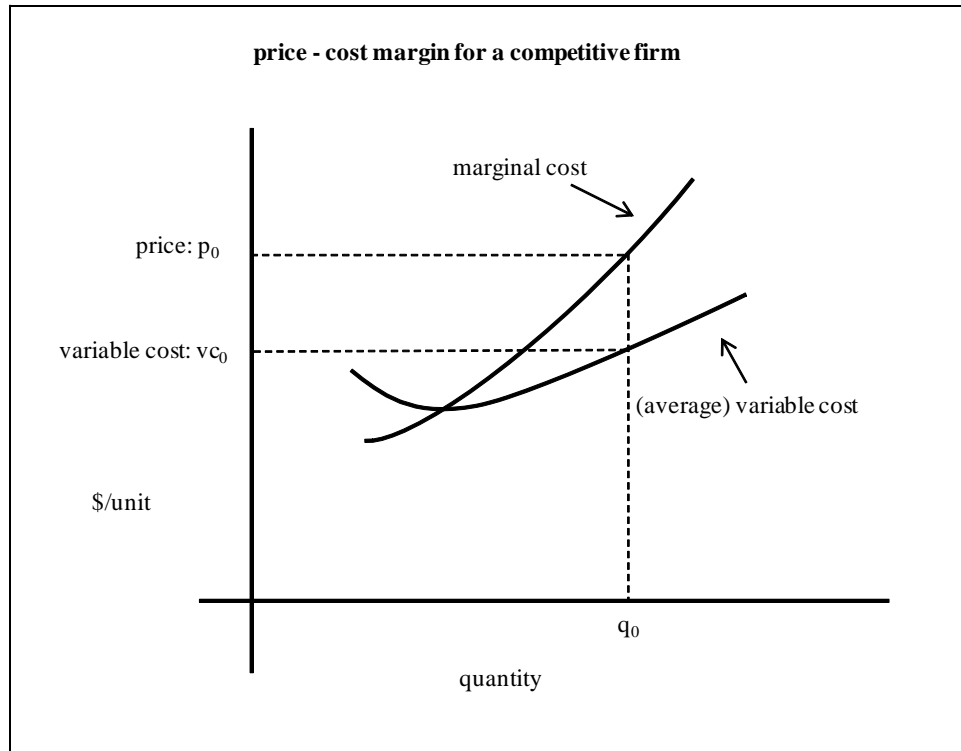
<sup>5</sup> See Shapiro and Farrell & Shapiro, *supra* note 2. The Guidelines also offer the following observations, both in footnotes and without further explanation: “[H]igh margins can be consistent with incumbent firms earning competitive returns.” (§2.2.1.) and “[H]igh margins are not in themselves of antitrust concern.” (§4.1.3.)

<sup>6</sup> Baumann & Godek, *supra* note 2.

<sup>7</sup> In mathematical terms, the marginal-cost function is the derivative of the total cost function with respect to quantity. The term variable cost generally refers to average variable cost, which is the sum of all of the non-fixed costs necessary to produce a given quantity, divided by that quantity. Following convention, we will use the term variable cost to refer to average variable cost.

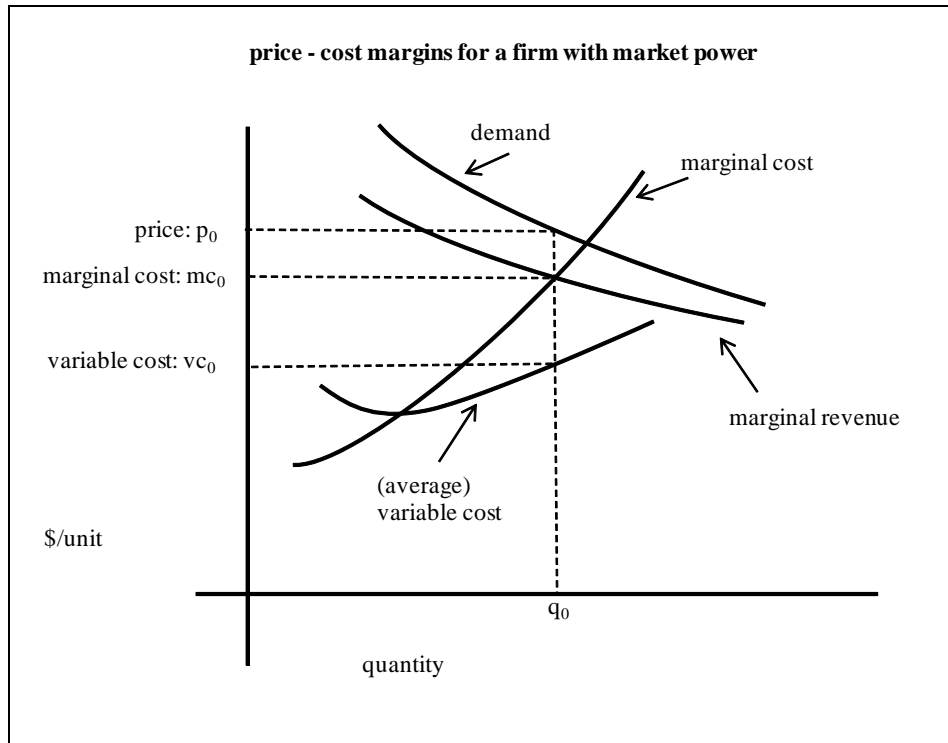
<sup>8</sup> There is one exception. Marginal cost and variable cost are equivalent functions when both are constant, which occurs when total cost is a linear function of quantity. In that case, marginal cost and variable cost are equal and invariant with respect to quantity. There is no reason to expect that this type of model would be consistent with reality. Indeed, with some fixed inputs the concept known as the law of diminishing returns implies increasing marginal costs. For a formal discussion, see EUGENE SILBERBERG & WING SUEN, *THE STRUCTURE OF ECONOMICS: A MATHEMATICAL ANALYSIS*, 3<sup>rd</sup> Edition, Chapter 8 (2001) (hereinafter “Silberberg & Suen”). Furthermore, constant marginal cost is not a valid basis for a competitive benchmark because, with any fixed cost, marginal-cost pricing would not cover total cost. See WILLIAM W. SHARKEY, *THE THEORY OF NATURAL MONOPOLY*, Chapter 3 (1982). Finally, the results in this paper do not depend on increasing marginal cost; the subsequent analysis still holds with constant marginal cost.

<sup>9</sup> This margin is known as a “quasi-rent” if it is based on short-run average variable cost. The term “rent” is used if a firm is able to maintain the margin in the long run, such that price exceeds average total cost. Long run rents can accrue to “infra-marginal” firms—firms with particularly efficient management or productive assets. For a definitive discussion, see GEORGE J. STIGLER, *THEORY OF PRICE*, 4<sup>th</sup> Edition, Chapter 16 (1987).



Competitive firms are price-takers, so price and marginal revenue are equivalent, and each firm produces where price equals marginal cost. Price is determined by the intersection of market demand and market supply. The market determines the difference between price and variable cost for each individual firm. More efficient firms are those that have lower average costs and, thus, higher rents.

The diagram for a firm with market power is similar with respect to the cost functions. The difference, as shown in the diagram below, is that a firm with market power faces downward sloping demand and marginal revenue functions. Profit is maximized at the output where marginal revenue equals marginal cost. Market power is indicated by the difference between price and marginal cost ( $p_0 - mc_0$ ); whereas the rent being earned by the firm is again indicated by the difference between price and variable cost ( $p_0 - vc_0$ ).



The confusion of marginal with variable cost becomes explicit in the Guidelines discussion of differentiated products:

High margins commonly arise for products that are significantly differentiated. Products involving substantial fixed costs typically will be developed only if suppliers expect there to be enough differentiation to support margins sufficient to cover those fixed costs.<sup>10</sup>

Given the Guidelines definition of margin, the assertion here is that only the expectation of market power can explain investments in fixed costs. That is not correct. The margin over marginal cost is uninformative about the profitability of such investments. As explained above, it is the margin over variable cost that determines whether a firm is earning enough to cover its fixed costs. Thus, production involving substantial fixed costs will occur if suppliers expect there to be *variable cost* margins sufficient to cover those fixed costs; and variable cost margins are uninformative about market power.<sup>11</sup> In the real world, of course, prices tend to far exceed variable costs regardless of the degree of market power. Otherwise, firms with substantial capital costs would not exist. We now turn to the measurement of marginal cost.

<sup>10</sup> Guidelines *supra* note 2, §2.2.1, footnote 3.

<sup>11</sup> One of the authors of the Guidelines makes this same error in an article about the Guidelines: “[T]he return on a marketing campaign that attracts new customers depends directly on the price/cost margins that will be earned on those customers.” Shapiro, *supra* note 2 at 80. The return to a marketing campaign, or any other investment, depends on the margin over variable cost, not on the existence of market power (the margin over marginal cost).

### III. THIS IS NOT A NEW ISSUE

That economic marginal cost is not readily observable has been long understood and generally accepted. In the 1980s, Frank Fisher wrote three articles that effectively refuted the use of accounting data to draw inferences about market power.<sup>12</sup> In particular, he negated the use of observable price-cost margins as indicators of market power.<sup>13</sup>

The difference between price and economic marginal cost, relative to the price, is known as the Lerner Index. The Lerner Index is inversely proportional to the elasticity of demand facing a firm and, thus, would be indicative of market power.<sup>14</sup> Regarding the ability of economists to readily calculate a Lerner Index, Fisher concluded as follows: (In the following quotes, the term “profits-sales ratio” is equivalent to the ratio of price to observable cost.)

The profits-sales ratio is an unreliable estimate of the Lerner Index. Simulated examples show that the errors involved in using it may be large in practice... [E]ven the direction of error cannot be easily determined, nor is there a simple way to recast profits/sales so as to recover the Lerner index from accounting data.<sup>15</sup>

[T]he relations of the profits-sales ratio to the Lerner measure bear considerable resemblance to the relations of the accounting rate of return on capital to the economic rate of return... Those who hope that the use of the profits-sales ratio instead of the accounting rate of return will avoid such problems will be disappointed.<sup>16</sup>

In another important article, Timothy Bresnahan recounts the refutation of the idea that “economic price-cost margins ... could be directly observed in the accounting data.” Bresnahan echoes Fisher’s observations when writing that a central idea in modern industrial organization is that “firms’ price-cost margins are not taken to be observables; economic marginal cost cannot be directly or straightforwardly observed.”<sup>17</sup> He goes on to describe the empirical, data-intensive methods that can sometimes be used to estimate marginal cost and measure market power. In their authoritative industrial organization textbook, Dennis Carlton and Jeffrey Perloff conclude that the use of margins based on variable costs to infer market power can “lead to serious biases.”<sup>18</sup> In sum, this aspect of the new Guidelines is contrary to the existing literature and the general consensus regarding the unobservability of economic marginal cost from available data.

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<sup>12</sup> Franklin M. Fisher & John J. McGowan, *On the Misuse of Accounting Rates of Return to Infer Monopoly Profits*, AMER. ECON. REV., (March 1983); Franklin M. Fisher, *On the Misuse of Accounting Rates of Return – Reply*, AMER. ECON. REV. (June 1984); Franklin M. Fisher, *On the Misuse of the Profits-Sales to Infer Monopoly Power*, RAND J. ECON (Autumn 1987). These three articles are reprinted as chapters 4-6 in FRANKLIN M. FISHER, *INDUSTRIAL ORGANIZATION, ECONOMICS, AND THE LAW* (1991) (hereinafter “Fisher”).

<sup>13</sup> Fisher, *Id.*, Chapter 6.

<sup>14</sup> DENNIS W. CARLTON & JEFFREY M. PERLOFF, *MODERN INDUSTRIAL ORGANIZATION*, 4<sup>th</sup> Edition, Chapter 4 (2005) (hereinafter “Carlton & Perloff”).

<sup>15</sup> Fisher, *supra* note 12 at 135.

<sup>16</sup> *Id.*, at 135 footnote 1.

<sup>17</sup> Timothy F. Bresnahan, *Empirical Studies of Industries with Market Power*, HANDBOOK OF INDUSTRIAL ORGANIZATION, (Richard Schmalensee & Robert Willig, eds.) pages 1012-1013 (1989). For a recent survey of the relevant literature, see Liran Einav & Jonathan Levin, *Empirical Industrial Organization: A Progress Report*, J. ECON. PERSPECTIVES (Spring 2010).

<sup>18</sup> Carlton & Perloff, *supra* note 14 at 254.

#### IV. THE PROBLEM ILLUSTRATED

After the new Guidelines were adopted, one of its authors offered the following observation:

Yes, there are well-known pitfalls in measuring margins using accounting data, but DOJ economists are well aware of these pitfalls and skilled at overcoming them when the data permit. *Footnote:* Academic researchers are often unable to obtain good estimates of marginal cost using publicly available accounting data. DOJ economists and economists working for merging firms often can estimate marginal costs using detailed, proprietary information that is available through the HSR discovery process but unavailable to academic researchers. *End footnote.*<sup>19</sup>

The problem of measuring economic marginal cost is far more profound than the above statement indicates.

Let us start with the Guidelines description of incremental cost:

Incremental cost depends on the relevant increment in output as well as on the time period involved, and in the case of large increments and sustained changes in output it may include some costs that would be fixed for smaller increments of output or shorter time periods.<sup>20</sup>

According to that description, incremental cost is lower the shorter the time period and the smaller the increment of output. As noted above, in the Guidelines context incremental cost is generally taken to include only the additional materials, energy, and labor needed to make additional units of the product. Such costs do not reflect any of the “capital” costs of doing business: physical plant and equipment, research and development, and advertising. The costs of management, selling effort, and much if not all of a firm’s labor costs are also generally not considered.

The Guidelines approach seems to be motivated by two related assumptions: 1) that the estimation of short-run marginal cost can be separated from the complex issues involved in the estimation of long-run marginal cost, and 2) that short-run marginal cost is typically well below long-run marginal cost. These assumptions are not consistent with basic economics.

First, it is helpful to review the nature of the marginal-cost function. Consider the following depiction of total cost as a function of output ( $Q$ ) and the cost of all inputs, which are often categorized as capital, labor, and materials ( $k, l, m$ ):

$$TC(Q) = f(Q, k, l, m)$$

The total-cost function is generated by cost minimization subject to the constraint of the production function. The marginal-cost function is the derivative of the total-cost function with respect to quantity:

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<sup>19</sup> Shapiro, *supra* note 2 at 79-80. No doubt it was an unintentional oversight not to include FTC economists in that statement. We do not question the skills of DOJ economists, FTC economists, or economists working with merging firms, having spent our careers among those groups. We do question the value of the information on this particular topic to be found in business documents. Farrell & Shapiro make the same claim about how firms “keep track of their cost functions” and that “such information is normally available to antitrust agencies and courts.” See Farrell & Shapiro, *supra* note 2 at 18.

<sup>20</sup> Guidelines, *supra* note 2, §2.2.1.

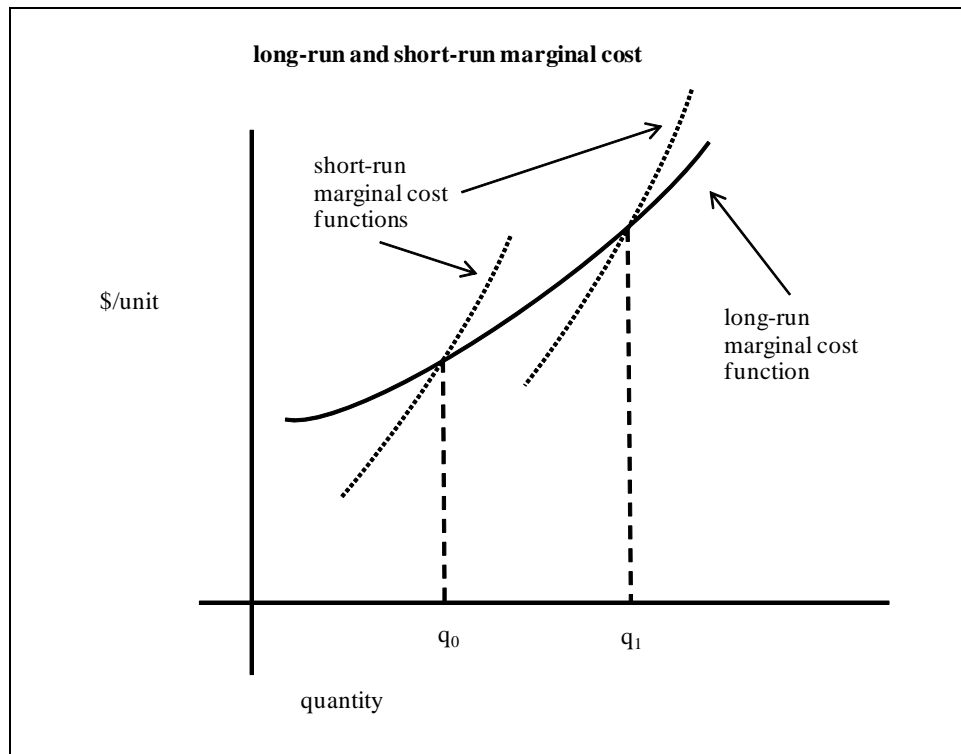
$$MC = dTC(Q)/dQ$$

Conversely, total cost is equal to the integral of the marginal-cost function over the entire range of output:

$$TC(Q) = \int_0^Q MC(Q) dQ$$

Thus, marginal cost is a function the integral of which equals the total of all variable costs necessary to produce and sell current output. A marginal-cost function reflects the long run if all inputs are variable with respect to changes in quantity. The length of the time period chosen as the short run determines which components of cost are fixed. Focusing on the short run, however, does not simplify the problem of estimating a marginal-cost function.

Short-run marginal cost differs from long-run marginal cost only to the extent that demand shifts cause a firm to operate off of its long-run marginal-cost function. In equilibrium, where marginal revenue equals long-run marginal cost, there is no distinction between short-run and long-run marginal cost. Thus it is that every standard price-theory textbook contains some version of the following diagram showing the relationship between long- and short-run marginal-cost functions.



At any point on a firm's long-run marginal-cost function, short-run marginal cost is equivalent to long-run marginal cost.<sup>21</sup> Substantial and unanticipated demand shifts may cause a firm to operate off of the long-run function, so that the short-run function comes into play.

<sup>21</sup> At any level of output, there is a short-run total cost function that is tangent to (and more convex than) the long-run total cost function. The point of tangency represents the optimal amount of the short-run-fixed input for that level of output. The tangencies are points of equal slope of the short-run and long-run total cost functions. Since



In the short run relative to the long run, increases in demand (price) will lead to smaller increases in output; decreases in demand (price) will lead to smaller decreases in output. Output will expand or contract more in the long run, when all inputs can be adjusted. Thus, the fixity of certain assets in the short run does not imply that short-run marginal cost tends to be substantially less than long-run marginal cost. Short-run fixity implies only that the short-run function will be less elastic. As a first approximation, the two marginal costs will be equal in value; if they are not equal, they are converging.

## V. WHAT IS THE COMPETITIVE MARGIN?

In sum, to those who argue that most of a firm's costs—other than the costs of incremental amounts of materials, energy, and labor—are not relevant in the shorter-run world of antitrust analysis, our reply is as outlined so far: 1) the costs being measured are short-run variable costs, not marginal costs, and are therefore not informative about market power; 2) a short-run marginal-cost function is no more easily estimated than a long-run marginal-cost function; and 3) as a first approximation, short-run and long-run marginal cost would have the same starting value.

A firm operating where price is approximately equal to long-run marginal cost has no economic margin and no market power. It is inconsistent with basic economics to “zero out” the capital—or any other—component of marginal cost and declare the resulting value to be short-run marginal cost, and the resulting margin to be indicative of market power. If the antitrust authorities can identify a margin as being above the competitive level, then they must be able to identify the margin that would be at the competitive level. The only way to do that would be to determine whether price is above long-run marginal cost.<sup>22</sup>

Furthermore, even if it were possible to generate a point-estimate of marginal cost, that estimate would not reveal the slope of a marginal-cost function. As discussed above, marginal cost will, in general, be an increasing function of output and the elasticity of marginal cost will itself be a function of the length of the run chosen. The slope of a marginal-cost function would be crucial in determining whether price increases would be profitable to merging firms.<sup>23</sup>

There is also the issue of total cost. As demonstrated above, the sufficiency of prices to replace invested capital is uninformative about market power. In other words, prices will not always allow for the replacement of invested capital, regardless of the degree of competition; such is the inherent risk of investing. That many investments turn out to be unprofitable,

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marginal cost is the slope (the derivative) of the total cost function at any level of output, short-run and long-run marginal costs are equal at any point on the long-run marginal cost function. See Silberberg & Suen, *supra* note 8. Determining the extent to which a firm is operating off of its long-run marginal-cost function would be an exceedingly complex task and, in any case, is not the approach advocated in the Guidelines.

<sup>22</sup> As noted, a marginal-cost function can sometimes be estimated through data-intensive empirical analysis, which requires information far beyond what can be found in business documents and, in any case, is not the approach the authors of the Guidelines are contemplating. *See* the papers cited in footnote 17.

<sup>23</sup> There are also reasons why margins over marginal cost, even if measurable, would not be evidence of market power in dynamic industries. For discussions of that issue, *see* Dennis W. Carlton & Mark Israel, *Will the New Guidelines Clarify or Obscure Antitrust Policy?* ANTITRUST SOURCE (October 2010); Jay Ezrielev & Janusz A. Ordover, *The 2010 Horizontal Merger Guidelines: A Static Compass in a Dynamic World?* ANTITRUST SOURCE (October 2010); and Carlton, *supra* note 2.

however, is no reason to expect prices generally to be far less than average total costs. Prices that preclude the replacement of invested capital are at least below competitive equilibrium levels and cannot as a general matter be an appropriate competitive benchmark for antitrust analysis. It is a simple refutation of the Guidelines approach that, in non-declining industries, the suggested analysis routinely generates supposedly competitive prices that preclude the existence of the products at issue.

## **VI. CONCLUSION**

For more than 20 years economists have accepted that there is no way to easily determine the extent to which a firm's price is in excess of marginal cost, as marginal cost is defined in economics. The authors of the Guidelines now claim that firms "keep track of their cost functions" and that such information is available in business documents.

We should remind ourselves that cost functions, and the production functions from which they derive, are inventions—the theoretical constructs of economics. These inventions are incredibly powerful tools for understanding the behavior of firms; but we should not expect firms to know their cost functions any more than we expect firms to know their production functions, as those concepts are defined in economics. Nor should we expect firms to manage their records in accordance with the definitions of economic theory. The information necessary to formulate a representative marginal-cost function is not generally available, even to the skilled researcher with complete access to a firm's documents.

In sum, the Guidelines assume that the estimation of short-run marginal cost can be separated from the issues relating to long-run marginal cost and, further, that short-run marginal cost is typically well below both long-run marginal cost and average total cost. These assumptions are not consistent with basic economic theory. In effect, the authors of the Guidelines want to imagine that marginal cost is equivalent to short-run variable cost, in order to apply their particular models of competitive analysis. Those dealing with the antitrust agencies ought not accept the approach.