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**PRICING IN THE NEW ECONOMY:
LESSONS FROM THE PERIOD OF THE E-COMMERCE BUBBLE**

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ABSTRACT

The New Economy increased U.S productivity sharply after 1995. The latest economics literature on the topic, which generally forecasts a secure future for the information economy, is reviewed. The down side of the New Economy were the strategies, especially the pricing strategies of NASDAQ and virtual firms. The critique of Michael Porter regarding the non-strategic price cutting common to those firms is reviewed. Traditional models by Sweezy and Baumol, which focus on pricing in imperfectly competitive industries, are applied to provide a cogent theory as to why those firms made mistakes that were once viewed as common for neophyte industries.

JEL Classifications: A1, D4, L1, M2

Key Words: New Economy, Information Economy, Pricing Strategy, Transactions Costs, Imperfect Competition, Revenue Maximization

PRICING AND THE NEW ECONOMY LESSONS FROM THE PERIOD OF THE E-COMMERCE BUBBLE

Use of the term “New Economy” to describe the information economy was probably unfortunate. If the New Economy is a lasting phenomenon, the term must ultimately become an anachronism. But more serious is the misconception that the New Economy perished with the bursting of the NASDAQ bubble and the arrival of recession.

It is true that to some people the New Economy was the belief that recessions had been permanently vanquished and that stock prices, which had ultimately become bubble prices, represented legitimate possibilities for future wealth, *i.e.*, the actual present value of firms. Serious economists saw the New Economy as much more, including the following three elements. First, it entailed the revival in productivity growth in the United States beginning in 1995. Second, it included developments in the information and communications technologies that rendered all sectors of the economy more productive. Finally, it had reference to the necessary institutional and organizational changes that permitted firms to accommodate themselves to the exigencies of the digital economy – these required the reorganization of the firm, coping with industrial competition unlike that of preceding eras, and changes so sweeping that many thought erroneously that the basic rules of economics had changed.

The recession of 2001 proved the belief that recessions had been permanently overcome to be misguided. But none of the other propositions were really changed by the recession. Those who tend to doubt that the New Economy was merely chimerical or transitory have not found substantiation from the literature, since specialists have provided evidence to the contrary. We need only to refer briefly to the substantive literature that insists that the information economy is alive and well, the recession notwithstanding. This article is motivated by the view of that literature, *viz.*,

that information and communications technologies (ICT) have irrevocably changed the US economy.

Section I will review the most significant econometric findings related to the upward shift in productivity attributed to the New Economy and the evidence that it is not defunct. This will be done only briefly to motivate the assertion that pricing issues are important for the information economy, which continues. Section II will ask what went wrong with the New Economy. That information is important for the US economy, which continues in some areas to be on the cutting edge of global development. It is also important for other advanced economies interested in avoiding the pitfalls encountered by some US firms in the bubble period of the late 1990s. Section III discusses the issue of the non-strategic pricing practices mentioned in Section II. The pricing discussion will address the imperfectly competitive conditions that permit economists to enjoy the process of abstraction, albeit at a level of only modest sophistication.

I.

The development of the information economy has been driven by a rapid decline in the prices of computers and other information and communications equipment. That process has permitted a dramatic diffusion of information and communications technologies over recent decades (Jorgenson and Stiroh, 1999). Investments in capital equipment result in technological “spillovers” which appear in econometric studies as “residual” economic growth beyond that attributable to labor and capital. According to Jorgenson and Stiroh, computers contributed nearly a sixth of the annual 2.4 percent output growth since 1990, representing c. 20 percent of the contribution of capital inputs to growth and 14 percent of the contribution of the services of consumers’ durables.

New Economy skeptics (*e.g.*, Heileman et.al., 2000, p. 36) agree that the quarterly productivity rates since about 1995 do indeed show an upward shift in the growth trend. Since the time period in question is very recent, they have doubted whether it can be sustained. Historically, some productivity spikes have proved, especially in the last phases of cyclical upturns, to be strictly temporary.

Between 1995 and 1999, the investments of American firms in information technologies, computers and peripheral equipment increased more than four-fold. Between 1995 and 1999, output per labor hour increased at roughly 2.5% *per annum*, while the contribution of IT capital to output growth nearly doubled to 1.1 percentage points (Oliner and Sichel, 2000).

Jorgenson (2001) attributes the resurgence of productivity growth to spectacular semiconductor technology improvements. Dramatic price reductions in IT prices followed and these resulted in heavy investments in IT products. Jorgenson indicates that declining semiconductor prices are projected to continue for at least another decade.

Robert Gordon is convinced that productivity growth has mostly been a cyclical phenomenon; he was not willing to concede that the ITC industries represent fundamental new technologies, completely transforming industrial production processes and making fundamental changes in the organization of the firm and its labor relations (Rheinisch-Westfaelisches Institut fuer Wirtschaftsforschung and Gordon, 2001).

Oliner and Sichel (2000) have challenged Gordon's conclusions. They emphasize that Gordon tends to focus on trend productivity growth while they addresses developments in actual productivity growth. These authors also cite the work of Whelan (2000) and Jorgenson and Stiroh (2000) as producing results similar to their own.

Baily and Lawrence (2001) reject Gordon's interpretation of the productivity growth of the late 1990s. They cite the work of Sharpe (2000), and argue as he does that there has been

considerable structural acceleration of total factor productivity outside the IT sector proper. They show evidence of accelerating productivity in those service industries which have made extensive purchases of IT equipment which verifies the existence of a new economy. They point out that labor productivity accelerated by 1.6 percentage points in the second half of the nineties; their estimates suggest that the cycle had nearly no impact on the period's productivity growth. The implication is that there was a structural acceleration of productivity for the period.

Baily (2002) observes that a growth accounting framework making use of both income and product data indicates a significant increase in multifactor productivity growth after 1995 outside the IT hardware sector. Moreover, innovative business practices (sometimes accompanying, although not always related to information technology) have promoted increased productivity. He also finds that the competitive intensity of particular industries can generate productivity growth, since intensive competition drives out slack management practices, squeezes out low-productivity firms and encourages the entrance of high productivity enterprises. Finally, it elicits innovation from companies that must compete in order to survive.

But what of the future? The euphoria of the late 1990s was followed by a lingering recession. Economists were not the only ones wondering whether the post-1995 productivity revival would continue. Baily attributed the productivity acceleration to the rapid improvements in information technology, strong competition in key industries and the dynamic effects of globalization. Those things certainly didn't disappear with the recession and Baily and other key observers expect the productivity growth revival to continue. The literature anticipates a near-term productivity trend will run from 2 to 2.7 annually over the coming years. That level of productivity growth would permit GDP expansion at a rate of 3.0 to 3.7 percent *per annum*.

II.

The New Economy is more solidly based on ICT industries than the economy had previously been. So long as the technologies continue to develop and find application through investments, one need not ask what went wrong with the New Economy. In the last half of the 1990s the development of a bubble economy and the poor managerial strategies of many NASDAQ firms did, of course, represent a problem that deserves our attention.

Firms too often failed to develop and follow carefully crafted strategies, trusting their futures instead to vague “first mover” hopes and the pursuit of market share through “introductory” pricing. These mistakes had serious consequences for the foolhardy, but sometimes as well for those of greater prudence caught in the pressures of an irrational environment (Bornstein and Saloner, 2002). The appeal of low-price strategies, which can readily generate price wars in some neophyte industries, appears to have had a significant impact on the Internet landscape. The hope of on-line commerce was that price discrimination would be facilitated by the new technologies. Sellers could retain and process detailed information about the buying habits of their customers. But that prospect is undermined to the extent that the customer uses the internet adroitly to find the best price available rather than staying with a company because of the initial price advantage that led to an early purchase.

It has been argued persuasively (Porter, 2001) that it was foolish to respond to internet technology by shifting the competitive approach to price cutting, paying little attention to product quality, desirable characteristics, and service. Not surprisingly, new internet technologies triggered extensive experimentation, but too often the outcome was that firms subsidized the purchase of their products hoping to secure a base of loyal customers. Psychological pressure to engage in such tactics was strong, since suppliers of intermediate goods also engaged in such price cutting for their customers. That subsidization drove costs for firms purchasing on line.

The focus of the dot.coms, Porter's contends, was on the internet's potential to reach large numbers of consumers and the rapidity with which internet use was increasing. The focus should actually have been on what impact internet use would have on industry structure. In some cryptic way the internet was expected to unleash forces that would sooner or later produce industry profits for "first movers." It would increase customer switching costs and promote network effects leading to strong competitive advantage. Unfortunately, the Internet itself was not likely to increase switching costs when the consumer could locate the next seller just one click away. And network effects hardly eliminate costs altogether, so even with a comparative advantage there are limits to reasonable price cutting tactics.

Closely related to the lack of focus on profits in the New Economy was the unrestrained pursuit of maximal revenues and market share through heavy advertising, giveaways, discounting, promotions, and channel incentives. Indirect revenues from advertising and click-through fees distracted the focus and misdirected the effort of too many firms. Porter, of course, argues that the firms' strategic focus should have been on profitability through the addition of real value for their buyers.

All of these problems, of course, do not negate the fact that electronic computation and communication capacities are powerful tools when properly used. The promise of the New Economy should be recognized -- the boost to productivity growth of the recent past and the prospects for such contributions in the future. Brynjolfsson and Hitt (2000) remind us that computers add value not only in the area of number crunching. It is their symbol processing capacity that will create complementary innovations far into the future. ICT industries encourage complementary organizational investments in business processes, enabling cost reductions and increased output quality. Such quality includes new products, improvements in difficult-to-measure product characteristics such as variety, convenience, timeliness and quality.

Brynjolfsson and Hitt also discuss the difficulty of measuring the information revolution's full impact with econometric methods. In their view, it is likely that econometric studies understate the ICT contribution to productivity growth. Litan and Rivlin (2001) discuss aspects of these contributions not easily captured by traditional growth accounting techniques. Intangible quality characteristics improve products and enhance their characteristics and become embodied in new products. Improved service for the consumer and the speed and convenience of transactions and ownership are not captured in the usual quantitative evaluations. In the same way, traditional measurement focuses on the measurable aspects of investment, e.g., the prices and quantities of ICT products. They fail to capture even larger intangible investments in developing complementary new products, services, and markets, internal business processes and organizational adaptations, and in developing requisite labor and management skills. A study by Brynjolfsson and Yang (1997) of 800 firms showed that the value of the intangible assets associated with information technology investments may be 10 to 1. Consequently, an investment of \$167 in computer capital in 1996 U.S. national accounts may have been the more apparent share of a total investment by industry of \$1.67 trillion.

Demonstrating how much the internet adds to the value enjoyed by producers and consumers, Litan and Rivlin (p. 314) show that it reduces transactions costs, increases management efficiency through effective supply chain management, and increases competition through increased transparency of prices. They envision a gradual transformation of the international market system as a product of the internet revolution. That implies increased competition, reduced profit margins, enhanced productive efficiency and greater consumer satisfaction over time. They expect specific sectors of the economy, e.g., health care and other services, to become much more productive through the internet. Extrapolating from their analysis of a sampling of firms across industries, they estimate that the internet enables total cost savings of from \$100-230 billion annually.

III.

To address New Economy price competition issues, this section refers first to Sweezy's contribution to our understanding of imperfect competition. The issue of revenue or sales maximization, observed above to be part of the New Economy, calls to mind the Baumol model of revenue or sales maximization.

Lacking concrete empirical information about the firm's demand curve, managers must make pricing decisions under uncertainty about the future. This can be especially difficult in conditions of imperfect competition in which Sweezy-type demand curves may apply, *i.e.*, one demand curve holds in the instance that a firm is free to adjust its prices without concern about evoking reaction from competitors, but a different, less elastic demand curve holds where price cuts will evoke aggressive, competitive response from other firms. Assume that the firm in this instance does not know the elasticity of demand it faces. It may have some idea about the nature of the competitive response that it may encounter when imposing a price change.

The initial, primary assumption that the elasticity coefficient exceeds unity is likely to be correct. With elastic demand a reduction in price will increase revenues. If that does not happen, management will assume that something unfavorable has occurred due to chance. At the next likely point of policy change, it will likely reduce its price again. It could do this two or three times before beginning to readjust the expectation that price reductions will be productive of increased sales revenues.

Sweezy's article (1939) on oligopoly pricing taught more than one generation of economists that in neophyte, unstable oligopoly industries there is an inclination to resort to possibly destructive price competition. Because the competition will always match price cuts and will never match price increases, managers perceive that competition should be limited to non-price competition, permitting stability and some net revenue earnings to persist in the industry. In my view, the New

Economy's disastrous price-cutting reflected infant-industry, oligopoly behavior. As we saw above, Porter (2001) decries the thoughtless, continuous price-cutting as a reflection of insufficiently-developed strategy on the part of the participants.

A simple analysis of this situation can be based on the assumption of neutrality in pricing optimism. Assume the pricing decision-maker sees the world as a set of rectangular-hyperbolic demand curves of unitary elasticity, or, alternatively, a set of iso-revenue curves. Picking a point reflective of current price and sales, the manager will hope to be able to change the price and move to a higher iso-revenue curve. This is seen in Figure 1 as a movement from point A. If the price is reduced, revenues will increase or decrease, as shown in Figure 1 as a movement towards point B or C. If toward B: $(\Delta P/P < 0) > (\Delta Q/Q > 0)$, $\Delta \Rightarrow TR < 0$. If the price change moves the firm toward C,

Insert Figure 1 here

$(\Delta P/P < 0) < (\Delta Q/Q > 0) \Rightarrow \Delta TR > 0$. The same reasoning applies for a price increase, which will move the firm away from point A towards point D or E, depending on the market response. A movement toward D implies a reduction in total revenues: $(\Delta P/P > 0) < (\Delta Q/Q < 0)$, $\Delta \Rightarrow TR < 0$.

A price reduction characterized by a greater percentage reduction in price than the percentage reduction in quantity will lead to an increase in total revenues as a movement toward E, or $(\Delta P/P > 0) > (\Delta Q/Q < 0) \Rightarrow \Delta TR > 0$.

New Economy pricing was probably as rich in the variety of approaches applied as in normal business situations. According to Porter (2001), however, there was a tendency for many firms to assume that the segment of the demand curve on which they were operating was characterized by elastic demand.¹ To this observation something should be added about the pressure firms felt in the New Economy to benefit from being “first movers.” The idea was that one needed to get quickly into the market with early sales so that economies of scale could be developed early. A shortcut to market dominance could be achieved quickly through very low prices

to attract sales. As Porter reminds us, “in the early stages of the rollout of any important new technology, market signals can be unreliable. New technologies trigger rampant experimentation... many companies have subsidized the purchase of their products and services in hopes of staking out a position on the Internet and attracting a base of customers” (*Ibid.*, p. 64).

The expectation was that a higher iso-cost line could be reached, or that at the very least, position could be retained on the same iso-revenue line. In the latter case, the percent of sales increase would precisely offset the percent reduction in price. But the inevitable sales surprise then appeared. The price-reduction induced increase in quantity was insufficient to maintain total revenues and one would fall to a lower iso-revenue curve.

The Cost Side

The internet has tended to reduce variable costs of production, making fixed costs more important. It has provided great savings in transactions costs. The Internet has helped us to understand that neo-classical economics overemphasized production costs and paid far too little attention to transactions costs. Note what Porter (*ibid*, p. 66) says about costs:

“Internet technologies tend to reduce variable costs and tilt cost structures toward fixed cost, creating significantly greater pressure for companies to engage in destructive price competition...The great paradox of the Internet is that its very benefits – making information widely available; reducing the difficulty of purchasing, marketing, and distribution; allowing buyers and sellers to find and transact business with one another more easily – also make it more difficult for companies to capture those benefits as profits.” (p. 66)

What Porter refers to as a great paradox is no paradox at all; it is the basic notion of competitive markets. In such markets, price is driven by competitive action down to the level of costs. According to Porter and other observers, variable costs tend to be low and fixed costs high in the information economy. In that environment it makes sense explicitly to add transactions costs to

those of production. The effect of this would be to flatten out the U-shaped average and marginal costs of neoclassical analysis. Although diminishing returns will result in short-run increases in costs with a given scale of plant, the addition of transactions costs to the equation tends to *offset* increasing costs. Information advantages arising from electronic and related technologies permit larger outputs for a given scale of plant. Firms will thus enjoy diminishing transactions costs which will offset, at least in part, increasing production costs.

We can safely assume that the negotiations, the search processes, the essential communications and other elements of transactions costs, associated with large as well as small transactions, do not increase in correspondence with volumes of output. Research into this area may prove that impressions are deceiving, but it seems logical that transactions costs would not be subject to the laws of nature's parsimony to the extent that production costs are. Because electronic technologies so greatly assist in information processes and hence transactions, short-run cost-curves encompassing both production and transactions costs may more closely resemble gently upward-sloping, nearly horizontal lines rather than U shaped curves.

If this is actually the case for costs, we would experience flat or nearly flat supply curves, since the sum of horizontal marginal production and transactions costs would be a horizontal line. This would imply market equilibria at lower price and larger quantity values.

New Information Costs in the Revenue Maximization Model

In a standard market situation, a *ceteris paribus* reduction of costs causes the supply curve to shift to the right, producing an equilibrium of lower price and larger quantity. If we have information economy costs as described above, including the effects of incorporating transactions costs into an analysis which has traditionally only included production costs, we could conclude that we would experience horizontal or nearly horizontal supply curves, which would dramatically

increase the normal cost reduction effects, *i.e.*, we would experience larger price reductions and quantity increases.

Consider, however, Baumol's (1959) model of the revenue-maximizing firm. The New Economy firm's costs as characterized above would have similar impacts on the revenue-maximizing firm: larger outputs sold at lower prices would be characteristic. This model, which can hold for either a monopoly or oligopoly firm,² does not exhibit the fierce price-cutting form of competition and is billed as a model which ignores interdependence³, but it can reflect larger sales and reduced prices where firms pursue larger sales rather than attempt to maximize net revenues.

Insert Figure 2 here

In Figure 2 the profit-maximizing solution prescribes an output of q^* , which will yield maximal, unconstrained profit Π^* , but implies sales smaller than q^0 , which is the largest possible level of sales consistent with the firm's choice of a minimally acceptable profit level, Π^0 .

In the standard model, the firm will max $TR(q)$ subject to

$$\Pi = TR(q) - TC(q) \geq \Pi^0 \quad (1)$$

Total revenue is positive and rising at the unconstrained profit maximization output, $TR'(q^*) > 0$, and the total revenue curve is continuous, smooth and twice continuously differentiable. When output rises beyond q^* , total cost rises at an increasing rate, so $TC''(q) > 0$ for $q \geq q^*$. The TR curve beyond q^* continues in the next phase to rise, although its slope, $TR''(q) < 0$, is decreasing. A solution will exist if $\Pi^0 < \Pi^*$, the situation normally posited, since sales revenues will increase for quantities greater than q^* or as profit declines toward the lower Π^0 .

Consider now the corresponding Baumol model of New Economy pricing. We will once again attempt to maximize revenues or sales $TR(q)$ subject to the minimal acceptable profit constraint as shown in equation (1). Here, however, we observe the New Economy's larger fixed costs and nominal or zero variable costs, as described above. Let us begin at an extremum of this

cost situation illustrated in Figure 2 as the horizontal line, TC_2 , which assumes no variable costs or

$$TC'(q) = TC''(q) = 0. \quad (2)$$

This will cause the profit function, now Π_2 to reach its maximum point at a larger output, precisely where TR reaches its maximum point. This simple result appears because $TC(q)$ becomes a constant, let us say $TC = \gamma$, where

$$TR = \alpha Q - \beta Q^2 - \gamma, \quad (3)$$

Now,

$$d\Pi/dq = \alpha - 2\beta Q = 0. \quad (4)$$

To maximize sales,

$$TR = \alpha Q - \beta Q^2, \quad (5)$$

with no consideration of costs, we take

$$dTR/dQ = \alpha - 2\beta Q = 0. \quad (6)$$

Thus, in the extreme New Economy cost case, maximizing sales is synonymous with unconstrained profit maximization. It implies higher prices and larger sales volumes.

In the case where variable costs are slight but positive, the second total cost curve is nearly like the one observed directly above, except that it has a slightly positive slope. In this case, the constrained profit-maximizing output will exceed the unconstrained one, but it will occur before the maximum point of the total revenue curve where $TR'(q) = TC'(q)$. This is at the output where realized profits equal the minimally acceptable profit constraint.

Pricing and Productivity Measurement through Micro, Industry Studies

It has not been apparent to econometricians measuring productivity growth that the Porter pricing effects referred to above are of excessive importance. More from a micro level, Baily and Solow (2001) have addressed the issue and raised some important points to be discussed

momentarily. Their key insight is that we need to know more about new economy productivity than is revealed through aggregate econometric analyses.

It is possible that such studies understate productivity growth throughout the economy to a considerable extent.⁴ Productivity measurements compare growth of output's market value, summing the products of the quantities and prices that measure such growth. But if the extent of the pricing competition is as serious as suggested by Porter, there are numerous industries whose productivities would be substantially higher if sales had occurred on a normal basis rather than at prices seriously understating what consumers had been willing to pay in the absence of non-reflective price cutting.

These and other considerations demonstrate that research on the information economy must include micro-economic considerations. Baily and Solow (2001) show that it is possible, albeit a difficult task, to make productivity measurements for comparative evaluation from the level of the firm (p. 152). Such studies show industrial detail on where productivity lags can occur and what can be done specifically to overcome them. Such insights would not appear from macro productivity studies. Moreover, in-depth, industry-by-industry analyses can reveal where measurement problems may occur and how they could be solved. Finally, these authors demonstrate their regard for studies combining a micro, industry-level approach to productivity with the more conventional macro measurement and comparisons. They provide a list of studies in their references (p. 152) sponsored by the McKinsey Global Institute which provide detailed comparisons of firms or groups of firms producing similar outputs but operating in different environments and adopting different practices. Cross-national comparisons at the micro level offer the opportunity to observe such differences at work. In particular, we sometimes find that total factor productivity and labor productivity differences have their roots not in anything one would describe as "technology," but rather in patterns of organization, motivation of managers, and the like. For example, the studies suggested

that the intensity of international and domestic competition can have a large impact on productivity.
(p. 152)

Industry studies of this type demonstrate that appropriate policy can enhance the extent of competition in particular markets. Industrial regulation, corporate governance institutions, and other elements of public policy can have an important impact on productivity. An environment of intensive competition among firms using best practice technology tends to generate high productivity in a given industry (p. 170).

To understand the information economy and to establish appropriate economic policy to promote competitive exploitation of its possibilities, studies of firms and industries at the micro level are essential. Considerations of pricing implications seem to help explain New Economy phenomena. Additional theoretical and quantitative analyses will help illuminate the vast changes we can continue to expect from the information economy.

Figure 1
New Economy Sales and Iso-Revenues

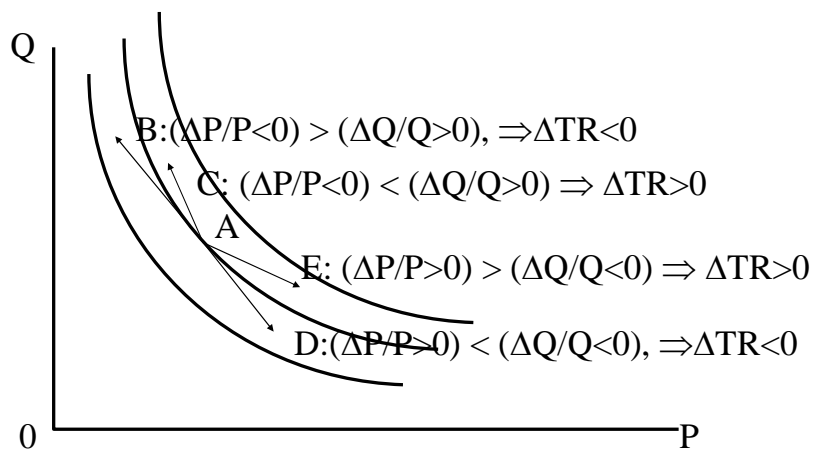
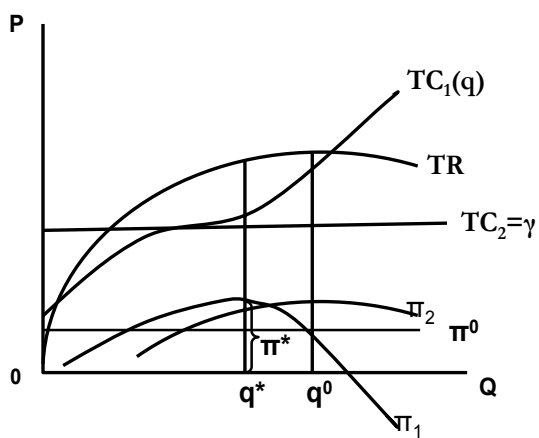


Figure 2
 Maximum Sales Revenue Equivalent to Maximum Net Revenues
 In the New Economy



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¹ The coefficient was likely to prove, as assumed, to exceed unity, since in the case of the linear demand curve the marginal revenue curve bisects the quantity axis halfway between the origin and the intersection of the demand curve. To the right of that point, marginal revenue is negative and the profit maximizing firm cannot equate positive marginal costs with negative marginal revenues. If the demand curve is curvilinear rather than linear, this logic, of course, need not hold.

² Henderson and Quandt (1971), p. 221 address the theory as "the revenue-maximizing monopolist."

³ Interdependence could easily be built into the model by allowing, for example, the Total Revenue function to reflect competitive price cutting. As competitors reduce their prices, the firm's TR curve would shift down, reducing both revenues and profits. But who wants a model that must continually be redrawn with every competitive round of interaction?

⁴ Daryl Clarke has suggested this idea to me in personal discussions.