Globalization and the Natural Limits of Competition

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Abstract

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The chapter begins with a review of the different meanings that are given to the term "competition" in the economics literature. I follow this by a survey of empirical evidence on returns to scale, of the impact of actual and potential rivalry on productivity growth and on market structure, and draw implications for the benefits, in the sense of improved market performance, that may be expected to flow from globalization. A final consideration of policy restrictions on the market mechanism suggests that the greatest limitations to competition

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in global markets may lie in a political unwillingness to accept the resource reallocations that are part and parcel of the benefits following from globalization.

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1 Introduction

The debate on competition and its limits, which has its roots at the very foundation of economics as a discipline, has a phoenix-like quality. It periodically flares up, burns itself out, and rises again, but largely without memory, unconscious of its previous incarnations. Certain themes appear and reappear — competition in the sense of structure, or of conduct, or of performance; potential distinguished from actual competition; advertising as a source of information or a means of persuasion; antitrust or competition policy seen as the heavy hand of government regulation or as the last best alternative to the heavy hand of government regulation — but each iteration seems to begin more or less anew, with different parties staking out positions that to them seem new but in fact are new only to them.

The issues raised by globalization at the dawn of the 21st century were also raised, on a smaller but still ample stage, by the forging of a continent-wide economy in the United States in the generation after the U.S. Civil War. Contrasting positions on those issues were laid out in a debate on competition and its limits that preceded passage of the Sherman Act of 1890. Those positions appeared again in policy debates in the run-up to the 1914 passage of the Clayton Act and the Federal Trade Commission Act. They appeared yet again in U.S. debates about the depression-era National Industrial Recovery Act of 1933, in the early 1950s,[1] and again in the 1970s.[2]

I will argue in this essay that while globalization – "a catch-all to describe the phenomenon of an increasingly integrated and interdependent world economy, one that exhibits supposedly free flows of goods, services, and capital, albeit not of labor" (Obstfeld and Tayler, 2002, p. 6) — may have triggered yet another cycle in the debate on competition and its limits, the terms of that debate are not new, and that it is useful to draw lessons from earlier considerations of these same issues.

In Section 2 I review the various meanings that have been given to the word "competition." Section 3 takes up the question of limits to actual rivalry, in particular the nature of returns to scale. Section 4 deals with limits to potential rivalry.[3] Section 5 considers the relationship between competi-

[1] See among others Lilienthal (1952), Dirlam and Kahn (1954).

[2] See among others Demsetz (1974), Bork (1978).

[3] I do not discuss limits to competition stemming from possible market failures, including tragedies of the commons (Gould; 1972; Clark, 1973; Smith, 1975) and and demand-side behavior (Scitovsky, 1950; Diamond, 1971; Waterson, 2003).

tion policy, governments' commitment to the market mechanism as a resource allocation mechanism, and competition. Section 6 draws conclusions.

2 The natures of competition

"Competition" is a word that is given many and different meanings. The result is persistent miscommunication. Sometimes such miscommunication is understandable, as when an economist gives the term "competition" a technical meaning in a context that is clear to other economists but open to misinterpretation by noninitiates. But economists themselves often apply the term "competition" to different phenomena, without sufficiently laying out what is intended. In the words of Fetter (1941, p. 398):

> Every economic discussion is beset with misunderstandings by reason of the shifting senses in which words are used by speakers or are understood by hearers. Words are often used with conscious sophistry to mislead; more often speakers and hearers alike are innocently misled by the same confusion of words; again, their minds fail to meet because they are talking about very different things under the same name.

Stigler (1957; 1965, p. 237) finds five preconditions for competition in *The Wealth of Nations*:[4,5]

1. The rivals must act independently, not collusively.

2. The number of rivals, potential as well as present, must be sufficient to eliminate extraordinary gains.

[4] McNulty (1967) reviews the pre-Smith literature on competition and writes (1967, p. 396) "by the time the *Wealth of Nations* appeared, competition was a familiar concept in economic writing and ... its analytical function was its recognized tendency to bring market price to a level which would eliminate both excessive profits and unsatisfied demand, that is, to the lowest level sustainable over the long run." See also McNulty (1968).

[5] Stigler himself (1942, pp. 2–3) put forward a definition of workable competition that included specifications about the number of actual competitors, the conduct of actual competitors, and the nature of entry conditions: "An industry is workably competitive when (1) there are a considerable number of firms selling closely related products in each important market area, (2) these firms are not in collusion, and (3) the long run average cost curve for a new firm is not materially higher than for an established firm."

3. The economic units must possess tolerable knowledge of the market opportunities.

4. There must be freedom (from social restraints) to act on this knowledge.

5. Sufficient time must elapse for resources to flow in the directions and quantities desired by their owners.

Condition #1 refers to competition in the sense of conduct. It says that the effectiveness of the invisible hand as a resource allocation mechanism is limited if suppliers do not behave in a rivalrous way. Condition #4 refers to constraints on the range of permissible conduct: the effectiveness of the invisible hand is reduced if firms are restricted by society from behaving in a rivalrous way.

Condition #2 refers to competition in the sense of elements of market structure, the number and size distribution of actual firms and costs facing firms that contemplate entry: the effectiveness of the invisible hand is limited if the number of actual and potential rivals is limited.

The effectiveness of the invisible hand is limited if suppliers are unaware of profit opportunities or if consumers are unaware of alternative sources of supply and the terms they offer (#3). The invisible hand is of limited effectiveness in time periods so short that rivalry cannot make itself felt (#5).

Globalization might be thought to make it more likely that the second condition is met, by increasing the number of actual and potential rivals. With globalization comes a greater knowledge, on the part of firms at least, of opportunities in once-distinct geographic markets. Globalization thus makes it more likely that the third condition is met. To the extent that firms are less likely to be able to collude or tacitly collude, the greater the number of actual rivals, globalization makes it more likely that the first condition is met as well.

The impact of globalization on the fourth precondition for competition is two-sided. Throughout the globalization process, governments have negotiated safeguards to ensure the reciprocal open access that will allow their home firms access to other geographic markets. At the same time, governments have negotiated escape hatches that allow them to impede access of foreign firms to their home geographic markets. Sequential negotiations see some such escape hatches close, while others seem inevitably to open. The

Ely (1901, p. 58)	Competition, in a large sense, means a struggle of conflicting interest.
Eddy (1913, p. 21)	. . . competition is on a level and practically synonymous with terms such as "struggle," "contest," "rivalry"...
Lilienthal (1952, p. 54)	To most of us laymen, competition means struggle, contest, rivalry, matching of wits or strength. ... To the noneconomist, competition *in business* is but one manifestation of this spirit of conflict and rivalry of ideas.
Stigler (1957; 1965, p. 235)	"Competition" entered economics from common discourse, and for long it connoted only the independent rivalry of two or more persons.

Table 1: Competition as rivalry

protectionist instincts of governments around the world are deeply rooted.[6]

The term "competition" is perhaps most often used in the lay sense of rivalry among actual competitors (Table 1).[7,8] In an broader sense, competi-

[6]The connection between protectionist tariffs and domestic market performance was made by some during U.S. Senate debates on the Sherman Act (remarks of Senator Vest, 21 Cong. Rec. 2466, 21 March 1890). Others denied any such connection. Simons (1936, p. 72) called for "Gradual but complete abolition of the gigantic federal subsidies implicit in [the U.S.] tariff structure and rapid termination of subsidies and production control for agriculture" and clearly saw a link between tariff policy and domestic market performance: "The open season on consumers must be abolished; for, if the direction of tariff changes is not reversed, we cannot hope to prevent wholesale extension of tariff politics into interference with internal trade."

[7]Van Hise (1912, pp. 72–5) writes of competition in quality, competition in price, and competition in service, but in all three dimensions it is competition in the sense of rivalry that is meant. Adelman (1948, p. 1303) writes that "Competition requires rivalry in buying and selling among business firms which are not in collusion. But rivalry alone is not competition" and cites an instance in which rivalry in advertising was thought to be an instrument of exclusion.

[8]As noted by Vickers (1995, footnote 6), Bork has objected to the characterization of competition, for [U.S.] antitrust purposes, in terms of rivalry on the ground that (1978, p. 58) "It is a loose usage and invites the further, wholly erroneous conclusion that the elimination of rivalry must always be illegal" and "It makes rivalry an end in and of itself, no matter how many or how large the benefits flowing from the elimination of rivalry." Vickers addresses this comment by observing that his own discussion goes beyond the framework of U.S. antitrust policy. For my part, I point out that a well-known exchange

tion in the sense of rivalry may be thought to include rivalry between actual and potential sellers and rivalry for a prize, as in an innovation race or a contest for promotion (Lazear, 1995).

Rivalry between actual and potential rivals is often made the linchpin of yet another definition of competition, competition in the sense of the absence of barriers to entry (Table 2).[9] This view of competition is a precursor of the theory of contestable markets (Baumol *et al.*, 1982), and might also be thought of as a device to shoehorn general equilibrium relationships into a partial equilibrium framework.[10]

Competition in the sense of rivalry also includes the view of competition as an evolutionary triage mechanism, selecting in the fit and selecting out the unfit (Table 3).[11] Marshall expressed a certain caution on this point. He wrote (1892; 1909, p. 140) of "the law that the struggle for existence causes

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between Senator Kenna and Senator Edmunds during debate on the Sherman Act (21 Cong. Rec. 3151–2), to which Bork himself refers (1978, p. 68, footnote) makes clear it was not intended that the elimination of less efficient rivals by more efficient rivals would violate to violate the Sherman Act. (The gist of the exchange is that a firm that acquires the position of single supplier by dint of competition on the merits is not a monopolist for purposes of the Sherman Act.) To write that the identification of competition with rivalry invites the conclusion that any and all elimination of rivalry is illegal is argument, not analysis.

[9] Andrews (1951, p. 142) reads Marshall as using the term "competition" in the sense of freedom of entry. The characterization of market competition as the absence of barrers to entry into the market is paralleled by Becker's (1958, p. 106) characterization of free political competition as the absence of barriers into the political arena. It draws on themes central to the too-maligned structure-conduct-performance paradigm and, by its reference to specialized resources, anticipates the emphasis given to sunk investments by the theory of contestable markets.

[10] For descriptions of competition in a general equilibrium setting, see Holmes (1910, p. 412), Triffin (1940, p. 88), Stigler (1957; 1965, p. 263), and for a survey Novshek and Sonnenschein (1987). Most industrial economists have resisted the temptation to go up what Mason (1959, p. 5) called "the garden path" of general equilibrium, and so in this essay will I. See, however, Lankford and Stewart (1980) and Suzumura (1995, Chapter 2), and for an effort by general equilibrium theorists, Dierker and Grodal (1998). Holmes and Schmitz, Jr. (2001) argue that railroad and truck transportation substantially limited the ability of water transport firms to exercise market power. Telser (1978, p. 59) *defines* a competitive equilibrium as being synonymous with a nonempty core. This definition, which he (1978, p. 257) describes as "a more basic definition of competition than the one familiar in economic theory," is idiosyncratic. Stigler (1949) offers a withering view of general equilibrium approaches.

[11] See also Clark (1887, p. 46, cited below), and the discussion of the survivor technique in Section 3.1.1.

Liefmann (1915, p. 316)	Competition . . . is then not merely the presence of several sellers in the market. One might define it as the possibility of the free movement of labor and capital. Competition, latent at least, is present as long as the appearance of a new seller in a branch of industry is not precluded.
Machlup (1942, p. 2)	In the succeeding discussion . . . the expression perfect competition . . . will exclusively denote free and easy entry into the industry.
Stigler (1957; 1965, pp. 264–5)	It seems preferable, therefore, to adapt the concept of competition to changing conditions by another method: to insist only upon the absence of barriers to entry and exit from an industry in the long-run normal period; that is, in the period long enough to allow substantial changes in the quantities of even the most durable and specialized resources.
Andrews (1964)	The *essential* characteristic of an industry which is in open competition . . . is nothing more than that such an industry is formally *open to the entry of new competition*. . . . it will follow from my later argument that an industry with only one firm in it might well have to be analysed as though it were competitive.

Table 2: Competition as the absence of barriers to entry and exit

Ely (1901, p. 64)	Competition is the chief selective process in modern economic society, and through it we have the survival of the fit.
Encyclopedia Britannica (quoted in Eddy, 1913, p. 19)	Competition, in the sense in which the word is still used in many economic works, is merely a special case of the struggle for survival... Competition, in the Darwinian sense, is characteristic, not only of modern industrial states, but of all living organisms...

Table 3: Competition as a selection mechanism

those organisms to multiply which are best fitted to derive benefit from their environment" and commented that "This law is often misunderstood; and taken to mean that those organisms tend to survive which are *best fitted to benefit* the environment. But this is not its meaning. It states that those organisms tend to survive which are *best fitted to utilize* the environment for their own purposes."

Competition has also been defined by negation, as the absence of monopoly (Table 4).[12] Like the definition of competition in the sense of rivalry, competition in the sense of the absence of monopoly is conceived of as a particular type of conduct, but a type of conduct that is very different from the lay

[12]See also Triffin (1940, p. 5 and the references in footnote 4) and Lerner (1944, pp. 73–4). Mason's (1937; 1949, p. 28) statement is more nuanced:

> The antithesis of the legal conception of monopoly is *free* competition, understood to be a situation in which the freedom of any individual or firm to engage in legitimate economic activity is not restrained by the state, by agreements between competitors or by the predatory practices of a rival. But free competition thus understood is quite compatible with the presence of monopoly elements in the *economic* sense of the word monopoly. For the antithesis of the economic conception of monopoly is not *free* but *pure* competition, understood to be a situation in which no seller or buyer has any control over the price of his product. Restriction of competition is the legal content of monopoly; control of the market is its economic substance.

Novshek and Sonnenchein (1987) relate partial- and general-equilibrium models of perfect competition in the sense of price-taking behavior, and analyze a perfectly competitive limit of the sequence of Cournot markets obtained as the market becomes larger relative to efficient firm size.

Chamberlin (1933, p. 7)	Monopoly ordinarily means control over the supply, and therefore over the price. A sole prerequisite to pure competition is indicated — that no one have any degree of such control.
Lerner (1934, p. 157)	...the monopolist is confronted with a falling demand curve for his product...while the seller in a purely competitive market has a horizontal demand curve...
Stigler (1957; 1965, p. 262)	If we were free to redefine competition at this late date, a persuasive case could be made that it should be restricted to meaning the absence of monopoly power in a market.

Table 4: Competition as price-taking behavior

conception of rivalry: price-taking firms in no sense engage in strategic or rivalrous behavior.

Competition, it would appear, is a many-splendored thing. But the feasibility of competition in the various senses reviewed above depends largely on a common set of underlying factors. The equilibrium number of actual competitors and the impact of potential competition on the conduct of actual competitors depend both on the underlying technology. Particularly important characteristics of the technology are the nature of returns to scale and scope, the presence or absence of network economies, and the extent to which investments required to operate in the industry are sunk It is to a consideration of such technology-based factors that we now turn.

3 Actual rivalry and its limits

3.1 Equilibrium market structure

It is to Henry Adams and his analysis of late-19^{th}-century American industry that we owe the distinction between technologies characterized by decreasing, constant, and increasing returns to scale. Adams saw the nature of returns to scale as determining whether or not competition among incumbents would be an effective resource allocation mechanism (1887, p. 519):

> all industries ...fall into three classes, according to the relation

> that exists between the increment of product which results from a given increment of capital or labor. These may be termed industries of constant returns, industries of diminishing returns, and industries of increasing returns. The first two classes of industries are adequately controlled by competitive action; the third class, on the other hand, requires the superior control of state power.

For Adams, competition failed as an organizing framework of increasing returns to scale industries because the equilibrium number of suppliers in such industries was one (1887, p. 528):

> There are many other lines of business which conform to the principle of increasing returns, and for that reason come under the rule of centralized control. Such businesses are by nature monopolies.

The railroad industry was the quintessential example of a sector that came to be supplied by firms that were large in relation to the size of the market because the technology exhibited increasing returns to scale (Hadley, 1886, p. 41):[13]

> in those lines of industry which involve large capital, under concentrated management, the old theory of free competition is as untenable as it was in the case of railroads.

Furthermore, it was thought that the rise of railroads and complementary technologies was the prerequisite for the rise of large firms in other sectors (van Hise, 1912, p. 7):

> The development of transportation and communication furnished the fundamental basis for concentration of industry, because through them it became possible at a moderate cost to transport goods long distances in a short time and easy to communicate with the customer who desired goods.

[13] Perelman (1994) discusses the impact of railroad economics on the development economists' views of imperfectly competitive markets.

It is now understood, as it was by Adams and some of his contemporaries, that where large-scale enterprise arose endogenously,[14] it carried with it efficiency advantages (Clark, 1887, p. 46):[15]

> In manufacturing industries the balance of power had been disturbed by steam, and the little shops of former times were disappearing. The science adapted to such conditions was an economic Darwinism... Though the process was savage, the outlook which it afforded was not wholly evil. The survival of crude strength was, in the long run, desirable. Machines and factories meant, to every social class, cheapened goods and more comfortable living.

This late-19^{th}-century literature made a distinction between competitive and monopolistic market structures — between a large equilibrium number of suppliers and a single equilibrium supplier. We would now distinguish between monopoly, small-numbers oligopoly, large-numbers oligopoly, and competitive equilibrium market structures. What is critical for the limits of competition in this structural sense — the equilibrium number of suppliers — is not absolute firm size, but firm size relative to market size (Stigler, 1955, p. 181):

> We all recognize that in a properly defined industry, if the largest firm has less than ten per cent of the output, competition will be effective—in the absence of collusion which itself generally will be less probable and effective when concentration is low. And

[14] And, we would now add, in the absence of strategic entry-deterring behavior.

[15] Non-efficiency political and social goals have of course been put forward in debates about public policy toward business behavior. Judge Hand accurately states one of the original goals of U.S. antitrust policy (*U.S.* v. *Aluminum Company of America* 148 F. 2nd 416 at 429 (1945)):

> Throughout the history of [U.S. antitrust and related] statutes it has been constantly assumed that one of their purposes was to perpetuate and preserve, for its own sake and in spite of possible cost, an organization of industry in small units which can effectively compete with each other.

Such views may be thought to relate to the fourth precondition for competition found by Stigler in *The Wealth of Nations*, freedom from social restraints to act on the knowledge of market opportunities. It is probably accurate to say that the development of U.S. antitrust law has ostensibly read such goals out of U.S. competition policy. See, however, Section 5).

> when one firm has forty or fifty per cent or more, or two to five firms have seventy-five per cent or more of the industry's output, competition will seldom plague the industry.

The equilibrium number of firms in an industry should not, in the long run and in the absence of government intervention, be more than that implied by the expectation that firms will operate at efficient scale. What evidence is there, it seems reasonable to ask, about the nature of efficient operation in different industries?

3.1.1 Scale economies

The conventional measure of returns to scale in neoclassical economic theory is the function coefficient, the elasticity of output with respect to a proportional change in the use of all inputs.[16] The function coefficient is, under the usual assumptions, the ratio of average cost to marginal cost (Ferguson, 1969, p. 160; Baumol *et al.*, 1982, p. 21). It is also the inverse of the elasticity of cost with respect to output (Ferguson, 1971, pp. 158–60). The function coefficient can be generalized in a natural way to a multiproduct technology (Panzar and Willig, 1977).

Patinkin (1947; see also Dewey, 1969, Chapter 3) notes that a multiplant firm, operating in a region of rising average cost in any one plant, can slide down those average cost curves by incurring the fixed cost associated with opening a new plant. The result is a scallop-shaped average cost curve that is, after an initial region of declining average cost as output rises from a low level in a single plant, approximately horizontal. This theoretical result takes on a certain interest in light of the results of the empirical studies surveyed below.

Managerial loss of control in large firms is the most commonly-cited source of diseconomies of large-scale operation.[17] The multidivisional firm may be thought of as an organizational device to mitigate such diseconomies (Chandler, 1962).

Economies of scale may be inherent in physical relationships (in the nature of the technology). A common example is a change in the radius of a pipeline by a factor $\lambda > 1$, which means an increase in the volume of the pipeline

[16] Ferguson (1967, footnote 1) attributes the term "function coefficient" to Carlson (1939). See also Ferguson (1969, pp. 79–80).

[17] See, for example, Robinson (1958, pp. 39–49).

by a factor λ^2. The point of Adam Smith's famous pin factory example is that increasing scale, supported by appropriate reorganization of production relationships, permits division of labor and can vastly increase output per worker.[18] The division of labor and of physical capital are among several factors leading to increasing returns to scale that are noted by Scherer *et al.* (1975, pp. 19–20):

> The unit cost reductions associated with increasing plant size can have numerous causes: increased specialization of machinery and labor; indivisibilities making it worthwhile to spread the cost of lumpy equipment and special skills over a large output; technological relationships permitting equipment to be scaled up at less than a proportional increase in investment outlays; economies gained in high-volume purchasing and shipping; and "massed reserves" advantages permitting a large plant to retain proportionately fewer repair men and backup machines to hedge against randomly occurring breakdowns.

Increased labor productivity with a greater division of labor is akin to, but distinct from, the learning-curve phenomenon of lower unit cost with greater cumulative output.[19]

Economies of scale are in turn distinct from economies of scope (Bailey and Friedlaender, 1982, p. 1026): "There are said to be positive economies of scope when a single firm can produce a given level of output of each product line more cheaply than a combination of separate firms, each producing a single product at the given output level." Economies of scope may arise as overhead costs are spread over production of multiple product lines (Clark, 1923) or may be inherent in the technology (Baumol *et al.*, 1982, pp. 71–2). There may also be economies of multiplant operation (Scherer *et al.*, 1975); at the plant level, some of these would appear as economies of scale; at the firm level, as economies of scope.

In the diagnosis of natural monopoly, the neoclassical concept of economies of scale and the more recent concept of economies of scope are subsumed at a theoretical level in the subadditivity or lack of it of the cost function, due

[18] On the same subject, see more recently Pratten (1980).

[19] See Fudenberg and Tirole (1983), Ghemawat (1985), and for an application, Gruber (1994).

to Faulhaber (1975), (Bailey and Friedlaender, 1982, p. 1037): "subadditivity is said to exist if the costs of joint production are less than the costs of separate production for any scale of output or combination of outputs."

The early empirical literature was, and much of the recent literature remains, organized in terms of estimating some version of the function coefficient or of minimum efficient scale. Subadditivity, involving as it does global properties of a relevant multiproduct cost function, is difficult to test in a definitive way. Results of some approximate and local tests of subadditivity are cited below.

Minimum efficient scale When the world, or at least the field of industrial organization, was young, neither microeconomic theory nor econometric techniques were sufficiently developed to estimate measures of returns to scale like the function coefficient. Industrial economists therefore developed techniques that permitted them to assemble some evidence on the determinants of market structure. One such class of evidence was based on analyses of the size distribution of plants or firms in an industry.

Bain (1956, Chapter 3) reported engineering estimates of minimum optimal plant (p. 72) and firm (p. 86) scale, (1956, p. 53) "the smallest scale at which a plant or firm may achieve the lowest attainable unit cost," as a fraction of industry output. Compilation of engineering estimates involves unavoidable subjective judgements. It is also highly labor-intensive, limiting its use to samples of a small number of industries.

Efforts to get at the same concept, later more often referred to as minimum efficient scale, for large cross-sections of industries most often relied on one of two variables that could be mechanically computed from (often, government census) data on the size distribution of firms in an industry. One of these variables was the average size of the largest plants accounting for at least 50 per cent of industry shipments, as a percentage of industry shipments. The second was average shipments of plants in the midpoint size

category, as a percentage of industry shipments.[20,21]

Stigler put forward the survivor technique for estimating minimum efficient scale (1958; 1968, p. 73):[22]

> Classify the firms in an industry by size, and calculate the share of industry output coming from each class over time. If the share of a given class falls, it is relatively inefficient, and in general is more inefficient the more rapidly the share falls.

Saving (1961) applied the survivor methodology to data on 200 U.S. 4-digit S.I.C. manufacturing industries. He was obliged to discard results for 43 industries that showed two or more distinct size classes with increasing market shares. For remaining industries he finds (Saving, 1961, p. 580) "in most cases, the magnitudes of ... optimum sizes are quite small relative to the size of the industries. In fact, 71.9 per cent of the industries for which we have estimates of optimum plant size have minimum optimum sizes of less than 1 per cent of their respective industry's total value added" and that there is often a large range of efficient scales of operation (1961, p. 582) "over 65 per cent of the industries in the sample have maximum optimum sizes which are greater than five times their respective minimum optimum sizes."

Classic cost studies Early econometric evidence on the nature of returns to scale came from statistical analyses of the relation between output and

[20] For discussions, see Scherer (1974) and Weiss (1974, pp. 224–5), Davies (1980), and Gupta (1981). Strickland and Weiss (1976, p. 1112) prefer the midpoint-size-class-based MES measure on the ground that it is more correlated with engineering-based measures than the top-fifty-percent-based measure. Saving (1965) draws conclusions about the shape of average cost function using an approach that generalizes Gibrat's Law. de Brabander and Vanlommel (1978) and Fuss and Gupta (1981) use estimated cost functions to infer the minimum efficient scale output level.

[21] Another variable used by Bain was absolute capital requirements, the investment needed to set up a plant of minimum efficient size. Caves et al. (1975) introduced the cost disadvantage ratio, value-added per worker in plants in the upper half of the industry plant-size distribution divided by value-added per worker in plants in the lower half of the industry plant-size distribution.

[22] For an earlier statement, see Stigler (1950; 1968, pp. 98–9). For critical views, see Weiss (1964, 1965), Shepherd (1967), and Bain (1969). For a comparison of survivor, engineering, and Census of Manufactures-based estimates, see MacPhee and Peterson (1990).

Johnston (1960)	
Electric power (UK, 1946–47)	"The minima of successive AVC lie on a practically horizontal straight line ... the envelope to these curves is only the first component of long-run average cost, but if Fig. 4-10 is a reliable indication of the second (capital cost) component, then long-run average cost is approximately constant over long ranges of output ... the economies of scale in electricity generation can be fully exploited by firms of medium size."
Passenger road transport (1 large UK firm, late 1940s–early 1950s)	Declining short-run average cost throughout observed output range.
Passenger road transport (24 UK firms, 1951)	Unable to reject hypothesis of constant long-run average costs.
Multiproduct food processing firm (UK, 9/1950-6/1951)	Constant marginal cost for each of 14 products.
Dean (1976)	
Furniture factory (single plant, 1932–34)	Constant marginal cost, declining average cost over observed output range.
Leather transmission belt shop (1935–38)	Constant marginal cost, declining average cost over observed output range.
Hosiery mill (1935–39)	Constant marginal cost, declining average cost over observed output range.
Department store (1931–35)	Hosiery department, shoe department: constant marginal cost, declining average cost; coat department: declining marginal cost.

Table 5: Results of typical early cost function studies

some more or less appropriately adjusted measure of accounting cost.[23]

Often a main purpose of these studies was to marshal evidence on the extent to which average and marginal cost curves for real-world plants and firms resembled the familiar ∪-shaped curves beloved of intermediate microeconomics courses. Short descriptions of the results of typical studies are given in Table 5. The findings typically imply that after falling over an initial range of low output, the average cost curve is relatively flat (Johnston, 1960, p. 168):[24]

> Two major impressions ... stand out clearly. The first is that the various short-run studies more often than not indicate constant marginal cost and declining average cost as the pattern that best seems to describe the data that have been analyzed. The second is the preponderance of the L-shaped pattern of long-run average cost that emerges so frequently...

Early production function studies Estimates of Cobb-Douglas and CES production functions, often with what now appear to be overly aggregated data, form a bridge between the types of studies discussed in Section 3.1.1 and later, more micro-based, estimates of cost and production functions. Ferguson (1967), who estimates Cobb-Douglas production functions for 2-digit U.S. Census of Manufactures industries using state-by-state data, is typical of this literature.[25] He interprets his findings as showing (Ferguson, 1967, p. 215):

[23] Friedman's (1955) remarks on the futility of analyzing accounting cost data should be noted. Read narrowly, these remarks may be seen as an argument that accounting measures of the value of a firm's capital stock are poor indicators of the corresponding economic value. This argument has been taken up by others (Fisher and McGowan, 1983; Fisher, 1987). It is probably a fair reading of the literature to say that this argument is accepted as correct in principle, although (by revealed preference) not in practice fatal to the use of appropriately adjusted accounting data in empirical research by industrial and other economists. Read broadly (Friedman, 1955, pp. 235–6), Friedman's remarks may be seen as the precursor of the panglossian view that there is no such thing as economic profit, only efficiency rents (see Dick and Lott, 1990, and the references therein).

[24] Heflebower (1955, p. 370) reaches a similar conclusion.

[25] For other such studies, see Besen (1967) and Morony (1967). Griliches and Ringstad (1971) find evidence of economies of scale, declining with firm size, using Norwegian data. Atack (1985, p. 178) obtains results broadly constent with the presence of constant returns to scale in nineteenth-century U.S. manufacturing, as does Doraszelski (2004) for France in the second half of the nineteenth century.

> that there is not sufficient evidence to reject the broad hypothesis of constant returns to scale in the American manufacturing sector. Using aggregate results alone, three industries showed increasing returns to scale (Food and Kindred Products, Primary Metals, and Electrical Machinery) and three showed decreasing returns to scale (Textiles, Apparel and Related Products, and Chemicals and Allied Products). Such interindustry differences are to be expected; but taking all results into consideration, one must conclude on balance that the hypothesis of constant returns to scale cannot be rejected.

The usual suspects Cost and production relationships in a few industries have been the subject of repeated study, in part because of data availability, in part because of their inherent policy interest (the former, of course, may be influenced by the latter). Studies of such industries are reviewed here.[26]

Automobiles White (1971) estimates minimum efficient automobile production scale at about 400,000 vehicles per year. Taking into account the risk implied by long design lead times and the difficulty in predicting public tastes far in advance, he concludes that for long-term viability, an automobile manufacturer should produce two makes of automobile and distribute them through separate dealer networks. Relating market concentration to this estimate of minimum efficient firm scale, he writes that (1971, p. 268):

> a minimum-size efficient firm would require a volume of 800,000 units annually through two makes. Thus an 8-million-unit car market could theoretically support ten efficient firms. In fact, there are only four, with one, American Motors, currently in the 250,000-unit category.

Cost-output relationships in the automobile industry have been a frequent subject of econometric analysis. Among these studies, Friedlaender *et al.* (1983) estimate a linear hedonic cost function from time-series cross-section data for the Big Three U.S. automobile manufacturers (GM, Ford, Chrysler) for the years 1955–79. They classify outputs into three categories, compact and subcompact cars, full-size and luxury cars, and trucks, and find evidence

[26] Studies of the airline industry are taken up in Section 4.

Friedlaender et al. (1983)	Firm-level annual data, U.S. Big 3, 1955–79: at sample mean, GM and Chrysler IRS, Ford DRS, "typical firm" CRS.
Fuss & Waverman (1992, p. 122)	Annual industry data: increasing returns to scale at the sample mean (scale elasticities Canada 1.17, Japan 1.07, Germany 1.1, U.S. 1.09).
Truett & Truett (1996)	Annual Mexican industry data, 1970-1990: economies of scale in the motor vehicle industry, diseconomies of scale in the auto parts industry.
Truett & Truett (2001, p. 1508)	Spanish industry data, 1967–92; increasing returns to scale at the sample mean, marginally significant decreasing returns to scale at maximum output in the sample.

Table 6: Returns to scale in automobile production

of varying returns to scale (1983, p. 18) "the global cost surface is decidedly not convex, but exhibits variable regions of increasing and decreasing returns to scale and increasing and decreasing returns to multiple production." At the sample mean, Chrysler and General Motors appeared to operate where there were increasing returns to scale (generalized function coefficients 1.16 and 1.23, respectively), Ford where there were decreasing returns to scale (generalized function coefficient 0.88).[27] The implied industry average function coefficient, 1.05, was not distinguishable from constant returns to scale.

Fuss and Waverman (1992) estimate a translog cost function from annual data for Canada, Germany, Japan, and the United States, with observations for each country covering slightly varying intervals of the 1960s through the early 1980s. They report estimated function coefficients at the sample mean of 1.17 (Canada), 1.07 (Japan), 1.10 (Germany), and 1.09 (United States).

[27] Friedlaender et al. also present evidence on returns to scope (1983, pp. 16–7):

> The results indicate that for all of the firms there appear to be marked economies of joint production from combining the production of large cars with small cars and trucks, varying diseconomies from combining the production of trucks with the production of small and large cars, and varying economies and diseconomies from combining the production of small cars with the production of large cars and trucks.

Truett and Truett (1996) estimate a translog industry cost function for the Mexican motor vehicle industry for the period 1970–1990, and find evidence of diseconomies of scale. They note (1996, p. 440) that "the Mexican domestic market of 300,000 to 400,000 vehicles [is] divided among five or six vehicle producers, the individual firms...;" their results are thus consistent with White's earlier estimates of minimum efficient scale in automobile manufacture. Truett and Truett (2001) estimate a translog industry cost function for the Spanish automobile sector using annual data for the period 1967–92. They find a cost elasticity that is less than one at the 5 per cent level at the sample mean, greater than one at the 10 per cent level at the maximum output in the sample. (The corresponding function coefficients are 1.319 at the sample mean, 0.773 at the maximum sample output.) They conclude that adaptation to the Single European Market will allow Spanish automobile firms to realize some economies of scale.

Banking Berger *et al.* (1987) give references to econometric studies of economies of scale and scope in banking in the 1980s. Their own results, for U.S. banks and for 1983, suggest that there are modest economies of firm scale for banks with deposits up to $25 million, with essentially constant or modest diseconomies of scale up to deposits of $1 trillion, in states that allow branch banking.[28] Results for states that do not allow branch banking suggest statistically significant diseconomies of scale for banks with deposits of or greater than $200 million.

The results of several more recent studies of cost-scale relationships in the banking sector are summarized in Table 7. The bulk of this literature has been concerned with U.S. banking, and for such studies (Cavallo and Rossi, 2001, p. 516):

> The main conclusions of the empirical literature concerned with the US experience ... are that overall the average cost curve is relatively flat with some evidence of scale efficiency gains for small banks. ... constant or slight diseconomies of scale prevail in the case of large banks.

Such results for the U.S. seem sensitive to the treatment of risk and diversification, although studies that take risk and diversification explicitly into

[28] See their Table 1, firm results using the production approach, p. 512.

Altunbas *et al.* (2000)	(Japanese commercial banks, 1993–96) Scale economies for banks of asset size up to ¥ 2 trillion, diseconomies of scale for larger banks (Mean sample asset size about ¥ 5 trillion, maximum sample asset size about ¥ 75 trillion).
Hughes *et al.* (2000)	(U.S. bank holding companies, 1994) Estimates that allow for utility maximization by managers show increasing returns to scale throughout the sample range.
Wheelock & Wilson (2001)	(U.S. commercial banks, 1985, 1989, 1994) ... banks could achieve potential economies by expanding the size of their output and adjusting their output mix toward those of banks with at least \$300–\$500 million of assets. Although we find some evidence of scale economies for banks as large as \$1 billion, our point estimates are not estimated precisely across all methodologies, and, hence, we do not draw firm conclusions. ... The wide range over which we cannot reject constant returns to scale suggests ... that banks of many sizes could be competitively viable, though firm conclusions are difficult to draw because the density of banks exceeding \$1 billion of assets is low.
Cavallo & Rossi (2001)	(Banks in 6 EU Member States, 1992–97) Increasing returns to scale for small and medium size banks, constant returns to scale for large size banks.
Carbo *et al.* (2002)	(EU savings banks, 1989–96) Constant returns to scale at smallest asset size classes; increasing returns to scale that rise with size class thereafter.

Table 7: Returns to scale in banking

account do not yield a consensus. Hughes *et al.* (2000) use a specification that allows for utility maximization by managers in a risky environment, and find evidence of increasing returns to scale throughout their sample. Dealing with the presence of risk in another sample — Japanese commercial banks — and in another way — by including risk proxies directly in estimating equations, Altunbas *et al.* find the economies of scale are exhausted, and diseconomies of scale set in, at relatively low asset sizes. Studies of EU banking show the presence of economies of scale over some size ranges, without consensus on where (if at all, in sample ranges) economies of scale are exhausted.

Electric power generation Weiss (1971, pp. 89–90) writes:[29]

> Electric power involves three major processes: (1) production . . . ; transmission . . . ; and distribution and sales. The economies of scale in distribution seem obvious. . . The presence of two or more sets of poles, wires, transformers, and meter readers would almost always imply so much unnecessary capacity that almost all observers accept the need for monopoly in the "retailing" of electricity. . . . Transmission from the power plant to the consuming centers also involves very large economies of scale. When transmission capacity over a given distance is doubled, investment in transmission lines increases by only about 2/3. . . . . . There are also economies of large scale in generation, but they do reach a limit.

More recent studies (Table 8) reach a similar conclusion: there are increasing returns to scale in the electric power industry, but they are exhausted at levels that permit effective competition (Christensen and Greene, 1976, p. 656):[30]

> We conclude that a small number of extremely large firms are not required for efficient production and that policies to promote competition in electric power generation cannot be faulted in terms of sacrificing economies of scale.

[29] An entry for the electric power industry appears in Table 5. See Walters (1963, Table VIII) for references to other early studies of electricity cost functions, as well as Nelson and Wohar (1983).

[30] For another survey of this literature, see Cowing and Smith (1978).

Christensen and Greene (1976, p. 656)	Our primary finding ... is that the U.S. electric power industry can be characterized by substantial scale economies at low levels of output. But the implied decreases in average cost diminish in importance for larger firms, resulting in an average cost curve which is very flat for a broad range of output.
Berndt (1991, p. 83)	... the econometric literature on estimated returns to scale in the electric utility industry in the United States appears to suggest that substantial economies of scale have been available, that such scale economies may have been largely exploited by the early 1970s, and that [in 1991] the bulk of electricity generation comes from firms generating electricity at the bottom of their average cost curves.
Lee (1995)	(70 investor-owned U.S. electric utilities) Price-cost margins between monopoly and perfect competition; constant returns to scale at the sample mean.
Thompson (1997)	(Major U.S. investor-owned electric utilities, 1977, 82, 87, 92; p. 294) "average sized firms expanding output to a fixed number of customers in a given area will experience decreasing average costs for sales volumes well beyond sample mean levels. ... firms that expand output, numbers of customers, and service territory proportionately will not experience decreasing average cost if the firm's values are at or above the sample mean."
Filippini (1998)	(39 Swiss electricity utilities, 1988–91) Economies of output density and customer density; economies of scale for all except the largest utilities.
Atkinson and Primont (2002)	Modestly increasing returns to scale in steam electric power generation.

Table 8: Returns to scale in electric power

Health sector The six studies noted in Table 9 examine four different health-care related markets. Cowing and Holtmann find increasing returns to scale in hospitals at their sample mean, and also that returns to scale decline as hospital size increases. Roughly half the hospitals in the Eakin and Knieser sample produce under conditions of increasing returns to scale, half under conditions of decreasing returns to scale, with the sample mean implying decreasing returns to scale.

Given (1996) and Town (2001) employ different techniques but both find constant returns to scale in health maintenance organizations, beyond low enrollment levels. Okunade (2001) gets similar results for hospital pharmacies.

Cockburn and Henderson (2001) find evidence of economies of scope in the probability that a drug development project will lead to permission to market a drug, but no evidence of economies of scale.

Railroads As noted above (Section 3.1), it was with the railroad sector that economists' and policymakers' concern with the nature of returns to scale began. Many studies have estimated short-run cost-output relationships, treating network size as given. Most such studies (see Table 10) find evidence that there are economies of density,[31] that is, that the marginal cost of increasing traffic on a network of fixed size is less than the average cost. Friedlaender et al. (1993) interpret their results as suggesting that increasing returns to density are an "inherent characteristic" of railroad technology, a results that justifies the early attention given to returns to scale in this industry.

Griliches (1972) and Keeler (1974) find constant returns to scale if the length of track size is adjusted optimally. Atkinson *et al.* (2003) estimate an input shadow distance system for four inputs (freight ton miles, passenger miles, average passenger trip length in miles, average freight haul in miles) and find some evidence of increasing returns to scale. Bitzen (2000) tests the subadditivity of an estimated multiproduct cost function for U.S. railroads

[31] Caves et al. (1985, p. 97):

> Returns to density reflect the relationship between inputs and outputs with the rail network held fixed. Returns to scale reflect the relationship between inputs and the overall scale of operations, including both outputs and network size.

Cowing and Holtmann (1983)	(340 New York State hospitals, 1975) Increasing returns to scale at the sample mean, decreasing as scale increases.
Eakin and Kniesner (1988)	(331 U.S. hospitals, 1975–6) 165 hospitals operate with decreasing returns to scale, 166 with increasing returns to scale; decreasing returns to scale at the sample mean.
Given (1996)	(California HMOs, 1986–92) Statistically constant returns to scale at sample mean output mix from about 115,000 enrollees to sample maximum of 850,000 enrollees.
Town (2001, p. 984)	(Products offered by California HMOs, 1993–97) "econometric evidence indicates that economies of scale are not present."
Okunade (2001, p. 182)	(U.S. hospital pharmacies, 1981–90) "Our results indicate an L-shape relationship of average cost of hospital pharmacy operations to bed size. There is no large cost differential effect of bed sizes between the largest hospital pharmacies ($\geq$ 500 beds, the base) and those with 400-499 and 200-299 beds. Positive and significant cost differences of 12.12%, 5.16%, 3.5%, and 2.21% exist, however, for smaller and mid-sized hospitals with 0-49, 50-99, 100-199 and 300-399 bed capacities."
Cockburn & Henderson (2001, p. 1052)	(drug development projects at 10 U.S. pharmaceutical firms, between 1960 and 1990) "drug development projects are more likely to result in [permission to market a drug] in firms which have significantly more diverse development efforts, rather than in those firms that simply spent more on development in total. Scale effects ... have a weak positive association with a project's success when entered alone, but this effect disappears when we control for scope."

Table 9: Returns to scale in health care-related sectors

Griliches (1972)	(97 U.S. railroads, 52 of which with more than 500 miles track, 1957–61) Constant returns to scale for railroads with more than 500 miles track.
Keeler (1974)	(51 U.S. railroads, freight, 1968–70) Long-run constant returns to scale (gross ton-miles), increasing returns to traffic density.
Harris (1977)	(55 U.S. essentially freight railroads, 1973-4) Increasing returns to density.
Caves et al (1981)	(U.S. Class I railroads, freight and passenger traffic, 1955, 1963, 1974) "...fairly strong, statistically significant, scale economies if output increases come in the form of increased haul and trip lengths. ...only slight, statistically insignificant scale economies if output is increased with length of haul and trip held fixed."
Caves et al. (1985)	(U.S. Class I railroads, 1951–75, p. 99) "...increasing returns to scale for small carriers, but for medium to large railroads returns to scale are nearly constant. ...substantial increasing returns to density that persist over a larger range of output than has been found in any prior study."
Braeutigam et al. (1982, 1984)	(firm-level data, one small U.S. railroad, one large U.S. railroad, quality of service taken into account) Important economies of density, both railroads.
Vellturo et al. (1992)	(Class I U.S. railroads, 1974–86) Substantial returns to scale, short run and with way & structures and route miles variable.
Friedlaender et al. (1993, p. 142)	When the network is held fixed, the estimates of returns to scale are uniformly greater than one, and substantially so in many cases. Thus, given the large amounts of fixed track and [way and structures] capital, there are substantial returns to density. Moreover, if capital is adjusted in an optimal fashion, returns to scale are somewhat larger, indicating that increasing returns is not a transitory phenomenon resulting from excessive capital, but may be an inherent characteristic of the railroads' technology.

Bitzan (2000)	(U.S. Class I railroads, 1983–97) Natural monopoly on a network of a given size, not on end-to-end networks.
Atkinson et al. (2003)	(U.S. Class I railroads, 1951–75; four inputs, four outputs) (p. 606): "average returns to scale [generalized function coefficient] 1.17 ... assuming [allocative efficiency]."
	(p. 609) "For all firms, the average cost savings resulting from [technical efficiency], from [allocative efficiency], and from both ... are approximately 63%, 12%, and 75%, respectively."

Table 10: Returns to scale, U.S. railroads

by comparing estimated cost functions for one and two firms. He finds that a single railroad network is a natural monopoly, while combined operation of end-to-end networks is not a natural monopoly.

Telecommunications The study of the nature of economies of scale and/or scope in telecommunications has been contentious (see, for example, Charnes *et al.*, 1988 and Evans and Heckman, 1988).[32] Waverman (1989, pp. 83–90) summarizes twenty such studies (of AT&T and Bell Canada) that were published between 1977 and 1986, covering intervals ranging from 1947 to 1978. Of the results of these studies, he writes (189, p. 87):

> The evidence on overall economies of scale ... would appear to favor the presence of such economies. In only two cases does the lower-bound estimate of overall economies of scale (95 percent confidence region below the mean estimates) fall below unity.

Waverman outlines methodological shortcomings of the literature. He sees some of those same difficulties in his own results, and in conclusion writes (1989, p. 94) "My view is that neither scale nor scope was significant in the 1947–77 period at the level of a firm such as AT&T before divestiture" and "It is unlikely that significant economies of scale existed in interchange service between 1950 and 1980."

[32] See Röller (1990b) for particularly useful discussion of Evans and Heckman (1983) and Charnes et al. (1988). See also Diewert and Wales (1991) for a discussion of the Evans and Heckman results.

Röller (1990a)	(Bell System, annual data, 1947–79; estimated quadratic cost function constrained to display theoretically expected properties) "strong overall economies of scale . . . at all output levels observed between 1947–79;" economies of scope; subadditivity not rejected; "the data are consistent with the natural monopoly hypothesis."
Bloch et al. (2001)	(Australia, annual data, 1926–91) Economies of scope, no economies of scale along the three rays examined.
Guldmann (1991)	(44 LECs, New York, 1980) With territory size fixed, minimum average cost at 51,053 telephone lines (sample range 874 to 552,868, median 7,000, mean 27,957).
Shin and Ying (1992), Ying and Shin (1993)	(58 LECs, 1976–83, 1976–87) Modest economies of scale at the sample mean; cost function not globally subadditive.
Sung (2002)	(8 LECs, annual data, 1950s–1991) "'the bulk of [local exchange carriers] are operating in the essentially flat area of the average cost curve;" "small and medium firms have slightly increasing returns to scale while large firms suffer from slightly decreasing returns to scale."

Table 11: Returns to scale in telecommunications

Röller (1990a) addresses some of the Waverman's points, and finds evidence of economies of scale in U.S. telecommunications before 1979. Shin and Ying (1992) and Ying and Shin (1993) estimate that there are modest economies of scale in local exchange carriers, but reject subadditivity of the multiproduct cost function. Local exchange carriers, by these estimates, are not natural monopolies. Sung (2002) finds statistically constant returns to scale, on average, for U.S. local telephone exchanges. Bloch *et al.* (2001) find no evidence of economies of scale for Australian telecommunications.

Despite the intuitively appealing and long-held notion that the telecommunications sector should be thought of as a natural monopoly, there is evidence both for and against that proposition, and the verdict at this writing must be "not proven."[33]

Unusual suspects Tables 12 and 13 gives capsule indications of the results of studies of the nature of returns to scale (and occasionally, scope) in 12 different sectors. There is some evidence of some increasing returns to scale in some of these studies — Geehan for Canadian insurance, Betancourt and Malanoski for supermarket distribution, and the four studies of food processing industries. Other studies suggest that such increasing returns to scale as are present decline with firm size, or over time. None of these studies find returns to scale that are so persistent as to suggest that the sector studied might be thought of as a natural monopoly.

Chirinko and Fazzari (1994; not listed in the tables) estimate returns to scale for firms in 11 U.S. four-digit SIC industries[34] for the years 1975–1985. They find constant returns to scale for four industries (apparel; paper mills; tires and inner tubes; and steel works), and decreasing returns to scale for one industry (oil field machinery). For firms in the other industries they ex-

[33] Schankerman and Nadiri (1986) analyze annual data for the Bell System for 1947–76 and find a long-run elasticity of cost with respect to output 0.57, implying substantial economies of scale. Their functional form implies the presence of some economies of scale; they treat R&D as an input.

[34] The industries are 2082 (malt beverages), 2200 (textile mill products), 2300 (apparel and other finished products made from fabrics and similar materials), 2621 (paper mills, except paperboard, building paper, and pulp mills), 2711 (newspapers, publishing and printing), 2834 (pharmaceutical preparations for human and veterinary use), 2844 (cosmetics, perfumes, and other toilet preparations), 3011 (tires and inner tubes for all types of vehicles), 3312 (steel works, blast furnaces, and rolling mills), 3533 (oil field machinery and equipment), and 3714 (motor vehicle parts and accessories, but not engaged in manufacturing complete motor vehicles).

Baumol & Braunstein (1977)	(56 academic journals, several publishers, 1969, 1971, 1973) evidence of economies of scope: "costs increased more slowly with increases in circulation than with increases in pages, and in both cases costs per journal declined as the number of journals per publisher increased." Firms in the sample appear to be operating at efficient size.
Geehan (1977)	(43 Canadian life insurance companies, 1970) Some evidence of statistically significant increasing returns to scale, not of economically significant returns to scale.
Wang Chiang & Friedlaender (1985)	(105 U.S. trucking firms, 1976) "At the grand sample mean, the [generalized function coefficient was] 0.998, while at the sample mean of the "large carriers, [it was] 0.929. Thus the 'typical' firm operating at the sample [mean] appears to be operating under constant returns to scale, while the representative 'large' firm is subject to moderate diminishing returns." Economies of scope at the sample mean, not for the representative "large" firm.
Kumbhakar (1993)	(Utah dairy farms) "In general, the small farms, as a group, are found to be less efficient relative to the class of medium and large farms. ... We find that the returns to scale of the small farms are much higher when compared to the medium and large firms."
Kerkvliet et al. (1998)	(U.S. beer brewing; annual industry data, 1952–92) Estimated efficient firm scale rose from at most 608,000 barrels of beer per year in 1960 to at most 1.3 million barrels of beer per year in 1970; from at least 2.653 million barrels of beer per year in 1975 to at least 5.008 million barrels of beer per year in 1990; by late 1980s, national producers larger than necessary to exploit economies of scale.

Table 12: Returns to scale, various sectors (1)

amine (malt beverages; textile mill products; newspapers; pharmaceuticals; cosmetics; motor vehicle parts), they find evidence of increasing returns to scale.

Keay (2003) similarly examines the nature of returns to scale for four U.S. and Canadian industries (oil refineries, paper mills, steel mills, and textile mills). Using samples of firm-level data for the period 1972-1988 (just before the 1989 Canada-U.S. free-trade agreement), he finds that all four of the Canadian industries were producing under conditions of modest increasing returns to scale and all four of the U.S. industries were producing under conditions of modest decreasing returns to scale. His estimated long-run average cost curves were very nearly flat, implying limited potential welfare gains from formation of a free-trade area (2003, p. 383).

Productivity studies Much of the extensive literature on the nature and determinants of trends in total factor productivity carries out empirical work at an extreme level of aggregation, such as the U.S. manufacturing sector. Studies with less aggregated data, like those of Baily *et al.* (1992), Burnside *et al.* (1995), and Klette (1999) report as a joint product with their productivity estimates findings of constant returns to scale. Studies with two-digit industries, which are much less aggregated than the whole manufacturing sector but far too aggregated to constitute meaningful industries in an economic sense, report finding increasing returns to scale (Morrison, 1990), and are inconsistent with the bulk of the micro-level evidence.[35]

A possible reconciliation of these differing results lies in an appeal to increasing returns to factors of production external to firms or industries, such as human capital and the state of knowledge. The results of Morrison and Siegel (1997) are at least suggestive of this explanation.[36]

It may be the case that studies with aggregate data indicate increasing returns to scale because they are picking up external economies based upon

[35] Caves and Barton (1990, p. 23) similarly note "Broadly based estimates of Cobb-Douglas and CES production functions in manufacturing ... typically find statistically significant economies of scale. However, a considerable weight of evidence from the field of industrial organization suggests that plant cost curves in narrowly defined manufacturing industries typically take the shape of a letter J lying on its side—indicating scale economies (which may or may not be substantial) at small scales of operation that diminish and give way to constant returns over an extensive range of large scales....".

[36] Henderson (1999) finds decreasing returns to labor, capital, and materials with plant-level data, but evidence of external economies from agglomeration of own-industry plants in the same region.

Betancourt & Malanoski (1999)	(U.S. supermarkets, 1982) Estimated constant returns to scale with respect to output, increasing returns to scale with respect to distribution services.
MacDonald & Ollinger (2000)	(Hog slaughter; establishment data, Census years, 1963–92) Modestly increasing returns to scale at the sample mean; returns to scale rising over time; largest plants operate near constant returns to scale.
Buccola et al. (2000)	(U.S. food processing industries; 4-digit SIC data, 1958–94) Largest economies of scale in bakery products, smaller in flour milling, near-constant in rice milling and feed milling.
Callan & Thomas (2001)	(Municipal solid waste disposal and recycling, Massachusetts, 1997) At the sample mean, estimated constant returns to scale in waste disposal, economies of scale in recycling, and economies of scope between disposal and recycling.
Morrison Paul (2001)	(U.S. meat packing, SIC 2011, 1958-91) Substantial economies of scale early in the sample period, near constant returns to scale by the end of the sample period.
Hollas et al. (2002)	(33 U.S. natural gas utilities, 1975–94) "The pattern of changes suggests promotion of competition has generally moved gas distributors "to the left" on their long-run average cost curves. After restructuring, 37 percent of gas distributors are in either the increasing or constant scale categories compared to 24.2 percent and 23.0 percent [before 1978] and [between 1978 and 1992] periods, respectively."
Drake & Simper (2002)	(Police forces, England and Wales, 1992/93–1996/97) Economies of scale, less than 3000 staff members; constant returns to scale, 3001 to 4500 staff members; diseconomies of scale, more than 4500 staff members.
Xia & Buccola (2002)	(4 4-digit SIC meat processing industries, 1973–94) With productivity growth, average cost curves become lower, flatter over time; economies of scale at the sample mean.

Table 13: Returns to scale, various sectors (2)

Morrison (1990)	(17 2-digit U.S. manufacturing industries, 1952-86) (p. 28) "...short and long run scale economies exist and are quite substantial in a number of industries. Scale economies also appear to be increasing, especially in industries which tend to be more capital intensive and have experienced productivity growth stagnation." (p. 29) "The procyclicality of the [elasticity of cost with respect to output] is evident ...declines are evident for most industries in the downturns of 1969-70, 1974-75 and 1982-83. To a large extent cyclical movements in [the elasticity of cost with respect to output] are driven by utilization fluctuations, since potential scale economies appear to be increasing over time rather smoothly."
Baily et al. (1992)	(Longitudinal Research Database; plant-level data; 23 4-digit SIC industries, 4 census years) "The general word among researchers at the Center for Economic Studies at the Census Bureau has been that there are constant returns to scale in the LRD panel. Our results are unlikely to change that conclusion. If anything, there is some sign of decreasing returns..."
Burnside et al. (1995)	(26 3-digit SIC industries, 1977–92) "...inference about returns to scale is quite robust across the three specifications of technology that we considered. There just is not much evidence in our data sets against the hypothesis of constant returns to scale."
Klette (1999)	(14 2/3 digit ISIC Norwegian manufacturing industries, 1980–90) "...the average firm in most industries seems to face constant or moderately decreasing returns to scale."

Table 14: Evidence on returns to scale from productivity studies

the public good aspects of knowledge, while studies with industry, firm, and plant data find constant returns to scale to factors of production that are internal to the firm. Such a conclusion suggests that there should be public support for public and private investment in knowledge. This support might take the form of the promotion of international technology alliances, as well as more traditional national policies.[37] Such a result would not overturn the conclusion suggested by studies based on less aggregate data that economies of scale within firms and plants are typically exhausted at outlet levels far below those of global markets.

3.1.2 Network externalities

There are network externalities if the utility enjoyed by any one consumer of a good is greater, the greater the total consumption of the good.[38] Telephone service is a classic example of a direct network externality: the more consumers there are joined to the network, the more phone calls any one consumer can choose to make. Indirect network externalities arise from the interaction of quantity consumed (installed customer base) and the provision of complementary goods. That Windows operating systems have an effective monopoly for personal computers encourages software developers to write packages that are compatible with Windows. This makes personal computer users better off, as they have a wider range of available applications.

Intuition honed on markets without network externalities can go astray in their presence. Economides and Flyer (1997) show that equilibrium market structure in the presence of strong network economies is typically asymmetric, with entrants attaining at most a fringe position and having little impact on the price set by the leading firm.[39] Further, consumer welfare and net

[37] For discussion of which, see Martin and Scott (2000).

[38] See the Spring 1994 issue of the *Journal of Economic Perspectives* for a symposium on network externalities, the October 1996 issue of the *International Journal of Industrial Organization* for a special issue on the topic, and Shy (2001). For references to the broader topic of path dependence, see Liebowitz and Margolis (1990, 1999) and David (1985, 2001).

[39] Of course, that the equilibrium which emerges in the absence of strategic behavior has a market structure that involves a dominant firm is not the same thing as an observed market structure with a dominant firm having emerged without strategic behavior by that dominant firm. See Borenstein for passenger airlines, Weiman and Levin (1994), Gabel (1994) for the U.S. telephone industry.

social welfare are typically greater when one firm has an asymmetrically larger market share, as this maximizes the network externalities enjoyed by consumers. Where network externalities are strong, the link between competition (in most of senses noted in Section 2) and good market performance is broken.

An implication is that globalization in network industries may lead to increased overall welfare and improved performance in the global market, but not to market structures that are competitive in the sense of having a large number of actual rivals of broadly similar sizes or in which the threat of potential competition would temper the conduct of incumbents. It can be presumed that regional political leaders in such a global market will not be indifferent to income transfers from their region to a network leader based in some other region. Possible consequences include the policies (less optimistically) to erect barriers to globalization and (more optimistically) to support local suppliers of products complementary to those of the network leader.

3.1.3 Endogenous sunk costs

Sutton (1991, 1998) analyzes the relationship between endogenous sunk costs — spending on advertising and on research and development — and equilibrium market structure.[40] Where the sunk costs that must be covered by a firm supplying a market are given by the technology, his models show, market concentration goes to zero as market size becomes large. Where the costs that are sunk are the cost of choice variables of the firm, variables that increase consumers' willingness to pay for a product, equilibrium seller concentration is bounded away from zero.[41] Evidence from the food sector supports the predicted impact of advertising on seller concentration (Sutton, 1991; Ellickson, 2007). Evidence from a cross-section of high-R&D intensity industries supports the predicted impact of R&D spending on market concentration (Sutton, 1998).[42]

Globalization implies the reduction of costs incurred by suppliers located

[40] For reviews, see Bresnahan (1992) and Scherer (2000). See also Sutton (2000).

[41] The lower bound for seller concentration implied by high levels of R&D spending depends on the extent to which firms supplying a market employ similar technology trajectories; see Sutton (1998, Section 3.6).

[42] See Robinson and Chiang (1996), Matraves (1999), Bakker (2005), and Marin and Siotis (2007) for other supporting evidence.

in one regional submarket that supply (either directly or by direct foreign investment) other regional markets. Globalization implies the reduction of costs incurred by consumers located in one regional submarket who wish to obtain a product variety offered by a supplier based in some other regional market.[43] Sutton's work suggests that to the extent that globalization leads to a reduction in exogenous sunk entry costs, globalization should lead to lower levels of concentration in larger, more-nearly-global, markets. Where the sunk cost of operating in global markets are endogenous, however, reductions in the equilibrium level of market concentration need not materialize. Globalization should not be expected to lead to an increase in competition in the sense of the equilibrium number of rivals in markets where endogenous sunk costs are a significant factor.

3.2 Competition, efficiency, and market structure

3.2.1 Efficient operation

The notion that rivalry promotes efficient operation long antedates Leibenstein and the analysis of X-efficiency.[44] For example, Chadwick (1859, p. 409) writes:[45]

> I recognise as a fact of common experience, that where a single tradesman is permitted to have the entire and unconditional

[43] For consumer goods, the reduction in purchasing transaction cost of an individual consumer will be via the intermediary of a reduction in costs to a wholesale or retail distributor of obtaining supplies from a foreign firm. In such cases, at least, the supply-side and demand-side impacts of globalization are, to borrow a metaphor, like the two blades of a scissors.

[44] On which, see Perlman (1990) and the references therein.

[45] Chadwick is in turn anticipated by Adam Smith, who notes that one consequence of the opening up of roads is to bring competition to previously isolated regions, and writes that one of the advantages of such competition is that (Smith, 1937, p. 147) "Monopoly, besides, is a great enemy to good management, which can never be universally established but in consequence of that free and universal competition which forces everybody to have recourse to it for the sake of self-defence." Not long after Chadwick, Adams (1887, p. 501) wrote that "Again, wherever the conditions for competitive action are maintained, society has a guarantee that goods will be produced at the lowest possible cost; for the hope of personal gain leads to the best disposal of labor, to invention, and to the adoption of the best machinery." Judge Hand's often-quoted observation (148 F. 2d 416 at 427) that "immunity from competition is a narcotic" is well known.

> possession of a field of service, as in remote rural districts, he generally becomes indolent, slow, unaccommodating, and too often insolent, reckless of public inconvenience, and unprogressive. To check these evils, competition of a second is no doubt requisite...

A modern rationale for the existence of technical inefficiency, and the possibility that the degree of inefficiency is itself the product of economic forces, is given by Caves and Barton (1990, pp. 4–5):[46]

> If costs are elevated X percent above the minimum attainable, we must suppose that it pays somebody to reduce them. A satisfactory theoretical story must explain why that opportunity is not seized. The main part of the answer lies in second-best bargains struck between principals and agents—whether the owners of equity shares in firms and their hired managers or managers at any level within the enterprise and the persons whom they hire and supervise. The potential for second-best outcomes of such bargains and the implied strong possibility that the degree of nonoptimality will vary from case to case supply one basis for explaining technical efficiency.

A body of empirical research suggests that rivalry promotes technical efficiency. Primeaux (1977) studies the average costs of monopoly and duopoly U.S. electric public utilities and finds that (1977, p. 107) "average cost is reduced, at the mean, by 10.75% because of competition."[47]

In their analysis of the efficiency of U.S. manufacturing industries, Caves and Barton (1990) find that a greater share of imported supplies promotes efficiency in domestic establishments, which seems to be greatest in industries where the four-firm seller concentration ratio is around 40 per cent.[48] A

[46] For theoretical contributions, see Horn et al. (1995), Bertoletti and Poletti (1996, 1997), Schmidt (1997), Barros and Macho-Stadler (1998), and Wright (2003), among others.

[47] Hausman and Neufeld (1991) compare the efficiency of publicly-owned and privately-owned U.S. electric utilities in 1897–98 and find publicly-owned utilities to be more efficient. As they note (p. 420) ownership and competition effects are distinct influences on efficiency.

[48] They also note that efficiency appears to fall with enterprise diversification and that (1990, p. 63):

> A major puzzle ... is a highly significant negative correlation between esti-

successor study of efficiency in six industrialized countries finds (Caves, 1992, p. 12) that:

> In every country high concentration is found hostile to technical efficiency. In four of them a quadratic relationship indicates that maximum efficiency comes at an intermediate level of concentration... In the other two a linear negative effect dominates...

Hay and Liu (1997) study the efficiency of 181 leading firms in 21 3- or 4-digit UK manufacturing industries for the period 1970–89. They find that firm efficiency increases with greater efficiency of firms in the same industry and as own market share falls.[49] Both results are consistent with the view that rivalry promotes efficiency.

Specific instances of deregulation allow case studies of natural (or, some might say, unnatural) experiments in the impact of increased rivalry on market performance. Graham *et al.* (1983) is an early study, followed by many more, suggesting that deregulation of U.S. airlines increased operating efficiency. That deregulation would decrease flight frequency and increase load factors had been anticipated by advocates of deregulation. Emergence of the hub-and-spoke system had not been anticipated. Eckel *et al.* (1997) report evidence (lower fares as well as stock market effects) suggesting that the privatization of British airways similarly improved market performance.

Ng and Seabright (2001) estimate a frontier production function for 12 EU and 7 US major airlines for the period 1982–95, and report among other results that (2001, p. 610):[50]

- "An increase of one percentage point in the proportion of a carrier's international routes on which it faced competition from a third airline (holding its market share constant) would lower rents to employees by 3% and costs to the airline by about 2%."

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mated efficiency and the number of plant observations used to estimate the production function.

[49] I am indebted to Dennis Mueller for the observation that a finding the efficiency falls as market share rises is inconsistent with the efficiency argument of Demsetz (1974), and suggests that the positive coefficient of market share commonly found in studies of line-of-business profitability (Martin, 1983; Ravenscraft, 1983; others) is evidence of the exercise of market power.

[50] They also find increasing returns to both scale and density. See Table 15 for results of other studies touching on these points.

- "...a reduction of ten percentage points in the share of public ownership would be associated (other things equal) with a 10% reduction in rents and therefore about an 6.5% reduction in costs."

Lien and Peng (2001) compute an efficiency measure for a sample of 25 OECD telecommunications operators over the period 1980–1995. Efficiency is estimated to be lower for markets and years where there are at most one or two operators. Similar comparisons with company-level data seem to confirm the country-level results.

Fabrizio et al. (2007) examine the impact of regulatory restructuring on input use of large fossil-fuel power plants of U.S. electric utilities over the years 1981–1999. They find (2007, p. 1251) "that the plant operators most affected by restructuring reduced labor and nonfuel expenses, holding output constant, by 3 to 5 percent relative to other investor-owned utility plants, and by 6 to 12 percent relative to government- and cooperatively owned plants that were largely insulated from restructuring incentives.

3.2.2 Efficient market structure

There is evidence that rivalry promotes the development of a cost-minimizing market structure. One class of such evidence is that on the development of the hub-and-spoke system in the U.S. post-deregulation passenger airline industry, noted above.

Elliott and Gribbin (1977), Broadberry and Crafts (1992) and Symeonidis (2000, 2002) analyze a quantum ratcheting-up of the toughness of UK competition policy toward collusion in the mid-1950s. The result seems to have been a quantum reduction in the ability of trade associations to deliver "the quiet life" to members, a shake-out of high-cost firms, and an increase in the market shares of low-cost firms.

Hay and Liu (1997) examine UK manufacturing and estimate that the market shares of less-efficient firms erode over time. But they find no simple pattern of types of product or market structure to explain the speed of such erosion, and caution that (1997, pp. 610–611): "The results are a warning against attempts to categorise the state of competition in a market *a priori*, on the basis of market structure and degree of product differentiation."

On balance, empirical evidence supports the view of rivalry as a selection mechanism.

3.3 Competition and the exercise of monopoly power[51]

It is a robust result of static models of imperfectly competitive markets that the noncooperative equilibrium level of market power falls as the number of firms rises. In repeated-game models, noncooperative collusion is generally less likely to be an equilibrium, the greater the number of firms. Much economic theory also leads one to suspect that actual collusion, as well as its tacit counterpart, is less likely to be stable, the greater the number of firms.[52]

Turning to empirical evidence, although cross-section studies of market performance are out of style, it should be noted that a multitude of such studies suggest that competition from foreign suppliers tempers the ability of domestic suppliers to hold price above marginal cost.[53]

Market integration in the European Union generates continuing data about the impact of increased competition on market performance.[54] Allen *et al.* (1998) examine the impact of the EU's Single Market Programme on 15 3-digit NACE[55] industries for the period 1976–94. Their results suggest that (1998, p. 452): "On average, after allowing for other influences on pricing, price-cost margins have fallen by 3.9% since 1991 across the fifteen sectors studied." Working with a sample of 745 Italian firms, Bottasso and Sembenelli (2001) find that for firms in tradable goods sectors that estimated price-cost margins between 15.8% to 19% for 1982–7 and between 6.6% to 10.7% for 1988-93. Siotis (2003) finds a reduction in price-cost margins for Spanish manufacturing with integration into the EU.

Of course, not all increased competition comes from lowering the barriers that separate suppliers located in different geographic markets. The U.S. Congressional Budget Office (1998) estimated that measures to permit increased competition between generic and brand-name pharmaceuticals from the 1980s onward (1998, p. ix) "have lowered average returns from marketing

[51] I defer discussion of the impact of potential rivalry on the exercise of market power to Section 4.

[52] See, generally, Scherer (1970, Chapter 6).

[53] See Esposito and Esposito (1971), Caves (1980), Neumann et al. (1985), and Katics and Petersen (1994), among many others.

[54] Official estimates, such as Emerson *et al.* (1988), have sometimes been skeptically received; see, for example, Peck (1989).

[55] Nomenclature générale des activités économiques dans les Communautés Européennes. See EC Commission (1996).

a new drug by roughly 12 percent. . . ."[56]

Lowering barriers to trade brings increased competition — actual and potential rivalry — and improves market performance. It is equally to be expected that vigorous domestic competition will hone efficiency — promote competitiveness — and promote success on international markets. Sakakibara and Porter (2001) present empirical evidence that the vigor of competition in Japanese domestic markets has contributed to Japan's strong exporting track record.

3.4 Rivalry and dynamic market performance

It was Emerson's phrase that "A foolish consistency is the hobgoblin of little minds," and "little minds" is a category into which Schumpeter certainly did not fall. The terms of the debate between the Joseph Schumpter (Schumpeter Mark I) of *The Theory of Economic Development* (1934), who argued that it would most often be new firms that drive innovation, and the Joseph Schumpeter of *Capitalism, Socialism, and Democracy* (1943) (Schumpeter Mark II), who argued that large firms with static market power would be responsible for most innovation, is too well known to require detailed review.[57]

There is evidence that competition, in various senses, promotes productivity growth.[58] Baldwin (1993, Chapter 9), examining data on a sample of Canadian manufacturing plants, finds that (1993, p. 235) "some 40 to 50 per cent of productivity growth is due to plant turnover" which he takes as evidence that "a Darwinian replacement process is at work. Progress is made as the successful displace the unsuccessful."

Olley and Pakes (1996), who limit their attention to a single industry (telecommunications equipment) also find evidence that productivity growth is driven by a plant-level selection effect (1996, p. 1292):

> the changes in the telecommunications industry improved perfor-

[56] Allen et al. (1998, p. 451) report improved market performance in EU pharmaceuticals under the Single Market Programme.

[57] See, generally, Winter (1984). The evolution in Schumpeter's views is noted by Samuelson (2003, p. 90).

[58] Satisfactory treatment of the large empirical literature relating alternative measures of innovation input or innovation output to market and firm characteristics would require a separate paper. The results of empirical studies of factors explaining differences in productivity growth rates may in any case be more easily related to the matter of the impact of globalization on dynamic market performance.

> mance by inducing a reallocation of capital to more productive plants. This reallocation process seems to be facilitated by entry and exit... ...it is the reallocation of capital, rather than an increase in the efficiency of the allocation of variable inputs or in average productivity, that seems to underlie the increase in productivity that followed the deregulation of the telecommunications industry."

Baily and Gersbach (1995) examine 9 industries in Germany, Japan, and the United States. They classify each industry for each country as locally, regionally, or globally competitive and find a broadly positive relationship between labor productivity and the breadth of competition. They also construct a globalization index based on exposure of lower-productivity industries to the rivalry of the high productivity industry via either imports or direct foreign investment, and find that greater globalization in this sense is associated with greater relative productivity. Börsch-Supan (1998) similarly finds a pattern of relative capital productivity across the three countries consistent with the hypothesis that globalization promotes efficient use of capital.

Nickell *et al.* examine U.K. firm-level panel data and (1992, p. 1072) "see in the data ...a time series association between increases in market share and falls in the level of productivity combined with a cross-section association between higher market share and higher rates of productivity growth." Nickell (1996) finds that firm-level productivity growth is higher, the lower the level of economic rents, the greater the number of competitors, and the lower is market share. Nickell *et al.* (1997) find that firm-level productivity growth is lower, the higher the level of economic rents.[59]

Carlin *et al.* analyze UK establishment data for 1980–1992 and report that (2001, p. 76):

> Only about one-half of productivity growth takes place within surviving establishments, with net entry accounting for about another 30 per cent. ...the survival and growth of some entrants and the cumulative impact of exit have a significant effect on productivity growth over a decade or more. An even more important

[59] High debt levels or the presence of a dominant shareholder substitute for low economic rent in promoting productivity growth. See also Kovenock and Phillips (1997), who find evidence of strategic influences on plant closing decisions in oligopoly.

contribution comes from the net effect of the opening and closure of plants by multi-product firms.

They also find that product-market competition raises the level and growth of productivity.[60]

Tybout and Westbrook (1995) examine the impact of late-1980s Mexican trade liberalization on Mexican manufacturing. They find evidence of productivity increases, in part due to cost reductions, in part due to market share increases of more efficient plants. They do not find evidence of gains due to the realization of scale economies.[61]

Hay looks at the consequences of Brazil's 1990 opening up to trade and finds (2001, p. 620) "the main effects of trade liberalisation as a reduction of market shares in the domestic market, a sharp fall in profits, and a marked increase in the efficiency of large Brazilian manufacturing firms." Pavcnik (2002) finds that Chilean trade liberalization induced higher productivity in continued plants and exit of less productive plants. In a remark that anticipates the discussion in Section 5, she writes (2002, p. 271) "that the barriers to plant turnover are important determinants of the success of trade liberalization."

Amato and Amato (2002) look at productivity growth in a sample of 274 U.S. 4-digit SIC industries for the years 1977, 1982, 1986, 1992, and find that productivity growth is greater, all else equal, the greater the growth rates of either import or export sales.

4 Potential rivalry and its limits

The idea that one can rely on potential rivalry alone to support good market performance is one of the periodically recurring themes in industrial eco-

[60] Carlin et al. also analyze a sample for Eastern European transition economies. They find evidence of restructuring, without much indication of concomitant productivity growth.

[61] This result is plausible, given the findings of the literature reviewed in Section 3.1.1, that in most industries available economies of scale can be realized at relatively low output levels.

nomics.[62] Gunton (1888, p. 403) writes of trusts that[63]

> They have therefore a direct interest in keeping prices at least sufficiently low not to invite the organization of counter enterprises which may destroy their existing profits. If the gates for the admission of new competitive capital are always open, the economic effect is substantially the same as if the new competitor were already there; the fact that he *may come* any day has essentially the same effect as if he *had come*, because to *keep him out* requires the same kind of influence that would be necessary to *drive him out*.

Along the same lines, Van Hise writes (1912, p. 84):[64]

> In making the statement that prices of many articles, from the great natural monopolies to matches, are controlled by some form of combination or agreement, it is not meant to imply that any price can be charged for an article. There is a limit beyond which, if the price be raised, competitors will enter a business. This so-called potential competition makes the combinations careful not to place the prices at so high a level as to lead to additional competition.

Machlup (1942) again emphasized the impact of potential competition on market performance. The importance of potential competition was a central element of the structure-conduct-performance framework, which emphasized the importance of barriers to entry precisely because the height of such barriers was thought to determine the extent to which potential competition

[62] Demsetz (1968, p. 57, footnote 7) cites Chadwick (1859) in connection with Demsetz' monopoly franchise argument questioning the theoretical rationale for regulation of natural monopoly. The citation of Chadwick in this context is not without peculiar aspect, as Chadwick himself (1859, p. 408) presupposed ongong administrative supervision of the conduct of a successful "bidder for the field." From the point of view of the modern theory of regulation, it would be thought doubtful that the informational requirements Chadwick mentions for such supervision could be met. Nor did Chadwick limit the scope of his proposal to natural monopoly (Dnes, 1994). What Chadwick put forward was an argument for a form of regulation, not an argument that regulation was unnecessary.

[63] Giddings (1887, p. 76) makes much the same argument.

[64] See also Liefmann (1915), Marshall (1923, p. 524).

could work its effect. Baumol *et al.* (1982) renovated the doctrine of potential competition, rebaptized it as the theory of contestable markets, and put forward the airline industry, with its "capital on wings" as a likely prototype of a real-world analogue of a contestable market.

The 1969 finding of Eads *et al.* that pilots and co-pilots could be treated as a fixed resource in the short run might be thought to raise the possibility of a range of increasing returns to scale on the supply side of the passenger airline market. Caves *et al.* (1984) find that what is at work is economies of density rather than economies of scale in the strict sense.[65] Later work confirms that the passenger airline industry cannot be said to be contestable. The results of some such studies are indicated in Table 15. From the point of view of obtaining good market performance, potential rivalry may be good; actual rivalry is better.[66]

This empirical literature suggests that it is not useful to analyze the passenger airline industry as if it were contestable. The broader implication for the impact of globalization on market performance is that in a wide range of industries, apparently minor market characteristics will often offer incumbents the opportunity to engage in strategic behavior that raises the cost of entry, blunting the force of potential competition. The extent to which incumbents are able to effect such strategic behavior depends on the commitment of public authorities to market competition as a resource allocation mechanism.[67]

5 Globalization and the limits of competition as a policy

When I write of "competition as a policy," I have in mind not merely what is called in the EU "competition policy" and in the U.S. "antitrust policy,"

[65] The nature of these results is similar to those reported by Caves and various sets of co-authors for railroads; see Table 10.

[66] The results of Bresnahan and Reiss (1987, 1991) on the impact of entry in local markets are consistent with this view.

[67] Hannan (1979) finds that after controlling for the number of actual competitors, Pennsylvania banks offered higher interest rates on savings accounts, the greater the number of legally permitted potential competitors. Cool et al. (1999) estimate that in the mid-1970s, actual and potential competition had about the same effect on U.S. pharmaceutical prices; by 1982, the impact of actual competition had grown to about twice that of potential competition.

Eads et al. (1969)	(12 local carriers, quarterly data, 1Q 1958–4Q 1966) Input of pilots and co-pilots treated as a fixed factor in the short run. No evidence of substantial increasing returns to scale.
Graham et al. (1983)	(194 local U.S. airline markets, 4Q 1980, 1Q 1981) "...fares seem to be positively related to concentration, thereby indicating that potential competition is not strong enough at present to eliminate all attempts to raise price in concentrated markets."
Caves et al. (1984)	(Annual observations, trunk and local airlines, 1970–1981) Constant returns to scale (proportional increases in network size and output), economies of density (increases in output, network size constant).
Borenstein (1989)	(1508 city-pair routes serviced by at least 2 of the 9 largest U.S. airlines, 3Q 1987) (p. 362) "...dominance of major airports by one or two carriers, in many cases the result of hub formation, appears to result in higher fares for consumers who want to fly to or from these airports."
Berry (1992)	(1219 U.S. city-pair markets, 1980) (p. 914) "...profits decline fairly rapidly in the number of entering firms. ...efforts to decrease city pair concentration by increasing airport access will be to some degree offset by competition within city pairs: even as the number of potentially profitable firms increases, within-market competition will limit the number of entering firms."
Brueckner et al. (1992)	(U.S. round trips with change at hub, 4Q 1985) (pp. 325–6) "...addition of the first competitor to a monopoly market lowers fares by 7.7%. Addition of a second or third competitor reduces fares by a further 3.4% ...addition of an extra competitor beyond three lowers fares by a further 0.6%. ...addition of a potential competitor to the market ...lowers fares by 1.6%."

Table 15: Returns to scale in and contestability of the airline industry

but rather a public commitment to the market mechanism as a resource allocation mechanism. Certainly such a commitment includes application of competition policy — in the words of Stigler (1955, p. 177), "An antitrust policy is employed by a society which wishes to use the competitive market, rather than powerful private or public bodies, to regulate most economic activity." Global trade evoked a World Trade Organization, and it seems likely that global markets will in due course evoke a Global Competition Organization (Scherer, 1994). That global markets bring with them business behavior that is typically condemned in national markets seems beyond dispute (Connor, 2001).

But public commitment to the market mechanism is more than having an antitrust policy. Competition or antitrust policy is but one in a menu of public policies that impact the functioning of the market mechanism. These include, among others, the boundary between the public and the private sector and the differences in the nature of the economic environment on either side of that boundary,[68] the nature of local programs to promote economic development, rules governing trade flows, labor market and workplace safety legislation, consumer protection legislation, property development (zoning) rules, and environmental protection legislation. A commitment to markets as a resource allocation mechanism includes not only using antitrust policy to promote effective market performance but also ensuring that these other elements of public policy are not applied in such a way as to short-circuit the functioning of markets. Full realization of the benefits of globalization requires that governments let the market mechanism work.

Examples of public policies that sidestep the market mechanism are all too easy to find. Countries that maintain a vigorous competition policy for their own domestic market typically permit their suppliers to collude for sale on export markets. This is difficult to justify in its own right, and ignores the fact that explicit collusion with respect to foreign markets facilitates tacit collusion with respect to the domestic market.

The historical record of trade distortion via voluntary export restraints is well known. So is the indefensible application of WTO antidumping provisions, the rule of which seems to be, as in *Romeo and Juliet*, "all are punish'd."[69] U.S. safeguard tariffs on steel (March 2002) represent a practical

[68] That there is a public sector is not, in and of itself, inconsistent with reliance on the market mechanism. It becomes so if public firms are given immunity from the rules that apply to private firms.

[69] For a more complete discussions of trade-distorting policy measures, see Martin (2010,

departure from reliance on competitive international markets. So do U.S. farm policies and the EU's Common Agricultural Policy.

Subsidies to firms by EU Member States have a track record of keeping inefficient firms alive, blocking one of the avenues for gains from EU market integration (Martin, 2010, Chapter 17). Similar prisoners'-dilemma races to promote local economic development occur in the US. The EU has a better policy track record than the U.S. in this area, in principle at least, in that the distortionary nature of state aid is recognized and control of state aid is an element of EU competition policy.[70]

Beyond policy measures that explicitly distort markets to accomplish a goal that is not otherwise reachable, or not otherwise reachable at acceptable political cost, national packages of product and labor market regulations may have the practical effect of shielding domestic firms from the buffeting winds of competition. Nicoletti *et al.* (2002) report the results of an OECD evaluation of national product and labor market policies in terms of their impact on product market competition. The study evaluates regulations, administrative procedures, barriers to entrepreneurship, barriers to trade, and other economic policies conditioning the ability of rivals to compete. The results of these evaluations are combined, using factor analysis, to construct an index of product market regulation, with lower values representing less restrictive regulation. A similar index is constructed for employment protection regulation.[71] These rankings are depicted in Figure 1, along with a simple regression line fitted to the observations.[72] It is evident that there is a tendency for countries where product market regulation is less cordial to competition also to have intensive labor market regulations.

Scarpetta *et al.* (2002) report evidence that restrictive product and labor market regulations of the kind described in Figure 1 have a negative impact on multifactor productivity and limit the market access of small- and medium-sized firms. Djankov *et al.* (2002) carry out a cross-section analysis

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Chapter 16).

[70] Incorporation of control of state aid into U.S. antitrust policy would need to navigate treacherous shoals of the U.S. federal system of government.

[71] With regard to which, the industrial economics adage that barriers to exit are barriers to entry comes to mind. Where it is difficult for firms to discharge employees, firms are reluctant to hire employees. Employee protection legislation very often appears to be legislation that protects workers with jobs at the expense of would-be workers who do not have jobs.

[72] Austria, Sweden, and The Netherlands have identical values of both indexes.

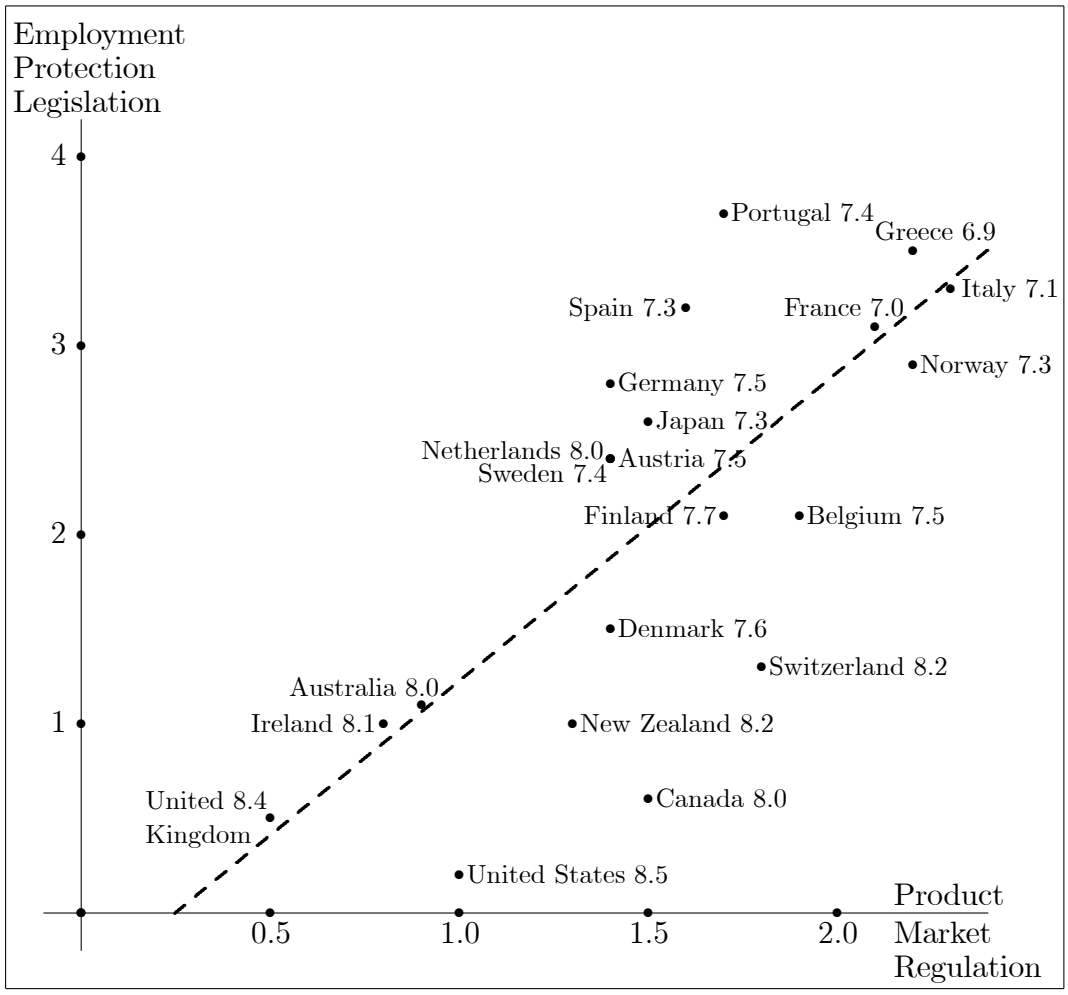

Figure 1: Product market regulation and employment protection regulation. Source: OECD (2000), Gwartney and Lawson (2002).

of entry regulations for 85 countries and find (2002, p. 35) "that heavier regulation of entry is generally associated with greater corruption and a larger unofficial economy". They do not directly analyze the relation between the nature of entry regulation and productivity growth, but do report the heavier regulation of entry is not associated (2002, p. 35) "with better quality of private or public goods."

Figure 1 also shows, for each country, its "Economic Freedom" ranking (Gwartney and Lawson, 2002), on a scale of 0 (low economic freedom) to 10 (high economic freedom). The subjective nature of this ranking means that it may be questioned by reasonable parties.[73] It nonetheless seems worthwhile to note that countries found by the OECD to have competition-friendly product and labor market regulations tend to rank high on the subjective economic freedom scale.

6 Conclusion

The large literature on competition is made obscure by the fact that some of its components deal with competition in one sense, some in another, with various, to use the phrase of Vickers (1995), concepts of competition, concepts not always clearly distinguished. Harkening back to the classic organizing framework of industrial economics, the structure-conduct-performance approach,[74] competition has at times been conceived of in terms of

- structure: a market is competitive if there are a large number of equally efficient active suppliers and/or if barriers to entry are low;
- conduct: a market is competitive if suppliers behave in a rivalrous way;
- performance: a market is competitive if equilibrium price is equal to marginal cost (and/or equal to average cost).

[73] The treatment of intellectual property rights in making the economic freedom ranking seems positively wrongheaded. Excessive intellectual property rights are not conducive to economic freedom, as is recognized by Milton Friedman in his preface to Gwartney and Lawson (2002).

[74] The structure-conduct-performance framework is largely superseded in academic research by a game-theoretic approach that grafts industrial economics onto to the neoclassical microeconomic theory of the firm (and, it can be argued, reproduces many of the results obtained using the S-C-P approach).

These capsule caricatures hint at further complications. The first two items refer to the supply side of markets, but markets have demand sides as well. The third item characterizes competition in terms of static market performance, but dynamic elements of market performance, such as the rate of technological progress, have their place as well.

Despite the attention given in the theoretical literature to the consequences of economies of scale in the traditional sense, there is no evidence of their general importance. There is little reason to think that diseconomies of scale will set a limit to the expansion of firms in global markets, and there is little reason to think that the attainment of minimum average cost mandates high levels of seller concentration in global markets.

Network externalities are likely to be present in a few sectors (telecommunications; distribution of electric power and natural gas). Such externalities have many of the effects traditionally ascribed to economies of scale in production. Outside of such sectors, there is no compelling evidence for the presence of natural monopoly. The initial reaction to any claim of natural monopoly should be scepticism. Where network economies are present, they imply that the best equilibrium market performance will be characterized by substantial rent transfers to a single leading supplier. In global markets, such an outcome may well be politically unacceptable.

Competition in the sense of rivalry seems clearly to promote efficient operation and productivity growth. Full realization of these and other benefits of globalization requires governments to accept the resource reallocations that more competitive, more rivalrous, markets bring. An unwillingness to do this may well prove to be the most serious limitation to competition in global markets.

7 References

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