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**COMPETITION, INNOVATION AND PRODUCTIVITY GROWTH:
A REVIEW OF THEORY AND EVIDENCE**

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**by
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ABSTRACT/RÉSUMÉ

Competition, Innovation and Productivity Growth : A Review of Theory and Evidence

This paper reviews recent studies on the links between competition, innovation and productivity growth in the long run. From a long-run perspective, one can see that gains from competition-enhancing regulatory reform are likely to exceed static gains observed in the short run since firms will continue to innovate in ways they would not have under regulation. By taking a dynamic perspective on competition and efficiency, one can also understand better the new modes of competition observed in "dynamically competitive" industries. This paper also attempts to cover some of relatively new research areas including: *i*) measuring welfare gains from product innovation; *ii*) competition and efficiency in e-commerce, education, and health care; and *iii*) interactions between product- and factor-market competition.

JEL classification: D40, L10, O30, O40.
Keywords: competition, innovation, market structure, productivity, regulatory reform, growth.

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La concurrence, l'innovation et la croissance de la productivité: un examen de la théorie et des travaux empiriques

Ce papier passe en revue les résultats des études récentes sur les liens entre concurrence, innovation and croissance de la productivité à long terme. D'un point de vue de long terme, on peut observer que les gains d'une réforme de régulation qui augmente le degré de concurrence sont susceptible d'être plus grands que les gains statiques observés à court terme puisque les firmes continueront à innover d'une manière différente qu'en état réglementé. En prenant une perspective dynamique quant à la concurrence et à l'innovation, on peut également mieux comprendre les nouveaux modes de concurrence observés dans des industries « dynamiquement compétitives ». Ce papier vise également à couvrir une partie des champs de recherche relativement nouveaux y compris : *i*) les mesures des gains de bien-être de l'innovation des produits ; *ii*) la concurrence et l'efficacité dans le commerce électronique, l'éducation et le secteur de santé ; et *iii*) les interactions entre la concurrence sur le marché des produits et le marché des facteurs d'input.

Classification JEL: D40, L10, O30, O40.
Mots clés : concurrence, innovation, structure de marché, productivité, réforme de réglementation, croissance

TABLE OF CONTENTS

Competition, Innovation and Productivity Growth: A Review of Theory and Evidence

Sanghoon Ahn[1]

I.   Introduction and Summary

1.   It is well known that competition brings about allocative efficiency gains by forcing price to converge to marginal cost. Efficiency gains from competition, however, are not limited to such static and allocative gains. As was pointed out by Leibenstein who contrasted allocative efficiency with so-called "X-efficiency", the empirical evidence suggests that "the welfare gains that can be achieved by increasing only allocative efficiency are usually exceedingly small" (Leibenstein, 1966). In an early study, for example, the costs of static resource misallocation due to lack of competition in the United States were estimated to be much less than one per cent of GNP (Harberger, 1954).[2]

2.   Indeed, recent theoretical and empirical studies on gains from competition have been paying increasing attention to "productive efficiency" and "dynamic efficiency", which can be broadly defined in terms of productivity growth through innovations. In short, "productive (or, technical) efficiency" gains come from productivity-enhancing innovations which introduce new and better production methods, and successful innovations will eventually raise the level and growth rate of productivity in the long run (i.e., "dynamic efficiency" gains). For example, Spence (1984) considered the links between market structure and industry performance in terms of both "static allocative efficiency" and "dynamic technical efficiency" channels (see Figure 1).[3] As Figure 1 also indicates, the latter channel is usually much more complicated than the former one.

3.   This paper aims to provide a brief review of findings from recent studies on the links between competition, innovation and productivity growth in the long run. From a long-run perspective, one can see that gains from competition-enhancing regulatory reform are likely to exceed static gains observed in the

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2 .   For a brief review of the empirical literature on estimating deadweight loss represented by the Harberger triangle, see Hines (1999).

3 .   For more examples of similar approaches, see Vickers (1995), Nickel (1996), and Evans and Schmalensee (2001). A theoretical case for the trade-off between allocative efficiency and productive efficiency is found in Vickers (1995) and also in Mankiw and Whinston (1986). Schumpeter's view on market power and innovation is a classical example of the trade-off between static efficiency and dynamic efficiency (see below).

short run since firms will continue to innovate in ways they would not have under regulation (Winston, 1993). By taking a dynamic perspective on competition and efficiency, one can also understand better the new modes of competition observed in "dynamically competitive" industries (Bresnahan, 1998; Evans and Schmalensee, 2001; Ellig and Lin, 2001). This paper also attempts to cover some of relatively new research areas including: *i*) measuring welfare gains from product innovation; *ii*) competition in new areas (e-commerce, education, health care, etc.); and *iii*) interactions between product- and factor-market competition.

4.   The paper consists of four sections. Section II first considers three sources of efficiency gains from competitions: *i*) incentives, *ii*) innovation, and *iii*) selection. Some new aspects of competition found in information and communications technology (ICT) sectors are also briefly reviewed. Section III reviews empirical issues and methods. Section IV reviews empirical findings reported in the literature from several angles. Section IV.1 through Section IV.4 considers the effects of competition on: *i*) innovation, *ii*) productivity, *iii*) consumers' welfare gains, and *iv*) growth. Competition in some selected sectors (e-commerce, electricity, health care, and education) appears to deserve special attention in current policy discussions and is covered in Section IV.5. The focus of this paper is on product market competition, but it touches upon empirical findings related to interactions between product and factor markets (Section IV.6).

5.   The main conclusions drawn from this literature review can be summarised as follows:

–   The positive impact of competition-enhancing polices cannot be fully appreciated by measures of static efficiency gains in the short run. Competition has pervasive and long-lasting effects on economic performance by affecting economic actors' incentive structure, by encouraging their innovative activities, and by selecting more efficient ones from less efficient ones over time.

–   In some high-tech industries such as information and communications technology (ICT) sectors, "network effects" and "positive feedback effects" make competition between different systems/networks fierce. Little sign of competition in the static measures (*e.g.*, concentration ratio, price-cost margin, etc.) in those industries might hide vigorous competition in the dynamic sense. New features of dynamic competition *for the market* (i.e., competition between different systems to become the standard in a new market based on new technology) raise new challenges for policymakers.

–   The claim that market concentration is conducive to innovation does not appear to be supported by recent empirical findings. Motivated by the Schumpeter's conjecture that large firms in concentrated markets have advantage in innovation, many empirical studies have investigated the relation between market concentration and innovation. On the whole, however, there is little empirical support for the view that large firm size or high concentration is strongly associated with a higher level of innovative activity.

–   A large number of empirical studies confirm that the link between product market competition and productivity growth is positive and robust. Interactions between the disciplining effect of product market competition and that of competition for corporate control are also found in a few studies. It remains inconclusive, though, whether competitive pressures from the product market and competitive pressures from the corporate governance side are substitutes or complements in enhancing productivity.

–   Empirical findings from various kinds of policy changes (*e.g.*, regulatory reforms in different sectors, increased openness to global competition, introduction of competition into not-for-profit sectors etc.) also confirm that competition brings about productivity gains, consumers'

welfare gains, and long-run economic growth. However, some studies suggest that sometimes it could take a long time for the producers and consumers to adjust themselves to the new environment with increased competition and to fully experience efficiency gains.

- Analyses based on micro data show that firm dynamics (i.e., birth and death, growth and decline of individual firms) is an important component of innovation and aggregate productivity growth. Dynamic efficiency gains from product market competition, however, can hardly be achieved without well-functioning factor markets which reallocate labour and capital of shrinking/exiting firms to entering/growing firms. An increasing number of empirical studies suggest that there exist considerable interactions between product market competition and competition in labour and capital markets.

II. Theoretical Background

II.1 Competition and incentives

6. A variety of principal-agent models under information asymmetry offer some explanation on the role of competition in raising efficiency. These models start from the idea that monopoly rents to a monopolistic firm can be captured by its managers (and workers) in the form of managerial slack or lack of efforts. Competitive pressure may reduce such slack by giving more incentives to the stakeholders of the firm (i.e., managers and workers) for increasing their efforts and improving efficiency. In other words, one can reasonably expect that product market competition would discipline firms into efficient operation.[4]

7. Three different channels can be considered in this regard (Nickel *et al.*, 1997). *i*) Competition creates greater opportunities for comparing performance under information asymmetry and hence makes it easier for the owners or the market to monitor managers. *ii*) Cost-reducing improvements in productivity could generate larger increase in revenue and profit in a more competitive environment where price elasticity of demand tends to be higher.[5] *iii*) The probability of bankruptcy is likely to be higher in a more competitive environment, which will force managers to work harder to avoid bankruptcy. In the sense that product market rents coming from lack of competition may be shared with workers in the form of higher wages or reduced effort, the degree of competition could also affect the level of workers' effort in similar ways.

8. However, it should be underlined that theoretical predictions on the effects of competition on incentives are "subtle and ambiguous" (Vickers, 1995). In the models of the market mechanism as an incentive scheme under information asymmetry, for example, product market competition among firms can reduce managerial slack so far as there is significant correlation among the firms' costs due to common exogenous shocks (Hart, 1983). But, by modifying model assumptions about managers' responsiveness to monetary incentives, Scharfstein (1988) showed that competition might actually exacerbate the incentive problem. Similarly, while higher demand elasticity under competition increases the relative rewards from a cost reduction, bigger scale of operations for a monopolist tend to increase his absolute reward from a similar cost reduction. Depending on the setting of the model, competition is shown to improve efficiency in many, but not all, circumstances.

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4 .   For related empirical findings, see Section IV.2.2, Section IV.6.1, and Section IV.6.2.

5 .   In other words, a cost-reducing innovator would be able to increase revenue more dramatically by lowering price in a more competitive market with higher price elasticity of demand.

II.2   Competition and innovation

9.   The potential trade-off between static and dynamic efficiency deserves special attention in considering the links between competition and innovation. According to Schumpeter (1942), for example, the organisation of firms and markets most conducive to solving the static problem of resource allocation is not necessarily most conducive to rapid technological progress. The positive effects of market power on innovation in his view can be summarised under the following two themes (Cohen and Levin, 1989).

– The expectation of some form of transient *ex post* market power is required for firms to have the incentive to invest in R&D.

– The possession of *ex ante* market power also favours innovation. When capital markets are imperfect, the rents from market power provide firms with the internal financial resources for innovative activities. Market power also helps reduce uncertainty associated with excessive rivalry which tends to undermine the incentive to invest.

10.   Is competition conducive to innovation? Predictions of theoretical models are mixed. In the Schumpeterian view of market power and innovation, competition appears to be rather detrimental to innovation and technological progress.[6] If more monopolistic firms are more active in innovative activities because of less market uncertainty and deeper pockets, competitive pressure would reduce their incentives to invest in R&D. On the other hand, however, one could also expect that competition will force firms to innovate in order to survive. In fact, recent empirical studies report positive correlation between product market competition and productivity growth.[7] Aghion and Howitt (1998) offer several theoretical cases where competition is indeed conducive to innovation and growth:

– *Darwinian effect*: Intensified product market competition could force managers to speed up the adoption of new technologies in order to avoid loss of control rights due to bankruptcy (Aghion *et al*., 1999). More generally, firms should innovate to survive under competitive pressure (cf. Porter, 1990).

– *Neck-and-neck competition*: In a simple model of "creative destruction", the incumbent firms unlike new entrants have no incentives to innovate. Under a more gradualist technological progress assumption with incumbent firms engaged in step-by-step innovative activities, competition could increase innovation. It is because more intensive product market competition between firms with "neck-and-neck" technologies will increase each firm's incentive to acquire or increase its technological lead over its rivals.

– *Mobility effect*: In the learning-by-doing model of endogenous growth, the steady-state rate of growth may be increased if skilled workers become more adaptable in switching to newer production lines (namely, Lucas effect). In this case, more competition between new and old production lines (parameterised by increased substitutability between them) will induce skilled workers to switch from old to newer lines more rapidly (Aghion and Howitt, 1996).

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6.   Strictly speaking, competition in this statement will have to be interpreted as "static" competition. See below (Section II.4) for more discussion on "dynamic" competition.

7 .   See Section IV.1, Section IV.2, Table 1.1 and Table 1.2 for related empirical findings.

II.3   *Competition and selection*

11.   Firm dynamics (i.e., birth and death, growth and decline of individual firms) make an integral part of dynamic competition. An increasing number of theoretical and empirical studies focused firm-level or plant-level dynamics show that aggregate productivity of an industry is significantly affected by compositional changes in the industry due to firm dynamics.[8] Dynamic competition incessantly weeds out less efficient firms from more efficient ones and reallocates productive resources from shrinking/exiting firms to entering/growing firms. In this context, well-functioning labour markets and capital markets are very important.[9]

12.   A theoretical framework for dynamic competition and firm dynamics can be found in the notion of "creative destruction" by Schumpeter.[10] Dynamic competition is a process in which innovators with new technology enter a market and compete with incumbents with conventional technology. If the innovation is successful, the entrants will be able replace the incumbents. If not, they will fail to survive. Indeed, such dynamic competition "from the new commodity, the new technology, the new source of supply, the new type of organisations" strikes "not at the margins of the profits and the outputs of the existing firms but at their foundations and their very lives" (Schumpeter, 1934).

13.   When incumbents which have already accumulated substantial experience with conventional technology are less enthusiastic about taking risks of adopting new technology, new entrants aggressively experimenting with new technology can be a driving force of innovations. Incumbents are also forced to innovate themselves by the competitive pressure coming from the existence of actual and/or potential entrants. Aggregate productivity evolves with successive innovations through selection process of firm dynamics under competitive pressure.

II.4   *New modes of competition*

14.   In some high-tech industries such as information and communication technology (ICT) sectors where technological changes are very rapid and competition centres on Schumpeterian innovation, "dynamic" competition *for the market* is arguably more important than static price/output competition *in the market* (Besen and Farrell, 1994; Evans and Schmalensee, 2001). In the static sense, competition in such high-tech industries appears far from being rigorous. A few dominant firms have significant market power and they set prices well above marginal costs. In the Schumpeterian view, however, the *expectation* of short-run market power is a necessary condition for dynamic competition and the *existence* of short-run market power does not necessarily imply lack of competition. Key characteristics of ICT industries include: *i*) low marginal costs and high fixed costs; *ii*) existence of scale economies and network/system effects; *iii*) winner-take-all races in innovation; and *iv*) high profits for industry leaders (Evans and Schmalensee, 2001). In such industries, competition between different systems/networks to become the standard in the market is fierce.

15.   "Network effects", "positive feedback effects", and "systems competition" are keywords in understanding new features of dynamic competition. In markets with "network effects", users want to buy products which are compatible with those bought by others because the value of a product is an increasing

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8.   For an overview of the literature on firm dynamics, see Caves (1998), Foster *et al.* (1998), Bartelsman and Doms (2000), Haltiwanger (2000), and Ahn (2001). For selected empirical studies, see Table 1.2.

9 .   Section IV.6 considers various aspects of interactions between product and factor markets based on empirical evidence.

10 .   See Schumpeter (1934), Nelson (1981), Aghion and Howitt (1992) and Cabellero and Hammour (1994, 1996), amongst others.

function of the size of the network of compatible products (Katz and Shapiro, 1994). Network effects are indeed pervasive, and can take different forms:

- *Direct network effects*: Direct network effects are found in communications networks (e.g., telephone, fax, mobile phone, etc.). As an extreme case, a fax machine would be of no use if one's counterparts do not have a compatible fax machine.

- *Indirect network effects*: A different type of network effects (namely, "indirect network effects") can be found in a system of hardware/software. A larger base of hardware owners implies a larger market for compatible software products. If software production has scale effects, consumers belonging to a larger network of a hardware/software system will be able to buy software at a lower price and they will also have more variety in choosing software products. In general, indirect network effects exist in any situation where the availability of complementary goods increases as the number of users of the good increases. Systems competition based on such indirect network effects is observed in various areas: computer hardware and software; credit-card networks; durable equipment and repair services, and the typewriter keyboard.

When more than one network are competing with one another, buyers want to get more benefits from network effects by joining a larger or winning network. Therefore, a larger network has advantage in competing with smaller ones and hence can grow even faster. In other words, network effects create "positive feedback effects" or "snowball effects".

16.   Both history and expectations matter in systems competition (Besen and Farrell, 1994). As buyers want compatibility with the existing standard system/network, better products that arrive later may be unable to displace the existing one with lower quality but with a broader base. Buyers' purchase decisions are also strongly influenced by expectations of the future network size. Systems that are expected to be popular will be more popular for that reason. As perceptions and expectations can play a crucial role, strategies and tactics are important in systems competition.

17.   In systems competition characterised by strong network effects and positive feedback effects, the coexistence of incompatible products tends to be unstable and the winning standard can easily dominate the whole market. For example, the VHS videocassette system and the Beta-max system coexisted only temporarily. In other words, such markets are "tippy" (Besen and Farrell, 1994) and the winners take all. Furthermore, once one system becomes the standard, it is very difficult to change the standard. Therefore, small differences (either in reality or in perception) can give disproportionately large gains to the winning system. That is why systems competition tends to be extremely fierce.

18.   New features of dynamic competition *for the market* (or, competition between different systems to become the standard in a new market based on new technology) raise new challenges to policymakers. Policymakers should aim at insuring dynamic efficiency, not just static efficiency in the present (Bresnahan, 1998). Arguably, an industry with little sign of competition in the static sense might hide vigorous competition in the dynamic sense (Evans and Schmalensee, 2001; Nevo, 2001). In systems competition which is sensitive to history and expectations, some theories say that market outcomes could be less than optimal. In this situation, the government might feel tempted to pick the "right" standard for maximising the social welfare in the long run. However, in addition to technological uncertainties which make it extremely difficult to choose a "correct" standard at the early stage of product life cycle, past experiences show that the government may have a significant informational disadvantage relative to private parties when emerging technologies are involved (Katz and Shapiro, 1994). Moreover, empirical evidence does not provide decisive support for theoretical models of the market failure due to network externalities (Liebowitz and Margolis, 1994).

III. Empirical Methods

III.1 *Major empirical issues*

19.   In the large literature on empirical links between competition and dynamic efficiency, two important empirical issues deserve special attention from policymakers. The one is on the relations between market structure and technological progress. The other is on evaluating effects of regulatory reform.

III.1.1 *Schumpeterian hypothesis on competition and innovation*

20.   In the Schumpeterian tradition, many empirical studies focused on the relationship between firm size and innovation. Some arguments for a positive effect of firm size on innovation are as follows (Cohen and Levin, 1989; Symeonidis, 1996):

- The returns from R&D are higher where the innovator has a large volume of sales over which to spread the fixed costs of innovation (*economies of scale* in R&D).

- Large diversified firms can benefit from positive spillovers between the various research programs (*economies of scope* in R&D).

- Large firms can undertake many projects at one time and hence diversify the risks of R&D.

- Large firms with market power have an advantage in securing finance for risky R&D, because size and market power can increase the availability and stability of external and internal funds.

But, one can also find counter-arguments in the spirit of Schumpeter (1942), namely, the bureaucratisation of inventive activity (Cohen and Levin, 1989):

- As firms grow large, efficiency in R&D is undermined through loss of managerial control.

- As firms grow large, the incentives of individual scientists and entrepreneurs become attenuated as their ability to capture the benefits from their efforts diminishes.

21.   In many empirical studies, Schumpeter's claim that large firms in concentrated markets have advantage in innovation was interpreted as a proposition that innovative activity increases more than proportionately than firm size (Cohen, 1995). Alternatively, some other studies examined the relationship between market concentration and innovative activities measured by innovative inputs (R&D expenditures, R&D employment, etc.) or by innovative outputs (patent counts, etc.). However, it was also pointed out that Schumpeter had never claimed a continuous relationship between R&D and firm size. What Schumpeter focused on is said to be the qualitative differences between small, entrepreneurial enterprises and large, modern corporations in their innovative activities. More recent studies extend the focus beyond firm size or industry concentration to: *i*) firm characteristics such as cash flow and diversification; and *ii*) industry characteristics including demand conditions, technological opportunity, and appropriability conditions.

III.1.2   Effects of regulatory reform

22.   Economic regulation (e.g., regulation of pricing, entry and exit) would deprive consumers of the benefits from price competition. Market distorting regulations would also create allocative inefficiencies by making prices deviate from marginal costs. Even though regulation could benefit protected firms by insulating them from competition, it would also restrict their operations and thus create dynamic inefficiencies as indicated by low productivity growth, slow technological innovation, and the poor quality of management (Winston, 1993). In fact, the United States and many other OECD countries have made considerable progress in regulatory reform in some sectors during the last two decades, and the available evidence suggests that progress in regulatory reform has been beneficial for efficiency and consumer welfare (Winston, 1998; Gonenc *et al.*, 2001).[11]

23.   Winston (1998) observes that progress in regulatory reform is sometimes stalled or even reversed when it fails to produce sufficient immediate benefits. However, it should be emphasised that it usually takes a long time for the affected producers and consumers to adjust to the new competitive environment and to fully experience gains from the regulatory reform.[12] Moreover, benefits of regulatory reform are not evenly distributed among producers and consumers (Joskow and Rose, 1989). Therefore, it is difficult but very important to examine how the long-run benefits of regulatory reform are achieved and distributed. And yet, due to various difficulties coming from analytical tractability and data availability, empirical studies usually focus on particular comparative static effects of regulatory reform such as price, profit, and wage changes. Arguably, sum of such static gains would represent only a lower bound of gains from regulatory reform, since firms will continue to innovate in ways they would not have under regulation (Winston, 1993). The existing evidence on the effects of regulatory reform on innovation includes anecdotes, case studies, and an increasing number of econometric studies (Joskow and Rose, 1989).

III.2   Indicators of market power

24.   Empirical studies typically use some measures of market concentration or profit margin as indicators of market power. Similarly, import penetration rate is sometimes used as a proxy for degree of foreign competition. These measures are relatively easy to calculate and hence most widely used, even though admittedly they are not accurate measures of competition (Schmalensee, 1989; Nickell, 1996):

   – *Concentration*: Concentration ratio is often calculated as combined output share or employment share of the largest *n* firms in a market. Major weakness of this measure is the fact that it does not reflect competitive pressures coming from "potential" entrants in a contestable market (see below). It is also pointed out that the market boundaries (geographic or product boundaries) in official data are sometimes inappropriate for identifying a market where competition actually occurs.

   – *Price-cost margin or mark-up*: Some measures of profitability are often used as a measure of market power. In theory, the price-cost margin (PCM) is defined as price less marginal cost divided by price (the Lerner index). This Lerner index reflects the degree of monopolistic mark-up pricing above marginal costs. In practice, as marginal cost is not readily observable, the PCM is often calculated as value of sales less payroll and material costs divided by value of sales. In this calculation, average variable cost is used as a proxy for marginal cost. This

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11 .   Table 2, Table 3, and Table 4 summarise major empirical findings from selected studies.

12 .   For more observations on this point, see below (especially, paragraph 69, paragraph 74, and footnote 28).

way of calculating the PCM as a profitability measure is sometimes criticised in that it omits capital costs.[13]

– *Import penetration*: The ratio of imports to domestic production is often used as a measure of foreign competition. In measuring the degree of product market competition in a highly integrated international market, it might be necessary to consider concentration in world markets rather than to focus on domestic markets.

25.   In a market where individual suppliers are infinitesimally small compared with the market size, suppliers would have no power to set price above marginal cost. In other words, concentration ratio and price-cost margin will be zero in the ideal case of "perfect competition". On the other hand, in a monopolistic or oligopolistic market, one or a few dominant players would use their market power and earn extra profits by setting the price above marginal cost. Therefore, one could say that concentration ratio or mark-up ratio is closely correlated with the degree of market power.

26.   And yet, it should be emphasised that they are still inaccurate measures of the degree of competition. This inaccuracy is related with the fact that those measures do not capture dynamic aspects of competition such as roles of future entrants or implications of selection effects. First of all, as mentioned above, competitive pressures from potential entrants are not reflected in any concentration measures. Import penetration ratio has the same problem as a measure of foreign competition. Secondly, strong competition will weed out the less productive firms and thereby increase the market share of the more productive ones. In this case, a higher degree of market concentration or a higher share of industry profits would reflect higher – rather than lower – product market competition (Aghion *et al*., 2001). Likewise, low concentration does not necessarily mean high degree of competition because less efficient firms can maintain substantial market share in a protected market while only most efficient firms can survive under fierce competition (Hay and Liu, 1997). As another case, import penetration could be low in some market segments even without any import barriers if domestic producers are much more efficient than foreign ones (Boone, 2000).

27.   In the tradition of the "structure-conduct-performance" paradigm of Bain (1956) in the field of industrial organisation (IO), relations between market structure and market outcomes were examined following a one-directional causation, i.e., from structure (*e.g.*, market concentration) to conduct (*e.g.*, collusive behaviour), and from conduct to performance (*e.g.*, markups or profitability). Empirical studies in this tradition typically aim at estimating the reduced-form relationship between market structure and performance using the cross-section variations across industries, implicitly assuming that market structure and performance could be captured by a small number of observable measures (such as those described above). However, economic marginal cost cannot be directly observed from accounting data. Moreover, it remains unclear whether to interpret high accounting profits as a sign of good or of bad performance of a market. It is often regarded as a sign of market power, but it could also be a result of high efficiency of firms (Bresnahan, 1989).

28.   As an alternative approach (namely, "New Empirical IO"), some recent studies tried to make the inference of market power by estimating structural econometric models of the demand and supply relations based on time series data from single industries or from a few closely related markets (Bresnahan, 1989).

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13 .   As an alternative approach, Hall (1986, 1988) econometrically estimated mark-up ratio which is defined as price divided by marginal cost (P/MC). Roeger (1995) offered another alternative method of estimating a markup of prices over marginal cost by modifying Hall's original method. Oliveria Martins *et al*. (1996) extended Roeger's method and applied it to industry-level data in 14 OECD countries. Among empirical studies reviewed in this paper, Levinsohn (1993), Harrison (1994), Klette (1999) and Bottasso and Sembenelli (2001) are also based on some extension of Hall's approach. See below.

Empirical findings from this new approach are still limited to some highly concentrated industries such as electricity (Wolfram, 1999), automobile (Berry *et al*., 1995; Petrin, 2001), and ready-to-eat cereal industry (Nevo, 2001). As a major problem of this approach, it is pointed out that the estimated parameters could be rather sensitive to model specifications (Boone, 2000).

29.   The ready-to-eat cereal industry in the United States – which is characterised by high concentration, high price-cost margins (PCM), large advertising expenditures and aggressive introductions of new products – was often regarded as a typical example of a concentrated industry with suppressed price competition and intense non-price competition. Nevo (2001) estimated the price-cost margins in this industry without observing actual costs by modelling brand level demand as a function of product characteristics and heterogeneous consumer preferences and by considering different models of supply conduct. Using detailed quarterly sales data (1989-92) for 25 different brands in a national random sample of supermarkets with scanning devices located in 65 different cities, he concluded that prices in the industry are consistent with non-collusive pricing behaviour despite the high price-cost margins. In other words, according to him, high price-cost margins in the industry are not due to lack of price competition, but due to consumers' willingness to pay for their favourite brand and firms' pricing decisions taking into account substitution between their own brands.

30.   Using about 25 000 observations on the equilibrium pool prices and quantities of wholesale electricity transactions in the UK electricity spot market after privatisation (half-hourly data over the period 1992-94), Wolfram (1999) estimated price-cost margins in both direct and indirect ways. Relatively straightforward and well understood production technologies in the electricity industry and availability of detailed information on plant efficiency in the pre-privatisation period allowed her to directly estimate short-run marginal costs based on the fuel price and the plant-level efficiency in converting fuel into electricity. She also tried two alternative approaches to measuring mark-ups that do not rely on information about marginal costs: *i*) estimating mark-ups based on changes in the generators' pricing behaviour induced by the price cap; and *ii*) estimating the elasticity-adjusted mark-up using comparative statics in demand. All estimates in her study consistently indicated that the size of mark-ups was rather moderate.

31.   Specific predictions of game-theoretic oligopoly models are often very sensitive to model assumptions on market behaviour, and hence, it is problematic to presume that such restrictive assumptions would hold across a broad set of different industries. While opposing the "structure-conduct-performance" approach to empirical analyses focused on cross-industry variation, Sutton (1991, 1998) emphasises the importance of investigating regularities across general run of industries. His "bounds approach" admits that a wide class of models may be plausible a priori and examines weaker predictions that can be supported by any candidate model but that are robust across a broad set of different industries. In particular, he points out that, under very general conditions, there exists a lower bound to the equilibrium level of concentration in the industry. The level of this lower bound depends on the responsiveness of demand faced by an individual firm to increases its endogenous sunk costs such as advertising or R&D outlays (Sutton, 1991).

III.3   *Measures of innovative activities*

32.   In empirical studies exploring links between market structure and innovation, measuring innovation is no less difficult than quantifying the degree of competition. Reflecting the difficulties, various proxy variables are found in the empirical literature. While R&D data represent inputs into innovative activities, outputs from innovative activities are reflected in innovation data or in patent data (Cohen and Levin, 1989).

33.   Ideally, one could expect most direct information on innovative outputs from *innovation data*. For example, by counting innovations identified by experts, one can have a direct measure of innovative

outputs of a certain sector. In practice, however, innovation counts data are rare partly because it is very difficult and costly to identify "significant" innovations and to make such innovation counts comparable across different industrial sectors and across different firm-size groups. In case of the Science Policy Research Unit (SPRU) innovations database in the United Kingdom, which identified 4378 major innovations defined as "the successful commercial introduction of new or improved products, processes, and materials" introduced during 1945-83, about 400 experts were involved in identifying major innovations.

34.   More frequently used measures for innovative activities come from *patent data*. Patent data have various nice features to offer an ideal output indicator of inventive activity. Patents are related to inventiveness by definition, and based on a relatively objective and stable standard which focuses on the novelty and potential utility (Griliches, 1990). Moreover, patent statistics can be rather easily obtained since national patent offices have compiled the patent information for a long period of time as a part of their function. However, it should be noted that not all innovations are patented. Certain kinds of innovations such as computer software and integrated circuit designs cannot be patented. Even with innovations that can be patented, the propensity to patent can vary across industries and across firms. Depending on the technological and competitive conditions, inventors in certain industries could prefer secrecy to patenting. Small firms tend to be more active in pursuing patents, because acquiring patents could help prove their technological competence and facilitate external financing (Cohen and Levin, 1989; Griliches, 1990). It is also important to notice that patents have very much dispersed and skewed distribution in their technological significance or economic value. Because of this enormous heterogeneity, simple patent counts may be a poor measure of innovative outputs. In recent studies, the "quality" or "value" of a patent is estimated in various ways using patent citation data, patent renewal data, or inferring from stock market responses to patenting.[14]

35.   Another major source of information on innovative activities is *R&D data*. In empirical studies, innovative inputs are most commonly measured by expenditures on R&D or by personnel engaged in R&D. Evidence based on firm and industry level data suggests a positive and strong relationship between R&D and productivity growth. However, it should be underlined that R&D data are also susceptible to considerable measurement errors. The definitions for financial reporting give firms substantial latitude in classifying their R&D activities (Cohen and Levin, 1989). Such 'soft' definition of R&D could weaken the comparability of available R&D figures across firms, size classes, industries, countries, and over time (Griliches, 1995). R&D data usually capture only formal R&D activities that are explicitly classified under R&D expenditures or R&D employment, and hence, miss a considerable amount of informal or part-time innovative activities by small firms (Kleiknecht, 1987). In addition to those measurement issues, Sutton (1996) suggests that R&D-intensity of an industry is an inadequate proxy for the technological factors relevant to the determinants of market structure.

IV.   Empirical Findings

IV.1   *Market power and innovation*

36.   In earlier empirical studies on the relation between market structure and innovation, many researchers focused on firm size as a main explanatory variable for innovation. A broad consensus reached

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14.   See Pakes and Simpson (1989), Trajtenberg (1990), Harhoff *et al.*(1998), and Hall *et al.* (2000), amongst others.

in recent literature surveys of the statistical evidence does not support the Schumpeterian hypothesis that large corporations are particularly more active in innovation.[15]

37.   From the sample of about 1500 listed manufacturing companies in the United Sates which reported positive R&D in 1976, Bound *et al*. (1984) found high R&D intensity (the ratio of R&D to size) both in very small firms and very large firms. Similarly, Pavitt *et al*. (1987) found from the Science Policy Research Unit (SPRU) innovations database in the United Kingdom that both very small firms and very large firms accounted for a disproportionately large share of innovations. Moreover, R&D productivity (innovations per unit of R&D) was found to decline with size in many studies. For example, Bound *et al*. (1984) observed that small firms received a larger number of patents per R&D spending and that R&D productivity tended to decline as the size of R&D increases up to a certain level.[16]

38.   One of the most important questions for policymakers regarding the Schumpeterian hypothesis is whether short-run allocative efficiency losses from lack of price competition could be justified for a higher rate of innovation under a more concentrated market structure (Symeonidis, 1996). Reflecting the importance of this question, there exists a large empirical literature on the relation between market concentration and innovation. The claim that industrial concentration is conducive to innovation is not supported by recent empirical findings.

39.   Findings from earlier empirical studies on the sign of linear relationship between market concentration and R&D were mixed, with the majority pointing to a positive relationship. Some studies tried running a simple regression of R&D intensity against market concentration and its quadratic term and found an "inverted U" relation, i.e., a positive relationship between concentration and R&D to a certain level of concentration but a negative relationship beyond that. However, more recent studies found that the relation between industry concentration and R&D intensity disappears when inter-industry differences are controlled for (Scott, 1984; Levin *et al*., 1985; Geroski, 1990).

40.   Concerning the mixed empirical results on the relationship between market concentration and R&D intensity, Sutton (1996) attributed it to two reasons: *i*) R&D intensity is not an adequate proxy for the technological factors that affect market structure. *ii*) The link between R&D intensity and concentration involves a 'bounds' constraint, which can be hardly captured by regression approach. Considering a joint restriction on the R&D intensity, the degree of fragmentation of the industry's products, and the level of concentration, Sutton (1998) underlined that bound relations between concentration and product homogeneity would differ in low R&D-intensity industries and in high R&D-intensity industries. Inter-industry differences appear to deserve a special attention. Acs and Audretsch (1987) analysed innovation counts data from the US Small Business Administration and found an interesting pattern in the relation between size and innovation. According to their study, large firms tend to have the relative innovative advantage in capital-intensive, concentrated industries and small firms tend to have the relative innovative advantage in highly-innovative, skill-intensive industries. In a parallel study, Acs and Audretsch (1988) found that the industry innovation tended to decrease unequivocally as the level of concentration rises.

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15 .   See Cohen and Levin (1989), Scherer (1992), Cohen (1995) and Symeonidis (1996). For a comprehensive survey of earlier literature, see Kamien and Schwartz (1975, 1982).

16.   Griliches (1990) offered two plausible explanations for this pattern of diminishing returns to R&D size observed in the cross-sectional level. First, it might be due to sample selection bias. For example, Bound *et al*. (1984) used the sample of companies listed in stock markets. While almost all of relevant large firms are listed, only very "successful" subgroup of the smaller firms can be listed. Therefore, the sample might over-represent "successful" firms among the smaller firms, and hence, make R&D productivity of the smaller firms overestimated. Second, it could be a result of the differential role of formal R&D and patents for small and large firms. As mentioned above, innovative efforts of small firms may be systematically underestimated in formal R&D data, or, the propensity to patent may be higher for smaller firms.

41.   While firm size or market structure was often regarded as exogenous in earlier studies, market structure as well as firm size is influenced by innovation, which is again affected by demand, technology and appropriability conditions. An empirical study by Geroski and Pomroy (1990), for example, suggests that the major innovations introduced in the United Kingdom during 1970s were basically lowering levels of market concentration. More recently, Gans *et al.* (2000) investigated the determinants of the commercialisation path of 118 small research-oriented firms funded either by venture capital or by the US federal government through the Small Business Innovation Research (SBIR) Program in the 1990s. Their findings suggest that the competitive consequences of start-up innovation are endogenous. Especially, start-up innovators who have control over intellectual property or are associated with venture capital financing tended to show higher probability of choosing co-operation with established firms (through licensing, strategic alliance, or outright acquisition of the potential entrant by the incumbents) over product market competition with the incumbents. All in all, empirical evidence does not support the view that market concentration is an independent and significant determinant of innovative behaviour and performance (Cohen and Levin, 1989).

IV.2   Competition and productivity

IV.2.1   Product market competition

42.   Results of comparative case studies of selected industries in the United States, Japan and Europe by Baily (1993) and by Baily and Gersbach (1995) suggest that competition (especially global competition with best-practice producers) enhances productivity. Comanor and Scherer (1995) contrasted long-run success of the US petroleum-refining industry with poor performance in the US steel industry, and attributed the diverging results to use and non-use of anti-trust enforcement on Standard Oil and US Steel Corporation in the 1910s.

43.   Comparative case studies in single industries over a long period of time could be problematic because productivity will be affected by changes in other factors unrelated to competitive environment (e.g., technological conditions). To avoid this problem, Zitzewitz (2001) focused on the tobacco industries in the US and the UK during 1879-1939. Tobacco industries in the US and the UK had similar access to manufacturing technology but different and changing industry structures and the changes in market structure (the formation of UK monopoly and the break-up of US monopoly) were exogenous with respect to productivity. His study again showed that productivity growth tended to slow down under lack of competition.

44.   Using micro-level panel data in the United Kingdom, Nickell (1996) and Disney *et al.* (2000) experimented with several indicators of competition in productivity regressions and concluded that competition has positive effects on productivity growth.[17] Nickell (1996) found from a sample of 676 UK firms over the period 1975-86 that competition (measured by increased numbers of competitors or by lower levels of rents) was associated with higher productivity growth rates. From a more recent and much larger data set of around 143 000 UK establishments over the period 1980-1992, Disney *et al.* (2000) found that market competition significantly raised productivity levels as well as productivity growth rates.

45.   As an alternative to using proxy variables for market power such as market concentration or price-cost margin, Klette (1999) extended Hall's approach of estimating market power in order to account for scale economies and the quasi-fixity of capital. With this method, he estimated mark-up ratios and scale

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17.   The competition indicators used in these studies include manager-based assessments, profit measures, market concentration, firms' market shares and import penetration.

elasticities simultaneously for 14 industry groups in Norwegian manufacturing using plant level panel data for the period 1980-90. His findings suggest that there is greater within-industry variation in market power than between-industry variation and that plants (firms) with higher market power tend to be less productive.

IV.2.2   Competition for corporate control and productivity effects of ownership changes

46.   Product market competition appears to be a major disciplining factor on firm performance, but not the only one. According to Nickell *et al.* (1997) based on 854 UK manufacturing companies during 1985-94, the impact of competition on productivity turns out to be weakened when firms are under financial pressure or when they have a dominant external shareholder. In their interpretation of the finding, competitive pressures from a capital market or a market for corporate control could substitute the disciplining effect of product market competition. Januszewski *et al.* (2001) applied the approach of Nickell *et al.* (1997) to an unbalanced panel of 491 German manufacturing firms over the period 1986-94 and found a significantly negative effect of rents (indicating lack of product market competition) on productivity growth. In contrast to the substitutability suggested by Nickell *et al.* (1997), Januszewski *et al.* (2001) find that the disciplining effect of product market competition tends to be strengthened by tight corporate control structures. In a comparable empirical study for a transition economy with 153 Polish firms during 1994-98, Grosfeld and Tressel (2001) found similar complementarity between product market competition and corporate governance in addition to a positive and significant effect of product market competition on productivity.

47.   Persistent differences in managerial ability have been considered as a plausible explanation for widely observed persistent differentials in productivity among plants/firms even in the same sector. If this is the case, ownership changes could increase productivity by creating better matches between management and firms and also by reducing X-inefficiency within firms (Lichtenberg and Siegel, 1992; McGuckin and Nguyen, 1995). Using an unbalanced panel of some 28 000 plants in the US food manufacturing industry (SIC 20), McGuckin and Nguyen (1995) showed that: *i*) ownership change is generally associated with the transfer of plants with above average productivity; *ii*) large plants are more likely to be purchased rather than closed when they are performing poorly; and *iii*) transferred plants tend to experience improvement in productivity performance following the ownership change. Using data on 25 airlines for 1970-84 and 10 start-up airlines for 1982-84 in the United States, Lichtenberg and Kim (1989) found that mergers lowered the average annual rate of unit cost growth by 1.1% on average. According to their results, part of the cost reduction was attributed to merger-related declines in the prices of inputs, particularly labour, but about 2/3 of it was due to increased total factor productivity. One source of the productivity improvement was an increase in capacity utilisation (i.e. load factor).

48.   However, one should be careful in interpreting observed positive association between ownership change and productivity, since the firms that underwent ownership change are not a random sample from the population (Bartelsman and Dom, 2000). According to a recent study by Himmelberg *et al.* (1999), for example, controlling for observed firm characteristics and firm fixed effects makes it difficult to conclude that changes in managerial ownership significantly affect performance.

IV.2.3   Regulatory reform and privatisation

49.   The experience of regulatory reform and privatisation for the past several decades has provided researchers with good opportunities for estimating productivity gains from enhanced competition. Based on cost function regressions using an unbalanced panel of 293 observations from 24 airlines over the period 1971-86, Baltagi *et al.* (1995) concluded that, despite the slowdown of productivity growth in the

1980s, deregulation did appear to have stimulated technical change due to more efficient route structures. Decomposing total productivity of AT&T (1977-87) and British Telecom (1984-87), Kwoka (1993) concluded that competition for AT&T and privatisation for BT accounted for 17% and 25% of their respective productivity growth over the studied period. Gort and Sung (1999) compared the performance (in terms of both productivity and cost) of AT&T Long Lines, operating in an increasingly competitive markets, with that of eight local telephone monopolies. Over the 1985-91 period, TFP growth rate of AT&T Long Lines was substantially higher than that of the regional companies.[18]

50.   For better understanding the effects of regulatory reform which is very likely to involve changes in firm dynamics (i.e., entry and exit, growth and decline of firms), one needs to delve into micro data. Olley and Pakes (1996) analysed the productivity dynamics in the telecommunications equipment industry in the United States using the unbalanced panel data for 1974-87 from the Longitudinal Research Database (LRD). They found that aggregate productivity increased sharply after each of the two periods in which the industry underwent changes that decreased regulation. Furthermore, the productivity growth that followed regulatory change appeared to result from a reallocation of capital from less productive plants to more productive ones rather than from an increase in average productivity. Their findings also suggested that competitive selection process via entry and exit facilitated this reallocation.[19]

51.   International comparisons in various ways also point to productivity-enhancing effects of regulatory reform. Caves et al. (1981) observed substantial differences in productivity growth of the railroad industry between the United States and Canada (0.6% vs. 1.7% during 1956-63, and 0.1% vs. 4.0% during 1963-74) and they attributed the differences to the regulatory environment in the United States (Joskow and Rose, 1989). Ehrlich et al. (1994) estimated a cost function and TFP growth for 23 international airlines with varying levels of state-ownership. Their point estimates of the ownership effects suggest that a shift from complete state ownership to full private ownership would increase the long-run annual rate of TFP growth by 1.6-2.0% and the rate of unit cost would decline by 1.7-1.9%. Marín (1998) included 10 European flag carriers in addition to 9 US companies and estimated a stochastic production frontier to measure technical efficiency. According to his results, the introduction of liberalisation in the form of bilateral agreement with the US has brought about a short run reduction in efficiency that is expected to be followed by long run efficiency improvements. Possible reasons for this short run efficiency loss include: *i*) Firms may decide to use more productive inputs which require some time before being efficiently utilised; and *ii*) Re-organisation of their output cannot be immediately followed by adjustments in their input requirement.

IV.2.4   Global competition

52.   As indirect evidence of the influences of competition on firms' productivity, Oulton (1998) points out that manufacturing sectors have significantly lower dispersion of labour productivity than the rest of the economy. A possible explanation is that manufacturing sectors are more exposed to international competition than service sectors. Evidence of a positive association between international competition and

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18.   It is a challenging policy issue how to introduce more competition into local telephone service markets without threatening social goals such as universal service objectives. Maher (1999), for example, addresses this issue empirically.

19.   Evidence supporting the importance of firm dynamics and selection effects in aggregate productivity is found in other countries as well. In the United Kingdom, compositional changes due to firm dynamics (i.e., expansion and shrink, entry and exit of firms) accounted for 50% of labour productivity growth and 90% of total factor productivity growth in the total manufacturing sector over 1980-1992 (Disney et al., 2000). In the Netherlands, one third of aggregate labour productivity growth over the period 1980-1991 was explained by the net entry effect alone (Bartelsman et al., 1995).

productivity growth is reported in a large number of empirical studies. MacDonald (1994) analysed the US Bureau of Labour Statistics (BLS) data on labour productivity growth in manufacturing industries during 1972-87 and observed that increase in the import penetration ratio had a large and highly significant effect on the next three-year period's productivity growth in highly concentrated industries. Using the annual census data which cover all plants in the greater Istanbul area of Turkey from 1983 to 1986, Levinsohn (1993) demonstrated that the imports-as-market-discipline hypothesis was supported by the data spanning the course of a broad and dramatic import liberalisation of 1984. Bottasso and Sembenelli (2001) also found a jump in productivity growth rates of Italian firms in industries where non-tariff barriers were perceived to be high, after the announcement of the EU Single Market Programme which proposed 282 specific measures to reduce non-tariff trade barriers in the EU.

53.   Increasing volume of the evidence suggests that global competition can contribute to aggregate productivity growth by enforcing natural selection in the global market. Roberts and Tybout (1997) develop a model of exporting with sunk costs of entry. In the presence of such entry costs, only the relatively productive firms will choose to pay the costs and enter the foreign market.[20] The implied relationship between exporting and productivity is positive in a cross-section of firms or industries, but the causality runs from productivity to exporting. In other words, exporting firms show higher productivity mainly because only firms with higher productivity can enter the export market and survive there. Using plant level data from the Longitudinal Research Database (LRD) in the United States, Bernard and Jensen (1999) examine whether exporting has played any role in increasing productivity growth in US manufacturing. They find little evidence that exporting per se is associated with faster productivity growth rates at individual plants. The positive correlation between exporting and productivity levels appears to come from the fact that high productivity plants are more likely to enter foreign markets, as is suggested by Roberts and Tybout (1997). While exporting does not appear to improve productivity growth rates at the plant level, it is strongly correlated with increases in plant size. Trade fosters the growth of high productivity plants, though not by increasing productivity growth at those plants.[21] According to the results of a parallel study for Germany by Bernard and Wagner (1997), sunk costs for export entry appear to be higher in Germany than in the United States, but lower than in developing countries. It is also found that plant success (as measured by size and productivity) increases the likelihood of exporting.

IV.3   Competition, product innovation, and welfare gains

54.   Gains in consumers' welfare must be an integral component in considering dynamic efficiency gains from competition, but measuring consumers' welfare gains from competition is apparently even more difficult than measuring productivity-enhancing effects of competition. In addition to the well-known difficulties in quantifying changes in product quality and effects of continuing product differentiation, quantifying the benefits of new products due to product innovation is a challenging task for empirical researchers.

55.   Based on the idea of "virtual" price of Hicks (1940), Hausman (1997a, 1997b) offered a simple way of estimating welfare gains of introducing new products and applied it to valuing new products in the ready-to-eat cereal industry and telecommunications industry. The fact that a new good had not existed in

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20.   Based on the idea of fixed costs in entering the export market, Jean (2000) offers a model of trade under monopolistic competition with free entry and exit of heterogeneous firms. According to the model, trade-induced increase in competitive pressure can be not only import-driven but also export-driven: *i.e.* the entry of new producers attracted by the profit opportunities from exporting can intensify competition in the domestic market.

21.   Very similar results were found in Clerides *et al.* (1998), which used plant-level data from Colombia, Mexico, and Morocco.

the market until its introduction can be interpreted as a result of its "virtual" price's having been prohibitively high. Such "virtual" or "reservation" price is estimated as the price level which makes the estimated expenditure function (demand curve) for the new product to be zero (the virtual price of the new product is usually much higher than the actual price). Then, the consumer surplus coming from the introduction of the new product can be calculated as ½ times 'the difference between the actual price and the virtual price' times 'the quantity consumed', which is the area of a triangle below the (linearised) demand curve and above the actual price level.

56.   According to the estimation by Hausman (1997*b*), consumers' welfare gains due to the introduction of new telecommunication services in the United States were very large. In case of voice messaging services by local telephone services, which was introduced in 1990, the gain was estimated to be US$ 1.27 billion in 1994. Similarly, the estimated gain from the introduction of cellular phone services was about US$ 50 billion a year. Then, the cost of regulatory delays in the introduction of the new services can be estimated by valuing the economic gains that consumers would have had if the service had been available during the regulatory delay. He estimated that the cost of regulatory delay in case of the cellular phone service to be US$ 100 billion in total. Even though several specific assumptions for his simple method of estimation were questioned (Bresnahan, 1997; Pakes, 1997), his findings of the huge amount of costs due to regulatory delays in telecommunications industry were accepted as convincing (Pakes, 1997).

57.   While the simple method by Hausman (1997*a*, 1997*b*) avoided complicating issues such as effects of the introduction of new product on related other products and implications of consumers' heterogeneity, Berry *et al*. (1995) showed that it is important to consider consumer heterogeneity in estimating cross-price elasticities of the demand system. In quantifying the benefits of introducing new product (minivan) into the automobile market in the United States, Petrin (2001) aimed to address these issues by augmenting market-level data with data that relates the average characteristics of consumers to the characteristics of the products they purchase. Total welfare gains from the minivan introduction during the first five years (1984-88) were estimated to be US$ 2.9 billion, of which US$ 2.8 billion was from consumer benefits and US$ 0.1 billion from producers' profits. Interestingly, according to his results, almost half of the consumer benefits accrued to new vehicle buyers that were not minivan purchasers, because they purchased other vehicles with lower prices due to increased competition. On the producer side, Chrysler obtained large benefits (US$ 1.5 billion profits by end-1987) from the minivan introduction, but at the expense of the rest of the industry. His empirical results suggest that competition between firms in a differentiated goods market could generate consumer benefits that outweigh benefits accruing to the innovator. In a similar way, Goolsbee and Petrin (2000) estimated the demand system for cable TV services and direct broadcast satellite (DBS) services. Their results suggest that direct welfare gains to satellite buyers from the introduction of the direct broadcast satellite (DBS) in 1994 were equivalent to US$ 50 a year per buyer on average and US$ 450 million per year in aggregate.

IV.4   *Competition and growth*[22]

58.   If competition has positive effects in productivity growth at firm- or industry-level, as already noted, one can also expect evidence of positive links between competition and aggregate economic growth. Largely due to difficulties of measurement, however, the issue of product market competition/regulation and growth has only rarely been investigated in cross-country growth regressions. Koedijk and Kremers (1996) calculated an indicator of product market regulation (based on six dimensions such as business establishment, competition policy, public ownership, industry-specific support, shop-opening hours and the implementation of the EU Single Market Programme) and found a negative association between regulation and growth in 11 European countries. Dutz and Hayri (1999) related an index of pro-competitive policy

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22.   This part is largely drawn from Ahn and Hemmings (2000).

environment (resulting from a survey of managers of multinationals) to growth in a cross-section of countries. They found a positive effect of their indicator on the growth rate of GDP per capita.

59. Some measure of trade openness is often included as an explanatory variable in cross-country growth regressions and, arguably, such openness measure can be interpreted as an indicator of openness to global competition. While many empirical studies based on cross-country regressions (*e.g.* Balassa, 1985; Barro, 1991; and Dollar, 1992) report a positive link between openness and growth, caution is required when interpreting those results.[23] Furthermore, not all studies find a significant statistical link between trade and growth. For example, the widely-cited Levine and Renelt (1992) analysis fails to find any of a large number of trade and trade policy indicators to be robustly correlated with growth, most notably when the estimated equation includes the investment share. These results are interpreted as indicating that the relationship between trade and growth may be based on enhanced resource accumulation (*e.g.* Baldwin and Seghezza, 1996*a*, 1996*b*).

60. Despite concerns about the results of early studies, more recent studies tend to show that the basic conclusion of a positive link between trade and growth is correct. In cross-country regressions, Harrison (1996) finds a trade liberalisation index, an indicator of black market premiums and a price distortion index all statistically significant out of a total of seven measures of openness. However, tests imply causality between openness and growth runs in both directions, suggesting that the independent effect of trade on growth may be rather less that that implied in straightforward regressions. Frankel and Romer (1999) address the endogeneity problem by focusing on the component of trade that is due to geographic factors. Some countries trade more just because of a proximity to well-populated countries, and some trade less because they are isolated. Geographic factors are not a consequence of income or government policy, and there is no likely channel through which they affect income other than through their impact on international trade and within-country trade. Thus, countries' geographic characteristics can be used to obtain instrumental variables estimates of trade's impact on income. Their empirical findings imply that trade has a quantitatively large and robust, though only moderately statistically significant, positive effect on income.[24]

61. More detailed evidence on the links between competition, innovation, and growth is found in a series of recent OECD studies on economic growth. Scarpetta *et al*. (2000) analysed growth performance in the OECD countries over the last two decades and found, among others, a generally positive correlation between R&D intensity and labour productivity growth at the industry level in almost all OECD countries. Bassanini *et al*. (2001) included R&D intensity in their "pooled mean-group (PMG)" estimation of growth equations for OECD countries and found a significant effect of business performed R&D on the growth process.[25] Guellec and van Pottelsberghe de la Potterie (2001) investigated the long-term relations between

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23. Harrison (1996) suggests that there are three reasons for being sceptical of earlier results in the context of the link between trade and growth. *i*) *Indicator problems*: "openness" measures based on actual trade volume are not necessarily related to policy and they are largely endogenous. For example, as Edwards (1998) also emphasises, a country can distort trade heavily and still have a high ratio of trade to GDP. *ii*) *Endogeneity problems*: it is sometimes difficult to interpret the observed correlation between trade and growth. Policies that are not directly concerned with trade (good macroeconomic policies or education policies, for example) may have caused both superior export performance and high GDP growth. It is not easy to draw causality from simple correlation of the two variables. *iii*) *Unobserved country-specific factors*: the use of cross-section data makes it impossible to control for unobserved country-specific differences. Moreover, long-run averages or initial values for trade policy variables ignore important changes (reducing tariff, for example) which have occurred over time for the same country.

24. Frankel and Romer (1996) interpret their results as indicating a rise of one percentage point in the ratio of trade to GDP increases per capita income by at least one-half percent.

25 . Bassanini *et al*. (2001) could not directly test the impact of product market regulations on growth using the dynamic-panel approach, because available indicators of product market regulation (Nicoletti *et al*., 2000)

R&D and productivity growth based on panel data from 16 OECD countries over the period 1980-98. According to their regression results, the positive impact of business R&D on multifactor productivity (MFP) growth has been increasing over time since 1980s. Regarding the links between regulations and R&D, Bassanini and Ernst (2001) found an unambiguous negative correlation between R&D intensity and indicators of domestic economic regulations and non-tariff barriers to trade.

IV.5   *Competition in specific sectors*

IV.5.1   *E-commerce and competition*

62.   Competition is known to be fierce in innovative sectors where "winner-takes-all" scenarios prevail. In many cases, competition in such sectors could be better understood in terms of dynamic competition, i.e., competition *for the market* rather than competition *within the market* (Evans and Schmalensee, 2001). Against this backdrop, exponential expansion of e-commerce transactions is widely expected to promote competition and to enhance welfare by reducing transaction and search costs (Coppel, 2000). While some of recent empirical studies pointed out the existence of wide price dispersion in the Internet retailing (e.g., Brynjolfsson and Smith, 1999), on-line buyers were found to be very sensitive to local retail price variation caused by local sales tax rates (Goolsbee, 2000).

63.   Linking purchase requests data from a major online car referral service company during 1999 with transactions data from a sample of 1 101 dealerships in California from January 1999 to February 2000, Scott Morton *et al.* (2000) investigated the effect of Internet car referral services on dealer pricing. They found that consumers who submitted a purchase request to the online car referral service paid on average US$ 450 less for an equivalent car than offline purchasers did. About 15% of the gains were attributed to the fact that they purchased from low-price dealerships affiliated with the web service. Conditional on the dealer, online customers still appeared to pay about US$ 380 less on average. They also found that dealer margins (price less invoice cost) on the sale of a vehicle through the online car referral service were significantly lower than margins from an equivalent offline sale. In addition, selling more cars through the online car referral service appeared to reduce price dispersion at the dealership level. All in all, their findings suggest that consumers' can gain substantially in this market from using Internet and that e-commerce has changed the product market behaviour of dealerships.

64.   Brown and Goolsbee (2000) examined the term life insurance market in the United States during 1992-97 and detected the competition-enhancing effect of Internet price comparison sites. On one hand, they obtained data on purchases of individual life insurance contracts that included insurance policy characteristics, prices, and individual characteristics of the insured such as age, state of residence, occupation, and income. On the other hand, from a nationally representative survey of almost 100 000 people, they created a measure of the probability of Internet use for each individual in each year by computing for each age-state-year, age-occupation-year, occupation-state-year and age-income-year the share of Internet users in that group. The results of their hedonic price regressions for the term life insurance indicated that a 10% increase in the share of Internet-using individuals in a group had reduced average insurance prices for the group by as much as 5%. However, the growth of Internet use did not appear to reduce the price of the whole life insurance which was not covered by the Internet insurance comparison sites. The growth of Internet use before 1996 (i.e., before the appearance of the Internet

did not provide adequate time-series variation. Nonetheless, from bivariate correlations between some oecd indicators of regulation and multifactor productivity (MFP) growth rate estimates, they found supporting evidence that the negative impact of stringent regulations on the efficiency of product markets also results in a negative influence in overall economic growth.

insurance comparison sites) did not reduce insurance prices, either. According to their calculation based on the regression results, the growth of the Internet has reduced term life insurance prices by 8-15% and increased consumer surplus by at least US$ 115-215 million per year. Using a new micro data set on individual computer purchases, Goolsbee (2001) also estimates that, conditional on buying a computer, the elasticity of buying "remotely" (i.e., buying either "direct from the manufacturer" or "online") with respect to local retail store prices is larger than one in the United States. His findings again suggest that competition between online and offline retailing is substantial.

IV.5.2   Market power in the electricity industry

65.   Price regulation combined with de facto franchise exclusivity in industries such as electricity, natural gas distribution, telephone service, and water and sewer service used to be justified on natural monopoly grounds (Joskow and Rose, 1989). Over the past decade, however, some OECD countries started to introduce competition into the generating sector of the electricity industry. Using a new panel data set constructed from International Energy Agency (IEA) and other sources for 19 OECD countries over the period 1986-96, Steiner (2001) examined the effects of the regulatory reform on efficiency and prices in this industry. The panel regression results suggest that:

  −   The unbundling of generation and transmission, expansion of Third Party Access (PTA), and creation of spot markets of electricity reduced both industrial end-user electricity prices and the ratio industrial to residential prices.

  −   Private ownership contributed to improving capacity utilisation in the electricity generation. However, a high degree of private ownership and imminence of both privatisation and liberalisation tended to increase industrial end-user prices.

  −   The unbundling of generation and transmission brought reserve margins (the ability of capacity to handle peak load) closer to their optimal level.

66.   Competition-enhancing effects of the regulatory reform in the generating sector of the electricity industry were expected from two major channels. First, the generating companies will compete on price and the resulting fierce competition will provide incentives for least-cost production. Second, new small- and medium-scale generating companies will enter the market with new technology and compete with existing large-scale generators. However, some empirical evidence suggests that substantial market power could exist after the regulatory reform. Green and Newbery (1992), for example, showed that privatised major generating companies under de facto duopoly at the early stage of the regulatory reform in the UK could exercise considerable market power without collusion by offering a supply schedule that is far above marginal operating cost. Simulation results of the California electricity market after deregulation by Borenstein and Bushnell (1999) also pointed out that, without significant divestiture of assets by incumbent producers, the restructured California electricity generation market could have a few large producers with significant market power.

67.   Wolfram (1998) analysed actual bidding behaviour in the daily electricity auction in the wholesale spot market in England and Wales over the period 1992-94. Her findings suggest that the generating companies strategically increase their bids to raise the price they are paid for infra-marginal capacity. For example, the larger supplier tended to submit bids reflecting larger mark-ups than its smaller competitor. And also, the suppliers tended to submit bids reflecting a larger mark-up for plants that are more likely to be used after a number of other plants with lower marginal costs are already operating. In a parallel study, however, Wolfram (1999) also found that the size of mark-up was not as large as predicted by conventional oligopoly models. A plausible explanation she suggested is that the incumbent generators

may be restraining prices either for deterring entry or for staving off substantial regulatory action. In a similar approach to the California wholesale electricity market over the period from June 1998 to September 1999, Borenstein *et al.* (2000) found significant departures from competitive pricing especially during the highest demand periods in summer.

68.   In fact, prices in the wholesale electricity market in California increased by 500% between the second half 1999 and the second half of 2000 due to a mixture of various reasons, while retail prices were fixed until early in 2001. As a result, California's two largest utilities effectively became insolvent in January 2001 and unregulated suppliers of wholesale electricity began to stop selling electricity to them. In just six months, what had been a modestly successful electricity reform programme had completely collapsed (Joskow, 2001). The unprecedented surge of wholesale prices for electricity in California during summer 2000 was attributed to various factors. They include: *i*) rising natural gas prices, *ii*) the rapid growth in electricity demand along with the slow pace of completion of new power plants, *iii*) reduced availability of power imports from other states, and *iv*) rising prices for NOx emissions credits. Even after controlling for those factors affecting "market fundamentals", Joskow and Kahn (2001) still found a large unexplained difference between actual prices and competitive benchmark prices during summer 2000. Based on analyses of competitive benchmark price and of capacity withholding, they concluded that the difference is attributable to supplier market power and related market imperfections.

69.   In this context, Joskow (2001) emphasised that the problems in California are not inherent problems with "deregulation". In his view, the problems resulted from the way that California implemented its reforms and also from ineffective government responses to extreme contingencies. For instance, he pointed to the fact that the process of designing the details of California's wholesale and retail market institutions was extremely contentious as different interest groups supported different reform models. The ultimate design of the wholesale market institutions represented a series of compromises drawing on bits and pieces of alternative models for market design, congestion management, transmission pricing, new generator interconnection rules, etc. The fact that consumers were completely insulated by regulation from wholesale market prices was another major problem. More importantly, in his view, California focused too much on illusive short run gains from low-priced power that was available when there was excess capacity and focused too little on creating sound institutional arrangements to support investments in new generation and transmission facilities. He underlined that the primary benefits of electricity sector reform would occur in the long run as a consequence of continuing innovations on both the supply and demand sides.

IV.5.3   Competition in education and health care

70.   Recently, a number of issues surrounding proposed or on-going reforms to enhance competition in education and health care sectors have drawn keen attention (*e.g.*, private school vouchers and managed-care health plans in the United States). Notably, education and health care sectors used to be regarded as quite different from typical markets in various aspects.[26] First, those sectors are characterised by the strong presence of non-profit suppliers. If those suppliers are not pursuing profit-maximisation like ordinary firms, arguably, consideration of market power should be also modified. Second, price competition is nearly absent in markets for education or health care, under the conventional institutional setting including public funding, medical insurance, tax incentives, and price regulation. Third, both education and health care sectors are characterised by the combination of differentiated products and heterogeneous preferences. All in all, the markets for education and health care appear to be considerably distant from the ideal type of

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26.   See, amongst others, Hoxby (2001) for education. For health care, see Gaynor and Hass-Wilson (1999), Gaynor and Vogt (1999), and Gaynor *et al.* (2000).

perfect competition. Not surprisingly, therefore, it is particularly difficult to evaluate costs and benefits of enhancing competition in these sectors and to reach a consensus on how to reform these sectors.

IV.5.3.1 Education

71.   To examine whether competition between schools improves the quality of education, Hoxby (1994) attempted to estimate a reduced-form education production function for public schooling outcome which has the private school enrolment share in the area as an explanatory variable. As public schools and private schools are substitutes, however, private school enrolment is likely to be endogenous to public school quality, leading to downward-biased estimates of the competitive effects of larger private schools enrolment. To control for this problem, she applied instrumental variables estimation approach to a constructed data set – which is mainly drawn from the National Longitudinal Survey of Youth (NLSY) – covering around 12 700 individuals' schooling outcomes, individuals' characteristics, and county-level area characteristics of schools in the United States around 1980. The results suggest that private school competition improves public school students' outcomes. If that is the case, one can expect that private school vouchers will not only enlarge students' room for choice but also improve public school quality by increasing competitive pressure on an inefficient public system. In fact, recent experiences of vouchers in Milwaukee and of charter schools in Michigan and in Arizona seem to support the view that regular public schools boost their productivity when exposed to competition (Hoxby, 2001).

72.   On the other hand, it is worried by many that peer quality of public schools might decline due to vouchers as private schools discriminate on ability and "skim the cream" off the public system. Epple and Romano (1998) developed a general equilibrium model with tax-financed, tuition-free public schools and competitive, tuition-financed private schools. When peer effects affect schooling outcomes, profit-maximising private schools have an incentive to attract more able students by offering lower tuition or fellowships. They conclude that tuition vouchers increase the relative size of the private sector and the extent of students sorting, and benefit high-ability students relative to low-ability students.[27] In a follow-up study to test the model predictions, Epple *et al*. (2000) analysed a sample of around 16 600 students in the National Education Longitudinal Survey (NELS) and found empirical results consistent with the theoretical model. Their findings include that: *i*) The propensity to attend private school increases with both income and ability, and, among private schools, the propensity to attend the highest-tuition school rises with both income and ability. *ii*) Within private schools, tuition declines with student ability, with a substantial fraction of even high-income households paying little or no tuition. *iii*) The correlation between income and ability is smaller in private schools than in public schools. *iv*) Both income and ability become stronger predictors of private school attendance as public school expenditure falls. *v*) Income becomes increasingly important in determining placement in the private school hierarchy as public school expenditure falls. In their interpretation, empirical findings support the view that competition-induced pricing by private schools aiming at attracting more able students will result in the stratification of students by income and ability across sectors and within the private sector. In fact, the institutional arrangements for the provision of schooling in public and private sectors vary substantially across countries. However, results from an empirical study by Toma (1996) which analysed a data set covering five countries (Belgium, France, New Zealand, Canada, and the United States) suggest that private-public school performance differences are widely observed regardless of the different degrees of public funding of private schools.

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27.   Even though this paper is basically focused on efficiency aspects of competition policy, there is no denying the importance of equity aspects especially in education and health care. For a deeper analysis of equity problems in the context of subsidising post-compulsory education, see Blöndal *et al*. (2001).

73.   Competition in education can also be considered in the context of competition among public schools. Hoxby (2000) focused on the facts that households make residential choices among local school districts and that such residential choices determine the quality of and expenditures on local public goods including public education (namely, "Tiebout choice"). In other words, public schools are also under some degree of competitive pressure in the sense that public-school districts effectively compete with one another to attract households. But, the degree of such competition varies substantially from area to area. The room for competition due to Tiebout choice can be very large, say, in Boston with 70 school districts within a 30-minute commute of the downtown area, while there is little room for such competition in Miami, for example, with one school district covering virtually the whole metropolitan area. Empirical findings from her study based on several sources of data in the United States, matched at the school-district or metropolitan-area level, suggest that public schools in metropolitan areas with greater Tiebout choice tend to show higher measures of achievement – ranging from test scores to wages – and lower per-pupil spending. Moreover, Tiebout choice appears to have larger productivity effects in states where school districts have greater financial independence, and households are less likely to choose private schools where they have more Tiebout choice.

74.   It is therefore important to take mobility and migration into consideration in designing school-finance policies. Using general-equilibrium simulations, Nechyba (2000) explored the role of residential mobility in shaping the impact of different private-school voucher policies. He underlined that statewide voucher programmes might cause significant changes in residential location patterns by severing the strong link between place of residence and school quality. For example, under a private-school vouchers system, private schools might grow in low-income districts in part to serve middle- to high-income immigrants who move to take advantage of lower house prices. He compared simulation results from three voucher programmes: *i*) a general voucher applicable to any child in private school; *ii*) a voucher targeted only to low-income households; and *iii*) a voucher targeted to poor districts. While school-district targeted vouchers show similar impact as non-targeted vouchers did, personally targeted vouchers turn out to be relatively ineffective. In his interpretation, it is mainly because income targeting isolates public schools in high- and middle-income districts from competitive pressures they would face under district-targeting or non-targeting vouchers. Due to long-lasting and pervasive effects of Tiebout choice, it could take a decade or even more for the supply response to a choice-based reform to be fully realised through entry/expansion of successful schools and shrink/exit of unsuccessful schools (Hoxby, 2000).[28]

IV.5.3.2 Health care

75.   The view that competition has a weak or perverse effect in health-care markets used to be shared by many, and this view is largely based on the presumption that patients and physicians are poorly informed and insensitive to prices. In the literature of health economics, competition on quality or facilities among hospitals to attract patients or to attract doctors who bring patient with them is often referred to as the "medical arms race (MAR)". According to the MAR hypothesis, hospitals compete by providing high-tech medical services excessively. Using 1983 data from the California Office of Statewide Health Planning that identifies providers of 171 specialised hospital services, for example, Dranove *et al*. (1992) found that increased competition did lead to a small increase in the supply of specialised services. In

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28.   Some other researchers have arrived at the same conclusion that it could take a long time for the effects of regulatory reforms to be fully realised. According to Winston (1998), for example, "it is not surprising that deregulated (or partially deregulated) industries are slow to achieve maximum efficiency" partly because "it takes a long time to tear down decades-old barriers to efficiency and to adopt more efficient production and marketing practices". In the view of Card (1998), "despite the passage of nearly two decades since the lifting of airline regulation, the full impact of deregulation is still unclear" and "it may take another 20 years to reach a compete assessment of the labour market effects of deregulation".

addition, it is pointed out that fully insured patients would have little incentive to consider price in choosing among hospitals. The emergence of highly price-responsive managed care plans in the United States can be understood as an institutional innovation in response to this problem, while much of concern over managed care seems to be due to a perceived emphasis on price at the expense of quality (Gaynor and Vogt, 1999). Nonetheless, the growth of managed care in the United States is accepted as an important factor which led to increased price competition in health care markets (Gaynor and Hass-Wilson, 1999).[29]

76.   Dranove *et al*. (1993) focused on the shift of purchasing power from patients toward well-informed and price-sensitive insurers and employers due to institutional changes in the United States around 1980s, and hypothesised that the shift from "patient-driven" to "payer-driven" competition would make hospital markets closer to ordinary markets. This hypothesis was supported by their empirical study on the links between hospital markups and concentration of near 600 private hospitals in California observed in 1983 and 1988. Using data on state medical spending between 1980 and 1993 from the Health Care Financing Administration in the United States, Cutler and Sheiner (1997) found that increased managed care enrolment significantly reduced hospital cost growth. An important issue here is whether the containment of medical costs by managed care was achieved at the cost of considerable deterioration of the quality of medical services. In answering this question, one should take into account the fact that managed care plans generally enrols healthier people than traditional health plans (Newhouse, 1996). Cutler *et al*. (1998) addressed this issue by limiting the sample to newly diagnosed patients or by applying an instrumental-variables approach. Their empirical results form two sources of data – the complete claims record of a large firm in Massachusetts offering both managed care plans and traditional plans (July 1993 through December 1995), and the complete set of inpatient claims for people admitted to hospitals in Massachusetts (fiscal years 1994 and 1995) – suggest that managed plans have 30-40% lower expenditures with little difference in actual treatments or in health outcomes.

77.   Reviewing a vast empirical literature on the consequences of competition in hospital services markets in the United States, Kessler and McClellan (2000) noted an interesting pattern. *i*) Research based on data from prior to the mid-1980s finds that competition among hospitals leads to increases in excess capacity, costs, and prices. *ii*) Research based on more recent data generally finds that competition among hospitals leads to reductions in excess capacity, costs, and prices. In their view, however, virtually no previous studies identified the effects of competition on both health care costs and patient outcomes. Especially, few studies have examined the consequences of managed care growth for health outcomes. Analysing a comprehensive longitudinal data set of non-rural elderly Medicare beneficiaries hospitalised for treatment of heart disease in 1985, 1988, 1991, and 1994, Kessler and McClellan (2000) concluded that competition led both to substantially lower costs and significantly lower rates of adverse outcomes in the 1990s. In contrast, in the 1980s, competition appeared to have led to better patient outcomes but with increased expenditures. Moreover, in states with high managed care enrolment, the welfare effects of competition were observed to be unambiguously positive throughout the sample period and uniformly larger in magnitude relative to estimates for states with low enrolment. In a follow-up study on the effects of hospital ownership on medical productivity, Kessler and McClellan (2001) found that areas with a presence of for-profit hospitals have approximately 2.4% lower levels hospital expenditures with virtually the same patient health outcomes.

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29.   In many OECD countries, the focus of health-care reform has shifted from controlling spending through budgetary caps towards enhancing micro-efficiency through a better market structure and contract relations between payers (insurers) and providers of health care. Oxley and MacFarlan (1995) provide a comprehensive overview of recent health-care reforms in OECD countries. For further discussions on country-specific issues, see Koen (2000; United Kingdom), Imai *et al*. (2000; France), Orosz and Burns (2000; Hungary), Girouard and Imai (2000; Poland), and Jeong and Hurst (2001; Japan), among others.

78.   Competition in health care markets interacts with competition in related markets such as pharmaceutical market. After the passage of the "Drug Price Competition and Patent Term Restoration Act" of 1984 in the United States, which was intended to reduce expenditures on prescription drugs by encouraging generic entry, Grabowski and Vernon (1992) observed a dramatic increase in the number of generic drugs in the market. Empirical findings from Hellerstein (1998) based on the 1989 National Ambulatory Medical Care Survey (NAMCS) suggest that the emphasis on cost containment in managed-care plans could make physicians more likely to prescribe low-cost generic drugs instead of equivalent brand-name drugs regardless of a patient's insurance plan. In Germany, reference pricing – a cost containment scheme that imposes a maximum reimbursable price to a patient for a given product – was introduced in 1989. Pavcnik (2001) analysed detailed product level data on oral antidiabetics and antiulcerants in Western Germany from 1986 to 1996 and found that producers significantly reduced prices as the implementation of reference pricing exposed patients to prices. Brand-name products reduced their reduced their prices on average by 21-26% more than generics, and the price drop was larger for brands facing more generic competition. She suggested that a carefully designed insurance reimbursement scheme for outpatient pharmaceuticals might be a better alternative to direct price regulation.

IV.6   *Interactions between product markets and factor markets*

79.   In addition to interactions within related product markets, the importance of interactions between product markets and production factor markets (*e.g.*, labour markets or capital markets) is being recognised in envisaging better competition policies.[30] To improve long run employment performance of an economy, for example, reducing regulatory burdens hindering job-creation in labour markets needs to be complemented with reducing entry barriers in product markets. Empirical findings also suggest that imperfections in financial markets are closely related with lack of competition and innovation in product markets. In particular, well-functioning financial markets appear to be crucial for enhancing competition and innovation through the entry and growth of new small entrepreneurial firms.[31]

IV.6.1   *Interactions with labour markets*

80.   Monopoly rents generated by market power in the product market can by captured by the employees in the form of higher wages, especially when the labour market is also non-competitive.[32] In union bargaining models, for example, increases in product market power enable workers to bargain over wages, workload, and/or job security (i.e., employment). As a good example of the links between the product market and the labour market, positive correlation between profits and wages has been reported in numerous empirical studies with different approaches to different data.

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30.   For recent OECD studies on product and labour market interactions, see Nicoletti *et al*. (2001), Bassanini and Ernst (2001), Jean and Nicoletti (2001), and Nicoletti and Scarpetta (2001). For the growth-enhancing effects of human capital accumulation and of work organisations, see Bassanini and Scarpetta (2001) and Arnal *et al*. (2001), among others.

31.   Comprehensive review of the literature on interactions between product and financial markets is, however, beyond the scope of this paper. For cross-country studies on venture capital activities and on entrepreneurial activities (by small firms and the self-employed) in OECD countries, see Baygan and Freudenberg (2000) and Audretsch and Thurik (2001). For theoretical and empirical links between financial market development and economic growth, see Tsuru (2000) and Leahy *et al*. (2001), amongst others.

32.   For a recent overview on theoretical issues and empirical findings related to this "rent-sharing" or "ability-to-pay" hypothesis, see Nickell *et al*. (1994), Blanchflower *et al*. (1996), Peoples (1998), or Nickell (1999), amongst others.

81.   While larger quasi-rents would allow more room for wage bargaining on one hand as predicted in "wage-sharing" hypotheses, on the other hand, increases in negotiated wages would affect a negative effect on profits. Abowd and Lemieux (1993) controlled for such simultaneity problem by using foreign competition (proxied by industry-level prices of imports and exports) as a natural experiment to identify the effects of changes in product market conditions on wages. Their empirical results based on data from collective agreements in Canada from 1965 to 1983 suggest that Canadian unions capture on average 20% of total quasi-rents. Pointing out that earlier empirical findings of the apparent profit-wage correlation mostly failed to control for industry fixed effects, workers' characteristics, and for unionism, Blanchflower *et al.* (1996) tried a new test for rent-sharing in the US labour market. Using the individual wage data from the 1964-1986 March files of the Current Population Survey (CPS) and the two-digit industry profit data from the NBER Productivity Database, they found a steady-state relationship between remuneration and profit-per-employee in US manufacturing. Their results show that changes in workers' remuneration follow earlier movements in profitability even in the absence of unions.[33]

82.   Based on regression analyses applied to an unbalanced panel data on 814 UK manufacturing firms over the period 1972-86, Nickell *et al.* (1994) found that: *i*) Product market power (measured by concentration ratio or market share) had a positive effect on wages, even though the magnitude was quite small. *ii*) This positive effect of market power on wages was enhanced in large firms but was not influenced by union status. *iii*) The negative effect of external unemployment on wages appeared to be much smaller for non-competitive firms than for competitive firms.[34] Noting that bargaining takes place not only over pay but also over working conditions in the majority of union plants in the United Kingdom, Nickell and Nicolitsas (1997) analysed data on 66 UK companies containing information on pay increases and reductions in restrictive practices (*e.g.*, rules on manning levels, etc.). The results suggest that falls in product market power or worsening financial conditions of companies lead to both lower pay rises and a high probability of reducing restrictive practices. In their conclusion, increases in the level of product market competition would lead both to lowered inflationary pressure in labour market and to improvements in company productivity via increased labour flexibility.

83.   Comparing the labour market performance in terms of employment growth in the United States with that in European countries, Krueger and Pischke (1997) observed that the slow growth in employment in many European countries appeared too uniform across skill group to result from relative wage inflexibility alone. This observation lead them to suspect that rigidities may arise from areas outside the labour market, such as regulatory burdens on start-up companies, capital market imperfections, product market regulations, restrictive zoning rules, etc. In their conjecture, the impact of product market constraints on the demand for labour contributes to slow growth of employment in many countries. Gersbach (2000) considered three potential effects of product market reforms on job-creation: lowering markups; improving productivity; and encouraging product innovation. His rough estimates drawn from industry studies by McKinsey Global Institute suggest that product market reforms could reduce unemployment in France and Germany by approximately 20%. Bertrand and Kramarz (2001) focused on the French zoning regulation on the creation and extension of retail stores which was introduced at the end of 1973. Using data on the entire universe of applications for store creations and extensions considered by every *département* (1975-1988), they find that increases in the approval rate in a *département* increase retail employment in that *département*, even after controlling for heterogeneity in retail business

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33 .   Similarly, Hildreth and Oswald (1997) found from the longitudinal data on UK companies that long-run movements in pay were found to be correlated with earlier movements in measures of profitability. They underlined that their findings were not driven by temporary wage effects or by the unionised workplaces in the data.

34.   They defined non-competitive firms as those that were described by a senior manager as either dominating their market or having five or fewer competitors.

opportunities over years and regions. Their empirical results indicate that retail employment could have been more than 10% higher now if entry regulation had not been introduced.

84. Major findings from a set of recent OECD studies on the cross-market effects of product and labour market polices are summarised as follows (Nicoletti *et al.*, 2001). *i*) Anti-competitive product market regulations were found to have significant negative effects on non-agricultural employment rates of OECD countries. *ii*) The estimated wage premia in manufacturing industries were found to increase with weaker product market competition and with product market regulations that curb competitive pressures or establish entry barriers. *iii*) The results suggest that strict employment protection policies are likely to negatively affect R&D intensity, particularly in high-tech industries of countries with relatively decentralised industrial relations systems. *iv*) Little empirical support was found for the hypothesis that product market regulations have a long-run effect on inequality in the labour market.

IV.6.2 *Interactions with capital markets*

85. Interactions between product and capital markets belong to relatively new research areas. Industrial economists had not considered the effects of capital structure on product market behaviour and financial economists had largely ignored the role of product market rivalry in assessing the choice of capital structure until the mid-1980s (Kovenock and Phillips, 1995). Even after recent increase in theoretical interests in this area, empirical studies examining links between capital markets and product markets still remain relatively scarce (Chevalier, 1995*a*).

86. Using a model of product market competition in which firms are pricing for market share under liquidity constraints due to capital market imperfections, Chevalier and Scharfstein (1996) offer an explanation for counter-cyclical markups. During recessions when firms have low cash flow and greater difficulty raising external funds, their model predicts that capital market imperfections induce liquidity-constrained firms to increase markups by increasing prices and forgoing attempts to build market share. Their empirical findings from supermarket industry in the United States are consistent with their model. But, their empirical results do not support competing models of counter-cyclical collusion which explain counter-cyclical markups based on the conjecture that firms may be more able to collude during recessions than during booms (Rotemberg and Saloner, 1986; Rotemberg and Woodford, 1992).

87. While Chevalier and Scharfstein (1997) combined capital market imperfections with a market share model of product market competition in order to explain counter-cyclical markups, related studies by Chevalier (1995*a*, 1995*b*) are more explicitly focused on the links between capital markets and product markets. Her empirical findings suggest that leveraged buyouts in the US supermarket industry in the late 1980s created incentives to raise prices and that leverage increase led to softer product market competition. Using data for 867 US firms – including 40 firms that increased debt through discrete changes such as leveraged buyouts, management buyouts, and public recapitalisations – in ten selected commodity industries, Kovenock and Phillips (1995) find that firms with low-productivity plants in highly concentrated industries are more likely to increase debt financing. They interpret this finding as suggesting that debt can be a mechanism of reducing excess investment in industries where high concentration reduces the disciplinary effect of product market competition.

88. Examining the broad pattern of financial development in developed countries over the twentieth century, Rajan and Zingales (2000) emphasise that financial development breeds competition. Their theory of the political economy of financial development suggests that the forces opposing financial development is weaker when a country is open to outside forces of competition both in the product market and in the financial market (i.e., international trade and capital flows). Their empirical findings indicate that a

country's level of financial development is directly related to its openness to trade in periods of free international capital movement.

89.   It must be a daunting task to view domestic and foreign competition in a comprehensive perspective of multilateral interactions between product, labour, and capital markets. Bertrand (1999) shows a possibility to this direction. Using individual-level labour data from the Current Population Survey (CPS) and the Panel Study of Income Dynamics (PSID) extracts matched with a panel of industry-level coporate variables from the COMPUSTAT database, she found the following results. *i*) As import competition increases, the sensitivity of wages to the current unemployment rate increases, while the sensitivity of wages to the unemployment rate prevailing upon hire decreases. *ii*) These changes are more pronounced among more financially constrained industries than among less constrained ones. In her interpretation inspired by Chevalier and Scharfstein (1997), the findings suggest that financially constrained companies are less willing to invest in building long-term relationships with their workers when import penetration is high because they cannot reap the future benefits of a good reputation once they go bankrupt. As an important policy implication, she underscores that differences in product and financial markets could play an important role in determining the wage setting process in labour markets.

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Figure 1. R&D and determinants of static/dynamic efficiency
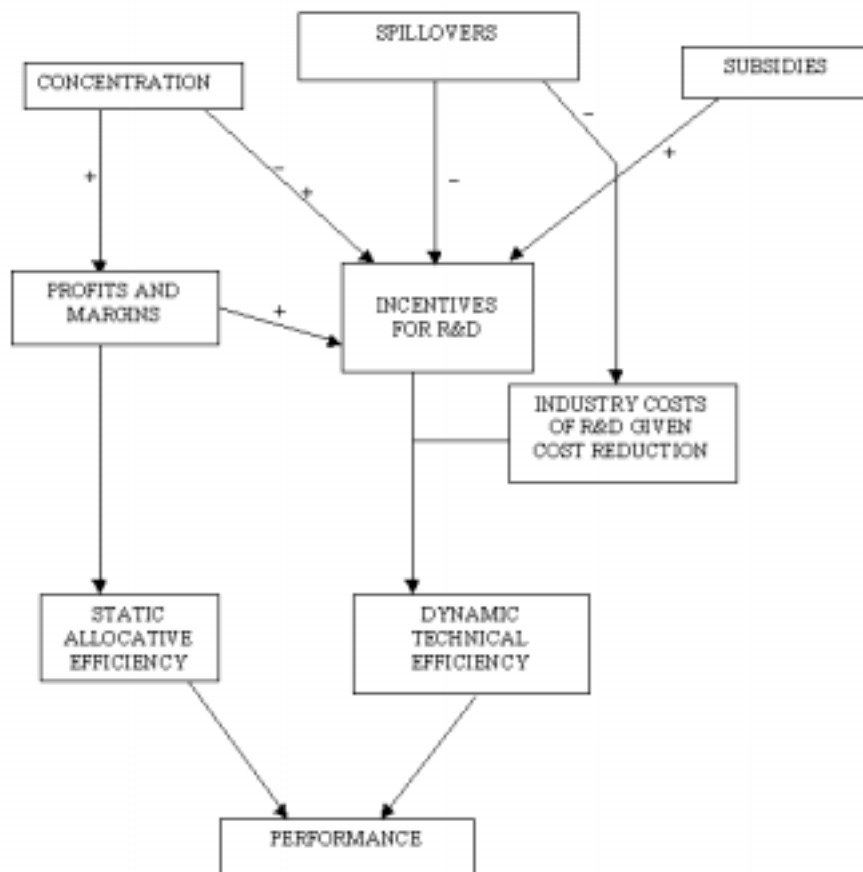
Source: Spence (1984)

Table 1.1 Competition and innovation: selected studies

Author	Topic	Country	Sample Period	Sample Coverage	Main Data Sources	Main Methods	Major Findings
Acs and Audretsch (1987)	Innovation and market structure	US	1982	2 608 large-firm (with at least 500 employees) innovations and 1 923 small-firm (with fewer than 500 employees innovations)	The US Small Business Administration	Regression analysis (independent variable: the difference in large- and small-firm innovative rates)	- The large firms tend to have the relative innovative advantage in industries which are capital-intensive, concentrated, highly unionised, and produce a differentiated good. - The small firms tend to have the relative advantage in industries which are highly innovative, utilise a large component of skilled labour, and tend to be composed of a relatively high proportion of large firms.
Acs and Audretsch (1988)	Innovation and firm size	US	1982	8 074 innovations introduced to into the US in 1982	The US Small Business Administration	Regression analysis (cross-sectional regressions for 247 four-digit SIC manufacturing industries	The total number of innovations is negatively related to concentration and unionisation, and positively related to R&D, skilled labour, and the share of large firms in the industry.
Gans, Hsu, and Stern	Start-up innovation and competition	US	1999	A sample of 118 start-up innovators funded by two distinct sources: the US Small Business Innovative Research (SBIR) programme and private venture capital	MIT Sloan School Commercialization Strategies Survey	Binary probit model for the probability of co-operation with the incumbents	Main robust findings are that the probability of co-operation is increasing in the innovator's control over intellectual property rights, association with venture capitalists, and in the relative cost of control of specialised complementary assets.
Geroski (1990)	Innovation and market structure	UK	1970-1979	73 three-digit industries for two 5-year periods (1970-74, 1975-79)	- SPRU innovations database - The Census of Production - Entry and exit data from the Business Statistics Office	Tobit model for the average number of innovations used in industry i.	No support was found in the data for Schumpeterian assertions about the role of monopoly power in stimulating innovation.
Geroski and Pomroy (1990)	Innovation and market structure	UK	1970-1979	73 three-digit industries for two 5-year periods (1970-74, 1975-79)	- SPRU innovations database - The Census of Production - The Office of Fair Trading	Regression analysis (explaining 5-year changes in market concentration)	The empirical results suggest that innovation reduces the level of concentration in markets and that most of the impact of innovation on concentration occurs very quickly.

Table 1.1 Competition and innovation: selected studies (continued)

Author	Topic	Country	Sample Period	Sample Coverage	Main Data Sources	Main Methods	Major Findings
Nevo (2001)	Product innovation and consumer gains	US	1988:q1-1992:q4	Sales data of 25 different brands of ready-to-eat cereal sold in 65 different cities	Information Resources Inc. (IRI) Infoscan Database	Regression analysis (demand function estimation)	High price-cost margins in this industry appear to be due to consumers' willingness to pay for their favourite brand and firms' pricing decisions taking into account substitution between their own brands.
Pavitt, Robson, and Townsend (1987)	Innovation	UK	1945-1983	4 378 significant innovations commercialised in the UK between 1945 and 1983	The Science Policy Research Unit (SPRU) Survey	Tabulation and regression analysis	- Innovations per employee has been consistently above average in very large firms (with more than 10 000 employees) and in small firms (with fewer than 1000). - Intersectoral variation in the size distribution of innovating firms can be explained as a function of technological opportunities and "technological ease of entry".
Petrin (2001)	New products and consumer gains	US	1981-93	- 916 distinct models of vehicles. - About 30 000 households in a rotating panel recording household purchasing behaviour for 5 quarters.	- *Automotive News Market Data Book* for passenger cars. - *Wards Automotive Yearbook* for station wagons, minivans, sport-utility vehicles, and full-size passenger vans. - Consumer Expenditure Survey (CEX)	Discrete choice demand and welfare estimation using GMM method	The results suggest that large improvements in consumers' standard of living arise from competition between firms in a differentiated goods market. These firms ignore the externalities imposed upon one another as they cannibalise each others profits by introducing new and different goods

Table 1.2 Competition, selection, and productivity: selected studies

Author	Topic	Country	Sample Period	Sample Coverage	Main Data Sources	Main Methods	Major Findings
Baily, Bartelsman, and Haltiwanger (1996*a*)	Selection and aggregate productivity growth	US	1977, 1987	All manufacturing industries (140 051 "continuers" plants + "exiters" + "entrants")	Longitudinal Research Database (LRD)	Decomposition of labour productivity growth by quadrants based on productivity-employment changes	Plants that increased employment as well as productivity ("successful upsizers") contributed to overall productivity growth almost as much as plants that increased productivity at the expense of employment ("successful downsizers").
Baily, Bartelsman, and Haltiwanger (1996*b*)	Selection and aggregate productivity growth	US	1972-1988	All manufacturing industries (8 669 plants that were in operation in all years from 1972 to 1988)	Longitudinal Research Database (LRD)	Comparing procyclicality of labour productivity by above four quadrants based on productivity-employment changes	Permanently downsizing plants disproportionately account for procyclical productivity, while plants that are upsizing in the long run exhibit little or no procyclical productivity. Internal increasing returns and labour hoarding appear to play little role in the procyclicality of productivity.
Baily, Hulten, and Campbell (1992)	Selection and aggregate productivity growth	US	-1963, 1967, 1972, 1977, 1982, 1987 (census) -1972-1988 (annual survey)	23 (SIC 4-digit) manufacturing industries (plant-level data with firm-identification)	Longitudinal Research Database (LRD)* * LRD was constructed by pooling information from the Census of Manufactures (CM) and the Annual Survey of Manufactures (ASM)	- Productivity growth decomposition (TFP-based) - Regression analysis (productivity, exit, and plant growth)	- Plant closure is frequent even within successful and growing industries. - Strong persistence in relative productivity of plants. - Growing output share in high-productivity plants is a major factor in the productivity growth of an industry.
Baldwin (1996)	Selection and aggregate productivity growth	Canada	1973-1990	All manufacturing industries (235 industries at the 4-digit level)	Longitudinal data file of plants in the Canadian Census of Manufactures	Decomposition of labour productivity changes	- The productivity growth experienced by the Canadian manufacturing sector in the 1970s was considerably higher than in the 1980s. - The evidence suggests that a restructuring phenomenon has been occurring in the Canadian manufacturing sector, with small less productive plants gaining employment share at the expense of the more productive.
Bartelsman, Leeuwen, and Nieuwenhuijsen (1995)	Selection and aggregate productivity growth	Netherlands	1980, 1991	All firms with more than 10 employees (8 859 firms in 1980, 8 388 firms in 1991, among which 4 261 continuers, 4 598 exiters, and 4 127 entrants)	- 1980 Survey of Production - 1991 Survey of Production	Decomposition of labour productivity and employment changes	- Net firm turnover contributes a third of the 3% annual average growth of labour productivity. This happens because exiting firms are much less productive than the average firm. - Successful upsizers appear to contribute slightly more to the aggregate productivity growth than the successful downsizers.

Table 1.2 Competition, selection and productivity: selected studies (continued)

Author	Topic	Country	Sample Period	Sample Coverage	Main Data Sources	Main Methods	Major Findings
Bernard and Jensen (1999)	Exports	US	1983-1992	All manufacturing industries (unbalanced panel with 50 000 - 60 000 plants each year)	Annual Survey of Manufactures (ASM) from Longitudinal Research Database (LRD)	- Regression analysis (TFP/employment/, shipment growth on export dummy) - TFP growth decomposition by plant type on export status	- The positive correlation between exporting and productivity levels appears to come from the fact that high productivity plants are more likely to enter foreign markets. - Faster growth of exporting plants, coupled with their higher productivity levels, provides a mechanism for exporting to augment aggregate productivity growth.
Bernard and Wagner (1998)	Exports	Germany (Lower Saxony)	1978-1992	All manufacturing industries (unbalanced panel of 7 624 plants with employees ≥ 20)	Annual Survey of Manufacturing Establishments	Regression analysis (probability of entering the export market)	- Sunk costs for export entry appear to be substantial in Germany (higher than in the US, lower than in developing countries). - Plant success (as measured by size and productivity) increases the likelihood of exporting.
Blanchflower and Machin (1996)	Competition, productivity, and wages	Australia and UK	1990	2 061 British workplaces with no less than 25 employees; 2 004 Australian workplaces with no less than 20 employees	- UK: The British 1990 Workplace Industrial Relations Survey (WIRS3) - Australia: The Australian Workplace Industrial Relations Survey (AWIRS)	Regression analysis (ordered probit estimation of relative productivity and productivity growth equations; OLS estimation of wage equations)	The results suggest rather limited support for the competition hypothesis. No significant competition effects on productivity are found in the UK data. In Australia, there is evidence of a positive competition effect but only in manufacturing establishments. Simple data description suggests that establishment faced with more competitors pay lower wages, but other factors (unionisation, worker characteristics, etc.) seem more important as determinants of wages and productivity.
Disney, Haskel and Heden (2000)	Competition and productivity	UK	1980-1992	Around 143 000 establishments (119 000 single establishments; 24 000 units belonging to multi-plant enterprises)	ARD (Annual Census of Production Respondents Database)	- Productivity growth decomposition (labour productivity and TFP) - Regression analysis (conditional probability of exit by Cox proportional hazard method) - Regression analysis (survivor productivity growth by market competition measures: industry concentration, import penetration, market share, and rents)	- 'External' restructuring (exit of less efficient plants, entry and growth of more efficient plants) accounts for 50% of labour productivity growth and 90% of TFP growth over the period. - Survival analysis shows that plants with below average productivity are more likely to exit. - Market competition significantly raises both the level and growth of productivity even after controlling for the potential selection bias.

Table 1.2 Competition, selection and productivity: selected studies (continued)

Author	Topic	Country	Sample Period	Sample Coverage	Main Data Sources	Main Methods	Major Findings
Foster, Haltiwanger, and Krizan (1998)	Selection and aggregate productivity growth	US	1977, 1982, 1987	All manufacturing industries and a selected service industry (automotive repair shops: SIC 753)	- Census of Manufactures (CM) - NBER Productivity Database - Census of Services	- Productivity growth decomposition (multifactor- and labour-productivity) - Regression analysis (productivity on exit/entry dummies, etc.)	- Reallocation of outputs and inputs from less productive to more productive plants makes a significant contribution to aggregate productivity growth. - The contribution of net entry to aggregate productivity growth is increasing in the horizon over which the changes are measured since longer horizon yields greater differentials from selection and learning effects. - The contribution of reallocation to aggregate productivity growth varies over time (*e.g.* is cyclically sensitive) and industries, and is sensitive to subtle differences in measurement and decomposition methodologies.
Gort and Sung (1999)	Competition and productivity	US	1952-1991	Telephone industry (AT&T Long Lines and 8 regional companies	- Statistics of Communications Common Carriers by the Federal Communications Commission (FCC) - Form M reports to FCC	Regression analysis (TFP regressions and cost function regressions. Output index constructed by deflating revenues by price indices for local service, toll service, and a miscellaneous category)	Both the estimation of TFP growth and the analysis of shifts in cost functions show a markedly faster change in efficiency in the effectively competitive market than for the local monopolies.
Griffith (1999)	Exports	UK	1980-1992	Motor vehicle industry (5 314 observations on 1 176 establishments over the period 1980-1992; unbalanced panel of 414 establishments with 3 259 observations used for regression)	Annual Business Inquiry Respondents Database (ARD)	Regression analysis (estimating production functions)	- Using the estimates of TFP from the static specification, German-owned plants in the motor vehicle and engines (SIC351) industry have around 12% and other foreign-owned have around 18% higher TFP than domestic-owned plants. - The estimates of TFP obtained using the dynamic specification indicate that only US-owned plants have higher TFP levels and this difference is fairly small, at around 6%.

Table 1.2 Competition, selection and productivity: selected studies (continued)

Author	Topic	Country	Sample Period	Sample Coverage	Main Data Sources	Main Methods	Major Findings
Griffith (2001)	Competition and productivity	UK	1980-1996		Annual Census of Production Respondents Database (ARD)		- The results suggest that the increase in product market competition brought about by EU Single Market Programme (SMP) increase in overall levels of efficiency and growth rates. - The increase in efficiency occurred in principal-agent type firms, and not in those where managerial control and ownership were more closely related.
Hahn (2000)	Selection and aggregate productivity growth	Korea	1990-1998	All plants with 5 or more employees in mining and manufacturing industries	Unpublished data underlying *Annual Report on Mining and Manufacturing Survey*	Decomposition of TFP growth	Plant entry and exit effects accounted for 45% of aggregate productivity growth during cyclical upturn (1990-1995) and 65% during cyclical downturn (1995-1998).
Klette (1999)	Market power and productivity	Norway	1980-1990	Operating establishments with at least five employees in 14 manufacturing industries	Annual Census by Statistics Norway	Regression analysis (estimating price-cost margins and scale economies)	- Estimated price-cost margins are statistically significant but rather small (5-10%) in most industries. The results show little evidence of scale economies. - Firms with higher market power tend to be less productive.
Levinsohn and Petropoulos (2001)	International competition	US	1972, 1977, 1982, 1987, 1992	23 000+ plants in apparel industry. 5 000+ plants in textiles industry	Longitudinal Research Database (LRD)	- Decomposition of industry productivity growth - Exit (probit) regression	Although the US textile and apparel industries as a whole were declining in the face of intensified import competition, productivity dynamics observed in the plant-level data suggest that surviving plants have emerged all the stronger.
Maliranta (1997)	Selection and aggregate productivity growth	Finland	1975-1994	All manufacturing industries (plants with 5 or more employees classified into 15 sub-industries)	The Finnish Industrial Statistics	Decomposition of labour productivity and TFP growth	- In each year, 2-6% of the labour hours are lost due to the closure of plants, while new plant entry covers 2-5% of total labour hours. - The relative importance of the entry-exit effect in the aggregate productivity growth seems to have increased especially since the early 1980s.

Table 1.2 Competition, selection and productivity: selected studies (continued)

Author	Topic	Country	Sample Period	Sample Coverage	Main Data Sources	Main Methods	Major Findings
Nickell (1996)	Competition and productivity	UK	1972-1986	Around 700 UK manufacturing companies	Published accounts from the EXSTAT company database, augmented by a postal survey of a subset of 147 companies	Regression analysis (production function with various competition measures: market share, a survey-based competition measure, and average rents normalised on value-added at the firm level, concentration measures and import penetration at the 3-digit industry level)	- Market power (measured by market share) appears to reduce *levels of productivity*. - Competition (measured either by increased numbers of competitors or by lower levels of rents) is associated with higher *productivity growth rates*.
Nickell, Nicolitsas and Dryden (1997)	Competition and productivity	UK	1982-1994	582 UK manufacturing firms	Published accounts from the EXSTAT and EXTEL company databases; additional information on the number of competitors and ownership for subsets of companies	Regression analysis (explanatory variables include: average rents normalised on value-added (an inverse measure of competition); interest payments normalised on cash flow; dominant shareholder dummies)	- Product market competition, financial market pressure and shareholder control are associated with increased productivity growth. - There is some evidence to suggest that the last two factors can substitute for competition. The impact of competition on productivity performance is lower when firms are under financial pressure or when they have a dominant external shareholder.
Oulton (1998)	Competition and productivity	UK	1989-1993	About 140 000 companies (of which 87 000 are independent, 53 000 are subsidiaries)	The OneSource database by OneSource Information Services Ltd.	Regression analysis (labour productivity and productivity dispersion)	- Productivity dispersion is very wide in any year, but there are significant differences between sectors. About three quarters of the variance of productivity is due to differences between firms in the same industry. - Amongst surviving companies, the rate at which productivity approaches the mean is higher for companies which were initially below the mean. - Manufacturing sectors have significantly lower dispersion than the rest of the economy. One explanation is that manufacturing sectors are more exposed to international competition than service sectors.

Table 1.3 Competition for corporate control and productivity effects of ownership changes: selected studies

Author	Topic	Country	Sample Period	Sample Coverage	Main Data Sources	Main Methods	Major Findings
Grosfeld and Tressel (2001)	Product market competition and corporate governance	Poland	1991-1998	About 200 non-financial companies listed on the Warsaw Stock Exchange	Based on published, audited accounts of balance sheets and income statements	Regression analysis (production function with competition variables such as rents concentration measures and ownership structure variables; GMM estimation)	- Product market competition has a positive and significant effect on firm-level productivity growth. - Ownership concentration appears to have non-monotonic relation with productivity growth. - Product market competition and good governance tend to reinforce each other.
Januszewski, Köke, and Winter (2001)	Product market competition and corporate governance	Germany	1986-1994	Unbalanced panel of 491 German firms (3465 observations)	- Hoppenstedt's Balance Sheet Database - Annual reports by former Bayerische Hypotheken- und Wechsel-Bank - Biennial reports of the Federal Anti-Trust Commission	Regression analysis (log-linear empirical production function with variables on cycle, product market competition, and corporate governance structure; GMM)	- Firms show higher productivity growth when operating in markets with intense competition. - Productivity growth is higher for firms under control of a strong ultimate owner, but not when the ultimate owner is a financial institution. - The positive effect of product market competition appears to be enhanced by the presence of a strong ultimate power.
Kim, E. H. and Singal (1993)	Corporate governance	US	1985-1988	14 airline mergers that were initiated during the period 1985-1988 (21 351 routes affected)	Ticket Dollar Value Origin and Destination data bank by the Department of Transportation	Regression analysis (relative fare changes)	- Routes affected by mergers show significant increases in airfares relative to the control group. - These price increases are positively correlated with changes in concentration and do not appear to be the result of an improvement in quality. - The fare changes are also positively related to the distance of routes, suggesting that airlines exploit greater market power on longer routes for which substitution by other mode of transportation is less likely. - Mergers may lead to more efficient operations, but on the whole, the impact of efficiency gains on airfare is more than offset by exercise of increased market power.

Table 1.3 Competition for corporate control and productivity effects of ownership changes: selected studies (continued)

Author	Topic	Country	Sample Period	Sample Coverage	Main Data Sources	Main Methods	Major Findings
Lichtenberg and M. Kim (1989)	Corporate governance	US	1970-1984	25 airlines for 1970-1984 and 10 start-up airlines for 1982-1984 (272 out of 420 annual observations on these airlines)	Database developed by Caves, Christensen, Tretheway and Windle (which was based on the Civil Aeronautics Board(CAB)'s Form 41 Report filed annually by each airline company)	Regression analysis (Estimating effects of mergers on selected variables such as unit cost and TFP. Output and some inputs are represented as multilateral indices of a number of components.)	- The average annual rate of unit cost growth of carriers undergoing merger was 1.1% lower, during the 5-year period centred on the merger, than that of carriers not involved in merger. - Part of the cost reduction is attributable to merger-related declines in the prices of inputs, particularly labour, but about 2/3 of it is due to increased total factor productivity. One source of the productivity improvement is an increase in capacity utilisation (load factor).
McGuckin and Nguyen (1995)	Corporate governance	US	1977, 1982	Food manufacturing industry (SIC 20) (unbalanced panel of 28 407 plants)	Longitudinal Research Database (LRD)	Regression analysis (probability of ownership change)	- Ownership change is generally associated with the transfer of plants with above average productivity, but large plants are more likely to be purchased rather than closed, when they are performing poorly. - Transferred plants tend to experience improvement in productivity performance following ownership change.
Nickell, Nicolitsas and Dryden (1997)	Competition and productivity	UK	1982-1994	582 UK manufacturing firms	Published accounts from the EXSTAT and EXTEL company databases; additional information on the number of competitors and ownership for subsets of companies	Regression analysis (explanatory variables include: average rents normalised on value-added (an inverse measure of competition); interest payments normalised on cash flow; dominant shareholder dummies)	- Product market competition, financial market pressure and shareholder control are associated with increased productivity growth. - There is some evidence to suggest that the last two factors can substitute for competition. The impact of competition on productivity performance is lower when firms are under financial pressure or when they have a dominant external shareholder.

Table 1.4 Competition in specific sectors: selected studies

Author	Topic	Country	Sample Period	Sample Coverage	Main Data Sources	Main Methods	Major Findings
Borenstein and Bushnell (1999)	Competition in electricity	US		California electricity market after deregulation		Cournot simulation	Under the pre-deregulation structure of generation ownership, there is potential for significant market power in high demand hours, particularly in the fall and early winter months when hydroelectric output is at its lowest level relative to demand.
Borenstein, Bushnell, and Wolak (2000)	Competition in electricity	US	June 1998 – Sept. 1999	California wholesale electricity market	- California Energy Commission - Natural Gas Intelligence - Energy Information Administration's *Electricity Power Monthly* - National Electricity Reliability Council - Independent System Operator (ISO) settlement data	Comparing actual price with estimated marginal cost	The results suggest that there were significant departures from competitive pricing and that these departures are most pronounced during the highest demand periods, which tend to occur during the months of July through September. The exercise of market power raised the cost of power purchases by about 16% above the competitive level.
Brown and Goolsbee (2000)	Internet use and competition	US	1992-1997	- 10 812 person-year observations of term life insurance contracts - About 100 000 people on their computer use, Internet use, on-line buying behaviour, etc. and their demographic and geographic characterisitcs	- Data on life insurance: LIMRA International (conducting annual surveys of individual life insurance contracts in the US) - Data on Internet use: Forrester's Technographics 1999 Survey	Regression analysis (hedonic price regressions for term life insurance)	The results suggest that a 10% increase in the share of individuals in a group using the Internet reduces insurance prices for the group by as much as 5%.
Cutler and Sheiner (1997)	Competition in health care	US	1980-1993	50 states in the US	The US Health Care Financing Administration	Regression analysis (effects of managed care on total and private spending growth)	Increased managed care enrolment significantly reduces hospital cost growth

Table 1.4 Competition in specific sectors: selected studies (continued)

Author	Topic	Country	Sample Period	Sample Coverage	Main Data Sources	Main Methods	Major Findings
Cutler, McClellan, and Newhouse (1998)	Competition in health care	US	1993-1995	- "Firm data" for 30 months from July 1993 through December 1995. - "State data" in fiscal years 1994 and 1995	- Complete claims record of a large firm in Massachusetts. - Complete set of impatient claims for people admitted to hospitals in Massachusetts.	Regression analysis (effects of insurance on treatments and reimbursement for heart attacks)	The results suggest that managed health insurance plans have 30-40% lower expenditures with little difference in actual treatments or in health outcomes. In other words, it is suggested that managed care may yield substantial productivity improvements relative to traditional health insurance.
Epple, Figlio, and Romano (2000)	Competition in education	US		15 590 students (1 952 of them enrolled in private schools)	National Education Longitudinal Survey (NELS)	Regression analysis (logit model on probability of private school selection; logit model on probability of selecting high tuition private school; multinomial logit model of selection among public, low-tuition private, and top-tuition private schools; etc.)	Their findings include that: i) The propensity to attend private school increases with both income and ability, and, among private schools, the propensity to attend the highest-tuition school rises with both income and ability. ii) Within private schools, tuition declines with student ability, with a substantial fraction of even high-income households paying little or no tuition. iii) The correlation between income and ability is smaller in private schools than in public schools. iv) Both income and ability become stronger predictors of private school attendance as public school expenditure falls. v) Income becomes increasingly important in determining placement in the private school hierarchy as public school expenditure falls.
Goolsbee (2001)	Competition in distribution sectors	US	Dec. 1998	20 000+ people on the computer purchase behaviour	Mail survey by a marketing research company on ownership patterns for computers and other electronic goods	- Hedonic price regressions for the prices paid for a computer in a retail store as a function of the computer characteristics - Logit regressions for the decision to buy remotely versus retail.	- The results suggest that there is significant competition in the case of computer equipment, especially for sales to experienced computer users and desktop buyers. - Conditional on buying a computer, the overall elasticity of buying remotely with respect to retail store prices is about 1.5, indicating that the decision to buy remotely is sensitive to the relative price of computers in retail stores.

Table 1.4 Competition in specific sectors: selected studies (continued)

Author	Topic	Country	Sample Period	Sample Coverage	Main Data Sources	Main Methods	Major Findings
Green and Newbery (1992)	Competition in electricity	UK	1989	UK electricity spot market	- Electricity demand over time: Electricity Council - Information on costs: Central Electricity Generating Board (CEGB) Statistical Yearbook	Empirical simulation	Privatised major generating companies under de facto duopoly at the early stage of the regulatory reform in the UK could exercise considerable market power.
Hoxby (1994)	Competition in education	US		12 686 young people surveyed every year since 1979	- National Longitudinal Survey of Youth (NLSY) - National Center of Education Statistics (NCES) Private Schools in America Survey, 1980 - 1982 Census of Governments	Regression analysis (effects of competition from private schools on public school students' outcomes)	The results suggest that greater private school competitiveness significantly raises the quality of public schools measured by the educational attainment, wages, and high school graduation rates of public schools.
Hoxby (2000)	Competition in education	US		6 119 students in 316 metropolitan areas	- Data on school districts and schools: Census of Governments; National Center of Education Statistics - Demographic information: Census of Population and Housing - Data on achievement: National Education Longitudinal Survey (NELS); National Longitudinal Survey of Youth (NLSY)	Regression analysis (effects of Tiebout choice on achievement)	- Competition among public schools in the form of Tiebout choice among public-school districts raises school productivity by simultaneously raising achievement and lowering spending. - Tiebout choice appears to have larger productivity effects in states where schools districts have greater financial independence. Where households have more Tiebout choice, they are less likely to choose private schools.

Table 1.4 Competition in specific sectors: selected studies (continued)

Author	Topic	Country	Sample Period	Sample Coverage	Main Data Sources	Main Methods	Major Findings
Joskow and Kahn (2001)	Competition in electricity	US	1998-2000			- Competitive benchmark price analysis - Capacity withholding analysis	- The high wholesale electricity prices in California observed in Summer 2000 cannot be fully explained as the natural outcome of "market fundamentals" in competitive markets (there is a very significant gap between actual market prices and competitive benchmark prices that take account of these market fundamentals). - Empirical evidence supports a presumption that the high prices reflect the withholding of supplies from the market by suppliers (generators or marketers).
Kessler and McClellan (2000)	Competition in health care	US	1985, 1988, 1991, 1994.	Elderly non-rural beneficiaries of Medicare who were admitted to a hospital with a new primary diagnosis of AMI (heart attack)	- Longitudinal Medicare claims data - Information on US hospital characteristics from the American Hospital Association (AHA) Survey - Information on annual HMO enrolment rates by state	Regression analysis (effects of hospital competition on expenditures and outcomes)	According to the regression results, the welfare effects of competition were ambiguous in the 1980s, but competition unambiguously improves social welfare. Increasing HMO enrolment over the sample period is interpreted to be partially explaining the dramatic change in the impact of hospital competition
Kessler and McClellan (2001)	Competition in health care	US	1985-1996	Elderly non-rural beneficiaries of Medicare who were admitted to a hospital with a new primary diagnosis of AMI (heart attack)	- Longitudinal Medicare claims data - Information on US hospital characteristics from the AHA Survey - Hospital system database constructed from multiple sources - Information on annual HMO enrolment rates by state	Regression analysis (effects of area density of hospital ownership on expenditures and outcomes for elderly AMI patients)	Areas with a presence of for-profit hospitals have approximately 2.4% lower levels of hospital expenditures, but virtually the same patient health outcomes.

Table 1.4 Competition in specific sectors: selected studies (continued)

Author	Topic	Country	Sample Period	Sample Coverage	Main Data Sources	Main Methods	Major Findings
Nechyba (2000)	Competition in education	US		Data (for calibration) from low-income, middle-income, and high-income school districts in the suburbs of the New York City	- 1990 School District Data Book (National Center for Education Statistics, 1995) - Census data from all districts in south-eastern New York (US Bureau of the Census, 1992)	General-equilibrium simulations (exploring the role of residential mobility in shaping the impact of different private-school voucher policies)	School-district targeted vouchers are similar in their impact to non-targeted vouchers but vastly different from vouchers targeted to low-income households. Strong migration effects significantly improve the likely equity consequences of voucher programs.
Pavcnik (2001)	Competition in health care	Germany	1986-1996	Prices and brand shares of oral antidiabetics (2 051 observations) and antiulcerants (1 347) observations)	IMS Health	Regression analysis (effects of insurance on pricing)	Producers significantly reduce prices after the implementation of referencing pricing which exposes patients to prices. Branded products that face more generic competition reduce prices more.
Toma (1996)	Competition in education	Belgium, France, New Zealand, Canada (Ontario), and US	1981	886 students in Belgium; 7 126 in France; 4 108 in New Zealand; 3 328 in Ontario; and 4 506 in the US	International Association for the Evaluation of Educational Achievement (IEA)	Regression analysis (of students' achievement in mathematics)	Controlling for individual student characteristics, school characteristics, and characteristics of peers in the schools, the results indicate that public funding and its subsequent effect of expanded enrolment do not erase the superior performance of private schools relative to public ones.
Wolfram (1998)	Competition in electricity	UK (England and Wales)	1992-1994	Daily observations from the spot market for wholesale power in six months (January, February, March, April, July, and November) from 1992, 1993, and1994.	All the information on the generators' bids and on average daily quantities was obtained from the National Grid Company	Regression analysis (of bid markups by fuel type and generating company, and also by available inframarginal capacity)	Evidence of strategic bid increases is found in the UK electricity auctions: i) The generators bid larger markups for units with high marginal costs, i.e., those that are likely to be used after a number of other units are already operating. ii) National Power, the largest supplier, submits bids reflecting larger markups over its units' marginal costs than PowerGen, its smaller competitor, does. iii) there is some evidence that bids for a give unit are higher when more of the units likely to run before that unit are available to supply electricity.

Table 1.4 Competition in specific sectors: selected studies (continued)

Author	Topic	Country	Sample Period	Sample Coverage	Main Data Sources	Main Methods	Major Findings
Wolfram (1999)	Competition in electricity	UK (England and Wales)	1992-1994	25 639 observations on the equilibrium pool prices and quantities from nearly half-hour period of every day in six months (January, February, March, April, July, and November) from 1992, 1993, and1994.	All the information on the pool-related variables was obtained from the National Grid Company (the pool administrator)	Estimating price-cost margins in both direct and indirect ways	All markup estimates indicate that prices are much closer to marginal costs than theories of non-collusive supply predict.

Table 1.5 Competition and cross-market effects: selected studies (continued)

Author	Topic	Country	Sample Period	Sample Coverage	Main Data Sources	Main Methods	Major Findings
Abowd and Lemieux (1993)	Interactions between product- and labour-markets	Canada	1965-1983	2 258 collective bargaining agreements for 299 bargaining pairs in the manufacturing sector of Labour Canada's *Wage Tape*	- Labour Canada's *Wage Tape* - Data on output and material input prices and quantities from Statistics Canada - *CANSIM University Base* - *COMPUSTAT*	Regression analysis (of wage determination and employment determination)	- Ordinary least squares (OLS) estimates of the effects of quasi-rents per worker on wages are positive but very small. But, they can be very misleading because of unobserved heterogeneity in the bargaining power parameter and because wages and quasi-rents are jointly determined when contracts are not strongly efficient. - Two-stage least squares (TSLS) estimates based on variation in foreign competition suggest a substantial degree of rent-sharing.
Bertrand (1999)	Interactions between product-, labour-, and capital-markets	US	1976-1981, 1983-1992	Randomly drawn sample of manufacturing workers representative of each industry-state-year cell	- May files of Current Population Survey (CPS) - Merged Outgoing Rotation Groups (MORGs) of the CPS - Panel Study of Income Dynamics (1981-92) -COMPUSTAT database	Regression analysis (effect of product market competition on the elasticity of current wage to current unemployment, effect of product market competition on the elasticity of current wage to unemployment at the start of tenure)	The empirical results suggest that exogenous shocks to foreign competition modify cohort effects in wages. Such shocks change the sensitivity of current wages to the current unemployment rate as well as the sensitivity of wages to the unemployment rate prevailing at the time the worker was hired. These changes are stronger among more financially-constrained industries than among less constrained ones.
Bertrand and Kramarz (2001)	Regulation and job creation	France	1975-1998	95 départements in France over the period 1975-98	- Labour Force Survey (LFS) conducted by INSEE - The DECAS "authorisation files"	Regression analysis (effects of zoning regulation on retail employment)	The requirement of regional zoning board's approval for the creation or extension of any large retail store in France since the early 1970s are found to have weakened employment growth in the retail industry.
Blanchflower, Oswald, and Sanfey (1996)	Interactions between product- and labour-markets	US	1964-1985	About 200 000 full-time full-year workers in manufacturing	- 1964-1985 March files of the Current Population Survey (CPS) - NBER Productivity Database	Regression analysis	The empirical results suggest that a rise in a sector's profitability leads to an increase in the long-run level of wages in that sector even when workers' characteristics, industry fixed effects, and unionism are controlled for.

Table 1.5 Competition and cross-market effects: selected studies

Author	Topic	Country	Sample Period	Sample Coverage	Main Data Sources	Main Methods	Major Findings
Chevalier (1995a)	Interactions between product-, and capital-markets	US	1985, 1991	13 512 super-markets in 85 Metropolitan Statistical Areas, among which 633 supermarkets were sold in a post-LBO asset sale	- Progressive Grocer's (1986, 1992) publication *Market Scope* - Quarterly editions of *Mergers and Acquisitions*	Regression analysis	- The announcement of an LBO (leveraged buy-out) increases the expected future profits of a firm's product market rivals. - Presence of LBO firms encourage local entry and expansion by rivals. - Both sets of results suggest that leverage makes product market competition less "tough".
Hildreth and Oswald	Interactions between product- and labour-markets	UK	1981-1990 1980-1986	- An unbalanced panel of 329 firms in manufacturing and non-manufacturing - A balanced panel of 58 establishments	- EXSTAT database - Author's survey on the largest 100 plants in West Midlands for the period 1980-86	Regression analysis (of wage equation using GMM estimation)	As predicted by rent-sharing models of the labour market, changes in profitability are shown to feed through into long-run changes in wages. These are not temporary wage effects and are not driven by the unionised workplaces in the data.
Rose (1987)	Interactions between product- and labour-markets	US	1973-1985	Full-time truck drivers employed in the for-hire trucking industry (2 172 observations over the period)	Current Population Surveys (CPS) by the Bureau of Census	Regression analysis (wage on union status dummy, worker characteristics, and regional dummies)	Union premiums over non-union wages in the trucking industry declined of roughly 40%, beginning in 1979, which coincides with the timing of deregulation in the trucking industry.

Table 2. **Product market liberalisation and perperformance**

A. Effects on growth and the macroeconomy					
Author	*Country/period*	*Explanatory variable*	*Performance variable*	*Effects found*	*Method*
Reported in van Bergeijk and Haffner, 1996:				Positive, GDP increases by (%):	
Emerson et al., 1988	EU medium-term	Implementation of Single Market (excluding trade-related measures)	GDP	4.1	Simulation
Industry Commission, 1995	Australia long run	Deregulation (implementation of the Hilmer report)	GDP	5.5	Simulation
Lipschitz et al., 1989	Germany annually	Deregulation	GDP	0.3	Simulation
Van Sinderen et al., 1994	Netherlands annually	Deregulation	GDP	0.5	Simulation
	8 OECD countries long-run:			Positive, GDP increases by (%):	
OECD, 1997	United States Japan Germany France United Kingdom Netherlands Spain Sweden	Regulatory reform in electricity, air travel, road freight, telecommunications and retail distribution	GDP	0.9 5.6 4.9 4.8 3.5 3.5 5.6 3.1	Simulation
Goff, 1996	United States 1950-92	Index of regulatory intensity	GDP	Negative (GDP decreases by 0.9% annually)	Econometric
Koedijk and Kremers, 1996	11 EU countries 1981-93	Index of strictness of product market regulation	GDP per capita growth TFP growth Labour productivity growth	Negative Negative Negative	Descriptive
Gwartney and Lawson, 1997	115 countries	Index of degree of economic freedom	GDP per capita GDP per capita growth	Positive Positive	Descriptive
Dutz and Hayri, 1998	52 countries 1986-95	Index of pro-competitive policy environment	GDP per capita growth	Positive	Econometric
Edwards, 1998	93 countries 1980-90	Indexes of openness to trade	TFP growth	Positive	Econometric

Source: Gonenc, Maher, and Nicoletti (2000)

Table 2 . **Product market liberalisation and performance** (continued)

B. Effects on labour market					
Author	*Country/period*	*Explanatory variable*	*Performance variable*	*Effects found*	*Method*
Reported in van Bergeijk and Haffner, 1996				Positive, employment increases by (%):	
Emerson et al., 1988	EU medium term	Implementation of Single Market (excluding trade-related measures)	Employment	1.2	Simulation
Industry Commission, 1995	Australia long run	Deregulation (implementation of the Hilmer report)	Employment	0.4	Simulation
Lipschitz et al., 1989	Germany annually	Deregulation	Employment	0.6	Simulation
Van Sinderen et al., 1994	Netherlands annually	Deregulation	Employment	0.1	Simulation
OECD, 1997	8 OECD countries long-run	Regulatory reform in electricity, air travel, road freight, telecommunications and retail distribution	Employment	Nil	Simulation
Goff, 1996	United States	Index of regulatory intensity	Unemployment rate	Positive (unemployment rate increases by 0.3%)	Econometric
Nicoletti et al., 2000	19 OECD countries 1982-95	Indexes of strictness of product market regulation	Employment rate	Negative	Econometric
	19 OECD countries 1982-95 9 manufacturing industries	Indexes of strictness of product market regulation	Wages	Mixed, predominantly positive	Econometric

Source: Gonenc, Maher, and Nicoletti (2000)

Table 2. **Product market liberalisation and performance** (continued)

C. Industry and firm-level effects					
Author	*Country/period*	*Explanatory variable*	*Performance variable*	*Effects found*	*Method*

Air travel

Author	*Country/period*	*Explanatory variable*	*Performance variable*	*Effects found*	*Method*
Haffner and van Bergeijk, 1997	Netherlands	Intra-EU liberalisation, reform slot allocation	Prices	Decline by 4%	Simulation
OECD, 1999a	United States	Domestic liberalisation of entry and prices	Prices Efficiency Quality	Decline by 33% Increase by 15% Unclear	-
OECD, 1999b	Mexico	Partial liberalisation of prices and entry	Prices Quality Employment Efficiency	Unclear Unclear Increase	-
Evans and Kessides, 1993	1000 routes United States 1986-88	Demonopolisation Airport dominance	Prices	Negative (but number of competitors irrelevant) Positive	Econometric
Borenstein, 1992	United States	Domestic liberalisation of entry and prices	Prices	Mixed (short-haul increase, long-haul decline)	Descriptive
Grimm and Milloy, 1993	Australia	Domestic liberalisation of entry and prices	Prices Quality	Negative Positive	Descriptive
Gonenc and Nicoletti, 2001	21 OECD countries, 1996	Liberalisation of entry and prices, competition	Efficiency	Positive	Econometric
	100 busiest international routes, 1996	Liberalisation of entry and prices, competition	Prices Efficiency	Negative Unclear	

Road freight

Author	*Country/period*	*Explanatory variable*	*Performance variable*	*Effects found*	*Method*
Haffner and van Bergeijk, 1997	Netherlands	Liberalisation of cabotage, driving periods	Prices	Decline by 1%	Simulation
OECD, 1999a	United States	Liberalisation of entry and prices	Prices Efficiency Quality Employment	Decline by 75% (TL) and 35% (LTL) Increase Improvement Increase by 16%	-
OECD, 1999b	Mexico	Liberalisation of entry and prices	Prices Quality Employment Efficiency	Decline by 37% Improvement Increase by 5% Increase	-
Ying and Keeler, 1991	56 firms United States 1975-83	Liberalisation of entry and prices	Prices	Decline by 25% to 35%	Econometric
Hoj et al, 1995	Australia	Liberalisation of entry and prices (1950 and 1960s)	Prices Quality	Negative Positive	Descriptive
	Canada	Liberalisation of entry and prices	Prices Quality	Negative Positive	Descriptive
	France	Liberalisation of entry and prices (1979 and 1989)	Prices	Negative	Descriptive
	New Zealand	Liberalisation of entry and prices (1983)	Quality	Positive	Descriptive
	United Kingdom	Liberalisation of entry and prices (1968)	Quality	Positive	Descriptive
McKinnon, 1996	United Kingdom (1987-1990) United States (1970-1978) New Zealand (1984-1987) France (1987-1990)	Road haulage deregulation	Prices	Decline by 25% Decline by 12-25% Decline by 25% Decline by 15%	Descriptive
Winston, 1993	United States	Liberalisation of entry and prices	Consumer welfare	Gain of 16 billion of 1990 US $	Ex-post assessment
Yamauchi, 1995	Japan	Liberalisation of domestic road haulage	Consumer welfare	Gains between 2.5 billion and 8.2 billion of 1990 US $	Simulation

70

Table 2. **Product market liberalisation and performance** (continued)

C. Industry and firm-level effects *(continued)*					

Retail distribution

Haffner and van Bergeijk, 1997	Netherlands	Liberalisation of entry, shop opening hours and zoning	Prices	Decline by 2%	Simulation
Hoj et al., 1995	22 OECD countries, 1990 8 OECD countries, 1960-90	Large outlet restrictions	Average size Outlet density	Negative Positive	Econometric
Centraal Planbureau, 1995	Netherlands	Liberalisation of shop opening hours	Employment Turnover and price	Increase 15000 jobs (11000 full time equivalent) Moderate effect	Simulation
Civildepartement, 1991 (Pilat, 1997)	Sweden	Liberalisation of shop opening hours	Prices	Fall by 0.6 per cent	Simulation
IFO (Pilat 1997 - OECD,1997)	Germany	Liberalisation of shop opening hours	Employment	Increase 1.3 per cent (full time equivalent)	Simulation
OECD, 1997	Japan	Revision of the LSRS (Large Store and Retail Store) law	GDP deflator for the distribution sector	During 1992 and 1993, the GDP deflator for the distribution sector fell by 2 per cent each year	Descriptive

Telecommunications

Majumdar, 1993	40 firms US 1973-87	Deregulation	Efficiency	Increase	Data Envelope Analysis
Haffner and van Bergeijk, 1997	Netherlands	Liberalisation	Prices	Decline by 18%	Simulation
OECD, 1999a	United States	Unbundling, liberalisation	Prices Quality Employment	Decline in long distance rates Improvement Nil	-
OECD, 1999b	Mexico	Liberalisation of long distance and local service, regulatory reform	Prices Quality Employment Efficiency	Decline in long-distance by 22% increase in local Unclear Increase by 50% Increase by 46%	-
OECD, 2000	Korea	Liberalisation of long distance and local service, regulatory reform	Prices Quality Employment Efficiency	Decline in long-distance by 50-60%, in mobile by 20% Improvement Increase by 25% Increase by 27%	-
Van Cuilenburg and Slaa, 1995	24 OECD countries 1989-92	Liberalisation of local and long distance	Innovation	Positive	Econometric
Gruber and Verboven, 1999	15 EU countries, 1984-97	Number of competitors	Mobile penetration	Positive	Econometric
Gort and Sung, 1999	9 firms United States 1952-1991	Competition	Efficiency	Positive	Econometric
Ying and Shin, 1993	46 firms United States 1976-87	ATT unbundling	Efficiency	Positive	Econometric
Oum and Zhang, 1995	United States, 1951-90	Competition	Efficiency	Positive	Econometric
Boylaud and Nicoletti, 2001a	23 OECD countries, 1991-97	Liberalisation, competition	Prices Efficiency Quality	Negative Positive Positive	Econometric

Table 2.   **Product market liberalisation and performance** (continued)

Author	Country/period	Explanatory variable	Performance variable	Effects found	Method
C. Industry and firm-level *(continued*					
Electricity					
Comnes *et al.,* 1996	US 1987-94	Liberalisation	Prices	Nil	Econometric
Estache and Rodriguez- Pardina, 1996	Argentina 1992-95	Regulatory Reform	Prices Efficiency	Decline Increase	Descriptive
Hope *et al.,* 1993	Norway 1991	Unbundling, TPA, Pool	Prices	Decline	Descriptive
Haffner and van Bergeijk, 1997	Netherlands	Liberalisation, unbundling, TPA	Prices	Decline by 11%	Simulation
Steiner, 2000	19 OECD countries	Liberalisation, unbundling, TPA, pool, consumer choice	Prices Efficiency	Negative Positive	Econometric
Rail freight					
OECD, 1999a	United States	Liberalisation of tariffs, shipping and exit	Prices Efficiency Quality Employment	Decline by 50% Increase Improvement Decrease by 41%	-
OECD, 1999b	Mexico	Horizontal unbundling, regulatory reform	Prices Quality Employment Efficiency	Decline by 7% Improvement Unclear	-
Wilson, 1994	United States	Liberalisation of tariffs, shipping and exit	Prices	Decline by 30%	

Source: Gonenc, Maher, and Nicoletti (2000)

Table 3. Improvements in industrial efficiency and consumer welfare after regulatory reforms in the US

Industry	Studies	Improvements in Industrial Efficiency	Improvements in Consumer Welfare
Airlines	Morrison and Winston (1998)	Average industry load factors have increased from roughly 52 per cent the decade preceding deregulation to roughly 62 per cent since deregulation. Real costs per revenue ton-mile have declined at least 25 per cent since deregulation. Industry profits have been very volatile during deregulation, although higher, on average, than they would have been under regulation.	Average fares are roughly 33 per cent lower in real terms since deregulation, and service frequency has improved significantly.
Less-Than-Truckload Trucking	Corsi (1996a)	Carriers have substantially reduced their empty miles since deregulation. Real operating costs per vehicle mile have fallen 35 per cent, but operating profits are slightly lower than they would have been under regulation.	Average rates per vehicle mile have declined at least 35 per cent in real terms since deregulation, and service times have improved significantly.
Truckload Trucking	Corsi (1996b)	Carriers have substantially reduced their empty miles since deregulation. Real operating costs per vehicle mile have fallen at least 75 per cent, but operating profits are slightly lower than they would have been under regulation.	Average rates per vehicle mile have declined at least 75 per cent in real terms since deregulation, and, because of the emergence of "Advanced Truckload" carriers, service times have also improved significantly.
Railroads	Winston, Corsi, Grimm, and Evans (1990)	Railroads have abandoned one-third of their track miles since deregulation. Real operating costs per ton-mile have fallen 60 per cent, and rail profits are much higher than they would have been under regulation.	Average rates per ton mile have declined more than 50 per cent in real terms since deregulation, average transit time has fallen at least 20 per cent, and the standard deviation of transit time has fallen even more than 20 per cent.
Banking	Berger, Kashyap, and Scalise (1995); Jayaratne and Strahan (1998)	The real cost of an electronic deposit has fallen 80per cent since deregulation. Operating costs have declined 8 per cent in the long run because of branch deregulation. Recent industry returns on equity exceed those just before deregulation.	Consumers have benefited from higher interest rates, from better opportunities to manage risk, and from more banking offices and automated teller machines.
Natural Gas	Henning, Tucker, and Liu (1995); Costello and Duann (1996), Herbert (1996); Crandall and Ellig (1997)	Pipeline capacity has been much more efficiently utilised during peak and off-peak periods since deregulation. Real operating and maintenance expenses in transmission and distribution have fallen roughly 35 per cent.	Average prices for residential customers have declined at least 30 per cent in real terms since deregulation, and average prices for commercial and industrial customers have declined even more than 30 per cent. In addition, service has been more reliable as shortages have been almost completely eliminated.

Source: Winston (1998)

Table 4. Recent studies on the effects of ownership on performance

Author/Year	Industry	Country/Period	Explanatory Variable	Performance Variable	Effects Found	Method
Fully or largely competitive industries						
Eckel, Eckel and Singhal, 1997	Air (British Airways)	UK 1987	Privatization	Stock Value	Positive	Descriptive
Gonenc and Nicoletti, 2001	Air	27 OECD countries 1996	Private vs. Public	Efficiency	Positive	Econometric
Dewenter and Malatesta, 1998	High information	63 firms 1981-93 cross-country pre/post privatization	Privatization	Profitability Efficiency	Positive Positive	Descriptive
Boardman and Vining, 1989	Miscellaneous	500 largest non US firms 1983 cross-country	Private vs. Public Corporatisation	Profitability Efficiency	Positive Positive	Econometric
Boubakri and Cosset, 1998	Miscellaneous (utilities included)	79 firms 1980-92 developing countries pre/post privatization	Privatization	Profitability Efficiency	Positive (higher in non-competitive industry)	Descriptive
Button and Weyman-Jones, 1992	Miscellaneous	Survey of 9 DEA studies, United States and European firms	Private vs. Public	Efficiency	Positive	Descriptive
Claessens *et al, 1997*	Miscellaneous	706 firms Czech 1992-95	Privatization	Tobin's Q	Positive (but especially if large investors)	Econometric
D'Souza and Megginson, 1999	Miscellaneous (utilities included)	85 firms 1990-96 OECD and developing countries pre/post privatization	Privatization	Profitability Efficiency	Positive (higher in non-competitive industry)	Descriptive
Frydman *et al.,* 1998	Miscellaneous	128 firms East Europe 1990-93 matched sample with privatized and public firms	Privatization	Profitability Efficiency	Positive (but only if outside investors)	Econometric
Galal *et al.,* 1992	Miscellaneous (utilities included)	12 firms cross-country	Privatization	Welfare	Positive	Counterfactual
La Porta, Lopez de Silanes, 1999	Miscellaneous (utilities included)	218 firms Mexico 1992 pre/post privatization matched sample with privatized and public firms	Privatization	Profitability Efficiency	Positive	Econometric
Martin and Parker ,1995	Miscellaneous	11 UK Firms 1981/88 pre/post privatization	Privatization	Profitability Efficiency	Mixed	Econometric
Megginson *et al.,* 1994	Miscellaneous (utilities included)	61 firms 1961-89	Privatization	Profitability	Positive	Descriptive
Pohl *et al.,* 1997	Miscellaneous	6300 firms East Europe 1992-95 cross-country matched sample with privatized and public firms	Privatization	Efficiency	Positive	Econometric
Vining and Boardman, 1992	Miscellaneous	500 largest firms Canada 1987	Private vs. Public Corporatisation	Profitability Efficiency	Positive Unclear	Econometric
Barberis *et al.,* 1996	Retail	452 firms Russia 1990	Privatization	Restructuring effort	Positive (but only if outside investors)	Descriptive

Table 4. Recent studies on the effects of ownership on performance (continued)

Author/Year	Industry	Country/Period	Explanatory Variable	Performance Variable	Effects Found	Method
Industries with non-competitive segments						
Burns and Weyman-Jones, 1994	Electricity	UK 1981-93	Privatization	Efficiency	Positive	Data Envelope Analysis
Duncan and Bollard, 1992	Electricity	New Zealand 1987-92	Corporatisation	Efficiency	Positive	Econometric
Hawdon, 1996	Electricity	Developing countries 1988	Privatization	Efficiency	Positive	Data Envelope Analysis
Kwoka, 1996	Electricity	US	Private vs. Public Corporatisation	Prices	Negative Positive	Econometric
Newbery and Pollitt, 1997	Electricity (CEGB)	UK 1990	Privatization	Efficiency Environment Welfare	Positive Positive Negative	Counterfactual
Pollitt, 1995	Electricity	95 firms, 9 countries	Private vs. Public	Efficiency	Positive	Econometric
Steiner, 2001	Electricity	19 OECD countries, 1986-96	Privatization	Efficiency Prices	Positive Positive	Econometric
Yarrow, 1992	Electricity	UK 1990-91	Privatization	Prices	Negative	Counterfactual
Ramamurti, 1997	Rail (Ferrocarilla Argentinos)	Argentina	Privatization	Efficiency	Positive	Descriptive
Boylaud and Nicoletti, 2001a	Telecommunications	23 OECD countries, 1991-97	Privatization	Efficiency Prices	Unclear	Econometric
Staranczack et al., 1994	Telecommunications	10 OECD countries, 1984-87	Private vs. Public	Efficiency	Positive	Econometric
D'Souza, 1998	Telecommunications	17 firms 1981-94 cross-country	Privatization	Profitability Efficiency	Positive	Descriptive

Source: Gonenc, Maher, and Nicoletti (2000).

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