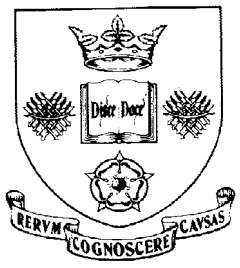
Monograph:
Dietrich, M. (2003) Giant Firms in the Information Economy. Working Paper. Department of Economics, University of Sheffield ISSN 1749-8368

Sheffield Economic Research Paper Series 2003006

Sheffield Economic Research Paper Series

SERP Number: 2003006



Michael Dietrich

Giant Firms in the Information Economy

December 2003

Department of Economics
University of Sheffield
9 Mappin Street
Sheffield
S1 4DT
United Kingdom
www.shef.ac.uk/economics

Earlier versions of this paper were presented at the Universities of Sheffield and Brighton and the European Association for Evolutionary Political Economy 2003 Annual Conference in Maastricht. I would like to thank the participants at these sessions for listening to and commenting on my work. In addition I would like to thank Abhi Sharma and Mohamed El-Farra for reading and commenting on an earlier version of the paper; their comments have led to improvements in the argument. Needless to say any remaining ambiguities or errors are the responsibility of the author.

1. Introduction

The primary objective of this paper is to present a discussion of the potential significance of giant companies in the emerging new information economy. In the 1970s and discussion of the significance of giant firms would be somewhat uncontroversial. Within economics, the work of, for example, Prais (1976) established empirically the central position of giant firms in market economies. From a more interdisciplinary perspective, theorists (particularly Marxist inspired writers) emphasised the development of a monopoly based capitalism (for example, Baran and Sweezy, 1968; Cowling, 1982). But more recently these established or stylised facts have been questioned. As discussed below, an explicitly small firms literature has developed. This literature is frequently linked to claims that the changing dynamics of modern market economies have undermined the position and significance of giant firms. Other writers, for instance the sociologist Castells (1996) links the very same dynamics to a continued role for giant firms in a globalised world.

In short, the straightforward and seemingly uncontroversial message based on an earlier era of market and historical development has given way to a rather confused picture with regard to the functioning and role of giant firms. This lack of clarity is the background to the discussion in this paper in which the significance of giant firms is considered both theoretically and empirically. The discussion is organised as follows. In the next section a simple cost based theoretical framework is developed that is used to understand the potential impacts on giant firms of an emerging information economy. Here it is argued that while giant firms in the old economy are likely to encounter problems that arise because of increasing environmental uncertainty there is no single response that might be used by the companies involved. In short it is not possible to derive a single evolutionary trajectory for giant firms in

the modern economy. This perspective informs the empirically based discussion that follows.

In section three the data used in this paper is introduced. The data set covers the 100 largest firms in the UK, (non-UK) EU and USA. The UK and EU are separated to allow for the possibility that the recent evolution of giant firms is influenced by the 'type' of market economy; the principle distinction here being between Anglo-Saxon and Continental European versions of capitalism. Analysis is based on aggregate concentration ratios. It is shown in appendix two that aggregate concentration can be decomposed into four different effects: market power, global presence, diversification and industrial structure. This framework allows changes in aggregate concentration to be mapped into changes in the role and significance of giant companies. In section 3 it is shown that the UK, EU and USA exhibit different evolutionary trajectories that can be understood in terms of the theoretical framework set out in section 2. The only common feature involves a movement away from what is termed 'old economy dominance'.

In section four the empirical analysis is further developed to take account of the changing structure of the population of giant firms. Here it is shown that, on the one hand, EU and, on the other, UK and US entrants into the population of giant firms appear to have different characteristics compared to continuing firms. Part of a possible explanation identified in section four involves the overwhelming significance of new giant financial firms in the EU and giant financial and retailing firms in the UK and USA. It is speculated that such firms are structurally part of the 'old economy' rather than a new information based economy.

This finding, of an increasing significance of 'old economy' giant firms, begs the question as to how we might define the term 'new information economy'. Rather

than attempt a single definition, a more useful approach in the current context is to present three alternatives: narrow, broad and systemic. A narrow definition views the information economy in technical terms as the information and communication technologies (ICT) sector. Hence a developing information economy implies an increasing importance of ICT activities. A good example of this definition is provided by Stiglitz (2003) in his discussion of the claimed mismanagement of the US and global economy in the 1990s

> The New Economy represented a change of equally momentous proportions [as the Industrial Revolution]: a shift from the production of goods to the production of ideas, entailing the processing of information, not of people or inventories. (pp4-5)

In terms of the possible effects of a narrowly conceived information economy on the recent evolution of giant firms, this definition somewhat simplifies the analysis. Attention can be focused on the relative size (dis)advantages of ICT firms, compared to non-ICT firms, and the way in which this is mapped into changes in aggregate concentration by the relative growth of the ICT sector. But while this narrow definition is useful, in that it focuses attention on the technological drivers behind current economic and organisational changes, it has a shortcoming in that the economic influence of ICT activities is not restricted to the ICT sector.

A broad definition of the information economy recognises the input-output, or supply chain, linkages between ICT and other activities. It therefore views the new economy as ICT activities plus other activities the functioning of which have been restructured as a result of ICT inputs. Note here that, with this broad definition, ICT outputs affect the input side of non-ICT activities. This impact of ICT outputs is driven by price reductions and quality improvements of the outputs concerned and

hence an increasing shift towards productivity improvements being ICT driven.[1] The neo-Schumpeterian analysis of technological and institutional restructuring appears to be consistent with this broad definition of the new economy. Freeman and Perez (1988) view a techno-economic paradigm (in our context a new economy) not simply as being based on new products and productive systems (i.e. a narrow new economy) but more importantly key inputs dominating change. This domination of change operates by new activities: facilitating cost reductions; being characterised by elastic long-run supply conditions; and having the potential for use with existing activities.

In terms of the current discussion, this broad definition presents a taxonomic complexity in that 'old' and 'new' activities are not separable. Furthermore, 'old' activities may be considered functionally part of the new information-based economy if ICT inputs are dominating developments. Hence some 'old economy' giant firms may be part of the 'new economy'. This complexity is further compounded with a systemic definition of the information economy. We can understand the difference between this latter view and a broad definition in terms of the way in which outputs are conceptualised. Following standard reasoning outputs determine the definitions of markets and inputs the definitions of industries. With a broad definition of the information economy emphasis is placed on the way in which ICT activities restructure non-ICT industries. With a systemic definition, non-ICT markets as well industries are restructured. With a broad definition, outputs are necessarily defined in objective and technical terms. With a systemic definition, outputs can be viewed as a bundle of characteristics that include, in addition to objective and technical aspects of a good or service, factors such as the way in which information about an output is

[1] See Jorgensen (2001) for evidence that US based ICT activities have experienced significant real price reductions and quality improvements that have resulted in a reorientation of the sources of productivity growth.

acquired or the manner in which a product is purchased. It follows that ICT activities can affect the outputs of non-ICT firms, a perspective argued by, for example Leadbetter (1999) as considered below. For instance, the development of internet banking need not have changed the technical aspects of bank account use but has clearly changed the bundle of characteristics that can be purchased. An implication here is that the growth potential of non-ICT firms can be significantly influenced by a developing information economy. In terms of a discussion of the evolution of giant firms, it follows that even though ICT firms may have different firm size advantages compared to non-ICT firms (but this is somewhat debatable for reasons set out below) the position of giant firms in the new economy is more complex. One implication is that new giant firms need not exhibit fundamentally different characteristics compared to those they replace.

2. The development of giant firms: a simple framework

This section will present a simple a framework that can be used to develop preliminary ideas about the impact of the information economy on giant firms. As background, and to facilitate presentation of the framework, the discussion will initially consider the development of giant firms in the 'old economy'. In this context 'old economy' firms are those with products in the mature stages of their life cycles. Following Simon (1991) and Galbraith (1974) we can suggest that the central characteristic involved in the development of giant firms is the increasingly organised or bureaucratised nature of firm activity. This observation, in turn, suggests that in developing a framework that can be used to understand the evolution or restructuring of giant firms, emphasis should be placed on the costs of organisation or bureaucratisation. Related to this emphasis on the centrality of organisation to

understanding giant firms is the distinction drawn by Kornai (1971), and more recently Casson (1997), that any economic activity involves real and control aspects. Following this logic we decompose a firm's costs into two elements: production, or real, costs that are attributable to specific outputs and non-attributable overhead organisation, or control, costs. Without loss of generality we can assume that, for an old economy firm, average production costs (APC) are constant. As organisation costs are an overhead it follows that average organisation costs (AOC) decline as firm output increases. A firm's average total costs (AC) are therefore APC + AOC.[2]

We view the evolution of giant firms as a process involving increasing organisation costs and declining average production costs. Obviously for any single firm this process is likely to be characterised by intermittent periods of major restructuring followed by incremental development. But we can abstract from this detail by projecting the historical process into a single decision: a firm can choose between high and low organisation costs and the accompanying low and high average production costs. To invoke a specific example we can cite the shift from functional to multidivisional organisation initiated in the USA in the early part of the 20th century with later diffusion in Europe (Chandler 1962, 1977). Referring to figure 1, initially firms have a management structure that defines AOC_1 and production costs APC_1, with resulting average costs being AC_1. This initial position is indicated by dashed curves. Managerial-organisational development allows more efficient production with the result that production costs fall to APC_2, but the management development implies increased organisational overheads resulting in the shift AOC_1 to AOC_2. It is important to recognise that this latter shift is not parallel but implies a

[2] To avoid ambiguity it can be noted that the costs referred to in the text are short-run not long-run. Short-run costs are the actual expenses incurred by a firm. In terms of the conceptualisation presented here, these short-run costs are based on a fixed organisational or control input into firm activity. Long-run costs are plans rather than actual outcomes.

steeper AOC curve. Following the managerial development average costs therefore pivot from AC_1 to AC_2. If the firm's planned output is, for example, Q* it follows that the organisational development is rational as AC_2 is lower than AC_1 at this output. But if output is less than Q_1 the original management structure is more efficient as AC_1 is lower than AC_2.

Figure 1 here, see end.

This general framework is consistent with more specific perspectives on the firm. For instance, Chandler (1977) argues that modern firms gained their advantage from the organisational infrastructure involved allowing an effective exploitation of production based scale economies. Without a developed organisational infrastructure a firm cannot guarantee a position on its long-run average cost curve. In terms of figure 1 the organisational infrastructure results in the shift AOC_1 to AOC_2 but has the advantage of consistently lower production costs. In a more explicitly empirical tradition, figure 1 is also consistent with the work of Prais (1976) and Hannah (1983). Both writers emphasise the importance of non-production based factors in the development of giant firms in the UK, most notably marketing, finance and R&D management benefits. But such advantages imply a requirement for more sophisticated organisational structures and processes.

Finally we can connect figure 1 to Williamson's (1975, 1985) transaction cost account of firm development. Key elements of this argument are that (a) an organisational hierarchy is necessary to control agent opportunism and (b) that the multidivisional organisation allows a more efficient allocation of resources within a

firm. In short, the development of the firm as an organisational entity allows more efficient production by controlling opportunism and allowing more rational management.

A complication apparently not recognised by transaction cost writers is that transaction cost advantages are contingent on predictability of output. This is clear from figure 1. On a vertical line defined by Q*, the shift AC_1 to AC_2 results in an overall efficiency gain. But if Q* cannot be guaranteed the efficiency gains cannot be guaranteed. In short, transaction cost theory is necessarily an equilibrium approach to organisations (Dietrich, 1994) as it appears to assume that plans and outcomes are the same for real output decisions. To some extent the necessary market predictability may follow from the restructuring of a firm's average costs. The shift AC_1 to AC_2 results in a steeper curve implying increased barriers to market entry for potential competitors. These increased barriers will themselves generate greater predictability. These observations are consistent with views that the modern corporation (Galbraith, 1974) or big business (Aaronovitch & Sawyer, 1975) requires predictability for effective functioning. The implication here is that effective transaction cost economising behaviour, at least as applied to the development of giant firms, requires a necessary degree of market power. That this market power might involve higher prices is to some extent secondary to the requirement of predictability. More generally, we cannot claim that market power and efficiency are two alternative, and mutually exclusive, accounts of firm development. Hence the perspective offered here distances itself from Williamson's (1981: 1566) argument that

> The view that the corporation is first and foremost an efficiency instrument does not deny that firms also seek to monopolize markets… But specific structural preconditions need to be satisfied if strategic behaviour is to be feasible – and most firms do not qualify, which is to say that strategic behaviour is the exception rather than the rule.

In particular it is being suggested here that the efficiency seeking basis of the modern corporation introduces the structural imperfections necessary for strategic behaviour i.e. greater organisational barriers to entry develop because of a steeper AC curve. In addition, these imperfections are not viewed as a separate approach to understanding the modern corporation but a necessary aspect of efficiency seeking behaviour because of a required predictability.

But it is also clear from figure 1 that this predictability implies reduced flexibility because of the steeper average total costs involved, and hence the local rather than global relevance of the more developed control systems involved with giant corporation. In addition, if this predictability is undermined the rationale for the traditional modern corporation may be, not is, similarly undermined. A key aspect of the recent history of market economies, emphasised by writers from different traditions, is increasing economic uncertainty. Of direct relevance to the current paper is that the development and use of information technology will itself engender greater market uncertainty, a key point argued by economists Shapiro and Varian (1999).

A not inconsistent perspective to that argued by Shapiro and Varian is suggested by Leadbetter (1999). He stresses the implications of a developing 'knowledge economy' with its particular organisational and institutional requirements. In his own words, the 'knowledge-driven economy is not made up by a set of knowledge-intensive industries fed by science. This new economy is driven by new factors of production and sources of competitive advantage - innovation, design, branding, know-how - which are at work in all industries...' (p10). In terms of the evolution of (giant) firms, he claims that currently giant corporations are having 'a new lease of life' (p60) because of their ability to survive the volatility of the emerging knowledge economy. But, eventually, it is claimed new flexible small-

medium organisations will become dominant based on networks of corporate relationships. This latter prediction is examined below.

A related perspective on current restructuring, to that suggested by Leadbetter, is the academic tradition known as flexible specialisation theory. Building on the seminal work of Piore and Sabel (1984), the explanation here views restructuring as a response to demand led effects (Hirst and Zeitlin, 1989). Mass production systems, with characteristic rigid hierarchies, have faced problems since the 1970s from external shocks that have made demand more uncertain. Furthermore, traditional consumer durable markets are becoming increasingly saturated and demand becoming increasingly fragmented, undermining the standardisation necessary to exploit scale economies. It is argued that these changes provide an increasing comparative advantage for networks of small firms (Marshallian industrial districts: Best, 1990; Pyke and Sengenberger, 1992). Note here that (1) there is no prediction about a short-run comparative advantage of giant firms and (2) economic uncertainty is not simply grounded in the information economy.

More generally Kumar (1985) and Dunne and Hughes (1994) have found smaller firms growing faster than larger firms. This represents an important shift from the significant growth advantages of size identified earlier by, for example, Prais (1976). These more recent findings are consistent with the more general ‘small firms’ literature that suggests an increasing importance of small scale production since the 1970s (Carlsson, 1989; Acs and Audretsch, 1987; Sengenberger et al, 1990). In terms of the implications for the current discussion, if we assume that these effects are decreasing but monotonic in firm size, an increasing importance of small scale activity suggests an increasing comparative disadvantage of large, and successively giant, firms.

It is clear, therefore, that a not uncommon theme in recent writing is the creation of a link between the increasing uncertainty of the modern economy and an increasing disadvantage of the inflexibility of the traditional corporation. The basis of such a link is clear from figure 1. But the suggestion that developing uncertainty will undermine giant firms in the long-run depends on a particular reading of how giant firms respond to the new environment. Using figure 1, we can suggest that a developing information economy might impact on the functioning and significance of giant firms in the following ways:

1. Reduced production costs.
2. Neoclassical organisational restructuring.
3. Evolutionary organisational restructuring.
4. Restructured production costs.

These will be considered in turn.

Reduced production costs

If we follow the argument of, for example Freeman and Perez (1988) as discussed above, information technology is a key input that is dominating current restructuring i.e. the information economy has the ability to provide generalised efficiency savings for firms in many industries. If these technologies reduce production, rather than organisation, costs we can see the possible impacts from figure 1. Production based efficiency savings will shift down APC_1 and APC_2, resulting in parallel shifts down in AC_1 and AC_2. Assuming that the shifts in APC_1 and APC_2 are of the same order, the implication is that the significance of the forms of organisation underlying AOC_1 and AOC_2 remain unchanged. In addition the significance of organisational barriers to entry and organisational inflexibilities are unchanged. In short, the use of information

technologies to improve production based efficiency appears not to undermine the significance of giant firms because of unchanged entry barriers, equally the flexibility disadvantages of giant firms, in uncertain conditions, still exist.

Neoclassical organisational restructuring

To understand the possible implications of a developing information economy on organisational restructuring, and hence on average organisation costs in figure 1, we can draw a distinction between neoclassical and evolutionary approaches to information. A neoclassical approach to information is clearly defined by Shapiro and Varian (1999: 8-9)

> In short, today's breathless pace of change and the current fascination with the information economy are driven by advances in information technology and infrastructure, not by any fundamental shift in the nature or even the magnitude of the information itself… What's new is our ability to manipulate information, not the total amount of information available. [emphasis added]

The final sentence of the above quotation emphasises the key distinction between neoclassical and evolutionary information. With neoclassical information, the information economy improves the ability to manipulate information not the total available. In an evolutionary world, the information available is not specifiable ex-ante, but rather reveals itself as an aspect of evolutionary processes (Hodgson, 1993). From an evolutionary perspective a developing information economy can impact on learning processes and hence impact on the discovery of new information. The possible implications here will be explored below. In terms of the definitions of an information economy presented above, a neoclassical perspective is based on a broad definition and an evolutionary perspective a systemic definition.

From a neo-classical perspective a greater ability to manipulate information will reduce control costs. Within the firm, managerial efficiency gains might result

from flatter organisational structures involving, for instance, elimination of organisation layers and centralisation of information management. In addition, subcontracting can be seen as a natural response to a developing information economy. For example Milgrom and Roberts (1990) suggest that flexible technology is reducing asset specificity and hence leading to vertical disintegration because of transaction cost factors. Any reduction in organisation costs will impact on AOC_2, in figure 1, in two ways: the curve will shift down and it will become flatter. The resulting shift in the average cost curve, and in particular because it is flatter away from Q*, implies a reduction in organisational barriers to entry. In addition AC_1 and AC_2 will cross at a lower output level, i.e. Q_1 will fall, implying that the bureaucratic requirements of giant size will be less compromised by environmental uncertainty i.e. there will be an increase in organisational flexibility.

In terms of developing specific predictions about the evolution of giant firms that might result from neoclassical organisational restructuring we can suggest the following. Restructuring will have a negative impact on the size of giant firms when size is measured by employment; hence employment concentration might be expected to decline. But the resulting changes in organisational flexibility and organisational entry barriers have an uncertain impact on giant firms as value generating units and hence sales concentration. On the one hand improved organisational flexibility implies a greater ability to respond to environmental uncertainty and hence improved performance; the logical prediction here is an increase in sales concentration. On the other hand a reduction in organisational barriers to market entry implies greater potential competition with a logical prediction being a reduction in sales concentration. The first possibility implies giant firm dominated restructuring, the second an undermining of giant companies.

Evolutionary organisational restructuring

An evolutionary perspective on information has potentially different organisational implications compared to those just discussed. The key issue here is that radical uncertainty exists in the Knightian (1921) or Austrian senses. Furthermore, using a characteristic Austrian method, we cannot assume a pre-given amount of information but rather information is only discovered and revealed following the decisions of economic agents (Hayek, 1945). But, in an organisational setting, rather than a setting of atomistic individuals with subjective knowledge, it is inappropriate to assume that firm observation of the decisions of other agents and outcomes of these decisions is a straightforward activity. Instead the organisational discovery process must recognise the costs of, and barriers to, firm learning. From this perspective, information can become more uncertain if the information economy influences the ability to manipulate information. With unchanged firm learning capacity, a greater density of decisions by other agents will increase uncertainty for the firm concerned, assuming the other decisions are different.

One way of conceptualising evolutionary organisational restructuring is to follow Langlois and Robertson (1995) and Foss (1993) and suggest that the firm can be conceived as a bundle of resources or competencies that can be coordinated in different, and idiosyncratic ways. Organisational change can then be thought of as a re-coordination of resources with managerial costs, or dynamic transaction costs, being necessary. It follows that tracking, responding to and exploiting a more uncertain environment requires greater dynamic transaction costs.

This recognition of the management costs of organisational evolution can be traced back to two sources. Penrose (1980) emphasised the link between managerial excess

capacity and firm growth. As with all excess capacity there is an (implicit) opportunity cost. The second tradition is behavioural economics and the claim that firm adjustment to a changed environment requires organisational slack (March and Simon, 1958).[3] But in terms of giant firms two factors are likely to inhibit dynamic capability. First the rigidities of efficiency seeking managerial control in a hierarchical setting will reduce the possibility of organisational excess capacity. Secondly, even if such excess capacity is allowed to develop, or exists despite managerial control, returns to individual creative efforts are the legal entitlement of the firm rather than the individual(s) concerned.

Given these comments we can suggest that a dynamic response to environmental uncertainty and change will involve, in terms of figure 1, increased organisation costs. In addition because of the rigidities of giant firms cited in the previous paragraph, we can assume that this increase is non-trivial. The potential implications follow from a steeper average cost curve than would exist without the dynamic transaction costs. Assuming the investment in dynamic capability is successful in generating greater output, increased organisational barriers to entry will exist. This greater market power will produce the predictability necessary for improved firm performance. Without this predictability the steeper average cost curve that follows from investment in dynamic capability implies increased organisational rigidities that in an uncertain environment undermines effective performance.

It follows that investment in dynamic capability, for giant firms, involves managing a trade-off between (1) market power and (2) organisational rigidities. With risk averse management this may result in a tendency not to invest in dynamic

[3] For UK giant firms there does appear to be a relationship between the existence of organisational slack and excellent firm performance (see Dietrich, 2003) that is consistent with investment in dynamic capability.

capability unless the returns involved are relatively certain or large i.e. if anticipated monopoly power is certain. For this reason we can characterise evolutionary organisational restructuring for giant firms as an essentially defensive development. An implication here is that more risky investments, that require individual entrepreneurial capability within larger firms, will be avoided and so can lead to the creation of small spin-off firms, as appears to have happened in Silicon Valley USA (Leadbetter, 1999).

In terms of specific predictions about the evolution of giant firms, and in particular input and output concentration changes, we can suggest the following. For aggregate employment concentration we cannot predict a necessary reduction (as with neoclassical information) because of the investment in dynamic transaction costs. If firm strategies are dominated by investment in dynamic capability, the change in employment concentration will depend on the extent to which this investment is distributed across giant and non-giant firms. If entrepreneurial investment is concentrated at the top end of the firm size distribution we can expect an increase in aggregate employment concentration. But for reasons discussed above any such increase is likely to be defensive in terms of giant firm strategy. If the investment in dynamic transaction costs is successful an increase in sales concentration can be expected. But if unsuccessful, particularly in the context of global competition, declining sales concentration can result because of the organisational rigidities involved.

This possibility of a failed defensive strategy is consistent with the Leadbetter (1999) view mentioned above that giant firms might have a short-run advantage but long-run disadvantage in the emerging new economy. But, in addition it may suggest a possible longer-run complementarity between giant and smaller firms in which the

former have advantages, involving for instance marketing and developmental R&D that involve investment in sunk assets, that complement smaller firm adaptability. This complementarity is different to that identified above with neoclassical information as with the current case the dominance of giant firms is somewhat qualified by (constrained) competition from smaller companies.

Restructured production costs

We can now turn to the final way in which a developing information economy might impact on giant firms. The previous three sub-sections have examined how 'old economy' firms might respond to the new environment, but there is in addition new, information based, firms. Such firms have the characteristic that they have not yet achieved the mature stages of their product life cycles. Following Shapiro and Varian (1999) we can suggest that the central characteristic of an 'information firm' is that fixed production costs are significant but marginal costs are minimal. The result is a continuously falling APC curve. In addition significant scope and scale economies are commonly available to information firms.

Figure 2 here, see end.

Initially discussion can be based on figure 2 that compares a 'small' (subscript S) firm with a 'large' (subscript L) firm. For illustrative convenience the small firm situation is shown with dashed curves. Economies of scale and scope shift the average production cost curve from APC_S to APC_L resulting in lower unit production costs for a large firm with output Q_L compared to a small firm with output Q_S. With small firm average management costs of AOC_S a small firm has average total costs of AC_S. With

unchanged average organisation costs, the economies of scale and scope will shift the average total cost curve from AC_S to AC'. With the managerial overhead required by a large firm the actual AC_L curve will be above AC' and steeper. Possible AC_S and AC_L curves are shown in figure 3.

Figure 3 here, see end.

The following comments, based on figure 3, would seem to be pertinent. For products and technologies not in the mature stages of their life cycles, arguably a reasonable depiction of the information economy, the relevant comparison in figure 3 might be between Q_S and Q' not Q_S and Q_L. It follows that early in life cycles small firms may be able to compete, on an equal cost based footing, with larger firms. But this need not be a general conclusion. It is clear that the general shapes of the average cost curves in figure 3 are the same as in figure 1. It follows that as the new information technologies mature the same cost based dynamics are likely to be involved. So, with output potential being Q_L large firms will have an absolute cost advantage over smaller competitors. In short, we might not expect significant long-run differences with regard to the significance of giant firms. Small firms will be restricted to niche activity. More generally the simple framework used here suggests that predictions about a developing comparative disadvantage of giant firms, example opinions of which were given above, may be a short-run rather than long-run phenomenon.

While there is this fundamental similarity between figures 1 and 3 there are important differences. First, because of the short-run and long-run cost structures of an information firm it is clear from figure 3 that the slope of AC_L at Q_L need not be

locally steeper than the slope of AC_S at Q_S; in fact the opposite may be the case. It follows that there appears to be no necessary cost-based relative inflexibility associated with larger sized information based firms. This is clearly different compared to old economy firms, and in addition reinforces the conclusion just drawn that any comparative disadvantage of giant size may be a short-run rather than long-run phenomenon.

A second difference between figures 1 and 3 follows from the underlying cost structure of an information firm. The AC curve may be steeper for significant, rather than local, shifts away from expected output compared to an old economy firm. This is the case for three reasons. First there is the already cited characteristic of significant fixed production costs but minimal marginal costs. Second, because of the non-mature nature of the technologies and products firms will invest in dynamic capabilities as a core aspect of competitive strategy rather than as a more temporary aspect of organisational turnaround. This increases organisational overheads compared to old economy firms. Finally, we must recognise the importance of lock-in and switching costs. Lock-in exists with 'old economy' firms, and is the basis of a transaction cost analysis of the firm (Williamson, 1985). But with information based firms lock-in is pervasive (Shapiro and Varian, 1999) because of the complementarity of durable assets. The implication here is that a new information based firm, attempting to enter an established market, must absorb the switching costs of customers from established producers. These switching costs will consequently increase a new firm's overhead costs with the result that significant first mover advantages can exist. The result of these cost effects is that we need not expect flexible information based giant firms to be necessarily associated with contestable markets. In short the information based economy can be just as giant firm based as the old economy.

There is one important qualification that must be made to this conclusion. Because of the non-mature nature of the technologies involved, new firm entry may be facilitated by the production of fundamentally new products. In addition, if investment in giant firm dynamic capabilities is governed by risk averse management, this type of new firm entry is more likely.[4]

3. Giant Firms in the UK, EU and USA

This section will put preliminary empirical flesh on the discussion undertaken in the previous section. The significance of giant firms is measured using aggregate concentration ratios, and in particular the 100 firm ratio. The use of 100 firms as the measurement threshold, is somewhat traditional and dates back to, for example, the work of Prais (1976). The firm data used here covers the 100 largest companies in the UK, USA and (non UK) Europe. Two measures of size are used: sales and employment. Obviously, the top 100 measured by sales is not identical to that measured by employment. In all cases the final year for the data is 1997, but the initial year changes because of data availability. For the UK the first data point is 1979 and for the USA 1980. For European companies data on company turnover is available for 1980 but for employment the first data point is 1990. In addition because of information availability problems two European data sets are provided covering seven and twelve countries, as detailed in the notes to tables 1c and 1d. As a rule of thumb the EU7 concentration ratios may be more accurate as they involve fewer data

[4] It might be argued that the above analysis of information based giant firms is overly cost oriented and consequently ignores important demand effects. One such demand effect concerns network economies that are likely to be pervasive in information based industries (Arthur, 1989; Varian and Shapiro, 1999). The result is a tendency towards standardisation and lock-in of technologies. But this standardisation is consistent with many or few firms depending on supply-side cost characteristics. Hence ignoring this demand effect would not seem to compromise the analysis in the text of the (potential) significance of giant firms in information industries.

imputations. More detailed discussion on sources and data set development can be found in appendix one.

If we follow the commonly accepted Clarke and Davies (1983) framework, any change in aggregate concentration can be decomposed into market diversification and market concentration effects. This perspective suggests a potentially useful way to map aggregate concentration developments into changes in the significance of giant firms. But for current purposes the Clarke and Davies framework has two limitations. First, it is based on an aggregate Herfindahl index. It need not follow that the same decomposition applies to an aggregate concentration ratio. Secondly, the Clarke and Davies framework assesses aggregate concentration based on production within a national economy. But it is clear that multinational companies have sales and employment allocated across different economies. It follows that with significant globalising trends, using data based on production within an economy, rather than company based data, drives a wedge between aggregate concentration and the significance of giant firms.

For these two reasons an alternative decomposition of aggregate concentration is presented in appendix two. The decomposition uses a logic similar to that used by Clarke and Davies except that aggregate concentration is measured by a concentration ratio, and firms are viewed in terms of their total size rather than size within a particular economy. Using this approach a 100 firm aggregate concentration ratio is shown to be determined by four factors: (1) market power for primary activities in the home market of the 100 largest firms; (2) the global presence for primary activities of the 100 largest firms; (3) weighted product diversification; and (4) the economic structure of the home economy. These four determinants of aggregate concentration

facilitate an interpretation of changes in concentration ratios in terms of the activities of giant firms.

Using this decomposition to asses the changing significance of giant companies requires data based on total firm size, with each firm allocated to the country that houses the company headquarters. It is clear that for this population of firms, size is not the same as size within a particular economy or particular market. The intention is to use respectively sales and employment aggregate concentration ratios as indicators of output and input developments. That output and input developments might diverge is indicated by discussion in the previous section.

We can recognise that employment concentration is obviously an imperfect indicator of firm size because of differing labour intensities. But in the absence of an adequate measure of firm capital there is little that can be done about this problem. A related point is that the current study uses total revenue not value-added as an output based measure of size. White (2002) argues that total revenue is an inappropriate size indicator because of double counting. In terms of the construction of concentration ratios, double counting is only a problem if GNP or GDP is used as the denominator of the ratios. The turnover concentration ratios reported here are not based on GNP or GDP, instead total gross output is used, as derived from input-output tables. In addition this double counting issue is only significant if we wish to evaluate the contribution of firms to a particular market or economy. This is not the case with aggregate concentration in which we are measuring the significance of firm size not simply economic net contribution.

The discussion in this section is essentially preliminary, or introductory, as it assumes that there is a given population of giant (and non-giant) firms. Any changes in aggregate concentration therefore result from zero-sum changes in domestic and

international competition. In terms of the decomposition presented in appendix one, the industrial composition of an economy is unchanged. Hence changes in aggregate concentration can be directly linked to giant firm activity and explained in terms of changes in monopoly power, global presence and diversification. Later discussion allows for changes in the population of giant firms. The current discussion is undertaken to simplify the development of linkages between discussion in the previous section and changes in aggregate concentration.

Figure 4 here, see end.

Possible linkages between earlier and current discussion can be presented in terms of the simple framework suggested in figure 4. In a rather stylised manner we can distinguish between output and input concentration increases and decreases. Cell 1 suggests a continuation of characteristic 'old economy' trends. Giant firm development would be characterised by increasing seller concentration and/or global presence and/or diversification. This possibility would imply a subordinate role for smaller firms. Of course this would not preclude the local relevance of smaller firms in particular industries or regions. Evidence consistent with cell 2 would indicate the general relevance of small/medium firm networking and decline of giant firms. Cell 3 defines a situation of reduced input concentration, involving for example reduced vertical integration or more generally diversification, but not reduced market power or global presence because of increased output concentration. We can, therefore, characterise cell 3 as giant firm dominated networks, involving the importance of subcontracting etc., along with no real competitive challenge from smaller firms. Cell 4 involves increased input concentration and reduced output concentration. In terms

of earlier discussion this defines a defensive strategy with giant firms investing in dynamic capabilities that can result in increased diversification and/or global presence. But the reduction in output concentration implies that such investment might have either (a) little long-run viability because of domestic and/or international competition or (b) have a complementary relationship with smaller firms. The former possibility suggests a transitional arrangement between cells 1 and 2 whereas the latter is potentially stable but suggests a downgrading of the importance of giant firms.

Tables 1a-1d here, see end.

Tables 1a-1d report 20, 50 and 100 firm aggregate concentration ratios for the UK, USA and Europe. The US ratios are consistent with data reported in White (2002). Using consolidated company data, i.e. the same as that used here, the latter study reports that the employment share of the largest 500 companies declined from 21.2 per cent to 15.4 per cent over the period 1980-97. This reduction for 500 firms is consistent with the change from 11.9 to 8.6 reported in table 1b. The relative sizes of the 500:100 firm shares for 1980 and 1997 are constant at 1.8. For Europe the results in tables 1c and 1d are not inconsistent with results presented by de Jong (1993). He shows that the contribution of the largest 100 European industrial firms to GDP declined by approximately 10 percentage points over the period 1982 to 1990. This result is consistent with the smaller changes of 3.6 and 3.9 points shown in tables 1c and 1d as the denominators of the EU sales concentration ratios used here are clearly larger than GDP; in addition the wider coverage of firms used here, that includes the financial sector, may be significant.

In terms of the ranking of concentration levels, the UK is highest, followed by the USA with Europe being lowest for both turnover and employment. The relative concentration levels in the UK and USA reflect a continuation of the position in the 1970s, as provided by the Prais (1976) and White (1981) studies that use value-added in manufacturing, and the more recent evidence in Hughes and Kumar (1984); although the inclusion of financial companies here, and their absence in the earlier studies, may be significant. The low level of aggregate concentration for EU countries is consistent with the low concentration in West Germany in the 1970s as discussed in Davies and Lyons (1996). In addition, the decline in concentration, when tables 1c and 1d are compared, indicates the relatively lower aggregate concentration in Austria, Belgium, Finland, Luxembourg and Sweden, compared to the EU7 countries of Denmark, Germany, Spain, France, Italy, Netherlands and Portugal.

Figure 5 here, see end.

Using the framework set out in figure 4, figure 5 uses the 100 firm results reported in table 1a-1d and shows that the experiences in the UK, USA and EU are different apart from the important fact that there is no continuation of old economy dominance. Hence only at a very basic level, i.e. movement away from cell 1, are the results reported here consistent with a 'new economy' thesis because these initial conclusions suggest that there is no single evolutionary trajectory. One possible explanation for these differences might be that giant firms in the UK, EU and USA are different simply because they are different sizes. For instance US giant firms may be 'more giant' than those in the UK and hence the two data sets may not be comparable. This possibility is explored in tables 2a–2b.

Tables 2a and 2b here, see end.

It can be seen in table 2a that, in terms of average employment, the top 100 is smallest in the UK and approximately the same size in the EU and USA. Hence the different changes in aggregate employment concentration in the USA and EU cannot be explained simply in terms of different firm sizes. In addition the similar changes in aggregate employment concentration in the UK and USA seems unaffected by the different firm sizes. The important similarity for these two countries, identified in table 2a, involves reductions in giant firm employment, whereas for EU firms there has been increased employment. With size measured by sales, shown in table 2b, the UK has, once again the smallest giant firms. In addition, when the UK and USA are compared the average size difference seems to have widened. It is also apparent from this table that at the start of the period US giant firms were clearly the largest whereas by 1997 the gap between the US and EU average had largely closed. In short, it seems that we cannot account for the differences identified in figure 5 simply in terms of size differences. Hence any explanation must lie elsewhere.

4. Giant Firm Mobility

Obviously the populations of giant firms in the UK, EU and USA are not static. With a narrow definition of the 'new economy' we might expect an introduction of ICT-based companies. If a broad or systemic definition is appropriate new technologies might also support the development of new giant firms in non-ICT activities, for instance in the finance sector. In terms of our general decomposition of aggregate concentration provided in appendix two, the development of an information economy

will affect the industrial structure. Hence even with constant market concentration levels, global presence and diversification, aggregate concentration can change. To analyse the possible impacts here we will initially examine the overall importance of giant firm mobility, which is indicated in table 3.

Table 3 here, see end

The US data in table 3 can be compared with that provided by Collins and Preston (1961) and Scherer and Ross (1990) who report exits from the top 100 industrial and distribution firms. The average exit rate for 1909-19 is 4 per year. This declines to 1.5 per year for 1935-48, and increases to 3.0 per year for 1977-87. The data reported here is not inconsistent with a further rise for 1980-97, but the different coverage may be significant involving, in particular the development of giant financial sector firms, as detailed below. Comparing the UK and USA, it can be seen that the UK has significantly lower degrees of mobility for both size measures. If giant firm births are small compared to deaths then, ceteris paribus,[5] we might expect lower domestic market shares and/or globalisation and/or diversification. In these circumstances it follows that greater giant firm mobility will reduce aggregate concentration (or increase it less). This may be part of a general explanation of why the UK has experienced an increase in aggregate sales concentration but the USA a reduction.

With respect to European companies table 3 indicates that mobility is higher for EU12 compared to EU7, signifying greater giant firm mobility for the additional

[5] The *ceteris paribus* assumption here may not be inappropriate. As will be discussed below the USA and UK appear to have similar giant firm populations.

five economies. For firm size measured by revenue, EU7 giant firms have mobility rates approximately the same as for the UK. This similar mobility appears to be associated, in tables 1a-1d, with very different changes in aggregate sales concentration: the UK has a rise and EU7 a fall in aggregate sales concentration. If we use the framework presented in appendix 2, the rise in the UK must be based on increased market power and/or global presence and/or diversification and/or the growth of activities with these characteristics. Given the reduction in employment concentration it is reasonable to place emphasis on the significance of market power in the UK. For EU7 firms there must have been reduced market power and/or global presence and/or diversification and/or the growth of activities with these characteristics. Part of the complexity here might be the different markets that giant firms are involved in. This is a matter considered in detail below. For the moment we can note that the market bases of EU giant firms are somewhat different from those in the UK and USA.

When interpreting the employment figures in table 3 the shorter time period over which the data is measured may be significant. To some extent the per annum figures may be a more useful indicator of employment mobility for Europe. But at the same time we cannot discount the possibility of greater firm births/deaths in the latter part of the 1980-97 period hence biasing upwards the per annum employment, compared to turnover, figures that are based on 1990-97.

The European data indicate an important point concerning the difficulty of drawing general conclusions about the effects of giant firm births/deaths. Per annum mobility measured by employment in Europe is higher than in both the UK and the USA. This has been associated with an increase in EU aggregate employment concentration (see tables 1c and 1d), with an explanation in terms of market power,

globalisation etc being possible. But with size measured by turnover a reduction occurred, implying lower market power etc. This difference is explicable using the data in table 4.

Table 4 here, see end.

With respect to turnover growth rates European giant companies seem to exhibit the same pattern as in the USA in that average firm growth is less than the growth rate of the economy. The UK is the exception here, perhaps reflecting the strong positive impact on turnover growth rates of increasing inequality within the giant firm population combined with relatively slow total gross output growth. But for employment growth rates there is a clear difference between, on the one hand, the UK and USA, and Europe on the other. For the UK and USA, average giant firm employment growth is negative whereas total employment growth is positive, particularly in the USA. But for European companies, positive giant firm employment growth coincides with negative total employment growth. These differences can explain the connections between firm mobility and aggregate concentration changes. The negative overall growth in total EU employment will affect the denominator of the employment concentration ratios in a manner opposite to the considerable growth in EU gross output. In addition, from appendix 2, reduced total employment will amplify the market power etc effects on aggregate employment concentration whereas considerable growth in gross output will dampen the same effects.

The effects of giant firm mobility on aggregate concentration can be further explored by recognising that any change in aggregate concentration will be caused by two different factors. First, continuing giant firms, i.e. those that exist throughout the

interval in question, might change. Secondly, new giant firms can have different characteristics compared to those replaced. It is obvious that these two effects need not exhibit the same trends. To analyse these effects we can decompose concentration ratios and changes in concentration into (1) the part accounted for by continuing firms and (2) the part accounted for by exiting and entrant firms. The results are shown in tables 5a-5d that report the decompositions of the 100 firm aggregate concentration ratios.

Tables 5a-5d here, see end.

For the UK (see table 5a) the increase in aggregate sales concentration is due to both continuing firms and replacement of firms in approximately equal amounts. The decline in employment concentration exhibits the same characteristic. In short, the developing new economy in the UK seems to be exhibiting the same characteristics as the changing old economy. For the USA (see table 5b), the output and input concentration ratio declines appears to be mainly because of continuing giant firms rather than replacement of giant firms. This is consistent with the relative decline of giant firms in the old economy, but less so for the new economy. For the EU (tables 5c and 5d), the decline in aggregate sales concentration is due to continuing firms, with replacement of firms having a marginal increase. The increase in aggregate employment concentration is due to both sets of firms.

Figure 6 here, see end.

This more detailed picture of the changing position of giant firms is summarised in figure 6, where the subscript ‘rep’ refers to replacement firms and the subscript ‘con’ to continuing firms. Two changes are apparent compared to figure 5. Perhaps the most significant concerns EU firms. Continuing firms exhibit ‘defensive’ strategies, but new firms are more like the ‘old economy’ compared to replacements. In addition we can draw attention to the fact that the input concentration is similar for both continuing and replacement firms. If we follow the conceptual framework set out earlier, this conclusion is consistent with EU giant firms investing in dynamic capabilities with the effect or intention of promoting market power, global presence and/or diversification. Furthermore, the fact that replacement firms have not exhibited a decrease in output concentration indicates that, at least for these companies, the investment was not unsuccessful.

For US giant firms the greater detail indicated in figure 6, suggest the following. The relative decline is only clearly apparent for continuing firms. The same decline is less apparent for replacement firms. Given the evidence presented here it is impossible to say if this, relatively minor, difference represents the initial stages of an evolutionary shift towards the UK or EU positions or merely a temporary effect. Some speculation, in this regard, is attempted below when the analysis identifies the particular markets represented by replacement firms. For the moment it can be suggested that the greater output concentration change of replacement, compared to continuing, firms may be simply an indication of successful growth and hence market power etc.

Tables 6a-6d here, see end.

Table 7 here, see end.

One final issue can now be examined: the extent to which the differences and similarities between continuing and replacement firms for the three data sets are due to the different markets and industries involved. Background data to examine this issue is presented in tables 6a-6d and table 7. The former tables identify exits and entrants, for sales and employment, by broad industry groups. The level of detail in tables 6a-6d somewhat masks the overall picture, hence table 7 presents summary statistics. So, for instance, the UK mining and petroleum –5 for the turnover number in table 7 is the difference between 5 exits identified in table 6a and zero entrants; the –17 in the % column for UK mining and petroleum is the difference, in table 6a, between the % total exit turnover (17) and % total entrant turnover (0) for this industry category.

In table 7 the losses appear to be broadly similar across the four data sets but giant firm entrants are somewhat different. The UK and USA appear to be similar. For the UK there appears to be the idiosyncratic development of giant firms in transport, utilities and construction. But apart from this, in both the UK and USA new giant firms have appeared in telecommunications, retailing, finance and services. For the EU giant firm development has been overwhelmingly dominated by financial companies, with telecommunications growth being similar to the USA. Retailing and service giant firms in the EU have declined in significance. This financial dominance in the EU may account for the finding identified above that EU replacement giant firms are closer to 'old economy dominance' than continuing firms; the finance sector may be structurally part of the 'old economy'. In terms of the definitions offered at the start of the discussion, a broad or systemic conception of the information economy would seem to be necessary to account for the evolution of EU giant firms in the new

era, i.e. the inter-linkages between ‘old’ and ‘new’ activities are as important as the ‘new’ activities themselves. If this interpretation is correct, the same principle can be extended to the USA. Finance and retailing have played a significant role in the changing structure of the US giant firm population. But both sectors may be structurally ‘old economy’.

5. Conclusion

This paper has presented an analysis of the potential significance of giant firms in the emerging information economy. The analysis has been both theoretically and empirically driven. In terms of general conclusions we can suggest the following. Using a simple cost-based theoretical framework we can identify significant potential impacts of an emerging information economy on giant firms. But the responses of ‘old economy’ firms in the new environment will depend on the strategies of the firms. The possible differences involved were simplified into two broad types: neoclassical and evolutionary strategies. In addition, for information based giant firms we identified a potential difference between giant firm limited dominance in the early stages of product life cycles but potentially significant dominance at later stages.

In terms of empirical results the only similarity apparent for the UK, EU and USA is movement away from ‘old economy dominance’. But even this is qualified for new EU giant firms that appear to be overwhelmingly dominated by financial companies. For the UK results appear to be consistent with the writing of the sociologist Castells (1996). The changes in aggregate concentration indicate the development of giant firm dominated networks. In addition UK giant firms appear to be the primary agents of change rather than, for instance, following the competitive challenges from smaller firms.

For the USA there appears to be for the whole giant firm population a relative decline but when this is divided between replacement and continuing firms the decline is only clearly apparent for continuations. For new US giant firms a shift towards the UK or EU positions may be expected for two reasons. First, part of the new giant firms population may be structurally old economy, i.e. finance and retailing. In addition, for theoretical reasons we might expect a different short and long-run competitive challenge from smaller firms in information based industries.

For the EU, giant firms appear to be adopting defensive strategies based on investment in dynamic capabilities. The key unanswered question here is whether such strategies are temporary or permanent. For new giant firms, the overwhelming dominance of the finance sector suggests a degree of permanence. More generally this dominance of the finance sector is consistent with the argument presented by Leadbetter (1999) in which non-financial giant firms are likely to be following the challenge from smaller firm competitors. But we can note that this conclusion appears not to apply to the UK and USA. Hence we cannot suggest a general evolutionary trajectory based on European experience.

Appendix One

This appendix details the sources for the data used in the text as well as data set development.

UK

The main source for the UK turnover and employment company data was the Times 1000 List of Companies (Times Books Ltd) for the years 1980 and 1998. But in addition various gaps in the data were covered using company accounts data. The gross output data for 1979 and 1997 was derived from UK input-output tables (Business Monitor PA1004, HMSO 1983; and Office of national Statistics, 1997). The denominator for the employment concentration ratios is UK total civilian employment, as published by Eurostat.

USA

The main source for the USA turnover and employment company data was the Fortune list of companies (Time Warner Publishing), but as with the UK various gaps in the data were covered using company accounts data. The gross output and total civilian employment data for 1980 and 1997 is published by the USA Federal Statistics Agency and downloadable from www.fedstats.gov.

Europe

The European turnover and employment company data was published in the Times 1000 List of Companies (Times Books Ltd). The turnover data was available for 1980 and 1997 the employment data was only available from 1990. To construct the gross output denominators of the turnover concentration ratios European Union input-

output tables were used, as supplied by Eurostat. These were available for 1980 and 1995 for Denmark, West Germany, Spain, France, Italy, Netherlands and Portugal i.e. the EU7 countries used in the text. To extrapolate the data from 1995 to 1997 the growth in GNP at current prices between 1995-97 for each of the seven countries was used (separately) as an adjustment factor. For complete accuracy this procedure assumes that the input-output structure of the economies is unchanged over the 1995-97 period. The calculated 1980 and 1997 gross output for each of the seven countries was transformed from ECUs to £s using the relevant average exchange rate for the year. The GNP and exchange rate data is supplied by Eurostat. The denominator of the employment concentration ratios uses total civilian employment in the EU7 countries. For Germany the 1997 employment data were adjusted to control for the unification of East and West Germany by using the average ratio of the old West German to total German employment for the years 1991, 92 and 93 as published in the OECD Economic Outlook. This average is 0.78.

The EU12 countries are EU7 + Austria, Belgium, Finland, Luxembourg, Sweden. For the EU12 countries input-output data are available 1995. The adjustment to 1997 used the same principles as just outlined. The non-availability of the 1980 data was overcome as follows. For 1997 the ratio of gross output of each of the five additional European countries to the EU7 1997 gross output was computed. This ratio was used to impute the 1980 gross output of the five additional countries using the EU7 1980 total gross output. Basically this procedure assumes that the relative positions of the five additional countries compared to the EU7 countries was unchanged over the 1980-97 period. The EU12 employment concentration ratios were calculated for comparative purposes using readily accessible Eurostat and OECD data as just outlined.

Appendix Two

This appendix sets out a simple framework that identifies the determinants of aggregate concentration. The logic is similar to that used by Clarke and Davies (1983). But two key differences are: (1) that an aggregate concentration ratio is used here rather than an aggregate Herfindahl index; and (2) the framework used here uses actual firm size rather than size in a particular economy.

We can define x_i as the size of the i'th firm and X as the size of the total (home) economy. After ranking x_i from large to small, the 100 firm aggregate concentration ratio can be defined as

$$C_{100} = \frac{1}{X} \sum_{i=1}^{100} x_i$$

Each firm can be viewed as producing in N different product market areas. The size of the i'th firm in the j'th product market is xij. Using x_{i1} as the largest activity, it follows that

$$x_i = x_{i1} + \sum_{j=2}^{N} x_{ij}$$

We can define the standard diversification ratio for the i'th firm

$$D_i = \frac{1}{x_i} \sum_{j=2}^{N} x_{ij}$$

It follows that

$$x_i = x_{i1} + x_i D_i$$

For the largest activity undertaken by the i'th firm we can identify the shares accounted for by the home economy (x^H_{i1}) and the non-home (global) economy (x^G_{i1})

$$x_{i1} = x^H_{i1} + x^G_{i1}$$

Defining X_i as the total (home) size of activity x_{i1}

$$x_i = X_i \frac{x_{i1}^H}{X_i} + X_i \frac{x_{i1}^G}{X_i} + x_i D_i$$

Dividing through by total home economy size (X)

$$\frac{x_i}{X} = \frac{X_i}{X}\frac{x_{i1}^H}{X_i} + \frac{X_i}{X}\frac{x_{i1}^G}{X_i} + \frac{X_i}{X}\frac{x_i}{X_i} D_i$$

Summing over the largest 100 firms and re-arranging

$$C_{100} = \sum \frac{X_i}{X}\left[\frac{x_{i1}^H}{X_i} + \frac{x_{i1}^G}{X_i} + \frac{x_i}{X_i} D_i\right]$$

It follows that the aggregate concentration ratio is determined by

1. Market power for primary activities in the home markets of the 100 largest firms i.e. $\frac{x_{i1}^H}{X_i}$.

2. The global presence for primary activities of the 100 largest firms i.e. $\frac{x_{i1}^G}{X_i}$.

3. Weighted product diversification i.e. $\frac{x_i}{X_i} D_i$

4. The economic structure of the home economy i.e. $\frac{X_i}{X}$.

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Figures

Figure 1

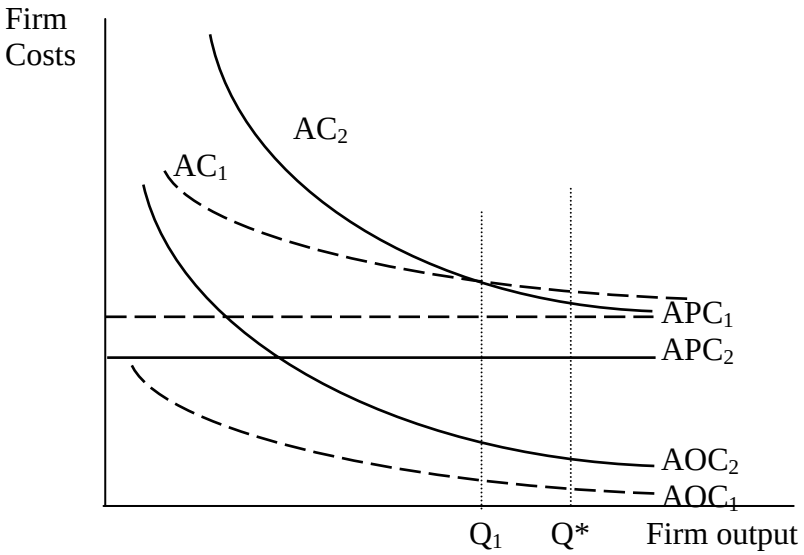

Figure 2

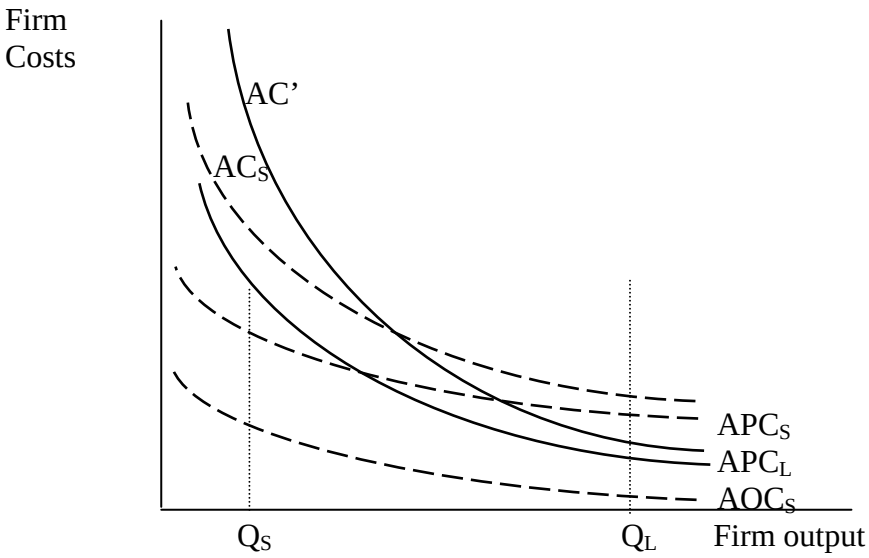

Figure 3

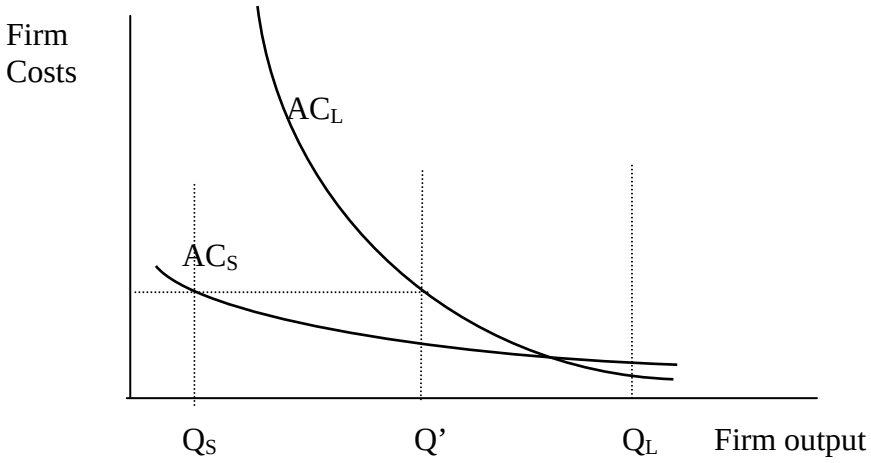

Figure 4

		Output Concentration	
		Increase	**Decrease**
Input Concentration	**Increase**	(1) Old economy dominance	(4) Giant firm defensive strategies
	Decrease	(3) Giant firm dominated networks	(2) Relative decline of giant firms

Figure 5

		Output Concentration	
		Increase	**Decrease**
Input Concentration	**Increase**	Old economy dominance	**EU** Giant firm defensive strategies
	Decrease	**UK** Giant firm dominated networks	**USA** Relative decline of giant firms

Figure 6

		Output Concentration	
		Increase	**Decrease**
Input Concentration	**Increase**	Old economy dominance	**EUrep** **EUcon** Giant firm defensive strategies
	Decrease	**UK** Giant firm dominated networks	**USrep** **UScon** Relative decline of giant firms

Tables

Table 1a

UK Turnover and Employment Concentration

	Turnover			Employment		
	1979	**1997**	**change**	**1979**	**1997**	**change**
C20	0.179	0.181	0.002	0.133	0.083	-0.051
C50	0.256	0.289	0.033	0.209	0.140	-0.069
C100	0.327	0.386	0.059	0.272	0.191	-0.081

Table 1b

USA Turnover and Employment Concentration

	Turnover			Employment		
	1980	**1997**	**change**	**1980**	**1997**	**change**
C20	0.167	0.111	-0.056	0.058	0.042	-0.016
C50	0.244	0.175	-0.069	0.088	0.066	-0.022
C100	0.316	0.244	-0.072	0.119	0.086	-0.033

Table 1c

EU7 Turnover and Employment Concentration

	Turnover			Employment		
	1980	**1997**	**change**	**1990**	**1997**	**change**
C20	0.079	0.047	-0.032	0.047	0.047	0.000
C50	0.119	0.081	-0.038	0.075	0.078	0.003
C100	0.148	0.112	-0.036	0.094	0.102	0.008

Note: EU7 countries are Denmark, Germany, Spain, France, Italy, Netherlands, and Portugal.

Table 1d

EU12 Turnover and Employment Concentration

	Turnover			Employment		
	1980	**1997**	**change**	**1990**	**1997**	**change**
C20	0.070	0.041	-0.029	0.041	0.041	0.000
C50	0.108	0.071	-0.037	0.067	0.069	0.002
C100	0.139	0.100	-0.039	0.086	0.092	0.006

Note: EU12 countries are EU7 plus Austria, Belgium, Finland, Luxembourg and Sweden.

Table 2a

Giant Firm Employment (numbers of employees)

	Max	Min	Range	Mean	Median
UK 1979	410,977	21,943	389,034	68,300	47,261
UK 1997	306,000	18,318	287,682	50,779	42,501
UK change	-104,977	-3,625	-101,352	-17,521	-4,760
USA 1980	1,044,041	48,974	995,067	118,330	82,775
USA 1997	728,000	26,200	701,800	110,835	79,363
USA change	-316,041	-22,774	-293,267	-7,495	-3,412
EU7 1990	374,217	26,015	348,202	90,794	57,252
EU7 1997	378,800	33,260	345,540	98,655	70,141
EU7 change	4,583	7,245	-2,662	7,861	12,889
EU12 1990	374,217	30,379	343,838	95,752	65,863
EU12 1997	378,800	37,214	341,586	101,212	73,639
EU12 change	4,583	6,835	-2,252	5,460	7,776

Table 2b

Giant Firm Sales (£m, current prices)[1]

	Max	Min	Range	Mean	Median
UK 1979	22,706	574	22,132	1,866	1,122
UK 1997	44,731	2,113	42,618	5,887	4,180
USA 1980	43,247	2,018	41,229	5,273	3,359
USA 1997	108,775	8,244	100,531	18,402	13,311
EU7 1980	23,770	773	22,997	2,910	1,786
EU7 1997	82,079	6,181	75,898	15,009	10,716
EU12 1980	23,770	998	22,772	3,093	1,938
EU12 1997	82,079	6,721	75,358	15,213	11,001

Note: 1. All non-UK sales data is transformed into £s using average exchange rates for the relevant year.

Table 3

Exits from the top 100 firms[1]

	UK		USA		EU7		EU12	
	Rev	**Emp**	**Rev**	**Emp**	**Rev**	**Emp**	**Rev**	**Emp**
Number	46	42	59	57	46	29	52	33
No / yr	2.6	2.3	3.5	3.4	2.7	4.1	3.1	4.7

Note: 1. Rev = firm size measured by turnover. Emp = firm size measured by employment.

Table 4

Turnover and Employment Annual Average Percentage Growth Rates[1]

	UK	USA	EU7	EU12
Average giant firm turnover growth	11.97	8.22	24.46	23.05
Gross output growth	9.29	12.40	34.39	34.39
Average giant firm employment growth	-1.43	-0.38	1.24	0.81
Total employment growth	0.32	1.79	-0.01	-0.11

Note: 1. Growth is defined as xt/xt-1 where x is turnover, gross output, or employment, as relevant, and the interval t, t-1 is the relevant data interval.
Source: See appendix 1.

Table 5a

UK C100: births/deaths decomposition

		Turnover				**Employment**	
	Contin-uations	Deaths/ births	total		Contin-uations	Deaths/ births	total
1979	0.221	0.105	0.327		0.166	0.106	0.191
1997	0.252	0.134	0.386		0.128	0.063	0.272
Change	0.031	0.028	0.059		-0.038	-0.043	-0.081

Table 5b

USA C100: births/deaths decomposition

		Turnover				**Employment**	
	Contin-uations	Deaths/ births	total		Contin-uations	Deaths/ births	total
1980	0.182	0.134	0.316		0.070	0.049	0.119
1997	0.133	0.111	0.244		0.049	0.037	0.086
Change	-0.050	-0.023	-0.072		-0.021	-0.013	-0.034

Table 5c

EU7 C100: births/deaths decomposition

		Turnover				**Employment**	
	Contin-uations	Deaths/ births	total		Contin-uations	Deaths/ births	total
1980/90	0.115	0.034	0.148		0.080	0.014	0.094
1997	0.071	0.041	0.112		0.083	0.019	0.102
Change	-0.044	0.007	-0.037		0.003	0.005	0.008

Table 5d

EU12 C100: births/deaths decomposition

		Turnover				**Employment**	
	Contin-uations	Deaths/ births	total		Contin-uations	Deaths/ births	total
1980/90	0.100	0.039	0.139		0.070	0.016	0.086
1997	0.058	0.042	0.100		0.073	0.019	0.092
Change	-0.042	0.002	-0.039		0.003	0.003	0.006

Table 6a
UK Giant Firm Mobility by activity

Activity		**Exits turnover**				**Entrants turnover**				**Exits employment**				**Entrants employment**	
	No.	% total exit turnover	% top 100		No.	% total entrant turnover	% top 100		No.	% total exit employment	% top 100		No.	% total entrant employment	% top 100
Mining, petroleum	5	17.0	5.5						2	14.9	5.8		1	6.0	2.0
Metals, rubber, paper, plastics, glass	7	14.0	4.5		4	5.6	1.9		6	10.4	4.0		2	2.6	0.9
Engineering, vehicles, aero, div. industrial	12	21.9	7.0		3	7.8	2.7		13	27.4	10.7		2	4.9	1.6
Electrical/office/ industrial equip															
Textiles, fibres									4	7.4	2.9				
Food, drink, tobacco, pharm.	9	16.9	5.4		6	13.6	4.7		7	13.0	5.1		8	18.7	6.2
Telecomms					1	7.2	2.5		1	1.0	0.4		1	8.1	2.7
Trans., utilities, construction	2	11.7	3.8		13	22.3	7.6		3	16.6	6.5		10	18.1	5.9
Retailing, wholesaling	7	11.5	3.7		7	12.8	4.4		4	4.2	1.6		9	22.0	7.2
Finance	3	5.8	1.9		8	25.1	8.6		1	2.4	0.9		4	5.7	1.9
Services	1	1.2	0.4		4	5.6	1.9		1	2.7	1.1		5	13.9	4.6
Total	46	100	32.2		46	100	34.4		42	100	39.0		42	100	33.0

Table 6b
USA Giant Firm Mobility by activity

Activity		**Exits turnover**			**Entrants turnover**				**Exits employment**			**Entrants employment**		
	No.	% total exit turnover	% top 100		No.	% total entrant turnover	% top 100		No.	% total exit employment	% top 100		No.	% total entrant employment	% top 100
Mining, petroleum	17	45.6	19.1		4	8.1	3.7		4	5.9	2.4		4	2.9	1.2
Metals, rubber, paper, plastics, glass, chemicals	14	18.0	7.5						13	21.2	8.8		5	7.0	3.0
Engineering, vehicles, aero, div. industrial	3	3.4	1.4		2	2.2	1.0		5	6.9	2.9		2	2.2	1.0
Electrical/office/ industrial equip	7	12.1	5.1		5	10.8	4.9		10	26.0	10.8		4	5.7	2.4
Textiles, fibres															
Food, drink, tobacco, pharm.	8	9.2	3.9		7	9.4	4.3		13	17.5	7.2		9	11.9	5.1
Telecomms					8	12.0	5.5						7	10.5	4.5
Trans., utilities, construction	4	4.8	2.0		4	4.7	2.1		5	9.3	3.8		4	5.6	2.4
Retailing, wholesaling	5	5.9	2.5		9	19.7	9.0		6	11.5	4.8		8	31.5	13.6
Finance	1	1.0	0.4		15	26.4	12.0		1	1.7	0.7		9	9.1	3.9
Services					5	6.7	3.1						5	13.6	5.9
Total	59	100	41.9		59	100	45.6		57	100	41.4		57	100	43.0

Table 6c
EU7 Giant Firm Mobility by activity

Activity		**Exits turnover**			**Entrants turnover**				**Exits employment**			**Entrants employment**		
	No.	% total exit turnover	% top 100		No.	% total entrant turnover	% top 100		No.	% total exit employment	% top 100		No.	% total entrant employment	% top 100
Mining, petroleum	3	6.3	1.4		1	2.4	0.9		3	6.4	1.0				
Metals, rubber, paper, plastics, glass, chemicals	12	32.0	7.3		2	3.7	1.4		8	20.0	3.0		2	6.0	1.1
Engineering, vehicles, aero, div. industrial	6	14.4	3.3		3	4.5	1.7		3	11.1	1.7		3	7.1	1.3
Electrical/office/ industrial equip	4	6.7	1.5						1	3.2	0.5		1	2.5	0.5
Textiles, fibres	1	1.6	0.4												
Food, drink, tobacco, pharm.	4	8.8	2.0		1	1.2	0.4		2	4.2	0.6		1	4.1	0.8
Telecomms	2	3.9	0.9		4	15.1	5.6						2	15.1	2.8
Trans., utilities, construction	5	8.9	2.0		3	5.9	2.2		7	32.3	4.9		3	9.4	1.7
Retailing, wholesaling	9	17.4	4.0		3	5.6	2.1		3	9.8	1.5				
Finance					29	61.6	22.7						17	55.8	10.4
Services									2	13.0	2.0				
Total	46	100	22.8		46	100	37.0		29	100	15.2		29	100	18.6

Table 6d
EU12 Giant Firm Mobility by activity

Activity		**Exits turnover**			**Entrants turnover**				**Exits employment**			**Entrants employment**		
	No.	% total exit turnover	% top 100		No.	% total entrant turnover	% top 100		No.	% total exit employment	% top 100		No.	% total entrant employment	% top 100
Mining, petroleum	6	13.2	3.7		1	2.1	0.9		2	4.9	0.9				
Metals, rubber, paper, plastics, glass, chemicals	19	36.6	10.4		2	3.2	1.4		8	19.0	3.5		4	9.2	1.9
Engineering, vehicles, aero, div. industrial	6	15.2	4.3		4	5.6	2.3		3	8.7	1.6		4	8.3	1.7
Electrical/office/ industrial equip	4	5.4	1.5						3	7.8	1.4		1	2.2	0.5
Textiles, fibres	1	1.2	0.3												
Food, drink, tobacco, pharm.	2	4.5	1.3		2	4.4	1.9		1	2.6	0.5		2	5.4	1.1
Telecomms	2	2.9	0.8		5	14.6	6.1		1	2.5	0.5		2	13.1	2.7
Trans., utilities, construction	3	4.9	1.4		5	8.3	3.5		8	33.0	6.1		5	14.0	2.9
Retailing, wholesaling	9	16.1	4.5		5	7.4	3.1		5	11.3	2.1		1	2.7	0.6
Finance					28	54.4	22.8						14	45.1	9.4
Services									2	10.2	1.9				
Total	52	100	28.2		52	100	42.0		33	100	18.5		33	100	20.8

Table 7
Changing structure of giant firm populations.

Activity	Turnover								Employment							
	UK		USA		EU7		EU12		UK		USA		EU7		EU12	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Mining, petroleum	-5	-17.0	-13	-37.5	-2	-3.9	-5	-11.1	-1	-8.9	0	-3.0	-3	-6.4	-2	-4.9
Metals, rubber, paper, plastics, glass, chemicals	-3	-8.4	-14	-18.0	-10	-28.3	-17	-33.4	-4	-7.8	-8	-14.2	-6	-14.0	-4	-9.8
Engineering, vehicles, aero, div. industrial	-9	-14.1	-1	-1.2	-3	-9.9	-2	-9.6	-11	-22.5	-3	-4.7	0	-4.0	+1	-0.4
Electrical/office/ industrial equip			-2	-1.3	-4	-6.7	-4	-5.4			-6	-20.3	0	-0.7	-2	-5.6
Textiles, fibres					-1	-1.6	-1	-1.2	-4	-2.9						
Food, drink, tobacco, pharm	-3	-3.3	-1	0.2	-3	-7.6	0	-0.1	+1	+5.7	-4	-5.6	-1	-0.1	+1	+2.8
Telecomms	+1	+7.2	+8	+12.0	+2	+11.2	+3	+11.7	0	+7.1	+7	+10.5	+2	+15.1	+1	+10.6
Trans., utilities, construction	+11	+10.6	0	-0.1	-2	-3.0	+2	+3.4	+7	+1.5	-1	-3.7	-4	-22.9	-3	-19.0
Retailing, wholesaling	0	+1.3	+4	+13.8	-6	-11.8	-4	-8.7	+5	+17.8	+2	+20.0	-3	-9.8	-4	-8.6
Finance	+5	+19.3	+14	+25.4	+29	+61.6	+28	+54.4	+3	+3.3	+8	+7.4	+17	+55.8	+14	+45.1
Services	+3	+4.4	+5	+6.7					+4	+11.2	+5	+13.6	-2	-13.0	-2	-1.9