

# Changes in European Industrial Organisation in Response to the Single European Market Programme

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## ***Abstract***

The Single European Market Programme was formally instigated with the Single European Act in 1987. It included around 300 measures designed to eliminate non-tariff barriers to trade (e.g. border controls, national standards, public procurement biases and national restrictions on entry). The essence of our approach is that barriers to trade/competition influence the organisation of the market (industrial concentration, multinationality of the operations of firms, and vertical integration). As those barriers are removed, we should observe the emergence of new organisational structures that are more appropriate to an integrated EU market. We identify the theoretical mechanisms through which these changes can be expected to take place, and argue that these differ according to the endogeneity of specific assets. The empirical part of the paper first reviews some of our earlier work on early changes in concentration and multinationality; then a more detailed case study of railway rolling stock brings out some of the inter-relationships between horizontal and vertical integration. This work is currently being extended to include eight further case studies.

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## **1. Introduction**

The Single European Market Programme was formally instigated with the Single European Act in 1987. It included around 300 measures designed to eliminate non-tariff barriers to trade (e.g. border controls, national standards, public procurement biases and national restrictions on entry).

The aim was to implement the whole package by the beginning of 1993, though in practice many measures took a lot longer put in place. In fact, 12.8% of all the detailed measures (directives) were still not implemented in one or more member states by June 1999. Although this was down from 18.2% a year before, the figures relating to telecommunications, transport, IPRs, and public procurement each still exceeded a third. Nevertheless, most member states had only between 2-5% of directives still to implement, and after much prevarication by member states, completion of the programme is at least in sight.

The attempt to create a Single European Market (SEM) represents an unusual experiment in changing the framework within which firms compete. Consequently, it provides a natural test of the effect of market integration on the organisation of firms. The essence of our approach is that barriers to trade and competition influence the organisation of the market (measured in our case by industrial concentration, multinationality of the operations of firms, and vertical integration).

As those barriers are removed, we should observe the emergence of new organisational structures that are more appropriate to an integrated EU market. We identify the theoretical mechanisms through which these changes can be expected to take place, and argue that these will differ according to the endogeneity of specific assets.

The rest of the paper develops this theme. Section 2 maps out the basic theoretical expectations

for concentration in the context of only production economies of scale. Section 3 develops the argument for markets in which firms invest in R&D and advertising as important competitive weapons (i.e. where there are endogenous sunk costs). Section 4 extends the framework to include vertical structure. The empirical part of the paper is in two parts. Section 5 summarises some of our previous work on market structure in the EU. This helps establish an understanding of EU industrial structure as it stood in 1987, at the beginning of the SEM programme; and the changes that took place between 1987-93 as the SEM was slowly established, and firms began to organise on the expectation of its implementation. Section 6 presents a more detailed case study of railway rolling stock which brings out some of the inter-relationships between horizontal and vertical integration, and traces changes up to the present. This work is currently being extended to include eight further case studies.

## **2. Theory of Concentration, Production Economies of Scale, and Integration**

The level of EU concentration is not a historical accident, resulting from luck, entrepreneurial success, and random mergers. Although these forces undoubtedly have a temporary effect, long-term market structure is determined by the interaction of technology and competition. If we begin by restricting ourselves to considering price as the only form of competition, the three most important economic factors are economies of scale relative to the size of the market, the toughness of price competition, and the extent of international integration.

*Economies of scale:* the greater are the savings due to large scale production relative to the size

of the market, the greater is the market share necessary for firms to break even at any given price. Put simply, there is less room for profitable firms to survive. In Figure 1, this relationship is represented by the upward sloping break-even line,  $(N, S, c) = 0$ , where  $N$  is the number of firms,  $S$  is market size, and  $c$  is a measure of fixed production costs.

*Price competition:* as a general principle, price is driven closer to marginal cost if there are more firms in a market. However, because of different histories, capacities, product differentiation and transparency of prices, different industries will differ in their >degrees of collusion= (or the >toughness= of competition *for any given number of firms*). If the nature of price competition is fierce, then even a small number of rivals will drive prices close to marginal cost, while more collusive pricing will allow a substantial price-cost margin to be sustained, even in the presence of a relatively large number of firms. The relationship between price and the number of rivals, for a particular toughness of competition, is represented by the pricing line  $P = f(N)$  in Figure 1.

In an industry of market size  $S$ , which has symmetric firms, no entry barriers and toughness of competition represented by  $f(N)$ , the industry will settle at a market structure with  $N_0$  firms each charging price  $P_0$ . This simple model can be used to highlight some of the key determinants of a more concentrated market structure:

- X Tougher price competition: this shifts the  $f(N)$  line downwards, reducing price for any given  $N$ , and so allowing fewer firms to survive profitably in the market.
- X Smaller market size: this shifts the break-even line upwards. Fewer firms can survive and, although price rises, the equilibrium structure must be more concentrated.
- X Larger economies of scale: this is conceptually identical to a smaller effective market size.

- X Barriers to entry: the  $(N, S, ) = 0$  line represents the *maximum* N that can survive in the market. However, barriers to entry that give incumbent firms an advantage will allow a more concentrated structure to be immune from the further threat of entry. If barriers do not affect the toughness of competition, the equilibrium could be anywhere along that part of the pricing line lying above and to the left of the break-even line.
- X Asymmetries between firms: if firms differ in their cost structures, locational or historical advantages, this will result in asymmetries in market shares and a reduced number of firms. The break-even constraint applies only to the smallest or least efficient, most marginal firms.

This background sets the context in which we are able to analyse horizontal market structure and integration.

*International integration:* market integration has two long-term impacts. a) The market size effect of raising both the potential geographical customer base for each firm, and the relevant geographical level at which concentration should be measured (if it is to be relevant for competitive analysis); and b) the toughness of competition effect, which shifts the industry onto a new  $f(N)$  line. These effects are discussed in more detail below. It is also important to note that structural adjustment to integration takes time, and this needs to be taken into account in any empirical analysis.

The effects of integration on market structure are illustrated in Figure 2. We need to take care with interpretation. Suppose, for simplicity, that the toughness of competition is the same in each

country (i.e. each has the same function,  $f(N^k)$ ) and we start from a set of unintegrated markets of similar size,  $S^k$ . The break-even line for each market is  $(N^k, S^k) = 0$ , where  $N^k$  is the number of firms in market  $k$ , and the total number of firms in the EU is  $N^E$ . The unintegrated equilibrium results in  $N_0^k$  firms with price  $P_0$  in each market, and a total of  $N_0^E$  firms in the EU.

X Market size effect: if the elimination of major barriers to trade (e.g. national standards/regulations) results in all firms raising their horizons to consider the whole of the EU as their potential customer base, there will be a new break-even line,  $(N^E, S^E) = 0$ . If there was no effect on industry price, then the industry might continue to break even with the same number of firms as initially in all the member states together (i.e. moving from A to B in Figure 2). However, assuming no change in the toughness of competition, then the fact that more firms are now facing each other means that prices will fall (i.e. moving from B to C in Figure 2). This reduces profitability in the market, resulting in the exit or consolidation of firms until a new equilibrium is reached at D, with fewer EU firms than before and lower prices.

X Toughness of price competition effect: the above dynamics assume this is constant, but in reality that is unlikely. Initially, it may weaken. Until *full* integration is achieved, although the integration process brings more firms into direct competition with each other, the remaining barriers to trade (e.g. different currencies) are likely to cloud the effectiveness of that competition - a Madrid-based firm is not immediately as effective a rival in Hamburg as is one in Hanover. Thus, a given number of firms in a partially integrated market will result in less effective competition than the same number would in

a fully integrated one (i.e.  $P = g(N^E)$ ) will lie above  $P = f(N^k)$ ). On its own, however, such a clouding effect could not result in higher prices than in the initial equilibrium, because the introduction of more rivals from other member states cannot directly weaken existing national competition (i.e. E lies below and to the left of B). Of course, anticipating the greater reach of competition, firms may build international alliances, going as far as full mergers, in order to soften the blow of competition and to ensure that they do not become one of the firms that is forced to exit. While mergers may be part of the natural structural adjustment to achieve economies of scale in the anticipation of fiercer competition, if allowed early by competition authorities, they may raise prices until the measures behind the SEM become fully effective. Despite these short-run possibilities, the later stages of effective integration are likely to lead to greater toughness of competition, rather than less (i.e. shifting the pricing line down to  $P = h(N^E)$ ). Consumers and professional arbitrageurs can more easily compare prices and exploit price differences, greater geographical distance between firms makes coordination more difficult, integration interrupts a history of cosy inter-firm relations, and pre-integration differences between member states (i.e. different  $f(N^k)$  functions) introduces heterogeneity in business cultures and the most competitive naturally dominates a market.

Thus, integration has two quite distinct effects on price competition, and so on market structure. First, it brings more firms into direct competition with each other (the market size effect). Second, it affects the underlying mode of competition that those firms engage in (toughness of price competition). In terms of structural change in industries characterised by predominantly price competition, which we call *Type 1 industries*, the increase in competition is expected to raise

both EU and national concentration.

Although this category of industries is characterised by predominantly price competition, the same broad analysis applies if there are firms which have *exogenous specific assets* (i.e. those that were historically acquired, and which require no further investment to maintain). Thus, products may be differentiated, but there is no significant competition in endogenously chosen advertising, R&D, etc, that could raise fixed costs associated with market success. In such industries, for well understood transaction cost reasons favouring technology transfer within the firm, transport and other trading costs may favour international production over export, and this may be reversed post-SEM. However, if the specific asset is unchanging (e.g. an established patent), technology transfer may be relatively efficiently achieved by a licensing agreement. Overall, the multinationality of firms in Type 1 industries post-SEM will generally remain relatively low and stable.

### **3. R&D, Advertising and Integration**

The mechanisms discussed in section 1 are applicable to all industries, but they need modifying in industries which engage in forms of competition characterised by investment in endogenous fixed costs (e.g. R&D, advertising). The important characteristic of such industries is that higher spending on, say, product R&D improves customer willingness to pay because perceived quality is improved. This has two effects of immediate interest for horizontal integration. First, price now depends on perceived quality as well as the number of rival firms. Second, higher fixed costs raise the break-even price for any given market size and number of firms.

In terms of our diagram, both the pricing and break-even lines shift upwards with greater spending on endogenous fixed costs. Both shifts suggest that prices will rise, but the net effect on the number of firms is not obvious. Sutton (1991) shows that if the increased spending is due to an increase in market size, then as that market size becomes infinitely large, the curve shifts exactly match each other such that the number of firms is insensitive to market size. This case is illustrated in Figure 3, where the increase in market size raises the incentive to invest in endogenous fixed costs from  $E_0$  to  $E_1$ . However, before reaching that limit, an increase in market size may either raise or reduce the number of firms in equilibrium, depending on the degree of production economies of scale and the sensitivity of willingness-to-pay to changes in fixed cost spending.

How does economic integration affect this competitive mechanism? The key issue is the extent to which the benefits of such expenditures apply over the wider geographical area. Start with R&D. New products and processes are typically applicable internationally, often with only minor adaptation to meet local requirements.

If existing, pre-SEM local standards and other non-tariff barriers did not substantially affect the international applicability of the core results of investing in R&D, further integration may have little effect on concentration. However, the extent of multinational production may change. For example, innovating firms may set up international production facilities (i.e. become multinational) to jump over tariffs; or they may set up joint-ventures with a local firms. In such purely horizontal cases, the main effect of market integration may be for multinational firms to consolidate their

production facilities in order to benefit from production economies of scale and the lowest cost local inputs. If, for transaction cost reasons, the firm had preferred licensing its technology to local firms, there may be an apparent increase in EU concentration if production is brought back in-house. However, the market was already integrated as far as R&D is concerned, so there would be no further competitive escalation of R&D. We call *these Type 2Rint industries*, where technology was international in nature even pre-SEM,.

In other industries, where there were substantial barriers to local production (particularly through strong public procurement bias), member states had developed their own national technologies and pre-integration market structures. Integration can then bring about a very major competitive escalation of R&D, and competitive shake-out of firms, as each tries to achieve the best product in the newly integrated market. EU concentration will rise, and the impact on national concentration will depend on the pattern of comparative advantage and the incidence of multinational firms. For example, higher EU concentration may be achieved either by the merger of several national firms, or by international mergers. The former raises national concentration, while the latter does not (though multinationality obviously does rise). We call these *Type 2Rnat industries*, where technologies had diverged pre-SEM along national lines.

Advertising differs from R&D in that it is typically dependent on national media, culture and language. Competition in advertising levels therefore tends to be limited geographically to the member state. In practice, many advertised products (e.g. packaged foods) also have large inherent transport costs which do not disappear with integration. In such cases, integration which allows greater ease of access by a particular brand (e.g. the mutual recognition of national

regulations) will encourage national producers with the best national products to exploit them across the EU by acquiring geographically dispersed local production facilities. Advertising intensities and national concentration may change little (it may rise if there is much MNE entry, or fall if MNEs introduce new aggressive marketing techniques to previously low advertising markets), but EU level concentration will rise due to the development of multinational activity. We these *Type 2A industries*, where national marketing expenditures are important for competition.<sup>1</sup>

TABLE 1 HERE

The expectations of organisational changes for these different combinations of initial barriers, incentive to invest in endogenous assets, and international applicability of such assets, are summarised in Table 1.

#### **4. Single Market and Vertical Structure**

The horizontal and vertical structures of industry are linked through the effects of economies of scale and the incentives to invest in firm specific assets. For example, if a larger market size allows firms to grow and so to achieve economies of scale through their own internal demand for a specialised component, then *ceteris paribus* the balance of transaction costs swings in

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<sup>1</sup> Advertising intensive industries without substantial transport costs, however, may experience a reduction in the multinationality of production by those firms that could achieve economies of scale by consolidating production and switching post-SEM to export provision to other member states (e.g. soaps and detergents?).

favour of integrated production rather than buying-in (Williamson, 1986; Lyons, 1996).<sup>2</sup>

The second horizontal-vertical relation comes through the incentive to invest in R&D and other endogenous specific assets. The way these incentives change has already been discussed in section 3. For example, an increase in market size can initiate a competitive escalation in R&D, and the knowledge created can be subject to substantial transaction costs if it is transferred between organisations. The usual contractual problems therefore favour vertical relationships closer to integration rather than more arms-length market relationships for the purchase of inputs. Thus, incentives for horizontal and vertical integration move in the same direction when raised by the prospect of a larger market.

Much of the regulatory reform under the SEM can be captured under these mechanisms. For example, the elimination of trade barriers or the reduction of public procurement bias both widen market access, and so affect both the ability to achieve economies of scale and the incentive to invest in R&D.<sup>3</sup> However, the harmonisation of product standards requires more careful treatment as it can have different effects according to whether it is of a form that creates: a) entirely standardised product specification; or b) basic quality requirements and essential basic parameters, within which a differentiated product may be developed. While both types encourage the achievement of economies of scale by opening up a larger effective market size, they do so in entirely different ways. Harmonisation of type a) reduces product specificity,

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<sup>2</sup> For project based industries (e.g. major capital equipment), where different combinations of components or activities are required for each project, the form of integration may stop short of full ownership and settle on some hybrid form such as a joint-venture or a consortium.

<sup>3</sup> Although not always part of the European Commission's programme for the SEM, the liberalisation of entry also affects vertical organisation through the same underlying mechanisms of: changing expected market size (e.g. new domestic entry may reduce the expected size of each firm, and so encourage vertical separation); and changed

and facilitates a wider range of both customers and rival suppliers. This reduces the degree of asset specificity for both sides to the trade and allows specialist suppliers to produce for the market (i.e. external demand). Harmonisation of type b) widens market access but still allows firms to develop their own designs and qualities. The consequent proprietary technologies and firm-specific idiosyncracies encourage a more vertically integrated market structure, with in-house production to meet internal demand. Most of the SEM harmonisation programme has been of type b.

Finally, international vertical integration within the EU (vertical multinationality) is likely to increase for all industry types as the problems of transferring inputs across borders are reduced, so firms can source inputs from a wider set of locations which may have some competitive advantage.

## **5. Empirical Background**

In this section, we summarise some of our previous work on market structure in the EU with a view to establishing:

- a) an understanding of EU industrial structure as it stood in 1987, at the beginning of the SEM programme (relevant results are to be found in Davies, Lyons et al, 1996, hereafter D&L);
- b) the changes that took place between 1987-93 as the SEM was slowly established, and

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incentives to invest in overhead costs such as R&D or advertising (e.g. these may increase in order to deter high quality entry, or possibly decrease if an equilibrium structure of many small firms is anticipated).

firms began to organise on the expectation of its implementation (see Davies, Rondi & Sembenelli, 1998, hereafter DRS).

### *EU Concentration*

Table 2 (D&L Table 6.1) shows that EU concentration was very much lower than in the USA at the time. For Type 1 industries (i.e. those which engage in neither advertising nor R&D), the US 4-firm concentration ratio was over twice that in the EU. This could be explained by the EU either being much less integrated, or having less tough price competition. Consistent with the supranational nature of most R&D, however, industries which engaged in significant R&D competition had concentration levels much closer to that in the USA.

TABLE 2 HERE

Two aspects of our econometric analysis of the determinants of EU concentration are of interest in the current context. First, we found that industries with low levels of intra-EU trade (i.e. less trade-integrated industries) also had lower levels of EU concentration; so increased trade that comes with integration can be expected to raise concentration. Second, industries engaging in R&D or advertising competition had concentration levels which were much less sensitive to market size than were other industries (i.e. consistent with a less extreme version of the effect summarised in Figure 3). As expected, the lack of sensitivity to market size was particularly pronounced in relation to R&D.

Table 3 (DRS Table 7) shows that during the anticipated implementation period, 1987-93,

concentration grew most strongly in industries that the European Commission's own *ex ante* study had found potentially most sensitive to the SEM. The growth of about 10% (or 3 % points) is quite striking over a six year period. The disaggregation by initial trade intensity confirms that, excluding essentially non-traded products, most change happened in the industries which for some presumably institutional reason had previously been little traded. Perhaps most interestingly, there was little change in the R&D intensive industries, which must have been dominated by those which were already setting their R&D at international levels. There was a modest growth of concentration in type 1 industries, but the largest growth by industry type was in type 2A (which advertise but do not engage in R&D). This is consistent with a strong early impact of international deregulation across a range of particularly food industries.

### ***Multinational Production Within the EU***

D&L ch 7 shows that, in 1987, multinational operations within the EU tended to be more pronounced in markets characterised by product differentiation (and associated with high R&D and/or advertising.) However, in the case of advertising-intensive industries, it appeared that cross-border production occurred *in place of* intra-EU trade, while for R&D intensive industries, multinational activity was more likely to occur *alongside* high trade flows. This illustrates the danger of equating integration simply with high trade flows - firms may be competing on the European stage without necessarily trading across member state borders.

Another significant finding for present purposes was shown in D&L (ch 13). In trying to understand the effect of very powerful barriers to trade, we separated type 1 and national

technology industries<sup>4</sup> subject to public procurement bias, and compared them with Type2Rint industries that were also subject to public procurement bias in 1987.<sup>5</sup> We found the striking result that where this bias existed, it raised the incidence of multinationals in Type2Rint sectors well above the average for R&D intensive industries, as firms sought to exploit international economies of scale in R&D while satisfying the requirement for local production. However, in type 1 and national technology industries, there was a complete absence of multinational activity in the presence of public procurement bias as firms found no incentive to try to break into local markets. As argued earlier, we would expect to see both of these unravel as public procurement bias is suppressed, with the affected Type2Rint sectors beginning to consolidate production to exploit production economies, and efficient Type 1 and national technology firms being able to operate internationally without any residual bias against foreign owned firms. As it happens, between 1987 and 1993, there was a substantial increase in multinationality across *both* groups, and it seems that at that time, global trends outweighed the early, and very patchy moves towards the elimination of public procurement bias.

More generally, we found that between 1987 and 1993, intra-EU multinationality [DRS, Table 16] has increased for all industry types. The strongest increase is associated with advertising intensive industries, which is probably due to the reduction in regulatory discrimination against foreign brands. The least effect was in R&D intensive industries, presumably because they were already the most multinational.

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<sup>4</sup> Boilers and containers, shipbuilding, and rail rolling stock.

<sup>5</sup> Pharmaceuticals, computers, insulated cables, electrical machinery, telecommunications and measuring equipment, aerospace, and medical instruments.

## **6. A Case Study of Railway Rolling Stock**

The purposes of this case study, which is the first of eight currently being conducted, are: to illustrate the ways in which structural adjustment has taken place; to consider the vertical dimensions of organisational change; and to bring the measurement of horizontal structural changes up-to-date. Railway rolling stock represents an industry that started with national technologies, but with substantial potential for innovation (i.e. Type 2Rnat). National organisation had been fashioned by a very strong history of public procurement bias and consequently was left with internationally divergent product standards. The SEM introduced some important measures designed to integrate these previously national markets and there were also some important regulatory changes in related downstream and horizontally related industries.

### ***Technological Trends***

Following a period of relatively slow technical change, the pace of innovation has been growing rapidly, including: high speed and tilting trains; computer controlled equipment and communications; three phase drives; use of lightweight materials such as aluminium and carbon fibres; lightweight propulsion systems; radial steering wheel bogies; signalling and safety systems; more comfortable trains. The Japanese are also developing magnetic levitation systems and satellite operation, which suggests innovations are unlikely to slow down in the near future. Technical change has halved the life-cycle of rail stock from 30-40 years to 15-20

years.

### ***Demand Trends***

Rolling stock demand is derived from that for rail services. The existence of monopoly national rail service operators resulted in few customers for rolling stock, each with idiosyncratic requirements, and placing infrequent, lumpy orders. This means that mass production has not developed and production economies of scale are small (though this might change with technical harmonisation).

Three main growth areas have been evolving: high-speed trains; urban transit systems; and to a lesser extent, combined road-rail haulage. Urban transit systems are likely to account for the highest share of demand in the medium term. Expectations of future demand for high-speed trains have been raised by European Council Resolution (91/C33/1). Although non-binding, it identifies fourteen priority high-speed rail links for the Trans-European High-Speed Rail Network, which is supposed to be implemented by 2010. F, D, I and E are at the forefront in setting up high-speed train systems.

### ***Regulatory Reform***

Long-standing relationships between national clients and national firms mean that the full effects of deregulation are likely to be slow to emerge. Meanwhile, this strongly suggests the shortcut of mergers as a strategy to speed up structural adjustment without the difficulties of

breaking into a resistant national client base. The first three of the following directives address public procurement bias, and the next two harmonise standards to allow inter-operability between different national railway systems.

*Utilities Directive* (90/531, in force since 1/1/93) imposes four requirements on public procurement contracts: information, non-discriminatory specifications, transparency and fairness.

*Remedies Directive* (92/13, in force since 1/1/93; except for E, Gr and P) gives rights to suppliers to ensure implementation of Utilities Directive.

*Service Directive* (93/38, in force since 1/7/94; except for E, Gr and P) applies to the opening of R&D contracts which affect the competitive award of subsequent contracts.

*Development of the Community Railways Directive* (91/440) requires the separation of accounts for the management of railway infrastructure from those for the operation of railway services. There is no similar compulsion to separate the two physically or institutionally, though this is possible (e.g. UK). The idea is that an infrastructure access charge will cover costs, while allowing competitive access by any authorised operator.

*Interoperability Directive* (draft in 1997) harmonises, through mandatory standards, national regulations and technical specifications relating to rolling stock. These are being devised by 80 experts, half appointed by the rail operators, and half by the manufacturers.

Further regulatory reforms in downstream and downstream competitor industries also have an impact on rail rolling stock. Rail service operators are facing more competition both from: ownership restructuring and freer entry directly into rail services; and from deregulation of road freight (e.g. cabotage) and airlines (e.g. more open access to routes previously monopolised by national carriers). Such pressures have encouraged rail operators to focus on their core activities, and separate from previously integrated activities such as rolling stock design and maintenance. Thus, there have been push factors behind vertical integration in rolling stock, as well as pull factors deriving from direct regulatory reform of that industry itself.

### *Horizontal Amalgamations*

One consequence of the long history of association between national firms and national rail operators has been lack of standardisation and the development of idiosyncratic national technologies. This has necessitated acquisition or consortia as the means of entry into foreign markets. It is not possible unambiguously to attribute changes to the SEM programme, but it is striking that the major reorganisation of the industry began as soon as the SEA was signed.

During the late 1980s, many firms merged into national groups (e.g. in B, 27 firms in 1960s down to just two; France down from 17 to eight in 10 years), but only two international groups were formed. Bombardier (Can) acquired BN (B), and ASEA (Swe) merged with BBC (Swi) to form

ABB (in 1988). Big national groups included Alsthom/CGE (F), BREL (UK), Siemens (D) and AEG/Daimler-Benz (D). In 1989, most European countries still had a rail rolling stock industry (except L, Ire, Gr and Ne). In Germany (D), six main manufacturers were all divisions of powerful private groups. In I (e.g. EFIM and Fiat-Ferrovarya) and UK (e.g. BREL and GEC), state owned and private firms competed, though BREL was shortly to be privatised.

By 1990, three large groups already dominated.<sup>6</sup> GEC- Alsthom (F-UK, rail operations merged in 1989) was mainly in F, B, UK, S and D; ABB (Swe/Swi) was in D, I Swi, Swe, Nor and UK; Siemens (D) was top in UK through a stake in Plessey (UK). Building on an early lead by Alsthom from the successful TGV in F, GEC- Alsthom led the world in high-speed trains, having manufactured 570 by 1994; with Siemens-AEG's ICE consortium having made 120 since 1991.

By 1995, ABB was even more pan-European, with bases in Den, D, I, Ne, P, E, UK (inc. 40% of privatised BREL in UK), Nor, Swe, A, and Swi. GEC- Alsthom had also acquired a majority holding of Linke-Hoffman-Bosch (D), which supplies the ICE consortium. Two major all-German groups had also formed: Siemens with 60% of Duewag and 25% of Krauss-Maffei; and Daimler-Benz joined the rail activities of AEG with Westinghouse (US), and railway building of MBB with MAN. Bombardier (Can) set up Bombardier Eurorail (inc. manufacture of wagons for the Channel Tunnel) having acquired ANF (F) and control of BN (B).

Also by 1995, three high-speed train consortia had been formed: GEC- Alstom (for TGV and its derivatives); AEG-Siemens and ABB (for ICE); and Ansaldo (I), Breda (I), ABB and Fiat (for ETR-500). The bigger two had also linked up with US firms to gain access to the US market: GEC- Alstom with Morrison-Knudsen; and Siemens-AEG with General Motors (to develop new generation lightweight transmission electricdiesel locomotives).

In 1996, ABB and AEG-DB amalgamated to form Adtranz, the largest rail equipment supplier in the EU, employing 23,000, with design, marketing and manufacturing capacity in 40 countries worldwide, and branches in a further 50 countries, giving it a global market share of 11%.

Summarising the major groups:

- Bombardier (Can): the only major non-European entrant; sequence of mergers acquiring capacity in various member states.
- Siemens (D) initial strategy of consolidation with German firms, but now broadening international base.
- GEC- Alstom: merger early in the period (1989) between train division of big UK electrical group and CGE's subsidiary responsible for the successful TGV. Consolidating with pan-European mergers including in D, E and B, and linking with US market.

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<sup>6</sup> While many of the smaller firms were specialised, the manufacture of locomotives was typically organised in firms that were divisions of giant electrical engineering conglomerates, which suggests there may be some economies of

- ABB: Asea and BBC joined two large electricals groups, both based in non-EU Western Europe, and for each of which rail stock was relatively small. Bought large UK privatised firm (BREL) before going in with Daimler.
- Daimler-Benz: remained mainly German based, though with US links, until joining with pan-European ABB in 1996 to form Adtranz; which the new Daimler-Chrysler took into full control in 1999.

Thus, there have been very substantial rises in national and EU concentration, and the leading firms have changed from being purely national to having very substantial international production capacity. Major driving forces behind the mergers seem to have been: growing demand for HST and urban transit systems; open procurement; prospect of greater standardisation; customer demand for comprehensive capabilities (i.e. design and maintenance as well as production); combination and pooling of technology; prospect of extra-EU competition; access to foreign markets. The sharing of knowledge in joint-ventures, as so often in industrial organisation, has frequently formed a stepping stone before full merger. As standardisation and inter-operability requirements between different national infrastructures and between urban and rail transit become necessary, this will require huge new investments, the importance of specific assets is likely to increase, and these trends will be reinforced.

### ***Vertical Organisation***

The traditional vertical structure of the railway industry was for the rail operators to employ engineers, who designed technical specifications for separate manufacturers to build. With deregulation in, and stronger competition from, road and air, rail operators have focused on their core activity of the provision of rail services; leaving primary design responsibility to the manufacturers. This trend is being reinforced by moves towards standardisation and open procurement, which allow suppliers to achieve economies of scale in supplying several member states.

Another trend driven by the same downstream changes is that suppliers are also being required to maintain rolling stock over its life-cycle, which can account for half of the lifetime cost. Since customers save transaction costs by dealing with just one supplier, the range of activities required of a rail rolling stock system supplier is being transformed from that of almost a subcontractor to an ‘integrator’ (i.e. either a fully integrated enterprise or a consortium under a lead firm). In practice, the industry structure has been evolving into several tiers. At the top are a few, very large, system suppliers who deal directly with rail operators, and who undertake design, procurement of subsystems and life-cycle maintenance (e.g. Adtranz and GEC-Alsthom). Beneath them, are subsystem suppliers who are becoming more specialised; and who subcontract to other suppliers of individual parts and components. The multinational operations of the system suppliers has been driven both by the horizontal desire to break into national markets, and the vertical search for partners with the best technology to incorporate into their range of products and systems.

## **7. Conclusions**

We have argued that it should not be expected that the SEM programme will change the organisation of all European industries in same broad manner. Factors such as the types of non-tariff barriers that are removed, the endogeneity of specific assets, degree of production economies of scale, residual transport costs, and inter-industry linkages, should all influence the nature of reorganisation. We have developed a theoretical framework to take such factors into account. The empirical picture that is emerging strongly supports a fine-grained approach to the effects of a change in the regulatory regime. Some industries have remained relatively untouched, while others have experience radical restructuring . Although our empirical work is still not compete, early results suggest that reorganisation is following the lines suggested by our theoretical framework.

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**Table 1 The SEM and Expected Changes in Industrial Organisation**

	CEU	Cnat	M	V
Type 1	+	+	O	O
Type 2A	+	-	+	O
Type 2Rint	O	+	-	+
Type 2Rnat	+	+	+	+

*Notes:* CEU = EU concentration; Cnat = member state concentration; M = intra-EU multinational production; V = vertical integration of firms.

**Table 2 Relative EU and US Four-Firm Concentration Ratios in 1987**

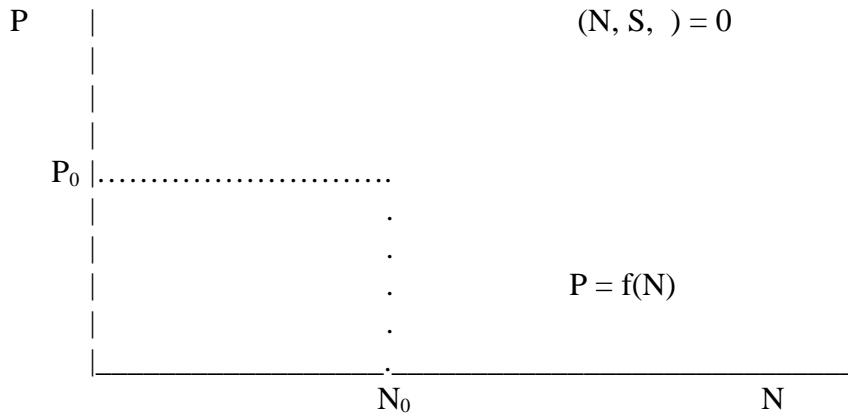
	Type 1	Type 2A	Type 2R	Type 2AR
C4US/C4EU	2.08	1.67	1.15	1.27
C4US-C4EU	13.5	14.7	4.8	9.6

*Notes:* No distinction was made between Type 2Rint and Type 2Rnat, but a fourth category of industries that both advertised and engaged in significant R&D was separated. 100 3-digit manufacturing industries; with US figures aggregated from 4-digit level taking account of diversification of firms across constituent industries

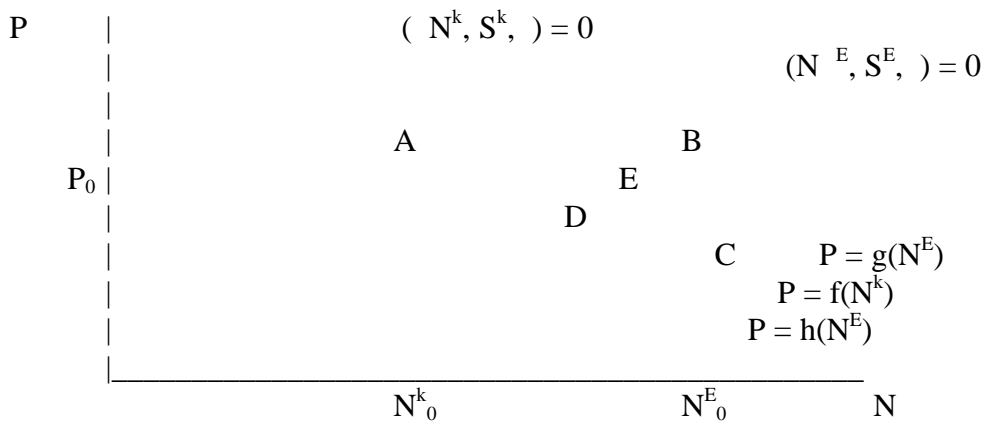
**Table 3 Early Changes in EU Concentration 1987-93**

	1987	1993	% Change 93/87
All Mfc (96 inds)			
Weighted by sales	26.2	25.6	-0.60
Arithmetic mean	24.8	25.7	+0.92
Very sensitive to SEM	29.2	32.4	+3.20
Type 1	16.6	18.0	+1.40
Type 2	31.7	32.2	+0.51
Of which			
Type 2A	23.0	25.1	+2.18
Type 2R	34.2	33.6	-0.58
Type 2AR	41.0	41.5	+0.51
By trade intensity (88 inds)			
High	35.5	34.1	-1.41
Medium-High	32.7	31.1	-1.57
Medium-Low	22.0	25.0	+2.98
Very Low	19.9	21.1	+1.16

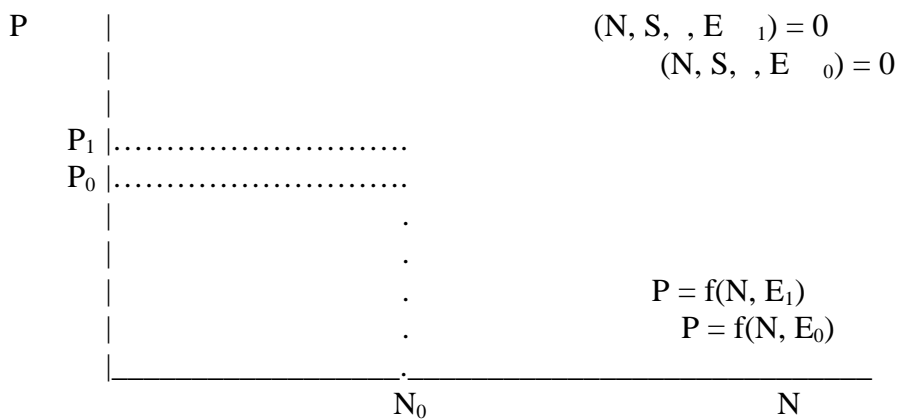
**NOTE: LINES ON FIGURES ARE NOT DRAWN IN THIS WORD FILE**



**Figure 1** *Price Competition and Market Structure*



**Figure 2** *Market Integration and Market Structure*



**Figure 3** *Endogenous Specific Assets and Market Structure*