UK manufacturing industry: international integration and trade performance

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The United Kingdom's trade performance in manufactured goods has been deteriorating for so many years that in a number of important sectors the once large surpluses have virtually disappeared.

One of the most interesting aspects of these trends is that the decline seems to be particularly strong in certain sectors, such as engineering and vehicles, in which the United Kingdom has traditionally done well. Apart from being responsible for a large proportion of UK output and employment, these sectors share a number of characteristics, including a high degree of integration into the world economy.

This article examines the possibility that there may be an important relationship between the extent of an industry's international integration and developments in its trade performance during the 1970s. The analysis uses certain data which have become available only during the last few years. However, it must be emphasised that the data have serious limitations and that, consequently, the results are tentative and suggestive, rather than conclusive.

The industrial concentration of foreign trade

Most of the existing studies analyse the United Kingdom's trade performance and problems within a basically 'classical' framework. This assumes that a large number of UK firms, located in the United Kingdom, compete against a large number of, say, US, West German and Japanese firms, also located in their own countries.

In practice, the United Kingdom's trade performance depends to a considerable extent on a relatively small number of large industrial enterprises. For example, according to a Department of Trade inquiry, 87 enterprises were responsible for no less than half of the country's exports in 1976. The proportion rises to two thirds if the top 260 enterprises are taken into account—see *Trade and Industry*[23].

Another important fact which emerges from the same inquiry is that—if the oil companies and public sector enterprises (other than the British Steel Corporation) are excluded—around 80% of the exports covered by the sample were made by enterprises with international connexions, that is by firms with parent companies overseas and by UK companies with overseas affiliates. Furthermore, about 29% of the United Kingdom's total exports went to related enterprises, though this figure varied appreciably according to the industry and the size of enterprise. The biggest exporters to related enterprises were the motor industry (60% of its total exports), chemical and allied industries (37%) and metal manufacturing and engineering (29%). Taking all industries together, the largest exporters (those with exports of over

£20 million in 1976) sent 35% or more of their exports to related enterprises, compared with 14% in the case of enterprises with exports of under £1 million.

Whether firms with international connexions also feature prominently among UK importers is less certain, as the comparable data are not available. However, most sectors of UK industry are highly concentrated, even by international standards (Hughes[11] and Prais[17]), and large firms nowadays tend to operate as 'multinational', rather than as purely 'national', enterprises. It seems, therefore, very likely that multinational enterprises[1] also account for a high proportion of UK imports. In the United States, where such data are available, slightly over 50% of imports of manufactured goods come from related enterprises. (In other words, intra-firm, or intra-group, trade accounts for half of these imports.) The proportion rises to over 60% in the case of US imports of manufactures from industrial countries (Helleiner [7]). The percentage of UK imports which comes from related enterprises may not be radically different from that estimated for the United States.

Other indirect evidence points in the same direction. The development of international intra-industry trade appears to have been particularly widespread in chemicals and engineering. These industries, which account for a large proportion of UK manufacturing output and trade, tend to have a very high concentration of multinational corporations. The available estimates for the United Kingdom show a very high degree of intra-industry trade in these sectors—see Grubel and Lloyd[6], and Aquino[1].

It is, of course, to be expected that firms which diversify and specialise on a world-wide scale will be much more involved in international trade than firms which produce in a single country. Moreover, as they invariably dominate, because of their size, the industries in which they operate, their involvement in international trade will be reflected in the trade of these industries.

But the real significance of multinational firms is that, as they operate internationally, they are likely to be more sensitive than national firms to changes in the world economic environment, and, consequently, to relative changes in the economic performance of the countries in which they operate. Temporary changes may well influence, among other factors, their decision where to produce most of their output in the short run. The choice is particularly important in conditions of world-wide underutilisation of capacity, such as those existing for most of the 1970s. More permanent changes will influence their long-run investment considerations, such as where to create new capacity and where to run down or discontinue production in existing plants. All these decisions affect output, employment and trade performance of the industries and countries in which they operate.

In the absence of relevant information, it is not possible to analyse in any detail, at present, the effects of such changes on

[1] There are various definitions of what exactly constitutes a multinational enterprise. However, as Dunning[2], pages 290-91, put it:
Since ... an overwhelming proportion of the capital of the affiliates in which MEs have a stake *is* financially controlled by them, we would not go far wrong by considering all companies with a foreign direct investment stake as MEs.

the UK economy. All that can be done is to bring together certain data which have become available over the last few years and to examine tentatively the extent to which some of the observed changes may be associated with them.

International integration of UK industry

The most obvious indicators of the extent to which an industry is integrated into the world economy are the proportion of its output which is exported and the degree of import penetration.

However, given the important rôle which multinationals seem to play in UK trade, it is also relevant to take into account the sectoral distribution of their productive capacity and output. The main problem with an assessment of this kind is that, while the data on foreign participation in UK industry are available for the early 1970s, there are no comparable data for UK participation abroad.

A statistical breakdown of foreign participation by major industrial sectors was first published in the United Kingdom in the 'Census of production, 1971: analyses of foreign enterprises'— see *Trade and Industry*[22] and the appendix to this article. The data are currently available for only three years: 1971, 1973 and 1975. They cover the number of establishments, employment, gross and net output and capital expenditure of foreign-owned firms in the United Kingdom.[1]

It is, therefore, possible to measure the extent of foreign participation in a particular industry as the share of either output (gross or net) or of employment of foreign-owned enterprises compared with all firms in the United Kingdom covered by the official census of production. As the three methods produce similar rankings of industries, only the net output ratio has been used in this study as the measure of foreign participation.

The data present two problems. First, they are published at the highly aggregated level of major industrial sectors in order to avoid the disclosure of data relating to individual firms.[2] This means that the comparative analysis that follows has to be restricted to fourteen broad industrial sectors. Second, in the census of production, establishments are classified on the basis of their major activity. However, given that the data used here relate to very broad industrial sectors, the method of classification is unlikely to distort significantly the analysis that follows.

Table A shows that, although the number of foreign-owned establishments increased in the first half of the 1970s, they still accounted for no more than 2% of all manufacturing establishments in the United Kingdom. However, as foreign enterprises in the United Kingdom are, on average, considerably larger than UK enterprises, they were much more significant in terms of employment. For instance, in 1975 they accounted for 13% of the total labour force in UK manufacturing industry.[3] The relatively large size of foreign

[1] 'Foreign ownership is considered to occur when a company registered abroad holds more than 50 per cent of the share capital of the United Kingdom companies to which the establishments forming the enterprise belong' (*Trade and Industry* [24], page 222).

[2] In two cases, even this level of aggregation creates problems of confidentiality, so that the data for shipbuilding and marine engineering are shown together with those for vehicles; and leather, leather goods and fur are merged with clothing and footwear.

[3] In 1975 the average number of employees per establishment (by nationality of ownership) was: United States 496, EEC 331, other foreign (mainly Canadian, Swiss, Australian and Swedish-owned establishments) 342 and United Kingdom 69.

enterprises, predominantly, as the table shows, of US origin, is further reflected in the fact that in 1975 they were responsible for almost 17% of the net output produced by UK manufacturing industry.

Table A
Foreign participation in UK industry by nationality of ownership

	Establishments (number)			Employment (thousands)			Net output (£ millions)		
	1971	1973	1975	1971	1973	1975	1971	1973	1975
Total in the United Kingdom	**91,443**	**93,952**	**103,778**	**7,506.3**	**7,268.3**	**7,118.7**	**19,334.3**	**25,377.0**	**35,402.9**
of which, majority foreign-owned (by nationality of ownership):									
United States	1,174	1,140	1,327	603.3	623.8	658.2	2,074.0	3,028.3	4,245.8
EEC	249	290	356	102.4	106.8	117.9	321.4	423.2	741.0
Other	283	247	438	99.5	90.9	149.6	321.4	432.6	891.8
Total	1,706	1,677	2,121	805.2	821.5	925.7	2,716.8	3,884.1	5,878.6
Foreign-owned as percentage of total	*1.9*	*1.8*	*2.0*	*10.7*	*11.3*	*13.0*	*14.1*	*15.3*	*16.6*
As percentage of foreign-owned:									
United States	*68.8*	*68.0*	*62.6*	*74.9*	*75.9*	*71.1*	*76.4*	*78.0*	*72.2*
EEC	*14.6*	*17.3*	*16.7*	*12.7*	*13.0*	*12.7*	*11.8*	*10.9*	*12.6*
Other	*16.6*	*14.7*	*20.7*	*12.4*	*11.1*	*16.2*	*11.8*	*11.1*	*15.2*

Source: Reports on the census of production 1971, 1973 and 1975, published in *Business Monitor PA1002;* data are summarised in various issues of *Trade and Industry.*

Table B
Foreign participation and trade by major sectors of UK industry

	Foreign participation (percentage)[a][b]			Proportion of total sales exported (percentage)[a]			Import penetration (percentage)[a]			Net trade ratios		
	1971	1973	1975	1970	1974	1978	1970	1974	1978	1970	1974	1978
Instrument engineering	23	29	27	39	52	56	32	50	56	0.1567	0.0255	0.0039
Chemicals and allied industries	20	23	24	25	34	38	18	27	29	0.1723	0.1390	0.1846
Vehicles	14	22	23	33	41	46	12	25	40	0.5860	0.3490	0.0979
Shipbuilding and marine engineering				31	23	37	43	56	44	0.3550	0.1031	−0.2052
Electrical engineering	19	23	22	21	29	40	17	29	37	0.1357	0.0040	0.0648
Other manufacturing	21	22	22	17	19	20	10	16	18	0.3253	0.0831	0.0778
Mechanical engineering	15	17	19	34	40	44	20	29	31	0.3489	0.2502	0.2812
Food, drink and tobacco	10	13	14	4	6	7	19	21	17	−0.5201	−0.4398	−0.2816
Paper, printing and publishing	3	4	11	7	8	11	18	22	20	−0.4845	−0.5141	−0.3414
Metal goods (not elsewhere specified)	8	8	9	12	14	17	6	10	13	0.0996	0.0707	0.0763
Bricks, pottery, glass, cement, etc.	6	5	7	10	13	15	6	9	9	0.3174	0.1911	0.2556
Textiles	5	5	6	20	26	29	15	25	31	0.1613	0.0139	−0.0532
Metal manufacture	5	7	5	16	17	19	19	24	22	−0.1081	−0.2387	−0.0905
Leather, fur, clothing and footwear	2	2	3	12	13	19	14	21	28	−0.0149	−0.2364	−0.1829
Timber, furniture, etc.	1	1	1	3	5	8	26	32	27	−0.8378	−0.8135	−0.6220

Sources: See Tables A and F.

[a] See the explanatory notes to Table F.
[b] Industries are ranked according to degree of foreign participation (net output measure) in 1975.

The figures in Table B show the extent of foreign participation in each of the fourteen major industrial sectors for which data are available. There is clearly a strong involvement of foreign firms in engineering and chemical industries. This is, in fact, a pattern of inward investment which the United Kingdom shares with other industrial countries in which US multinationals play a prominent rôle—see, for example, Hood and Young[8].

There is an important difference, therefore, as Table C shows, between foreign investment in the United Kingdom and UK investment abroad. Despite a significant increase since the mid-1960s in net UK direct investment abroad in engineering and chemical industries (Dunning[4]), by 1974 57% of UK capital assets abroad were still in 'less technology intensive industries'. The comparable figure for foreign assets in the United Kingdom was 36%.

The data in Table C have serious shortcomings. For example, the level of aggregation is even greater than for foreign participation in the United Kingdom. Moreover, there are enormous conceptual and statistical problems in estimating the value of capital assets wîthin a country (and even more so internationally). Nevertheless, the broad pattern and differences in the distribution of foreign assets in the United Kingdom and UK assets abroad would seem to be confirmed by comparisons based on employment and output data, and to lead to the conclusion that 'one of the distinctive features of

Table C
Manufacturing industry: distribution of UK capital assets abroad and foreign capital assets in the United Kingdom, 1974

Percentages of total

	UK assets abroad	Foreign assets in the United Kingdom
More technology intensive sectors[a]		
Chemicals and allied industries	19.2	15.7
Electrical engineering	11.1	13.6
Mechanical and instrument engineering	8.1	20.6
Rubber	2.5	6.1
Motor vehicles	2.4	8.2
Total	43.2	64.3
Less technology intensive sectors[a]		
Food, drink and tobacco	25.8	11.9
Other manufacturing (including shipbuilding)	12.0	9.1
Paper, printing and publishing	7.3	6.2
Textiles, leather, clothing and footwear	7.2	1.7
Metal manufacture	4.5	6.7
Total	56.8	35.7
Total manufacturing	**100.0**	**100.0**

Source: Triennial census of overseas assets published in *Business Monitor M4,* 1974 Supplement.

[a] Dunning[4] defines 'more technology intensive sectors' as those which 'spent at least 2 per cent of their net output on research and development in 1974...' and 'lower technology intensive sectors' as those which 'spent less than this percentage' (page 8).

UK experience has been the extent to which foreign enterprises entering the domestic market have concentrated in relatively advanced technologies, while UK multinational enterprises have strengthened their position in the "basic" [i.e. low technology] industries' (Houston and Dunning[10], page 23).

In the next section, one possible consequence of this difference will be examined, although only the data on foreign participation in the United Kingdom are used, partly because they are available at a somewhat more disaggregated level, and partly because they seem to be more reliable than the data for UK direct investment abroad.

Trade performance of major industrial sectors

This section examines therefore the degree of association between foreign participation and a number of indicators of trade performance. Three such indicators have been used. They are shown in Table B and are defined in the appendix—see also Wells and Imber[26].

It is important to recall that, when UK trade data are reclassified according to their industrial sectors, the various commodity categories are allocated to those industries of which they are the principal products—see Sellwood[20]. This means, for example, that imports allocated to a given industry will include goods which were not imported by that industry. The definition of industrial sectors used here is so broad that a certain proportion of imports allocated to each industry will almost certainly be 'complementary', i.e. used as inputs in the industry's production. Nevertheless, all of the imports allocated to each industry may be regarded as competitive in the sense that they will be competing with the domestic output of that industry on the domestic market. (There is no such conceptual problem in the case of exports, though some exports allocated to individual industries may not actually be exported by those industries.) Thus, the data provide a rough measure of UK trade in competitive goods by comparing UK exports by exporting industry with UK imports of goods which compete on the domestic market with the domestic output of those industries.

It can be seen from Table B[1] that sectors in which foreign participation is high tend to export a higher proportion of their total sales. This is confirmed in Table D which shows high and statistically significant correlation coefficients between the two variables.

The picture is somewhat less clear in the case of imports. Table D indicates that, although import penetration tends to be high in sectors where foreign participation is high, the correlation coefficients are not as big as in the case of exports, and the one for 1971 is very small and statistically insignificant.

These results do not necessarily imply that foreign participation in UK industry is responsible for higher export ratios, or for a high level of import penetration. For instance, a comparison of the major sectors of UK and West German industries according to their international integration showed a very high and statistically significant correlation between the two, in terms of trade flows in a particular year and of changes

Table D
Correlation coefficients between the degree of foreign participation and different measures of trade performance in selected years

	1971	1973	1975	1978[a]
Foreign participation and:				
Export/sales ratios	0.71	0.78	0.77	0.75
Import penetration	0.27[b]	0.53	0.53	0.56
Normalised net trade balance	0.58	0.51	0.60	0.52

[a] Calculated with reference to foreign participation in 1975.
[b] With the exception of this result, all the coefficients are statistically significant at the 95% or higher levels.

[1] See also Tables F and G in the appendix.

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·in those flows over a longer period—see Maroof and Rajan[13]. It would seem, therefore, that some sectors are more likely, because of certain important characteristics, to be integrated into the world economy than others; and that the expansion of their trade, relative to the rest of domestic industry, will be similar even in countries with as diverse trade performances as the United Kingdom and Western Germany.

Among the characteristics shared by industries in which international trade has grown fast are: considerable scope for product differentiation and economies of scale; rapid technological changes and a high income elasticity of demand for their products; large plants; and a high degree of industrial concentration. These, of course, are also the factors which account for a high proportion of international, especially US, direct investment—see Dunning[2], and Hood and Young[8]. There is, in other words, a tendency for firms in industries engaged heavily in international trade also to invest in productive capacity in other countries. Consequently, these industries will also tend to have a high proportion of multinationals.

However, while it is only to be expected, for all these reasons, that such sectors should trade relatively more, there is no *a priori* reason why the United Kingdom's trade performance should be either better or worse in these industries than in the sectors in which international integration is relatively weak. Yet it appears from Table B that, where foreign participation is high, the net trade ratio tends to be more favourable. This is confirmed in Table D which shows positive and statistically significant correlation coefficients between the two.

The net trade ratio, though a relatively simple indicator, requires a brief explanation. It shows normalised trade balances obtained by relating the net trade balance in products of an industry to total trade (exports plus imports) in these products. Defined in this way, the index can theoretically vary between +1 (in the case of products which the United Kingdom exports but does not import) and −1 (in the case of products which the United Kingdom imports but does not export). In conditions of reasonably free trade, this suggests that, where the ratios are persistently positive, the United Kingdom has managed to build up certain advantages which enable it to run persistent surpluses in these particular products. Alternatively, continuous negative ratios imply that the United Kingdom is suffering from disadvantages, for whatever reason, in the production and trade of such goods. To the extent that the ratio changes over a period of time from +1 to zero the country appears to be losing advantages which it has enjoyed in foreign trade; and a drop from zero to −1 suggests that its disadvantages in international trade are increasing. The opposite is, of course, implied by changes in the reverse direction.

Interpreted in this way, the correlation coefficients in Table D (and the ratios in Table B) suggest that those industries in which the United Kingdom's foreign participation is high tend to enjoy certain advantages which enable them to have a relatively more favourable trade balance. It is by no means certain, however, that foreign multinationals are mainly responsible for this—even though such a conclusion appears to be supported by Dunning's[3] finding that US firms in the United Kingdom tend to export a higher proportion of their

output than·domestic firms; and by similar findings reported for other industrial countries (Dunning[2]). But these studies almost invariably compare export performance of foreign firms with that of all domestic firms engaged in an industry, irrespective of whether they export or not. When an attempt was made in a study of the UK mechanical engineering industry to compare firms engaged in foreign trade, the results turned out to be quite different. Contrary to expectations, it was found that foreign subsidiaries had lower labour productivity and exported less, though they were larger than indigenous firms (Solomon and Ingham[21]).

It is clear from Table B that important changes were taking place in many sectors during the 1970s in the proportion of output exported, the degree of import penetration and the net trade ratio. Where the import penetration ratio is rising and the net trade ratio is static or rising, the change can be interpreted as an indication of increasing specialisation within that industry. This seems to have happened, for example, in the case of chemicals and mechanical engineering products. But in some cases the growth of exports has failed to match increases in import penetration and the net trade performance has deteriorated sharply. Vehicles and textiles provide clear examples of such deterioration in trade performance.

To test for these possibilities, changes in the net trade ratio during the 1970s were regressed on the average level of foreign participation. The results are reported in Table E. They suggest that, during a period in which the trade performance of UK industry was generally declining,[1] exports increased more slowly relative to imports, in goods produced by the sectors where foreign participation was higher than the average for manufacturing industry. Consequently, these sectors have experienced the biggest deterioration in their trade balances.

Although the estimated coefficient for the period 1971–75 has a sign consistent with this conclusion, it is not statistically significant at the 95% level. However, for 1975–78 the coefficient is statistically significant. The evidence, therefore, seems to point to the development of certain adverse trends, in the latter half of the 1970s, in the trade performance of the sectors with high foreign participation.

Possible explanations

The main conclusion to emerge from the preceding analysis is therefore this: although those sectors of UK industry in which international participation is high still tend to have relatively more favourable trade balances than the rest of industry, it is in these sectors that the biggest deterioration in trade performance appears to have occurred during the 1970s.

As emphasised earlier, these results need to be interpreted with some caution. The number of observations is small and the period over which the changes were examined is relatively short.

Nevertheless, the main conclusion is not inconsistent with other studies concerning UK economic and trade performance. For example, it was pointed out in the early

Table E
Regressions of changes in net trade balance on the average level of foreign participation

	Constant	Foreign participation[a]	$\bar{R}^2$	F ratios	SEE	RSS
1971–75	−0.32 (2.02)	−0.09 (1.48)	0.08	2.18	0.21	0.55
1975–78	−0.42 (2.95)	−0.17 (3.03)	0.39	9.18	0.19	0.44
1971–78	−0.75 (2.84)	−0.26 (2.56)	0.30	6.53	0.35	1.48

t-ratios are in parentheses.

Note: There are twelve degrees of freedom in each equation.

[a]   Average of foreign participation in 1971, 1973 and 1975.

[1]   This general decline is indicated by the sign of the estimated constant terms in the simple regression equations.

1970s that there was a tendency for UK exports to do least well in those products for which world demand was increasing most rapidly (Panić and Rajan[16]). These are normally the goods which tend to have a high income elasticity of demand; and it was suggested a few years ago (Panić[14]) that it is such products which have made the United Kingdom's propensity to import unusually high. Most of them tend to be produced by engineering and chemical industries, i.e. 'high technology' sectors.[1]

There are, of course, many explanations which could be offered for these changes. It might be argued, for example, that the relatively slow growth of the world economy since the early 1970s has had a particularly adverse effect on demand and output in those industries which are highly integrated internationally. In fact, with the exception of vehicles, most of the sectors in the top half of Table B experienced a faster rate of growth of output in the 1970s than UK manufacturing industry as a whole, as indeed they had done during the previous two decades. There might consequently be a temptation to attribute the observed decline in their trade performance to inadequate productive capacity in the United Kingdom. However, the limited available evidence indicates that most sectors of UK industry were working with much wider margins of spare capacity in the 1970s than during the previous decade (Panić[15]). The coexistence of spare capacity and deteriorating trade performance might, in turn, lead to suggestions that the latter was caused by adverse changes in, say, cost competitiveness. But the existing evidence shows that, in fact, virtually all the measurable indices of competitiveness improved during the period covered by this study. Moreover, the deterioration in competitiveness which took place at the end of the period could not have influenced the results significantly because of the lags with which such changes affect the trade account, especially exports (Enoch[5]).

It is more likely, therefore, that the observed deterioration may represent the outcome of certain longer-term developments. As pointed out earlier, the sectors which are highly integrated internationally tend to be dominated by a relatively small number of firms, most of which operate in more than one country. This means that it is open to them to decide, in order to maximise their global returns, which plants to use more intensively at any particular time, and where to expand their productive capacity over a period of time.

Among the factors likely to affect these decisions, the most important would seem to be: the relative growth (actual and/or potential) of a market; the relative efficiency with which productive facilities are used, or likely to be used; relative profitability; continuity of supply; and relative stability, i.e. predictability of economic developments and policies—see Dunning[2], and Hood and Young[8].

Such detailed evidence as there is has tended to draw attention to the weaknesses of UK industry in a number of these areas. Thus, a comparison of productivity levels in subsidiaries of a number of multinationals in major industrial countries concluded that it was lowest in the United Kingdom (Pratten[18]). Similarly, profitability of foreign direct

[1] According to a recent study (Saunders[19], pages 83 and 84 respectively), the UK exporters of engineering goods 'have been moving progressively down-market in relation both to German and French exporters ...'. Consequently, the United Kingdom 'tends to export cheap and import dear (using these terms to denote "quality" rather than price)...'.

investment appears to have been lower in the 1970s in the United Kingdom than in Western Europe and North America—see Dunning[4], and Hood and Young[9]. International comparisons of profitability need to be interpreted with extreme caution. Even so, the surveys of the behaviour and performance of multinational corporations would seem to support the conclusion of a widening gap in profitability between operations in the United Kingdom and abroad (Houston and Dunning[10], and Hood and Young[9]). Moreover, the inflationary pressure, which has been stronger in the 1970s in the United Kingdom than in many other industrial countries, may have reduced, by the uncertainties that it has generated, the relative attractiveness of the United Kingdom as a production base.

In fact, there have been sharp increases in *net* direct UK investment in Western Europe and North America during the 1970s, especially in high technology sectors. There appear also to have been substantial divestments, in the early part of the decade, by multinationals in the United Kingdom, particularly by those of US origin—see Van Den Bulcke *et al*[25].[1] As the US investments tend to be mainly in high technology sectors, it is in these sectors that most of the divestment has probably taken place.

The observed changes in trade performance may well reflect these developments. In a survey of the investment intentions of the leading UK multinationals, carried out by Houston and Dunning in 1974 and covering the period 1972/73 to 1977/78, it was pointed out that 'UK companies are planning to service their new or expanded European markets mainly from continental bases. This, when coupled with the evidence that continental firms are servicing their UK markets more through exports than from production facilities in the UK, is somewhat discouraging for the future growth of the UK economy' (Houston and Dunning[10], page 342). But, on a more optimistic note, they also concluded (page 343) that 'the absolute level of investment [by multinationals] in the UK would increase if the UK could move on to a growth path again'; and that it is this 'rather than attempts to control the activities of UK multinationals abroad, [that] would do most to promote production in the UK.'

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[1] At least some of this must have been done by corporations which invested in the United Kingdom in the 1960s expecting a marked improvement in the country's rate of growth during the next decade (Jensen[12]).

Appendix

This appendix sets out more fully the results referred to in the text and adds explanatory detail.

Data used in the study

The percentage foreign participation in major sectors of UK industry was calculated as the ratio of the net output of foreign-owned firms in each sector to the net output of all firms in each sector. Data relating to the net output of foreign-owned firms in the United Kingdom and of all firms in the United Kingdom, analysed by major sectors of industry, were extracted from the 'Report on the census of production, summary tables', issued as *Business Monitor PA1002*. These statistics have been reproduced in various issues of *Trade and Industry*. The complete data are available for 1971, 1973 and 1975.

Estimates of UK exports and imports of goods, analysed by major sectors of UK industry, were first published in the February 1975 issue of *Economic Trends*. Since then, they have been issued regularly in *Business Monitor M10*, 'Overseas trade analysed in terms of industries'. These statistics have also been reproduced in various issues of *Trade and Industry*. Annual data for the years 1971 to 1978 were used in this study.

Estimates of the export/sales ratios and import penetration ratios of the major sectors of UK industry were first published in the August 1977 issue of *Economic Trends*. Since then, they have been issued regularly in *Business Monitor MQ12*, 'Import penetration and export sales ratios for manufacturing industry'. Data for the years 1971, 1973, 1975 and 1978 have been used in this study.

Tables F and G, below, present the basic data relating to the major sectors of UK manufacturing industry.

Table F

Trade by major sectors of UK industry[a]

	1970	1971	1972	1973	1974	1975	1976	1977	1978
Export/sales ratio (percentage)[b]									
Instrument engineering	39	43	45	47	52	55	56	56	56
Chemicals and allied industries	25	27	27	28	34	32	34	37	38
Vehicles	33	37	34	37	41	45	46	47	46
Shipbuilding and marine engineering	31	31	33	30	23	39	34	36	37
Electrical engineering	21	22	23	24	29	34	37	40	40
Other manufacturing industries	17	18	16	17	19	19	20	20	20
Mechanical engineering	34	37	38	37	40	44	45	44	44
Food, drink and tobacco	4	4	4	6	6	6	6	6	7
Paper, printing and publishing	7	8	7	8	8	9	10	11	11
Metal goods (not elsewhere specified)	12	13	11	13	14	15	16	17	17
Bricks, pottery, glass, cement, etc.	10	11	10	11	13	14	13	15	15
Textiles	20	21	21	23	26	24	26	29	29
Metal manufacture	16	18	16	16	17	17	18	20	19
Leather, fur, clothing and footwear	12	11	11	12	13	13	16	20	19
Timber, furniture, etc.	3	3	3	3	5	5	6	8	8
Import penetration ratio (percentage)[c]									
Instrument engineering	32	35	39	45	50	52	54	54	56
Chemicals and allied industries	18	19	19	22	27	23	25	27	29
Vehicles	12	16	19	24	25	28	32	38	40
Shipbuilding and marine engineering	43	51	57	57	56	59	39	48	44
Electrical engineering	17	17	21	27	29	28	32	35	37
Other manufacturing industries	10	11	12	15	16	14	15	17	18
Mechanical engineering	20	20	23	27	29	28	29	29	31
Food, drink and tobacco	19	19	19	21	21	19	18	19	17
Paper, printing and publishing	18	17	17	18	22	20	22	22	20
Metal goods (not elsewhere specified)	6	6	7	9	10	10	11	11	13
Bricks, pottery, glass, cement, etc.	6	5	5	7	9	8	8	9	9
Textiles	15	18	19	22	25	25	26	28	31
Metal manufacture	19	19	18	20	24	21	24	23	22
Leather, fur, clothing and footwear	14	15	17	20	21	22	26	26	28
Timber, furniture, etc.	26	26	24	29	32	24	28	27	27
Net trade performance ratio ($-1 <$ ratio < 1)[d]									
Instrument engineering	0.1567	0.1725	0.1190	0.0476	0.0255	0.0529	0.0389	0.0391	0.0039
Chemicals and allied industries	0.1723	0.2044	0.1761	0.1594	0.1390	0.1996	0.1897	0.2157	0.1846
Vehicles	0.5860	0.5007	0.3634	0.3030	0.3490	0.3573	0.2781	0.1891	0.0979
Shipbuilding and marine engineering	0.3550	0.3160	0.3281	0.1461	0.1031	0.4721	0.3160	0.3178	−0.2052
Electrical engineering	0.1357	0.1578	0.0582	−0.0663	0.0040	0.1237	0.1049	0.0916	0.0648
Other manufacturing industries	0.3253	0.2890	0.1693	0.0807	0.0831	0.1795	0.1728	0.1101	0.0778
Mechanical engineering	0.3489	0.4140	0.3519	0.2323	0.2502	0.3303	0.3189	0.3214	0.2812
Food, drink and tobacco	−0.5201	−0.4866	−0.4870	−0.5001	−0.4398	−0.3746	−0.3930	−0.3822	−0.2816
Paper, printing and publishing	−0.4845	−0.4289	−0.4455	−0.4535	−0.5141	−0.4371	−0.4409	−0.3700	−0.3414
Metal goods (not elsewhere specified)	0.0096	0.1414	0.1171	0.1234	0.0707	0.0458	0.1352	0.1036	0.0763
Bricks, pottery, glass, cement, etc.	0.3174	0.3820	0.3016	0.2676	0.1911	0.3150	0.3135	0.3030	0.2556
Textiles	0.1613	0.0922	0.0425	0.0280	0.0139	−0.0093	−0.0267	0.0039	−0.0532
Metal manufacture	−0.1081	−0.0233	−0.0764	−0.1383	−0.2387	−0.1498	−0.1793	−0.1067	−0.0905
Leather, fur, clothing and footwear	−0.0149	−0.1248	−0.1706	−0.2618	−0.2364	−0.2697	−0.2223	−0.1433	−0.1829
Timber, furniture, etc.	−0.8378	−0.8164	−0.8218	−0.8621	−0.8135	−0.7226	−0.7031	−0.6238	−0.6220

Sources: *Business Monitor M10* 'Overseas trade analysed in terms of industries' and *Business Monitor MQ12* 'Import penetration and export sales ratios for manufacturing industry'.

[a] Industries are ranked according to degree of foreign participation (net output measure) in 1975.

[b] Export/sales ratio is the ratio of exports to manufacturers' total sales (= home sales + exports).

[c] Import penetration ratio is the ratio of imports to total home demand (= home production + imports − exports).

[d] Net trade performance ratio is $(X_i - M_i)/(X_i + M_i)$ where X_i = exports, M_i = imports by industrial classification.

Table G

Output and trade by major sectors of UK industry[a]

£ millions

	Net output of all UK companies	Exports by industrial classification[b]	Imports by industrial classification[b]	Net trade by industrial classification[b]
1971				
Instrument engineering	381.5	248.8	175.6	73.2
Chemicals and allied industries	1,919.5	926.4	612.0	314.4
Vehicles	1,787.0	1,545.7	514.3	1,031.4
Shipbuilding and marine engineering	363.8	113.7	59.1	54.6
Electrical engineering	1,850.9	715.8	520.7	195.1
Other manufacturing industries	854.6	258.7	142.7	116.0
Mechanical engineering	2,623.9	1,545.0	640.3	904.7
Food, drink and tobacco	2,730.1	553.8	1,603.7	−1,049.9
Paper, printing and publishing	1,671.9	188.1	470.6	− 282.5
Metal goods (not elsewhere specified)	1,277.8	766.1	576.3	189.8
Bricks, pottery, glass, cement, etc.	914.2	151.4	67.7	83.7
Textiles	1,230.1	536.7	446.1	90.6
Metal manufacture	1,350.4	632.1	662.3	− 30.2
Leather, fur, clothing and footwear	751.0	183.4	235.7	− 52.3
Timber, furniture, etc.	649.4	36.9	365.0	− 328.1
1973				
Instrument engineering	413.8	323.7	294.3	29.4
Chemicals and allied industries	2,377.4	1,313.8	952.6	361.2
Vehicles	2,597.4	1,904.4	1,018.7	885.7
Shipbuilding and marine engineering	463.0	159.6	118.9	40.7
Electrical engineering	2,332.1	1,004.8	1,147.4	− 142.6
Other manufacturing industries	1,104.6	331.3	281.8	49.5
Mechanical engineering	3,070.8	1,738.6	1,081.9	656.7
Food, drink and tobacco	3,431.3	784.2	2,353.3	−1,569.1
Paper, printing and publishing	2,176.5	253.0	672.9	− 419.9
Metal goods (not elsewhere specified)	1,601.5	1,357.7	1,059.5	298.2
Bricks, pottery, glass, cement, etc.	1,134.1	201.3	116.3	85.0
Textiles	1,645.4	783.0	740.3	42.7
Metal manufacture	1,887.2	783.9	1,035.6	− 251.7
Leather, fur, clothing and footwear	919.3	248.0	423.9	− 175.9
Timber, furniture, etc.	1,015.4	54.0	729.3	− 675.3
1975				
Instrument engineering	631.8	527.5	474.5	53.0
Chemicals and allied industries	3,343.4	2,239.2	1,493.9	745.3
Vehicles	3,473.0	3,012.2	1,426.4	1,585.8
Shipbuilding and marine engineering	630.0	235.1	84.3	150.8
Electrical engineering	3,338.2	1,863.2	1,452.9	410.3
Other manufacturing industries	1,531.4	522.5	363.5	159.0
Mechanical engineering	4,746.4	3,181.3	1,601.4	1,579.9
Food, drink and tobacco	4,772.1	1,261.0	2,771.5	−1,510.5
Paper, printing and publishing	2,877.7	398.1	1,016.3	− 618.2
Metal goods (not elsewhere specified)	2,260.3	1,804.7	1,646.6	158.1
Bricks, pottery, glass, cement, etc.	1,519.5	322.5	168.0	154.5
Textiles	1,944.4	933.2	950.8	− 17.6
Metal manufacture	2,352.3	1,088.1	1,471.5	− 383.4
Leather, fur, clothing and footwear	1,264.6	347.9	604.8	− 256.9
Timber, furniture, etc.	1,238.9	105.0	652.0	− 547.0

Sources: *Business Monitor PA1002* 'Report on the census of production', for 1971, 1973 and 1975; and *Business Monitor M10* 'Overseas trade analysed in terms of industries'.

[a] Industries are ranked according to degree of foreign participation (net output measure) in 1975.

[b] Exports are broadly by exporting industry: imports, however, are by category of goods imported, not by importing industry—i.e. they are by industry of production in the countries of origin.

Throughout the study, variables for use in econometric estimation have been constructed with fourteen observations which relate to the following major sectors of UK industry: food, drink and tobacco; chemicals and allied industries; metal manufacture; mechanical engineering; instrument engineering; electrical engineering; shipbuilding, marine engineering and vehicle manufacture; metal goods not elsewhere specified; textiles; leather, fur, clothing and footwear; bricks, pottery, glass, cement, etc.; timber, furniture, etc.; paper, printing and publishing; and other manufacturing industries. The data are therefore cross-sectional. Data relating to coal and petroleum products were omitted from the analysis on the grounds that the rapid rise in North Sea oil production and its effects on refining activity would have distorted the results.

Significance levels for econometric results

With fourteen observations and two independent variables (including the constant), the significance levels are:

	99%	97½%	95%
F-ratio	9.3	6.6	4.8
t-ratio (one-tailed test)	2.68	2.18	1.78

Regressions of different measures of trade performance in selected years on the degree of foreign participation

The coefficients of correlation between the various measures of trade performance and the degree of foreign participation referred to in the text and quoted in Table D are calculated from the following variables:

$$\text{Percentage foreign participation} = \frac{\text{net output of foreign-owned firms in each UK industry}}{\text{net output of all firms in each UK industry}};$$

Export/sales ratio = X_i/total sales of each UK industry;

Import penetration ratio = M_i/total home demand for the products of each UK industry; and

Normalised net trade balance = $(X_i - M_i)/(X_i + M_i)$,

where X_i and M_i are exports and imports respectively of the products of each UK industry and 'total home demand' is output minus exports plus imports.

The relationship between foreign participation and trade performance may also be shown by regressing the latter on the former. The results of regressing export/sales ratios and import penetration ratios on the degree of foreign participation are given in the following table:

Dependent variable	Independent variable	Constant	$\bar{R}^2$	F	SEE	RSS
XGP1	RNP1 114.5 (3.51)	7.0 (1.63)	0.47	12.3	9.1	1,002.1
XGP3	RNP3 107.1 (4.28)	6.1 (1.54)	0.57	18.3	8.5	876.2
XGP5	RNP5 139.5 (4.23)	4.4 (0.83)	0.56	17.9	10.4	1,289.8
XGP8	RNP5 134.4 (3.96)	7.7 (1.51)	0.53	15.7	10.7	1,361.4
MGP1	RNP1 26.2 (0.96)	14.9 (4.17)	0.00	0.9	7.6	694.5
MGP3	RNP3 52.8 (2.16)	15.4 (3.97)	0.23	4.7	8.3	834.5
MGP5	RNP5 65.6 (2.16)	14.4 (2.94)	0.22	4.7	9.6	1,095.4
MGP8	RNP5 79.6 (2.33)	16.3 (2.95)	0.25	5.4	10.7	1,384.1

t-ratios are in parentheses.

where:

RNPx = percentage foreign participation (measured by net output) in major sectors of UK manufacturing industry in year 197x.

XGPx = exports/sales ratio of major sectors of UK manufacturing industry for year 197x.

MGPx = import penetration ratio of major sectors of UK manufacturing industry for year 197x.

In the case of the normalised net trade ratio, it turns out that the fit of the regression is better if the variable is transformed into logs. However, clearly $\frac{X-M}{X+M}$ cannot be transformed as it stands, since the ratio may be non-positive. Now $\frac{X-M}{X+M} = \frac{X}{X+M} - \frac{M}{X+M}$. Thus, in the log formulation, instead of the variable $\log(\frac{X-M}{X+M})$, the variable $[\log(\frac{X}{X+M}) - \log(\frac{M}{X+M})]$ was tested. This variable reduces, of course, to $\log(\frac{X}{M})$. The correlation coefficients between $\log(\frac{X}{M})$ and $\log(RNP)$ are given below for the purpose of comparison with Table D:

1971	1973	1975	1978
0.73	0.70	0.71	0.66

The following table sets out the results of regressing the log formulation of the net trade performance measure on the degree of foreign participation:

Dependent variable	Independent variable	Constant	$\bar{R}^2$	F	SEE	RSS
FGU1	RNP1 0.64 (3.67)	1.69 (3.47)	0.49	13.4	0.65	5.05
FGU3	RNP3 0.59 (3.36)	1.20 (2.62)	0.44	11.3	0.65	5.01
FGU5	RNP5 0.58 (3.44)	1.24 (3.03)	0.46	11.9	0.54	3.52
FGU8	RNP5 0.40 (3.06)	0.82 (2.56)	0.39	9.4	0.42	2.16

t-ratios are in parentheses.

where:

RNPx = log (percentage foreign participation, measured by net output, in major sectors of UK manufacturing industry) in year 197x.

FGUx = $\log(\frac{Xx}{Mx})$.

Regressions of changes in trade performance on the average level of foreign participation

Table E in the text presents the results of regressing changes in trade performance between certain years on the average level of foreign participation. The variables employed are defined below. The regressions were performed after the variables were transformed into logs.

Net trade balances 197x to 197y = $\log(\frac{Xy}{My}) - \log(\frac{Xx}{Mx})$.

Foreign participation = $\log(\frac{FON1 + FON3 + FON5}{UKN1 + UKN3 + UKN5})$

where:

FONz = foreign companies' net output in 197z, and

UKNz = all UK companies' net output in 197z.

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