The Role and Importance of Manufacturing to the Scottish Economy

Lecture given to the Institution of Engineers and Shipbuilders in Scotland (14/11/2006)

By

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Director of CPPR

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Summary

Manufacturing industry (in terms of its share in the economy) has declined in recent decades. Trends for Scotland and other areas are briefly reviewed, together with changes in other sectors (such as the public sector and business services). An overview of such changes is presented, with reasons put forward as to why this has occurred in developed economies like Scotland. The lecture then examines in more detail the key sources of economic growth, and why manufacturing can still be regarded as an important catalyst (or 'engine') of development, especially in a regional economy setting.

1. Introduction

Manufacturing has declined significantly in terms of (relative) output and employment in all developed economies in recent decades, a process referred to as de-industrialisation. However, manufacturing is still argued to be:

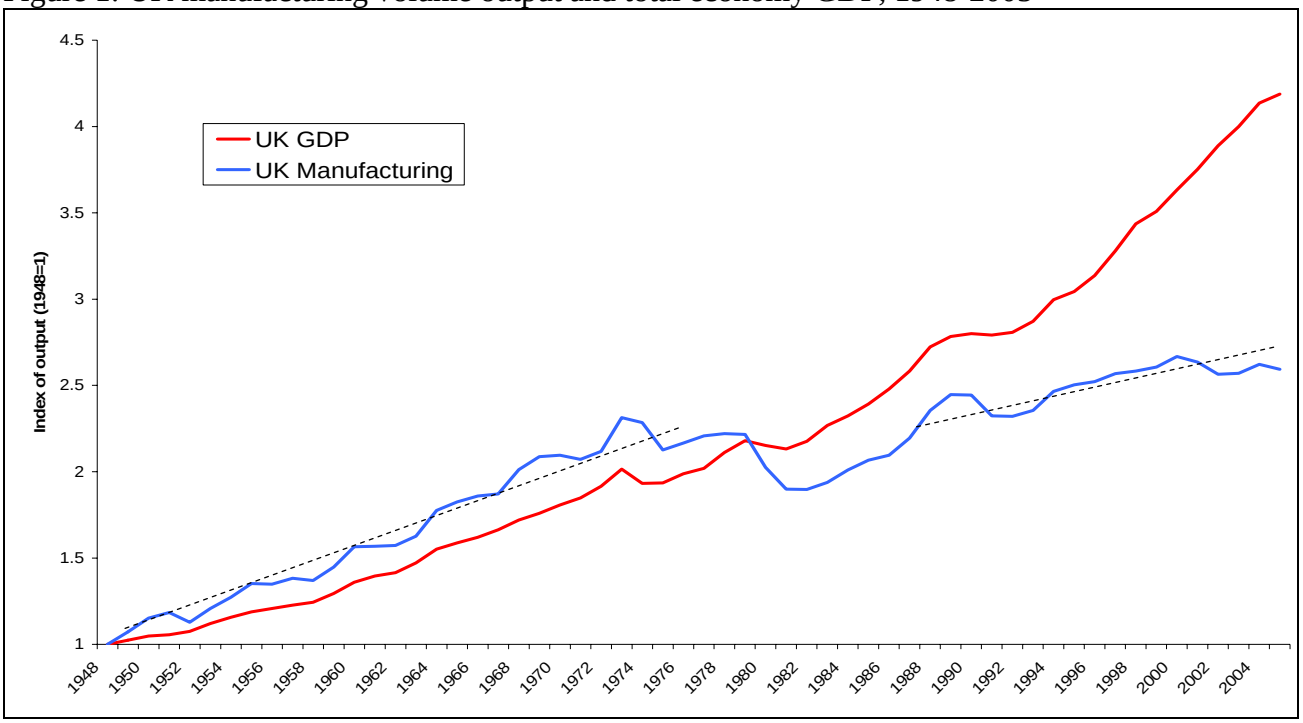
> "… a source of supply growth produced by technological innovation and dissemination, and of demand growth spawned by economic deepening and the creation of good jobs – both of which promote macroeconomic stability and lead to widely dispersed and increasing prosperity… A vibrant manufacturing sector creates the broad foundation upon which the rest of the economy grows" (Hersh and Weller, 2003)

In this lecture I shall be considering this decline in manufacturing, together with changes in other sectors, including a discussion of the reasons as to why manufacturing is now a much smaller contributor to overall GDP (section 2). This is followed in Section 3 by an overview of the characteristics of 'self-reliant growth', and thus which sectors have a dominant role in determining long-run economic prosperity. The lecture concludes with a summary and the argument that further work needs to be undertaken on the key role that manufacturing makes to a (regional) economy like Scotland.

2. Manufacturing's Share of Output and De-industrialisation

In absolute terms, UK manufacturing output has grown much more slowly than the rest of the economy since the end of the 1970's (Figure 1). Following the 1973 peak in the economic cycle, manufacturing first of all went through a period of stagnation which was followed by a severe downturn that saw a significant 'shakeout' of capacity. Since the late 1980's, manufacturing in the UK has experienced a lower growth rate when compared to the rest of the economy.

Figure 1: UK manufacturing volume output and total economy GDP, 1948-2005



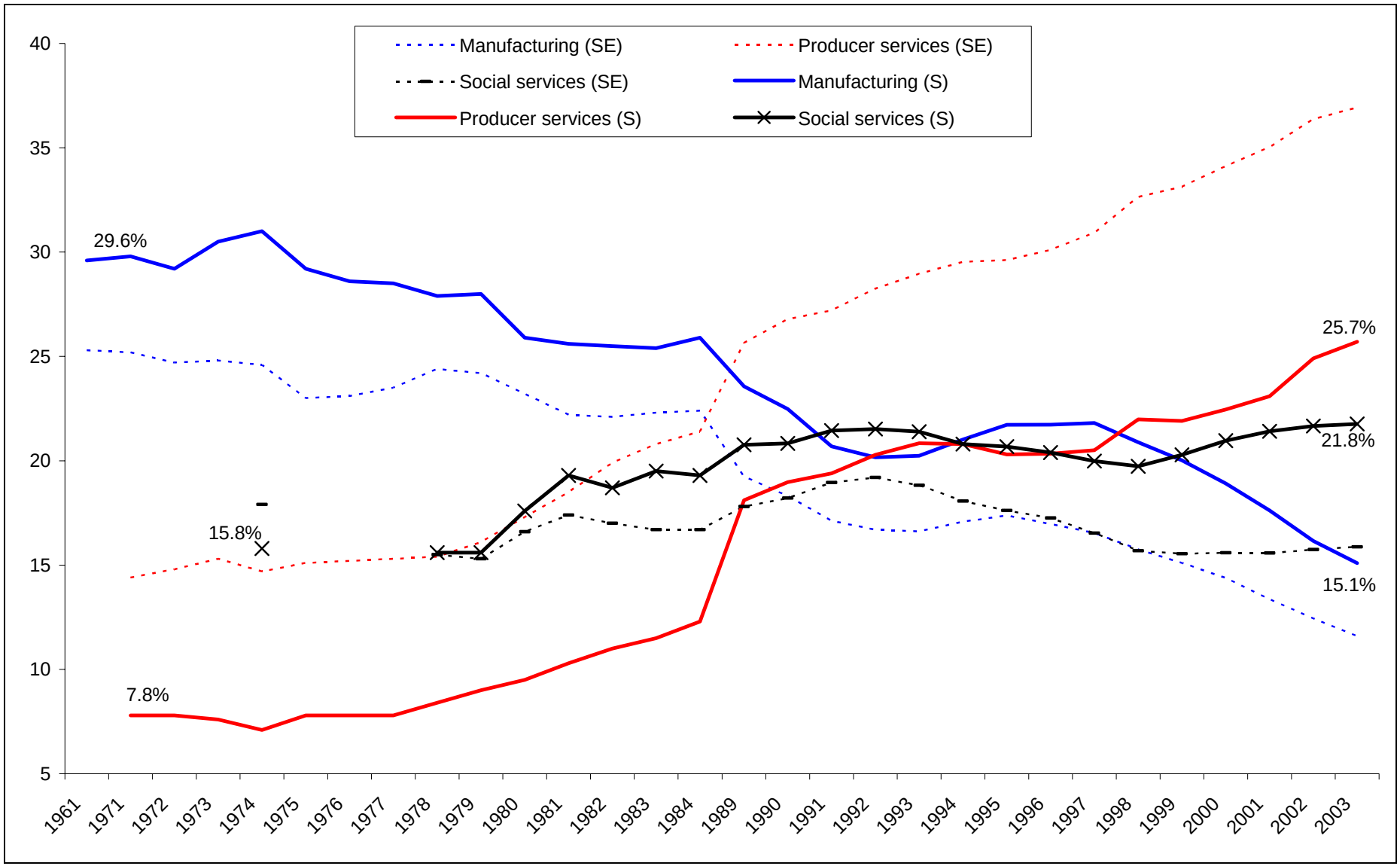
Source: ONS

The slower growth in manufacturing since the early 1970's has therefore led to a decline in the sector's share of overall output. Figure 2 presents information for two regions of the UK to illustrate this decline; in 1961 manufacturing accounted for nearly 30% of Scottish GDP, but by 2003 this had declined to only 15%. In the South East, the fall in manufacturing's share was from just over 25% in 1961 to 11.6% in 2003.

This decline in manufacturing coincides with a substantial increase in the importance of the 'producer services' sector:[1] between 1971-2003 an increase from 7.8% to 25.7% of total economy output in Scotland (from 14.4% to 36.9% in the South East). Therefore, there is substantial evidence of de-industrialisation (a move from the production of marketed manufacturing goods to especially marketed business services) during this period, but little (if any evidence) that the public sector (as represented by 'social services') was 'crowding-out' the market sectors of the economy.

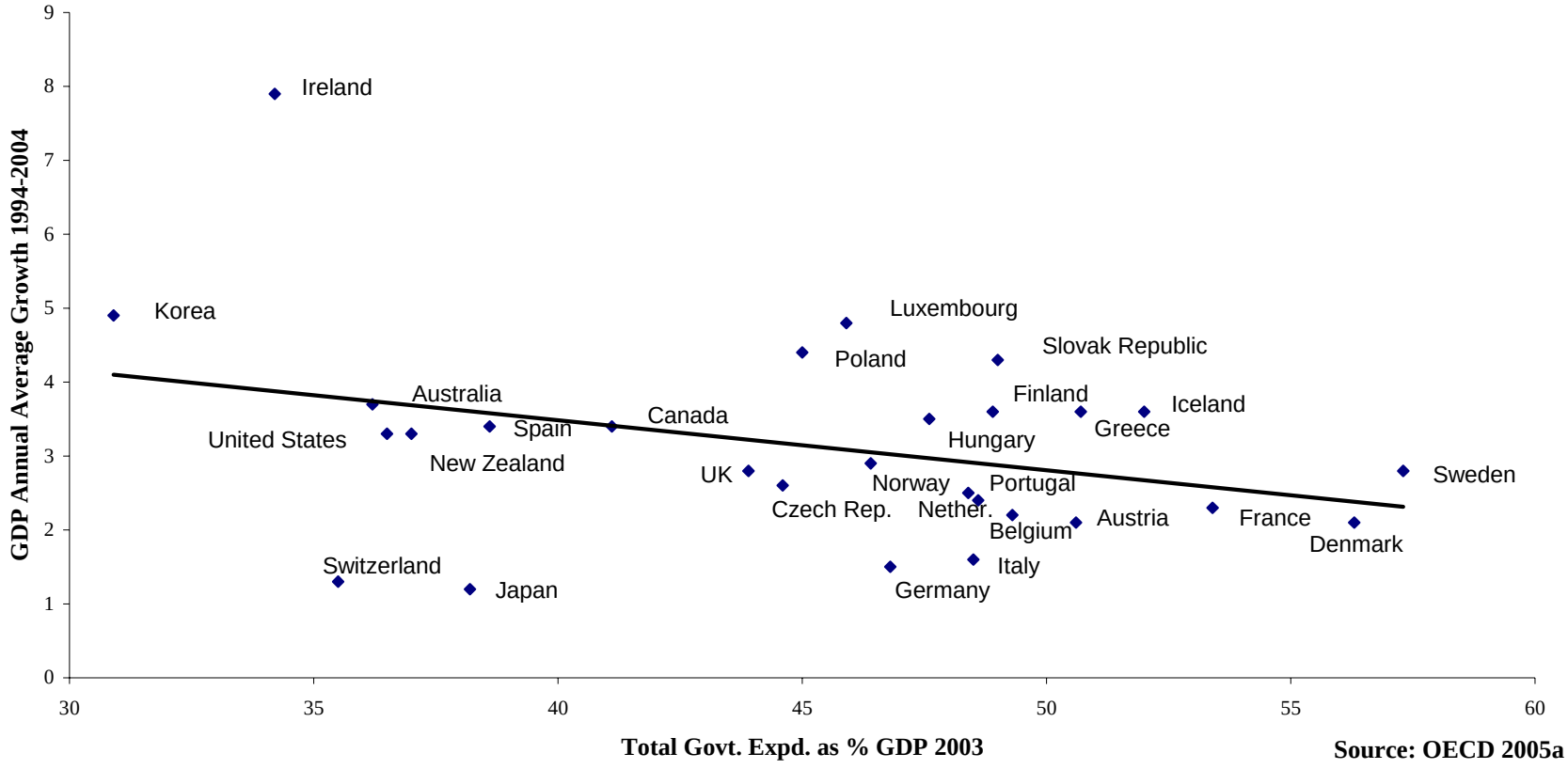
[1] Producer services are defined as insurance, banking, finance, business services and leasing, and R&D. Distributive services comprise wholesale and retail trade; hotels and catering; transport and communications. Social services cover public administration and defence; social security; education and medical services; Personal services cover the ownership of dwellings (letting, and estate agents), and all other services to the public.

Figure 2: Shares in (nominal) Gross Value Added – certain sectors- Scotland and the South East, 1961-2003



Source: based on ONS Regional Accounts data

Figure 3: GDP growth versus Government Expenditure for OECD countries



Source: Cumbers and Birch (2006)

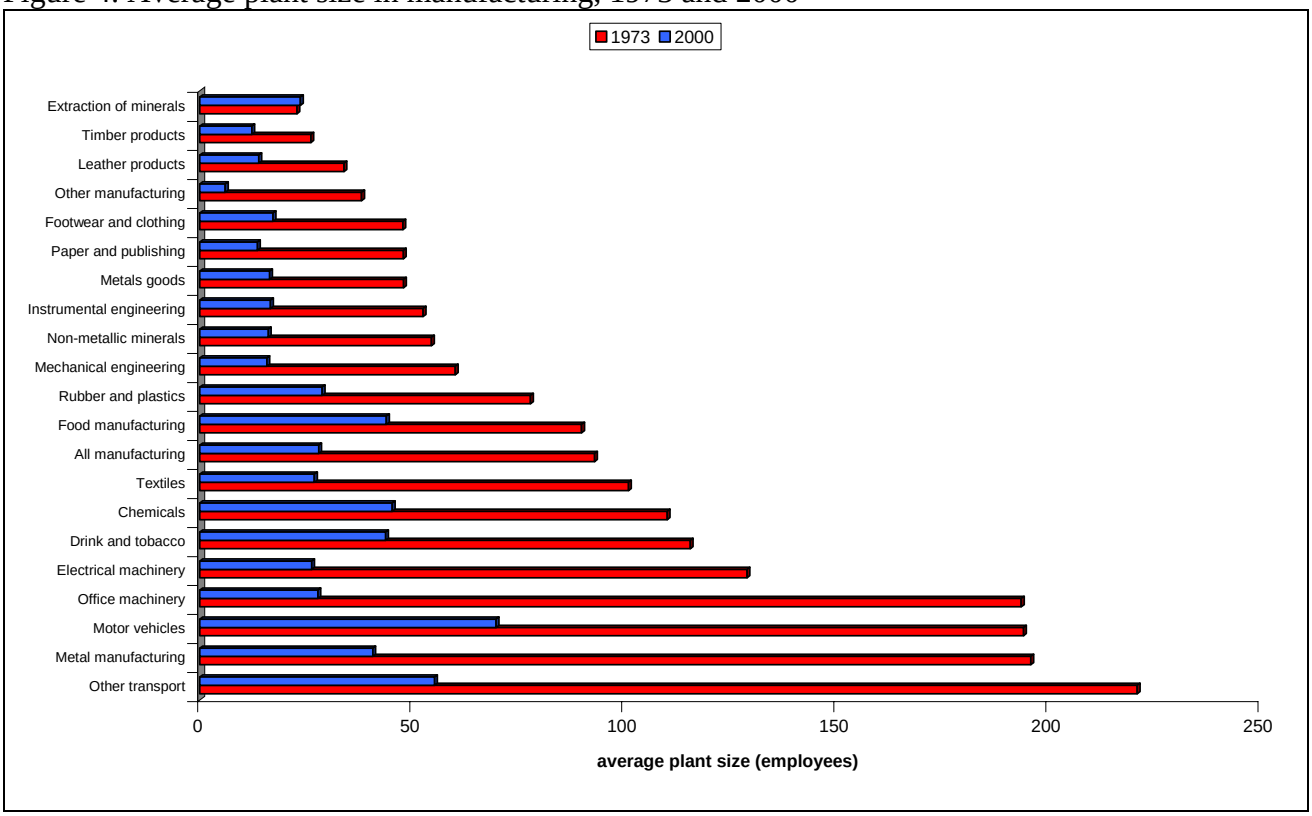
This issue of 'crowding-out' seems to be regaining momentum in recent years (particularly in Scotland), although it was first debated (and largely discounted) during the 1980's. Figure 2 shows that social services accounted for 15.8% of the Scottish economy in 1974, rising to 21.8% by 2003 (in the South East the comparable figures are 17.9% in 1974 declining to 15.9% in 2003). The rise in Scotland can be mostly attributed to its greater 'need' (higher levels of poverty and unemployment historically, exacerbated by the deep recession of the early 1980's), and perhaps also the workings of the Barnett formula (the means by which public spending is allocated across the regions, with its tendency to use public sector funds as a means of compensating for relative economic disadvantage in regions like Scotland). In addition to Figure 2 providing little support for 'crowding-out' of the market sector in Scotland or the South East, Figure 3 shows that there is very little evidence to support the idea that there is a significant negative relationship between economic growth and the size of the public sector.

So what accounts for this decline in manufacturing? Several reasons can be advanced, including a shift in demand in developed economies towards market-based service sectors. Partly this revolves around changes in the pattern of demand towards services where (i) their income elasticity of demand is higher (thus as incomes grow there is a shift towards such services); and (ii) where relative prices and profitability is higher (i.e. these services have 'greater' value-added attached to them). Scarce economic resources tend to flow where the potential rates of return are higher. But this simple hypothesis fails to recognise that Scottish consumers continue to demand more in the way of audio-visual equipment, motor vehicles, computers and household durables. Someone somewhere has to manufacture these goods, suggesting that part of the explanation lies with changes that have been occurring within the manufacturing sector itself.

With the growth of multinational enterprises, and therefore foreign direct investment, much of world trade has come to be dominated by the decisions of MNE's as to where they locate their manufacturing operations. Generally, there has been a trend in recent years for assembly-based manufacturing plants to be located in those areas and countries where costs are lowest (especially labour costs), while higher value-added production (involving R&D and the need of a higher skills base) have concentrated in the most competitive locations in the more developed economies. Where an economy (like Scotland) tends to be over-dependent on assembly-based manufacturing, with lower levels of R&D and therefore product development, it is likely that this will increase the pace of de-industrialisation (but for mostly the wrong reasons).

There is also the issue of outsourcing: manufacturing firms in the 1960's and 1970's undertook a larger amount of the production of the final good produced 'in-house' using larger plants. Especially since the early 1980's, there has been a considerable increase in the buying-in of finished and semi-finished goods (especially from abroad, including other branches of MNE's) that would have once have been produced on the same site. In addition, ancillary (value-added) non-production based goods and services that would have been available in-house (such as marketing, R&D, accounting and other business services) are now much more likely to be outsourced, as manufacturing plants concentrate on their 'core' business. Such outsourcing has partly helped to downsize manufacturing (cf. Figure 4), and partly led to an increase in the size of the producer services sector, which now supplies specialised services to manufacturing firms.

Figure 4: Average plant size in manufacturing, 1973 and 2000



Source: ONS

3. Self-reliant Growth

In attempting to reverse the pattern of unbalanced growth that is characteristic of the UK regional economy, great importance has always been placed on supporting and promoting the growth of industries that are likely to be self-reliant, since it is these industries that will *lead* the region towards greater prosperity. Harris (1987) discussed the necessary attributes of self-reliant growth in terms of certain key elements; these include that the industry should:

- Not be dependent upon local demand alone (it can generate income from trading in other markets);
- Dominate other industries through strong inter-industry linkages, and thus encourage wider growth by its own expansion; and
- Have a high ability to innovate.

(i) Export-led growth

The argument concerning the importance of exports is two-fold: firstly, firms that export (especially into international markets) have to be more competitive, overcoming barriers to entering export markets, whereas much of the service sector is dependent on local demand alone. There is a growing body of evidence that shows that plants/firms that export have a greater

probability of survival (vis-à-vis those not exporting/importing), higher growth rate, greater productivity, higher capital-intensity; and they pay higher wages and employ 'better' technology and more skilled workers (see Harris and Li, 2005, for a review of the literature). Secondly, since regional economies are very 'open', the major source of (exogenous) demand is exports. Such economies, it is argued, are dominated by export-led growth, since in the long-run the main driver of demand in the region is demand for the goods and services produced in its export-base. In essence, the long-run growth of the region is constrained by its balance-of-payments (exports minus imports) such that exports are the only element of demand that can relax this constraint, so allowing the regional economy to expand.

In short, it can be argued that economic growth is determined by the growth of exports, with non-export sector growth dependent upon the export-base. So which sectors comprise this export-base? Table 1 shows that manufacturing accounts for most of the goods and services that are sold outside Scotland. It's share in 1979 was nearly 86%, but by 2002 this had declined to 50% of total exports – presumably reflecting the smaller size of the manufacturing sector in 2002 and also the growth of producer services which (like manufactured goods) are also often tradeable and provide intermediate inputs used to produce goods in other sectors. In 2002, manufacturing still provided some 72% of exports to overseas countries, where competition would be the strongest.

Table 1: Scottish Exports (£m) to the UK and abroad, 1979 and 2002

	1979	%	2002	%	2002[a]	%
Primary	569.1	5.9	5,045.0	11.0	729.3	4.2
Manufacturing	8,239.9	85.6	23,134.3	50.4	12,384.3	72.0
Distributive	590.1	6.1	4,846.7	10.6	1,755.1	10.2
Producer services	179.6	1.9	11,727.9	25.6	2,128.2	12.4
Social services	0.0	0.0	560.4	1.2	152.7	0.9
Personal services	49.9	0.5	571.4	1.2	51.7	0.3
Total	9,628.6		45,885.6		17,201.4	

[a] overseas only

Source: I-O tables for Scotland

Table 2: Highest ranked export industries in Scotland, 1979 and 2002

Highest ranked industries	10	15	25	40	60	70	83	128
No. of non-manufacturing industries, 1979	0	1	4	7	9	16	28	na
No. of non-manufacturing industries, 2002	3	5	8	14	22	26	31	53

Source: I-O tables for Scotland

Table 2 confirms the dominant position of exporting by showing how many non-manufacturing industries (out of 83 in the 1979 IO table for Scotland, and 128 in 2002) were ranked at the top of the exporting league table. Manufacturing's position is slightly weaker in 2002, as certain industries outside the sector are included near the top (in 2002 wholesale distribution is ranked

3rd, architectural etc. activities come 5th, and the extraction of oil and gas is ranked 8th highest producer of exports[2]).

It is clear that manufacturing accounts for the bulk of exported goods and that it is even more important in this respect at the international level. The corollary to this is that manufacturing is not dependent upon local demand alone.

Table 3: Industrial Linkages in Scotland, 1979 and 2002

Sector		Relative Linkages, 1979		Relative Linkages, 2002	
		Forward	Backward	Forward	Backward
Primary:	agriculture etc	1.05	1.36	1.19	0.95
	energy	1.10	1.01	1.15	1.02
	construction	1.00	1.12	1.07	0.92
Manufacturing		1.38	1.11	0.85	1.05
Distributive:	distribution	1.01	1.04	0.84	1.11
	telecommunications	1.02	0.97	0.99	0.80
Producer services		0.94	1.01	1.13	1.62
Social Services		0.75	0.75	0.90	0.77
Personal services		0.99	0.87	0.87	0.78

Source: author's calculations based on 9 × 9 collapsed I-O tables for Scotland

(ii) Inter-industry dominance

The traditional approach in the literature has been that a growth industry should have strong input-output (i.e. purchase and sales) linkages with other industries that it dominates, and therefore have a high capacity for transmitting growth impulses. Dominance is usually assessed through the strength, or otherwise, of inter-industry linkages. Using input-output tables, it is possible to measure the extent to which a particular industry or sector has these strong linkage effects[3]; Table 3 shows that in 1979 manufacturing had the highest overall linkages both forward (to purchasers) and backward (to sellers)[4] and thus was more dominant than any other sector. In 2002, the position is different, with producer services now taking on the role of the most dominant sector, followed by the energy sector, although manufacturing is still strong in terms of its ability to induce growth in other sectors as and when it expands. Presumably this decline in the 'dominant' role of Scottish-based manufacturing has much to do with the decline in the size of the sector over the 23 years considered; local industries in 2002 had to depend on importing intermediate goods to a much greater extent (especially from overseas) resulting in a much

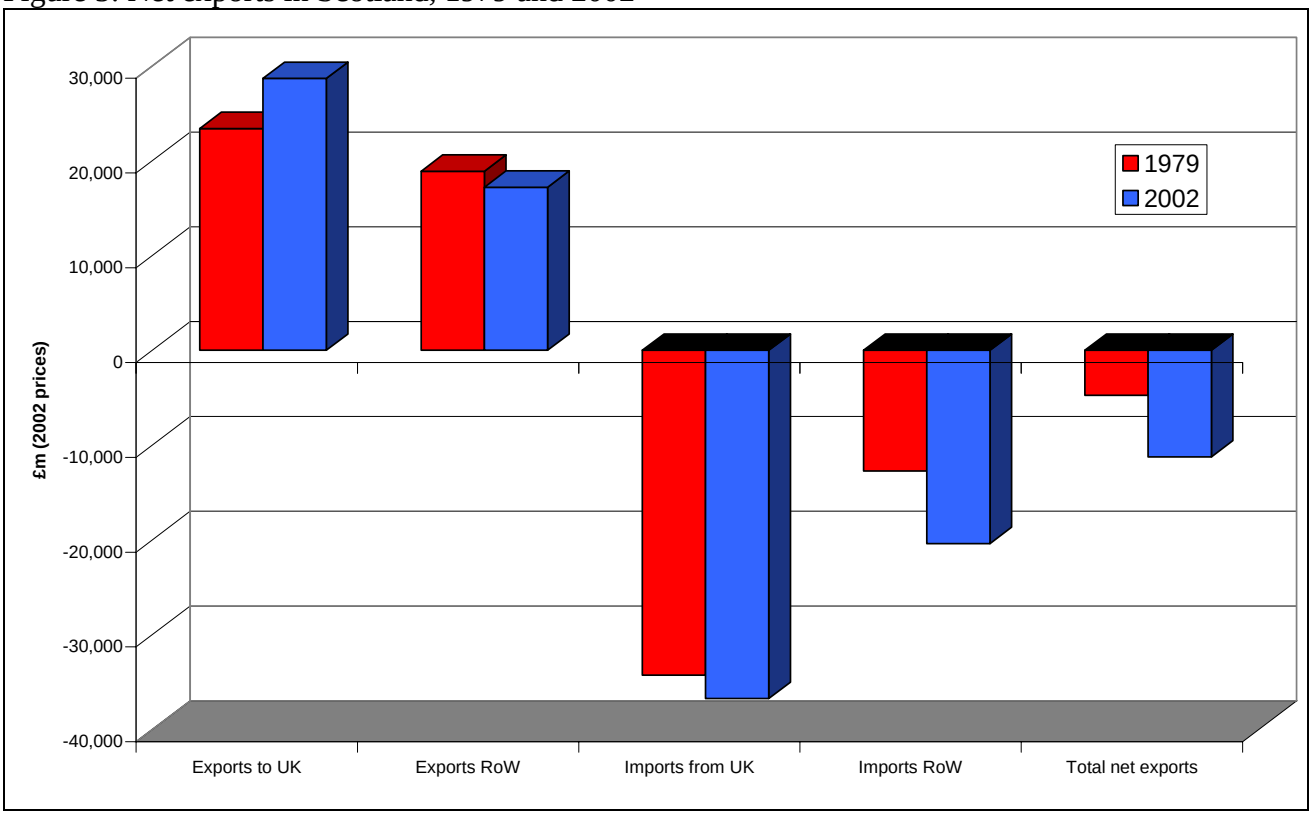
[2] Indeed, most of the non-manufacturing industries making it into the top ranks of exporters are from the producer services sector.

[3] The methodological details are provided in Harris (1987), and are based on the multipliers produced using input-output tables (see, for example, http://www.scotland.gov.uk/Topics/Statistics/14713/460).

[4] For example, if manufacturing in 1979 increased production by £1, this would have induced a further 11p of production in other sectors who would have had higher sales to manufacturers to meet the higher demand in manufacturing. Alternatively, a £1 increase in sales in all other sectors would have induced a 38p increase in manufacturing output, as manufacturing was called on to supply the extra intermediate inputs needed by these other sectors in order to increase their output levels.

weaker balance-of-payments position (net exports declined from –£4.7 billion in 1979 to –£11.2 billion in 2002 – see Figure 5).

Figure 5: Net exports in Scotland, 1979 and 2002



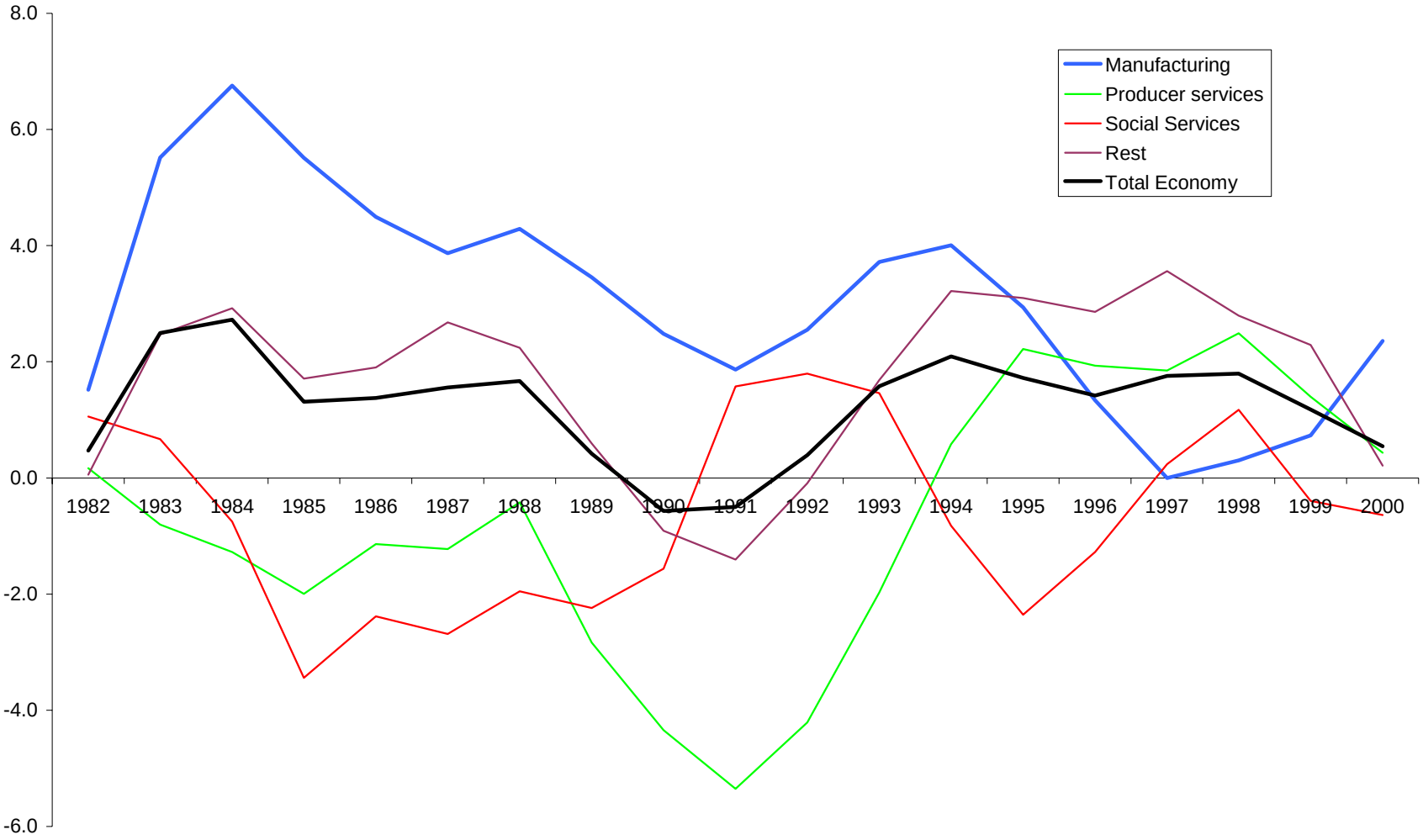
Source: Scottish I-O tables

(iii) Innovation and contributions to growth

In supply-side terms, growth of output for firms or industries is determined by the growth of factor inputs needed for production, i.e. (quality-adjusted) labour-hours, (quality-adjusted) capital services, and what economists call total factor productivity (TFP). The latter covers the increase in output that is not due to increases in labour and capital, and it captures technological progress and increases in efficiency. Clearly, growth can be constrained by under-investment in fixed capital, or a shortage of labour with the appropriate skills; but ultimately, the major driver of economic growth (on the supply-side) is TFP.

Moreover, it can be argued that the major force behind TFP is innovation (especially product innovation); the ability and initiative of firms to innovate and thus create new opportunities for investment, growth and employment lies at the heart of many (e.g. Schumpeter's, 1939) theory of economic development. Industries that innovate are often the source of new products and processes used by non-innovative firms and industries; that is, there is diffusion of technological progress from innovative to non-innovative sectors.

Figure 6: Total Factor Productivity in the UK Economy by Broad Sector, 1980-2000 (figures are percentages expressed as 3-year moving average)



Source: based on O'Mahony and van Ark (2003)

I begin by examining the relative importance of different sectors to the overall growth of TFP in the UK. Figure 6 shows that manufacturing has made the largest contribution with an annual average growth rate of 3% p.a. during 1980-2000, while the comparable rates for producer services, social services, and all other sectors was –0.8%, –0.7%, and 1.7% respectively. Given that the annual average rate of TFP growth for the whole economy was 1.2% p.a., it can be seen that overall manufacturing has been the greatest source of technological progress in this period. The relative underperformance of manufacturing during 1995-1997 (and the better performance of producer services) may be linked to external pressures that prevented manufacturing investing as heavily in ICT relative to what happened in other sectors.

Table 4: R&D spending[a] 2003 by industrial sector: Scotland and UK (£m)

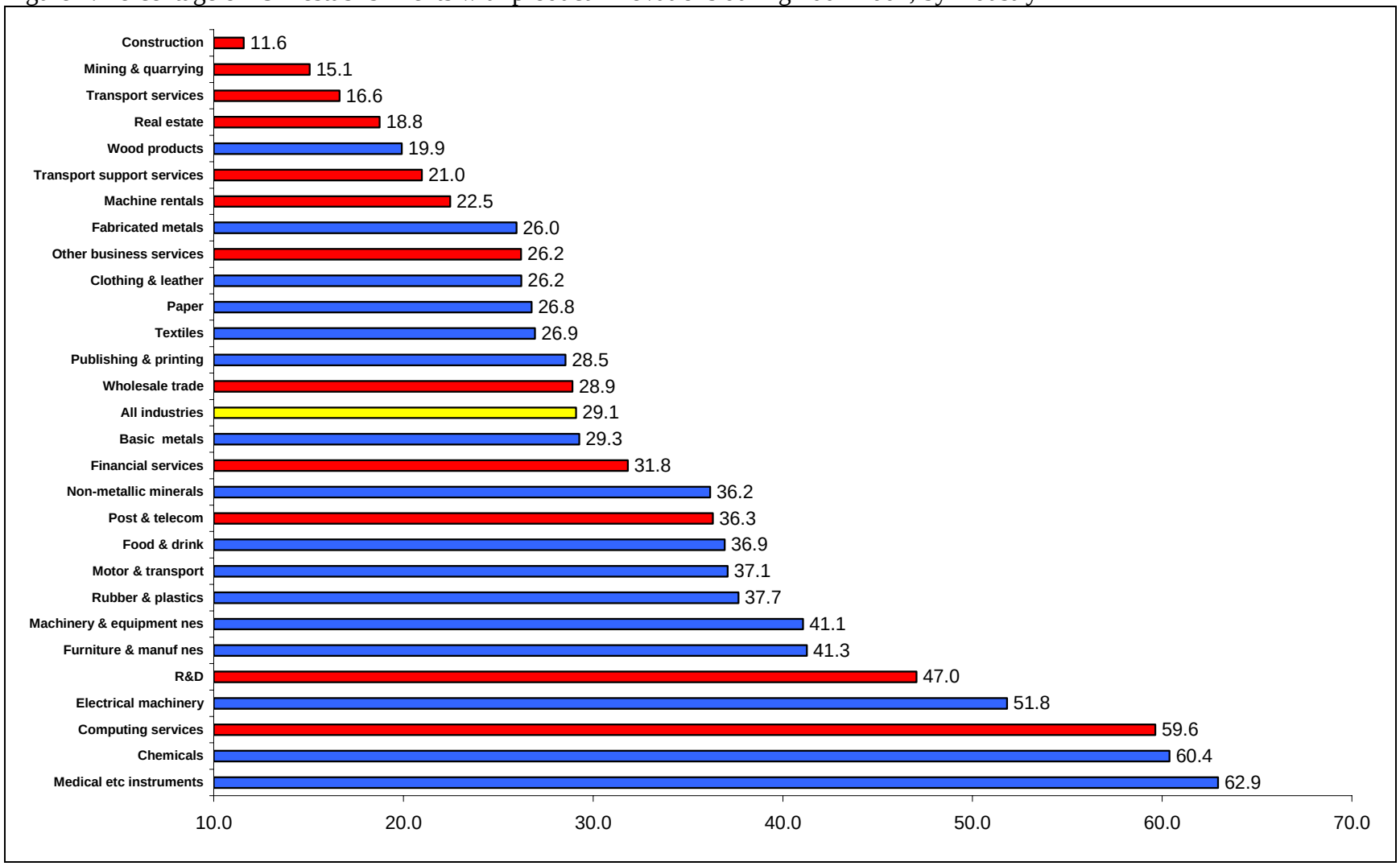
	Scotland	%	UK	%
Pharmaceuticals	194	37.2	3241	23.7
Chemicals, man-made fibres	27	5.2	552	4.0
Office machinery & computers	5	1.0	58	0.4
Electrical machinery	12	2.3	443	3.2
Radio, TV & communication equipment	48	9.2	948	6.9
Precision instruments	61	11.7	400	2.9
Motor vehicles & parts	11	2.1	1173	8.6
Other transport (including aerospace)	21	4.0	1825	13.3
Other manufacturing	61	11.7	1895	13.8
Extractive industries	11	2.1	56	0.4
Computer & related activities	30	5.8	1323	9.7
R&D services	18	3.5	465	3.4
Other sectors	19	3.6	1088	7.9
Total	521		13687	

[a]R&D undertaken by government (e.g. for defence) and higher education is omitted from these data Source: BERD

The overall strong performance of manufacturing in driving economic growth is linked to the amount that is spent on R&D in the sector, and its subsequent ability to innovate and introduce technological improvements. Table 4 shows that manufacturing typically accounts for the majority of spending on business R&D, in both Scotland (accounting for around 85% in 2003) and the UK (covering 78.6% of all business R&D). Figure 7 provides information from the most recent Community Innovation Survey for the UK (covering 2002-2004) that shows that establishments belonging to manufacturing industries (highlighted in blue) are much more likely to have produced a product innovation(s) when compared to the UK average and most non-manufacturing industries. Those non-manufacturing sectors where product innovation is high include computer services, the R&D sector, and post & telecommunications – all which provide important intermediate services to other sectors.

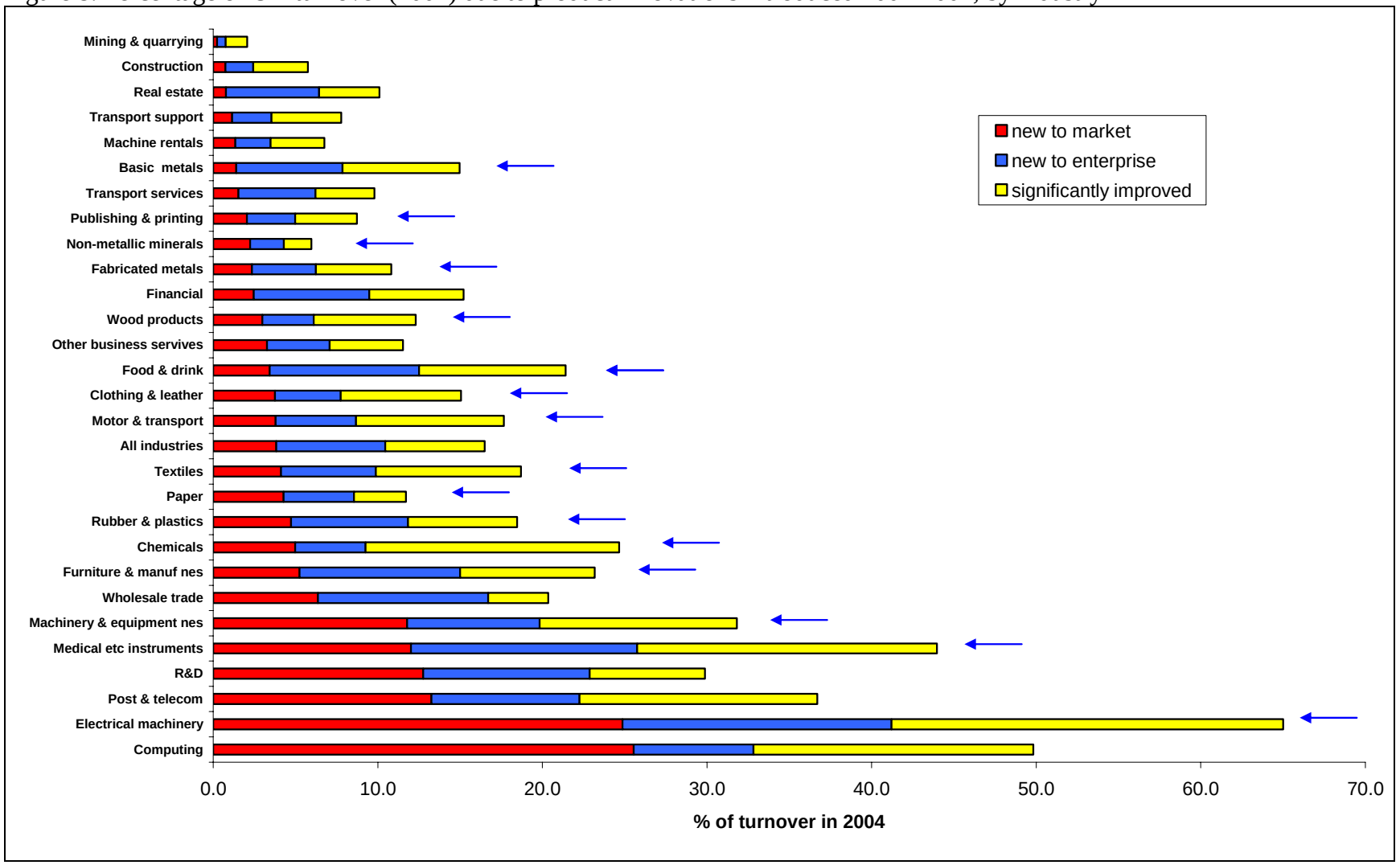
Producing a product innovation is significant; however, the amount of total sales that is accounted for by innovations is perhaps more relevant when considering the link between innovation and TFP. Thus Figure 8 shows the percentage of turnover in each industry that can be attributed to innovations that were new to the market (with presumably the most fundamental impact on technological change), new to the enterprise, or just a significant improvement in an existing product.

Figure 7: Percentage of UK establishments with product innovations during 2002-2004, by industry



Source: based on weighted data from CIS4

Figure 8: Percentage of UK turnover (2004) due to product innovations introduced 2002-2004, by industry

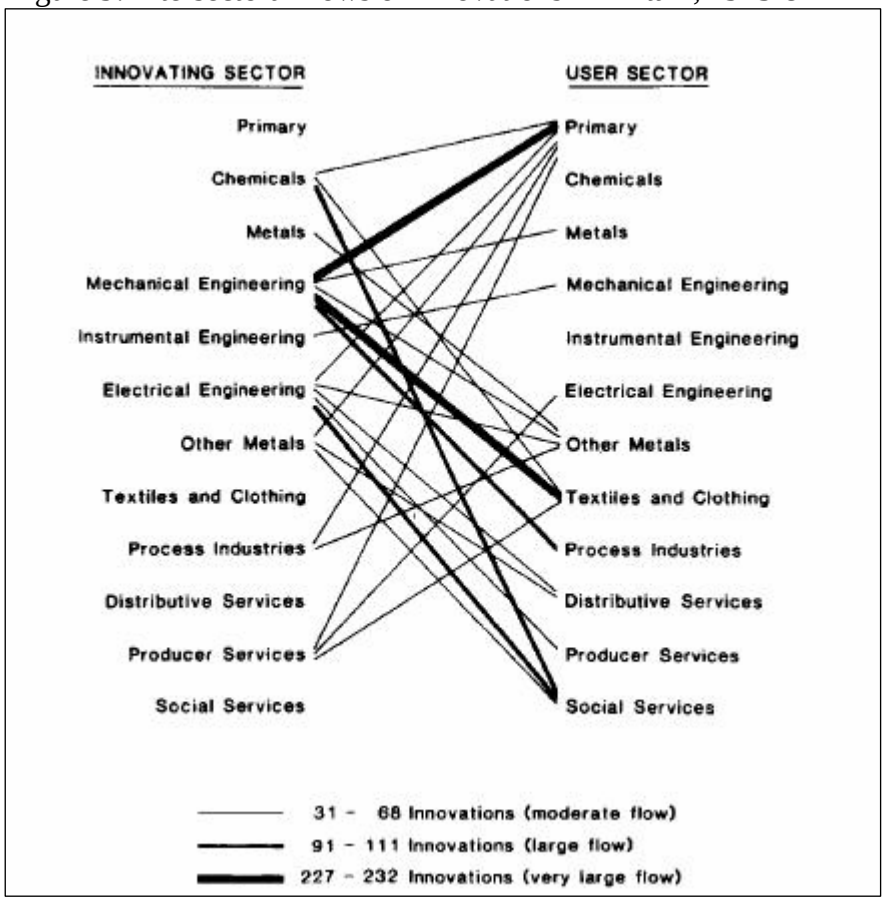


Source: based on weighted data from CIS4

As can be seen, industries with the highest turnovers due to product innovations that were new to the market are concentrated in the manufacturing sector (along with computing software, telecoms, and the R&D sector).

Lastly, I provide some information on the diffusion of product innovations during 1945-84, based on the most comprehensive historical dataset in the UK on fundamental innovations compiled by the Science Policy Research Unit. Figure 9 shows the sectors from which the innovation originated (first column) and the sectors that made first use of the innovation, with manufacturing industries dominating in terms of producing innovations, while non-manufacturing (particularly the primary sector and social services – especially the NHS and defence) is prominent as the users of these innovations.

Figure 9: Intersectoral flows of innovations in Britain, 1945-84



Source: Harris (1987)

Manufacturing is therefore centrally linked to growth associated with technological change, since it has a high rate of innovation, and is the source of the diffusion of new innovations particularly through its strong input-output linkages with other sectors. In more recent years, there is evidence that producer services are beginning to take on more of this role that has traditionally been associated with manufacturing.

4. Conclusions

A major part of this lecture has looked at various key elements of 'self-reliant' growth, and has pointed to the key role of manufacturing. Manufacturing features strongly vis-à-vis other sectors in terms of its not being over-dependent on local demand; its strong inter-connections with other industries (and therefore its ability to transmit growth impulses); and perhaps most importantly of all, its ability to undertake R&D and produce new product innovations that provide the basis for economic renewal and development into the future (what Schumpeter called "creative destruction"). Overall, on each of the demand- and supply-side factors examined, manufacturing proves to be important to the overall growth of the (regional) economy. Downgrading this role is unlikely to be beneficial to long-run aggregate growth and thus ultimately employment levels, even with the growing importance of producer services (which exhibit many of the attributes linked to self-reliant growth traditionally associated with manufacturing).

I have shown that manufacturing has continued to decline significantly in recent years in terms of its share of overall (regional) economic output. Partly the reason for this is changing patterns of demand (higher incomes leading to greater demand for services), but much of it is linked to the inability of manufacturing itself to capture 'high value-added' markets. In addition, MNE's (which control a large proportion of world trade in manufacturing goods) have shifted assembly-based production to cheaper locations overseas. The upshot is that many of the manufacturing goods that would have been produced locally 20 – 30 years ago are now imported, from those regions with higher levels of competitiveness (and especially from abroad). The result is an increase dependency on imports, and ultimately this would not be sustainable without increasing net transfers from outside the economy (in Scotland's case, net transfers from other UK regions).

There is need for further research into the role of manufacturing in the UK regions and its contribution to growth, as some of the reasons for its decline are not based on a solid evidence-base. We need to know more about the changes that been occurring in recent decades, especially with regard to (inter-regional) trade in manufactures, as well as the causes and consequences of outsourcing. We also need to understand much better what determines R&D spending and its linkage with product and process innovations, and how well equipped is manufacturing to continue being successful at such activities (i.e. we know that a major reason for Scotland's poor performance in manufacturing can be linked to its lower level of R&D spending and ability to innovate, compared to other regions like the South East of England).

To conclude, in being invited to give this lecture I was asked to comment on whether we should be concerned about the decline in manufacturing, or whether the economy can survive without, or with a significantly reduced, manufacturing contribution. I believe we should be very concerned about the strength of the manufacturing sector, and further declines are only likely to be detrimental to both the Scottish and UK economies.

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