

Changes in Manufacturing Linkage Patterns in Scotland and Wales: Hollowing Out and Foreign Direct Investment?

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Abstract

Trends in inward investment in Scotland and Wales have influenced manufacturing's inter-linkages with the local economy in different ways. The paper shows that there could be a hollowing out of the manufacturing sector in these regional economies which is linked to trends in inward investment.

1. Introduction

This paper explores the connections between inward investment, manufacturing inter-linkages with the regional economy and the concept of hollowing out. The paper takes as a case the economies of Scotland and Wales which have both seen strong increases of foreign capital within their respective manufacturing sectors. Moreover, in both of the case economies, policy resources have been targeted on trying to increase intra-regional manufacturing transactions through local sourcing programmes. The paper questions whether this is appropriate given the importance of extra-regional linkages in promoting local competitiveness.

The remainder of the paper is structured as follows. The second section contains background, and explores factors that might explain changes in manufacturing linkages over time. The section then shows how regional initiatives have tried to encourage manufacturing local sourcing, with these initiatives partially juxtaposed to evidence that highlights the importance of extra-regional trade in promoting regional competitiveness. The third section shows that in both Scotland and Wales, one key factor affecting the propensity to trade within the region is the growth of manufacturing inward investment. The development of inward investment in the two economies is described. The fourth section then examines the linkage propensity of

the foreign sector in Scotland and Wales. The section then explores changes in manufacturing linkages in the economies of Scotland and Wales within the framework of Input-Output tables. This leads to a discussion of whether there is a link between linkage changes and inward investment growth. The paper shows that making these connections is problematic. It is argued that this vein of research is of value in understanding the more dynamic impacts of foreign manufacturing investment on regional economies.

2. Background: Changes in Manufacturing Linkages

Manufacturing and Regional Linkages

The pattern of structural change in regional industry groups is always complex. A series of economic, social and technological factors affect structure and then the level of intra- and extra-regional linkages. For example, over time successful industries may attract subcontracting clusters into their environs as happened with Nissan in the North East (see for example Morris et al. 1993). Moreover, as local incomes increase some industries may be attracted by new demand thresholds to serve local markets, such that a measure of import substitution occurs.

However, the opposite may occur as a result of structural change and the replacement of older more regionally embedded industries with those lodged more in national and international logistics chains. For example, in Wales, the steel and coal industries supported significant indirect employment in the region through their purchasing linkages. These industries have been replaced by manufacturing sectors such as electrical and electronic engineering that tend to require higher levels of imports (see e.g. Roberts, 1996) and that trade less with local firms.

There are other reasons to suggest that extra regional trade will increase over time. The theory of comparative advantage shows that regions tend to become more specialised over time. Linked factors would include the membership of free trade areas. Supporting this is the development of scale economies in transport, communications and other trade-related activity which imply increasing extra-regional trade and a reduction in intra-regional mediation. For example, these factors have encouraged corporate rationalisation and restructuring in the financial and business services sectors of the Scottish and Welsh economies, with new spatial

divisions of functions affecting local purchasing patterns (see Gripaos and Munday, 2000).

Juxtaposed to these issues have been a range of regional initiatives to encourage firms to more fully 'embed' into their respective economies, and with other initiatives to identify and support groups of industries that support relatively high levels of local activity. This has been one focus of competition and regional policy in the UK, with the Department of Trade and Industry and regional development agencies currently devoting extensive resources to improving the local transactions relationships between foreign and domestic manufacturers (Izushi, 1999 – see also UNCTAD, 2001 for a review of local sourcing programmes in Wales and the North East regions of the UK and other international examples). Buyer-supplier linkages are clearly one factor determining the indirect employment and output supported by industry operations (Hirschman, 1958). In both Scotland and Wales this has prompted investigation of the changing local trading propensities of industry groups, and the differences between foreign and domestic firms' purchasing patterns (see for example, Roberts, 1996, Turok, 1993; McCann, 1997; Turok, 1997, Munday and Roberts, 2001). In some measure, local sourcing programmes imply an element of market failure with targeted interventions seen to reduce search costs in making local transactions. Moreover, intervention is also predicated on the perceived economic value in the identification and promotion of sectors that display strong backward (and forward) linkages in a region (following Hirschman 1958). The 'linkage hypothesis' finds further support in contributions which show that tighter patterns of local trading could provide agglomeration externalities which are linked to the performance of industry groups (see for example, Porter, 1990), and with local interlinkages also being a way through which knowledge can be transferred between firms, with wider ramifications for productivity spillovers and regional competitiveness (Driffield, 2001).

Hollowing Out?

Connections between intra-regional and inter-industry trade and then regional competitiveness have been examined by Hewings et al., (1998). The contribution reviews the nature of contemporary agglomeration economies, and how these could change linkage patterns. For example, in the US Mid-West economy the authors observed something of a temporal transformation whereby there was a relative

decrease in local economy dependence, but an increase in long distance dependence related to the changing nature of both internal and external economies of scale and scope. Consequently, the economic ties that had bound establishments closely together were seen to be unravelling in favour of spatial association at the inter-state level. The net result of such changes was decreasing intermediate transactions in the local economy. This 'hollowing out' could result in local production levels staying unchanged, but with typical output multipliers falling because of changes in the nature of spatial association. Whilst these patterns may be seen as detrimental from an industry 'embeddedness' point of view, the structural changes occurring might be linked to growing area competitiveness with new extra-regional trade patterns linking through to increasing returns. The corollary of this is that falling levels of local intermediation in the presence of local growth of output could be a sign that the economy is becoming better integrated into the wider economy. The next section shows that inward investment trends are a key factor underpinning these developments.

3. Inward Investment Trends and Hollowing Out?

Inward Investment Trends

It is expected that increases in inward investment could promote the processes outlined above. The case considered here is inward investment in the Scottish and Welsh economies. Foreign-owned manufacturing has long histories in these regions, with both benefiting from increases in US inward investment in the immediate post-war years. In 1963, foreign manufacturing employment in Scotland was nearly 46,000 and was around 24,000 in Wales (Hill and Munday, 1994). According to Census of Production data, Scotland saw a large increase in new foreign manufacturing between 1963 and 1971. Scotland has maintained a share of around 10% of UK foreign manufacturing employment. Wales has seen its foreign manufacturing employment steadily increase throughout the period 1963-1997. Both regions have also been successful in attracting new foreign investment (Hill and Munday, 1994). Between 1982-1992 Scotland and Wales attracted respectively 545 and 500 foreign manufacturing projects which were together associated with over 90,000 new jobs.

Table 1¹, reveals the fall in foreign company manufacturing employment in Scotland over the period 1975-1994 (but note significance of foreign manufacturing increased over the period see Table 3 below). In 1975, there were an estimated 113,000 people employed falling to 82,000 by 1994. Large falls were recorded in food and drink, mechanical engineering, and transport equipment. Although numbers employed in electrical, electronic and instrument engineering fell, this industry alone still accounted for over 40% of foreign manufacturing company employment in 1994. Industries with particularly high shares of foreign employment were chemicals (35%), mechanical engineering (26%), electrical, electronic and instrument engineering (59.0%).

Table 2 shows foreign owned manufacturing company employment in 1974 and 1998 for Wales. In 1974, around half of foreign manufacturing employment in Wales was in just two sectors basic metals and metal products, and electrical, electronic and instrument engineering. During the 1980s, Wales, experienced a ‘boom’ in inward investment, with particularly high levels of new investment from European and Asian multinationals (Munday, 2000). Despite a slowdown in inward investment during the early 1990s, levels recovered and by 1998, according to the Welsh Register of Manufacturing Employment, just over 75,000 people were employed in foreign multinationals, around one third of total employment. Most sectors have seen extensive growth in number of plants, and employment in the period 1974-1998. A number of sectors such as food and drink, wood and wood products, and rubber and plastics have more than doubled foreign manufacturing employment, whilst the electrical, electronic and instrument engineering sector has seen an increase of 11,000 employees – largely down to the investment of Asian-owned multinationals.

¹ The development of foreign manufacturing employment by industry can be examined by analyses of data from the Scottish Register of Employment, and the Welsh Register of Manufacturing Employment. Reconciliation problems with industry groups meant that in Tables 1 and 2 the analysis is restricted to 1975-1994 for Scotland, but 1974-1998 for Wales, where better quality data is available for more recent years. The construction of the data-set means that it is almost impossible to reconcile individual sectors over the period 1975-1996.

Table 1 Foreign Involvement in Scottish Manufacturing Employees in Foreign Companies/Total Sector Employment 1975 and 1994

Sector	SIC 92	Employment 1975	Employment 1994
Food and drink	15-16	8.8	4.8
Textiles, leather and Clothing	17-18	7.0	7.0
Paper, printing and publishing etc	20-22	3.8	6.8
Chemicals and man made fibres	24	6.0	5.7
Metals and mineral extraction	23, 26 28	1.3	2.4
Metal goods	27	3.5	2.0
Mech engineering	29	27.0	8.0
Electrical, elec and instrument engineering	30-33	38.5	33.8
Transport equipment	34-35	10.7	4.8
Other manufacturing	36	6.2	6.8
Total	15-36	112.9	82.1

Source: Industry Department for Scotland, various.

Table 2 Employment in Overseas Manufacturing; Wales 1974 & 1998

Sector	SIC 92	Employment (Firms) 1974	Employment (Plants) 1998
Food and drink	15-16	2.0 (4)	4.5(24)
Textiles, leather and clothing	17-18	1.0 (5)	1.1 (9)
Wood, wood products, printing etc	20-22	1.3 (10)	4.0 (23)
Chemicals	24	6.4 (15)	8.6 (56)
Rubber and plastics	25	1.3 (5)	4.4 (36)
Non-metallic minerals	26/23	0	3.0 (16)
Basic metals & metal products	27-28	10.5 (23)	5.4 (39)
Mech engineering	29	5.9 (21)	5.4 (31)
Electrical, elec. and instrument engineering	30-33	13.0 (18)	24.1 (64)
Motor vehicles	34	7.6 (11)	11.5 (33)
Other transport	35	0	2.2 (5)
Other manufacturing	36	3.8 (15)	1.3 (12)
Total	15-36	52.8 (127)	75.5 (348)

Note: Derived from Welsh Economic Trends, 1977 & Digest of Welsh Statistics 1999. Some figures for 1974 are estimated. Figures in brackets for 1974 are companies, in 1998 are plants.

The growing contribution of the foreign sector in both regions is brought into sharper focus when compared to developments in the respective indigenous manufacturing sectors. Table 3 provides information for the years 1981, 1990 and 1997. In both economies the proportion of foreign manufacturing employment in total employment increased through time. For example, although foreign manufacturing employment fell by nearly 19% in Scotland between 1981-1997, domestic manufacturing employment fell by 31%. Consequently, by 1997 the proportion of total manufacturing jobs in overseas plants in Scotland had grown to 20%.

Table 3 Manufacturing Employment in Foreign and Domestic Forms

	1981		1990		1997		Change 1981-1997	
	Foreign	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign	Domestic
Scotland	81.5	395.1	77.3	293.8	66.2	272.5	-18.8	-31
Wales	45.4	190	49.3	181.3	53.1	167.3	17	-11.9

Source: Census of Production, various.

Table 4 uses Census of Production data to show growth in value added across selected industries in Scotland and Wales for both the foreign and domestic sector². Table 4 reveals the importance of foreign investment in the Scottish electrical, electronics and instruments industry. By 1997 this industry contributed half of foreign manufacturing value added in Scotland – the next largest foreign sector is food and drink contributing around 10% of the foreign sector gross value added. In Wales, foreign manufacturing value added is more evenly distributed across industries, with, for example, electrical, electronics and instruments contributing just 19% of foreign sector value added in 1997.

Table 4 Growth of Manufacturing GVA Scotland and Wales 1984-1997: Selected Industries

Sector and 1992 SIC code	Scotland: Foreign Share of Manu.GVA in 1997 (%)	Scotland: Growth of Manu. GVA Foreign-Owned 1984-97 (%)	Scotland: Growth of Manu. GVA Dom1984-97 (%)	Wales: Foreign Share of Manu. GVA in 1997 (%)	Wales: Growth of Manu. GVA Foreign 1984-97 (%)	Wales: Growth of Manu. GVA Dom.1984-97 (%)
Food and drink 15-16	10.0	53	96	9.3	304	139
Printing, publishing and paper 21-22	6.4	64	130	7.2	170	255
Chemicals etc. 24	5.1	49	11	11.9	130	-33
Rubber/plastics 25	2.1	32	242	7.2	442	357
Non-metallic mineral products 26	0.8	390	44	1.8	110	-18
Basic metals/manufacturing 27-28	7.2	430	137	14.1	126	149
Mechanical engineering 29	7.2	73	2	4.6	328	77
Electrical, electronics 30-33	49.3	192	142	19.3	263	103
Total –all for.owned manu. inc sectors not specified above	£3545.5m	150	75	£2298.9m	205	118

Note: Columns 2&5 do not sum to total as some industries are not included in the table.

Source: Derived from data sheets provided by the Office of National Statistics by special request.

² Attempting to explain changes in foreign manufacturing employment and value added by broad industry is made difficult by changes in Standard Industry Classifications, and the general paucity of data. The industry data (2 digit SIC80/92) was available from the Office for National Statistics, but these only covered the period 1984-1997, and with some industry information having to be either estimated, or in other cases aggregated together to avoid disclosure problems.

Table 4 also reveals that the growth of foreign manufacturing GVA in Wales exceeded that in Scotland across most industries. The exceptions are basic metals/metal products and non-metallic mineral products. Particularly noticeable are stronger Welsh performances in food and drink, chemicals and pharmaceuticals, rubber and plastics, mechanical engineering and electrical and electronics and instruments. In both regions the nominal growth of GVA in the foreign sector overall was around twice as strong as that in the domestic manufacturing sector – although some of this imbalance occurs as a result of cross border merger and acquisition activity. The strength of foreign activity in Wales over the period is also evident in figures on net capital expenditure. Between 1984-1992 total foreign manufacturing net capital expenditure was an estimated £2.5bn in Wales, and £2.7bn in Scotland. Between 1993-1997 Scotland does rather better with an estimated £3.1bn of net foreign manufacturing capital spend compared £2.0bn for Wales. In Wales between 1984 and 1992 at least 50% of net capital expenditure from the foreign sector was in chemicals and pharmaceuticals, electrical, electronic and instrument engineering and motor vehicles. These three industries also accounted for in excess of 60% of foreign net capital expenditure in Wales between 1993 and 1997. In Scotland, the foreign-owned electronics sector has a far greater significance, accounting for an estimated 44% of net capital expenditure in the period 1984-92, and nearly 70% of expenditure in the period 1993-1997.

Wales has maintained its foreign manufacturing employment and output at a higher level than Scotland. This is confirmed by Stone and Peck (1996) who, using regional databases, identified a distinct foreign manufacturing performance gap between Wales and Scotland in the period 1979-1993.

Several conclusions can be made from the above review. First, in both Scotland and Wales, the foreign sector has gained importance through time as domestic manufacturing has grown more slowly or declined. Foreign take-overs of domestic manufacturing undoubtedly account for some of this increase in foreign ownership and external control (see Stone and Peck, 1996). Second, the growth of the foreign sector has been uneven in terms of sectors. There is some evidence that Wales has maintained much of its foreign manufacturing employment (and output), at a time when Scotland has lost employment in the foreign-owned manufacturing sector.

Dramatic inward investment trends are likely to result in changes in aggregate manufacturing linkage patterns, and then also connect through to debates surrounding 'hollowing out'. Several subtle processes may be working here. Parr et al (2002) highlight in their case study of the US Mid-West that factors leading to hollowing out include the decline of the single establishment firm and an extension of ownership across state and then international boundaries. Inward investment links to these developments. Parr et al (2002) also highlight how local plants may become more specialised in production, and with complex scale economies being recognised increasingly at firm as opposed to establishment level. As highlighted earlier underlining these developments are improvements in transport and communications infrastructure. Once again inward investment can be linked to these factors with larger foreign enterprises more specialised and able to take advantage of higher levels of spatial specialisation, and also potentially able to make the best use of improvements in transport and communications. Indeed, a key factor leading to the development of the multinational as a dominant form of modern business enterprise has been the post war improvement in the ability to co-ordinate activities over long distances (see Dunning, 1993).

4. Manufacturing Inter-Connections: Scottish and Welsh Evidence?

Previous research on linkage patterns in Scotland and Wales

The comparatively low level of local purchasing of goods and services in the foreign as opposed to the domestic sector has been a common theme in recent research in Scotland and Wales. For example, Turok (1993, 1997) demonstrated that the Scottish electronics industry (including large numbers of inward investors) purchased just 12% of material inputs in Scotland, and that output based multipliers for the electronics sector revealed a poor level and quality of linkages into the local economy. In Wales, Roberts (1996) considered the backward (and forward) linkages created by foreign manufacturing sectors and found that, on average, less than 17% of non-wage spending of foreign manufacturing firms occurred in the Welsh economy (this is low compared to the average local proportion of non-wage spending of domestic enterprises, see for example Brand et al., 2000; see also Gillespie, 2000). Munday and Roberts (2001) also demonstrate the relatively low regional purchasing propensities of

foreign enterprises in Wales compared to those in the domestic sector. Finally, Brand et al., (2000), demonstrated that, generally, foreign owned manufacturing in Scotland and Wales purchased less locally than domestic firms, supporting lower levels of indirect output in the rest of the regional economy. The analysis also explored how far each job created in foreign and domestically owned manufacturing contributed to regional value added. The superior productivity of the foreign sector meant that it generally contributed more per direct employee to regional value added than its domestic counterpart.

A common theme in the above is increases in inward investment being associated with growth in reliance of imports both from other regions of the UK and particularly from overseas. The high levels of specialisation in foreign-owned plants have also been observed (see for example in Wales, Morris et al., 1993), and with this factor connected through to debates about the stability of the foreign sector (Munday, 2000). Foreign enterprises have been shown in Wales to have greater opportunity to gain from global purchasing economies, particularly in high value components (Morris et al., 1993, Munday et al., 1995). This has ramifications for the value of regional output indirectly supported by establishments. This might be expected to fall over time as less and less is bought locally by an increasingly significant foreign manufacturing sector. Then as the foreign sector becomes more significant in the overall manufacturing sector there would be an expectation of increasing imports, and increasing exports.

Care needs to be taken with general conclusions relating to foreign and domestic firm local purchasing propensities in the two case regions. First, selected foreign groups have sought to develop a nest of suppliers in close proximity to their assembly plants in order to reap logistics advantages, reduce risks inherent in modern manufacturing, and to strengthen formal and informal ties (for electronics industry exemplars see Morris et al., 1993). Second, changes in purchasing behaviour over time might also be the result of more subtle general economic changes in firm behaviour such as changes in capital intensity, and subcontracting relationships between firms. The 1980s saw large changes in industries outsourcing components production. Third, through time there is also the possibility that inward investors who were initially dependent on imports are able to gain more perfect information about local purchasing opportunities such that local sourcing may increase. This has been

particularly noticeable in the Asian-owned sector of Welsh manufacturing (Munday et al., 1995).

In addition to influencing manufacturing linkages into the regional economy, inward investment has related effects. Foreign manufacturing in Scotland and Wales features higher earnings than the domestic sector (Brand et al., 2000). This could be connected to some increase in value added effects, this being largely down to the higher incomes being paid in the foreign sector. Conversely, higher labour productivity in the foreign sector might reduce the ratio of value added to gross output. Overall then there might be a strong (relative to the domestic sector) direct value added effect via earnings, but this could be counteracted by indirect effects in the supply chain as highlighted in the previous paragraph.

Finally, inward investment trends linked to foreign plant specialisation, and improvements in transport and communications through time will be associated with a higher level of economy exports (both to other areas of the UK, but especially overseas). The key location criteria for much of the new inward investment in Scotland and Wales has been the need to take maximum advantage of regional production conditions and factor costs whilst gaining access to final goods and intermediate product markets (Hill and Munday, 1994). Once again, however, care needs to be taken in attributing growth in export propensity in an industry to growing overseas control. Increasing overseas exports could be due to structural improvements in trading conditions, or the strengthening of trading blocs such as the European Union. Much foreign direct investment in Wales and Scotland serves mainland European markets.

Unfortunately much of the research reviewed earlier in this section has been undertaken in a static framework with little indication of whether industries with high levels of inward investment activity through time have seen the most marked changes in linkage patterns. Clearly, it is difficult to show conclusively whether foreign investment in manufacturing in Scotland and Wales has definitely contributed to changes, and in particular the extent to which the investment can be connected to growing extra-regional trade.

Evidence from Regional Input-Output Tables?

Input-Output tables for Scotland and Wales may provide some clues as to whether inward investment trends can be linked to changes in linkage patterns. Within an Input-Output framework there are a variety of measures available which hint at the linkage complexity of the economy. Here the focus is on simple Type 1 output and value added multipliers, and statistics on external trade propensities derived from the Input-Output framework, for a select group of manufacturing industries.

Comparing manufacturing's interconnections with the regional economy within an Input-Output framework is far from easy. Information here is based on an analysis of information from the Scottish Input-Output tables for 1973 and 1996 (see Fraser of Allander Institute et al., 1978, and Scottish Executive, 1999), and Welsh Input-Output tables for 1968 and 1996 (see Ireson and Tomkins, 1978; and Hill and Roberts, 2001). To provide a similar time frame of analysis, and to match data with the earliest comprehensive survey of foreign manufacturing in Wales, the Welsh tables for 1968 were updated to 1974³.

There are several immediate difficulties here. The system of industrial classification changed several times during these periods. Moreover, the level of aggregation within the tables varies through time and by region. The 1973 Scottish tables are classified to 78 industries, while the 1996 tables define 123 separate industries. In the case of Wales the 1968 tables contain just 34 industries whilst the 1996 tables are classified to 67 industries. There was no easy way of reconciling industries from this diverse set of tables. The procedure adopted was to examine the definition of the industries for each of the tables, and the correspondence between 1968, and 1992 (and by necessity 1980) Standard Industrial Classifications, to match up sectors – in some cases with an element of judgement. In the case of Scotland 40 industry (further aggregated in the proceeding analysis) tables were produced for 1973 and 1996 – inclusive of 17 manufacturing industries. In the Welsh case the smaller number of industries in the base 1968 tables meant that it was only possible to produce comparable tables by some aggregation – this left in the Welsh case 23 industries inclusive of 13 in manufacturing. For comparative purposes it was decided to match the industries across both of the regions. Differences in aggregation of the manufacturing industries

³ This updating was achieved using a RAS procedure (see Allen and Gosling, 1975).

in Scotland and Wales meant that it was only possible to match 10 broad manufacturing groups across the two regions – these are defined in terms of their 1992 SIC in Table 5.

From the Input-Output table set the following information was derived. In each case this was for 1973 and 1996 for Scotland and 1974 and 1996 for Wales.

- Indirect output generated per £1m of gross output for industry.
- Total value added generated per £1m of industry gross output.
- Indirect value added (i.e. in the supply chain) per £1m of gross output for the industry.
- Industry export orientation for the period. Export orientation is percentage of gross output exported overseas.
- Import reliance over the period. Import reliance is total imports (UK and overseas) as a percentage of industry gross output.

Table 5 summarises changes in selected input-output relationships in Scotland and Wales, and the final column of the table shows changes in the foreign employment share in the given industry in each region. Estimates of foreign activity (employment) in the selected manufacturing industries was derived from a number of sources including, Industry Department for Scotland, Forsyth (1972), Davies and Thomas (1976), and Office of National Statistics (for 1996 data). The approach taken here is to describe overall patterns but to then focus on relationships in selected industries.

Table 5 Absolute Changes in Input Output Relationships: Scotland 1973-1996 & Wales 1974-1996

Sector and SIC 1992 code	Change in Type 1 Output Supported in Supply Chain	Change in Total Value Added Supported by the Industry	Change in Indirect Value Added Supported by the Industry	Change in Exports Propensity of the Industry	Change in Regional Import Propensity of the Industry	Change in foreign employ share in the industry
Scotland						
Food and drink 15-16	-0.05	-0.18	-0.09	0.12	-0.02	5.2
Chemicals and pharms 24	0.11	0.08	0.02	0.29	-0.11	24.8
Metal manufacturing etc. 27-28, 291-6	0.07	-0.01	0.00	0.29	-0.01	3.2
Electronics, electrical etc. 297, 30-33	0.13	-0.21	0.02	0.42	0.14	-7.6
Vehicles and other transport 34-35	0.13	-0.01	0.04	-0.09	-0.05	1.5
Textiles, clothing, footwear 17-19	0.14	0.13	0.04	0.10	-0.16	12.8
Paper, printing, publishing 21-22	0.26	0.07	0.08	0.19	-0.12	13.1
Rubber products 251	0.00	-0.06	-0.01	0.21	0.06	-26.8
Non metallic minerals etc. 26	0.15	-0.08	0.00	-0.03	0.03	5.34
Other manufacturing groups 20, 252, 36	0.13	-0.01	0.02	0.16	-0.04	2.6
Wales						
Food and drink 15-16	-0.33	-0.03	-0.16	0.06	-0.02	12.6
Chemicals and pharms 24	-0.14	0.01	-0.09	0.04	-0.05	27.1
Metal manufacturing etc. 27-28, 291-6	-0.35	-0.11	-0.11	0.11	0.19	-0.1
Electronics, electrical etc. 297, 30-33	0.02	-0.07	0.00	0.17	-0.01	17.7
Vehicles and other transport 34-35	-0.11	-0.13	-0.04	0.21	0.08	9.3
Textiles, clothing, footwear 17-19	-0.12	0.05	-0.06	0.15	-0.05	1.9
Paper, printing, publishing 21-22	-0.17	-0.10	-0.09	0.18	0.07	13.1
Rubber products 251	-0.09	-0.09	-0.06	0.19	-0.02	9.6
Non metallic minerals etc. 26	-0.31	-0.09	-0.16	0.10	0.11	24.0
Other manufacturing groups 20, 252, 36	-0.06	-0.11	-0.05	0.19	0.00	-2.1

Note: Change data is in absolute terms. So for example in food and drink for Wales the type 1 multiplier moves from £0.59m to £0.26m supported in the region per £1m of direct food and drink output giving an absolute change of £0.33m per £1m of direct industry output over the period.

In Scotland eight out of the ten industries show an increase in output supported in their respective supply chains over the period, and then in most cases a consequent increase in the value added being supported in the supply chain. However, the overall value added supported per £1m of gross output fell in seven out of ten cases. Loss of value added per unit of gross output could be related to the falling proportion of earnings in total output as capital intensity in the industries increases. The proportion of industry output exported overseas shows a similar pattern to Wales (below) with eight out of the ten sectors showing an increase. The most marked increases were in electronics, metals manufacturing and processing and chemicals. In electronics 38% of industry output in Scotland was exported in 1973, growing to 81% by 1996. Several large international electronics groups have European production platforms in Scotland. Finally here, seven out of the ten industries saw their regional import propensity fall over the period 1973-1996. Notable exceptions were the electronics and rubber industries which both saw a reduction in the penetration of the foreign-owned sector.

For Wales nine out of the ten industries had a reduction in the indirect output supported per £1m of direct industry output. The largest reductions in output supported per £1m of direct sector output were in metal manufacturing and processing where in 1974 around £0.59m was supported in the Welsh economy per £1m of gross output, this falling to just £0.24m in 1996. Much of this is likely to down to imports of raw materials taking over from locally sourced goods (i.e. coal). Food and drink also recorded a similar fall in the amount of output supported indirectly. The findings in the first column reflect through into the amount of indirect value added supported in the supply chain by these sectors. This has also fallen in nine out of the ten selected sectors. Total value added supported per £1m of gross output fell in eight of the ten industries. This could be the result of falling wage share in gross output. For example in Welsh electronics and automotive payments to households as a proportion of sector output fell from around 30% to just under 20% in the period.

Electronics was the only industry in Wales to see an increase in indirect output supported over the period, and also recorded one of the largest increases in foreign ownership. Connected to this has been the fact that the electronics sector in Wales has been one of the fastest to embrace lean production systems during the 1980s and 1990s. This has been connected to many of the larger consumer electronics and

components firms trying to purchase as much locally as possible to secure accelerated materials flows through factories (see for example, Munday et al., 1995). Moreover, the largest foreign electronics firms in Wales and Scotland have attracted subcontracting complexes to the vicinity of final assembly plants to produce sub-assemblies, plastics, packaging and selected electronic components (see for example, Morris et al., 1993). There is some expectation that moves towards just-in-time production in this sector might have led to increased output being supported in a locally based supply sector, and the information in the table provides some evidence for this with the increase in foreign penetration leading to little change in the regional import propensity of the sector.

Overseas exports as a percentage of industry gross output has increased in each Welsh industry case. The automotive and other transport sector in Wales saw the largest increase in export propensity from 12% of gross output in 1974 to 33% in 1996. This sector in Wales has become dominated by component manufacture (first and second tier automotive suppliers) rather than vehicle assembly. During the 1980s and 1990s the larger multinational and domestic automotive component groups in Wales became far more integrated into the globally based logistics chains being developed by the car manufacturers meaning that more Welsh produced automotive components were finding their way into mainland Europe car plants. The internationalisation of the car industry in Wales is also reflected in the growth of regional imports to support the sector. Overseas imports are expected to have been particularly significant here as component firms purchase overseas to gain pecuniary economics from other parts of their groups or other international firms.

As a partial consequence of increasing imports, the indirect activity supported in Wales by the automotive and other transport sector has fallen, as has the amount of value added supported in the region per £1m of sector output. The loss of value added is greater in the sector itself (i.e. indicated by a reduction from £0.55m to £0.41m giving a change of £0.13m in Table 5) rather than in its Welsh based supply chain.

In the final column of Table 5 are changes in foreign penetration across each of the ten sectors. In Scotland, foreign penetration increased in seven out of ten industries. In Scotland foreign penetration of the large electronics sector actually fell over the period from 54.3% to 46.7%. Largest increases in foreign penetration were in chemicals. In Wales, eight out of the ten industries have seen an increase in foreign

penetration in terms of employment over the period 1974-1996. The largest changes have been in chemicals where the foreign share of industry employment leapt from 38.4% to 65.5% over the period, and in electronics where the share moved from 32.5% to 50.2%.

The nature of the data in Table 5 does not permit rigorous testing. However, a simple correlation⁴ based on the levels of the variables in each of the regions for each of the years highlighted a significant and negative relationship between the level of the type 1 multiplier and the level of foreign involvement in the industry (in terms of employment or sales), a negative and significant relationship was also found between the indirect value added (i.e. in the supply chain) per £1m of gross output for the industry. Finally a positive and significant correlation was found between export propensity and degree of foreign penetration of the industry. However, this analysis is far from conclusive given the numerous region effects (i.e. Scotland is far larger than Wales and it is expected that regional size influences variables such as the magnitudes of output and value added supported in the local economy), and industry specific factors that could affect the input-output characteristics of the selected industries including a general trends towards outsourcing, and increasing external trade as a result of membership of the European Union.

5. Conclusions

The earlier review has suggested that trends in inward investment will affect manufacturing linkage, and could contribute to a subtle hollowing out of the regional economy. It remains difficult to explicitly tie changes in foreign ownership of regional manufacturing to any hollowing out in the Scottish and Welsh case. Certainly the evidence for Scotland and Wales points firmly to foreign firms having lower levels of local purchasing than their domestic counterparts such that in sectors where foreign involvement has increased, local intermediation is likely to have fallen. If anything

⁴ Correlation results on levels 1973/4 and 1996

	Foreign manufacturing employment/total employment	Foreign manufacturing sales/total sales
Type 1 output multiplier	-0.396*	-0.403**
Total value added gen. per £1m of ind. gross output	-0.267	-0.245
Indirect value added per £1m of ind.gross output	-0.453**	-0.468**
Industry export orientation	0.541**	-0.613**
Industry import orientation	-0.179	-0.066

N=40, ** correlation is significant at the 0.01 level * at the 0.05 level

changes as reflected in reductions in output supported in regionally based industry supply chains are more noticeable in Wales than in Scotland, and with the smaller Welsh economy generally accepted as having had more success in attracting foreign manufacturing investment during the 1980s and 1990s.

It is expected that in order to move towards more concrete conclusions research will have to progress on an industry case by case basis. However, this paper shows that in the context of debates surrounding hollowing out and its implications, regional trends in overseas investment need to be connected to more general trends in long term dependence which are in turn related to the changing nature of both internal and external economies of scale and scope.

The juxtaposition of regional policies on local sourcing are likely to remain in place. Whilst falling levels of output supported in the regional supply chains of manufacturing sectors has been a concern amongst development professionals and academics, these concerns may be mitigated by the fact that overseas investors forge extra-regional linkages for regions that may be important to the development of longer term competitiveness.

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