

Dewhurst, John; Munday, Max; Roberts, Annette

Conference Paper

Foreign manufacturing and changes in industry linkage patterns in Scotland and Wales

41st Congress of the European Regional Science Association: "European Regional Development Issues in the New Millennium and their Impact on Economic Policy", 29 August - 1 September 2001, Zagreb, Croatia

Provided in Cooperation with:

European Regional Science Association (ERSA)

Suggested Citation: Dewhurst, John; Munday, Max; Roberts, Annette (2001) : Foreign manufacturing and changes in industry linkage patterns in Scotland and Wales, 41st Congress of the European Regional Science Association: "European Regional Development Issues in the New Millennium and their Impact on Economic Policy", 29 August - 1 September 2001, Zagreb, Croatia, European Regional Science Association (ERSA), Louvain-la-Neuve

This Version is available at:

<https://hdl.handle.net/10419/115201>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

Foreign Manufacturing and Changes in Industry Linkage Patterns in Scotland and Wales

John Dewhurst, Department of Economic Studies, University of Dundee, Dundee, DD1 4HN, UK. (j.h.l.dewhurst@dundee.ac.uk).

Max Munday & Annette Roberts, Welsh Economy Research Unit, Cardiff Business School, Colum Drive, Cardiff CF10 3EU. (mundaymc@cf.ac.uk; robertsal@cf.ac.uk).

Paper for European Regional Science Association 41st Annual Meeting “European Regional Development Issues in the New Millennium and their Impact on Economic Policy”, Zagreb, Chamber of Economy, Croatia, August 2001.

1. Introduction

The paper explores whether the development of foreign manufacturing in Scotland and Wales, is reflected in temporal changes in sectoral input-output relationships (i.e. indirect employment, direct and indirect value added and output effects, export orientation, and import propensity). Prior analyses of the impact of foreign (and domestic) manufacturing on local economies within an input-output framework have been based either on cross-sectional information (see for example, Brand et al., 2000), or have considered single industry groups (see for example McCann, 1997). This paper works towards a more dynamic perspective by considering structural changes in input-output relationships over time for a series of industry groups which have received foreign direct investment.

Key information sources are the Scottish Input-Output tables 1973 and 1996 (see Fraser of Allander Institute, 1978, and Scottish Executive, 1999), and Welsh Input-Output tables 1968 and 1996 (see Ireson and Tomkins, 1978; and Hill and Roberts, 2001). A wider context of the paper is continuing concerns in the UK over the more dynamic impacts of foreign manufacturing industry in improving regional economic prospects, and the longer term validity of the ‘inward investment model’ of economic development (Turok, 1993; Munday, 2000).

The second section of the paper reviews the development of foreign manufacturing in the Scottish and Welsh economies. The section reveals the development of foreign manufacturing in the two economies, and critically analyses previous research that has explored the role of the foreign sector in these regions, particularly studies examining the effects of the foreign sector on the regional economy within an Input-Output framework. The third section describes the Input-Output tables that are available for Scotland and Wales, and more specifically, discusses issues of comparability of tables of different vintages. The methodology used to reconcile the industry sectors in the tables is discussed. The section also outlines how foreign manufacturing might be expected to have affected input-output relationships in the Scottish and Welsh economies over time. The fourth section examines the nature of changes in input-output relationships in the two economies, including an analysis of local trading propensities, together with estimates of multiplier effects of selected industries characterised by strong foreign manufacturing involvement (in the period 1973-1996 for Scotland and 1968-1996 for Wales). This work is still in progress with future research expected to involve a more detailed analysis of sectors which have exhibited different patterns of growth in foreign involvement over time, to more fully explore the different impacts on input-output relationships. The final section contains conclusions.

2. Foreign Manufacturing in Scotland and Wales

This section examines the recent development of the foreign manufacturing stock in Scotland and Wales, and highlights trends within individual foreign manufacturing sectors. Throughout this section two main types of

data source are used. Much of the analysis is based upon foreign manufacturing data derived from the Annual Census of Production (Business Monitor, PA1002, various) supplemented by sectorally disaggregated data on foreign manufacturing in Scotland and Wales (1984-1997) supplied directly from the Office of National Statistics (ONS). Other tables are based on foreign manufacturing plant and employment data which (previous to devolution) were published by the Welsh Office (i.e. Welsh Register of Manufacturing Employment) and the Scottish Office (Scottish Register of Employment via the Industry Department for Scotland). Unfortunately, according to Stone and Peck (1996) the Census data consistently provides lower estimates of foreign manufacturing activity than the regional data-sets from the Scottish and Welsh Offices. This discrepancy is most likely due to definitional problems (i.e. the regional databases would include as foreign those firms with a UK registered office, but where the ultimate majority shareholding is overseas), and with the Central Statistical Office (now ONS) failing to fully represent acquisitions of domestic firms by foreign firms (for problems with data sources of foreign manufacturing in the regions also see Hill and Munday, 1992; and for a full description of data sources on foreign manufacturing in the UK regions see Stone and Peck, 1996).

Foreign-owned manufacturing has long histories in both Scotland and Wales. Both regions benefited from increases in US inward investment in the immediate post-war years. In 1963, foreign manufacturing employment in Scotland was nearly 46,000 and in Wales was 24,000 (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 been successful in attracting new foreign investment. For example, Hill and Munday (1994) report that between 1982-1992 Scotland and Wales attracted respectively 545 and 500 foreign manufacturing projects which were together associated with over 90,000 new jobs. Then over this period Scotland and Wales together attracted around 32% of UK inward investment projects, and 40% of connected jobs. The scale of the inward investment successes in the two regions is not always clear from the Census of Production due to closures and divestments (see also Table 3 below).

The strong contribution of the foreign sector in both regions is brought into sharper focus when compared to developments in the respective indigenous manufacturing sectors. Table 1 provides information for the years 1981, 1990 and 1997. In both economies the proportion of foreign manufacturing employment in total employment has increased through time. Between 1981-1997, although foreign manufacturing employment fell by nearly 19% in Scotland, domestic manufacturing employment fell by 31%, which meant that by 1997 the proportion of total manufacturing jobs in overseas plants in Scotland had grown to 20%. In Wales, foreign manufacturing employment increased by 17% in the period 1981-1997, while employment in the domestic sector fell by nearly 12%. The net result of this was that by the end of the period 25% of total manufacturing jobs in Wales were in foreign-owned plants (although note that the Welsh Register of Manufacturing Employment suggests that this figure is currently closer to one in three).

Table 1 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

Table 2 uses Census of Production data for 1984-1997 to show growth in value added across selected industries in Scotland and Wales for both the foreign and domestic sector. Attempting to explain changes in foreign manufacturing employment and value added by broad industry sector is made difficult by changes in Standard Industry Classifications, and the general paucity of data. The sector data (2 digit SIC80/92) was available from the ONS, but these only covered the period 1984-1997, and with some sectors having to be either estimated by the authors, or in other cases aggregated together to avoid disclosure problems. In the first instance Table 2 reveals the importance of foreign investment in the Scottish electrical, electronics and instruments sector. By 1997 this sector 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 sectors, with for example, electrical, electronics and instruments contributing just 19% of foreign sector value added in 1997.

Table 2 Growth of Manufacturing GVA Wales and Scotland 1984-1997: Selected Sectors

Sector (SIC 92 code)	Estimated GVA of foreign sector Scotland (£m)		Scotland – Growth in GVA 1984-1997 (%)		Estimated GVA of foreign sector Wales (£m)		Wales – Growth in GVA 1984-1997 (%)	
	1984	1997	Foreign-Owned	Domestic	1984	1997	Foreign-Owned	Domestic
Food and drink 15-16	231.8	354.5	53	96	52.8	213.3	304	139
Printing, publishing and paper 21-22	137.8	226.6	64	130	61.4	165.8	170	255
Chemicals and pharmaceuticals 24	121.5	180.6	49	11	118.8	273.4	130	-33
Rubber and plastics 25	55.6	73.4	32	242	30.7	166.4	442	357
Non-metallic mineral products 26	5.6	27.3	390	44	20.0	42.0	110	-18
Basic metals and metal manufacturing 27-28	48.0	254.0	430	137	143.5	324.6	126	149
Mechanical engineering 29	147.8	255.8	73	2	24.8	106.3	328	77
Electrical, electronics and instruments 30-33	598.6	1748.9	192	142	122.0	443.3	263	103
Total –all foreign-owned manufacturing inc sectors not specified above	1416.7	3545.5	150	75	754.0	2298.9	205	118

Note: Columns do not sum to total –all manufacturing because of sectors not included in the table.

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

Table 2 also reveals that the growth of foreign manufacturing GVA in Wales exceeded that in Scotland across most sectors. 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 sectors 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 1993-1997.¹

Wales has maintained its foreign manufacturing employment and output at a higher level than Scotland (see also Table 5 below). This is confirmed by Stone and Peck (1996) who, using regional databases (see above), identified a distinct foreign manufacturing performance gap between Wales (and Northern region) and Scotland (and Northern Ireland) in the period 1979-1993. Stone and Peck revealed in their study that differences in overall foreign manufacturing employment performance were not just down to better performance in terms of the attraction of new manufacturing investment, but also reflected differences in performance in other critical components of change. So, for example, Table 3 reveals that, compared to Wales, Scotland suffered a large number of foreign manufacturing closures in the period 1979-1993, which were not compensated by new foreign 'creation' or transfers as a result of acquisitions. Table 3 shows the importance of acquisition amongst key components of change in the case of both regions.

¹ Data in this paragraph derived from special data sheets provided by the Office of National Statistics at Newport.

Table 3 Components of Foreign Owned Manufacturing Changes 1978-1993 Plants and Employment

	Plants		Employment	
	Scotland	Wales	Scotland	Wales
Initial Stock	352	217	108065	58900
New Creations	144	129	19219	17000
Closures	158	59	41760	6700
Acquisitions	84	118	19272	22600
Divestments	46	53	9261	12400
In situ change +	55	52	8407	5500
In situ change -	79	64	18148	16800
Net change	24	135	-21976	9100
Stock at end	376	348	86089	68000

Source: Stone and Peck, 1996.

Other information on broad sectoral trends in foreign manufacturing employment are examined from analyses of data from the Welsh Register of Manufacturing Employment, and the Scottish Register of Employment. Starting with Wales, Table 4 shows employment and estimated numbers of companies at 1974 and 1998. The change in SIC code means that a precise reconciliation of sectors over the period was not possible – however, the table shows overall sector trends. 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. Davies and Thomas (1976) reveal that around 90% of foreign manufacturing employment in Wales in 1974 was in North American firms. During the later 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 etc, 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.

Table 4 Employment in Overseas Manufacturing; Wales 1974 & 1998

Sector	SIC 92	Employment (Plants) 1974	Employment (plants) 1998
Food & 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 for 1974 in brackets are companies, in 1998 are plants.

Table 5 Foreign Involvement in Scottish Manufacturing Employees in Foreign Companies/Total Sector Employment 1975 and 1994

Sector and approximate 1992 SIC reconciliation	Emp 1975	Emp 1994	1994 Foreign sector emp/ total emp (%)
Food & drink 15-16	8.8	4.8	8.8
Textiles, leather and Clothing 17-18	7.0	7.0	16.4
Paper, printing and publishing etc 20-22	3.8	6.8	29.5
Chemicals and man made fibres 24	6.0	5.7	35.4
Metals and mineral extraction 23, 26 28	1.3	2.4	17.8
Metal goods 27	3.5	2.0	14.9
Mech engineering 29	27.0	8.0	26.1
Electrical, elec and instrument engineering 30-33	38.5	33.8	59.0
Transport equipment 34-35	10.7	4.8	23.1
Other manufacturing 36	6.2	6.8	29.5
Total	112.9	82.1	27.9

Source: Industry Department for Scotland, various.

Information on the development of the foreign sector in Scotland is shown in Table 5. The construction of the data-set mean that it is almost impossible to reconcile individual sectors over the period 1975-1996. However, some reconciliation is possible over the period 1975-1994. Table 5 reveals the fall in foreign company manufacturing employment in Scotland over the period. In 1975, there were an estimated 113,000 employed in foreign manufacturing companies in Scotland in 1975. The largest foreign sectors in terms of employment were electrical and instrument engineering and mechanical engineering, together accounting for 58% of employment in foreign manufacturing in Scotland. In the period to 1994 overall employment in foreign manufacturing plants in Scotland fell to 82,000. Particularly large falls in employment were recorded in food and drink, mechanical engineering, and transport equipment. Although numbers employed in electrical, electronic and instrument engineering fell, this sector alone still accounted for over 40% of foreign manufacturing company employment in 1994. The final column in Table 5 shows the significance of employment on overseas-owned firms as a proportion of total sector employment in 1994. This reveals that sectors with particularly high levels of foreign

to total industry employment were chemicals (35%), mechanical engineering (26%), electrical and instrument engineering (59.0%).

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 Table 3). Second, the growth of the foreign sector has been uneven. In the Scottish case few foreign manufacturing sectors have seen an increase in employment, but there has been strong growth of value added in some industries. In the Scottish case, the fastest growth of foreign sector gross value added has been in sectors such as non-metallic mineral products, basic metals, and electrical, electronics and instrument engineering. In Wales, foreign manufacturing activity has grown fastest in food and drink, rubber and plastics, mechanical engineering and electrical, electronics and instrument engineering. Third, there is some evidence that Wales has maintained much of its foreign manufacturing employment (and output), at a time when Scotland has actually lost employment in the foreign-owned manufacturing sector.

There is some expectation that the changing trends in foreign ownership across Welsh and Scottish industries will be reflected in changes in input-output relationships (e.g. direct and indirect output and value added supported, export orientation, and import propensity). For example, previous research has highlighted the comparatively low levels of linkage that exist between inward investing sectors and local supply bases. 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 (with reference to Input-Output tables for Scotland) output based multipliers for the electronics sector revealed a poor quality of linkages into the local economy. In Wales, Roberts (1996) considered the backward (and forward) linkages created by foreign manufacturing sectors in the local economy using 1994 Input-Output tables for Wales. Overall, this research 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). Finally, Brand et al., (2000), explored in a regional Input-Output framework, the direct and indirect economic contribution of foreign owned and domestic manufacturing to the economies of Wales, Scotland and the West Midlands. The study demonstrated that generally foreign owned manufacturing in these regions 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 employee to regional value added than its domestic counterpart.

3. Examining Structural Change in Scotland and Wales

The comparison of structural change in the Scottish and Welsh economies is based on an analysis of information in 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). In both the Scottish and Welsh cases there have been Input-Output tables produced in the intervening period (Scotland 1979, 1989 and 1995) and Wales (1994 & 1995). The analysis covers a period over

which both regional economies have experienced extensive development of their foreign manufacturing sectors as demonstrated in Section 2 (see also Hill and Munday, 1994).

Unfortunately making inter or intra-regional comparisons over time using input-output tables is far from easy. Firstly, the system of industrial classification changed several times during the period. The Welsh tables for 1968 and Scottish tables for 1973 use the Standard Industrial Classification (SIC) for 1968, whilst the 1996 tables define sectors using 1992 SIC codes. Secondly, the level of aggregation within the input-output tables varies through time and by region. The 1973 Scottish tables are classified to 78 sectors, while the 1996 tables define 123 separate sectors. In the case of Wales the 1968 tables have just 34 sectors whilst the 1996 tables are classified to 67 sectors.

There was no easy way of reconciling sectors from this diverse set of tables. The procedure adopted was to examine the definition of the sectors 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 sector (further aggregated in the preceding analysis) tables were produced for 1973 and 1996 – inclusive of 23 manufacturing sectors. In the Welsh case the smaller number of sectors in the 1968 tables meant that it was only possible to produce comparable tables by some aggregation – this left in the Welsh case 23 sectors inclusive of 14 manufacturing sectors. In both the Scottish and Welsh cases very little disaggregation of the service industry sector proved possible (for example, in the Wales 1968 tables just 5 services sectors are defined).

A further complication was the difficulty matching up the aggregated sectors from the input-output tables to those broadly defined sectors for which data on foreign manufacturing activity was available (see Section 2 above). Whilst, the research process to overcome some of these problems is ongoing, this paper summarises trends in the export and import reliance of a selected set of industries in each region, and trends in indirect output and value added multipliers for these industries, and makes an attempt to tie this to the level of foreign manufacturing involvement in the two regional economies over time.

A number of possible hypotheses about the effects of foreign-owned manufacturing on input-output relationships over time emerge from the preceding review. The development of a strong foreign-owned manufacturing presence in a given industry is expected to be associated with growth in reliance of imports both from other regions of the UK and from overseas. Clearly, this is partly a function of the industry concerned, but research has demonstrated the relatively low local/regional purchasing propensities of foreign enterprises compared to those in the domestic sector, and this has been connected to a reduction in the regional development opportunities from foreign manufacturing (see for example Munday and Roberts, 2001). Foreign enterprises with their scope also have greater opportunity to gain from global purchasing economies, particularly in high value components. This has ramifications for the value of Type 1 output multipliers which might be expected to fall over time as less and less is bought locally by an increasingly significant foreign manufacturing sector. Conversely, changes in Type 1 output multipliers 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, often to suppliers and subcontractors in close proximity to final assembly plants. This has certainly been the case in electronics and automotive sectors which have been in the forefront of movements towards lean production emphasising an accelerated flow of materials through plants (Munday and Roberts, 2001). Moreover, 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 increases.

In terms of the total value added supported by industry sectors it is necessary to recognise that the foreign manufacturing sector features higher earnings than the domestic sector (Brand et al., 2000). Therefore in sectors where there have been high concentrations of foreign manufacturing we might expect some increase in value added/GDP effects this being largely down to the higher incomes being paid in the foreign sector (see for example, Brand et al., 2000). Set against this is the fact that foreign multinationals in the UK regions are to be involved in transfer pricing activity which reduces the profits declared in the region (and the UK – see for example, Munday and Peel, 1998). 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, here there is also some expectation that a higher level of involvement from foreign firms 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). Foreign firms, more than domestic investors, are expected to place a far higher priority on exporting activity.

4. Patterns of Change

In what follows data for 1973 and 1996 for Scotland, and 1968 and 1996 for Wales is used to describe underlying changes in import and export propensities and value-added and output multipliers (Type 1). The focus is on four aggregated manufacturing sectors in each regional economy where there have been or continue to be high levels of foreign manufacturing activity (in terms of either absolute employment, or in terms of estimated share of industry employment in plants of foreign origin). Each sector is defined as closely as possible with the 1992 SIC and broadly matched across the two regions.

The selected sectors are Electrical machinery and electronics (including components and instrument engineering); Automotive and other transport; Chemicals and pharmaceuticals; and finally Mechanical engineering and metal products. Table 6-9 provides summary information for each of these sectors.

4.1 Electrical machinery and electronics

The data in Table 6 shows the growth of the significance of the electrical machinery and electronics sector to the Welsh economy over the 1968-1996 period, and to a greater extent in Scotland over the period 1973-1996. In 1968 the sector is estimated to have accounted for 6.6% of total manufacturing industry gross output in Wales, this growing to 15.3% in 1996 (In 1997 it is estimated that the foreign sector accounted for approximately 42% of this industry's gross value added in Wales). In Scotland, the respective figures are 9.6% and 30.4%. As demonstrated in section 2 this is a sector that has seen very high levels of foreign investment, particularly in consumer electronics and electronic components. It is important to recognise that perhaps more than in the other selected sectors technological changes make the 1996 sector very different from the 1968/1973 sector when

elements of the present electronics sector did not exist. That noted, technological change, together with the strong presence of foreign investment appears to have wrought some changes in the broad sector.

In the Scottish case in 1973 the sector imported 70% of its intermediate purchases (25% from overseas). By 1996 the proportion of imports in total sector intermediate purchases was still around 70%, although the proportion of total intermediate purchases from overseas had grown to around 51%. In spite of import propensities remaining steady in the Scottish sector, the indirect output supported per £1m of direct sector output increased from £0.19m to £0.32m in the period 1973-1996.

Table 6 Patterns of Change 1968/73-1996 Electrical Machinery and Electronics –

Industry (definition in terms of 1992 SIC) Electrical machinery and electronics (29.7; 31-33)		
Scotland	1973	1996
Sector output as a percentage of total manufacturing gross output	9.6	30.4
Imports (UK & Overseas) as a proportion of total intermediate purchases (%) (overseas imports as % of total intermediate purchases)	70.2 (24.7)	69.5 (51.0)
Exports (UK & Overseas) as a proportion of total output (%) (overseas exports/total output)	84.2 (38.5)	90.6 (80.8)
Indirect output supported per £1m of direct sector output.(£m)	0.194	0.323
Regional value added supported per £1m of direct sector output (the amount supported in the industry supply chain alone) £m	0.595 (0.105)	0.383 (0.128)
Payments to households as a proportion of sector output	26.1	10.8
Wales	1968	1996
Sector output as a percentage of total manufacturing gross output	6.6	15.3
Imports (UK & Overseas) as a proportion of total intermediate purchases (%) (overseas imports as % of total intermediate purchases)	78.2 (15.4)	70.5 (38.0)
Exports (UK & Overseas) as a proportion of total output (%) (overseas exports/total output)	51.6 (14.6)	86.9 (31.3)
Indirect output supported per £1m of direct sector output.(£m)	0.170	0.226
Regional value added supported per £1m of direct sector output (the amount supported in the industry supply chain alone) £m	0.469 (0.089)	0.423 (0.102)
Payments to households as a proportion of sector output	28.1	17.7

In Wales the sector as a whole imported (overseas and other UK) 78% of its intermediate products. By 1996, this had fallen to 71%. However, over the same period imports from overseas increased from 15.4% to 38.0% of total intermediate product purchases. These figures have some bearing upon the indirect output supported per £1m of direct electrical machinery and electronics output in Wales. This grows from £0.17m in 1968 to £0.23m by 1996. Interestingly, the electrical machinery and 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.

Regional value added supported per £1m of direct output in electrical machinery and electronics has fallen over the respective periods in both Scotland and Wales. Interestingly further analysis revealed that this fall was in terms of direct value added supported in the sector itself, with an increase in value added supported in the sector supply chain. What seems to emerge here in both cases is that the proportion of intermediate products bought locally has changed little, but perhaps the mix of products bought has changed such that the indirect output supported by a given level of direct sector output has increased. At the same time although the mix of purchases has changed, the value added in the supply chain by this new mix had gone up i.e. what is being purchased may be of a higher value added nature in 1996 compared to the earlier period. The figures questions Turok's (1993) argument of the creation of dependent supply sector to the Scottish electronics sectors as a whole, where purchases of the sector are orientated towards lower value added products. However, direct value has fallen. This may then reflect the higher productivity of foreign plants possibly combined with lower earnings within them (see Morris et al., 1993). The reduction in direct sector value added could also be linked to an 'accounting' reduction in profit caused by transfer pricing. For example, foreign electronics plants have previously been shown to make lower returns than their domestic counterparts (see Munday and Peel, 1998).

The electrical machinery and electronics sector in Scotland and Wales saw a strong increase in exports over the period 1968/1973-1996. The growth of overseas exports is particularly noticeable in both cases. Both regions became favoured export platforms for consumer electronics and component products during the late 1970s and 1980s. For example, in Wales a high proportion of the consumer electronic products of regionally based firms such as Aiwa, Sony, Panasonic and Hitachi is destined for European as well as UK markets.

Finally here the electrical machinery and electronics sector saw its payments to households as a proportion of its gross output fall over the respective periods in both regions. The fall in the proportion of payments to households is also reflected in the trends in the amount of direct value added supported locally per £1m of direct output (see above).

4.2. Automotive and Other Transport Equipment

The material in the second section of the paper revealed that foreign activity in Wales automotive and other transport equipment sector has grown as both employment and number of plants has increased in the period 1975-1998. In Scotland, the opposite has occurred partially as the result of losses in some elements of other transport (shipbuilding) and the Scottish sector as a whole foreign activity in terms of direct employment supported has decreased.

In Wales the automotive and other transport sector has grown in significance from 5.4% to 9.5% of Welsh manufacturing output over the period 1968-1996. This sector is dominated by component manufacture (first and second tier automotive suppliers) rather than vehicle assembly with the figures for 1968 and 1996 revealing a high proportion of final products being exported, but increasingly overseas as opposed to other regions of the UK. 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 is also reflected in the growth of overseas imports into the

sector as inward investors such as Valeo, Bosch and Calsonic 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, rather than in its Welsh based supply chain. The automotive sector, as electrical machinery and electronics has also seen a market reduction in payments to Welsh households as a proportion of sector output.

In Scotland, things are very different in this sector. It should be noted that the mix of activities in the aggregated sector is the very different from that in Wales, where automotive components in dominant. In Scotland this sectors share of total manufacturing output has fallen to less than 5%. Over the period 1973-1996 sector imports as a percentage of total intermediate purchases have fallen (although the percentage from overseas has increased) which partially explains the growth of indirect output supported in the supply chain per £1m of direct sector output i.e. from £0.21m to £0.34m. As in Wales, the overall value added supported by the sector has fallen, although that portion in the supply chain has increased. Once again this partially reflects the reduction of payments to households, and the growing capital intensity. In general there was a reduction in overall value added by each of the four selected sectors.

Table 7 Patterns of Change 1973-1996 – Automotive and Other Transport Equipment

Industry (definition in terms of 1992 SIC) (34-35)	1973	1996
Scotland		
Sector output as a percentage of total manufacturing gross output	10.5	4.8
Imports (UK & Overseas) as a proportion of total intermediate purchases (%) (overseas imports as % of total intermediate purchases)	71.5 (8.2)	61.7 (26.9)
Exports (UK & Overseas) as a proportion of total output (%) (overseas exports/total output)	80.5 (34.9)	74.0 (25.6)
Indirect output supported per £1m of direct sector output.(£m)	0.212	0.343
Regional value added supported per £1m of direct sector output (the amount supported in the industry supply chain alone) £m	0.537 (0.103)	0.530 (0.142)
Payments to households as a proportion of sector output	29.5	22.9
Wales	1968	1996
Sector output as a percentage of total gross manufacturing output	5.4	9.5
Imports (UK & Overseas) as a proportion of total intermediate purchases (%) (overseas imports as % of total intermediate purchases)	64.5 (7.5)	70.5 (36.1)
Exports (UK & Overseas) as a proportion of total output (%) (overseas exports/total output)	79.2 (11.8)	82.5 (32.7)
Indirect output supported per £1m of direct sector output.(£m)	0.278	0.217
Regional value added supported per £1m of direct sector output (the amount supported in the industry supply chain alone) £m	0.535 (0.115)	0.418 (0.095)
Payments to households as a percentage of sector output	32.2	18.4

4.3. Chemicals and pharmaceuticals

In chemicals and pharmaceuticals in both regions the influence of the foreign-owned sector has grown over time. Gross value added in the foreign-owned sector has increased faster than in the domestic chemicals and

pharmaceuticals sector. In Wales overseas –owned firm employment in this relatively capital intensive sector has increased slightly in the period 1975-1996, whilst the number of plants has trebled. In Scotland employment in the foreign-owned chemicals and pharmaceuticals sector has been maintained. By 1994, just over one third of the sector employment in Scotland was in overseas owned plants.

Table 8 Patterns of Change 1973-1996 – Chemicals and Pharmeceuticals

Industry (definition in terms of 1992 SIC) (24)	1973	1996
Scotland		
Sector output as a percentage of total gross manufacturing output	9.2	7.2
Imports (UK & Overseas) as a proportion of total intermediate purchases (%) (overseas imports as % of total intermediate purchases)	71.3 (42.7)	61.7 (44.6)
Exports (UK & Overseas) as a proportion of total output (%) (overseas exports/total output)	61.9 (26.2)	81.0 (55.0)
Indirect output supported per £1m of direct sector output.(£m)	0.250	0.363
Regional value added supported per £1m of direct sector output (the amount supported in the industry supply chain alone) £m	0.448 (0.127)	0.529 (0.149)
Payments to households as a proportion of sector output	13.5	14.4
Wales	1968	1996
Sector output as a percentage of total manufacturing gross output	6.6	7.4
Imports (UK & Overseas) as a proportion of total intermediate purchases (%) (overseas imports as % of total intermediate purchases)	72.7 (20.7)	71.1 (29.8)
Exports (UK & Overseas) as a proportion of total output (%) (overseas exports/total output)	91.6 (32.4)	85.0 (35.6)
Indirect output supported per £1m of direct sector output.(£m)	0.225	0.177
Regional value added supported per £1m of direct sector output (the amount supported in the industry supply chain alone) £m	0.453 (0.125)	0.497 (0.073)
Payments to households as a percentage of sector output	17.5	14.9

Table 8 reveals that chemicals and pharmaceuticals have increased in terms of their shares of overall manufacturing industry output Wales but not in Scotland. In Scotland the pattern in chemicals and pharmaceuticals 1973-1996 shows that the percentage of imports of intermediate goods and services has decreased, which goes some way to explaining the increase in the indirect output supported per unit of direct sector output over the period. At the same time the value added supported in the sector per unit of output has increased both in the sector itself and in its supply chain.

For Wales, the proportions of intermediate products imported over the period changed little. However, unlike Scotland, the indirect output supported per £1m of direct output fell by 21% in the period. Moreover the amount of regional value added supported per £1m of direct sector output increased in the period 1968-1996. This reflected at the same time an increase in the value added supported in the sector but a decrease in the value added supported in the supply chain.

In chemicals and pharmaceuticals the changes in input-output relationships are very different across the regions although the sector in both economies has seen an increase in the proportion of sector activity in overseas-owned firms.

4.4. Mechanical engineering and metal products

The mechanical engineering and metal products sector has retained a strong element of foreign activity in Scotland and Wales, particularly (in the case of mechanical engineering) when compared to falling levels of

overall sector activity (see Table 2, 4 and 5). Table 9 shows that in Scotland this aggregated sector has decreased in its share of total manufacturing gross industry output in the period 1973-1996 – in Wales the contribution of the sector to total manufacturing output has also fallen. The proportion of intermediate products imported (UK and overseas) by this sector has decreased slightly in Scotland, but increased in Wales. In the case of Wales there has been a strong growth in that proportion of products bought from overseas. Indeed across each of the four selected sectors there is plenty of evidence of increasing internationalisation in purchasing and selling activity, part of which is reflected in the scope of international firms based in Wales, but also improved infrastructure links making it easier to move goods to Europe.

In mechanical engineering and metal products the increase in imports in Wales has reduced the amount of activity supported in the locally based supply chain, with indirect output supported per £1m of sector output falling from £0.34m to £0.22m between 1968 and 1996. Value added supported per £1m of direct output changes little in the period in Wales. However, further analysis revealed that of the £0.49m of value added supported per £1m of direct output in 1968, £0.15m was in the supply chain – by 1996 the amount of value added supported in the supply per £1m of direct sector output had fallen to £0.09m – this attributable in part to the decline in the local purchasing of the sector.

Scotland presents a very different picture to Wales for this sector possibly reflecting the different mix of industries contained in this sector. Here the indirect output being supported per £1m of direct sector output increased in the period 1973-1996. In addition the value added overall per £1m of direct sector output is maintained in the sectors and its supply chain.

The pattern of change in sector exporting is also very different across Scotland and Wales. In the former exports have increased overall, but especially that proportion of exports going overseas. In Wales, exports have also grown as a proportion of sector output, but there has been a reduction in the proportion going overseas.

Table 9 Patterns of Change 1973-1996 – Mechanical Engineering and Metal Products

Industry (definition in terms of 1992 SIC) (27.5, 28-30)	1973	1996
Scotland		
Sector output as a percentage of total gross manufacturing output	13.2	12.2
Imports (UK & Overseas) as a proportion of total intermediate purchases (%) (overseas imports as % of total intermediate purchases)	59.9 (9.6)	56.5 (7.5)
Exports (UK & Overseas) as a proportion of total output (%) (overseas exports/total output)	67.5 (26.5)	82.4 (52.4)
Indirect output supported per £1m of direct sector output.(£m)	0.288	0.370
Regional value added supported per £1m of direct sector output (the amount supported in the industry supply chain alone) £m	0.611 (0.146)	0.581 (0.156)
Payments to households as a proportion of sector output	33.2	25.1
Wales	1968	1996
Sector output as a percentage of total manufacturing gross output	9.9	7.1
Imports (UK & Overseas) as a proportion of total intermediate purchases (%) (overseas imports as % of total intermediate purchases)	61.7 (10.2)	67.4 (27.3)
Exports (UK & Overseas) as a proportion of total output (%) (overseas exports/total output)	48.4 (18.0)	62.9 (14.3)
Indirect output supported per £1m of direct sector output.(£m)	0.337	0.218
Regional value added supported per £1m of direct sector output (the amount supported in the industry supply chain alone) £m	0.491 (0.146)	0.503 (0.090)
Payments to households as a proportion of sector output	26.4	23.6

5. Foreign Manufacturing and Input-Output Relationships : Discussion

The preceding analysis reveals some consistent patterns of change in the input-output relationships in the two economies over time. Table 10 shows a summary of the findings. The most consistent results across the two economies are for electrical machinery and electronics, which is also where the most significant foreign manufacturing presence has developed. In both cases the indirect output supported by the industry as a whole has increased whilst local value added has fallen in the sector itself, but increased in the supply chain. Exports have increases, particularly overseas, and imports have gone down in Wales, but changed little in Scotland.

Other structural patterns differ across the regions. In Scotland, in each of the selected manufacturing sectors, the indirect output supported per £1m of direct sector output, and value added supported in the supply chains has increased. Imports have generally decreased and exports increased, with the exception of the automotive and other transport sector. In Wales, the pattern is not so clear. With the exception of electronics value added in the supply chain has decreased. Overall value added has decreased in two sectors and increased in the two others. In automotive and other transport, and in mechanical engineering and metal products the trend in Wales seems to be the opposite of that in Scotland in most of the structural relationships. The strongest commonality across both economies is the propensity of the selected sectors to trade overseas.

Table 10 Summary of Findings Scotland 1973-1996: Wales 1968-1996

	Indirect Output supported/£1m of direct output	VA supported overall	VA supported in supply chain	Imports intermediate goods	Exports as proportion of output
Electrical machinery and electronics					
Scotland	Increased	Decreased	Increased	Little Change	Increased
Wales	Increased	Decreased	Increased	Decreased	Increased
Automotive and other transport					
Scotland	Increased	Little change	Increased	Decreased	Decreased
Wales	Decreased	Decreased	Decreased	Increased	Increased
Chemicals and pharmaceuticals					
Scotland	Increased	Increased	Increased	Decreased	Increased
Wales	Increased	Increased	Decreased	Little change	Decreased
Mechanical engineering and metal products					
Scotland	Increased	Decreased	Increased	Decreased	Increased
Wales	Decreased	Increased	Decreased	Increased	Increased

The research process is ongoing, but there is a strong expectation that some of the trends being outlined from section 4 are related to the development of foreign manufacturing investment in the two economies. Of particular concern are reductions in sector value added. This would be expected as a result of technological change and productivity improvements causing a reduction in payments to households. However, the loss of direct value added also ties to recurrent concerns about the underlying quality of inward investment in these two periphery economies. Another linked issue is the extent to which foreign manufacturing has a displacement effect in the local economy where domestic firms are effectively crowded out. In addition, there is the possibility that

relatively productive foreign firms may create spillovers into the domestic manufacturing sector changing the nature of input-output relationships (see also Crone and Roper, 1999).

Further research will attempt to further disaggregate the broad manufacturing sectors examined here, and link more carefully through to the development of foreign sector. There is more opportunity for this type of analysis in Scotland, where a longer series of Input-Output tables are available. Ultimately, there is the prospect of an econometric model which seeks to explain movements in the structural relationships in the input-output tables over time to a set of independent variables which includes foreign manufacturing involvement.

References

- Brand S., Hill, S. and M. Munday (2000), Assessing the Impacts of Foreign Manufacturing on Regional Economies: The Cases of Wales, Scotland and West Midlands. *Regional Studies* 34, pp. 343-55.
- Crone, M. & S. Roper (1999), Knowledge Transfers from Multinational Plants in Northern Ireland, paper given to *Regional Science Association European Congress*, University College Dublin, August 23rd-27th.
- Davis, G. & I. Thomas (1976), *Overseas Investment in Wales*, C.Davies: Swansea.
- Fraser of Allander Institute, University of Strathclyde, The Scottish Council Research Institute Limited and IBM UK Scientific Centre (1978), *Input-Output Tables for Scotland 1973*. Scottish Academic Press, Edinburgh.
- Gillespie, G. (2000), *Modelling the System-wide Impact of Foreign Direct Investment in Scotland: An Ownership-Disaggregated Regional Computable General Equilibrium Analysis*, Ph.D thesis, University of Strathclyde.
- Hill, S. & A. Roberts (2001), *Welsh Input-Output Tables for 1996*. Cardiff: South East Wales Economic Forum.
- Hill, S. & M. Munday (1994), *The Regional Distribution of Foreign Manufacturing Investment in the UK*, MacMillan: London.
- Hood, N. (1991), Inward Investment and the Scottish Economy, *Royal Bank of Scotland Review*, 169, pp. 17-32.
- Ireson, R. & C. Tomkins (1978), *Inter-Regional Input-Output Tables for Wales and the Rest of the UK 1968*. HMSO, London.
- Morris, J. Munday, M. & B. Wilkinson (1993), *Working for the Japanese*, Athlone: London.
- Munday M. (2000), Foreign Direct Investment in Wales: Lifeline of leash? In Bryan J and C. Jones (Eds), *Wales in the 21st Century: An Economic Future*, Basingstoke: MacMillan Business.
- Munday, M. and M. Peel (1998), The Comparative Performance of Foreign Owned and Domestic Manufacturing Firms During Recession: Some Descriptive Evidence from Wales, *Contemporary Wales*, 10, pp. 50-80.
- Munday, M. and A. Roberts (2001), Assessing the Regional Transactions of Foreign Manufacturers in Wales: Issues and Determinants, *TESG*, 92. pp. 202-16.
- Munday, M. Morris, J. and Wilkinson, B. (1995), Factories or Warehouses - a Welsh Perspective on Japanese Transplant Manufacturing, *Regional Studies*, 29, pp. 1-17.
- Roberts, A. (1996), *The Economic Impact of Foreign Manufacturing Investment in Wales*. Unpublished Ph.D, University of Wales, Cardiff.
- Scottish Executive (1999), *Input-Output Tables and Multipliers for Scotland 1996*. Government Statistical Service, Edinburgh.

Stone, I. and Peck, F. (1996), The Foreign Owned Manufacturing Sector in UK Peripheral Regions, 1978-1993: Restructuring and Comparative Performance, *Regional Studies*, 30.1. pp. 55.68.

Turok, I. (1993), Inward Investment and Local Linkages: How Deeply Embedded is 'Silicon Glen'? *Regional Studies* 27, pp. 401-17.

Turok, I. (1997), Linkages in the Scottish Electronics Industry: Further Evidence, *Regional Studies* 31, pp. 705-711.