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Forestry Industry Network Transactions And Regional Economic Development Prospects.

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Forestry Industry Network Transactions and Regional Economic Development Prospects

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Abstract

This paper assesses the economic contribution of the forestry industry to the Welsh economy, and examines the specific methodological difficulties in modelling the scope and scale of the forestry industry at this spatial level.

Introduction

This paper assesses the economic contribution of the forestry industry to the Welsh economy, and examines the specific methodological difficulties in modelling the scope and scale of the forestry industry at this spatial level.

The next section summarises the scale and scope of the forestry industry in Wales, explores recent changes in the sector, and outlines the current economic problems of the industry. The third section reviews the methodological approach adopted. The use of input-output modelling techniques to assess forestry industry activity presents a number of specific problems and this section includes a review of previous forestry-related research that has used this methodology. The fourth section describes the survey approach adopted to generate transactions data on the forestry industry. The fifth section reports the main findings revealing the dimensions of forestry industry activity in Wales. In particular, the section explores the nature of “within-industry” transactions revealing the degree of inter-dependence between forestry sectors i.e. between timber growers, harvesters, saw-mills, and paper mills. The section also develops simulations within the input-output framework and explores the impacts of sector growth/contraction. The final section contains conclusions.

Forestry in Wales

The Forestry Industry: Scope and Scale

Wales has an estimated 247,000 hectares of woodland (12% of Wales’ land area), of which private woodland constitutes 52% with the remainder owned and managed by the Forestry Commission. A relatively high proportion of forest coverage (68%) is provided by conifers. In 1997/98, just over one million cubic metres of wood (90% of Welsh conifer production) were harvested from the Forestry Commission estate. The small proportion of production from private forests is expected to increase to 30% in 20 years’ time owing to the relative age class structures of private and Forest Enterprise conifer woods. The majority of hardwood production in Wales (from broad-leaved woodlands) is by the private sector.

The forestry industry in Wales includes:

- Forest Enterprise and its employees;
- Private forestry owners, including large private estates of over 500 hectares, but down to small areas of forestry of less than one hectare owned, for example, by farmers;
- Forest management companies, who are contracted to some owners to manage forests;
- Forest nursery owners;
- Timber harvesting, extracting, haulage and marketing companies;
- Primary processors including saw-mills (these often being allied to other activities such as fencing production and furniture making), wood-based panel manufacturers and pulp mills.

According to the 1993/94 Forest Employment Survey, the forestry industry (including primary processing, but excluding secondary processing activity) employed an estimated 4,750 full-time equivalents (FTEs) in Wales (Forestry Commission, 1995). The 1993-4 figure represented around 15% of the total (34,820 FTEs) employed in Great Britain. Of the total employed in Welsh forestry, the largest share (36%) was accounted for by employment in wood processing industries (see Table 1), and much of this employment (over two-thirds) was in just four organisations: BSW (Newbridge and Senghenydd), Shotton Paper (Deeside), St Regis (Sudbrook) and Kronospan (Chirk).

Table 1: Forestry Employment in Wales and GB 1993/94

	Wales		Great Britain	
	FTEs	(%)	FTEs	(%)
Forestry Commission (1)	1,270	27	6,650	19
Private estates	1,100	23	10,750	31
Forest management companies	125	3	1,910	6
Timber harvesting companies	515	11	4,295	12
Wood processing industries (2)	1,740	36	11,215	32
Total	4,750	100	34,820	100

1. Forestry Commission figures include contractors working in its forests.

2. Wood processing is the primary processing of timber grown domestically in Great Britain.

Source: Forestry Commission (1998).

Total employment in the forestry industry in Britain as a whole fell by an estimated 15% between 1988 and 1994. The 1993/94 Forest Employment Survey revealed that total employment in Wales had remained relatively unchanged on the level recorded in 1988/89, falling by only 0.5%. However, a significant restructuring in employment has occurred, with employment increases in harvesting and processing activities, as well as in 'other' forest uses such as recreation, conservation and sport. In contrast, employment has fallen in establishment and maintenance activities as a result of lower levels of planting activity and increased labour productivity (Forestry Commission, 1995). Moreover both upstream and downstream forestry industry sectors have experienced significant increases in labour productivity as a result of mechanisation. This is particularly evident in harvesting activity in automated cutting machinery and rapid forwarding to road/ride side. This has led to some restructuring and consolidation in the harvesting contracting sector. However, there are constraints imposed on mechanisation in harvesting by the steep Welsh hillsides and gullies which make access to timber difficult, hence maintaining the more labour-intensive harvesting methods for the near future.

Forest Management and Policy

Management of forests lies in the hands of private owners (sometimes through specialist forestry management companies) and the Forestry Commission. Forestry policy is a devolved subject, and since May 1999 funding for forestry in Wales has come from the National Assembly, which also has powers of direction over the Forestry Commission. The Commission's primary objective, from its inception in 1919, was to increase woodland area for purposes of building a strategic timber reserve, with import saving and rural employment pursued as secondary objectives. The 1990s has seen the gradual emergence of the 'post-industrial forest', characterised by a shift away from the primacy of wood production in policy-making and practice and towards the meeting of conservation, sustainable development, and recreational needs and priorities (Mather, 1991).

Current policy instruments include a mixture of regulatory controls and financial incentives. Felling licences and tree preservation orders control the felling of trees,

whilst forestry and woodland grant schemes, forest plans (for the private sector) and forest design plans (for the national estate) serve as the principal mechanisms for granting forestry approvals and supporting economic, community and recreational activities. In January 1998, the UK Forestry Standard set out the criteria and standards required for the sustainable management of all forests and woodlands in the UK.

Forestry policy is changing. The Forestry Commission is no longer actively acquiring land for afforestation, and there has been very little new planting on Commission land in Wales since 1992 (Forestry Commission, 1998). However, because of declining levels of support to agriculture, farm forestry is being promoted as one alternative, and is supported by the Farm Woodland Premium Scheme (FWPS). Current policy developments, coupled with the progress and expansion of Coed Cymru¹, have led to increased financial support for, and interest in, the care, management and productive use of the hardwood timber resource contained in native broad-leaved woodlands in Wales.

Current Forestry Industry Problems

The forestry industry in Wales (and elsewhere in the UK) has come under severe economic pressure in the recent past. The upstream forestry industry has been characterised by: falling levels of optimism caused by high sterling (leading to cheaper imports and low timber prices); the cancellation of tax concessions to the private growing sector; landfill taxes (these effectively influencing paper mill demand for wood over recycled material); and increasing diesel prices – these reducing margins down the timber supply chain. Recent evidence has suggested that the majority of private forest estates in Wales are doing no better than breaking even in the current climate, with several cases of forestry maintenance being subsidised by other activities (WERU, 1999). Poor returns in the timber production sector have further impacts on the sub-contracting sector, and contribute to an ongoing restructuring process with ramifications for rural economic development prospects.

Forestry Industry Activity in an Input-Output Modelling Framework

¹ Coed Cymru is an independent intermediary that stimulates management of the Welsh hardwood resource, and seeks to develop markets for the produce of such woodlands.

The economic contribution of the forestry industry is estimated using Welsh input-output tables for 1996 (Hill and Roberts, 2000). A detailed description of input-output methodology, assumptions and limitations are found in Bulmer-Thomas (1982) and Richardson (1972) and are not repeated here. However, input-output modelling techniques, when applied to forestry activities, raise a number of particular methodological and data issues. Thomson and Psaltopoulos (1996) summarise the methodological issues in forestry input-output modelling under three headings: conceptual issues (relating to industry time-scales, self employment, and supply dependencies); data issues and recreation issues.

The annualised accounting framework and linear production functions described within input-output tables can enable the estimation of multipliers by further assuming ready supply availability. In the case of the establishment or growing sector of the forestry industry, with extensive production cycles – often over 75 years, the assumption of supply availability, for use by processing sectors is inappropriate. The ‘outputs’ of forest establishment are then typically treated as additions to stocks within the input-output table (i.e. as a sale to final demand), and not as an intermediate input, whilst the purchases of this output by harvesting companies are made via ‘sales by final demand’. Disaggregation of forestry activity to separate out planting/establishment activities from the harvesting and maintenance activity can limit these problems, although the supply relationships within this sector are more difficult to interpret in the forestry industry than in most other sectors of the economy.

The second conceptual issue relates to self employment. The UK input-output framework separates income received by employees from that received by the self-employed. Identification of self-employed income, which can be significant in the forestry industry because of extensive sub-contracting in upstream sectors, is therefore difficult at a UK level without access to primary data. However, with the Welsh input-output tables (used in this analysis), self-employed income is separated from ‘other value added’ and aggregated with ‘income from employment’(Brand et al., 1998). Whilst the published Welsh tables aggregate forestry with agriculture and fishing, the

primary data generated by this study (see later) was used to develop augmented tables, separately identifying forestry sectors.

The third conceptual difficulty relates to the supply linkages of forestry activities to downstream primary processors. The significance to the local economy of changes in forestry activity depends on the supply relationships between upstream and downstream users. If upstream forestry output declined, some downstream users may be able to substitute local wood purchases with saw-mill residues, recovered wood waste or recycled paper. In other cases imported raw materials can be used, whilst other users may be less able to substitute for local supplies. The full impacts on the economy then depend on the extent of supply dependence (see also McGregor and McNicoll (1992)).

The data related issues include the difficulties in estimating private (i.e. non Forest Enterprise) sector forestry output, and in assessing levels of self-employment. Finally, there are issues relating to the recreational use of forests. Some industry activity relates not only to planting, harvesting and production, but to the recreational use of forests by visitors. Separation of these costs from those of more traditional forestry sectors can be a problem, just as the identification of tourist or consumer expenditure on ‘forest visits’ may be difficult (see Benson and Willis, 1993). One of the purposes of the forestry industry survey (described below) was to overcome these methodological and data related issues.

A number of other UK studies, have, however, explored the economic role of forestry within an input-output framework.

For example, McGregor and McNicoll (1989, 1992) used the 1984 UK input-output framework to assess the forward and backward linkages of the forestry industry. They reported that the absence of UK forestry (in terms of the outputs from upstream activity in establishment, maintenance and harvesting etc.) would have reduced total gross output by £840m, increasing to nearly £2.0bn when account was taken of the critical supply dependency of the processing industry on the domestic timber production sector.

Psaltopoulos and Thomson (1993) analysed the role of forestry in the rural Scottish economy. Their results demonstrated that an increase in the output of forestry leads to significant increases in total output and income in rural Scotland. Whilst the labour-intensive forestry sectors offered potential for improving economic activity, this was because of the high direct impact of forestry in the economy, rather than its backward linkages with other rural industries, which were found to be weak.

Finally, Roberts et al. (1999) used an input-output framework to analyse the economic linkage effects of particular generic forest types in Scotland. Multiplier based analysis revealed that different woodland types generated very different economic effects in the Scottish economy. For example, the study demonstrated that in terms of harvesting, activities connected to commercial conifer plantations were associated with the largest total income and output multiplier effects, but that additional harvesting of native woodlands gave rise to the greatest employment effects per unit of additional demand. The study also revealed that removal of the forestry sector in Scotland would result in the loss of an estimated £447m of gross output, and over 6,900 ftes. When allowance was made for the supply dependence of timber using sectors on the domestically produced resource, then the effects of sector removal resulted in a reduction of gross output of £811m and the loss of over 12,000 fte jobs.

Forestry Industry Survey

The direct and indirect economic impacts of the forestry sector in Wales were estimated by analysis of financial and employment data collected from a representative number of forestry industry organisations. These data informed the construction of forestry sectors in the Welsh input-output tables from which further analysis was undertaken.

The forestry industry was divided into upstream and downstream activities where the dividing line was the saw-mill or 'other' processor's gate. Defined upstream activities included: forest establishment and nurseries; maintenance and management; harvesting and extraction.² Employment in the upstream industry is heavily concentrated in Forest

² These categories did not encompass all upstream activity. Other activities include road and bridge construction and repair which may occur at intervals during the rotation cycle (these were dealt with under harvesting and allied contracting – see later), together with more general clerical, technical, and

Enterprise, and the largest forest management and contracting companies. In undertaking the survey it was also necessary to cover different types of upstream activity allied to different forest types. For example differences in species, elevation, rotation, harvesting method, and management activity determine underlying differences in forest establishment, maintenance and harvesting costs and the nature of scale economies. Consequently the upstream industry survey was designed to cover different types of upstream forestry activity including: upland/commercial conifer plantations; mixed commercial lowland plantations (i.e. mixed conifer/broadleaf forests); farm and community woodlands.

The downstream primary processing sectors surveyed comprised:

- saw-milling, planing and preparation of hard and soft woods.
- pulp and paper and paperboard – the scope of the study here was limited to integrated pulp/paper mills using domestically produced timber resources.
- wood-based panels and chipboard including production of particleboard, fibreboard and veneered sheets.

The construction of an industry sample drew upon several sources of information. The Forest Employment Survey for 1993-4 provided estimates of the size of forestry sectors in terms of employment and activity which are shown in Table 2.

Table 2 Detailed Employment Breakdown of Welsh Forestry Industry in 1993-94

	Establishment (inc. nursery)	Maintenance and Management	Harvesting	Processing	Other	Total
Forestry Commission	40	65	75	0	405	585
Private Estates and Management Companies	95	195	90	275	105	760
Contractors	125	140	1145	0	255	1665
Primary processors	0	0	0	1740	0	1740
Total	260	400	1310	2015	765	4750

Note: Employment in Forestry Commission and private estates excludes contractors.

Source: Forest Employment Survey, 1993-94

In constructing the detailed sample for the questionnaire and interview survey a number of industry sources were used including the Timber Growers Association (TGA), the Forestry Contracting Association, the Association of Professional Foresters, Forest Enterprise lists of approved contractors, the Forestry Commission Woodland Grant Scheme database, the UK Forest Products Association, and Forestry Industry Council publications. Forest Enterprise provided information directly to the researchers for each of its Welsh districts. Table 3 reveals the selected sample frame for the questionnaire survey and the programme of follow-up interviews (excluding Forest Enterprise where data was provided directly). The objective was to generate a sample for each forestry industry sector which would give a comprehensive representation of activity in each sector as the basis of further analyses and construction of forestry industry sectors within the regional input-output modelling framework.

Table 3 Survey Sample

	Sample frame	Estimated proportion of population in employment terms contacted	Returns by main activity	Return rate (%)	Interviews completed ¹
Saw-mills and Other Processing ex Pulp/Paper	62	>95%	21	33.9	7
Contractors and Hauliers	72	>70%	11	15.3	6
Private Estates	130	>80%	28	21.5	12
Management Companies	5	>80%	5	100.0	2
Farm/Small Woodlands	114	<5%	41	36.0	5
Nurseries	6	>95%	1	16.7	0
Panel and Pulp/Paper ²	6	>95%	4	66.7	4
Total	395	Na	111	28.1	36

1. Interviews were selected from the returns listed in column 3. 2. Panel board and pulp mills were not sent the postal questionnaire but were contacted by letter for interview because the general survey questionnaire was designed to be completed by upstream sectors and saw-mills, as opposed to wood panel producers and paper mills which differed from other parts of the forestry industries sector in the nature of their purchasing patterns.

Completion of the questionnaire required respondents to provide information on business activities, employment, earnings, expenditure (broken down into 13 broad categories, with estimates on proportion purchased in Wales, rest of UK, outside UK), and finally revenue sources broken down into 6 defined categories, with estimates of proportions of categorised revenues from Wales, and rest of UK. A follow-up interview process was also undertaken amongst a sub-sample of respondents who had completed (or who in some cases had not fully completed) the postal questionnaire. The interview programme served to clarify financial details provided by respondents, and allowed investigation of the specific characteristics of different forestry industry sectors, providing insight into the complex financial transactions which then informed the construction of forest sectors in the Welsh input-output table. Table 3 also summarises the survey returns.

Economic Dimensions of Forestry

The survey was used together with industry information to allocate the purchases and outputs of the forestry industry to different parts of the economy, and to estimate the size of the industry, and sectors of the industry, in Wales. For each part of the industry, survey data was grouped, and then separately analysed for representativeness. The overall size of each forest sector, in terms of output and full-time equivalent (FTE)

employment was then estimated, and the questionnaire data scaled up accordingly to estimates of the total size of each forestry sector at an all-Wales level.

Forestry Industry Dimensions

Table 4 reports the estimated scale and transactions of forestry sectors. The nine separate sectors have been aggregated into five to combine smaller sectors and to avoid possible disclosure problems. Table 4 then shows estimated dimensions of harvesting (including all of Forest Enterprise), saw-mills, panel board and paper, and haulage). The private estates sector includes activities such as forest management/technical services, nurseries, and farm woodlands. The survey was undertaken to collect data for 1998-99. The financial information was deflated into 1996 pounds, for consistency with the latest Welsh input-output tables.

Table 4 Economic Characteristics of Forestry Related Sectors
(Financial Figures £000s 1996 prices)

Sector	All Forest Sectors	Private Estates etc	Harvesting and Allied Contracting	Sawmills	Panel Board and Paper	Haulage
FTEs* in Wales	3,281	728	846	557	936	215
FTEs in Rest of UK	649		90	45	514	
Total Ftes	3,930	728	936	602	1,450	215
Gross output	403,448	16,533	43,474	47,253	286,837	9,352
Av Gross Wage	17.6	10.4	19.6	13.6	24.4	15.1
Total non-wage spending in Wales	81,673	5,605	9,293	26,031	38,592	2,152
Total Forestry related purchases in Wales	52,133	4,197	3,875	23,514	20,548	0
All other non-wage spending in Wales	29,540	1,408	5,419	2,517	18,044	2,152
Imports (UK and Overseas incl labour)	166,621	1,354	4,302	5,703	153,411	1,852

In 1998/9 the forestry industry in Wales employed an estimated 3,930 full-time equivalent employees. Over 70% of the gross output of the industry is accounted for in the panel board and paper sector, and much of this output is concentrated in just two plants outside rural Wales. Broadly defined upstream sectors (including haulage) accounted for just over 17% of gross industry output, with almost 12% of output in the

saw-mill sector. The distribution of employee income in the forestry industry sectors is very different from the distribution of output. Total gross wages in the industry were estimated at £57.8m (not separately shown in table), but with just 40% of these incomes derived from the more capital-intensive panel board and paper industries. The average gross wage in the forestry industry was estimated at £17,625. The highest earnings were found in the panel board and paper sectors, also characterised by the highest labour productivity. Lower levels of earnings are found in the saw-mills and private estates sector. The average gross earnings figure for the defined private estates sector should be treated with caution because of the difficulty in estimating employment in this sector. The survey identified high levels of part-time and casual working, whilst assessing FTEs on farm woodlands was problematic. The reported figure of £10,400 is an average across private estates, farm woodlands and forest management companies and nurseries.

Table 4 shows total non-wage spending for all forest sectors as an estimated £81.7m, comprising of just over £52.1m of forestry related purchases in Wales, and a further £29.5 of other Welsh purchases. These purchasing patterns also vary significantly by sector. For example, the local forestry related purchases of Welsh saw-mills was an estimated £23.5m, with a further £2.5m spent on other supplies within Wales, out of a gross output value of £47.3m. This compares to the panel, board and paper sector, where a much higher share of total spending is on imported (from the rest of the UK or overseas) goods and services (including labour), an important part of which is energy. Overall, just under £63m or 68% of forestry industry Welsh purchases are from other parts of the forestry sector (the pattern of intra-industry transactions is discussed in more detail below).

Table 5 summarises transactions within the forestry industry. Sales to forest sectors are shown in the rows, with purchases shown in the columns. This table then shows, for example, that the saw-mills sector purchased £19.6m from the harvesting sector, while panel board and paper purchased £6.6m from harvesting and a £8.6m from the local saw-mills sector. Haulage sold £3.7m of its output to harvesting, and £3.3m to the panel board and paper sector. The table evidences a series of tight intra-industry

connections such that changes in one sector could quickly spill over into adjacent sectors. In particular, and in the current industry climate (see later), some parts of the upstream sector could be very vulnerable to the loss of saw milling capacity in some rural areas.

Impacts of Forestry Industry Changes

Tables 4 and 5 demonstrate the nature and scale of estimated inter- and intra-forestry industry trading relationships. These inter-relationships have a significant influence on the overall multipliers for the industry, as changes in the level of economic activity in any of the forest sectors will have consequences for other parts of the industry, and then for the rural economy itself.

Table 5 Intra-Forestry Industry Sales and Purchases (£000s 1996 prices)

Sales to>

Sector	All forest sectors	Pvt.Estates Etc.	Harvesting and allied contracting*	Saw-mills	Panel Board and Paper*	Haulage
<i>Purchases from</i>						
Private estates etc.	5,416	147	155	3,096	2,018	-
Harvesting	30,050	3,883	0	19,560	6,607	-
Saw-mills	9,102	28	18	411	8,645	-
Panel Board and Paper	-	-	-	-	-	-
Haulage	7,565	138	3,702	447	3,278	-
Total Forestry related purchases in Wales	52,133	4,197	3,875	23,514	20,548	-
All other purchases in Wales	29,540	1,408	5419	2,517	18,044	2,152
TOTAL purchases from Welsh industry	81,673	5,605	9,293	26,031	38,592	2,152

Note: * The table does not include purchases of standing timber, or recycled goods by these sectors. These are found in the row sales by final demand in the input-output modelling framework and were estimated at £9.2m and £1.7m respectively (see conceptual issues earlier). The (notional) purchase of standing timber by Forest Enterprise (from itself), which is then harvested, is included in these estimates.

The multipliers reported below in Table 6 estimate the ultimate impact on the Welsh economy of changes in demand for individual forest sector output (i.e. these are

multipliers that include both the supplier and induced income effects of activity changes). Care should be taken in the interpretation of these multipliers as they partly depend on the treatment of sub-contracted labour services. For example, a number of the larger organisations sub-contract a high percentage of activity to other similar companies (such as a timber harvesting company sub-contacting to another harvesting company), hence the direct employment to output ratio is low. However, the total employment impact, accounting for sub-contractors in the same industry (part of the multiplier impact), would be relatively high. On the other hand if these sub-contractors were treated as direct employees, the direct impact would be high, with lower indirect ‘multiplier’ employment generation. The ultimate impact on employment in both cases would, however, be the same. In this study the latter approach was adopted with companies analysed on a case-by-case basis ensuring sub-contractors (included as direct employees) were not counted twice. To help with this interpretation, the table lists ultimate output, income and employment effects with the multiplier estimates.

The output multipliers in Table 6 range from 1.25 in panel board and paper to 1.94 in saw-mills. Higher multiplier impacts are partly a consequence of a relatively high degree of local (Welsh) purchasing per unit of output. Thus a £1m increase in the demand for saw-mills output would support another £0.94m of output in other Welsh industry sectors. A high share of total saw-mill spending is with other forestry sectors. Similar factors explain the comparatively high output multiplier in the private estates and other category. Conversely, by its nature and location, the panel board and paper sector purchases a much lower share of total inputs within Wales, with large volumes of chemical inputs, as well as energy and some wood inputs purchased from the rest of the UK.

Income and employment multipliers are derived by dividing the ultimate income or employment generated per unit of output (shown in the table) by the initial income or employment per unit of output. So, for example, a £1m increase in demand for harvesting sector output would directly support £0.32m of disposable income (not shown in the table). However, once the supplier and induced-income effects of the £1m of harvesting output are spread through the Welsh economy, then this will generate a

total of £0.42m of disposable income. The multiplier is then calculated by dividing 0.42 by 0.32 i.e. 1.3. Similarly, each £1m of harvesting output supports around 19 jobs directly. When the economic impacts of the £1m of output are spread through the local economy then a total 29 jobs are supported, giving an employment multiplier of around 1.5. Expected increases in harvesting activity in the period to 2010 could then have substantial impacts on the rural economy, with the embedded nature of the upstream sector directly and indirectly supporting other jobs and incomes.

Table 6 Demand-Driven Multipliers for Forest Sectors

Forest Sector	Output Effects (£m)*	Output Multiplier	Disp Income Effects (£m)*	Income Multiplier	Employment effects (FTEs)*	Employment Multiplier
Private Estates, etc	1.77	1.77	0.57	1.49	59.01	1.34
Harvesting/allied	1.51	1.51	0.42	1.33	28.94	1.49
Saw-mills	1.94	1.94	0.39	2.90	31.23	2.65
Panel Board and Paper	1.25	1.25	0.12	1.76	7.48	2.29
Haulage	1.48	1.48	0.34	1.40	31.53	1.37

* effects per £1m increase in demand

Multipliers are highest in the saw-milling sector. On average, each saw-mill job created by an increase in sector demand supports a further 1.65 jobs in Wales. Similarly, every £1m of income created by an increase in saw-mill output creates an estimated additional £1.9m of disposable income in the Welsh economy. A £1m increase in demand for saw-mill output would ultimately generate an estimated £0.39m of income and 31 jobs. Once again this strong local effect reflects the localised direction of saw-milling purchases. Note should however be taken of the underlying assumption of the input-output multiplier estimates. This assumes that there are no supply constraints. Hence if processors wished to expand output, appropriate timber supplies are assumed to be available. A significant part of the multiplier impact of any of these separate forest sectors is then within other forest sectors, often in rural areas of Wales.

In the panel board and paper sector each additional £1m of sector demand supports (after multiplier effects) just £0.12m of disposable income and 7.5 jobs. The

employment multiplier is comparatively high, but this must be related to the fact that this is an extremely capital-intensive sector, such that each additional £1m of sector output only creates just over 3 jobs directly. Lower overall income and employment effects are also affected by the high imports of labour from the rest of the UK in this sector.

The private estates and ‘other’ category generate the highest income and employment effects when standardised in terms of additional output. Each £1m of private estates and ‘other’ output leads to an additional £0.57m of disposable income in Wales, and 59 FTEs. This is largely a consequence of high direct effects (because of the relative labour intensity of production, directly requiring 44 ftes per £1m of output) rather than multiplier impacts. The comparatively low earnings levels in this sector, together with low levels of spending in other forest sectors, result in relatively low multiplier effects in other areas of the local economy.

Using the demand-driven input-output methodology, an increase in demand for saw-mill, panel board, and paper output would have significant impacts on the rest of Wales, particularly in harvesting which supplies raw materials for processors.

Elimination of Welsh Forestry Industry

An estimate of wider economic significance of Welsh forestry can be derived by estimating the impact of the complete removal of the industry from the Welsh economy. Here the purchases of forestry output by other industries in Wales (such as those made by the construction or furniture industries) are assumed to be replaced by imports, whilst suppliers to Welsh forestry (for example, business services etc.) are assumed to contract due to the loss of forestry business. Table 7 shows the direct impact of forestry in Wales (i.e. £403.5m of output, £47.6m of disposable income etc.), while the ‘total’ column includes the impact on other Welsh industries. Welsh forestry supports (directly and indirectly) almost 4,440 direct FTE jobs in Wales, £61m of disposable income and £475m of output. The ‘economic significance multipliers’ shown in Table 7 (derived by dividing the total impact by the direct forestry impact) differ from the usual input-output multipliers that result from a stimulus to the forestry industry (those used in Table 6).

For example, the feedback effects to other parts of the forestry industry which would result from a change in the scale of the industry, are not included in the economic significance multiplier.

Table 7 The Economic Significance of Forestry Related Industries in Wales

	Output, £m		Income, £m		Employment, FTE	
	Forest direct	Total	Forest direct	Total	Forest direct	Total
Total	403.5	474.6	47.6	60.7	3281	4438
Multiplier		1.18		1.27		1.35

Conclusions

This study estimated that the defined forestry industry in Wales provided nearly 4,000 full time equivalent jobs, over £400m of gross output, and generated around £80m on non-wage spending in the regional economy. While significant amounts of industry output are accounted for by the more capital intensive paper, and wood-based panel producers mostly located in more industrial areas, other forestry industry sectors are far more embedded in the rural economy in terms of the directions of their wage and non-wage spending. This study revealed that economic inter-connections within the forestry industry itself accounted for £50m of spending in Wales, with particularly strong linkages between private estates and harvesting, between harvesting and hauliers, and between harvesting and saw-mills. In policy terms the comparatively embedded characteristics of parts of the forestry industry, with high levels of local sourcing, means that policy initiatives assisting one part of forestry may spillover into allied forestry sectors. In addition, the study revealed that the forestry industry had strong connections to other parts of the economy, with an estimated 1,200 jobs in other parts of Wales dependent on the industry.

Finally the study revealed important sectoral differences in how output growth might directly and indirectly affect rural areas of the local economy. For example, an increase in saw-milling output was shown to have a greater local impact than an equivalent increase in harvesting output. Differential impacts have their causes in the different capital intensities of sectors, and different propensities to purchase goods and services

locally. Consequently the effects of any new initiatives will vary considerably according to which forestry sectors are targeted, even allowing for the impact of industry spillovers.

While better economic information on forestry sector transactions and impacts will inform new strategy directions, it is also important to highlight the economic realities within which forestry currently operates. New policy directions will be mediated by a series of industry demand and supply-side rigidities largely outside the control of Welsh agencies. Moreover, and in the context of the contemporary Welsh economy the forestry industry will compete for scarce developmental resources with other industries. Hence, the more general poor industry conditions must be borne in mind when planning policy supports, and assessing their overall feasibility. This paper has shown that planning new directions will be difficult. Over-arching debate on new directions is the very long growing cycle of timber, meaning that comprehensive changes of strategy in terms of species, and management techniques, could take decades to undertake. Regardless of new policy directions, the softwood harvest in Wales is projected to increase to 1.8 million cubic metres by 2007. Assuming there are markets for this timber, then the evidence from this study suggests that rural areas of Wales could benefit considerably from the increase in harvesting and saw-milling activity that this could engender.

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