Economic Impact of the Dairy and Blue Gum Plantation Industries in South West Victoria

Report prepared for the Gardiner Foundation by

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Purpose of the study

The objective of this study is to assess the economic implications of plantation forestry in an area where the activity is in its early stages of development. Specifically, the study aims to identify the economic effects of the spread of privately owned blue gum plantations into long established intensive dairying districts. The study area comprises statistical local areas in the shires of Corangamite, Colac Otway and Moyne. Within these areas land use change has been occurring with the replacement of established dairy farms with blue gum plantations.

APPROACH TAKEN

The direct economic impacts of the two industries have been identified and analysed. The results have been modelled using the regional economic modelling and planning (REMPLAN) software package. Multiplier estimates have been calculated and used to assess the value of the indirect effects generated by the dairy and blue plantation industries. A series of scenarios have been constructed to predict the likely future economic impacts of the two industries.

DIRECT EFFECTS

In 2006 the dairy sector as a whole (milk production and manufacturing) generated 21 per cent of the intensive dairy region's output; added 16.5 per cent to gross regional product; provided 13.7 per cent of the region's employment; generated 8.8 per cent of the region's income; was responsible for 36 per cent of the region's exports and 29 per cent of the region's imports. The forestry sector as a whole (forestry and logging) generated 1.4 per cent of the region's output; added 1.2 per cent to gross regional product; provided less than one per cent of the region's employment and income; was responsible for 2.7 per cent of the region's exports and 2.3 per cent of the region's imports.

INDIRECT EFFECTS

In 2006, for every one dollar of output generated by the dairy sector a further 50 cents was spent on inputs sourced from within the region. For every one dollar of output generated by the blue gum plantation industry a further 38 cents was spent on inputs sourced from within the region.

Projections

SCENARIO 1: LOW GROWTH ONE PER CENT

Assuming a growth in industry output of one per cent per annum during the period 2006–2020 the dairy industry is projected to increase regional value added and gross regional product by 2.2 per cent. Regional income associated with the dairy industry will increase by 1.8 per cent and jobs increase by 2.1 per cent. Over the same period the blue gum plantation industry will increase regional value added and gross regional product by 0.28 per cent. Its activities will increase regional employment by 0.28 per cent and regional income by 0.3 per cent.

SCENARIO 2: MODERATE GROWTH THREE PER CENT

Assuming a growth in industry output of three per cent per annum during the period 2006–2020 the dairy industry is projected to increase regional value added and gross regional product by 7.1 per cent. Regional income associated with the dairy industry will increase by 5.9 per cent and jobs increase by 6.7 per cent. Over the same period the blue gum plantation industry will increase regional value added and gross regional product by 0.4 per cent. Its activities will increase regional employment by 0.41 per cent and regional income by 0.42 per cent.

SCENARIO 3: HIGH GROWTH SEVEN PER CENT

Assuming a growth in industry output of seven per cent per annum during the period 2006–2020 the dairy industry is projected to increase regional value added and gross regional product by 23.6 per cent. Regional income associated with the dairy industry will increase by 16.3 per cent and jobs increase by 18.1 per cent. Over the same period the blue gum plantation industry will increase regional value added and gross regional product by 0.74 per cent. Its activities will increase regional employment by 0.78 per cent and regional income by 0.78 per cent.

In summary blue gum plantation production in the defined dairy intensive region between the period 2006 and 2020 is estimated to increase gross regional product, total regional income and total regional employment by less than one per cent. There is not likely to be any significant competition for resources in the region between the dairy industry and the blue gum industry during the period 2006–2020. As there has been very little planting of blue gums in the region since 2005, the economic impact of the blue gum industry in the region, other things being equal, is likely to be very small post-2020.

Several caveats need to be considered when interpreting the results of this study. First, all estimates are based on published data collected by the Australian Bureau of Statistics (ABS) or industry bodies. Second, multiplier models do not necessarily provide a definitive statement of projected outcomes. They reflect the average expected impact of a change in economic activity, not small or marginal changes. Multiplier values can also be overstated for industries that account for a small proportion of regional output (less than one per cent).

1 Introduction

The expansion of private forestry and the partnership between government and private sector timber growers and processors (Plantations 2020) has highlighted the issues associated with changing patterns of land use within the primary sector. Rural development through plantation forestry on existing farm properties has been promoted as a means of revitalising rural communities, providing both economic and social gains to regional areas. The Plantations Incentive Strategy announced by the Victorian government in 2005 sought to further encourage the development of the private forestry sector.[1]

Various studies conducted into the impact of changing patterns of land use associated with the spread of plantation forestry suggest positive outcomes for local regions.[2] Community concern, however, has been expressed in a number of forums over the negative impacts associated with this change in land usage. Plantations have been linked with the decline in small rural communities, loss of infrastructure and productive agricultural land.[3] Such issues have been highlighted with the spread of blue gum plantations into traditional dairying districts in South West Victoria. The problem in validating such perceptions is in isolating the various forces at work contributing to regional decline.

This study aims to analyse the economic implications of plantation forestry in an area where plantation forestry is in the early stages of development. Specifically, the study aims to identify the economic effects of the spread of privately owned blue gum (*eucalyptus globulus*) plantations into long established dairying districts. It also considers possible constraints to expansion and the extent to which competition for resources between the two sectors could occur. The intended study area is that of dairy farming areas in the Corangamite and Colac Otway and Moyne Shires in South West Victoria.

1 Department of Primary Industry Victoria, The plantations incentive strategy, DPI, Melbourne, 2005.
2 J Schirmer, M Parsons, C Charlambou & C Gavran, *Socio-economic impacts of plantation forestry in the Great Southern region of WA, 1991–2004, FWPRDC Project* PN04.4007, AGPS, Canberra, 2005.
3 M Tonts, C Campbell & A Black, *Socio-economic impacts of farm forestry*, RIRDC, AGPS, Canberra, 2001.

2 Background

In recent years there has been a marked shift away from native forests to plantation farming as a means of providing forest wood products. In 2006 in Victoria, 395,656 hectares of land were under plantation, of which 11,057 hectares represented new areas opened up for plantation forestry (BRS 2006). In South West Victoria, plantation forestry (particularly blue gum plantings) has become a significant alternative land use, especially in the Green Triangle Region (Econsearch 2005). While the plantations have generally been established on broadacre farming areas in the far western part of the state there are now a number of dairy farms that are being transformed into plantations.

While the rapid expansion of plantations has raised concerns about the wider economic and social implications of such land use on a broader scale (see Spencer & Jellinek 1995; Kelly & Lymon 2000; Schirmer 2000; Petherham et al. 2000; Tonts, Campbell & Black 2001); there have been no studies that have specifically targeted dairy areas. The more general concerns have included the loss of farm families that lead to the contraction of local economies, the withdrawal of services, depopulation, and a decrease in levels of social interaction. By contrast there are those who suggest that plantation forestry can contribute to alternative local industries based on forest products and services, thus halting the outflow of population. Whilst both dairy and blue gum plantation industries are associated with economic and social benefits and costs, there has been a limited assessment of alternative forms of land use from which a comparative analysis can be conducted.

Socio-economic impact assessments are used extensively in the forestry, fishing and mining sectors to evaluate the impact of changing methods of resource use involving a specific industry. In recent times a number of reports have been commissioned into various aspects of the forestry industry. A report to the FWPRDC[4] reviewed 57 socio-economic studies from 1988 to 2003.[5] Very few equivalent studies have been conducted into other types of agriculture, such as dairying, thus opportunities for comparative assessments of relative impacts are limited. The current study focuses on the economic effects of land use change in which the two industries are involved. By assessing this impact it is possible to gauge the role that the spread of blue gum plantations will play in the future of direction rural and regional economic and social structures.

2.1 Study outline

The study provides an analysis of the relative economic impact of the dairy and blue gum plantation industries in specified local government areas within South West Victoria. An understanding of the wider economic impact of the two industries provides the context for the operation of the industries locally. In order to formulate projections of future impacts of land use change it was necessary to identify the key drivers of industry trends. The research analyses national trends in both the dairying and forestry product markets and uses this as a foundation upon which to build a localised assessment of relative impacts. It provides a framework that can be applied to evaluating the economic impact of other regions in the Australian economy.

The methodologies already applied at the national level are used to provide insight at the local level. This provides a consistent analysis of the significance of the two industries overall. The report undertakes an analysis of the structure of two industries within the designated intensive dairy region of south west Victoria. This includes analysis of the

4 Forest and Wood products Research and Development Corporation.
5 FWPRDC, *Review of studies of the socio-economic impact of forest industries in Australia,* FWPRDC, Victoria, PN03.1314, AGPS, Canberra, 2003.

share of total regional employment, average income generated, and an assessment of the contribution to other regional industries such as processing industries.

As blue gum plantations are an emerging industry within South West Victoria a benchmarking exercise was undertaken with regions where the sector is more established to gauge the likely long-term growth patterns of the industry.

Four steps were involved in determining the relative impact of dairying and blue gum plantation industries within the designated study area:

1 A review of appropriate methodologies for evaluating economic impacts and collection of primary data was undertaken.

2 National industry trends were identified and linked to the regional profile of the two industries. The profiles of the benchmarking regions were detailed. Benchmarking was used as a means of validating results. Further validation was undertaken by conducting interviews with key stakeholders in both the dairy and forestry industries. The purpose of these interviews was to ground-truth the data used for the input-output analysis.

3 The economic impacts of the two industries were modelled and multiplier effects were calculated.

4 A series of scenarios predicting the likely future economic impacts of the two industries were estimated and the results were analysed.

2.2 Regional profiles

For purpose of comparison three regions have been analysed to assist in evaluating the potential significance of a change in land use away from dairying to blue gum plantations. These regions are the target region in South West Victoria, which is dairy intensive (Region 1); a region in which a mix of dairying and plantation forestry occurs (Region 2); and a predominantly plantation region (Region 3).

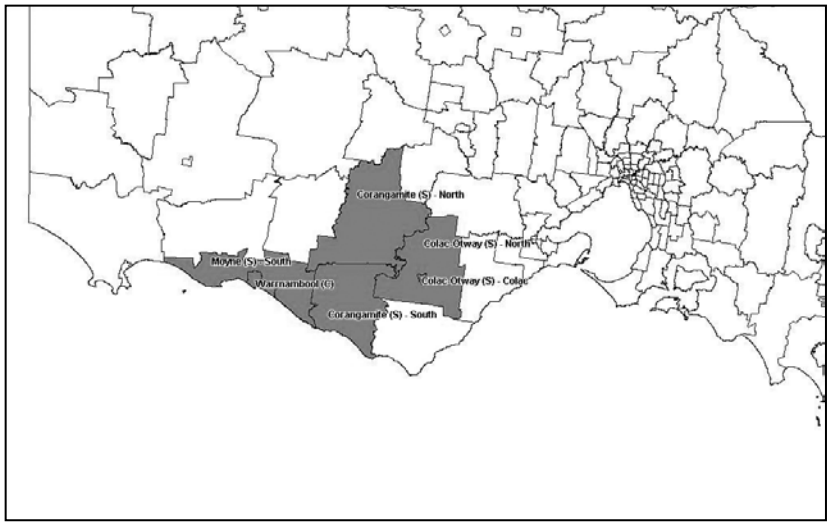
REGION 1: DAIRY INTENSIVE REGION

The region defined for the purposes of analysis in this study comprises key dairying locations in South West Victoria. It included the ABS statistical local areas (SLAs) of Colac Otway (North), Colac Otway South, Corangamite Shire (North), Corangamite Shire (South), Warrnambool City and Moyne Shire (South). These Shires were identified as having the largest number of dairy farms within their boundaries.[6] The city population centres of Warrnambool and Colac are included within the dairy region to ensure the full input-output effects of the dairy producing and manufacturing industries are captured for the region.

The population in this region was 72,613 in 2001 and has increased to 74,192 in 2006 an increase of 2.17 per cent. It is situated within one of the largest milk producing areas in the country, producing 21 per cent of national milk output. There are around 1,700 dairy farms and eight major processing factories located in the South West dairy region.[7] The area under blue gum plantation in the study region is estimated at 4,913 hectares.[8]

6 E Herreria, C Magpantay & H Aslin, *Social profile of Australian dairy regions*, RIRDC publication no 14/107, AGPS, Canberra, 2004.
7 Dairy Australia, *Dairy 2007: Situation and outlook*, retrieved 19 September 2007, <http://www.dairyaustralia.com.au/component/option,com_remository/Itemid,26/func,select/id,34/>.
8 Estimated from 2005 data available at <http://data.brs.gov.au/mapserv/plant/index.phtml>.

Figure 1 Dairy intensive region South West Victoria



(REMPLAN)

REGION 2: DAIRY–PLANTATION REGION

Region 2, which is located in Gippsland Victoria comprises the ABS statistical local areas (SLAs) of Wellington Shire (Maffra), Wellington Shire (Avon), Wellington Shire (Sale), Wellington Shire (Rosedale) and Wellington Shire (Alberton). This region has a strong mix of dairying and blue gum plantations. There are approximately 1,000 dairy farms located in the region and an estimated 3,595 hectares of blue gum plantations[9]. The population in this region in 2001 was 40,275 and has decreased to 40,080 in 2006, a decline of 0.04 per cent.

Figure 2 The dairy–plantation region South East Gippsland

(REMPLAN)

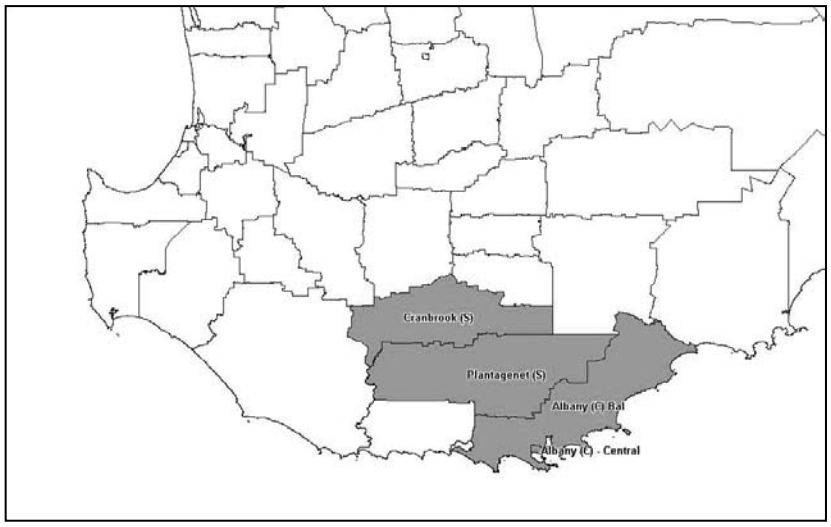
9 Estimated from 2005 data available at <http://data.brs.gov.au/mapserv/plant/index.phtml>.

REGION 3: PLANTATION REGION

Blue gum plantations are significant within this region which is located in South East Western Australia and the SLAs of Cranbrook Shire (Plantagenet) Shire, Albany (City Balance) and Albany (City Central). This region was chosen because it is an established blue gum plantation region (93 per cent of all plantings by 2001 were blue gums. Blue gum plantations comprise an estimated 115,928 hectares.[10] The industry expanded between 1991 and 2001 and is now reaching its maturity. Between 10 per cent and 22 per cent of agricultural land in the listed local government areas is used for plantation forestry. The industry is also large enough to support processing facilities allowing a fuller analysis of the economic impact of plantation activities.

The population in this region in 2001 was 34,949 and has increased to 37,120 in 2006, an increase of 6.2 per cent.

Figure 3 The plantation region South East Western Australia



(REMPLAN)

2.3 Measuring economic impact

There a number of ways in which economic impacts may be measured. A most effective and frequently used approach for evaluating regional impacts is the input-output methodology. Input-output analysis takes into account inter-industry relationships. It explains how the output of one industry represents the input of another industry. These transactions are tabulated into input-output tables which provide percentage measures of the contribution of each industry's activity relative to other industries. It provides a snapshot of the level of economic activity taking place in the economy at any one time. From input-output tables economic impacts in terms of direct effects on output, employment, income, and gross regional product for specific industries in specific regions can be determined.

Another important function of input-output analysis is that it can be used to estimate indirect flow on effects generated by the activities of particular sectors of the economy. In this context there are two types of effects that can be determined:

- *Production-induced effects* are the extra output, employment and income effects that result from the spending of firms as they earn income from the sale of their products.

10 Estimated from 2005 data available at <http://data.brs.gov.au/mapserv/plant/index.phtml>.

- *Consumption-induced effects* relate to the extra output, employment and income created by the spending of households which receive wages and salaries through employment in specified industries.

These indirect impacts can be measured by the estimation and application of a multiplier. Multipliers are ratios which measure the overall change in economic parameters, such as income or employment, resulting from an initial change in economic activity. There are two categories of multipliers:

- Type 1 multipliers measure the impact of direct and production induced effects.
- Type 2 multipliers measure the impact of direct, production induced and consumption induced effects.

National input-output tables are produced by the ABS and these form the basis of the data which has been used to construct the regional profiles in this report. The statistical analysis package REMPLAN was used to analyse data. REMPLAN is a regional input-output model based on ABS data which generates detailed regional economic data for up to 109 different industry sectors. Regions are defined by single, or combinations of statistical local areas. For any actual or hypothetical economic change in a region, REMPLAN produces the direct and flow-on implications across industry sectors in terms of employment, wages and salaries, output and gross regional product for that region.[11] All economic measures are in 2006 prices. The REMPLAN (2002, 2006) model is based on the following ABS datasets:

- 2001 and 2006 Census four-digit ANZSIC journey to work employment data
- December 2006 release, 2001–02 national transactions matrix
- November 2006 release, June quarter 2006 gross state product tables.

An explanation of the REMPLAN methodology is presented in Appendix 2.

11 A glossary of economic terms is provided in Appendix 1.

3 Industry analysis

An analysis of global and national trends in both the dairy and forestry products market provide a foundation upon which to build a localised assessment of relative impacts. The wider economic impacts arise in three main areas requiring investigation.

1 The scale and economic contribution of the two industries in terms of resource use and output produced from the local through to the global level.

2 Trade impacts, that is, patterns and factors in international trade and their significance for the two industries.

3 The competitive market environments of the two industries.

SCALE OF THE INDUSTRIES

A measure of the size or scale of industry production can be obtained at various levels of activity including national, state and regional levels. From this it is possible to develop a comparative profile of stages of value added in the two industries and their respective economic contributions at those levels.

TRADE IMPACTS

The influences on national and local production decisions may be understood in terms of three key elements for analysis. These are the observed patterns of industry trade, global economic trends; and those factors underlying the patterns of trade over time.

MARKET COMPETITION

The state of competition within the markets related to each industry provides insight into the constraints and opportunities faced by producers. An understanding of market structures and relationships provides an important context in which to evaluate performance.

3.1 National industry trends

SCALE OF THE INDUSTRIES

Table 3.1 provides a snapshot of the two industries based on 2001 Census of Population and national transaction matrix data from the ABS.

Table 3.1 National economic parameters for the dairy and forestry sectors, 2002

	Output		Income		Employment		Exports		Imports		Value Added	
	$m	%	$m	%		%	$m	%	$m	%	$m	%
Dairy cattle	4936.56	0.54	388.35	0.09	28389	0.36	0.00	0.00	0.00	0.00	2659.57	0.31
Dairy products	11691.22	1.27	1233.95	0.28	17070	0.21	3545.76	1.69	864.39	0.45	2754.03	0.32
Total dairy	16627.77	1.80	1622.30	0.36	45459	0.57	3545.76	1.69	864.39	0.45	5413.60	0.63
forestry and logging	2309.93	0.25	582.53	0.13	11678	0.15	181.27	0.09	70.40	0.04	1326.28	0.15
sawmill products	4408.65	0.48	677.73	0.15	13240	0.17	815.91	0.39	842.85	0.44	1751.46	0.20
Total forestry	6718.58	0.73	1260.26	0.28	24918	0.31	997.18	0.48	913.25	0.47	3077.74	0.36
Total (all sectors)	921747.00	100.00	446095.21	100.00	7982710	100.00	209465.38	100.00	192978.26	100.00	858225.46	100.00

(CONSTRUCTED FROM REMPLAN NATIONAL DATA)

The Australian dairy sector (cattle plus dairy products) generates 1.8 per cent ($16,628m) of national output. It adds 0.63 per cent value added to national product and provides 0.57 per cent (approximately 45,500) of national employment. More than 60 per cent of the national dairy sector employment is on dairy farms, while most of the output, income, exports and imports are the result of milk processing. Dairy farms and milk processors contribute nearly equally to value added in national product. The national dairy sector contributes 1.7 per cent of Australia's total exports and 0.45 per cent of total imports.

The forestry sector as a whole (both hardwood and softwood forestry, logging and processing) generates 0.73 per cent of national output. It adds 0.36 per cent value added to national product and provides employment nationally of 25,000 or 0.31 per cent of the national total. Forestry contributes 0.28 per cent to national income. The majority of the forestry contribution to the national economy comes from the timber processing activities of the forestry sector. The national forestry sector contributes 0.48 per cent of Australia's total exports and 0.47 per cent of total imports. Timber plantations represent more than half the volume of timber harvested. Of this, hardwood plantations account for 44.3 per cent of the plantation harvest. [12]

Appendix 3 gives a further breakdown of industry data from which national multipliers can be calculated. Based on latest available data the dairy sector has a total goods and services output of $17 billion per annum. It spends $10.7 billion on inputs within Australia and $1.6 billion on wages and salaries. The forestry sector has a total goods and services output of $6.7 billion per annum. It spends $2.7 billion on inputs within Australia and $1.2 billion on wages and salaries.

12 IBISWorld, 'Logging in Australia: industry report', A0302, retrieved 13 February 2008, <http://www.ibisworld.com.au>.

Table 3.2 indicates the national multipliers for both sectors. Type 2 multipliers refer to the full impact upon the economy of an initial change in the economic parameter. They are usually much greater than regional multipliers because full flow on effects and change in industry economic parameters are accounted for. For example a Type 2 national dairy cattle output multiplier of 2.610 means that for every initial dollar increase in national dairy cattle output you would expect to see an extra $1.61 of output generated in the national economy.

Table 3.2 Type 2 National multipliers for the dairy and forestry sectors

Industry	Type 2 Multipliers			
	Output	Income	Employment	Value Added
Dairy Cattle	2.610	5.180	2.026	2.322
Meat and Dairy Products	3.367	4.254	6.695	6.668
Forestry and Logging	2.856	2.626	2.508	2.424
Wood and Wood products	2.982	3.200	2.740	3.479

(REMPLAN 2006)

TRADE IMPACTS

The dairy sector has been adversely affected by drought conditions that have persisted for the last five years. Industry production and revenue have declined as a result. Further ongoing structural adjustment is continuing in the wake of industry deregulation and the exit of dairy farmers. It is expected that efficiency gains that will accrue from economies of scale as farm sizes increase and farm management improvements will lead to increases in production levels. Milk processors are currently operating at less than full capacity.

Over half the country's national milk production is exported. The expansion of the export market in recent years has meant that the future of the industry has become increasingly linked to trade in international markets. The value of exports in 2006–07 was $3,156 million, making Australia the third largest exporter of dairy products in the world. Key markets are Japan, Malaysia, Indonesia and the Philippines. Global prices for milk products are forecast to increase over the following year 2007–08. However, global price trends are volatile and a slowdown in growth is expected the following year in 2009.[13] Movements in international prices are a key factor influencing farm gate prices.

Greater reliance on export markets means that Australian producers are now more susceptible to changes in trade patterns. In this respect, competition from emerging producers in countries such as Russia, India and Brazil may have an impact on future global prices. Australian producers have to look to productivity reforms and product differentiation to compete.

The forestry sector provides wood products for both domestic and overseas markets. In recent times two main factors have influenced industry revenue

- strong domestic consumer demand resulting in demand for wood products in both the construction and packaging industries.
- increased export demand principally from the Chinese and Japanese markets.

Industry revenue has fluctuated over the past five years. Average annual growth in real terms over this period is estimated at 0.3 per cent.[14] Export growth is estimated to have

13 IBISWorld, 'Dairy cattle in Australia', A0130, retrieved 13 February 2008, <http://www.ibisworld.com.au/>.
14 IBISWorld, 'Logging in Australia', A0302.

increased at an average annual rate of 1.3 per cent over the past five years. However, overseas markets are very responsive to changing demand conditions and exchange rate fluctuations. Export revenue fell in 2004–2005 because of these factors. In the immediate future demand and industry revenue is expected to grow at an average rate of 3.4 per cent per annum in line with market expansion in Japan and China, providing exchange rate conditions are favourable to importing countries.[15]

The structure of the logging market has excluded competitive pricing for native hardwood logs. In the past prices were heavily influenced by the royalties on logs harvested from native forests. These were determined with reference to the market conditions faced by the wood processor rather than the costs of producing logs. Each Australian state uses a different measure of price determination. A report by KPMG estimated that timber was sold at between 30–60 per cent below its market value.[16] It can be expected that as logging markets becomes more geared to competition in the future, prices will become more volatile.

MARKET COMPETITION

The dairy sector

The dairy sector can be categorised into two main industries, dairy cattle farming and dairy product manufacturing.

Dairy cattle farming is the third largest agricultural sector. The number of dairy farms has fallen from 22,000 in 1980 to 10,112 in 2005–06 largely as a result of deregulation.[17] Industry concentration remains low and competition in the industry has increased in recent years as a result of deregulation and the opening up of international markets.

Dairy farming is in the consolidation stage of the industry life cycle characterised by falling numbers of producers and increasing farm size associated with production efficiency gains. Deregulation and technological innovation have made the industry internationally competitive but also more susceptible to fluctuations in export prices.[18]

Dairy product manufacturing comprises 169 firms with three major firms accounting for 41 per cent of industry turnover. These are Murray Goulburn Ltd, Fonterra Ltd and Australian Co-operative Foods Ltd (Dairy Farmers). The cooperative organisational structure has been a feature of dairy product manufacturing in Australia. Market share of the major firms is: Fonterra 24 per cent, Murray Goulburn 10 per cent and Dairy Farmers 7 per cent. In addition there are a number of other firms, including Warrnambool Cheese and Butter (market share 3.4 per cent), that have the potential to increase market share in the future. The level of industry concentration is classed as medium but is expected to increase with further consolidations and mergers.[19]

Dairy manufacturing is in the mature stage of the life cycle characterised by a rationalisation within the industry, a decline in the number of firms and a fall in industry gross product. Future growth opportunities are geared to new product development, innovation and the development of new export markets.[20]

15 IBISWorld, 'Logging in Australia', A0302.
16 IBISWorld, 'Logging in Australia', A0302.
17 IBISWorld, 'Dairy cattle in Australia', A0130.
18 IBISWorld, 'Dairy cattle in Australia'.
19 IBISWorld, 'Other dairy product manufacturing in Australia: industry report', C2129, retrieved 13 February 2008, <http://www.ibisworld.com.au>.
20 IBISWorld, 'Other dairy product manufacturing in Australia', C2129.

The forestry sector

The forestry industry is divided between government and private operators and between softwood and hardwood producers. The private sector accounts for 88 per cent of new plantations. Table 3.3 indicates the types of private sector involvement in the industry. Hardwood plantations make up 14.2 per cent of revenue generated which was estimated to be $170.6 million in 2007.

Table 3.3 Segment shares of the private forestry market, per cent, 2007

Market segment	Share of Revenue %	Revenue, $m, estimated
Managed Investment Schemes	36.5	439.3
Timber Industry Companies	23.8	286.5
Other Industries	20.6	248.3
Super Funds	19.0	229.2
Total Private	100	1203.3

(ESTIMATED FROM IBISWORLD, 'FORESTRY IN AUSTRALIA', A0301)

Plantation forestry is a concentrated industry. There are a small number of relatively large producers within the industry. The top four account for 49.2 per cent of total industry revenue in 2006–07. Their market position has been increasing; in 2001–02 it was 38.2 per cent. The major producers of hardwood plantation timber are: Great Southern, with 22.9 per cent of market share; Timbercorp, 10.7 per cent; Integrated Tree Cropping (ITC), 5 per cent; Hancock Victorian Plantations, 4.5 per cent; Gunns Ltd, 2.9 per cent; and Forest Enterprises Australia, 1.5 per cent. In terms of the private hardwood plantation sub-sector the level of concentration is much higher; the market share of the top four firms is estimated to be between 83–95 per cent.

Industry concentration has been associated with increased foreign ownership including the purchase in 1998 of Victoria Government plantations by Hancock Timber Resource Group (US) and Weyerhauser's purchase of CSR's softwood plantations in Victoria and South Australia. Japanese hardwood plantation investment includes that by the Albany Plantation Forest Company, Victorian Treefarm Project, and Green Triangle Treefarm Project.[21]

Forestry is in the growth stage of its life cycle. This is a new growth phase brought about by a number of factors including a reduction on government involvement in the industry, an increase in plantation forestry to offset the decline in native forests, government investment incentives and a shortage of wood and wood products.

The industry receives a high level of government assistance and this has been a key driver of investment in the industry. Of particular note is the impact of the tax breaks associated with managed investment schemes (MIS) which have encouraged a number of institutional investors into the market. An explanation of how an MIS scheme may apply to blue gum plantations is given in Appendix 4.

21 IBISWorld, 'Forestry in Australia: industry report', A0301, retrieved 13 February 2008, <http://www.ibisworld.com.au>.

3.2 Regional industry trends

This section examines the economic trends within the three defined regional areas (see Section 2.2). The purpose of this analysis is to provide the background upon which regional multipliers and impacts can be determined.

REGION 1: DAIRY INTENSIVE REGION

This region comprises key dairying locations in South West Victoria. It includes the local statistical areas (SLAs) of Colac Otway (North), Colac Otway (South), Corangamite Shire (North), Corangamite Shire (South), Warrnambool City and Moyne Shire (South). The following table summarises the aggregate economic characteristics of the region.

Table 3.4 Agriculture, forestry and farming sector aggregates in the dairy intensive region 2002–2006

	Output ($M)	% of Regional Output	Income ($M)	% of Regional Income	Employment	% of Regional Employment	Contribution to GRP ($M)	% of total GRP
2002	1080.19	15.68	91.8	6.17	5,417	18.22	579.61	20.09
2006	959.32	12.98	91.2	4.93	4,788	15.12	521.0	16.2
% change	-11.18		0.65		-11.61		-10.11	

(REMPLAN DATA 2002, 2006)

The agriculture, fishing and forestry sector contributed 15.7 per cent to regional output in 2002 and 13 per cent in 2006. The decline in output reflects a national trend associated with the impact of drought conditions. In 2007, 87 per cent of dairy farms were affected by drought.[22] Although adverse seasonal conditions have led to a decline in the sector's contribution to income and employment it remains the largest contributor to gross regional product, contributing 16.2 per cent in 2006. The second largest contributor, manufacturing contributed 15 per cent in this period.

Table 3.5 The contribution of the dairy and forestry sectors to output, income and employment in the dairy intensive region 2002, 2006

Sector	Output % of Total 2002	Income % of Total 2002	Employment % of Total 2002	Output % of Total 2006	Income % of Total 2006	Employment % of Total 2006
Dairy cattle	9.89	3.54	12.16	7.76	2.7	9.6
Dairy Products	19.09	9.22	5.39	13.1	6.1	4.1
Total Dairy	**28.98**	**12.76**	**17.55**	**20.82**	**8.8**	**13.7**
Forestry and Logging	0.2	0.23	0.22	0.08	0.09	0.09
Wood Products	0.95	0.67	0.6	1.32	0.9	0.86
Total Forestry	**1.15**	**0.9**	**0.82**	**1.4**	**0.99**	**0.95**

(CONSTRUCTED FROM REMPLAN DATA)

22 Dairy Australia, Dairy 2007: *Situation and outlook, 2007*, p.71.

Table 3.5 indicates the contribution of the two industries to regional income and output. More detailed tables are provided in Appendix 5. Milk production and manufacturing were the most important industries within the region in 2006 accounting for 20.8 per cent of output, 8.8 per cent of income and 13.7 per cent of employment. By comparison forestry production and processing in 2006 contribute 1.4 per cent to the region's output and provide around one per cent of the region's income and employment. Whilst the dairy industry has experienced a decline in its contribution to the region's output and employment between 2002 and 2006, the contribution of the hardwood forestry industry has grown. Its contribution to output grew from $106.8 million in 2002 to $129.4 million in 2006. This increase has come not from forestry and logging activities but from the processing of wood products. The value of the output of forestry and logging fell during this period from $12.2 million to $5.5 million. This trend reflects the growth cycle of blue gum plantations in the area which have not yet reached their harvesting stage.

Blue gum plantations were first established in the region in 2002 and harvesting usually occurs between 9–15 years later.[23] There was a substantial increase in the number of blue gum plantations in the region between 2002 and 2005. Since then no new plantations have been established.[24] An explanation given for the cessation of new plantings was the relatively high price of farm land within the dairy intensive region compared to surrounding Western Victorian farming regions. It is unlikely that blue gum plantation companies will seek to purchase substantial tracts of land in the dairy intensive region in the next decade. In 2007, land prices in locations such as Noorat, Terang, Colac, Boorcan, Cobden, Timboon, Ecklin South, Simpson and Heytesbury, where blue gum plantations were in the process of becoming established, ranged from $4,600 and $6,500 per acre.[25] By comparison, the price of drier cattle grazing land in the Western District, for example, North Colac, North Kolora, Ballengeich, Hawkesdale, Macarthur, Glenormiston and Buckley Swamp was around $2,000 to $3,500 per acre.[26] Further inland in the cropping and sheep/beef regions, for example, Nerrin Nerrin near Lake Bolac, Balmoral, Hamilton to Edenhope land prices fell to around $1,000 to $2,000 per acre.[27]

Table 3.6 The contribution of the dairy and forestry sectors to exports, imports and value added in the dairy intensive region

Sector	Exports % of Total 2002	Imports % of Total 2002	Value Added % of Total 2002	Exports % of Total 2006	Imports % of Total 2006	Value Added % of Total 2006
Dairy cattle	6.93	14.34	12.52	7.54	12.73	9.49
Dairy Products	43.44	21.65	10.56	28.49	16.41	6.98
Total Dairy	**50.37**	**35.99**	**23.08**	**36.0**	**29.14**	**16.47**
Forestry and Logging	0.08	0.15	0.27	0.03	0.06	0.11
Wood Products	1.91	1.21	0.89	2.69	2.28	1.19
Total Forestry	**1.99**	**1.36**	**1.16**	**2.72**	**2.34**	**1.3**

(CONSTRUCTED FROM REMPLAN DATA)

Table 3.6 indicates the contribution to regional trade and value added. The significance of dairying to the regional economy is further indicated by reference to the contribution businesses in the sector make to gross regional product ($529 million in 2006).

23 G Anderson, 'When is the best time to harvest blue gum?', *Agriculture Notes*, Department of Primary Industry, Victoria, Information Series AG0812, August 2003.
24 Industry interview 23/10/07.
25 At that time the *Warrnambool Standard* reported dairy land prices in the region as being the highest on record, *Warrnambool Standard*, 15 December 2007, p.11.
26 For example, the *Warrnambool Standard*, 15 March 2008, p. 24.
27 For example, the *Warrnambool Standard*, 16 February 2008, p.23; and 22 March 2008, p. 22.

The importance of milk processing to the region and nation is shown by the value of exports of dairy products which was $866 million in 2006. By contrast the size of the hardwood forestry and logging sector is relatively small within the region and this is reflected in its contribution to exports ($83 million) and its businesses make to gross regional product ($42 million).

REGION 2: DAIRY–PLANTATION REGION

Region 2 located in Gippsland, Victoria comprises the five SLAs areas within the Wellington shire. The following table summarises the aggregate economic characteristics of the region.

Table 3.7 Agriculture, forestry and farming sector aggregates in the dairy–plantation region 2002–2006

	Output ($M)	% of Regional Output	Income ($M)	% of Regional Income	Employment	% of Regional Employment	Contribution to GRP ($M)	% of total GRP
2002	488.52	11.82	47.24	6.04	2,531	17.39	268.07	14.17
2006	432.48	8.55	41.19	4.83	2,226	15.22	239.02	9.39
% change	-11.4		-12.8		-12.05		-10.83	

(REMPLAN DATA 2002, 2006)

As with the dairy intensive region, the Agriculture, Forest and Farm sector in the dairy–plantation region has experienced a decline in output and employment between 2002 and 2006. This again, is a reflection of the adverse seasonal conditions experienced in this sector across the state.

Table 3.8 The contribution of the dairy and forestry sectors to output, income and employment in the dairy plantation region, 2002, 2006

Sector	Output % of Total 2002	Income % of Total 2002	Employment % of Total 2002	Output % of Total 2006	Income % of Total 2006	Employment % of Total 2006
Dairy cattle	6.3	2.58	9.53	4.47	2.07	8.27
Dairy Products	3.18	1.81	1.15	3.43	2.16	1.63
Total Dairy	**9.37**	**4.27**	**10.61**	**7.9**	**2.23**	**9.90**
Forestry and Logging	0.55	0.72	0.73	0.37	0.55	0.61
Wood Products	0.68	0.54	0.53	0.87	0.76	0.79
Total Forestry	**1.23**	**1.26**	**1.26**	**1.24**	**1.31**	**1.40**

(CONSTRUCTED FROM REMPLAN DATA)

The dairy sector in this region represents a much smaller proportion of the total output, accounting for less than 10 per cent of its total value. The hardwood forestry industry contributes slightly more to total output than it does in the dairy region but accounts for less than 1.3 per cent of total regional output. The value of dairy processing output increased from $130 million in 2002 to $172 million in 2006. The processing of hardwood products also increased during this period by a similar amount from $33.7 million to $60.5 million.

Table 3.9 The contribution of the dairy and forestry sectors to exports, imports and value added in the dairy plantation region 2002, 2006

Sector	Exports % of Total 2002	Imports % of Total 2002	Value Added % of Total 2002	Exports % of Total 2006	Imports % of Total 2006	Value Added % of Total 2006
Dairy cattle	9.48	8.21	7.32	5.11	6.18	4.76
Dairy Products	4.55	2.8	1.59	4.51	3.24	1.58
Total Dairy	**14.03**	**10.99**	**8.88**	**9.62**	**9.42**	**6.34**
Forestry and Logging	0.7	0.35	0.68	0.40	0.36	0.42
Wood Products	1.01	0.73	0.58	1.39	1.42	0.89
Total Forestry	**1.71**	**1.08**	**1.26**	**1.79**	**1.78**	**1.21**

(CONSTRUCTED FROM REMPLAN DATA)

The trend in value added in the two industries reflects those of output and employment. There has been a marked decline in percentage valued added by the dairy industry which was associated with noticeable decline in exports. Within the forestry sector the decline in value added has been associated with a rise in imports as a percentage of the total spending.

REGION 3: PLANTATION REGION

This region is located in South East Western Australia. It comprises the statistical local areas of Cranbrook Shire (Plantagenet) Shire, Albany (City Balance,) and Albany (City Central) and is an established hardwood plantation area. The following table summarises the aggregate economic characteristics of the region.

Table 3.10 Agriculture, forestry and farming sector aggregates in the plantation region 2002, 2006

	Output ($M)	% of Regional Output	Income ($M)	% of Regional Income	Employment	% of Regional Employment	Contribution to GRP ($M)	% of total GRP
2002	369.6	12.4	39.46	5.45	1,898	13.39	217.63	16.29
2006	336.485	11.85	36.10	5.22	1,849	12.5	196.64	15.56
% change	-8.95		-8.51		-2.58		-9.64	

(REMPLAN DATA 2002, 2006)

The agriculture, fishing and forestry sector contributed 12.4 per cent to regional output in 2002 and 11.9 per cent in 2006. It accounted for 13.4 per cent of employment in 2001 and 12.5 per cent in 2006. It also accounted 16.2 per cent of gross regional product in 2002, falling to 15.5 per cent in 2006.

Table 3.11 The contribution of the dairy and forestry sectors to output, income and employment in the plantation region, 2002, 2006

Sector	Output % of Total 2002	Income % of Total 2002	Employment % of Total 2002	Output % of Total 2006	Income % of Total 2006	Employment % of Total 2006
Dairy cattle	0.17	0.06	0.2	0.18	0.06	0.21
Dairy Products	0.05	0.03	0.06	0.16	0.1	0.07
Total Dairy	**0.4**	**0.16**	**0.26**	**0.34**	**0.16**	**0.28**
Forestry and Logging	0.71	0.73	0.73	0.76	0.78	0.79
Wood Products	0.26	0.16	0.16	0.93	0.67	0.75
Total Forestry	**0.97**	**0.89**	**0.89**	**1.69**	**1.45**	**1.54**

(CONSTRUCTED FROM REMPLAN DATA)

This region had traditionally been one in which broadacre farming, cropping and grazing have been the major agricultural enterprises. Plantation forestry became established in the late 1980s and expanded rapidly during the next decade. The main forest crop planted was blue gums, which made up 93 per cent of plantations in 2001. Most blue gum plantations were established between 1989 and 2001.[28] Harvesting of blue gums began in this region in 2001. The extent of growth in output, income and employment since that date can be seen in Table 3.11. In 2006 the value of output from the growing and processing of blue gums was $48.5million. Whilst the industry has grown it does not represent a significant proportion of output or employment in the region. Within the agricultural sector, sheep, beef and grain production still continue to make a greater contribution to the region's economy.

Table 3.12 The contribution of the dairy and forestry sectors to exports, imports and value added in the plantation region 2002, 2006

Sector	Exports % of Total 2002	Imports % of Total 2002	Value Added % of Total 2002	Export % of Total 2006	Imports % of Total 2006	Value Added % of Total 2006
Dairy cattle	0.39	0.14	0.21	0.38	0.2	0.21
Dairy Products	0.09	0.03	0.02	0.39	0.2	0.07
Total Dairy	**0.63**	**0.45**	**0.33**	**0.77**	**0.4**	**0.28**
Forestry and Logging	1.68	0.69	0.91	1.63	1.00	0.97
Wood Products	0.5	0.56	0.43	1.52	1.28	0.73
Total Forestry	**2.18**	**1.25**	**1.34**	**3.15**	**2.28**	**1.7**

(CONSTRUCTED FROM REMPLAN DATA)

Income generated from the export of wood and wood products has increased between 2002 and 2006 and this is reflected in the value added to the regional economy from blue gum plantations. This represented $22.03 million in 2006, compared to $76.5 million from beef farming and processing and $39.3 million from grain production.

28 J Schirmer, M Parsons, C Charlambou & C. Gavran, *Socio-economic impacts of plantation forestry in the Great Southern region of WA*, 1991-2004, p.10.

3.4 Summary

Within the dairy intensive region, the dairy sector as a whole (milk production and manufacturing) generates 21 per cent of the region's output; adds 16.5 per cent to gross regional product; provides 13.7 per cent of the region's employment, generates 8.8 per cent of the region's income; is responsible for 50.4 per cent of the region's exports and 36 per cent of the region's imports. The forestry sector as a whole (forestry, logging and processing) generates 1.4 per cent of the region's output; adds 1.2 per cent to gross regional product; provides less than one per cent of the region's employment and income, is responsible for 2.7 per cent of the region's exports and 2.3 per cent of the region's imports. Most of the forestry contribution to the dairy intensive region's economy comes from the timber processing activities of the forestry sector. Blue gum production and processing contributes a relatively small amount to output, employment and income at this stage in the growth cycle of the product. During the harvesting stage it is expected that the impact of the industry on economic aggregates will increase, however the total impact will be limited by the size of the industry. High land prices have restricted the further expansion of blue gum plantations in the region and it is not expected that the industry will grow markedly within the region in the next decade. Analysis of other regions suggests that even as blue gum plantations reach maturity the direct economic effects of the industry are comparatively small. In 2006 the value added by forestry and wood production in Regions 2 and 3 was 1.21 per cent and 1.71 per cent respectively.

4 Economic analysis of the dairy intensive region

A more detailed examination of the economic relationships within the dairy intensive region provides the background for determining projections of the future economic impacts of the dairy and blue gum industries.

4.1 Input-output analysis

The tables in this section provide a more comprehensive analysis of the relationships between the dairy and forestry sectors and other businesses, households and government within and outside the region. Input and output transactions form the basis for aggregated data and multiplier estimates.

The input transactions represent the source of inputs from sectors within the region or beyond. They comprise inputs from other producers and workers in the form of intermediate commodities and labour. They also include inputs from the business within the sector in the form of gross operating surpluses as well as government taxes paid and inputs from beyond the region in the form of imports.

The output transactions represent the destination of outputs to other sectors within the region or beyond. This includes output sold to other producers in the form of intermediate goods, to consumers and government in the form of final consumption goods, as capital goods for investment purposes or beyond the region as regional exports.

Table 4.1 summarises the source of input transactions for the regional dairy industry (dairy cattle, dairy products) in 2006. The input coefficient expresses each input component as a proportion of one dollar of sector output. For example, for each $1.00 of output generated by the dairy products sector in the region, intermediate goods to the value of nearly 43 cents were purchased from other businesses in the region. Alternatively, the input coefficient can be expressed as a percentage of the sector output. That is, the dairy products sector in the region purchased nearly 43 per cent of its inputs from other businesses in the region.

Table 4.1 Regional dairy input transactions 2006

	Intermediate Total	Wages and Salaries	Gross Operating Surplus	Domestic Imports	Overseas Imports	Total
Dairy cattle						
Input coefficient	0.0711	0.0744	0.4103	0.4191	—	1.0000
Transactions ($,000)	42,563	44,535	245,486	250,776	—	598,330
Dairy products						
Input coefficient	0.4276	0.1051	0.1206	0.2643	0.0736	1.0000
Transactions ($,000)	409,061	100,495	115,370	252,858	70,397	956,608

(REMPLAN 2006, TRANSACTIONS MATRIX)

The dairy cattle sector employed 3,043 people in the region in 2006. Regional input-output analysis estimates, shown in Table 4.1, indicate that this sector had a total output of $598.3m in 2006 and made the following direct contribution to the regional economy in 2006. The sector:

- spent $42.6m (7.1 per cent) on inputs sourced from within the region (e.g. services to agriculture). That is, for every one dollar of output produced by the industry seven cents was spent on inputs sourced from within the region.
- paid $44.5m (7.4 per cent) on wages and salaries in the region.
- spent $250.8m (41.9 per cent) on domestic imports into the region and had a gross operating surplus of $245.5m (41 per cent).

The dairy cattle sector also paid $15.0m (2.5 per cent) in net taxes to the region.

The dairy products industry employed 1,299 people in 2006. Table 4.1 indicates that this sector had a total output of $956.6m in 2006 and made the following direct contribution to the regional economy in 2006. The sector:

- spent $409.6m (42.8 per cent) on inputs sourced within the region (e.g. the sector purchased $333.9 m on inputs from the dairy cattle sector). For every dollar of output produced by the sector nearly 43 cents was spent on inputs from within the region.
- paid $100.5m (10.5 per cent) on wages and salaries in the region.
- spent $252.9m (26.4 per cent) on domestic imports into the region and $70.4m on overseas imports (7.4 per cent).
- had a gross operating surplus of $115.4m (12.1 per cent).

The dairy products sector also paid $8.4m (0.9 per cent) in net taxes to the region

For every dollar of output produced by the dairy industry (dairy farming and dairy products) 50 cents was spent on inputs purchased from within the region.

Table 4.2 summarises the destination of output transactions from the region's dairy sector (dairy cattle, dairy products) in 2006. The output coefficient expresses each output destination as a proportion of one dollar of sector output. For example, for each $1.00 of output generated by the dairy cattle (dairy farming) sector in the region, goods to the value of nearly 56 cents are sold as intermediate goods to other businesses in the region. Alternatively, the dairy cattle sector sold almost 56 per cent of its output to other businesses in the region.

Table 4.2 Regional dairy output destination 2006

	Intermediate Total	Private Investment	Household Consumption	Exports	Total
Dairy cattle					
Output coefficient	0.5587	0.0579	0.0000	0.3834	1.0000
Transactions ($,000)	334,279	34,657	0	229,386	598,330
Dairy products					
Output coefficient	0.0682	0.0042	0.0215	0.9060	1.0000
Transactions ($,000)	65,240	4,058	20,589	866,678	956,608

(REMPLAN 2006, TRANSACTIONS MATRIX)

Regional input-output analysis estimates that in 2006 the dairy cattle industry had output of $598.3m and contributed the following to the regional economy. In 2006 the sector:

- sold $334.3m (55.9 per cent) to other businesses within the region. Fifty-six cents of every dollar of output produced by the dairy cattle sector goes to other producers as intermediate goods within the region. $333.9m was sold to the dairy products manufacturing sector in the region.
- sold $34.7m (5.8 per cent) of its total output to the private investment sector within the region.
- sold $229.4m (38.3 per cent) of its output for export out of the region.

Input-output analysis estimates that in 2006 the dairy products industry had an output of $956.6m and contributed the following to the regional economy. The sector:

- sold $65.2m (6.8 per cent) of its output to other businesses in the region.
- sold $20.6m (2.2 per cent) of its output for household consumption within the region.
- exported $866.7m (90.6 per cent) of its output out of the region.

Table 4.3 Regional forestry and sawmill input transactions 2006

	Intermediate Total	Wages and Salaries	Gross Operating Surplus	Domestic Imports	Overseas Imports	Total
Forestry and logging						
Input coefficient	0.2528	0.2482	0.3061	0.1522	0.0300	1.0000
Transactions ($,000)	1,581	1,552	1,914	952	188	6,254
Sawmill products						
Input coefficient	0.1283	0.1554	0.2359	0.2768	0.1933	1.0000
Transactions ($,000)	12,246	14,834	22,520	26,422	18,448	95,452

(REMPLAN 2006, TRANSACTIONS MATRIX)

In 2006 the forestry and logging sector employed 29 people in the region. Table 4.3 indicates that in 2006 the sector had a total output of $6.25m and made the following direct contribution to the regional economy. The sector:

- spent $1.6m (25.3 per cent) on inputs sourced within the region. For every one dollar of output produced by the industry 25 cents was spent on inputs sourced from within the region.
- paid $1.6m (24.8 per cent) on wages and salaries in the region.
- had a gross operating surplus of $1.9m (30.6 per cent).
- spent $952,000 (15.2 per cent) on domestic imports into the region and $188,000 (3 per cent) on overseas imports.

The forestry and logging sector also paid $67,000 (1.1 per cent) in net taxes to the region.

In 2006 the sawmill products, or wood processing industry, employed 271 people in the region. Table 4.3 indicates that in 2006 the sector had a total output of $95.5m and made the following direct contribution to the regional economy. The sector:

- spent $12.3m (12.8 per cent) on inputs sourced within the region. For every one dollar of output produced by the industry nearly 13 cents was spent on inputs sourced from within the region.
- paid $14.8m (15.5 per cent) on wages and salaries in the region.
- had a gross operating surplus of $22.5m (23.6 per cent).
- spent $26.4m (27.7 per cent) on domestic imports into the region and $18.5m (19.3 per cent) on overseas imports.

The sawmill products sector also paid $982,000 (one per cent) in net taxes to the region.

Table 4.4 Regional forestry and sawmill output destination 2006

	Intermediate Total	Household Consumption	Government Consumption	Private Investment	Exports	Total
Forestry and logging						
Output coefficient	0.7167	0.0088	0.0984	0.0160	0.1602	1.0000
Transactions ($,000)	4,482	55	616	100	1,002	6,254
Sawmill products						
Output coefficient	0.1515	0.0011	0.0000	-0.0117	0.8586	1.0000
Transactions ($,000)	14,460	108	0	-1,114	81,954	95,452

(REMPLAN 2006, TRANSACTIONS MATRIX)

Regional input-output analysis estimates that in 2006 the forestry and logging industry had output of $6.3m and contributed the following to the regional economy. The sector:

- sold $4.5m (71.7 per cent) of its output to the wood processing businesses within the region. For every dollar of output generated by forestry and logging at least 71 cents was sold to other businesses in the region.
- sold $55,000 (0.9 per cent) to households within the region.
- sold $616,000 (9.8 per cent) of its output to the government sector within the region.
- sold $100,000 (1.6 per cent) of its output to the private investment sector within the region.
- exported $1.0m (16 per cent) of its output out of the region.

Regional input-output analysis estimates that in 2006 the sawmill products industry (e.g. log sawing and dressing, wood chipping) had output of $95.5m and contributed the following to the regional economy. The sector:

- sold $14.5m (15.2 per cent) of its output to other businesses within the region. For every dollar of output generated by the sawmill products sector 15 cents was sold to other industry sectors in the region.
- sold $108,000 (0.1 per cent) of its output for household consumption purposes within the region.
- exported nearly $82m (85.9 per cent) of its output out of the region.

In total the value of output produced by the dairy sector in the region in 2006 was $1.5 billion. The value of output produced by the blue gum plantation industry for the same period was $102,821 million. Further breakdown of the value of industry output allows a much more detailed analysis of the flow on effects of production. Appendix 5 provides a more specific analysis of industry input transactions and output destinations for the dairy and forestry–sawmill sectors.

4.2 Regional multipliers

Using REMPLAN input-output modelling (see Section 2.3 and Appendix 2), Type 2 multipliers that measure the economic impacts of change have been calculated for the dairy intensive region. Type 2 multipliers take into account the direct effect and indirect production induced and consumption induced effects for a given change in an economic aggregate.

Table 4.5 provides the Type 2 multipliers associated with a change in the region's output, income, employment or value added.

Table 4.5 Type 2 multipliers for the dairy intensive region 2006

	Type 2 Multipliers			
Industry	Output	Income	Employment	Value Added
Dairy Cattle	1.181	1.533	1.148	1.151
Meat and Dairy Products	1.675	1.882	3.251	2.457
Forestry and Logging	1.668	1.692	1.716	1.535
Wood and Wood Products	1.475	1.682	1.652	1.559

(REMPLAN 2006)

For example, the Type 2 dairy cattle output multiplier of 1.181 means that for every initial one dollar increase in dairy cattle output you would expect to see an additional 18 cents of output generated in the region. Similarly, the dairy products Type 2 employment multiplier of 3.251 indicates that the employment of one extra person in that industry sector would see another 2.25 jobs created in the region.

Input-output multipliers need to be treated with some caution. Input-output multipliers are summary measures used for predicting the total impact on all industries of changes in output of any one industry. Multipliers reflect the average impact and not the impact of a marginal or small increase or decrease in activity. Nevertheless they provide a useful tool of analysis for estimating the likely broader impact of a change in the level of economic activity. They are particularly suited to the purpose of comparing the impacts of changes in different segments of the economy.

As noted in Section 3, blue gum plantation forestry is in its establishment phase of development and has yet to reach the point where harvesting of the product will take place. This industry could be expected to have a greater impact on regional income and employment when harvesting occurs. Comparison with other regional areas has been used to gauge the likely impacts of the blue gum industry as trees are harvested. Table 4.6 compares the dairy intensive region multipliers with benchmark regions.

Table 4.6 Benchmarking dairy intensive region multipliers against other regions, 2006

Region	Industry	Type 2 Multipliers			
		Output	Income	Employment	Value Added
Dairy Intensive Region	Dairy Cattle	1.181	1.533	1.148	1.151
	Meat and Dairy Products	1.675	1.882	3.251	2.457
	Forestry and Logging	1.668	1.692	1.716	1.535
	Wood and Wood products	1.475	1.682	1.652	1.559
Dairy–Plantation Region	Dairy Cattle	1.139	1.433	1.122	1.126
	Meat and Dairy Products	1.656	1.879	3.239	2.318
	Forestry and Logging	1.338	1.378	1.397	1.294
	Wood and Wood products	1.413	1.624	1.610	1.493
Plantation Region	Dairy Cattle	1.501	2.388	1.378	1.466
	Meat and Dairy Products	1.943	2.020	3.775	4.005
	Forestry and Logging	1.480	1.511	1.531	1.410
	Wood and Wood products	1.761	2.005	1.885	1.937

(REMPLAN 2006)

An examination of Table 4.6 suggests that when the industry's proportion of regional output is small (less than one per cent) the multiplier value for a change in output, income, employment or value added may overstate the final impact. This is likely to be the case for forestry and logging in the dairy intensive region and for the dairy sector in the plantation region. In the plantation region the multipliers associated with wood and wood products are higher but not significantly higher than those in the other regions. This suggests larger economic impacts accrue when the processing of the product is undertaken within the region. Overall there are not sustained differences in the size of multipliers between the industry sectors or between the regions.

5 Future economic impacts

The REMPLAN input-output model was used to estimate the likely future economic impacts of dairy and blue gum plantation industries within the dairy intensive region. Projections were developed for three scenarios which reflect outcomes on the basis of low, medium and high growth rates in output. Projections extend from 2006 to 2020. The estimates are expressed in 2006 dollar terms.

The projection process is outlined in Appendix 6. In calculating projections to 2020 the following considerations were taken into account in respect to the dairy and blue gum industries:

- The dairy industry projections are based on estimated initial changes in yearly production in the dairy processing sector not the dairy farming sector. Output in the dairy farming sector is heavily dependent upon the dairy processing sector. A primary factor influencing the dollar value of output of the dairy farming sector is the demand for fresh milk by processing plants and the price the processors are willing to pay for that milk. In 2005–2006 the dairy farming sector sold 94 per cent of its production to milk processing firms. (Table 4.2 and Appendix 5).
- Most of the blue gum plantations are owned and managed by private companies and the blue gums are grown for hardwood pulpwood. These are managed on rotations of around 10–14 years. The economic contribution of the blue gum plantation industry at present is relatively limited. The income generated is currently primarily derived from the establishment of new plantations.[29] The harvesting stage of the production cycle could be expected to alter economic impacts in the future.
- The harvesting of current blue gum plantations in the dairy intensive region can be expected to begin some time after 2010 and given current stands reach full production after 2015. The blue gum industry projections are based on estimated initial changes in yearly production in the forestry and logging sector for the period 2006 to 2010 and the sawmill products sector (which includes wood chips) for the period 2011 to 2020. This projection approach reflects the production characteristics of the blue gum industry. Almost all of the output from the blue gum forestry and logging sector is used to produce wood chips for the manufacture of paper and cardboard.

5.1 Scenario 1: Low growth

Scenario 1 provides independent projections for each of the dairy and blue gum industries. The dairy industry projections are based on a yearly increase in the sector's output of one per cent. Similarly, the independent and separate blue gum industry projections are based on a yearly increase in that sector's output of one per cent. Scenario 1 does not provide estimates for a simultaneous output growth rate in both industries of one per cent per annum.

A one per cent yearly growth rate is regarded as the minimum growth rate for each industry's output, given the current state of international demand for dairy and wood chip products.

29 URS Forestry, *Socio-economic study of the forest industries in Central Victoria*, Report prepared for Central Victorian Plantations Committee, Victoria, 2003, p.10.

Table 5.1 Low growth estimate [i] of regional economic aggregates 2006–2020

Industry/Economic Parameters	Total Value of Economic Parameters							
	2006	2008	2010	2012	2014	2016	2018	2020
Dairy Industry								
Output ($m)	7,295	7,328	7,360	7,394	7,428	7,462	7,498	7,534
Income ($m)	1,648	1,652	1,656	1,661	1,665	1,670	1,674	1,679
Employment (no.)	31,676	31,767	31,858	31,949	32,046	32,144	32,241	32,342
Value Added ($m)	3,212	3,323	3,333	3,344	3,355	3,367	3,378	3,390
Gross Regional Product ($m)	3466	3,477	3,487	3,498	3,509	3,521	3,532	3,544
Blue Gum Industry								
Output ($m)	7,295	7,296	7,296	7,423	7,426	7,429	7,431	7,434
Income ($m)	1,648	1,648	1,648	1,652	1,652	1,653	1,653	1,653
Employment (no.)	31,676	31,677	31,677	31,758	31,760	31,761	31,765	31,766
Value Added ($m)	3,212	3,212	3,213	3,221	3,221	3,222	3,222	3,222
Gross Regional Product ($m)	3466	3,466	3,467	3,475	3,475	3,475	3,476	3,476

(NOTE: [i] LOW GROWTH ESTIMATES ARE BASED ON A PROJECTED OUTPUT GROWTH OF ONE PER CENT P.A. FROM 2006 AND REMPLAN MULTIPLIER VALUES)

Based on a low rate of growth in dairy industry output of one per cent p.a. from Table 5.1 the projected increase in the dairy industry output between 2006 and 2020 is estimated to:

- increase gross regional product by $78m (2.3 per cent) from $3,466m to $3,544m.
- increase total income by $31m (1.9 per cent) from $1,648m to $1,679m.
- increase total employment by 666 (2.1 per cent) from 31,676 to 32,342.

Growth in dairy industry output of one per cent each year over the period 2006–2020 is estimated to increase gross regional product, total regional income and total regional employment by around two per cent over the period.

Based on a low rate of growth in blue gum industry output of one per cent p.a. from Table 5.1 the projected increase in the blue gum industry output between 2006 and 2020 is estimated to:

- increase gross regional product by $10m (0.29 per cent) from $3,466m to $3,476m.
- increase total income by $5m (0.30 per cent) from $1,648m to $1,653m.
- increase total employment by 90 (0.28 per cent) from 31,676 to 31,766.

Growth in blue gum industry output of one per cent each year over the period 2006–2020 is estimated to increase gross regional product, total regional income and total regional employment by about 0.3 per cent over the period.

5.2 Scenario 2: Medium growth

In Scenario 2 the dairy industry projections are based on a yearly increase in the sector's output of three per cent. Similarly, blue gum industry projections are based on a yearly increase in that sector's output of three per cent.

A three per cent yearly output growth rate is regarded as the average growth rate that might be expected for each industry, given the current state of international demand for dairy and wood chip products.

Table 5.2 Medium growth estimate [1] of regional economic aggregates 2006–2020

Industry/Economic Parameters	Total Value of Economic Parameters							
	2006	2008	2010	2012	2014	2016	2018	2020
Dairy Industry								
Output ($m)	7,295	7,393	7,496	7,605	7,721	7,844	7,975	8,113
Income ($m)	1,648	1,661	1,674	1,688	1,703	1,718	1,735	1,753
Employment (no.)	31,676	31,949	32,235	32,540	32,865	33,210	33,574	33,964
Value Added ($m)	3,212	3,344.4	3,377	3,413	3,451	3,491	3,533	3,578
Gross Regional Product ($m)	3466	3,498	3,531	3,567	3,605	3,645	3,687	3,732
Blue Gum Industry								
Output ($m)	7,295	7,296	7,297	7,440	7,449	7,459	7,470	7,481
Income ($m)	1,648	1,648	1,648	1,653	1,654	1,654	1,654	1,655
Employment (no.)	31,676	31,679	31,681	31,768	31,780	31,788	31,796	31,806
Value Added ($m)	3,212	3,213	3,213	3,223	3,223	3,224	3,225	3,239
Gross Regional Product ($m)	3466	3,467	3,467	3,476	3,477	3,478	3,479	3,480

(NOTE: [1] MEDIUM GROWTH ESTIMATES ARE BASED ON A PROJECTED OUTPUT GROWTH OF THREE PER CENT P.A. FROM 2006 AND REMPLAN MULTIPLIER VALUES)

Based on a medium rate of growth in dairy industry output of three per cent p.a. from Table 5.2 the projected increase in the dairy industry output between 2006 and 2020 is estimated to:

- increase gross regional product by $266m (7.7 per cent) from $3,466m to $3,732m.
- increase total income by $105m (6.4 per cent) from $1,648m to $1,753m.
- increase total employment by 2,288 (7.2 per cent) from 31,676 jobs to 33,964 jobs.

Based on a medium rate of growth in blue gum industry output of three per cent p.a. from Table 5.2 the projected increase in the blue gum industry output between 2006 and 2020 is estimated to:

- increase gross regional product by $14m (0.40 per cent), from $3,466m to $3,480m.
- increase total income by $7m (0.43 per cent), from $1,648m to $1,655m.
- increase total employment by 130 (0.41 per cent), from 31,676 jobs to 31,806 jobs.

Based on output growth projections of three per cent for both industries over the period 2006–2020, it is expected that the dairy industry will have a substantial impact upon the region's economic parameters. The aggregates grow around seven per cent over the period due to the increase in dairy activity and around 0.4 per cent due to the increase in blue gum plantation activity. This means that over the period 2006–2020 the dairy

industry is projected to increase gross regional product by $266 million whilst the blue gum industry will increase GRP by $14 million. The dairy industry impact upon regional income is $105 million compared to the blue gum industry $7 million. The dairy industry increase to regional employment 2,289 compared with 131 in the blue gum industry.

The increase in output generated by the dairy industry over the period is 4.4 times that generated by the blue gum industry ($818m compared with $186m). The significant amount of resources employed from outside the region (e.g., labour) by the blue gum industry is also reflected in the much smaller contribution to regional employment and income generated by the blue gum industry over the period.

As the blue gum industry is projected over the period 2006–2020 to increase gross regional product, total regional income and total regional employment by less than 0.5 per cent, there is not likely to be any significant competition for resources in the region between the dairy industry and the blue gum industry over the period 2006–2020. Furthermore as there has been very little planting of blue gums in the region since 2005, the economic impact of the blue gum industry in the region, other things equal, is likely to be very small post 2020.

5.3 Scenario 3: High growth

In Scenario 3 the dairy industry projections are based on a yearly increase in the sector's output of seven per cent. A seven per cent rate of growth per year would result in an industry's output doubling every ten years. A seven per cent yearly growth in output is regarded as a high rate of growth given the current state of international demand for dairy and wood chip products.

Table 5.3 High growth estimate [(i)] of regional economic aggregates 2006–2020

Industry/Economic Parameters	Total Value of Economic Parameters							
	2006	2008	2010	2012	2014	2016	2018	2020
Dairy Industry								
Output ($m)	7,295	7,527	7,791	8,095	8,442	8,839	9,294	9,814
Income ($m)	1,648	1,678	1,712	1,751	1,795	1,846	1,904	1,971
Employment (no.)	31,676	32,323	33,064	33,909	34,881	35,993	37,264	38,720
Value Added ($m)	3,212	3,388	3,474	3,572	3,685	3,814	3,962	4,131
Gross Regional Product ($m)	3466	3,541	3,627	3,726	3,839	3,968	4114	4,285
Blue Gum Industry								
Output ($m)	7,295	7,297	7,299	7,479	7,507	7,539	7,576	7,618
Income ($m)	1,648	1,648	1,649	1,655	1,656	1,657	1,659	1,661
Employment (no.)	31,676	31,683	31,689	31,804	31,829	31,856	31,885	31,922
Value Added ($m)	3,212	3,213	3,214	3,226	3,229	3,231	3,235	3,261
Gross Regional Product ($m)	3466	3,467	3,468	3,480	3,482	3,485	3,489	3,492

(NOTE: [(i)] HIGH GROWTH ESTIMATES ARE BASED ON A PROJECTED OUTPUT GROWTH OF SEVEN PER CENT P.A. FROM 2006 AND REMPLAN MULTIPLIER VALUES)

Under assumptions of a high rate of growth in dairy industry output from Table 5.3 the projected increase in the dairy industry output between 2006 and 2020 is estimated to:

- increase gross regional product by $819m (23.6 per cent) from $3,466m to $4,285m.
- increase total income by $323m (19.6 per cent) from $1,648m to $1,971m.
- increase total employment by 7,044 (22.2 per cent) from 31,676 to 38,720.

The projected increase in the blue gum industry output between 2006 and 2020 is estimated to:

- increase gross regional product by $26m (0.75 per cent) from $3,466m to $3,492m.
- increase total income by $13m (0.79 per cent) from $1,648m to $1,661m.
- increase total employment by 246 (0.78 per cent) from 31,676 jobs to 31,922 jobs.

Based on output growth projections of seven per cent for each industry over the period 2006–2020, it is expected that the dairy industry will continue to have a large impact upon the region's economic parameters. Dairy industry impact on gross regional product is estimated to be $819m compared with $26m for the blue gum industry. The dairy industry impact upon regional income is $323m compared to the blue gum industry $13m. The dairy industry increase to regional employment is 7,044 compared with 246 for the blue gum industry. Even with a high output growth estimate of seven per cent p.a., the blue gum industry is projected over the period 2006–2020 to increase gross regional product, total regional income and total regional employment by less than 0.8 per cent and there is not likely to be any significant competition for resources in the region between the dairy industry and the blue gum industry over the period 2006–2020.

6 Summary discussion

The objective of this study was to assess the economic implications of plantation forestry in an area where activity is in its early stages of development. The study aimed to identify economic effects of the spread of privately owned blue gum plantations into long established dairying districts. Input-output analysis was used to analyse regional economic impacts of two industries (dairying and blue gum plantation forestry) in a specified area of South West Victoria. The modelling program REMPLAN was used to evaluate the direct and indirect effects of the two industries on the regional economy. The economic impacts of the two industries were modelled and estimates of the value of the indirect effects generated by the dairy and blue plantation industries calculated. A series of scenarios were then constructed to predict the likely future economic impacts of the two industries.

The dairy sector (milk production and manufacturing) generates 29 per cent of the dairy intensive region's output; adds 23.1 per cent to gross regional product; provides 17.6 per cent of the region's employment, generates 12.7 per cent of the region's income; is responsible for 50.2 per cent of the region's exports and 36 per cent of the region's imports. The forestry sector (forestry and logging) generates 1.2 per cent of the region's output; adds 1.2 per cent to gross regional product; provides less than one per cent of the region's employment and income, is responsible for two per cent of the region's exports and 1.4 per cent of the region's imports.

Multiplier estimates indicated that for every dollar increase in regional dairy cattle output a further 18 cents of extra output is created in the regional economy. For forestry and logging an extra 67 cents is generated. For every extra dollar of value added by the dairy manufacturing sector a further $1.46 is added to gross regional product. For every extra dollar of value added in the wood processing industry a further $0.56 is added to gross regional product.

Scenario projections suggest that given the current state of the blue gum plantation industry within the dairy intensive region, there is not likely to be any significant competition for resources in the region between the dairy industry and the blue gum industry over the period 2006–2020. The blue gum plantation industry is estimated to increase gross regional product, total regional income and total regional employment by less than one per cent.

There are a number of caveats that need to be taken into account when interpreting these results. First, all estimates are based on published data collected by the ABS or industry bodies. Specific industry data relating to output yields, costs, prices and productivity for blue gum plantations was not made available to the researchers. Second, it was not possible to gain an accurate estimate of the projected impact on value added of blue gum plantations once they reach the harvesting stage. Third, it should be noted multipliers are estimates of the change in economic activity. They reflect the average impact and not the impact of a marginal or small change. They may err on the conservative side in that they may not reflect fully the spill over effects of any change impacting the regional economy. Furthermore multiplier estimates for industries that account for a small proportion of regional output (less than one per cent) the multiplier value for a change in economic parameters may overstate the final impact.

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Appendixes

Appendix 1: Glossary of economic terms

Consumption-induced effects are additional output, employment and income created from the spending by households that receive income form direct and indirect activities.

Employment is the number of people employed by businesses/organisations in each of the industry sectors in a defined region. Aggregate employment is the total number of employees and includes full-time, part-time and some casual employees.

Gross regional product (GRP) is the value of **final** goods and services produced in the region over the period of one year. This includes exports but excludes imports. GRP can be measured by adding up all forms of final expenditure but not intermediate expenditure as this would lead to double counting (e.g. the wheat and flour in a loaf of bread). GRP can be measured by adding up all incomes earned by individuals (wages and salaries), firms (gross operating surplus and profits), and governments (taxes on products or services). Additions to GRP represent the extra contribution generated by businesses to gross regional product.

Income is the value of wages and salaries paid by businesses and organisations in each of the industry sectors in a defined region. Aggregate income is a measure of the household income generated.

Input-output analysis is a system of accounting for inter-industry transactions.

Input-output table is a table that quantifies the purchases and sales of goods and services taking place in the economy at a given point in time. Each item is shown as a purchase by one sector and a sale by another.

Input transactions represent the source of inputs from within the region in the form of intermediate commodities and labour or beyond the region in the form of regional imports.

Input coefficients are calculated by scaling down total regional output of each sector to $1.00 and the value of all sector inputs is then scaled down proportionally, for example, for each $1.00 of output generated by the dairy products sector in the nation, goods to the value of $0.49 are purchased from other productive sectors in the national economy.

Output transactions detail the destination of outputs from sectors to other sectors within the region, to consumers in the form of final consumption, used as capital goods as part of investment or go beyond the region as regional exports.

Output coefficients are calculated by scaling down the total regional output of each sector to $1.00 and the value of all sector outputs is then scaled down proportionally, e.g. for each $1.00 of output generated by the dairy cattle (dairy farming) sector in the national economy, goods to the value of $0.83 are sold to the dairy products sector in the national economy.

Life-cycle analysis investigates the various turning points in the growth of an industry. There are several stages in the life cycle of the industry. These are introduction, growth, maturity and consolidation or decline. Life-cycle stages are measured by changes in industry sales, as well as trends in demand, supply and competition between firms.

Multiplier is a ratio which indicates the final change in the level of economic activity that results from an initial change in economic activity.

Output is the gross revenue generated by businesses/organisations in each of the industry sectors in the defined region. Aggregate output is measured by the 'income approach'. Output is the contribution of each industry sector in the region to incomes earned by individuals and firms. This includes incomes earned by households (wages and salaries), incomes earned by firms (gross operating surplus), incomes earned by government (taxes on goods and services) and incomes earned by producers outside the region (imports).

Production-induced effects are additional output, employment and income resulting for spending by firms that receive income from the sale of goods and services to other firms; sometimes referred to as 'indirect effects'.

Type 1 multipliers are ratios which measure the impact of direct and production-induced effects.

Type 2 multipliers are ratios which measure the impact of direct, production-induced and consumption-induced effects.

Value added is the value added by the industry sector in the region to intermediate inputs sourced from within the region and imported from outside the region. It is the value added only by businesses to GRP. Aggregate value added represents the contribution only by businesses/organisations in each of the industry sectors in the defined region to GRP. The value added by businesses can be calculated using the income approach. It is the addition of the Intermediate totals of wages and salaries, gross operating surplus and net taxes.

Appendix 2: REMPLAN methodology[30]

2.1 Introduction

The REMPLAN regional economic modelling program was developed by Ian Pinge, Principal Research Fellow (now retired) at the Economic Research Unit, La Trobe University, Bendigo, Victoria, Australia. REMPLAN is distributed through Compelling Economics <www.compellingeconomics.com.au>.

REMPLAN 2.0 is a regional economic modelling and planning software package and provides detailed region specific data at up to 109 industry sectors in Australia and 124 industry sectors in New Zealand. REMPLAN 2.0 also has a dynamic economic impact assessment capability that allows impacts to be modelled at up to 109 or 124 different industry sectors.

The region-specific economic data which is presented and analysed by REMPLAN 2.0 is provided in the form of data files compiled by the Economic Research Unit (ERU) at La Trobe University. The base datasets used by the ERU are sourced from the Australian Bureau of Statistics and other government agencies.

2.2 Model approach

There are basically three approaches to constructing regional models:

Bottom up

The first approach is to survey all firms in the entire region to obtain details of the source of supply of all inputs and the destination of outputs, commonly referred to as the 'bottom-up' approach to economic modelling. Whilst such an approach is seen as the most reliable it is also a very expensive way of assembling the data necessary for the construction of a regional model.

Top down

Fortunately a number of non-survey techniques have been developed. Most of these adopt a 'top-down' approach where national tables are modified to match the local region. Processes include the adjustment for prices, local imports and exports including interregional trade and actual employment figures. The approach has the advantage of being much cheaper to compile and readily accessible for regional economies. This top-down approach uses available regional data such as census tables, including employment by industry group, to disaggregate the national data into a regional table. Various approaches can be used to complete this process.

Hybrid method

A third approach is the hybrid method that begins with the top down disaggregation of the national model but is supplemented by selective surveys of key sectors to the region.

30 Summarised from *Compelling economics,* <www.compellingeconomics.com.au>.

The ERU uses a top down approach when generating region- specific economic data. The REMPLAN 2001 data files are constructed from the following ABS datasets:

- 2001 Census 4-digit ANZSIC journey to work employment data
- December 2004 release, 2001/02 National transactions matrix
- November 2006 release, June quarter 2006 gross state product tables.

The REMPLAN 2006 data files have been updated to take account of the 2006 Census 4-digit ANZSIC journey to work employment dataset.

2.3 Model assumptions

Some care needs to be taken in the use of input-output data and it is important the underlying assumptions are kept clearly in mind. Certain assumptions need to be made in the interests of the overall simplicity of input-output modelling.

The first assumption is one of fixed production coefficients, which imply constant returns to scale. That is, if we wanted to double output of sector j, we would have to double all of its inputs with no evidence of scale economies.

Also assumed is that regional performance matches national average performance. Some of these assumptions have been tested by local surveys in key sectors and will reduce margins of error.

For the life of the existing model input proportions will remain the same and there will be no change in technology. As long as the model is kept up-to-date this latter concern should not pose a threat to its effectiveness, except as a tool for long-term forecasting.

Another assumption is one of homogeneity where it is assumed that each industry sector produces a fixed set of products that are not produced by any other sector. While it is possible to have some overlap, for example, liquor sold in hotels (the retail sector) and in cafes (the accommodation, cafes and restaurants sectors). Such an assumption does not appear to be too far away from reality and should not inhibit the validity of the model to any great extent.

Finally input-output models assume that there are no supply constraints and that the intermediate and household sectors will be able to service any increases in final demand. This assumption could weaken the predictive capacity of the model in those cases where increases in overall demand could bring about factor shortages and raise the prices of those factors in the short term. However, in most day-to-day cases increased factor demand should not present a problem.

2.4 Model structure

The underlying structure of an input-output model is the transactions table. This table sets out the various economic sectors of a region in a grid or matrix format with each sector listed in both the rows and columns of the matrix. The table is able to show both the source of inputs for each sector by reading down the columns and the destination of the outputs for each sector by reading across the rows.

Inputs can be sourced from within the region in the form of intermediate commodities and labour or beyond the region in the form of regional imports.

Outputs from sectors will either go to other sectors within the region, to consumers in the form of final consumption, used as capital goods as part of investment or go beyond the region as regional exports.

It is possible to divide the overall input-output or transactions table into four distinct quadrants.

Table A2.1 Input-output by quadrant

Industry Sector	1 Agric	2 Manuf	3 Serv	H'holds	Govt	Investment	Exports	Total Ouput
	Q1. Intermediate Sector			**Q2. Final Demand Sector**				
1 Agriculture	20	40	0	20	0	0	20	**100**
2 Manufacturing	20	20	10	75	10	10	55	**200**
3 Services	0	40	10	25	20	5	0	**100**
Payments for	**Q3. Primary Inputs Sector**			**Q4. Primary Inputs Absorbed by Final Demand**				
H'hold Incomes	40	45	70	5	0	0	0	**160**
Govt Taxes	10	15	5	0	0	0	0	**30**
Imports	10	40	5	0	0	0	5	**60**
Total Inputs	**100**	**200**	**100**	**125**	**30**	**15**	**80**	**650**

(REMPLAN, *COMPELLING ECONOMICS*)

2.5 Model benefits

2.5.1 UNDERSTANDING THE NATURE OF THE REGIONAL ECONOMY

There are a number of benefits gained once an input-output model of the region has been constructed.

The first of these is to offer a better understanding of the relative performance of economic sectors in the regional economy. Information gained from the model includes estimates of regional output, regional exports, regional imports and wages for each of the sectors, which can be viewed alongside sectoral employment figures.

It is also possible to examine the types of inputs used by each sector and determine the source of supply of these inputs, be it local or from outside the region in question. It is also possible to determine the destination of outputs and whether this is to be used as an input for other sectors in the region, for final consumption by local consumers, or whether these outputs will go beyond the region in the form of intermediate or final goods and services for exports.

The most important outcome of all this is to provide a picture of the interdependent nature of the regional economy and the way all these individual pieces of data fit together. Actions by one sector will have ramifications on many of the other sectors operating in the region.

2.5.2 CALCULATING GROSS REGIONAL PRODUCT

By following the social accounting conventions used in the national accounts it is also possible to calculate gross regional product by measuring regional expenditures on final goods and services for consumption or investment purposes plus exports (the expenditure method), by measuring incomes accruing to the factors of production in the form of wages, gross operating surplus, net taxes less imports (the incomes method) or finally by using total output by all sectors less intermediate goods used in the productive process (the value-added method).

Whatever method used is incidental to the fact that such a measure provides an opportunity to measure the relative position of a regional economy, set benchmarks and measure this on a per capita basis. Without such a measure, a region will be unable to carry out basic regional economic monitoring and assessment.

2.5.3 ASSESSING THE ECONOMIC IMPACTS OF CHANGE

Once a regional economic model is in place it is also possible to model the effects of change by assessing the economic impact of real or proposed changes in the region. These changes could include proposed increase or decreases to any sector or an assessment of the economic impact of any existing sector in the region. Impacts can be measured in terms of the direct, indirect and induced effects to regional output, income, and employment. Such information can alert regional planners to the need for additional work skills, retraining, employment programs, infrastructure changes and further opportunities industrial support. It can also help planners prioritise in terms of competing strategies and help determine which strategy best matches the particular need of the region in terms of output, income and employment.

2.5.4 ASSISTING STRATEGIC PLANNING

Regional modelling can be seen as a tool for regional economic development practitioners rather than a provider of ready-made answers. Information provided by the regional economic model can provide a more comprehensive understanding of the regional economy in terms of its strategic position (i.e. strengths, weaknesses, opportunities and threats).

In summary, input-output modelling has much to offer regional economies in terms of the analysis of the interrelationship of the various sectors and in identifying strategies for sustainable development. It also offers a cost-effective set of tools capable of measuring the impact of industry change in terms of overall benefits and the way they will impact on individual sectors of the regional economy.

Appendix 3: National industry input-output transactions

3.1 Dairy cattle input-output transactions

The dairy cattle sector employs 28,389 people in Australia.

Table A3.1 National dairy cattle input transactions

Dairy cattle					
	Intermediate Total	Wages and Salaries	Gross Operating Surplus	Overseas Imports	Total
Input coefficient	0.4903	0.0744	0.4103		1.0000
Transactions ($,000)	2,558,163	388,185	2,140,759	0	5,217,546

(REMPLAN 2006)

- The dairy cattle sector has a total goods and services output of $5.2b per annum.
- The sector spends $2.6b (49 per cent) on inputs in Australia (e.g. services to agriculture and dairy products), pays $388.2m (7.4 per cent) on wages and salaries in the region, spends little on imports from overseas (recorded at 0 or less than $1,000) and has a gross operating surplus of $2.1b (41 per cent), per annum.
- The sector pays $130.4m (2.5 per cent) in total net taxes per annum.

Table A3.2 National dairy cattle output destinations

Dairy cattle					
	Dairy Products	Intermediate Total	Private Investment	Exports	Total
Output coefficient	0.8279	0.8291	0.1705		1.0000
Transactions ($,000)	4,319,831	4,325,844	889,823	38,496	5,217,584.255

(REMPLAN 2006)

- The Australian dairy cattle sector has a total goods and services output of $5.2b per annum.
- The national dairy cattle sector sells $4.3b (82.8 per cent) of its goods and services to the dairy products manufacturing sector in Australia (e.g. milk and cream processing, cheese and ice cream manufacture) and $890m (17 per cent) of its total output of goods and services to the private investment sector in Australia, per annum.

3.3 Dairy products input-output transactions

Table A3.3 National dairy products input transactions

Dairy Products						
	Dairy Cattle	Intermediate Total	Wages and Salaries	Gross Operating Surplus	Overseas Imports	Total
Input coefficient	0.3678	0.6919	0.1051	0.1206	0.0736	1.000
Transactions ($,000)	4,320,164	8,127,030	1,234,501	1,416,563	864,503	11,745,961

(REMPLAN 2006)

- The dairy products sector has a total goods and services output of $11.7b per annum.
- The sector spends $8.1b (69 per cent) on inputs from within Australia (mainly inputs from the dairy cattle sector, ($4.4b), pays $1.2b (10.5 per cent) on wages and salaries in the region, spends $865m (7.4 per cent) on overseas imports and has a gross operating surplus of $1.4b (12.6 per cent), per annum.
- The sector pays $1.3b (0.9 per cent) in net taxes in Australia per annum.

Table A3.4 National dairy product output destination

Dairy products					
	Dairy Products	Intermediate Total	Household Consumption	Exports	Total
Output coefficient	0.2098	0.2517	0.4385	0.3019	1.0000
Transactions ($,000)	620,233	2,956,096	5,150,023	3,545,761	11,745,961

(REMPLAN 2006)

The Australian dairy products sector has a total goods and services output of over $11.7b per annum.

- The sector sells $620.2m (5.3 per cent) of its goods and services to the dairy products manufacturing sector in Australia for further processing. This is a part of nearly $3b worth of dairy products sold to sectors for further processing. The dairy products sector contributes $5.2b (43.8 per cent) of its total output of goods and services to Australia's household consumption sector, per annum.
- The Australian dairy sector exports $3.6b (30.2 per cent) worth of dairy products to overseas.

3.4 Forestry and logging input-output transactions

The forestry and logging sector employs 11,678 people in Australia.

Table A3.5 National forestry and logging input transactions

Forestry and Logging						
	Forestry and Logging	Intermediate Total	Wages and Salaries	Gross Operating Surplus	Overseas Imports	Total
Input coefficient	0.1083	0.405	0.2482	0.3061	0.03	1.000
Transactions ($,000)	254,222	950,692	582,622	718,535	2,482	2,347,388

(REMPLAN 2006)

- The forestry and logging sector has a total goods and services output of $2.3b per annum.
- The sector spends $951b (40.5 per cent) on inputs sourced within Australia (mainly inputs from other firms within the forestry and logging sector, $254m), pays $583m (24.8 per cent) on wages and salaries, spends $2.5m (0.03 per cent) on imports from overseas and has a gross operating surplus of $718m (30.6 per cent), per annum.
- The sector pays $25m (1.1 per cent) in net taxes per annum.

Table A3.6 National forestry and logging output destination

Forestry and logging							
	Forestry and Logging	Saw Mill Products	Other Wood Products	Intermediate Total	Government Consumption	Exports	Total
Output coefficient	0.1083	0.2423	0.0996	0.7446	0.1489	0.0772	1.0000
Transactions ($,000)	254,307	568,745	233,762	1,747,951	349,515	181,272	2,347,388

(REMPLAN 2006)

- The forestry and logging sector has a total goods and services output of over $2.3b per annum.
- The sector sells $254.3m (10.8 per cent) of its output of goods and services to other industry sectors in Australia, around half of which is for saw mill products (e.g. log sawing and dressing, wood chipping), per annum.
- The sector exports $181.3m (7.7 per cent) of its goods and services to overseas, per annum.

3.5 Sawmill input-output transactions

Table A3.7 National sawmill input transactions

Sawmill products						
	Forestry and Logging	Intermediate Total	Wages and Salaries	Gross Operating Surplus	Overseas Imports	Total
Input coefficient	0.1304	0.4051	0.1554	0.2359	0.1933	1.000
Transactions ($,000)	568,664	1,766,609	677,687	1,028,741	842,966	4,360,920

(REMPLAN 2006)

- The saw mill products sector (e.g. log sawing and dressing, wood chipping) has a total goods and services output of $4.4b per annum.
- The sector spends $1.8b (40.5 per cent) on inputs sourced within Australia (mainly inputs from the forestry and logging sector, $570m, 13 per cent; the sawmill products sector, $254m, 5.8 per cent and the road transport sector, $194m, 4.4 per cent), pays $678m (15.5 per cent) on wages and salaries in the region, spends $843m (19.3 per cent) on imports from overseas and has a gross operating surplus of $1.028b (23.6 per cent) per annum.
- The sector pays $45m (one per cent) in net taxes per annum.

Table A3.8 National sawmill output destination

Sawmill products							
	Sawmill Products	Other Wood Products	Residential Building	Construction Trade	Intermediate Total	Exports	Total
Output coefficient	0.0582	0.1341	0.1255	0.1164	0.8065	0.1871	1.000
Transactions ($,000)	253,931	584,929	547,198	507,486	3,517,074	815,910.	4,360,920

(REMPLAN 2006)

- The Australian sawmill products sector (e.g. log sawing and dressing, wood chipping) has a total goods and services output of $4.4b per annum.
- The sector sells $254m (5.8 per cent) of its total output of goods and services to other industry sectors within the Australia (e.g. further saw milling, other wood products, residential building and construction trade) worth over $3.5b, per annum.
- Australian exports of sawmill products are worth $816m, 19 per cent of the sector's output, per annum.

Appendix 4: Managed investment schemes

The *Managed Investments Act 1998* has led to a rapid growth in agribusiness investment. Rationalisation of these schemes in recent years has seen a growing concentration of investor funds in plantation forestry. Managed investment schemes (MIS) have focused on blue gum plantations. For example, during 2004–2005 $700 million was invested in blue gum schemes.

MIS vary in structure but there are common features. Usually investors will purchase woodlots at a rate of between $7,000 and $9,000 per hectare. Woodlots are effectively a leasehold interest in one rotation of the crop (between 8–12 years). All costs of the woodlots are tax deductible as they are classed as management fees and establishment costs. The investor receives payment for the timber at harvest less deductions for costs such as marketing. The return is subject to income tax at this point, however, the investor is able to defer payment of income tax by paying expenditure at the outset.[31]

31 Summarised from P Mackarness & B Malcolm, 'Public policy and managed investment schemes for hardwood plantations', *Extension Farming Systems Journal,* vol.2, no.1, 2006, p.105.

Appendix 5:
Dairy intensive region input-output transactions

5.1 Dairy intensive region economic parameter estimates

Table A5.1.1 Dairy intensive region economic parameters for the dairy and forestry sectors, 2002

	Output		Income		Employment		Exports		Imports		Value Added	
	$m	%	$m	%		%	$m	%	$m	%	$m	%
Dairy cattle	670.24	9.89	52.73	3.54	3615	12.16	189.42	6.93	275.56	14.34	361.09	12.52
Dairy products	1293.99	19.09	136.50	9.17	1619	5.45	1187.81	43.44	415.98	21.65	304.65	10.56
Total Dairy	1964.22	28.98	189.23	12.71	5234	17.61	1377.23	50.37	691.53	35.99	665.74	23.08
Forestry & logging	13.58	0.20	3.32	0.22	64	0.22	2.18	0.08	2.90	0.15	7.79	0.27
Sawmill products	64.55	0.95	9.91	0.67	180	0.61	52.31	1.91	23.22	1.21	25.60	0.89
Total Forestry	78.12	1.15	13.23	0.89	244	0.82	54.49	1.99	26.12	1.36	33.40	1.16
Total (all sectors)	6778.81	100	1488.68	100	29726	100	2734.20	100	1921.34	100	2884.02	100

(REMPLAN 2002, REPORTS' SUMMARY)

Table A5.1.2 Dairy intensive region economic parameters for the dairy and forestry sectors, 2006

	Output		Income		Employment		Exports		Imports		Value Added	
	$m	%	$m	%		%	$m	%	$m	%	$m	%
Dairy cattle	566.107	7.760	44.535	2.700	3,034	9.610	299.386	7.540	250.776	12.730	304.990	9.490
Dairy products	952.663	13.060	100.495	6.100	1,299	4.100	866.678	28.490	323.255	16.410	224.292	6.980
Total Dairy	1518.770	20.820	145.030	8.800	4,333	13.710	1,166.064	36.030	574.031	29.14	529.282	16.470
Forestry & logging	6.154	0.080	1.552	0.090	29	0.090	1.002	0.030	1.140	0.060	3.533	0.110
Sawmill products	96.667	1.320	14.834	0.900	271	0.860	81.954	2.690	44.870	2.280	38.336	1.190
Total Forestry	102.821	1.400	16.386	0.990	300	0.950	82.956	2.720	46.010	2.340	41.869	1.300
Total (all sectors)	7,295.991	100.00	1,648.642	100.00	31,676	100.00	3,042.395	100.00	1,970.152	100.00	3,212.887	100.00

(REMPLAN 2006, REPORTS' SUMMARY)

Dairy intensive region input-output transactions by intermediate industry sectors, 2006[32]

5.2 Dairy cattle input-output transactions

Table A5.2.1 Dairy cattle input transactions

Dairy cattle											
	Grains	Dairy Cattle	Ag. Services	Dairy Products	Other food Products	Chemicals/ Pesticides	Water & Drainage	Wh/sale Trade	Road Trans	Business Services	Intermediate Total
Input coefficient			0.0248	0.0101	0.0110	0.0089					0.0711
Transactions ($,000)	433	359	14,809	6,052	6,566	5,299	1,678	1,344	1,390	313	42,563

In 2006 the dairy cattle industry spent $42.563m on goods and services sourced from industries within the region (Table 4.1).

Table A5.2.2 Dairy cattle output destination

Dairy cattle				
	Beef Cattle	Dairy Cattle	Dairy Products	Intermediate Total
Output coefficient			0.5580	0.5587
Transactions ($,000)	20	359	333,896	334,279

In 2006 the dairy cattle industry sold $334.279m worth of goods and services to other industry sectors in the region (Table 4.2).

5.3 Dairy products input-output transactions

Table A5.3.1 Dairy product input transactions

Dairy cattle										
	Dairy Cattle	Oil ,Gas, Electricity & Water	Dairy Products	Other Food Products	Plastic Products	W/sale Trade	Retail Trade	Road Trans	Business Services	Intermediate Total
Input coefficient	0.3490		0.0528			0.0110		0.0058		0.4276
Transactions ($,000)	333,896	903	50,513	1,433	415	10,514	1,475	5,542	951	409,061

In 2006 the dairy cattle industry spent $409m on goods and services sourced from industries within the region (Table 4.1).

32 REMPLAN 2006, Transactions matrix

Table A5.3.2 Dairy product output destination

Dairy products									
	Dairy Cattle	Meat and Meat Products	Dairy Products	Bakery Products	Other Food Products	Retail Trade	Accommodation, Cafes etc.	Education	Intermediate Total
Output coefficient			0.0528						0.0682
Transactions ($,000)	6,052	214	50,513	264	600	2,178	3,326	302	65,240

In 2006 the dairy cattle industry sold $65.240m worth of goods and services to other industry sectors in the region (Table 4.2).

5.4 Forestry and logging input-output transactions

Table A5.4.1 Forestry and logging input transactions

Forestry and Logging							
	Forestry and Logging	Pharmaceutical, Pesticides	Wholesale Trade	Mechanical Repairs	Retail Trade	Road Transport	Intermediate Total
Input coefficient	0.0769	0.0108	0.0352	0.0408	0.0089	0.0068	0.2528
Transactions ($,000)	481	68	220	255	56	42	1,581

In 2006 the forestry and logging industry spent $1.581m on goods and services sourced from industries within the region (Table 4.3).

Table A5.4.2 Forestry and logging output destination

Forestry and Logging								
	Beef Cattle	Dairy Cattle	Other Agriculture	Forestry and Logging	Sawmill Products	Other Wood Products	Pharmaceutical, Pesticides	Intermediate Total
Output coefficient	0.0345	0.0107	0.0128	0.0769	0.4484	0.0955	0.0109	0.7167
Transactions ($,000)	216	67	80	481	2,805	597	68	4,482

In 2006 the forestry and logging industry sold $4.482m worth of goods and services to other industry sectors in the region (Table 4.4).

5.5 Sawmill products input-output transactions

Table 5.5.1 Sawmill products input transactions

Sawmill products										
	Forestry and Logging	Sawmill Products	Other Wood Products	Electricity Supply	Wholesale Trade	Road Transport	Transport Storage Services	Other Property Services	Business Services	Intermediate Total
Input coefficient	0.0294	0.0545			0.0066	0.0176				0.1283
Transactions ($,000)	2,805	5,199	224	109	634	1,680	123	205	370	12,246

In 2006 the sawmill products industry spent $12.246m on goods and services sourced from industries within the region (Table 4.3).

Table A5.5.2 Sawmill products output destination

Sawmill products									
	Sawmill Products	Other Wood Products	Structural Metal and Prefabricated Buildings	Furniture	Residential Building	Other Construction	Construction Trade	Retail Trade	Intermediate Total
Output coefficient	0.0545	0.0282			0.0226		0.0192		0.1515
Transactions ($,000)	5,199	2,695	236	807	2,153	180	1,830	241	14,460

In 2006 the sawmill products industry sold $14.460m worth of goods and services to other industry sectors in the region (Table 4.4).

Appendix 6: Projection assumptions and multiplier sensitivity analysis

The determination of the magnitude of economic variables for the period 2008–2020 is undertaken by the following process:

- Calculation of the **increase in output** between 2006 and selected future years to 2020, using a range of annual growth rates (one per cent–seven per cent).
- The increase in outputs from 2006 is taken as the starting variable for the REMPLAN economic impacts analysis for future years.
- Use of the REMPLAN economic impacts analysis to determine the **initial changes and multipliers** for the output, income, employment and value added parameters.
- The initial changes and multipliers for each economic parameter are used to determine **the change in the magnitude** of the parameters from 2006 for selected future years to 2020.
- The addition of the estimated change in the economic parameter to the 2006 estimate to determine the **total magnitude** for each of the economic parameters for the selected growth rates (one per cent, three per cent, seven per cent) and selected years to 2020.
- Undertaking multiplier sensitivity analysis by varying the magnitude of the multipliers in the above estimation procedure. The results of the sensitivity analysis are outline below.

The 2008–2020 projections are based on the following assumptions:

- national input-output coefficients are applied to the region with few modifications.
- dairy industry projections are based on the manufacturing—meat and dairy sector input-output coefficients.
- dairy products account for 81 per cent of the 2006 output of the meat and dairy products sector in the region.
- blue gum industry projections (2006–2010) are based on the agriculture—forestry and logging sector input-output coefficients.
- blue gums account for 95 per cent of the 2006 output of the forestry and logging sector in the region.
- blue gum industry projections (2010–2020) are based on the manufacturing wood and wood products sector input-output coefficients.
- blue gums account for 20 per cent of the 2010 output of the manufacturing- sawmill products sector in the region.

Sensitivity analysis undertaken on the 2001 multipliers for the dairy industry within the dairy intensive region indicated that economic aggregate projections are not particularly sensitive to changes in the values of Type 2 multipliers. This analysis is based on a dairy industry output growth rate of three percent p.a., for the period 2001 to 2015.

- A one-third increase in the multipliers (REMPLAN Type 2 multiplier x 1.333) result in the aggregate economic parameters increasing between 1.15 and 1.21 times
- A one-half increase in the multipliers (REMPLAN Type 2 multiplier x 1.500) result in the aggregate economic parameters increasing between 1.22 and 1.32 times.

Table A6.1 Regional dairy industry multiplier sensitivity analysis

Year	Initial Increase in Output ($m)	Multiplier	Output		Income		Employment		Value Added	
			Type 2 Multip'r	Total Output ($m)	Type 2 Multip'r	Total Income ($m)	Type 2 Multip'r	Total Emp'ment (No.)	Type 2 Multip'r	Total Value Added ($m)
2008	251.097	REMPLAN	1.698	1,720.353	1.894	189.540	3.608	2,798.82	2.480	444.815
		x 1.333	2.263	1,862.222	2.525	207.210	4.810	3,191.87	3.306	491.499
		x 1.500	2.547	1,933.534	2.841	216.059	5.412	3,388.72	3.720	514.897
2010	345.193	REMPLAN	1.698	1,880.127	1.894	209.415	3.608	3,238.99	2.480	497.339
		x 1.333	2.263	2,075.161	2.525	233.707	4.810	3,778.69	3.306	561.516
		x 1.500	2.547	2,173.196	2.841	245.873	5.412	4,048.99	3.720	593.683
2012	445.019	REMPLAN	1.698	2,049.632	1.894	230.501	3.608	3,708.03	2.480	553.062
		x 1.333	2.263	2,301.068	2.525	261.818	4.810	4,403.99	3.306	635.799
		x 1.500	2.547	2,427.453	2.841	277.502	5.412	4,752.55	3.720	677.268
2015	606.272	REMPLAN	1.698	2,323.440	1.894	264.563	3.608	4,465.71	2.480	643.073
		x 1.333	2.263	2,665.984	2.525	307.228	4.810	5,414.09	3.306	755.790
		x 1.500	2.547	2,838.165	2.841	328.594	5.412	5,889.07	3.720	812.285

(REMPLAN, BASED ON CONSERVATIVE OUTPUT GROWTH OF THREE PER CENT P.A. FROM 2001)