FORECASTING IN THE LABOUR MARKET

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Abstract

An assessment of future labour market outcomes is of considerable interest to policy makers and for those making operational decisions with respect to training. These could take the form of forecasts of employment by occupations and skill levels or needs at the national, sectoral or regional level. Often forecasts are made of the demand for labour, both additional and replacement demand, the latter often surpassing the former due to the present demographic composition of the labour force. In order to assess likely future shortages (or surplus) of labour, knowledge of the current supply (not always known with certainty as in the case of seasonal labour) and an understanding of future supply is required, all of which pose considerable challenges. In this paper, an overview of the forecasting needs of the Department of Labour, approaches and methodology likely to be applicable and the required level of accuracy and relevance of forecasts are discussed in relation to national, sectoral, regional and seasonal labour market outcomes. Some preliminary and provisional results are presented as an illustration of likely outcomes.

In summary, the total employment level is expected to show an annual average growth of 1.8% from 2005 to 2010, following a higher annual average growth of 2.8% from 2001 to 2005. For the Primary and Manufacturing Sectors, the employment is likely to transform to a positive growth at an average rate of 1.0% and 0.3% respectively from 2005 to 2010 after having experienced a decline from 2001 to 2005. However, for the Private and Public sectors services, employment is expected to increase at an average rate of 1.7% and 2.8% respectively from 2005 to 2010 following a higher growth rate of 3.3% and 4.8% respectively from 2001 to 2005. The consequences of a number of variations in GDP growth and employment ratios by industry are explored in terms of occupational forecasts.

Introduction

The main goal of building the forecasting capability in the Labour Market Dynamics team is to contribute to the goal of the Work Directions Group of the Department of Labour (the Department) to be the authority on labour market knowledge. Appropriate models of the structure and behaviour of the labour market (supply and demand) on its own and/or in relation to developments in the rest of the economy will enable necessary forecasting of labour market outcomes.

In this effort associated activities such as education, training, immigration on the supply side and growth in industries, sectors and regions on the demand side have to be incorporated to analyse past and recent trends in the labour market within appropriate frameworks to provide insights about likely future developments. Overall, the

modelling and forecasting activity is likely to lead to the strengthening and enhancing of the labour market monitoring activities by identifying labour market information needs by sectors and regions along with improvements to their collection, development and dissemination.

Scope and Coverage

The forecasting effort will place greater emphasis on the near (next 5 years) to medium term (5-10 years) and some on the longer term (beyond 10 years) depending on the particular areas of modelling and the extent of relevant data. The focus will also be on forecasting aspects of the labour market of national importance and of wider and general relevance to most sectors and regions.

The modelling work will cover key occupations and sectors identified as critical for the unconstrained and sustained growth of the national economy and areas that have experienced employment and skill shortages in recent years. The focus of the regional effort will be on identifying the common drivers of the labour market to optimise the modelling and forecasting activities recognising the limited staff resources.

The priorities of forecasting labour market outcomes within the Department, especially forecasting of employment by industry and occupations, is to contribute towards policy development and programme design. There is potential to make significant contribution to Immigration policy (both skilled migrant categories and temporary worker schemes) and in setting funding priorities for tertiary education and industry training. Other areas are sectoral and seasonal forecasting of the food and beverage sector and the horticulture and viticulture activities. Also of importance is the forecasting of regional labour market drivers and developments.

The modelling and forecasting work programme will also have to be aware of model developments by other agencies and industry groups interested in labour market outcomes in order to facilitate, monitor and co-ordinate the necessary working relationships. This could also involve the temporary hosting of models and forecasting tools to carry out necessary improvements and enhancements before they are taken over for on-going use.

Forecasting Employment by Industry and Occupations

Occupational forecasting involves forecasting by occupation and skill group. There has been a professional debate among economists over the need for such a forecasting capability to be developed within the Department given the ability to forecast occupational levels and mix accurately enough to make them operational and useful in a policy context. But policy makers continue to request predictions of future labour market outcomes by occupation and skill level.

Many countries have developed systems of occupational forecasting and have several years of experience in implementing them across numerous occupations and industries. In Australia, the occupational forecasting effort has been underway for more than 30 years. It is facilitated by the Department of Employment and Workplace Relations (DEWR) with the major General Equilibrium modeling effort (ie, MONASH model) and the subsequent labour market extensions carried out at Monash University by the Centre of Policy Studies (CoPS). The coverage of both occupations (340) and in particular industries (158) is quite widespread in Australia and the prediction for a 5 year period is usually carried out twice a year.

This paper discusses some of the considerations in setting up a system of forecasting employment by industry and occupations in New Zealand. This is followed by the description of the method adopted to develop these forecasts at a high level. The main employment forecasts by industry and occupations are summarised along with some illustration of changes in GDP growth by industries and the labour (intensity) ratios which determine the forecasts. The appendix contains the results for all industries and occupations covered.

In setting-up a forecasting system in New Zealand, issues of effectiveness, fitness for purpose and the comparative advantage of carrying them out within the Department have to be considered.

Key steps involved in occupational forecasting are:

- Exploring options for GE model outputs in New Zealand
- Investigating steps to derive employment forecasts from GE model outputs
- Projecting occupational shares by industries or sectors
- Deriving employment levels by occupations for industries.

Additional considerations are related to the number of occupations and industries (qualification levels) to be covered, the forecast horizon and frequency of forecasts, and modelling within and outside of the Department.

Methodology – Initial Steps

The method used in the projection of occupations to 2010 at the 2-digit occupation level is based on the idea that FTEs (full time equivalents) for each industry or sector could be derived as the product of GDP (in 1995/1996 dollars) and labour ratios (i.e. number of FTEs needed to create 1 million dollars of output) for the sectors. We first use the GDP growth rate by each industry[1] projected by NZIER to derive the level of GDP by each sector in 2010. The labour ratios for each sector are projected to 2010 based on historical trends of these ratios. Changes in these ratios reflect changes occurring at the industry level in terms of labour intensity, utilisation efficiency and productivity.

The details of the method used can be summarised as following three steps:

1. **Project employment levels for each industry to 2010**
   a. Project GDP levels for each sector in 2010 by using the GDP growth rate forecast by NZIER and the 2005 (production) GDP as a base.
   b. Calculate the number of FTEs employed in each industry from 1998 through to 2006 by assuming that 1 full time employment makes 1 FTE and 1 part time employment makes 1/3 FTE (employment data is sourced from HLFS).
   c. Calculate the labour ratios for each industry from 1998 to 2006 using the corresponding (production) GDP and the FTEs derived in step b.
   d. Use weighted averages (with higher weighting for more recent years) to project labour ratios for each industry in 2010 and then apply manual adjustments to incorporate known and expected industry developments.
   e. Calculate the number of FTEs employed in 2010 by using the GDP levels and labour ratios projected for 2010 in steps a. and d.
   f. Convert the FTEs for each industry to Employment counts[2] by using average ratios (of FTE/Employment counts) from 1998 to 2006.

2. **Project occupational shares for each sector in 2010**
   a. Calculate the occupational shares for each industry in 1996 and 2001 using the respective Census based industry by occupation[3] information at the 5 digit level.
   b. Employ linear extrapolation methods to project the occupational shares for each sector in 2010 and subsequent manual adjustment to maintain consistency.

3. **Calculate employment for each occupation for 2010**
   a. Calculate employment levels for each occupation in each sector in 2010 by applying occupational shares to the employment counts of each industry projected above.(i.e. 1f and 2b)
   b. Sum up the employment levels for each occupation across all industries to derive total employment that is consistent with the results in 1f.

The above method of forecasting is partly based on the projection of GDP growth for each industry produced by NZIER. The accuracy and the assumptions behind NZIER's projection of GDP growth by industries are therefore critical to the employment and occupational forecasts. Linear extrapolation of occupational shares based on historical information from the 1996 and 2001 Census alone lacks sufficient basis to project the occupational shares in 2010 and especially for further periods in the future. Adjustments to some labour ratios and occupational shares projected for 2010 involve some subjective judgements and need further verification and justification.

Key Preliminary Findings

Total employment is expected to grow at an annual average rate of 1.8% between 2005 to 2010[4], following a higher annual average growth of 2.8% from 2001 to 2005 (Table 1). This forecast growth in total employment is independent of the potential constraint arising from slower labour supply growth over the next 5 years given the limited natural growth in domestic supply possible, medium growth in net migration and limited potential to raise participation rates.

Table 1: Annual Employment Growth by Sector.

Sector	01-05 WAAPC[5]	05-10 (Projection) AAPC[6]
Primary	-0.8%	1.0%
Manufacture	-0.1%	0.3%
Service - Private	3.3%	1.7%
Service - Public	4.8%	2.8%
Total	**2.8%**	**1.8%**

Note: [5] WAAPC-Weighted Annual Average Percentage Change
[6] AAPC-Annual Average Percentage Change

In the case of the Primary and Manufacturing sectors, employment growth is likely to become positive averaging 1.0% and 0.3% respectively from 2005 to 2010, after having experienced a decline from 2001 to 2005. However, in the case of the Private and Public service sectors, employment is expected to increase at an average rate of 1.7% and 2.8% respectively, from 2005 to 2010 following higher growth rates of 3.3% and 4.8% between 2001 to 2005.

Table 2 forecasts changes in employment shares for each major sector over time. Primary and Manufacturing sector employment shares are forecast to experience a downward trend between 2001 and 2005 with the share declining further through to 2010 even though the employment numbers actually increase slightly. The service sector will continue to increase employment (with gains of about 120,000 in private and just under 100,000 in public) between 2001 and 2005. The private and the public sector service activities are likely to add about 90,000 and 80,000 jobs, respectively, from 2005 to 2010.

Overall, the changes in the primary and manufacturing sector employment levels are likely to be driven by the expansion in trade and the growth in the world economy but their shares will decline due to the higher growth in both the private and public service activities. Employment growth in private sector services is driven by forecast GDP growth in these industries but the share of employment is forecast to be stable between 2005 and 2010. Greater employment growth in public sector services, is likely to increase its share of employment from under 28% in 2005 to just over 29% in 2010.

Table 2: Employment levels and shares by Sector (000s).

Sector	2001		2005		2010 (Projection)	
Primary	156	8.6%	153	7.6%	161	7.3%
Manufacture	289	16.0%	293	14.4%	297	13.4%
Service - Private	900	49.8%	1022	50.4%	1113	50.2%
Service - Public	462	25.6%	561	27.6%	645	29.1%
Total	**1808**	**100.0%**	**2028**	**100.0%**	**2216**	**100.0%**

Table 3: Occupation by Skill Levels (000s).

Occupations	2001		2005		2010	
Highly skilled	477	26.4%	540	26.6%	672	30.3%
Skilled	395	21.8%	431	21.2%	434	19.6%
Semi skilled	815	45.0%	921	45.4%	980	44.2%
Low skilled	123	6.8%	137	6.7%	130	5.9%
Total	1810	100%	2028	100%	2216	100%

Employment by occupation at the 2-digit level, classified according to skill level, suggests a continuation of the increase in the number of highly skilled workers between 2001 and 2005 with the share rising to 30% in 2010; See Table 3. This will be accompanied by a decline in the share of skilled, semi-skilled and low skilled workers even though the actual number of semi-skilled workers is expected to increase by about 60,000 between 2005 and 2010.

Summary of High Level Industry and Occupational Forecasts

The results presented in the main body of the paper are examples of a range of GDP changes and labour ratio variations (for historical and forecast periods) and consequent changes in employment growth by industry and occupation. The results for all the 29 industries and 32 occupations at the 2-digit level are reported in the Appendix.

GDP Growth Effects

The contribution to GDP from the *Construction industry* is expected to be negligible on average between 2005 and 2010, following a significant growth of 9.9% from 2001 to 2005. In contrast, the contribution from the *Communication services* is likely to have a still greater impact of 8.9% in the late 2000s after a substantial increase in the early 2000s. The contribution from the *Accommodation, cafes and restaurants* is expected to remain steady while the contribution of primary industries to GDP is expected to increase further; See Table 4.

Table 4: GDP growth by industries - Sample highlighting varying historical and forecast changes.

GDP Growth	2001-05 (WAAPC)	2005-10 Projection (AAPC)	
Construction	9.9%	0.0%	Fall from large increase to no change
Communication Services	6.3%	8.9%	Increase from large increase to even larger increase
Accommodation Cafes and Restaurants	3.2%	3.3%	Stay steady
Forestry and Logging	0.7%	3.5%	Rise from smaller increase to larger increase
Agriculture	0.3%	1.8%	Rise from small change to medium increase
Fishing	-1.4%	1.7%	Rise from moderate decrease to increase

Table 5: Labour ratios by industries - Sample highlighting varying historical and forecast levels.

	Level of Labour Ratio	Average 01-05	2010 (projection)	
High level	Personal and other Community Services	46	50	Rise further
	Education	27	27	Remain steady
Medium level	Agriculture	22	20	Fall somewhat
	Business Services	17	17	Remain steady
	Government Admin. and Defence	15	13	Fall further
Low level	Electricity, Gas and Water Supply	4	4	Remain steady
	Communication Services	5	4	Fall further

Labour Ratio Effects

The average value of the labour ratios for *Personal and other community services* was at a very high level of around 46 as well as rising from 2001 to 2005 and hence the level is expected to reach 50 in 2010. However, for *Agriculture*, *Government administration and defence* activities and *Communication service*, the respective labour ratios are expected to fall slightly by 2010 compared with the average level from 2001 to 2005. The labour ratios in 2010 for *Education*, *Business service* and *Electricity, gas and water supply* are expected to remain unchanged at their average level from 2001-05; Table 5.

For most of the industries, the underlying trends in labour ratios tend to suggest a decline from 2005 to 2010 period compared to the 2001 to 2005 period. In the *Personal and other community services*, the trend falls significantly from 5.0% to 0.3%. The labour ratio trends for *Education* and *Wholesale trade* are also expected to fall from a positive to a negative value, suggesting rising levels of labour utilisation efficiency and productivity within these industries during the 2005 to 2010 period: Table 6.

Employment Levels

The decline in employment growth for most industries is significant; Table 7. The *Construction industry*, for example the growth of employment is expected to fall from a high of 8.1% to a negative change of -0.4%. However, for other industries such as *Communication services*, we expect employment to grow as a negative change of -2.6% during 2001-05 shifts to a high positive change of 4.8% during 2005-10.

Occupation Levels

The employment growth for *Legislators and Administrators* experienced an unusually high growth during the period from 1996 to 2001 and is still expected to increase from 2001 to 2010; Table 8. For *Office Clerks* and *Precision Trades Workers*, the employment growth is expected to fall from a high level to a low and even negative level over time. In contrast, for some occupations such as *Personal and Protective Services Worker* and *Corporate Managers*, the growth of employment tends to increase over time. Especially for *Corporate Mangers*, the employment level is expected to pick up to a high positive change of 3.5% during 2005-10 following a negative change of -0.5% during 2001-05.

Table 6: Labour ratios by industries - Sample highlighting varying historical and forecast changes.

Trend of Labour ratio	2001-05 (WAAPC)	2005-10 Projection (AAPC)	
Personal and other Community Services	5.0%	0.3%	Fall from larger increase to smaller increase
Health and Community Services	2.9%	1.0%	Fall from moderate increase to smaller increase
Education	1.2%	-0.6%	Fall from moderate increase to smaller decrease
Wholesale Trade	0.9%	-1.1%	Fall from smaller increase to moderate decrease
Agriculture	-1.1%	-0.9%	Remain steady
Food, Beverage and Tobacco Manufacturing	-3.2%	-1.2%	Rise from larger decrease to moderate decrease

Table 7: Resulting employment levels by industry.

Employment Growth (By Industry)	2001-05 (WAAPC)	2005-10 Projection (AAPC)	
Construction	8.1%	-0.4%	Fall from larger increase to smaller decrease
Education	5.0%	1.2%	Fall from larger increase to moderate increase
Retail Trade (incl. Motor Vehicle Repairs)	1.3%	1.1%	Stay steady
Agriculture	-1.2%	1.0%	Rise from moderate decrease to smaller increase
Communication Services	-2.6%	4.8%	Rise from moderate decrease to larger increase
Fishing	-6.9%	-1.9%	Rise from large decrease to moderate decrease

Table 8: Resulting employment levels by occupation.

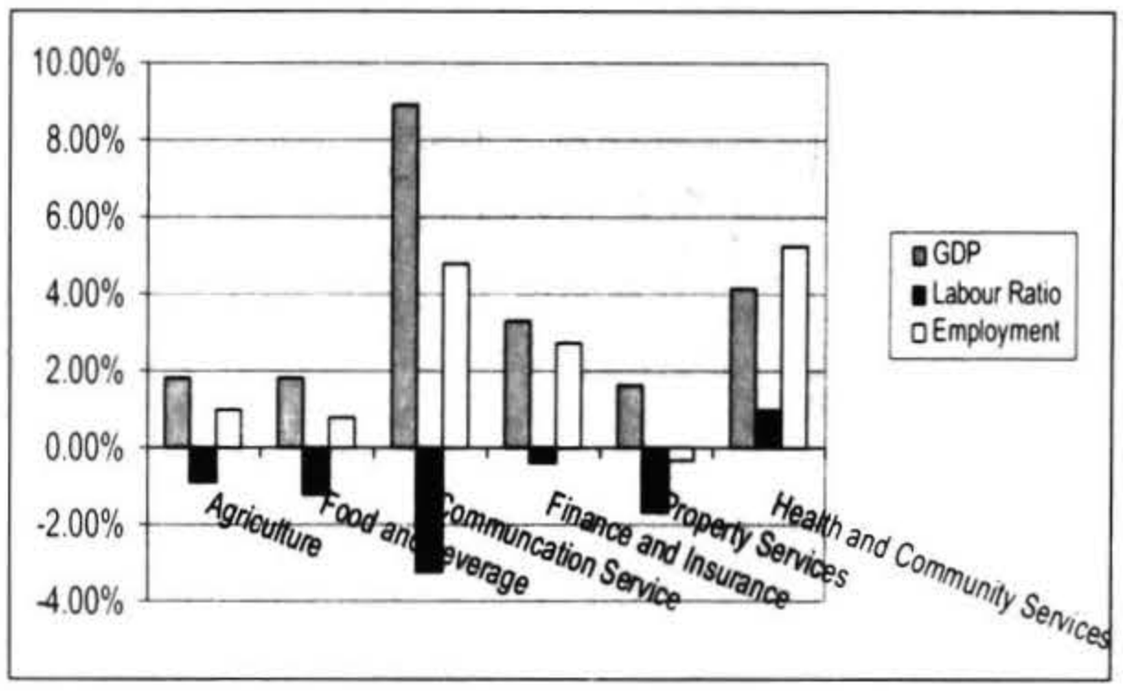
Employment Growth (By Occupation)	01-05 (WAAPC)	2005-10 (AAPC) Projection	
Legislators and Administrators	62.5%	23.8%	Fall from very large increase to large increase
Precision Trades Workers	9.2%	-2.9%	Fall from larger increase to moderate decrease
Office Clerks	6.6%	0.5%	Fall from larger increase to small change
Personal and Protective Services Workers	2.7%	3.8%	Rise from moderate increase to larger increase
Corporate Managers	-0.5%	3.5%	Rise from small decline to increase

Implications for the Labour Market

Employment levels in most industries are likely to increase from 2005 to 2010 due to the combined impact of a relatively higher GDP growth by industry and an offsetting decrease in the labour (utilisation) ratio. In other words, the GDP contribution from most industries will grow at a faster rate than the growth in labour productivity within these industries, resulting in a demand for more labour.

For instance, as the GDP growth for the agriculture industry from 2005 to 2010 is forecast to average 1.8% per annum but the labour ratio is expected to fall -0.9%. The resulting employment growth is the approximate sum of these two figures (i.e. 1.0%). Similarly, in the case of the communications sector, GDP growth is forecast to average above 8% per annum but the labour ratio expected to decline further by about 3%, resulting in an employment growth above 4% per annum. We expect employment in all occupations (at the 2-digit level) to grow from 2005 to 2010 because GDP growth will exceed a decline in labour (utilisation) ratios; See Figure 1.

Figure 1: AAPC form 2005 to 2010 (Projection).



Further work in forecasting employment by industry and occupation will focus on extending the assessment made here at a more disaggregated level. The forecast period could also be extended to 2015 when 2006 Census based occupational breakdowns by industry are made available. These national projections could also be extended to produce industry and occupational employment forecasts at the regional level once GDP forecasts for industries by regions are developed by external consultants who have been interacting with the Departments-Work Directions.

Sectoral and Seasonal Forecasting for Targeted Industries

Forecasting the employment outcomes for key sectors within the economy is another area of priority within the Department. In this context, the Food and Beverage sector was identified as one of the sectors for which a forecasting framework was considered useful in order to assess the future skill requirements. This work was organised as part of the Skills Working Group (SWG) of the Food and Beverage Taskforce, which was co-chaired

by the Department during 2005-06. The framework developed by external consultants (BERL, 2006) in consultation with and under the direction of the Department was applied to the dairy and wine sub-sectors to assess its effectiveness. It is yet to be extended to other sub-sectors.

There is also a need for a Forecasting Tool to assess the regional seasonal labour requirements for the horticulture and viticulture industries. This Tool was developed by external consultants (BERL, 2005) under the direction of the information sub-group of the horticulture and viticulture taskforce during 2005 whose job it was to assess and minimise seasonal labour shortages through the temporary worker schemes (eg, Seasonal Worker Pilot).

Both the seasonal labour forecasting tool and the food and beverage forecasting framework have been hosted by Labour Market Dynamics within the Work Directions Group. The main purpose was to extend the scope of these forecasting activities to other sub-sectors (ie, of the Food and Beverage Sector) and crops (ie, other horticultural activities, including vegetable crops requiring seasonal labour).

Approaches to forecasting labour requirements for particular sectors ideally combine the strengths of economy-wide modelling tools with the advantages of firm-based knowledge of trends in production and labour productivity. In the case of the food and beverage sector appropriate coefficients and multipliers were used to 'trace' the implications of 'farm-gate' production through processing, wholesaling, retailing and food service requirements (i.e. paddock to plate).

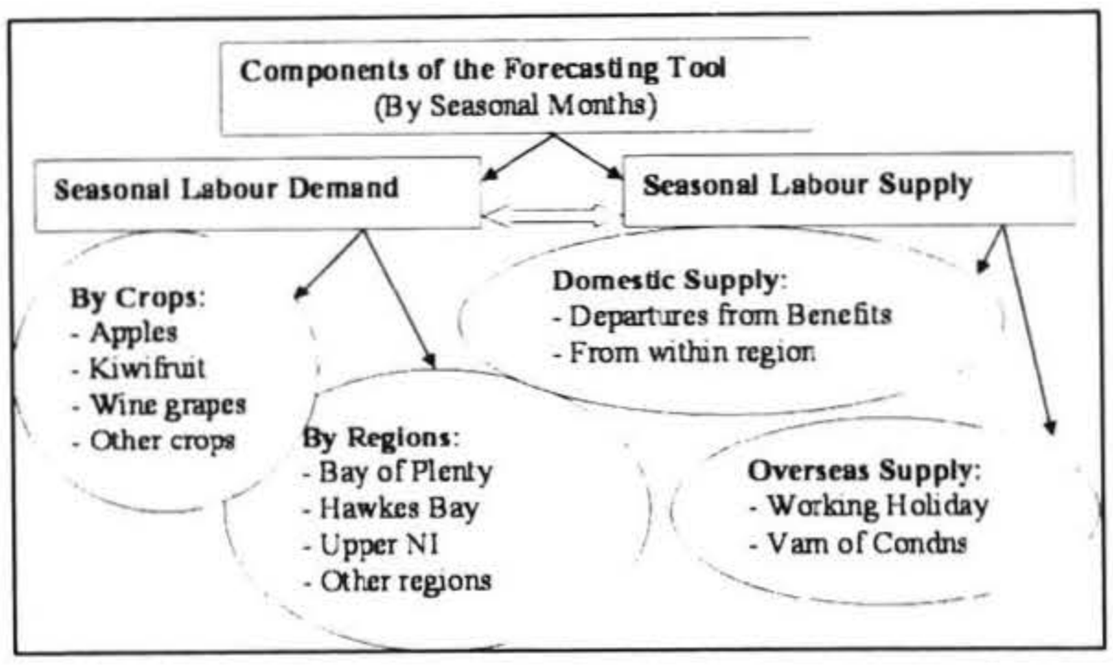
Although out of date, existing input-output data provided a starting point for this work. Information from the Coriolis research mapping exercise provided recent data to upgrade this base information. Prospective changes in the ratios or coefficients that make up the value chain were important in driving projected scenarios. Industry knowledge and consultation regarding such changes are central to formulating scenarios around a 'base case no change' option.

An all-encompassing list of data and information ideally required, including some from industry players is listed below. However, the feasibility and the practicality of obtaining all of this information, even if available, will be a challenging task. Thus, the approach adopted by BERL was to develop the framework using the data readily available at time of development while substituting 'default' parameters for unavailable data variables.

- Output projections;
- Composition of labour and potential changes (e.g. changes in the mix of occupations employed by sector, or changes in training [qualification] requirements of such occupations);
- Labour-output ratios;
- Changes in labour-output ratios (perhaps as a result of adoption of different technology or production or processing methods);
- Changes in mix of value chain (e.g. proportion of output that is further processed versus proportion that goes direct to consumer; or, proportion of value that is added by retail service activity);
- Annual labour turnover figures (including information on proportions that exit firms and proportions that actually leave the sector); and
- Potential changes in labour arrangements (e.g. shifts in the ratio of part-timers to full-timers).

A forecasting tool was developed to assess both seasonal labour demand and the seasonal labour supply as outlined by the flowchart in Figure 2. It was fully implemented on the demand-side for the main crops (i.e., apples, kiwifruit and winegrapes) and the key regions (i.e., Hawkes Bay, Bay of Plenty and Nelson-Marlborough etc) where these crops are grown. On the supply-side, it was implemented only with respect to those coming-off welfare (i.e., unemployment) benefits as information on other locally available seasonal labour was difficult to assess.

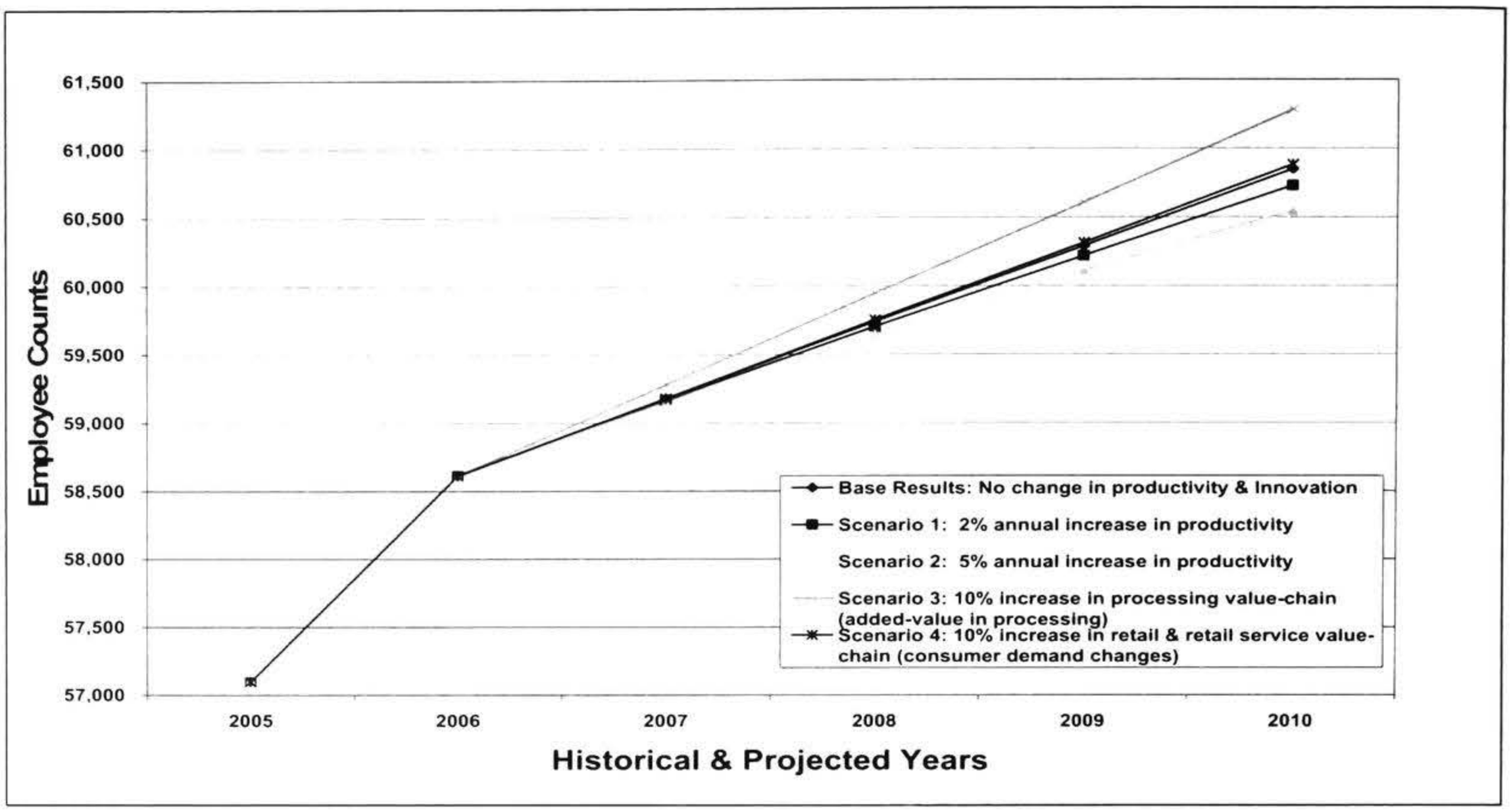
Figure 2: Forecasting seasonal labour demand and supply.



Some Results

In the illustrative case of the dairy sub-sector, total employment rose by about 1,600 employees from 57,000 to almost 58,600 between 2005 and 2006 March years, mostly at the farm or paddock level and in processing. Employment is expected to rise at a much slower rate by another 2,200 counts to almost 61,000 between 2006 and 2010, with higher rates of growth expected in the wholesale, retail and retail service activities.

Figure 3: Changes in productivity and innovation and the effects on employment numbers.



Considering some alternate scenarios of productivity improvements between 2% and 5%, the overall growth in dairy sector employment between 2006 and 2010 could reduce from 6.6% to only 6%. On the other hand, a 10% increase in the value of the processing value chain could raise the overall employment by 7.3% from 6.6%; See Figure 3. A 10% increase in the retail and retail service value chain will lead to limited change in overall dairy sector employment.

Seasonal labour demand for apples, kiwifruit and wine grapes were forecast for the 2007-10 period. They are derived by combining the medium term forecasts of apple, kiwifruit and wine grape area and production by MAF along with the corresponding labour ratios and the timing of seasonal operations like pruning, thinning, picking and packing.

Results presented in Figure 4 are for the 2007 season and cover the seasonal labour requirement for these three crops in the major regions of Bay of Plenty, Hawkes Bay, Nelson-Marlborough, Gisborne, Otago and for New Zealand as a whole.

Figure 4: 2007 Seasonal labour demand for apples, kiwifruit and wine grapes in New Zealand and other major regions.

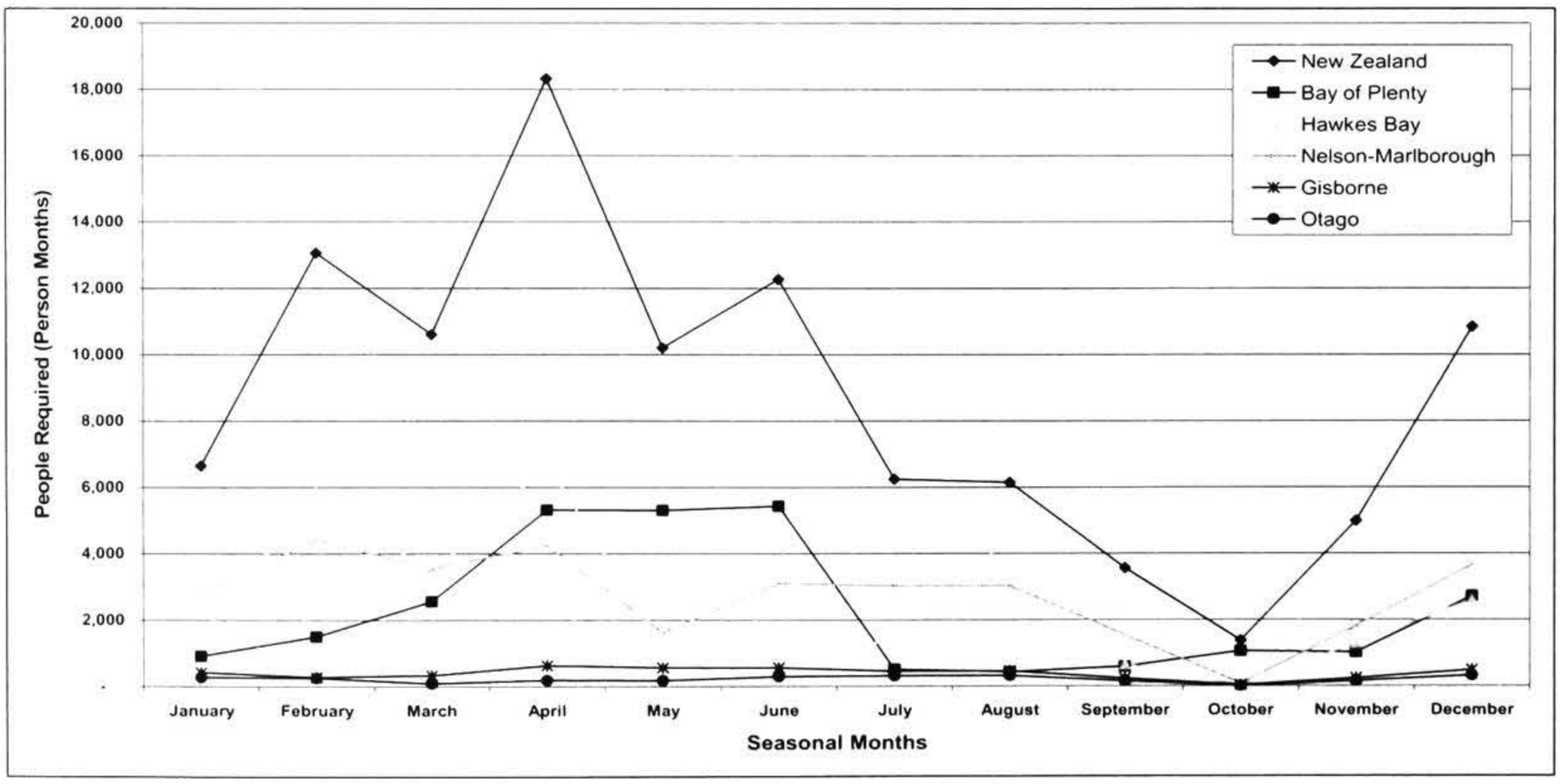
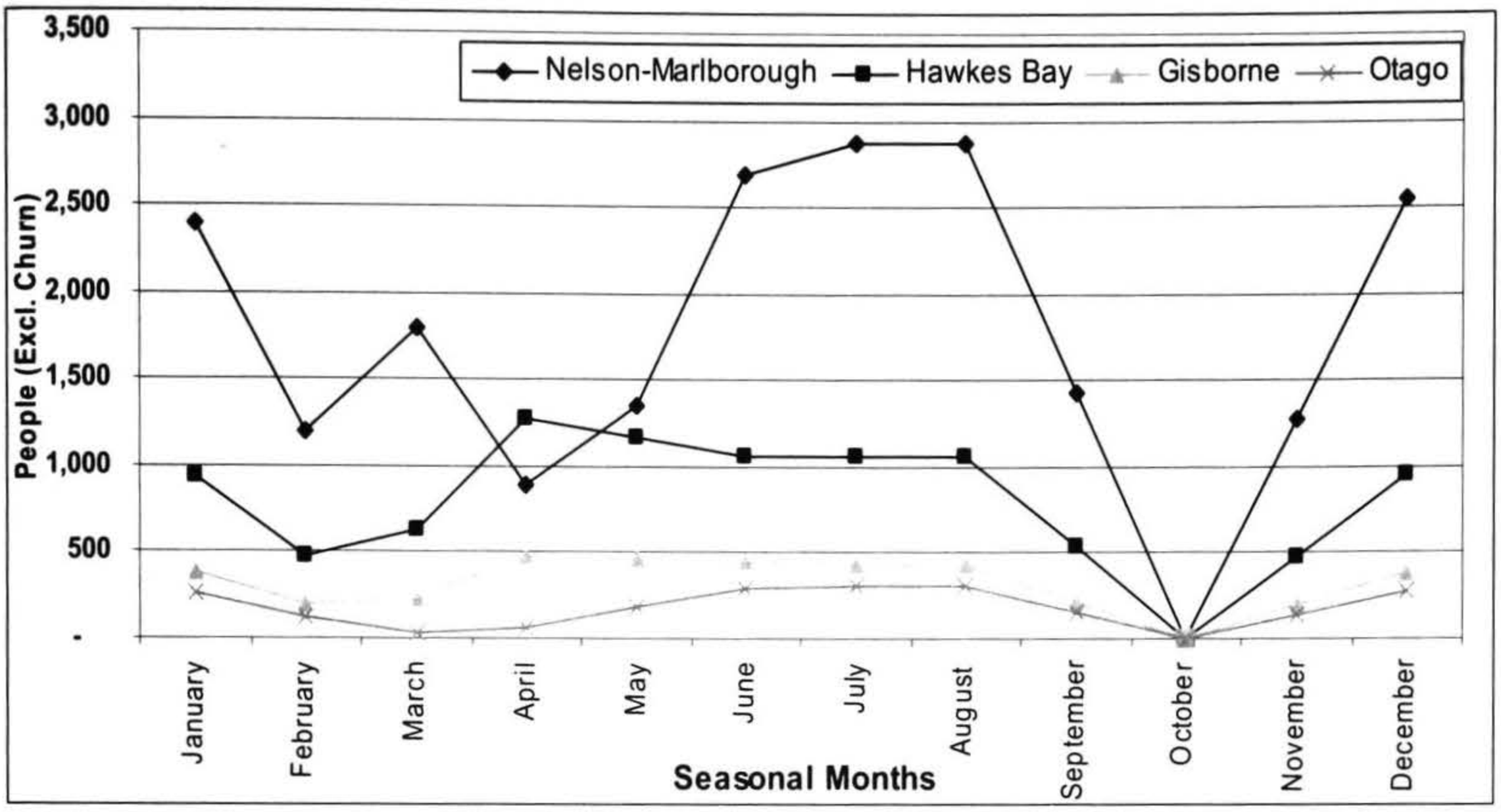


Figure 5: 2007 Wine grapes seasonal labour requirements for major regions.

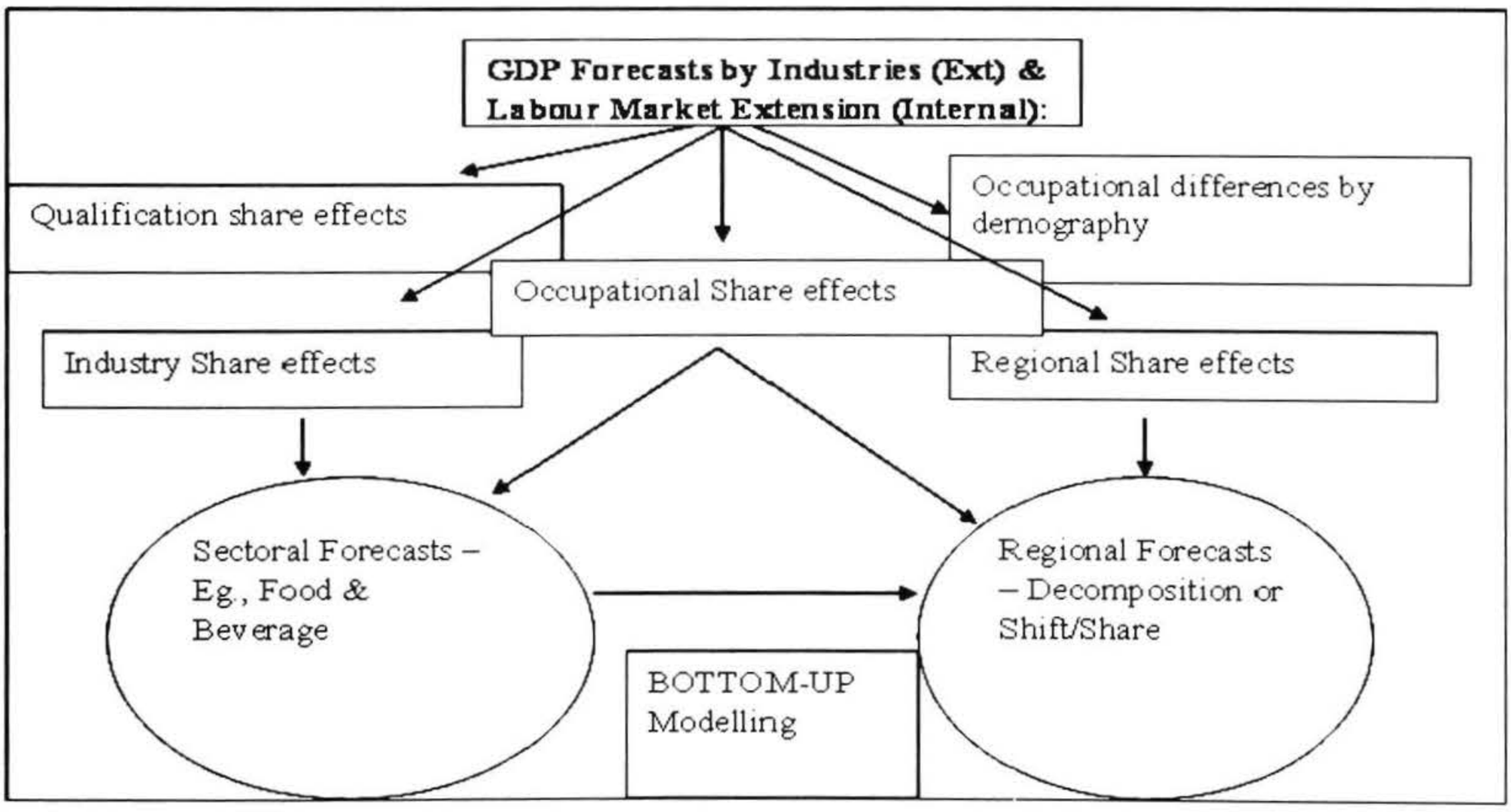


The seasonal labour requirement in 2007 for wine grapes in the major growing regions of Nelson-Marlborough, Hawkes Bay, Gisborne and Otago are present in Figure 5.

Implications

The forecasting frameworks and tools we have described have been developed and their underlying assumptions tested in order to forecast. This has been set-up along value chain within the key sectors of the economy such as the food and beverage sector and the seasonal labour needs for the main regions where crops requiring such labour are grown. Demand is derived using external forecasts of future area and production levels. The resulting forecasts are expected to facilitate useful input towards assessing the future training requirements in these sectors and the immigration policy towards temporary worker schemes.

Figure 6: Labour market extensions to GDP forecasted growth by industry.



Forecasts of Regional Labour Market Developments and Drivers

There is a great need to identify both the common drivers of regional labour market developments and their relative impact factors which are unique as well as those to individual regions.

In many countries with a long history of forecasting employment and skill requirements by industry and occupations, forecasting is now carried out *only* on a regional basis. This has been the case in Australia for about two years now where the results are provided for each state and territory. Employment levels by occupations are forecast by carrying out what are called labour market extensions to the results of GDP growth by industry from the CGE (Computable General Equilibrium) model of the Australian economy (ie, MONASH model); Figure 6.

Overall Assessment of Forecast Outcomes

The range of forecasts of labour market outcomes covered in this paper has to be assessed in terms of the fitness for purpose. This covers issues such as occupational and industry detail required as well as the forecast horizon to which it is applied, the factors influencing the forecast accuracy and the required levels of accuracy for different purposes.

The industry and occupational employment forecasts presented in this paper are illustrative of the labour market outcomes that could be assessed over the near to medium term (i.e., 1-5 years). But in order for the preparation of the list of occupations to be included in the skilled migrant category (SMC) under the long-term skill shortage list (LTSSL) for immigration purposes, the occupational detail will have to be at least at the 3-4 digit NZSCO level. Similarly, the forecast horizon required for assessing tertiary education and industry training funding requirements has to be extended beyond the next 5 years given the lags between labour market demand in the future and the periods of training and completion.

The factors influencing forecast accuracy are linked to our ability to implement the most appropriate methods subject to the availability of the required type of data and data sources. Certainly other countries have been able to develop a standardised series of industry and occupation related employment data over a period of time.

In New Zealand, this is likely to involve the use of a combination of data sources, both those which are population based (e.g. LEED and BD) and those which are sample based (e.g. HLFS and QES). A standardised time series data of employment by industries and occupations is still at an early stage of development. When developed these data will enable the forecasting effort to be extended from mainly trend analysis to factor analysis.

The accuracy of forecasts is also linked to the levels of precision required and the indicative results sufficient for policy development (as opposed to those required for the operational design of longer-term immigration and training programs). The labour market extensions carried out are linked to the exogenous CGE model results of GDP growth forecasts by industries which are usually diverge by forecaster. They also vary over time with fluctuations in the macro-economic factors and assumptions determining the CGE model results.

Given that the parameters of the CGE models are a combination of numerous elasticities describing the many production relationships and consumption behaviour in the economy, the CGE model results are not associated with standard errors and/or confidence intervals. This will ideally require the use of a range of CGE model results as input to the labour market extension effort in order to provide a consensus-type employment forecasts by industries and occupations. For this reason, it is often argued that the CGE models are more amenable to studying the impacts of various policy changes from a baseline scenario or situation rather than focusing on the level based results.

This scenario approach will still be required in the context of occupation and industry based employment forecasting to assess the impacts of likely and/or already emerging developments with respect to new products and innovations within specific industries and those arising from changes in consumer preferences related to healthy, safe and nutritious foods for instance.

Future Research

In terms of forecasting employment at the national level by industries and occupations, the next step is to extend the forecast presented in this paper at a high level (i.e., 1-2 digit level industries and occupations) to at least 3-4 digit level. This analysis will focus mainly on occupations which have experienced shortages in order to be able to feed into the immigration and tertiary education funding priorities. When the 2006 census data is obtained and analysed alongside the 1996 and 2001 census data in terms of the changes in the occupational structure of industries, the forecast horizon could also be possibly extended from 5 to 10 years (i.e., 2015).

Sectoral forecasting of employment and skill requirements across the many sub-sectors of the food and beverage sector from the present coverage of dairy and wine sub-sectors is considered important along with extending the coverage of crops included in seasonal forecasting of labour demand. This will have to take place while the forecasting framework and tools are fully tested and refined in terms of various parameters and assumptions.

With respect to regional forecasting of employment by industries and occupations, the work programme is dependent on the availability of regional GDP data by industry. This has to be accompanied by further needs analysis and the identification of common and unique drivers of regional labour markets.

Notes

1 The 29 industries covering industries at the 1-2 digit level ANZSIC codes are defined. Please see Appendix for details.

2 Annual percent changes in employment are forecast by many consultancies, banks and government agencies, including the Department of Labour which is often based on a consensus forecast for each of two years into the future and is updated frequently. The employment results forecast here for a longer period (4-5 years) in the future will encompass these results for the interim period. The occupational forecasts could also be extended to a longer period (e.g. 2015) when the 2006 Census results are made available by SNZ early in 2007.

3 23 occupations at the 2-digit level NZSCO categories are included in this initial analysis. Details in Appendix.

4 The employment growth for March 2006 year was 2.6% and the forecast for 2007 and 2008 March years ranges from -0.5% to + 2.6% across different consultancies, banks and government agencies. The Consensus forecast suggests employment growth of about 0.9% for 2007 and 2008 March years and if this is the case the employment growth during 2009 and 2010 March years will have to average above 2% to achieve an overall employment growth of 1.8% over the five year period from 2005-10.

5 Excludes industries unidentified

6 Excludes industries unidentified

7 Excludes occupations unidentified

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Appendix A-1

GDP March Year (1995/96 Dollar, in Millions)	2005	WAAPC 01-05	AAPC 05-10 (Projection)
Agriculture	5,591	0.3%	1.8%
Fishing	239	-1.4%	1.7%
Forestry and logging	1,432	0.7%	3.5%
Mining and quarrying	1,155	-4.2%	-0.2%
Food, beverage and tobacco manufacturing	5,802	3.8%	1.8%
Textiles and apparel manufacturing	889	0.7%	-2.1%
Wood and paper products manufacturing	2,535	4.5%	3.3%
Printing, publishing and recorded media	1,386	0.7%	0.0%
Chemicals manufacturing	1,748	-1.5%	-0.5%
Non-metallic mineral products manufacturing	801	6.3%	2.0%
Metal product manufacturing	2,312	5.5%	1.8%
Machinery and equipment manufacturing	2,823	3.6%	1.9%
Furniture and other manufacturing	561	1.0%	0.0%
Electricity, gas and water supply	2,451	2.9%	1.3%
Construction	6,123	9.9%	0.0%
Wholesale trade	10,768	4.7%	3.0%
Retail trade (including motor vehicle repairs)	7,453	5.7%	3.2%
Accommodation, cafes and restaurants	1,960	3.2%	3.3%
Transport and storage	6,122	4.7%	2.3%
Communication services	6,996	6.3%	8.9%
Finance and insurance	7,434	5.5%	3.3%
Property services	5,885	2.7%	1.6%
Ownership of owner occupied dwellings	7,471	1.4%	0.0%
Business services	9,723	5.4%	2.8%
Government admin. and defence	5,120	4.6%	1.9%
Education	4,539	3.7%	1.8%
Health and community services	6,402	3.7%	4.1%
Cultural and recreational services	2,499	4.8%	4.0%
Personal and other community services	1,432	4.8%	2.5%
Total[5]	**119,652**	**4.1%**	**2.6%**

Sources: GDP figures (from DX database); Forecasts (NZIER: Quarterly Predictions-June 06)

Appendix A-2

Labour ratios by Industry (FTE/$1M)	Average 01-05	2010 (Projection)	WAAPC 01-05	AAPC 05-10 (Projection)
Agriculture	22	20	-1.1%	-0.9%
Fishing	13	9.0	-7.5%	-2.8%
Forestry and logging	6	5.8	2.0%	0.0%
Mining and quarrying	1	2.1	36.7%	-3.5%
Food, beverage and tobacco manufacturing	12	11	-3.2%	-1.2%
Textiles and apparel manufacturing	25	25	-2.9%	0.0%
Wood and paper products manufacturing	12	10	-7.6%	-0.8%
Printing, publishing and recorded media	18	18	3.1%	-1.4%
Chemicals manufacturing	13	13	1.9%	-0.9%
Non-metallic mineral products manufacturing	10	7.5	-10.2%	-2.9%
Metal product manufacturing	18	14	-11.0%	-1.7%
Machinery and equipment manufacturing	16	17	3.8%	-0.2%
Furniture and other manufacturing	31	32	1.0%	-0.6%
Electricity, gas and water supply	4	3.6	-1.4%	-0.1%
Construction	24	23	-1.6%	-0.5%
Wholesale trade	9	8.9	0.9%	-1.1%
Retail trade (including motor vehicle repairs)	29	24	-3.9%	-2.3%
Accommodation, cafes and restaurants	35	33	1.7%	-0.3%
Transport and storage	13	12	-0.8%	-1.4%
Communication services	5	3.5	-9.2%	-3.2%
Finance and insurance	7	7.0	-3.2%	-0.4%
Property services	5	4.5	-0.5%	-1.7%
Ownership of owner occupied dwellings	0	0.2	-33.4%	0.5%
Business services	17	17	-1.3%	0.0%
Government admin. and defence	15	13	-5.7%	-2.0%
Education	27	27	1.2%	-0.6%
Health and community services	21	23	2.9%	1.0%
Cultural and recreational services	17	15	-5.0%	0.2%
Personal and other community services	46	50	5.0%	0.3%

Sources: Historical – 2005 (GDP & HLFS employment data); Projection – Department of Labour (based on the level and changes in Labour Ratios over the 2000-06 period).

Appendix A-3

Employment by Industry (000s)	2005	2010 (projection)	WAAPC 01-05	AAPC 05-10 (Projection)
Agriculture	137.9	145.0	-1.2%	1.0%
Fishing	3.0	2.7	-6.9%	-1.9%
Forestry and logging	8.8	10.5	2.8%	3.6%
Mining and quarrying	3.5	2.9	25.3%	-3.8%
Food, beverage and tobacco manufacturing	71.2	74.1	-0.1%	0.8%
Textiles and apparel manufacturing	24.5	22.0	-1.9%	-2.1%
Wood and paper products manufacturing	27.4	31.0	-3.3%	2.6%
Printing, publishing and recorded media	30.2	28.7	2.3%	-1.0%
Chemicals manufacturing	25.4	24.3	-1.2%	-0.9%
Non-metallic mineral products manufacturing	7.6	7.2	-4.8%	-0.9%
Metal product manufacturing	35.7	35.6	-5.8%	-0.1%
Machinery and equipment manufacturing	51.2	55.5	7.4%	1.6%
Furniture and other manufacturing	19.6	19.0	2.1%	-0.7%
Electricity, gas and water supply	9.5	10.1	0.4%	1.2%
Construction	153.7	150.6	8.1%	-0.4%
Wholesale trade	109.8	121.4	5.9%	2.0%
Retail trade (including motor vehicle repairs)	249.5	263.5	1.3%	1.1%
Accommodation, cafes and restaurants	94.9	107.7	5.4%	2.6%
Transport and storage	84.9	90.0	3.1%	1.2%
Communication services	34.2	43.1	-2.6%	4.8%
Finance and insurance	60.3	68.9	2.1%	2.7%
Property services	33.5	33.0	3.0%	-0.3%
Ownership of owner occupied dwellings	2.9	3.0	-27.3%	0.6%
Business services	188.8	221.2	3.3%	3.2%
Government admin. and defence	75.7	77.0	-2.4%	0.3%
Education	163.3	172.9	5.0%	1.2%
Health and community services	183.9	236.4	6.8%	5.2%
Cultural and recreational services	49.6	59.2	1.1%	3.6%
Personal and other community services	88.3	99.1	10.4%	2.3%
Total[6]	**2028.5**	**2215.8**	**2.8%**	**1.8%**

Sources: Historical – 2005 (HLFS annual data); Forecasts – Department of Labour (based on GDP forecasts by industries from NZIER and Labour Ratio projections by DoL).

Appendix A4

Employment by Occupations (000s)	2005	2010 Projection	WAAPC 01-05	AAPC 05-10 (Projection)
Legislators and Administrators	8.8	25.6	62.5%	23.8%
Corporate Managers	234.2	278.7	-0.5%	3.5%
Physical, Math & Eng Sci Prof.	58.4	75.6	8.8%	5.3%
Life Science and Health Prof.	62.9	75.3	0.7%	3.7%
Teaching Prof.	92.1	104.7	4.3%	2.6%
Other Prof.	84.0	111.6	9.1%	5.8%
Physical Sci. & Eng. Ass. Prof.	49.0	51.8	-3.1%	1.2%
Life Sci. & Health Ass. Prof.	23.8	22.1	8.1%	-1.4%
Other Ass. Prof.	163.9	181.3	0.4%	2.0%
Office Clerks	190.4	194.8	6.6%	0.5%
Customer Services Clerks	63.1	81.6	-0.5%	5.3%
Personal and Protective Services Workers	174.6	210.2	2.7%	3.8%
Salespersons, Demonstrators and Models	153.9	138.4	6.9%	-2.1%
Market Oriented Agricultural and Fishery Workers	157.6	153.0	-0.3%	-0.6%
Building Trades Workers	98.5	93.7	5.7%	-1.0%
Metal and Machinery Trades Workers	60.9	54.4	0.9%	-2.2%
Precision Trades Workers	13.6	11.7	9.2%	-2.9%
Other Craft and Related Trades Workers	21.1	19.3	-3.1%	-1.7%
Industrial Plant Operators	20.5	18.1	1.4%	-2.4%
Stationary Machine Operators and Assemblers	84.2	101.6	0.7%	3.8%
Drivers and Mobile Machinery Operators	64.7	70.5	3.5%	1.7%
Building and Related Workers	12.1	11.7	8.8%	-0.7%
Labourers and Related Elementary Service Workers	136.5	130.1	3.5%	-1.0%
Total[7]	**2028.4**	**2215.8**	**2.9%**	**1.8%**

Sources: Historical – 2005 (HLFS data); Projections – Department of Labour (based on inter-Census changes between 1996 and 2001).