ASSESSING THE RELIABILITY OF LABOUR MARKET FORECASTS

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1. Introduction

A primary motivation for providing education and training is to equip the workforce with the skills it requires to meet the needs of industry. Furthermore, as training takes some time to accomplish, the training that is provided today must be targeted at the needs of industry at some time in the future. Hence policy makers with a responsibility for the allocation of training resources require access to a labour market forecast of some kind.

Formal labour market forecasts produced using an economic model have several features which ought to make them attractive to policy makers. For example, they embody modern economic theory and large amounts of relevant economic data, they are comprehensive and coherent, and they can be updated regularly at reasonable cost. Yet many training professionals are reluctant to avail themselves of formal forecasts, preferring instead to rely on more informal methods such case studies and opinion surveys. Formal forecasts are held to be too unreliable for most policy purposes. It is argued in this paper that the reluctance is misplaced and, indeed, that it constitutes an unnecessary barrier to the efficient promulgation of training policy.

The discussion is predicated on a detailed analysis of the performance of a labour market forecasting system built around the MONASH applied general equilibrium model of the Australian economy. Section 2 of the paper contains an outline of the MONASH forecasting system. Using forecasts published over the last thirteen years, section 3

- reviews their accuracy for industries and occupations and regions,
- compares their accuracy at various levels of aggregation,
- compares their accuracy for various time horizons from one to eight years,
- compares their accuracy with forecasts derived from time series extrapolation, and
- identifies the role of sampling errors in the Labour Force Survey (the source of the historical values against which the forecasts are assessed).

In section 4, the paper reviews various criticisms that have been made of the MONASH forecasts in published assessments by independent government and private sector agencies. It includes a consideration of the role currently accorded to the MONASH forecasts by Skills Australia in the development of workforce policy.

Section 5 contains some concluding remarks.

2. The MONASH Forecasting System

The MONASH forecasting system (MFS) has been used to produce labour market forecasts in Australia for more than 15 years. During much of that time, the forecasts were actually forecasts of the demand for labour for a given scenario about the average wage rate and constant relative wage rates. In other words, the forecasts could only be construed as employment forecasts on the assumption that there was excess supply of all types of labour under the stated wage rate regime. In recent years, the unemployment rate has fallen to less than five per cent of the work force, and the economy can be considered to be operating at close to full employment in the sense of the non-accelerating inflation rate of unemployment (NAIRU). Hence the assumption of slack labour markets became untenable for an employment forecast and labour supply constraints were introduced. In this section, both versions of the forecasting system are briefly described and the implications for assessing the reliability of the system are reviewed.

Forecasting with slack labour markets

The demand for labour depends on many factors. It depends on the state of macroeconomic health of the domestic economy and of the economies of trading partners. It depends on the amount of capital investment and on its allocation between industries. It depends on the rate of technical change and on changes in government policy. Moreover, all these factors are interconnected. Developments in one industry affect the demand for labour in other industries. The Monash forecasting system incorporates all these factors in a set of formal economy-wide forecasts for labour demand.

The elements of the MFS are set out in Figure 1. As a formally specified system, its role is to supply a framework for incorporating relevant data into the forecasting framework. Published data accessed by the system include the national accounts, input/output tables, State accounts, population censuses, foreign trade statistics, capital stock statistics, and income and expenditure surveys. Additional unpublished material is prepared by the Australian Bureau of Statistics especially for the

system. Moreover the MFS requires all its data to be consistent. If any inconsistencies do exist in the primary sources, they must be reconciled before the data can be included. This consistency requirement makes the system especially powerful as a framework for organising data.

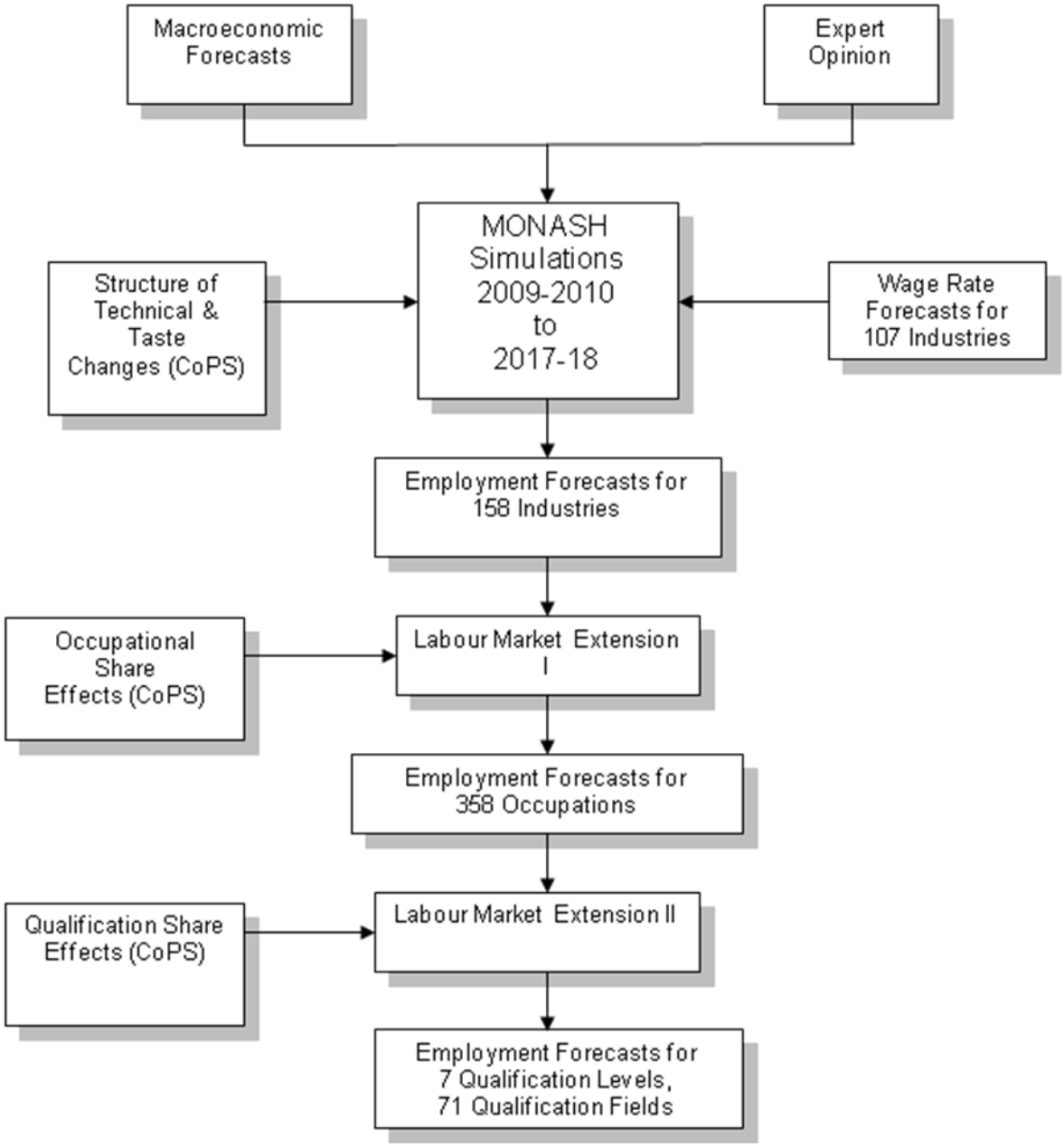
As well as data about the past, formal or model-based forecasts usually rest upon informed opinion about future changes in variables that are exogenous to (i.e., determined outside) the system. The MFS is quite adaptable in this regard. It incorporates the views of numerous expert bodies and can accommodate more detailed exogenous forecasts as they become available. The most important sources of exogenous expert opinion are:

- the private forecasting agency, Access Economics (which contributes information about the future state of the macro economy),
- The Australian Bureau of Agricultural and Resource Economics (export prices and volumes for primary products),
- The Tourism Forecasting Council (prospects for tourism),
- The Productivity Commission (changes in protection implied by government industry policy), and
- The Centre of Policy Studies (changes in technology and consumer tastes).

The system can also produce alternative forecasts corresponding to competing views about the future. Just as for historical data, all opinions formally incorporated in a particular forecast must be consistent with each other. A forecaster using the MFS must either seek a consensus between the expert bodies involved in forecasting the exogenous variables or impose his/her own judgment to resolve any outstanding differences before the forecast can proceed. In other words, the MFS provides a framework for coordinating both historical data and expert opinion about the future that bear on the future demand for labour.

An MFS forecast of the demand for labour proceeds in five stages. It begins with a macroeconomic scenario derived from the Business Outlook published quarterly by Access Economics. At the second stage the forecasts for GDP and its components are converted into forecasts of output and employment by industry. The structural forecasts supplied by the expert bodies indicated in Figure 2 are incorporated at this stage. In particular, the array of exogenous information is treated as a set of constraints which governs a simulation using the *MONASH* applied general equilibrium model in forecast mode.

Figure 1 : The MONASH Forecasting System for Slack Labour Markets



The output and employment forecasts are related by production functions which determine the increase in output associated with given increases in inputs (capital and labour) and a given rate of primary factor saving technical change. The influence of capital growth and technical change can produce quite different output and employment forecasts for some industries. The change in capital

inputs depends critically on whether an industry was under- or over-capitalised in the base period of the forecast (i.e., on whether the rate of return in the industry was above or below the average across industries). An industry with a relatively high rate of return attracts investment and enjoys a relatively high rate of capital growth. For a given rate of output growth and technical change, this implies a relatively low rate of employment growth. Similarly an industry with a relatively rapid rate of technical change will tend to have a relatively low rate of growth in employment.

At the third stage, the national forecasts for output and employment are converted into regional forecasts using the MONASH top-down regional model (MTDRM), a derivative of the ORANI regional equation system (Dixon et al., 1982, Chapter 6). The regionalisation process takes account of:

- differences in industrial structures,
- inter-regional trade flows,
- region-specific industry effects, such as mine closures,
- population movements,
- expected expenditures by regional governments, and
- local multipliers.

Regional forecasts are produced at two levels of aggregation, namely, eight State and Territories and 56 Statistical Divisions.

At the fourth stage, the employment forecasts are converted from an industry basis to an occupational basis. Employment growth (measured in persons) for a particular occupation can be decomposed into:

- a component due to the growth in aggregate employment (measured in hours),
- a component (the *industry share effect*) due to changes in the distribution between industries,
- a component (the *occupational share effect*) due to changes in the distribution of employment between occupations within industries, and
- a component due to changes in the number of hours per worker.

The industry share effects are computed from the growth rates in employment by industry using an industry-by-occupation matrix derived from the Population Census and the Labour Force Survey. The occupational share effects are treated as a type of technical change and are forecast by extrapolating historical trends in the occupational mix in each industry. The method is described in

detail in Meagher (1997). Changes in the number of hours per worker in an occupation are also derived by extrapolating past trends.

At the final stage, the forecasts for employment by occupation in persons are used to determine the employment outlook for workers identified by age, sex, qualifications and hours worked per week. The method is analogous to that used to determine the occupational forecasts from the industry forecasts.

Forecasting with tight labour markets

As already indicated, the MONASH forecasts originally assumed that excess labour would always be available at the average wage rate predicted by Access Economics as part of its macro scenario. Commensurately, relative wage rates across industries, occupations and skills were assumed to remain constant. As labour markets tightened during the long boom leading up to the Global Financial Crisis in 2008, these assumptions became increasingly untenable and labour supply constraints were introduced.

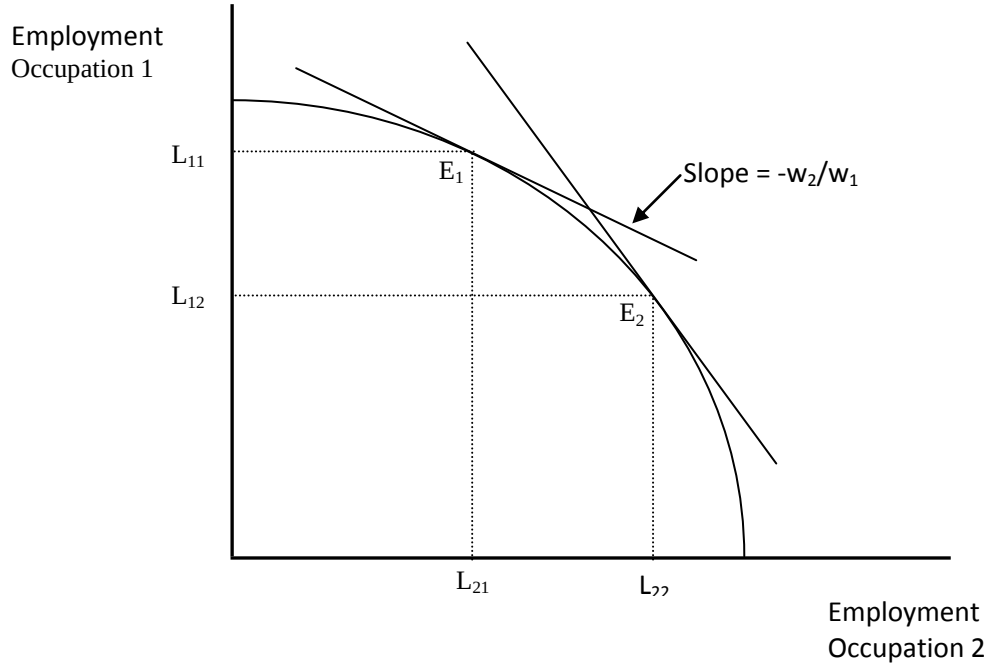
In particular, labour supply is now determined by progressively projecting the following variables:

- adult population,
- labour force participation rates,
- labour force measured in persons,
- unemployment rates,
- employment measured in persons,
- average hours worked,
- employment measured in hours.

All these projections are differentiated by age and sex. A skill dimension is then incorporated using data from the Labour Force Survey and the Survey of Education and Work. At present 67 skill groups defined on categories from the Australian Standard Classification of Education are identified. They comprise six levels of educational attainment cross-classified with eleven major fields of study plus the unskilled category *No Post-School Qualification*.

In addition, labour markets for 81 occupations, the minor groups of the Australian Standard Classification of Occupations[1], have been incorporated in the MONASH model. On the supply side of these markets, labour by skill can be converted into labour by occupation according to Constant Elasticity Transformation (CET) functions. Figure 2 presents the idea diagrammatically. The position of the transformation curve is determined by the supply of the skill. If the wage rate of occupation 2 increases relative to that of occupation 1, the isorevenue line becomes steeper, and the owners of the skill can increase their income by transforming some of occupation 1 into occupation 2. Hence, they change the occupational mix from E_1 to E_2. In principle, each of the 67 skills can be transformed into any of the 81 occupations. However, if none of a particular skill is used in a particular occupation in the base period, none of it will be used in that occupation in any of the forecasts.

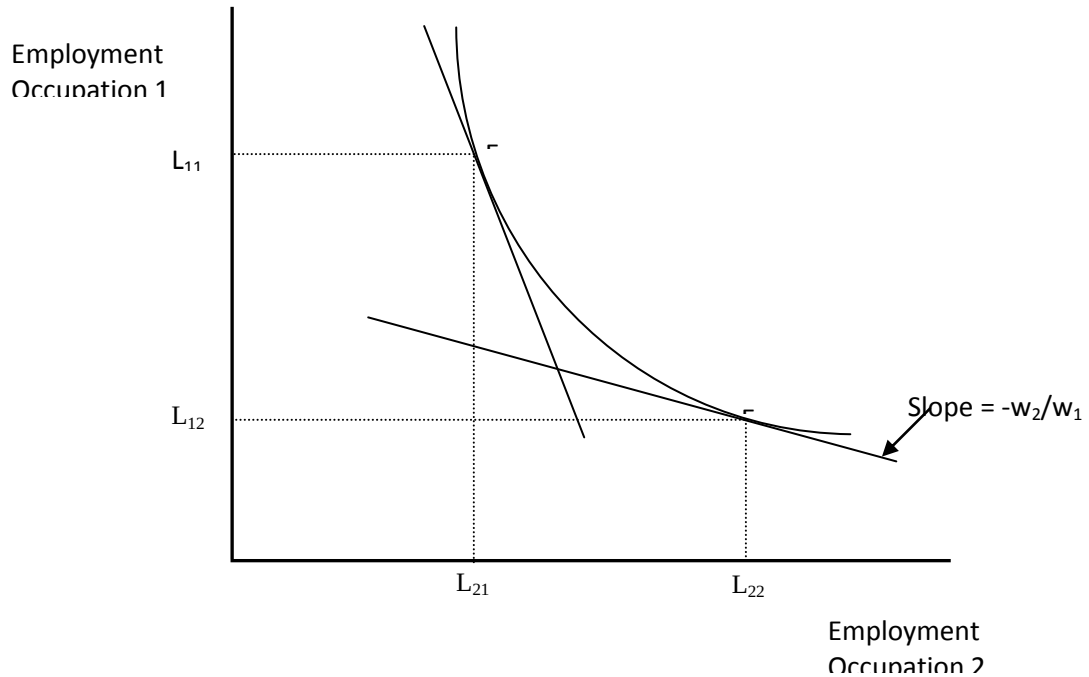
Figure 2 : Skill Transformations between Occupations



[1] As not all the required data sources have yet been converted to the new ANZSCO and ANZSIC06 classifications, the MONASH forecasts are also carrying along the old ASCO and ANZSIC03 classifications for the time being.

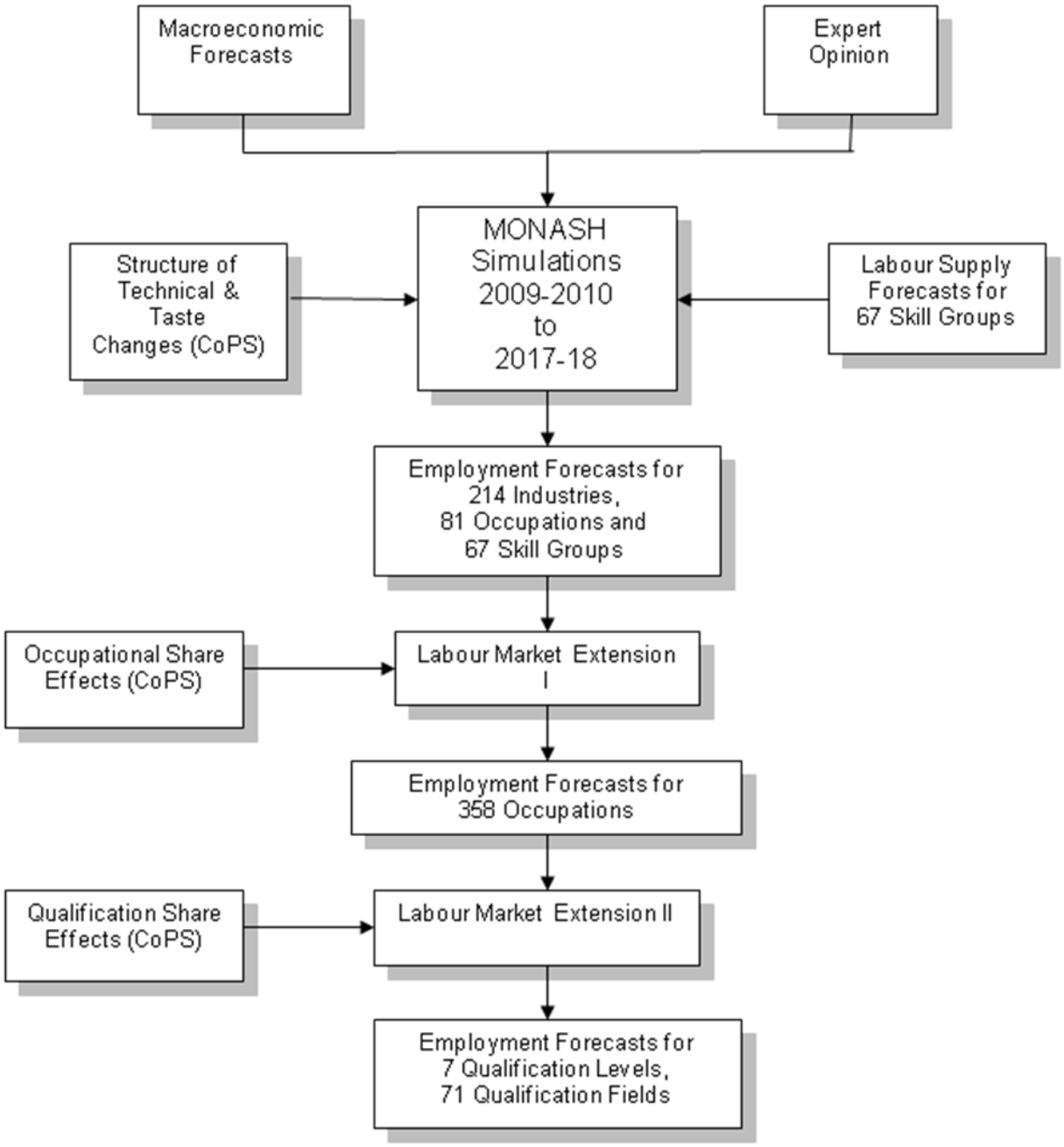
Labour of different occupations can be converted, in turn, into effective units of industry specific labour according to Constant Elasticity Substitution (CES) functions. In Figure 3, the position of the isoquant is determined by the demand for labour in the industry. If the wage rate of occupation 2 decreases relative to that of occupation 1, the isocost line becomes flatter, and the producers in the industry can reduce their costs by substituting some of occupation 2 for occupation 1. Hence they change the occupational mix from E_1 to E_2. In principle, each of the 107 MONASH industries can employ any of 81 occupations but, as before, none of a particular occupation will be used by an industry in a forecast if none of it was used by that industry in the base period.

Figure 3: Substitution between Occupations in Industries



These modifications are sufficient to support the current forecasting methodology in which relative wage rates are assumed to adjust to clear the occupational labour markets. The revised system is shown in Figure 4. In future versions, lagged adjustment will be introduced in the labour markets.

Figure 4 : The MONASH Forecasting System for Tight Labour Markets



3. Performance of the MONASH System[2]

Table 1 shows the errors associated with employment forecasts for Australia produced using the MONASH forecasting system in a typical year, namely, 2001-02. Consider first the errors in the forecasts for 158 3-digit industries one year out, i.e., for the year 2002-03. For each industry, the absolute percentage error is calculated from the difference between the employment forecast and the employment outcome as represented by the estimate obtained subsequently from the Labour Force Survey (LFS). The 158 errors are then averaged using employment weights. That is, the errors in large industries are accorded more importance in the average than similar errors in small industries. The result is the employment-weighted average percentage error or EWAPE[3]. Thus, on average, the error in the forecasts for 158 industries was 4.99 per cent. As the number of years of the forecasting time horizon increases, the error increases but not monotonically so. Eight years out, i.e., in 2009-10, it has risen to 15-16 per cent.

The first panel of Table 1 shows the EWAPEs for industry classes (158 industries), groups (54 industries) and divisions (18 industries). The errors decline as the level of aggregation increases. The same trends are evident in the second panel which shows the EWAPEs for occupational unit groups (340 occupations), minor groups (81 occupations), and major groups (9 occupations).

Table 2 presents EWAPEs corresponding to the first row of Table 1 but disaggregated by region, namely, Australia's States and Territories. The errors increase as the population of the region declines. For the Northern Territory, which has the smallest population, the errors are relatively large.

As the future is inherently uncertain and all forecasts are subject to some level of error, the question arises as to whether the MONASH errors should be regarded as being large or small. One way of answering this question is to compare the MONASH errors with those obtained by alternative forecasting methods. Table 3 provides one such alternative in the form of time series extrapolation conducted on an industry-by-industry basis. Trends derived from historical LFS data of various lengths from 3 years to 9 years are reported. The accuracy of the forecasts improves as the number of years included in the database increases, reflecting a reduction in the influence of the sampling errors in the Survey. The MONASH forecasts perform better than all the trend extrapolations. Moreover, unlike the trend extrapolations, the MONASH forecasts are coherent and can be

[2] Note that it is the forecasting system, rather than the MONASH model, whose performance is assessed here. For an assessment of the reliability of a related CGE model, see Dixon and Rimmer (2009).

[3] Because of the variability of the accuracy of the forecasts across industries, occupations and skills, and because of the variability of the "actual" outcomes due to sampling error, it is not possible to satisfactorily infer the overall performance of the MONASH forecasts from a small number of "representative" forecasts. An economy-wide measure such as the EWAPE is required

rationalised in terms of an explicitly-stated and defensible view about the future state of the economy.

Another way of answering the accuracy question is to use the published standard errors associated with the Labour Force Survey employment estimates. In particular, if it is assumed that each LFS estimate is a drawing from a normally distributed employment distribution with a mean equal to the published level of employment and a standard deviation equal to the associated standard error, alternative drawings from the distribution can be made and compared. The corresponding EWAPEs are recorded in the column labelled LFS in Tables 1 and 2. Thus, from the first row of Table 1, when alternative random drawings were made for 158 industries for the year 2002-03 and those estimates compared with the published LFS employment estimates, an EWAPE of 5.16 per cent was obtained.[4] This is to be compared to the MONASH error of 4.99 per cent for 2002-03. In other words, the EWAPE due to the sampling error associated with LFS employment estimates exceeds the EWAPE associated with the MONASH forecast one year out. As the LFS sampling error is routinely ignored by many, if not most, of the users of the MONASH forecasts, the result suggests that the magnitude of the MONASH forecasting errors is not a cause for particular concern.

Finally, based on quarterly LFS data for the period 1987-88 to 2009-10, an employment series was constructed using the Hodrick-Prescott filter. This series can be regarded as representing the underlying employment once all the transients, including those due to the LFS sampling error, have been removed. The EWAPEs obtained when this series is compared with the published LFS employment estimates are shown in Table 3. Thus, one year out, the EWAPE associated with the MONASH forecast is 4.99 per cent. However, the HP-filtered series produces an EWAPE of 3.42 per cent for the same year. Hence, a significant share of the MONASH error can be attributed to transients about which the MONASH system has nothing to say and, indeed, about which it cannot be expected to have anything to say. An implication of this result is that, in future work, the forecasting system should address a filtered employment series, such as the HP series, rather than the LFS employment estimates.

Table 4 shows the EWAPEs for Monash forecasts made between 1996-97 and 2008-09. In general, the trends evident in the results for the typical year 2001-02 are repeated in the other years, although the performance is sometimes patchy. Consider first the forecast for the years 2004-05 to 2011-12 (forecast 8 in Table 4). The EWAPE for the first year of the forecast (8.56 per cent) is relatively large. When the individual contributions of each of the 158 industries are examined, the main contributor is found to be the industry *School Education*, which accounts for about seven per

[4] Of course, the EWAPE will be different for each set of random drawings, but its magnitude will not vary much from that reported.

cent of the error. Figure 5 shows the employment estimates for this industry as published by the LFS and after applying the HP filter. Evidently it is the reduction in the LFS estimate from 450 thousand to 425 thousand between 2003-04 and 2004-05 which accounts for the large EWAPE. As employment in the industry recovered in the next year, the large error would appear to be due to sampling error in the LFS rather than any limitation in the MONASH forecast.

Now consider year 2 of forecast 3 (i.e., the forecast for the years 1999-00 to 2006-07), for which the EWAPE is again relatively large at 11.93 per cent. This time there are two significant contributors, the first being the industry *Machinery Equipment and Wholesaling* which accounts for about 5 per cent of the error. The employment estimates for the industry are given in Figure 6. They show that the reduction in the LFS estimate from 140 thousand to 110 thousand between 1999-00 and 2000-01 is partly responsible for the large EWAPE. As the drop in employment is sustained, the EWAPE represents a failure of the forecasting system. The cause of the sudden decline in the fortunes of the industry between 1998-99 and 2000-01 is not known but it could presumably be revealed by further investigation.

The second important industry is *Computer Services* which also contributes about 5 per cent to the error. Figure 7 shows that the proximate cause is the rapid increase in employment from 121 thousand to 164 thousand between 1999-00 and 2000-01. Here the underlying phenomenon is more obvious. The MONASH forecast in 1998-99 underestimated the surge in the employment of computer specialists prompted by fear of the possible effects of Y2K bug.

The discussion suggests that variations in the performance of the forecasting system over time can be traced either to unlikely employment estimates obtained from the Labour Force Survey or to discreet economic events which the forecasts failed to account for adequately. Further investigation would appear to be warranted.

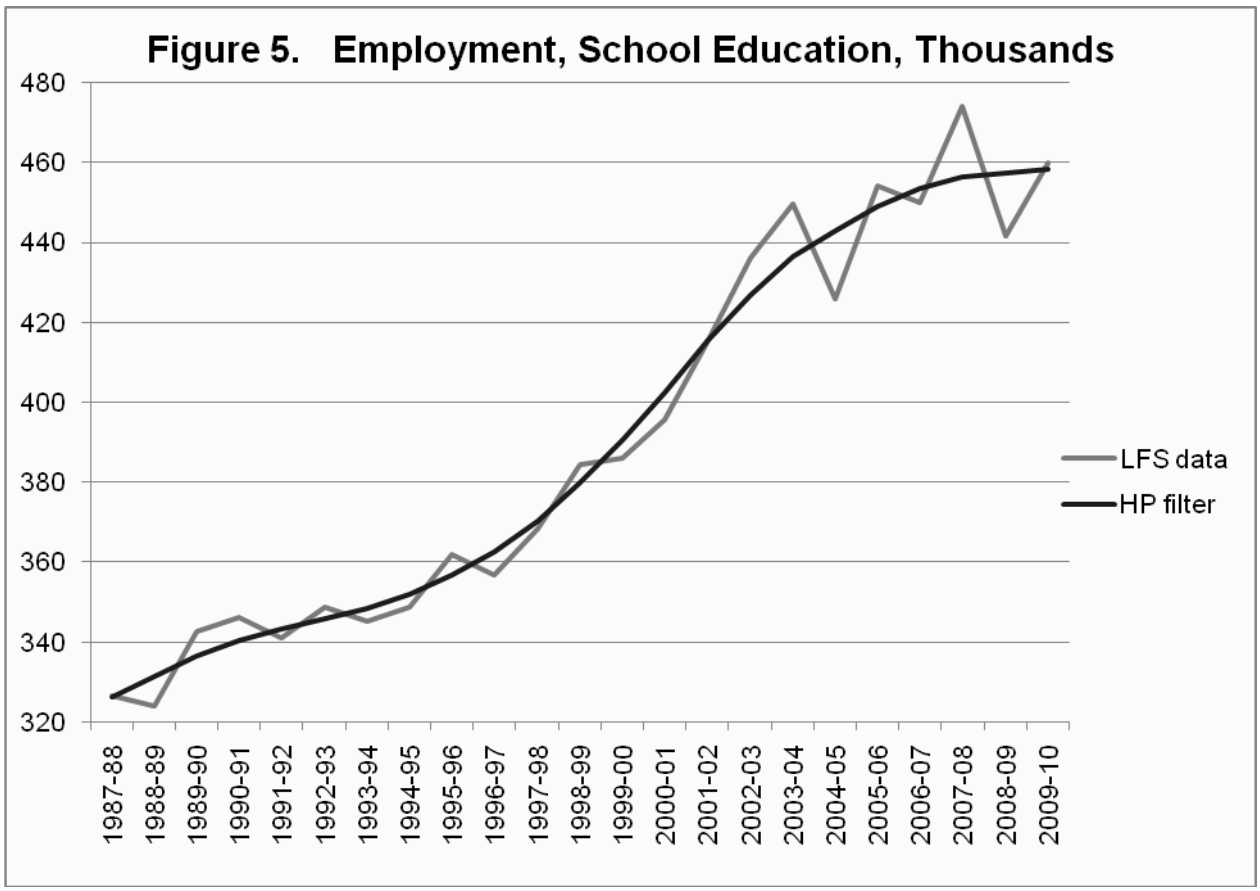


Figure 5. Employment, School Education, Thousands
480
460
440
420
400
380
360
340
320
1987-88
1988-89
1989-90
1990-91
1991-92
1992-93
1993-94
1994-95
1995-96
1996-97
1997-98
1998-99
1999-00
2000-01
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2002-03
2003-04
2004-05
2005-06
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2007-08
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2009-10
LFS data
HP filter

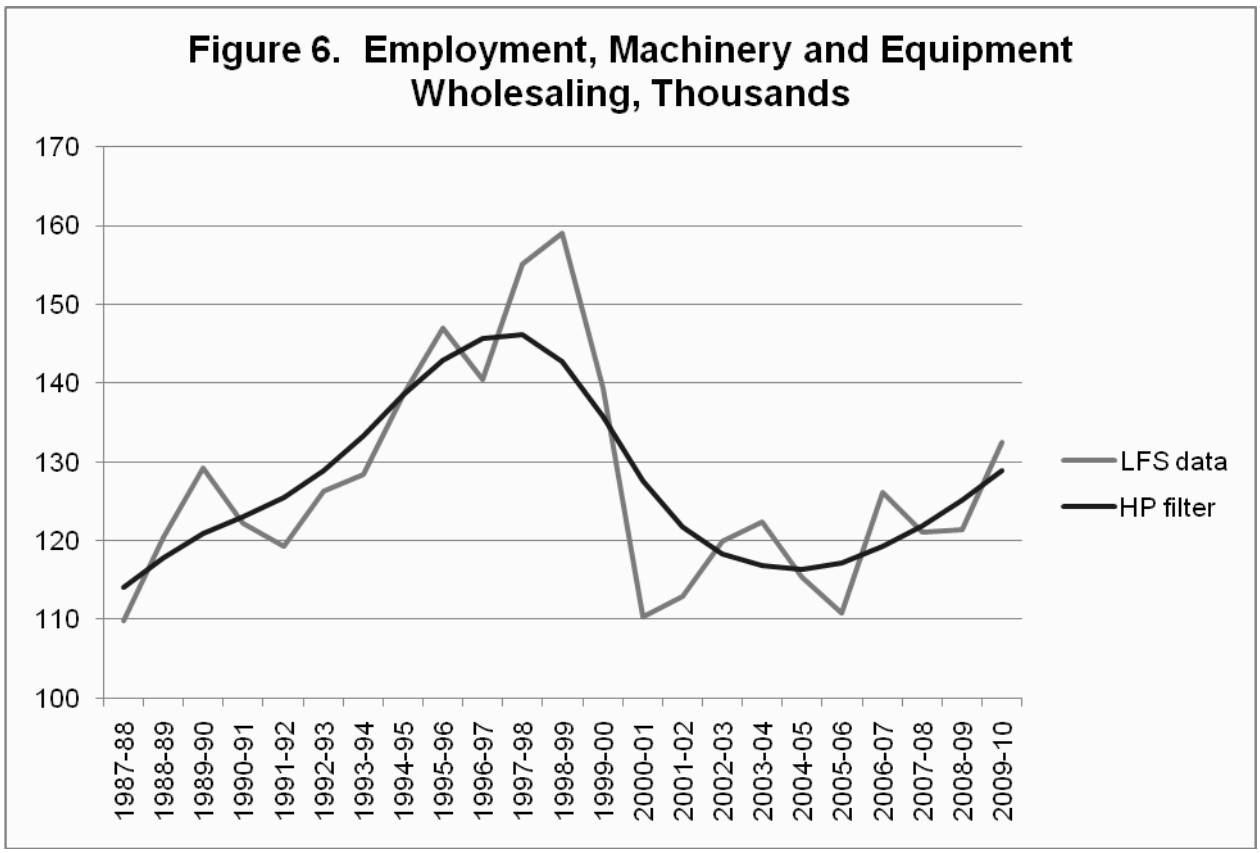
Figure 6. Employment, Machinery and Equipment Wholesaling, Thousands
170
160
150
140
130
120
110
100
1987-88
1988-89
1989-90
1990-91
1991-92
1992-93
1993-94
1994-95
1995-96
1996-97
1997-98
1998-99
1999-00
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2005-06
2006-07
2007-08
2008-09
2009-10
LFS data
HP filter

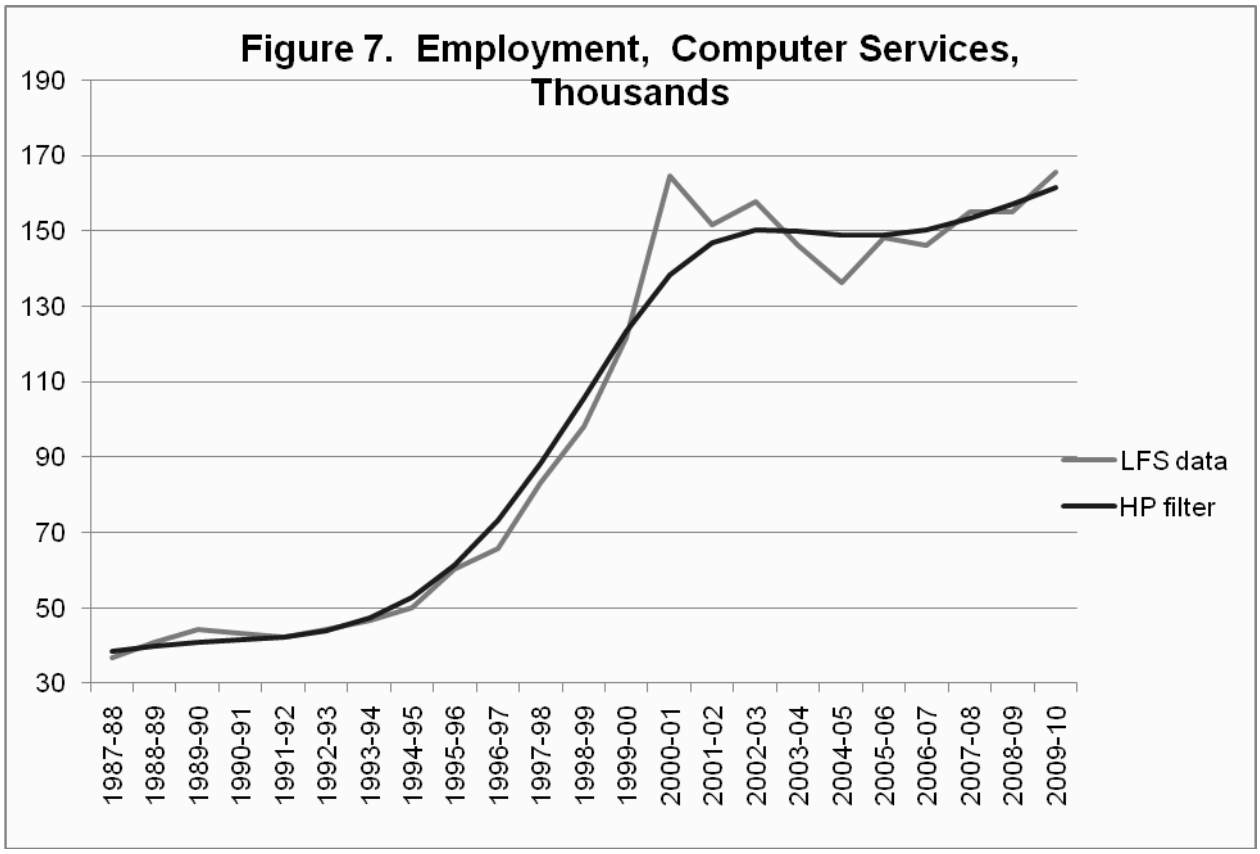


Figure 7. Employment, Computer Services, Thousands
190
170
150
130
110
90
70
50
30
1987-88
1988-89
1989-90
1990-91
1991-92
1992-93
1993-94
1994-95
1995-96
1996-97
1997-98
1998-99
1999-00
2000-01
2001-02
2002-03
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
2009-10
LFS data
HP filter

4. Forecasting and Workforce Development

As already mentioned, it is usually considered that a primary objective of workforce development is to equip the workforce with the skills it will need to meet the future needs of industry. In its recent report on *Australian Workforce Futures: A National Workforce Development Strategy*, Skills Australia (2010) expresses this kind of objective as being to "sustain economic growth and raise productivity by increasing skills and avoiding future skills shortages" (p.8). That being the case, there are several reasons for thinking that the MONASH forecasts would be attractive to policy makers such as Skills Australia concerned with workforce development.

- The MONASH forecasts are coherent. Whatever their level of detail, all MONASH forecasts are consistent with each other, and with an articulated, defensible view about the future of the Australian economy.
- The MONASH forecasts embody very large amounts of relevant economic data and expert opinion. As a formal modelling system, MONASH provides a framework for incorporating data from a wide variety of sources in a consistent manner.
- The MONASH forecasts are updated regularly.
- The MONASH forecasts are subject to relatively good quality control. The forecasts and the models used in their derivation come under constant, and often intense, scrutiny from the numerous subscribers to the former and from the participants in regular training courses in the use of the latter.
- The MONASH forecasts are comprehensive and relatively cheap. As the forecasts cover the whole economy, the cost of producing them can be spread over a relatively large number of subscribers.
- The MONASH forecasts are progressive. The MONASH forecasting system is supported by an ongoing program of economic research which leads to improvements in the forecast methodology over time.
- The MONASH forecasts are transparent in the sense that the economic processes that determine a particular forecast can always be traced and each step in each process can be understood intuitively.

Yet Skills Australia, and many other contributors to discussions on workforce development, are reluctant to concede that formal labour market forecasts have anything much to offer. The main

objection is that such forecasts are "unreliable". In this section, arguments advanced in favour of this position are reviewed. One problem which confronts such a review is that the preferred alternatives often do not provide any forecasts that can be tested directly against the empirical evidence. In that case, reliability must be assessed according to qualitative arguments which tend to be imprecise and open to interpretation. Nevertheless, as the perceptions of the reliability of formal forecasts (such as the MONASH forecasts) are usually based on such arguments, it is appropriate that they be considered here.

The MONASH forecasts have been independently reviewed several times over the years, the most important assessments being due to Burns and Shanahan (2000), Access Economics (2005), Peng et al. (2005), Richardson and Tan (2008), Hoeckel et al. (2008) and Lewis (2008). However, to contain the discussion, particular attention will be paid to the reports by Skills Australia (2010) and the OECD (Hoeckel et al., 2008), and to the paper by Richardson and Tan (2008) whose ideas appear to have exerted a special influence on the other two reports. Each of the three components of the national strategy advanced by Skills Australia will be explicitly considered. They are

- a scenario analysis using a formal forecasting model ,
- a common planning framework which recognises that skills and workforce planning is a shared enterprise between a range of players, and
- a focus on specialised occupations which targets occupations that cannot be left to market mechanisms alone.

Taken together, the three reports provide a useful summary of the dominant view of the education and training establishment in Australia concerning the role of formal labour market forecasts in workforce development. The discussion is organised around five propositions.

Proposition 1. In choosing between different forecasting methodologies, all alternatives should be subject to the same criteria regarding reliability.

On the basis of a handful of ill-considered comparisons between MONASH forecasts and historical outcomes[5], Richardson and Tan conclude "that it is not at present possible to project future skill needs with much accuracy" (p.30). Further, the forecasts are sufficiently unreliable as to raise the question of "whether, *at the level of disaggregation that is needed for VET capacity planning*, the forecasts are robust enough to be better than no forecasts" (p.27).

[5] Insofar as it purports to be a quantitative assessment of the reliability of the MONASH forecasts, the paper by Richardson and Tan is simply incompetent. See Meagher (2008).

Because of their supposed unreliability, Richardson and Tan maintain that only a restricted subset of the MONASH occupational forecasts are suitable for VET planning. In particular, the forecasts should only be used "at a fairly broad level", they should be confined to "around five years", and they should retain "an Australia-wide focus" (p.33). For other purposes (i.e., detailed occupational forecasts, planning horizons of more than five years and regional forecasts), other ways of looking forward are to be preferred. These "other ways" include

- using "local information from employers' associations, graduate destination surveys and recruitment agencies", and
- undertaking separate, bottom-up, high-quality studies of expected skills demands for those major skills that take a long time to learn and gear up to teach—it is for these that the ability to make accurate projections is of most importance" (p.34).

An important feature of the "other ways" is that they are to be used *instead of*, rather that *in addition to*, the MONASH forecasts. Since the reason for relegating the MONASH forecasts to a strictly limited role is their perceived unreliability, this recommendation can only mean that Richardson and Tan believe the "other ways" are more reliable than MONASH. They present no evidence to support this contention. When it comes to the reliability or otherwise of the "other ways", they are completely silent. Indeed, to judge from their discussion, unreliability would appear to be a condition which is somehow peculiar to the MONASH forecasts.

Hoeckel et al., likewise, are at pains to warn their readers about the unreliability of "skills forecasting" but offer no comment as to the reliability of their preferred alternatives. Indeed, as evidence of the unreliability of skills forecasting, they rely mainly on the following opinion of Richardson and Tan: "Our own comparisons of projections with outcomes for the MONASH model confirm that, over a nine-year period, its projections diverged substantially from the actual outcomes for a number of occupations. Indeed, even at the major occupational group level, the direction of change was in some cases incorrect projecting growth when there was decline and vice versa (p.26 of Hoeckel et al.)". That they have chosen to highlight the direction of change issue is curious. Firstly, one of the more egregious errors committed by Richardson and Tan in their assessment of the MONASH forecasts was to attribute uniform growth to the forecasts over the forecast period. That is, Richardson and Tan misrepresented the MONASH forecasts in such a way as to preclude any changes in direction. In any case, a failure to forecast the direction of change does not, of itself, indicate unreliability. If employment in an occupation is remaining fairly constant over time, so that in some periods it increases a little and in other periods it decreases a little, it is entirely possible for a forecast to get the direction of change wrong in every period but still predict the level

of employment to a high degree of accuracy. In other words, despite their repeated warnings, the Hoeckel et al. are unable to offer anything but highly dubious evidence concerning the unreliability of skills forecasting.

It is simply illogical to reject one forecasting method on the grounds that it is unreliable and to espouse an alternative method whose reliability is unknown. As the future is inherently uncertain, all forecasts are unreliable to some extent. Hence a "reliable" forecast can only be considered to be one which is less unreliable than the best available alternative.

Proposition 2. If a workforce development strategy is to equip the workforce with the skills it will need to meet the future needs of industry, the strategy must identify what the future needs of industry are going to be.

As indicated earlier, the Skills Australia development strategy includes an analysis of a number of alternative scenarios concerning the future of the Australian economy[6]. Each scenario identifies a view about future industry needs and determines the allocation of training resources which are appropriate to those needs. If the scenario changes, so too does the appropriate allocation. A forecast can be thought of as an analysis of the particular scenario considered most likely to eventuate. As with the other scenarios, there is a particular allocation appropriate to the forecast.

This is not to say that the workforce will be impotent if it embodies skills that are better suited to an economy that is different to the one which actually eventuates. Whatever the needs of industry turn out to be, the economy will adjust to accommodate the workforce which is available. However, to the extent that the workforce has acquired skills that are not particularly appropriate for industry needs, there will be a cost in the form of reduced output. A development plan, based on a reliable forecast, can help to minimise such costs.

However, in the Skills Australia strategy, the allocation of training resources is not determined by any scenario, forecast or otherwise; it is determined by the common planning framework. This network is an ongoing collaborative planning effort involving:

- Skills Australia;
- the Department of Education, Employment and Workplace Relations;
- the states and territories;
- industry;

[6] It should be noted that the scenarios were not conducted using the MONASH forecasting system. For that purpose, Skills Australia preferred the comparatively outmoded forecasting technology of Access Economics.

- education providers; and
- Industry Skills Councils.

In other words, the allocation of resources is to be decided as an exercise in bureaucratic decision making. It is essentially a political system designed to afford a voice to all those with an interest in the allocation. It is not a system which will deliver an economic analysis of how the future skill needs of industry will be met. It will certainly deliver an allocation of resources but it will not identify the industry needs which the allocation is supposed to service. Hence it cannot be argued or, at least, it cannot be plausibly argued, that the allocation will meet future industry needs.

Skills Australia advances the following argument. *"Decentralised engagement can be the most effective way to 'plan':* New skill demands may flow from the changing skill composition of existing occupations, resulting from new technology, services or products, rather than from industry or occupational growth and decline. Such demands will vary from firm to firm, depending on their innovation intensity and business strategy. The responsiveness of education providers to changing industry needs, and ongoing dialogue between education and industry, may therefore be more important than centralised planning efforts" (p.18). According to this view, businessmen know best what the future needs of industry will be. Hence the workforce development strategy should focus on surveying business opinion via the common planning framework and then reallocate training resources as quickly as possible to conform to changes in that opinion.

The immediate problem with this approach is that a committee of businessmen can be expected to disagree about future industry needs. The committee then has the unenviable task of forming a consensus view from disparate, and possibly contradictory, opinion. There are no rules to govern this process. Perhaps the opinion of the person with the most bureaucratic authority is the one that will prevail. However it is done, it will not be free of a considerable measure of uncertainty. This kind of "unreliability" is routinely ignored because the process is not transparent and, the costs associated with bad decision making cannot be easily identified.

A second problem with a system like the common planning framework, but not one canvassed by Skills Australia, is rent seeking behaviour. In the context of skills shortages, Richardson (2007) has argued as follows:

"The usual way of learning that there is a shortage of particular skills is to ask (or be told by) employers. For several reasons, this is not very reliable.

- Employers have every incentive to exaggerate the problem of shortage in the hope that someone else will assist them to find the skills they want without their having to make the jobs more attractive for their workers and hence more costly for them as employers.
- Employers interpret shortage in a variety of ways and do not act consistently when dealing with an environment they characterise as one of shortage.
- This is one area where we expect unions and employers to have common cause. It is in the interests of both groups to exaggerate the problem of shortage." (p.27)

The common planning framework is just an institutionalised system for asking (or being told by) employers about how to allocate training resources. It can be expected to be prone to exactly the same limitations as employer advice on skills shortages and, on Richardson's assessment, it is "not very reliable".

Proposition 3. In determining what skills are required to meet the future needs of industry, structural linkages are important.

Once a view has been adopted about what the future needs of industry are going to be, it remains to determine the associated skill requirements. In this process, structural linkages are important. Here, the term "structural linkages" refers, firstly, to the composition of the cost and sales shares of each industry and, secondly, to the way industries interact with each other via the markets for commodities and factors.

Richardson and Tan "emphasise that the labour market is dynamic. People are constantly changing their jobs, learning new skills from their work, moving to new locations, moving in and out of the labour force, changing the number of hours per week they work. At the same time, firms are being born, growing, dying, declining, altering the size and skill set of their workforce, recruiting strategic new skills, training some of their existing staff with the additional skills they find they need. ... In all of this, formal vocational education has an important, but modest role to play. It is a misunderstanding of how the labour market adjusts to think that there is a direct, one-to-one relation between an expansion in output, the associated increase in skills needed to produce that extra output, and a requirement for the VET system to provide those extra skills. Indeed, there is only a loose match between the qualifications that people have and the jobs they do. Many people have qualifications they do not utilise in their current job. Many also work in jobs for which they have no formal qualification. (Hence) VET planners should not try to match vocational education and training to projected skills needs in any precise way." (p.9)

These sentiments are dutifully recycled by Skills Australia. In deciding where to direct planning efforts, Skills Australia nominates the following "labour market facts" to be of particular significance.

- *People change jobs frequently*: 45 per cent of the workforce changes their employer within a three-year period, and many people change not just their employer but also their industry and occupation.
- *Job destinations are varied*: The job destinations people arrive at following training are often quite different to the jobs for which they initially trained.
- *Employer requirements change*: Labour market conditions lead employers to adapt their requirements for workers, varying the quality of those they are prepared to employ, and increasing their tolerance for people learning on the job.
- *Non-accredited and informal learning can supplement or substitute for formal education:* Skills are often learned on the job, through experience and unaccredited structured training, rather than by formal study for a qualification. (p.17)

In fact what matters is whether particular industries employ particular occupations and skills more intensively than other industries and, if they do, whether the differences in intensity persist over time. This is an empirical question which can be tested directly with quantitative evidence rather via a suggestive qualitative argument. That evidence is presented in Tables 5 to 8.

Consider the first row of Table 5. For this row, employment shares for 7 levels of educational attainment (3 higher education levels, 3 VET levels and the unskilled level *No Post-School Qualification*) are determined for each of 358 occupations from 2001-02 employment data published by the Australian Bureau of Statistics (ABS). Assuming the 2001-02 shares remain constant over time, forecasts of employment by qualification level in 2002-03 are derived from published LFS estimates for employment by occupation in 2002-03. These forecasts are then compared with published ABS estimates of employment by level of educational attainment for 2002-03 and the EWAPE computed. The result is an error of 3.70 percent. In other words, a forecast of employment by qualification level based only on a knowledge of

(a) the intensity with which each occupation uses each qualification and

(b) employment by occupation

is more than 96 per cent accurate on average. Using the same 2001-02 shares but updating the LFS estimates of employment by occupation each year, the EWAPE to 4.36 per cent and to 7.08 per cent after eight years. Rows 2 to 8 of Table 5 show the EWAPEs when more up-to-date estimates of the qualification intensities are used.

Table 6 shows the results of analogous computations in which the qualification intensities are defined for 214 industries rather than 358 occupations. Tables 7 and 8 show the corresponding results when the 7 qualification levels are replaced with 71 qualification fields (i.e., the narrow fields of major study defined in the Australian Standard Classification of Education (ASCED)). In no case does the EWAPE rise above 12 per cent.

These results flatly contradict the conjecture of Richardson and Tan and Skills Australia. Notwithstanding their characterisation of labour markets as being in a state of constant turmoil, employment by occupation and/or industry remains a powerful determinant of employment by skill (represented here by qualification). At least part of the failure of their conjecture can be attributed to their misplaced concern with which persons hold down which jobs. It is the amount of labour (measured in hours) of various types delivered to the production process which matters here. Whether or not a particular worker has changed jobs often is not important. Likewise the production process is indifferent to whether a particular job meets the past aspirations of the worker who holds it.

The OECD take on this issue is as follows. "Even when it is possible to forecast the future occupational mix – *e.g.* so many cooks and so many childcare workers – this does not necessarily translate into an equivalent mix of training requirements, except on the assumption that all cooks need training as cooks, and all childcare workers need training as childcare workers. In fact, people trained in one field often work in another, and this may be a good thing, as it allows for the evolution and development of careers and for the cross-fertilisation of fields and ideas" (Hoeckel et al.,p.26). The assertion is misleading. All that is required for an informative skills forecast is that

- the occupation *Cooks* employs persons with the relevant training (a qualification with the major field of study *Food, Hospitality and Personal Services* in the ASCED classification) relatively more intensively than other occupations,
- the occupation *Child Carers* employs persons with the relevant training (in this case a qualification with the major field of study *Society and Culture)* relatively more intensively than other occupations, and
- the relative intensities remain reasonably stable over time.

The results in tables 5 to 8 indicate that these requirements are met decisively.

Proposition 4. To the extent that the distribution of training resources is left to market forces, labour market forecasting has a valuable role to play in providing the economic agents involved with information on which to base their decisions.

According to Richardson and Tan, "There is no need to put serious effort into forecasting the demand for skills that are quite quickly and easily learned. The demand for these skills can be met at the time, if the need actually eventuates. Rather than attempting to forecast, with all the attendant errors in over- or underestimating the true outcomes, it is preferable to have effective systems for rapidly identifying emerging trends and for responding to them" (p.9). This view is endorsed by Skills Australia, which attaches particular significance to the last sentence in determining where to direct research efforts.

In the context of the discussion by both Richardson and Tan and Skills Australia, the "forecast" they advise against attempting refers to a formal labour market forecast such as a MONASH forecast. In the MONASH forecasts, and they are not atypical in this regard, the minimum skill level considered is ASCED Certificate I or II[7], and the minimum time horizon for a forecast is one year. Hence, when put into context, the Richardson and Tan position is that

(a) a Certificate I or II qualification is to be considered "quickly and easily learned" and

(b) a person considering undertaking such training to meet expected demand can conveniently wait one year before starting the training to see if the expected demand eventuates.

Neither of these propositions is particularly plausible in the absence of supporting evidence.

Furthermore, the dichotomy they pose is false. "Emerging trends" are not of interest unless they are expected to continue into the future. But, in that case, the identification of emerging trends is simply another way of making a forecast and, presumably, it comes with the same "attendant errors in over- or underestimating the true outcomes" as any other forecast. Tedious though it becomes, it is necessary to continually unpick this kind of argument because it is just this kind of argument which Skills Australia and others advance for rejecting formal forecasting methods.

If no forecasting (and, by implication, no planning) is to be undertaken for skills which are "quickly and easily learned", the question arises as to how economic agents are to decide whether to acquire such skills. In this regard Richardson and Tan believe "there is much to be said for focusing on what people want to study, as well as on what future employers are anticipated to need. Individuals themselves will have a feel not only for what they like and are good at, but where the future job opportunities lie." (p. 9). To the extent that workforce development is to be directed at personal development objectives rather than training for jobs, Labour market forecasting is not relevant and its reliability not an issue. However the idea that students "will develop a feel for where the future job opportunities will be" is very strange indeed and is not supported by any evidence or argument. By their own assessment, "It is extremely difficult, in both theory and practice, to forecast how the demand for labour is going to evolve—beyond a few years into the future. Economies are complex and dynamic and are affected by many forces that

[7] In other words, the acquisition of "skills" which are insufficient to lift a person out of the unskilled category *No Post-School Qualification* are not considered to be skills in this discussion.

cannot be predicted with any confidence" (p.8). Yet Richardson and Tan imply that students are able to accomplish this feat satisfactorily without the benefit of any economic analysis or even any economic training. The idea seems more than faintly ridiculous.

Ridiculous or not, the idea is also given credence by the OECD, at least to a limited extent. Hoeckel et al. assert "The entitlement model opens the choice of field of study and of qualification to the market, so that within certain limits, students may choose their training in response to their own assessments of future labour market needs" (p.24). In contrast to their treatment of skills forecasting, Hoeckel et al. advance no warnings about the reliability of "student assessments of future skill needs". However, they do concede that "despite their methodological problems[8], skills forecasts can provide some useful information to labour market actors who remain free to make their own decisions" (p.27). Neither Richardson and Tan nor Skills Australia countenance any role for labour market forecasting in informing the econ0omic agents operating in the markets for labour.

One thing that can be said about leaving things to the market is that the costs of bad decisions will be borne by the persons who make the decisions rather than by somebody else. However, it does not follow that the market participants will make good decisions or that they will quickly rectify bad decisions. Without good information, they may simply make one bad decision after another. Hence an assessment of the advisability of leaving labour market outcomes to market forces without providing the participants with good forward-looking information (i.e., without providing them with labour market forecasts) ought to be importantly concerned with the costs of bad decisions. Neither Richardson and Tan nor Skills Australia consider the issue.

Proposition 5. Whether or not a particular occupation (or skill) constitutes a bottleneck to economic growth is a property of the state of the economy and not a property of the occupation.

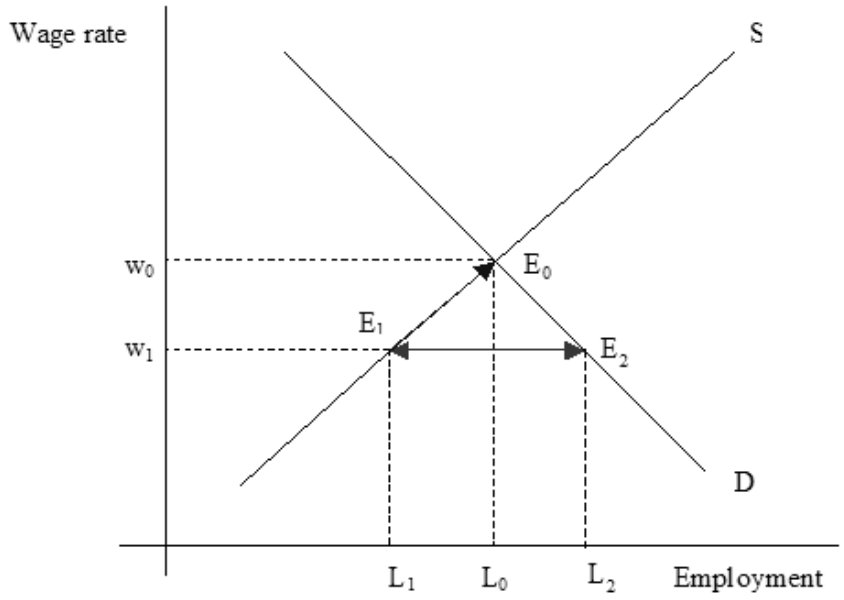
The final component of the Skills Australia strategy is a focus on specialised occupations. Specifically, "Skills Australia in its review of research found that for most occupations there is no clear link with any specific qualifications and also that many workers are highly mobile. As a consequence, the existing labour market mechanisms and demand monitoring by education providers work adequately for meeting the skill needs for these occupations. However, there are a significant number of jobs that cannot be left to market mechanisms alone. These occupations include ones where:

[8] The methodological "problems" to which Hoeckel et al. refer are the turning-points issue and the cook/child carer issue, both of which have been discussed above.

- the preparation time for development is long and it is therefore difficult for employer demand to quickly translate into workers with the requisite skills
- there is a strong connection between the education or training undertaken and the destination occupation (so that government intervention has a reasonable likelihood of being effective)
- the jobs are central to the achievement of other national economic and social priorities, or cause significant supply bottlenecks.

Skills Australia has developed and tested a set of criteria to determine where planning attention is best targeted. Stakeholders were overall in favour of an approach that targets specialised occupation groups where government intervention is most appropriate and potentially effective" (p.20). The first two of these criteria have already been discussed, at least in part. The third will be considered here.

Suppose there is excess demand for labour belonging to a particular occupation at the wage rate w_1.



Excess Demand for Labor (Skills Shortage)

One measure of the structural pressure on the occupation (or the extent to which it poses a supply bottleneck) is given by the so-called skill gap, i.e., the percentage change $100\ (L_2-L_1)/L_1$ in the supply of labour required to establish equilibrium at the wage rate w_1. An alternative measure is the percentage change $100\ (w_0-w_1)/w_1$ in the wage rate required to establish equilibrium at the wage

rate w_0. The wage rate measure is a better indicator of the extent of the bottleneck because it shows the additional output that could be produced with an additional unit of labour of the kind under consideration.

Using wage rates obtained from the 2009-10 MONASH forecasts, 81 minor group occupations were ranked according to the wage rate measure and divided into five groups: those under high structural pressure, medium-high, medium, medium-low and low. Each group contained 16 occupations except the last which contained 17. Each of the 4-digit "specialised occupations" defined by Skills Australia and each of the residual 4-digit occupations were then assigned to the appropriate structural pressure group. The results are shown in Table 9.

Only 6 per cent of the "specialised" occupations appear in the high structural pressure group whereas nearly 50 per cent appear in the low pressure group. Conversely, 30 per cent of the "non-specialised" occupations appear in the high pressure group and only 9 per cent in the low pressure group. In other words, the set of criteria developed by Skills Australia to identify occupations causing supply bottlenecks would appear to have largely identified the wrong set of occupations.

The problem is that the occupations which cause supply bottlenecks can only be identified in terms of the state of the economy. An Australian mining occupation may constitute a bottleneck if the Chinese economy continues to grow strongly but not if Chinese growth falters. The Skills Australia strategy tries to determine the issue using a bottom-up, largely bureaucratic classification which is not associated with a particular state of the economy. The allocation of occupations to structural pressure groups described above depends on the state of the economy envisaged in the 2009-20 MONASH forecast. If a different forecast were adopted, a different allocation between structural pressure groups would eventuate. Just as the future is uncertain, so too is the identification of the bottleneck occupations. This uncertainty cannot be avoided by bureaucratic machination.

5. Concluding Remarks

In this paper, evidence has been presented concerning the reliability of labour market forecasts as represented by the performance of the MONASH forecasting system. Based on comparisons using economy-wide employment-weighted average percentage errors, the system was found to have produced more accurate forecasts than simple trend extrapolations of varying length. Moreover, in the short term (forecasts for one year into the future), the MONASH errors were no worse than the sampling errors associated with the Labour Force Survey. In other words, given the uncertainty that surrounds any method of forming a view about the future magnitude and distribution of

employment, the reliability of labour market forecasts would appear to be quite satisfactory for purposes of policy formation.

However, members of the education and training establishment in Australia[9] and elsewhere frequently express an exaggerated concern about the reliability of formal forecasting. That their concern is exaggerated can be ascertained from their apparent lack of any concern at all about the reliability of their preferred methods of looking forward and, in particular, for determining the allocation of training resources to meet the future skill needs of industry. On methodological grounds (i.e., on the grounds that they are based on modern economic theory and very large amounts of relevant data), formal forecasting methods can only be expected to be more reliable than the informal, qualitative alternatives. Three circumstances suggest themselves as possibly contributing to this situation.

Firstly, to make the connection between some perceived future state of the economy and skill needs requires a specification of the production system. Moreover, because of the inter-connectedness of the product and factor markets, the specification should be economy-wide. The MONASH model and its labour market extensions provide just such a specification. However, among the very large number of people who comprise the education and training establishment, very few have the training or experience necessary to conduct their own economy-wide modelling simulations. An important advantage of using formal modelling results to inform the allocation of training resources is that the allocation can then be rationalised in terms of the associated future state of the economy. That is, in principle at least, the sources of the future skills needs of industry can be understood intuitively by policy makers (albeit, not without effort). In practice, formal modelling techniques remain a black box to most policy makers. Because of their lack of appropriate training and experience, they are not in a position to take advantage of the transparency offered by those techniques. Given that, from their point of view, the method by which formal forecasts are determined is obscure, and given that, in common with all ways of looking forward, formal forecasts come with a considerable degree of uncertainty, it becomes politically difficult to base allocation policy on formal forecasts in other than the vaguest manner. Rather, reliance is placed on more familiar bureaucratic methods and arguments are mounted to obscure the real contribution that formal modelling can make to training policy.

Secondly, some poor manpower planning decisions made in the 1960s remain an issue of current concern for some in assessing the reliability of labour market forecasts. Thus, according to

[9] The education and training establishment can be thought of as the participants in Skills Australia's common planning framework (listed above) plus a number of government and academic research organisations such as the National Centre for Vocational Education and Training, the Centre for the Economics of Education and Training and the National Institute for Labour Studies.

Richardson and Tan, “It is a misunderstanding of how the labour market adjusts to think that there is a direct, one-to-one relation between an expansion in output, the associated increase in skills needed to produce that extra output, and a requirement for the VET system to provide those extra skills” (2008,p.9). Further, according to Skills Australia, “the idea of matching education and training to the labour market is unrealistic if it is conceived as a mechanical process of identifying skill needs and then filling them” (2010, p.18). Again, the context suggests that these admonishments are meant to apply to formal labour forecasts such as the MONASH forecasts. In fact, modern applied general equilibrium modelling, as it applies to labour market forecasting, owes nothing to those early manpower planning exercises. Its antecedents are entirely separate. The technique has been widely used to analyse the effects of a huge variety of policy changes and other changes in the economic environment. In no other context is the “mechanistic” nature of formal modelling considered to be important. It is no more mechanistic than any other technique for conducting quantitative economic analysis. An economic model is a tool to be used by the analyst to conduct an economic analysis. The responsibility for the analysis rests with the analyst and not with the model. The belief that formal forecasting is just the re-emergence of discredited manpower planning analysis in another guise is not uncommon among education and training professionals, but it is quite misguided.

Finally, and perhaps most importantly, training policy attempts to serve multiple objectives which may well be in conflict. In particular, the national strategy put forward by Skills Australia identifies six objectives including that of leading “a new partnership approach to workforce development at government, industry and enterprise level” (2010, p.8). Clearly, the common planning framework is directly related to this objective. Equally clearly, the common planning framework will not, on its own, determine the future needs of industry in any specific sense, and hence will not deliver the skills required to meet those needs. It may well be a political imperative that the interests of all the stakeholders be represented in the decision making process by which training resources are allocated. In that case, the strategy requires a mechanism whereby the common planning framework can be appropriately informed by formal forecasts so that it does deliver the skills required to meet some identifiable future industry needs. Attempts to dismiss the contribution of labour market forecasts by resort to largely polemical argumentation concerning reliability are not productive.

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Table 1. Employment Weighted Average Percentage Errors, Monash Forecasts, Australia

Forecast	LFS*	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10
158 industries	5.16	4.99	6.78	10.28	11.73	12.48	13.35	15.99	15.55
54 industries	3.40	1.99	4.05	6.56	7.28	8.35	8.91	10.58	10.56
18 industries	1.63	0.00	2.28	5.05	6.42	7.10	7.67	9.33	8.87
340 occupations	7.10	7.89	8.93	13.50	14.11	15.28	16.68	18.30	19.63
81 occupations	4.07	4.61	5.71	9.70	10.71	12.57	13.53	14.99	16.53
9 occupations	1.50	2.05	2.24	3.32	4.78	6.20	7.46	8.59	9.42

Table 2. Employment Weighted Average Percentage Errors, Monash Forecasts, 158 Industries

Forecast	LFS*	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10
New South Wales	10.72	8.60	11.02	15.17	13.99	14.70	16.01	17.33	16.36
Victoria	10.95	9.89	11.73	14.49	13.60	15.57	15.54	16.33	19.34
Queensland	11.98	11.53	13.05	16.07	20.24	21.38	21.25	24.27	23.09
South Australia	15.02	13.59	14.23	17.92	18.22	18.71	21.02	22.58	22.55
Western Australia	15.09	12.83	15.11	15.34	18.06	18.61	21.40	26.16	24.22
Tasmania	19.51	13.05	19.44	22.36	20.48	24.58	22.27	26.90	26.82
Northern Territory	23.35	21.66	29.89	35.03	40.29	41.07	38.19	37.38	41.30
Australian Capital Territory	17.92	12.37	18.16	16.76	20.96	24.34	30.80	29.08	30.68
Australia	5.16	4.99	6.78	10.28	11.73	12.48	13.35	15.99	15.55

* The LFS columns represents the difference between two alternative drawings from a normally distributed employment distribution with a mean equal to the level of employment published in the Labour Force Survey and a standard deviation equal to the associated standard error.

Table 3. Employment Weighted Average Percentage Errors, Alternative Methodologies, 158 Industries, Australia

Forecast	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10
3-year trend extrapolation	7.92	10.79	16.50	19.08	22.58	25.17	27.57	29.50
4-year trend extrapolation	7.35	9.98	14.29	16.16	19.62	21.64	26.14	27.39
5-year trend extrapolation	7.04	9.51	13.39	15.17	18.11	19.67	24.12	25.27
6-year trend extrapolation	6.98	9.27	13.08	14.73	17.15	18.39	22.36	23.31
7-year trend extrapolation	6.85	9.02	12.73	14.34	16.38	17.48	20.80	21.59
8-year trend extrapolation	6.80	8.79	12.47	13.94	15.71	16.58	19.81	20.71
9-year trend extrapolation	6.78	8.73	12.33	13.86	15.46	16.33	19.03	20.09
Hodrick-Prescott filter	3.42	3.81	3.97	2.97	3.45	3.85	4.05	2.24
MONASH	4.99	6.78	10.28	11.73	12.48	13.35	15.99	15.55

Table 4. Employment Weighted Average Percentage Errors, Monash Forecasts, 158 Industries, Australia

	Forecast Period	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
1	1997-98 to 2004-05	6.57	8.38	9.70	13.80	14.37	16.11	17.26	18.40
2	1998-99 to 2005-06	5.41	8.15	12.67	13.08	15.24	16.22	18.01	20.03
3	1999-00 to 2006-07	7.27	11.93	11.82	13.57	14.25	16.38	18.35	19.40
4	2001-02 to 2007-08	6.62	9.30	10.16	12.97	14.40	14.84	16.48	
5	2002-03 to 2008-09	6.37	7.36	9.97	11.78	12.85	14.40	17.61	
6	2002-03 to 2009-10	4.99	6.78	10.28	11.73	12.48	13.35	15.99	15.55
7	2003-04 to 2010-11	4.94	9.09	10.27	11.91	13.23	16.20	15.39	
8	2004-05 to 2011-12	8.56	9.51	11.20	12.34	15.75	15.21		
9	2005-06 to 2012-13	6.35	7.38	8.34	12.38	12.88			
10	2006-07 to 2013-14	4.92	6.56	10.22	10.89				
11	2007-08 to 2014-15	5.69	10.47	10.19					
12	2008-09 to 2015-16	9.87	11.14						
13	2009-10 to 2016-17	6.06							

Table 5. Employment Weighted Average Percentage Errors, 7 Levels of Educational Attainment, Occupation Based Forecasts, Australia

	Forecast Period	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
1	2002-03 to 2009-10	3.70	4.36	4.77	4.82	4.74	4.86	5.97	7.08
2	2003-04 to 2009-10		1.99	2.18	2.25	2.14	4.51	5.47	7.22
3	2004-05 to 2009-10			0.44	0.47	0.43	2.51	3.47	5.21
4	2005-06 to 2009-10				0.08	0.08	2.32	3.28	5.02
5	2006-07 to 2009-10					0.13	2.25	3.21	4.95
6	2007-08 to 2009-10						2.37	3.33	5.08
7	2008-09 to 2009-10							1.75	2.70
8	2009-10								2.31

Table 6. Employment Weighted Average Percentage Errors, 7 Levels of Educational Attainment, Industry Based Forecasts, Australia

	Forecast Period	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
1	2002-03 to 2009-10	3.64	4.52	5.09	5.42	5.48	6.42	8.23	9.87
2	2003-04 to 2009-10		2.38	3.37	3.77	3.76	6.49	7.99	10.09
3	2004-05 to 2009-10			1.33	1.69	1.59	4.11	5.78	7.71
4	2005-06 to 2009-10				0.42	0.40	3.11	4.64	6.71
5	2006-07 to 2009-10					0.27	2.71	4.22	6.31
6	2007-08 to 2009-10						2.72	4.24	6.32
7	2008-09 to 2009-10							2.40	3.71
8	2009-10								2.09

Table 7. Employment Weighted Average Percentage Errors, 71 Major Fields of Study, Occupation Based Forecasts, Australia

	Forecast Period	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
1	2002-03 to 2009-10	5.64	7.11	7.81	7.85	7.81	8.21	9.31	8.78
2	2003-04 to 2009-10		5.48	5.84	5.96	5.91	6.27	7.63	7.74
3	2004-05 to 2009-10			1.18	1.22	1.14	1.64	2.98	3.75
4	2005-06 to 2009-10				0.15	0.19	0.98	2.53	3.94
5	2006-07 to 2009-10					0.21	0.94	2.48	3.87
6	2007-08 to 2009-10						1.04	2.61	3.97
7	2008-09 to 2009-10							1.79	3.26
8	2009-10								2.66

Table 8. Employment Weighted Average Percentage Errors, 71 Major Fields of Study, Industry Based Forecasts, Australia

	Forecast Period	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
1	2002-03 to 2009-10	5.69	7.36	8.29	8.82	8.86	9.78	11.24	11.34
2	2003-04 to 2009-10		5.74	6.90	7.17	6.98	7.61	9.41	10.38
3	2004-05 to 2009-10			1.72	2.17	2.22	3.28	5.20	6.36
4	2005-06 to 2009-10				0.79	0.94	2.14	4.03	5.49
5	2006-07 to 2009-10					0.61	1.72	3.65	5.24
6	2007-08 to 2009-10						1.50	3.61	5.20
7	2008-09 to 2009-10							2.29	4.33
8	2009-10								2.62

Table 9. Structural pressure on specialised occupations

	Specialised Occupations	Other Occupations
High	6	30
Medium-high	24	16
Medium	1	21
Medium-low	21	24
Low	47	9
All occupations	100	100