THE NAIRU IN THE TREASURY MACROECONOMIC (TRYM) MODEL OF THE AUSTRALIAN ECONOMY:

DEFINITION, MEASUREMENT AND POLICY IMPLICATIONS

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Peter Downes

Gavin Stacey

Modelling Section

Commonwealth Treasury

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1. INTRODUCTION

This paper outlines the approach to the labour market and the NAIRU used in the TRYM model, the measurement of the NAIRU and its implications for macroeconomic outcomes and policies to reduce unemployment.

The TRYM model is a small macroeconomic model developed by the Australian Treasury for policy and sensitivity analysis and to produce projections which are one input into the Department's forecasting process. The model has a core of key macroeconomic relationships that are estimated using quarterly time series data. The estimated equations are linked together by a larger number of accounting identities. The model could be described as broadly new Keynesian in its dynamic structure but with an equilibrating long run. Activity is demand determined in the short run but supply determined in the long run. There are 25 estimated equations, 3 financial market identities, 2 default response functions for monetary and fiscal policy and about 20 behavioural identities with 60 accounting identities linking these key behavioural relationships. In constructing TRYM, effort has been directed towards ensuring consistency between and within sectors, with 16 of the model's 25 behavioural equations being jointly estimated with other equations. Care has also been taken to identify separate demand and supply curves where possible. Most equations are estimated with either error correction or partial adjustment specifications with an identifiable long run. This allows the construction of a steady-state representation of the model's equations. The steady-state version of the model is simulated to provide model consistent future values for forward looking variables such as the exchange rate. Details of the model are contained in Commonwealth Treasury (1996a) "Documentation of the TRYM Model" and (1996b) "The Macroeconomics of the TRYM Model".

Section 2 of the paper outlines the approach to the labour market taken in TRYM particularly the Beveridge Curve and the wage equation. The approach taken in TRYM yields two different definitions of equilibrium unemployment and allows disaggregation of changes in the NAIRU at a very broad level. Broadly speaking, the specification in TRYM yields the conclusion that the NAIRU has increased from around 2 per cent in the 1960s to between 4 and 5 per cent in the early 1970s and around 7 per cent in the 1980s and 1990s. The outward shift appears to have been due to a combination of reduced search effectiveness of the unemployed and an outward shift due to wage bargaining factors. However, as TRYM is an aggregative model these conclusions should be treated with caution. The model does not contain the detail to allow a comprehensive analysis of the causes of the increase. *Section 2.2* discusses long-run versus short-run NAIRUs, the latter more specifically relating to non accelerating inflation paths (NIPS) for unemployment, that can be derived from the model's wage equation.

Section 3 discusses the uncertainty that surrounds the TRYM measure of the NAIRU and briefly compares it to measures coming out of other models of the Australian economy. Reasonably well defined time series data on unfilled job vacancies seem to provide a relatively reliable guide to movements in the search effectiveness of the unemployed over time, although problems in the linkage of various data sources over time introduces a note of caution. The greatest uncertainty comes from accurately discerning the role of various factors in determining wage movements in Australia's highly institutionalised wage setting environment. The uncertainty surrounding the NAIRU measure appears to have increased over recent years.

Section 4 briefly discusses various policies to reduce unemployment at a very broad level, although the model has little to say on some of these points due to its aggregative nature. A parallel is drawn between active labour market programs and expansionary fiscal policy. Active labour market policies that had little effect on the search effectiveness of the unemployed would have no greater

employment effects than other forms of fiscal expansion in the model (the model confirms the normal Mundell Fleming result for fiscal policy in a small open economy with free capital flows). However, if active labour market programs in combination with reforms to the unemployment benefit system increased the search effectiveness of the unemployed this would have a twofold effect in the model. Business employment would directly increase as vacancies fell for any given level of unemployment, and would further increase as the NAIRU and wage pressures decreased. Large reductions in real wages are not required in the model to reduce unemployment. The logic behind this result conforms closely to the Layard, Nickell and Jackman (1991) description (p.384) that changing wage pressures have very little impact on real wages in the medium run, but rather only lead to effects on unemployment once the capital stock has adjusted. The model result is demonstrated by artificially lowering the NAIRU and simulating the model.

Section 5 uses the results from the NAIRU shock to discuss the linkage between labour market imbalances with other macroeconomic outcomes, such as the fiscal deficit, national saving and investment and the CAD. These linkages are similar to those described in a theoretical model by Bean (1990). In the short term investment rises as the capital stock adjusts to the higher level of employment and activity. However, saving also rises so that there is little deterioration in the CAD in the short term and a marked improvement in the medium term. The reduction in the NAIRU leads to substantial improvements in per capita living standards as the proportion of the population in employment rises without significant reductions in average wages. The tax base also increases spreading the tax burden of public expenditures more widely across the population at the same time as benefit outlays are falling.

2. EQUILIBRIUM UNEMPLOYMENT CONCEPTS IN TRYM

The following section describes the labour market structure specified in TRYM, presents the two concepts of equilibrium unemployment that can be derived from the model, and briefly describes the rationale for the particular labour market specifications chosen.

2.1 Structural Concepts

2.1.1 The Labour Market in TRYM

Empirical and Theoretical Background

High real wages in the face of continuing high unemployment from the second half of the 1970s onwards led to renewed interest internationally in the determinants of unemployment and wage formation. The research into the reasons for the increase in unemployment appears to be divided into two broad streams:

- *Wage setting / price setting explanations* - wage setting explanations include the efficiency wage theory (and variants thereof), the insider or membership theory, and wage bargaining models tied to increases in union power or the reservation wage.[1] Tied in with factors that effect price setting behaviour (such as the slow down in productivity growth in the early seventies or changes in the tax wedge), these theories suggest reasons why the labour market equilibrium[2] may not be a market clearing equilibrium (eg the point where unfilled vacancies equal unemployment on the Beveridge curve[3]) and why that equilibrium might have shifted over time.

- *Search effectiveness theories*. There are a number of factors that might lead to reductions in the effectiveness of the unemployed in filling available jobs and hence explain the rise in unemployment. Increases in long-term unemployment may lead to deterioration of skill levels or morale problems which reduce search intensity. Structural change (particularly in the face of relative wage rigidities) can increase the mismatch between the skills of the unemployed and available jobs. Increases in welfare benefits can reduce the incentive to seek employment. In all cases unfilled vacancies should rise for a given unemployment rate. The unemployed would be less search effective and the unemployment rate would be higher at the point where the market clears.

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[1] See, for example, Stiglitz and Shapiro "Equilibrium Unemployment as a Worker Discipline Device", Yellen "Efficiency Wage Models of Unemployment" and Blanchard and Summers "Hysteresis in Unemployment" collected in Mankiw and Romer (1991).

[2] Equilibrium here refers to the point where the wage setting and price setting curves intersect. There are also explanations for persistence on the price setting side, with the price-setting curve shifting relative to the wage-setting curve because of for example: the slow down in productivity growth in the early 1970s; and changes in the wedge between consumer and producer prices due to the oil price shocks or changes in the tax wedge. Price setting behaviour may also have changed due to such diverse factors as changes in industry exit costs due to employment protection legislation, changes in the regulatory environment, and changes in international competition (trade share).

[3] This is a working definition and is really only true from a matching point of view if the probability of an employer filling a vacancy is equal to the probability of an unemployed person finding a job. Vacancies are sometimes filled by persons already in employment or directly from not in the labour force, while the unemployed flow to not in the labour force as well as to employment. Ignoring these other flows s/V would equal s/U in equilibrium - where s is employment turnover.

Some theories embody the idea that the equilibrium unemployment rate depends on the history of the actual unemployment rate and either takes a long time to return to equilibrium (persistence) or has no unique equilibrium. This phenomenon where there is no unique equilibrium is usually labelled 'hysteresis'. There are explanations for unemployment persistence from both the wage setting and search effectiveness points of view.

- On the search effectiveness side, a common argument is that higher unemployment leads to higher levels of long-term unemployment. Higher long-term unemployment leads to deterioration in skill levels and possible morale problems which reduce search intensity. The loss of human capital and reduction in search effectiveness associated with long periods of unemployment will lessen the potential competition from the unemployed leading to higher wage pressures at a given rate of unemployment. Thus, the equilibrium rate of unemployment increases.

- On the wages setting side, the insider-outsider or membership theory of Gregory (1985), Blanchard and Summers (1986) and Lindbeck and Snower (1986) provides a reason why unemployment may be path dependent. The essential idea here is that the number of insiders will fall during a recession. As only insiders participate in the wage bargaining process (the welfare of the unemployed does not enter the equation), insiders will bid up wages as the economy comes out of recession and before unemployment falls back to its original levels. Unemployment will tend to ratchet up after each recession. (Necessary adjustments to the capital stock can amplify this process - see Bean (1990). In its extreme form, the insider theory leads to the conclusion that there is no unique equilibrium rate of unemployment even in the long term.)

However, these theories are not mutually exclusive. It seems likely that the behaviour of unemployment is due to a range of factors both on the wage bargaining, price-setting side and the search effectiveness side.

Wage Bargaining

The theories on the wage bargaining side are particularly diverse. Originally these tended to be a little ad hoc. However, more recent developments have used micro foundations to explain wage determination. The focus of this research has been centred around four possible mechanisms for wage determination (summarised in Layard and Nickell, 1985). The first group of models allow real wages to be determined by supply and demand - ie by impersonal forces. The second group of models involve firms setting wages. Many of these models are summarised in Johnson and Layard (1984). Efficiency wage models are one type of such models. These models have the property that an increase in the wage paid generates a benefit to the firm, which partially offsets the direct cost. For example, increasing wages relative to external wages raises employees' work effort[4].

The third and fourth groups of models are union and bargaining models. The bargaining type of model forms the basis of the influential analysis by Layard and Nickell (1986). They argue that all four mechanisms may be used in various sectors of the economy, so it is important that a wage equation be sufficiently general to encompass all these forms of behaviour. The most general form of the wage equation is generated by the bargaining type of model, and so is the one concentrated on in their work. Layard and Nickell develop a three equation model for determining wages, prices and employment, emphasising the role of 'push' variables, including tax wedges, real import prices and mismatch between unemployment and vacancies. For given values of such variables there is a unique level of equilibrium

[4] See, Stiglitz and Shapiro "Equilibrium Unemployment as a Worker Discipline Device" collected in Mankiw and Romer (1991).

unemployment, the NAIRU, which leads bargainers to settle for a real wage which is consistent with that which firms are willing to accept in their pricing behaviour.

Empirical Literature

The specification of the wage equation has important implications for the overall properties of econometric models. The wage equation in most macroeconomic models is an important link in the resolution of the overall association between changes in unemployment and inflation, and therefore between the demand and supply sides of the model. Consequently, a vast empirical literature has evolved trying to effectively model the wage determination process.

Labour Market Pressures

A major concern with wage equations for the Australian economy has been to achieve adequate modelling of labour market pressures. A common feature of wage equations has been the inclusion of a term related to the level of unemployment. The unemployment rate is included by invoking the Phillip's curve, efficiency wage models or bargaining models of wages. The higher the level of the unemployment rate, the weaker will be the bargaining position of employees and the lower the level of wage increases.

The expectations-augmented Phillip's curve has been the dominant approach to modelling wage determination in Australian empirical literature. This may be partly due to the convenience of estimating the long-run equilibrium rate of unemployment directly from the equation. In a macro modelling context it is quite useful to tie down the steady state with an estimated NAIRU.[5]

Persistence effects have been investigated by including the effects of changing labour market conditions as well as the unemployment level in the equation. Simes and Richardson (1987) adopt this methodology in examining whether a stable expectations-augmented Phillip's curve existed in Australia. They use a modified expectations-augmented Phillip's curve specification which incorporates variables related to both the level and the change in unemployment for labour market pressure. Their results suggest that wages were influenced by the level of unemployment, as well as, the reaction of those in secure employment to changing labour market conditions, in their case the level of overtime (related to change in the unemployment rate).

However, the adoption of the expectations-augmented Phillip's curve approach has been questioned by some commentators. Grubb (1986) provides evidence against the expectations-augmented Phillip's curve vertical long-run restriction for many OECD countries including Australia while Hughes (1985) observes that "perhaps this formulation of wage theory has been imported too readily into Australia". Gregory and Smith (1983) argue that those in secure employment are sensitive to changes in, rather than levels of, labour market conditions. While Watts and Mitchell (1990) employ a wage equation using the change in capacity utilisation as its labour market pressure variable and conclude that "there is not a steady-state or natural rate of unemployment". Accordingly, they argue against the "conventional Phillips curve relating inflation and unemployment."

Layard and Nickell Framework

Wallis (1992) examines the econometric implementation of wage equations developed within the Layard-Nickell framework for Australia. He notes that it is of interest to an Australian audience that Nickell (1988) adds income policy to the list of wage-pressure effects that might be investigated in the

[5] cf Nickell, 1988, P 216.

Layard-Nickell framework. However, he adds that Nickell then observes that "appropriate data may not be available and the relationship between the available data and the true wage pressure variables is likely to be weak. As a consequence, the wage equation lacks robustness because trends and dummies have to be used to cope with these problems."

Wallis also raises the question of how appropriate the Layard-Nickell bargaining model is in an Australian context. He argues that "as for the wage determination process itself, neither the empirical results nor institutional knowledge support the basic bargaining model....". He continues that "Australian negotiations have clearly gone beyond the wage, to include such matters as taxation and investment incentives during the life of the Prices and Incomes Accord, and unions encroach on the firm's 'right to manage' whenever large scale redundancies are planned. Equally clearly negotiations have involved another party, namely government.....Theoretical bargaining models are not yet sufficiently developed that they can provide good guidance to empirical research in this context...".

Approach in TRYM

It is reasonably clear from observing the history of wage setting in Australia that institutional factors have played a large role. This makes modelling wage behaviour a difficult exercise. It is also clear from the brief discussion above that it is difficult to distinguish between alternative theories of wage behaviour from the aggregate data. As Nickell (1988) and Bean (1990) point out, aggregate wage behaviour is likely to reflect a mix of factors, some of which may be more important in some sectors than others. Given the aim of parsimony in modelling the labour market in TRYM, it is not possible to introduce the detailed disaggregated data required to distinguish between the different theories (although the inclusion of the change in unemployment term, discussed later, is suggestive of insider/outsider effects being present in the data to some extent).

However, it does appear to be possible to distinguish between search effectiveness and wage setting explanations of the increase in unemployment at a very broad level by the use of unfilled vacancy data. Any decrease in the search effectiveness of the unemployed (for whatever reason) should lead to an increase in unfilled vacancies for a given level of unemployment. The unemployment/vacancy relationship thus represents a powerful summary indicator of the state of the labour market, and there has been something of a resurgence in interest in this relationship over recent years. Some have attempted to examine the Beveridge curve in combination with the Phillip's curve to identify the sources of unemployment shocks. Blanchard (1988) for example, does this for the US, UK and Germany and concludes that labour market efficiency and mismatch problems (ie a reduction in search effectiveness) explain most of the rise in unemployment in the US and the UK but not in Germany. Attempts within Treasury to replicate the Blanchard approach for Australia appear to indicate that only a part of the increase in unemployment can be explained by search effectiveness factors.[6] This is consistent with earlier work by Trivedi and Baker (1985) and Matthews (1991).

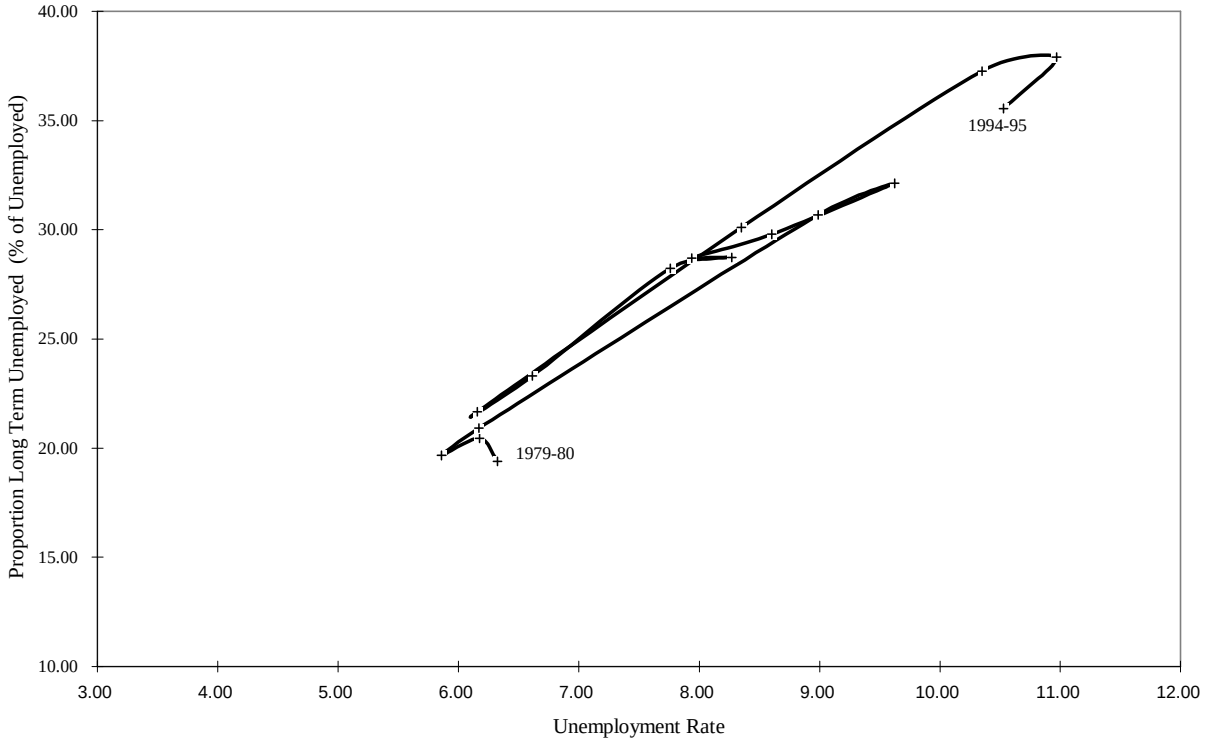
Given the interest in search effectiveness factors (such as the increase in long-term unemployment), a Beveridge curve is estimated to introduce a simple summary measure of search effectiveness into the TRYM wage equation. However, no attempt is made to comprehensively model in TRYM the unemployment/vacancy relationship. For example, it has become popular following the work of Jackman, Layard and Pissarides (1983) and Blanchard and Diamond (1989) to use labour market flows data to estimate an equilibrium unemployment/vacancy relationship. The lack of gross flows data in TRYM and other relevant factors (such as immigration occupational or industry mismatch data, unemployment duration or other factors that researchers have found to be relevant to the relationship) means that it is not possible to identify the cause of shifts within the context of the variables used in

[6] The application of the technique is limited by the quality of the Australian labour market flows data.

TRYM. A fairly simple formulation is therefore adopted for modelling purposes and the results of this should be interpreted with caution.

The choice of a Beveridge curve for estimating the level of search effectiveness and shifts in structural unemployment was partly based on the desire for parsimony in the overall model design. The vacancies data, for example, helps to identify the labour demand equation and also enters into the hours worked equation. A recent trend in macro-economic modelling has been to use unemployment duration data to separate out the short-term unemployed and enter this into the wage equation, on the basis that the long-term unemployed have effectively separated from the labour market (eg Beaumont, Dennis and Ng (1995)). This approach was considered for TRYM but rejected on the ground that most models of long-term unemployment in Australia find that the lagged aggregate unemployment rate itself is the best predictor of long-term unemployment (eg Chapman, Junanker and Kapukinski (1993) show that 93% of the variation in male long-term unemployment is accounted for by the third lag of the unemployment rate.)[7] As unemployment rises the proportion who are long-term unemployed also rises, but with a lag. (It takes twelve months for the newly unemployed to become long-term unemployed.) The relatively stable relationship between the lagged unemployment rate and the level of long-term unemployment in Australia is exemplified by the chart below which shows the relationship between the proportion of the unemployed who are long-term unemployed and the unemployment rate in the previous financial year.

Figure 1: Proportion Long-Term Unemployed against Unemployment Rate in Previous Year



It was not clear therefore that introducing unemployment duration data into the model would add very much in terms of explanatory power in the wage equation. Moreover, while changes in long-term unemployment clearly contribute to changes in search effectiveness (see for example Fahrer and Pease (1993) and Hughes (1987)) there is a large range of other factors that impinge on search

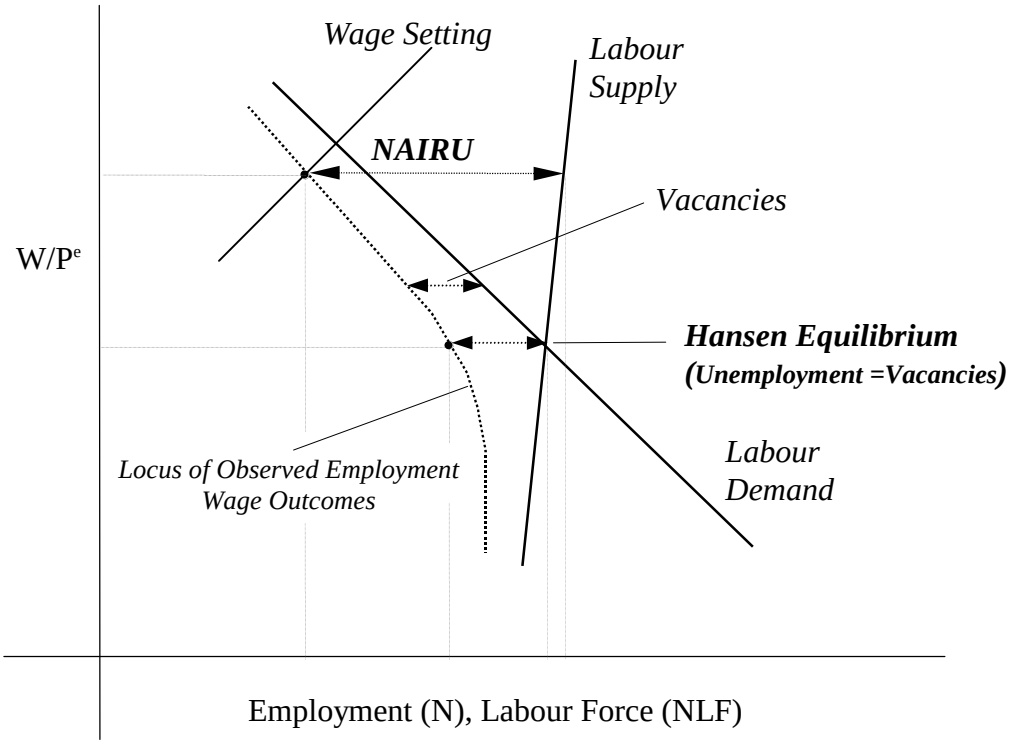
[7] See also Committee on Employment Opportunities (1993), Background Paper 2A "Long-Term Unemployment Projections".

effectiveness. Therefore, as mentioned above, to capture search effectiveness in a comprehensive way an unemployment vacancy relationship is estimated. The effects of changes in long-term unemployment on search effectiveness should be captured by movements in this relationship. Estimates of search effectiveness are then introduced into the wage equation. While the reasons for shifts in search effectiveness are not explained (endogenised), where a shift in the relationship is established by more detailed study it can be imposed on the model. The use of vacancy data thus limits the number of additional variables that need to be endogenised, as well as being very useful in properly identifying employment demand and in explaining movements in average hours worked.

Overall Structure

The overall structure of the labour market adopted in TRYM can be represented by the diagram below:

Figure 2: Stylised Representation of the Labour Market in TRYM



The model's labour market consists of an upward sloping labour supply curve (relatively invariant to the real wage (W/P^e); a downward sloping labour demand curve and an upward sloping wage setting curve. The horizontal distance between the labour demand curve and the locus of observed employment/wage outcomes measures unfilled vacancies. The horizontal distance between the labour supply curve and the locus of observed employment/wage outcomes measures the unemployment rate. The depiction above is based on Hansen's (1970) structure, but with the addition of a wage setting schedule separate from labour supply.[8]

As can be seen, Figure 2 presents two possible equilibrium unemployment points. The first is the NAIRU which is determined by the point where the wage setting schedule crosses the employment demand curve adjusted for unfilled job vacancies. The second is the point where the number of unfilled vacancies equals the number of unemployed.[9] In the unemployed were perfectly effective in filling vacancies, this would be the point where wages would clear the labour market - labour demand would

[8] Given that in TRYM, firms set prices while workers bargain over the nominal wage, the labour demand curve above could be replaced with a price setting curve a la Layard Nickell and Jackman (1991) (sometimes referred to as a labour demand correspondence curve). The slope of the labour demand curve in Figure 1 reflects the short to medium term elasticity of substitution (partial derivative of employment with respect to wages - capital and output fixed). However, as the firm also makes decisions about output, and investment the total differential yields a flatter labour demand correspondence or price setting curve. This would be virtually horizontal in the medium to long term (no capital constraints). That is, workers can only bid up the real wage in the short term in TRYM. In the medium to long term wages are largely determined by technology. Thus, analysis using TRYM leads to similar conclusions as that derived from the Layard Nickell and Jackman imperfect competition wage bargaining framework.

[9] See footnote 3.

equal labour supply and unemployment would fall to zero. However, in practice, unemployment can never fall to zero. As a result, this equilibrium point provides a summary measure of frictional, mismatch and motivational factors which determine the search effectiveness of the unemployed. It is referred to below as the Hansen equilibrium unemployment rate or Hansen's equilibrium.

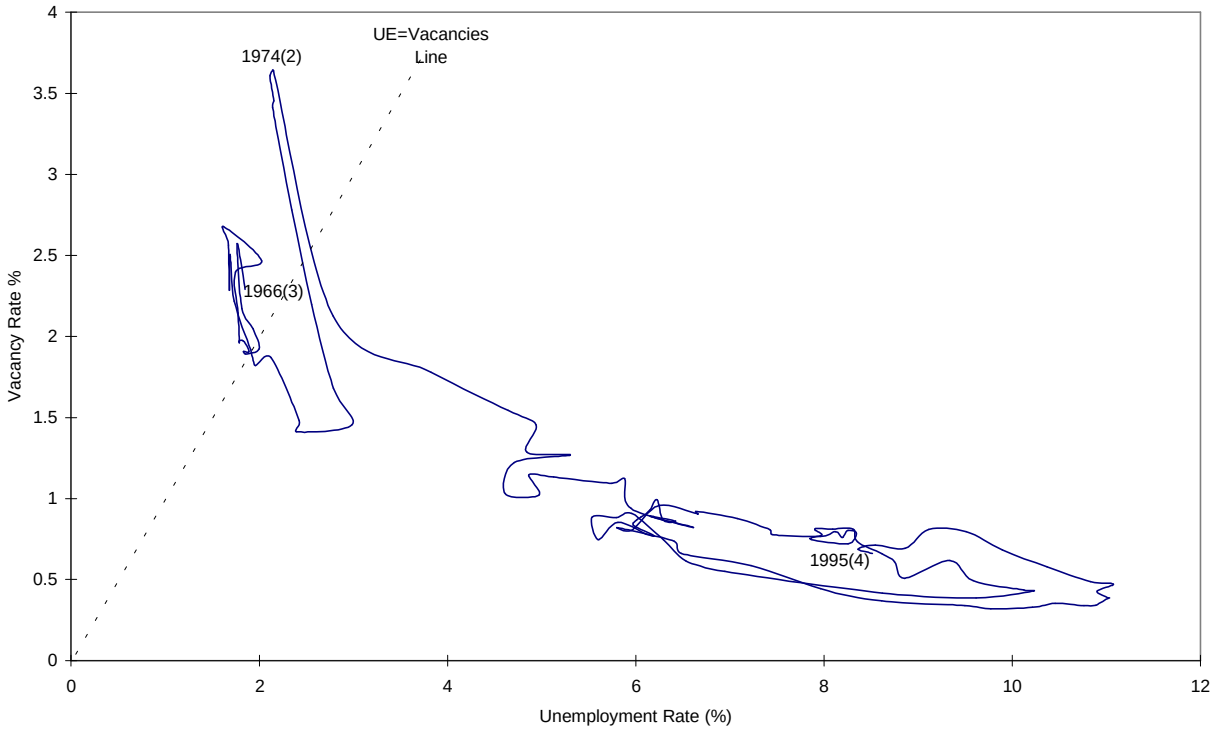
In implementing the above structure, the wage setting schedule is assumed to be a function of unemployment adjusted for search effectiveness (ie will shift with changes in the unemployment/vacancy relationship). In this framework, any increase in unfilled vacancies for a given level of unemployment (ie reduction in the search effectiveness of the unemployed) will lead to an increase in the NAIRU and shift the wage setting curve in Figure 2 to the left. That is, the Phillips curve will shift with the search effectiveness adjustment to unemployment. However, the wage setting curve can also shift independently of any shift in search effectiveness due to wage bargaining or insider-outsider factors discussed above. The wage setting parameter thus captures the effect on the NAIRU of factors associated with the wage bargaining process. For example, it may reflect insider/outsider factors in combination with institutional features of the wage bargaining system.

2.1.2 Beveridge Curve - Hansen's Equilibrium

Traditionally, unemployment has been decomposed into frictional, structural and cyclical components. The gradual rise in the unemployment rate, in association with the increase in long-term unemployment, suggests that frictional and/or structural unemployment has increased over time. That is, due to factors such as skills atrophy, diminishing job search skills, low morale and false signals that long unemployment duration may send to employers, the unemployment rate may not be exerting the same influence on wages that has occurred in the past. In other words, there may have been an outward movement in the unemployment/vacancy (U/V) relationship or Beveridge curve.

Hansen (1970) provided the most widely used justification for the existence of the inverse relationship between the unemployment rate and the vacancy rate. According to Hansen, the convex shape of the Beveridge curve (see Figure 3 below) is caused by the effect that excess supply or excess demand for labour has on the matching of the unemployed to vacancies. He assumes that there are always, in a given short period, some employers who do not succeed in finding sufficient labour to satisfy their demands completely, even though total supply exceeds total demand. Furthermore, there will always be some members of the labour force who do not succeed in getting a job even though there is more than a sufficient number of jobs to employ the total supply. In terms of ordinary demand and supply theory, this means that actual employment is never on the supply or demand curves.

Figure 3: Australian Beveridge Curve 1966(3) to 1995(4)



The TRYM approach to estimating the Beveridge curve is based around a dynamic error correction specification, including a logistical function to help capture the structural shift in the Beveridge curve thought to have occurred in the early 1970s. The logistical function is an S shaped curve which acts as a structural break 'dummy' variable where the data determines the size and timing of any shift in the relationship. The inflection point of the function, or timing of the break, is captured by the c_3 parameter, which is estimated rather than imposed. Similarly, c_2 reflects the size of the shift while c_4 determines the slope of the function (whether the shift is sudden or gradual). The function indicates a significant outward movement in 1974 in the unemployment/vacancy relationship (reduction in search effectiveness). Tests for a structural break in the 1980s and early 1990s were unsuccessful.

The estimated Beveridge curve equation is:

$$\Delta \ln(RNU) = -a_1 \times \Delta \ln\left(\frac{NVA}{NLF}\right) + a_2 \times \Delta LGF + a_0 \times \left\{\ln\left(RNU(-1)\right) - \left[c_0 + LGF(-1) + c_1 \times \ln\left(\frac{NVA(-1)}{NLF(-1)}\right)\right]\right\}$$

Logistical Function: $LGF = c_2 / \left[1 + \exp\left(QTIME + c_3\right) / c_4\right]$

Results

Sample: 1967(3) to 1995(4)

Parameter	Interpretation	Estimate	t-Statistic
a_0	error correction	0.162	4.25
a_1	change in vacancy rate	0.225	4.96
a_2	change in LGF	2.481	2.58
c_0	constant	1.307	12.13
c_1	vacancy rate	0.778	7.11
c_2	LGF parameter	0.389	2.58
c_3	LGF parameter	15.27	255.36
c_4	LGF parameter	0.205	4.64

Diagnostic Statistics

$R^2 = 0.59$	
SE = 4.92%	
DW = 2.20	
Box-Pierce Q (1-8th order auto correlation)	9.89
Jarque-Bera Test for Normality	76.54* #
Chow Test for Parameter Stability	0.18
Ramsey's Reset Test	0.94
Breusch-Pagan Heteroscedasticity Tests:	
Trend	8.09* ##
Y-Hat	0.001
Joint	8.32* ##

* Indicates the test has failed at the 5% confidence level.

\# The failure of the test at the 5% confidence level was thought to be attributable to a number of outliers in the residuals in the first half of the sample period.

Inspection of the vacancy data revealed greater volatility in the period prior to 1980. The failure of the test at the 5% confidence level may therefore be data related. The vacancy data used were from the ABS spliced vacancy series (see data base documentation for the TRYM model).

Figure 4 shows the Hansen equilibrium unemployment rate (RNUST) derived from the equation (including unexplained movements). The relationship indicates a significant increase in this measure in the mid seventies (reduction in search effectiveness). The figure indicates that reductions in search effectiveness have increased the unemployment rate by around half of a percentage point over the past twenty five years (although this estimate should be interpreted with caution). This compares with estimates of the NAIRU for Australia (discussed later) which have risen by around 2 percentage points. Hence, it seems likely that other factors associated with the wage setting process are also at work. This view is consistent with the findings of Trivedi and Baker (1985) who argue that the NAIRU has risen in Australia because of wage bargaining factors rather than search effectiveness factors. The distinction between the Beveridge curve and the wage setting curve is also outlined in the OECD Employment Outlook (1993) and in many other recent analyses of the labour market including Layard, Nickell and Jackman (1991).

Figure 4: Hansen Equilibrium Unemployment Rate (RNUST)

The result above in terms of the shift in the relationship are similar to those found in other Australian studies. The most recent and comprehensive empirical study is that by Fahrer and Pease (1993) of the Reserve Bank of Australia.[10] Fahrer and Pease ran two models. The first was a simple model similar to the equation above. The second attempted to distinguish between cyclical changes and equilibrium movements in the unemployment vacancy relationship using the methodology set out in Layard Nickell and Jackman (1991) and employing ABS gross flows data to identify flows to and from unemployment. In neither case did they find any large outward movement in the relationship in the 1980s and early 1990s. With the simple model (which they ran with both linked ABS vacancy series and an alternative series based on CES vacancies data) they found no outward shift in the 1980s, but a significant outward shift in the mid seventies. In the second model, they found an outward shift in the equilibrium relationship around 1983-84 of about half a percentage point, but this was unwound in the late 1980s early 1990s (as long-term unemployment fell).

The outward shift in the relationship in the mid seventies coincided with a number of changes in the Australian labour market. These included:

- changes to the unemployment benefit system (increases in the unemployment benefit replacement ratio, changes to eligibility requirements and relaxation of the work test);
- reductions in the overall level of immigration following the high levels of the sixties and early seventies, (previously migrants had been directed towards areas of labour shortage);
- the equal pay decision in 1973 which led to a marked increase in female wage relativities;
- increases in youth wage relativities at around the same time; and

[10]Other empirical studies of the Australian relationship such as in Trivedi and Baker (1985), Hughes (1987) and Matthews (1991) have been virtually unanimous in finding a significant structural break in the mid seventies but no significant outward movement in the 1980s. The empirical studies all use the linked vacancy series.

- changes in the duration structure of unemployment (due to factors other than the changes to the unemployment benefits system mentioned above).

Of the above factors, the only variable tested in the estimation of the TRYM equation was the unemployment benefit replacement rate. This was not found to be significant.[11] However, it seems likely that the combined effect of changes to the benefit rate and the other changes to the unemployment benefit system (changes in eligibility requirements and relaxation of the work test) would have made the unemployed more selective in their job search and reduced motivation and search effectiveness. Unfortunately, the model does not contain the detail to quantify the effect of these other factors. Nor does it have the detail to test the role of changes in immigration levels and the relative wage structure on mismatch unemployment.

On the last dot point, the relatively stable relationship between unemployment and long term unemployment (see Figure 1) tends to suggest that the movements in long-term unemployment since the late seventies have been endogenous rather than exogenous. The effect of any such systematic variation in long-term unemployment should already be largely captured in the dynamic structure of the equations parameters (eg the parameters that determine the degree of non linearity in the relationship). As noted above, while there appears to be a significant structural break in the unemployment/vacancies relationship in the mid 1970s, we could not find evidence of a further structural break in the 1980s.

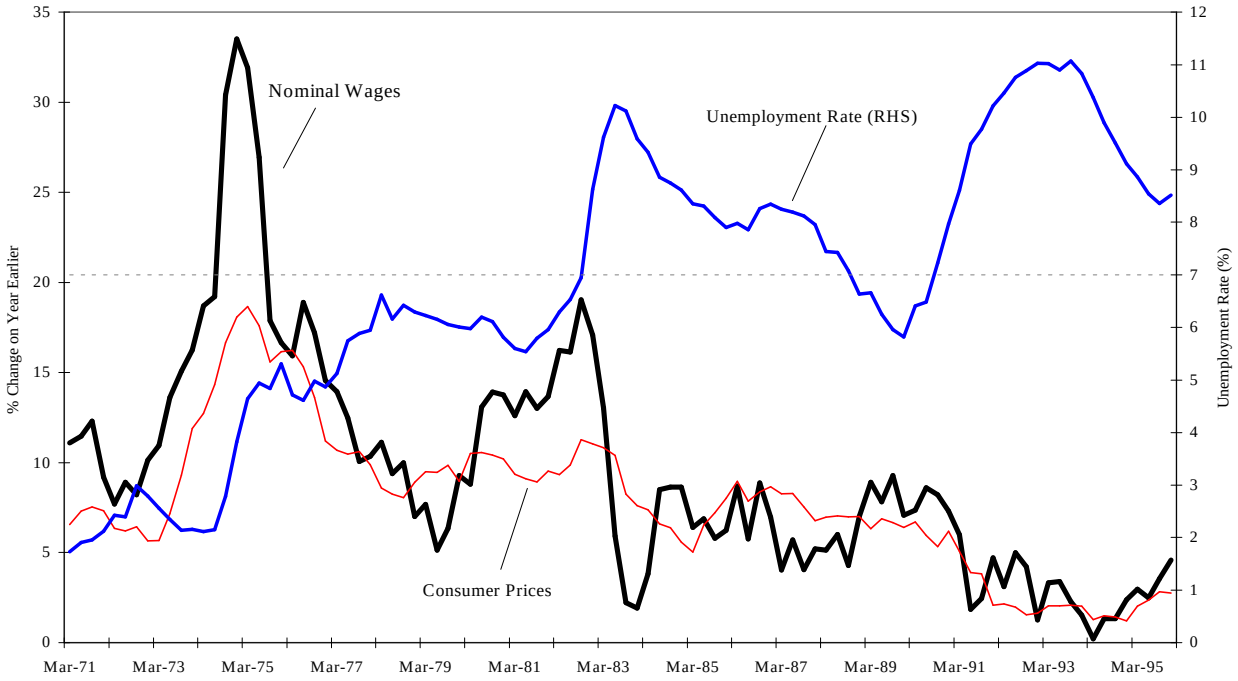
2.1.3 Wage Equation - NAIRU

Wage Data and Institutional Context

Figure 5 below depicts the evolution of the unemployment rate, and wage and price inflation in Australia over the past twenty five years. One of the characteristics of the period has been the development of persistently high levels of unemployment following the apparent increase in the NAIRU in the 1970s. Broadly speaking the period can be divided into two. The period of accelerating wage inflation in the 1970s and early 1980s when the unemployment rate was lower than 7 per cent, and the period of disinflation in the mid to late 1980s and 1990s when unemployment has generally been higher than 7 per cent.

[11] Perhaps this is not too surprising given that a change in the UB replacement ratio will have opposing income and substitution effects on job search activity. Changes in unemployment benefits will also have effects on the reservation wage separate to those on search effectiveness, and in a full model context any rise in unemployment and increase in benefits will necessarily be funded by an increase in tax rates increasing the tax wedge and lowering the price setting curve. That is in a full model context the effects of unemployment benefits on unemployment may be much greater than they appear to be from studying individual relationships. However, the unemployment benefit replacement ratio did not appear to be significant when tested in the wage equation and consequently is not included in that relationship. Nor does the wage equation include an income tax variable. This limits what the model can say about the effect of benefit rates on unemployment.

Figure 5: Wage and Price Inflation and Unemployment



Unfortunately, (from the point of view of estimating the effect of unemployment on wage inflation) these distinct periods have also been characterised by changed wage-setting arrangements. The two periods of rapid wage inflation in 1974-75 and 1981-82 were both characterised by movements to collective bargaining but within the context of a centralised system where the Conciliation and Arbitration Commission (now the Industrial Relations Commission) registered collective agreements from leading sectors and passed them on to other workers on the basis of "comparative wage justice". The period between these two inflationary episodes was one of centralised wage indexation which tended to maintain the increases in the real wage which occurred in 1974-75. Following the second round of wage inflation in 1981-82, there was a move back to centralised wage fixing, first with the "wage freeze" in 1982-83 and then with the Price and Incomes Accord (Marks 1 to 8) from late 1983 to early 1996. However, within the centralised framework there was increasing scope for decentralised bargains first under the "two-tier" wage structure of the late eighties which encouraged bargaining over productivity and award conditions, and then in the early nineties with the increasing encouragement of and moves towards enterprise bargaining, particularly with the introduction of the Industrial Relations Reform Act in 1994.

An impression of the scope and timing of the changes to the wage setting system can be gained from the percentage contribution of national wage increases to the total increases in the minimum wage rates (Table 1). These figures werer used as a guide for the dummy variable QCC which attempts to capture the effect of changes in institutional arrangement in the TRYM wage equation.

Table 1. Percentage Contribution of National Wage Increases to the Total Increase in the Weighted Average Minimum Wage Rate, Males

Year	%	Year	%
1967/68	39.5	1980/81	87.0
1968/69	41.4	1981/82	34.0
1969/70	52.6	1982/83	wage freeze
1970/71	50.9	1983/84	93.0
1971/72	28.2-	1984/85	93.0
1972/73	37.7	1985/86	95.0
1973/74	19.1	1986/87	95.0
1974/75	21.2	1987/88	47.0 + 2nd tier
1975/76	88.5	1988/89	73.0
1976/77	98.5	1989/90	73.5
1977/78	98.9	1990/91	73.5
1978/79	96.6	1991/92	74.0
1979/80	91.6		

Sources: From 1974/75 to 1979/80 "Wage fixation in Australia" edited by John Niland, 1986, pg 23.
From 1980/81 to 1991/92 approximate calculations carried out by Wages Section, Treasury.

The fact that major changes in institutional wage arrangements have coincided with the movement between periods of wage inflation and wage deflation makes it difficult to interpret the exact role of changes in unemployment in determining wage behaviour. It seems likely that changing institutional arrangements in combination with other factors such as the slow down in productivity growth, the reduction in the immigration intake, and insider outsider dynamics played a major role in generating high levels of wage inflation in the 1970s. It could also be argued that in the 1980s the Accord played some role in generating wage restraint in the face of factors which may have reduced the influence of high rates of unemployment on wage outcomes. (Factors such as: the craft-based cross-industry union structure; high level of award coverage {around 90 per cent of the work force covered by awards}; and high levels of union membership {around 56 per cent of the workforce in the early eighties} could be argued to have contributed to a high level of insider power in the 1980s, reducing the role of the unemployed in the wage bargaining process.) A counter view is that while the centralised wage fixing system could enforce wage minimums, it had little power to restrict over-award payments and hence to enforce wage restraint. The system could contribute to wage inflation as in the 1970s, and alter wage relativities as with the equal pay decision of 1973, but do little to generate lower wage outcomes in the 1980s. Against this view, it could be argued that the National Wage Decisions during the Accord period played a *coordinating* role in generating wage outcomes broadly in line with the Accord agreements.

It is obviously difficult to quantify the exact role of various institutional factors either in terms of the role of the centralised system in generating wage inflation in the 1970s, the role of the Accord in generating wage restraint in the 1980s, or in terms of the effects of the more recent shifts towards enterprise bargaining, increases in product market competition and changes in union structures. This is particularly the case in the context of an aggregative model such as TRYM. The increases in wage inflation in the 1970s are largely attributed to an increase in the NAIRU to around 7 per cent in 1974. Likewise, the wage deflation following from the high levels of unemployment in the 1980s seems broadly consistent within the framework of the model with what would have been expected if the NAIRU were around 7 per cent.

TRYM Wage Equation

The TRYM approach to modelling Australian wage behaviour, in common with other Australian models, takes the form of an expectations augmented Phillip's curve (wage inflation is the dependant variable and the unemployment level is introduced in a non-linear fashion).[12] Wage inflation in the equation is adjusted for productivity growth and conditioned on expected consumer price inflation (proxied by lags of past inflation) and the degree of excess demand in the labour market (measured by the deviation in the level of the unemployment rate from some NAIRU level[13]). At the heart of the equation is the assumption that those people outside employment (the unemployed or "outsiders") will place downward pressure on wages in periods of excess supply, and this will restore equilibrium in the labour market.

The TRYM wage equation augments the basic Phillips curve specification with modifications to allow for the wage behaviour of those inside employment or "insiders". Outsiders may be viewed as imperfect substitutes for insiders for a variety of reasons, including labour market rigidities or regulations, imperfect information, on-the-job training or significant transaction costs involved in hiring/firing decisions. In this world, insiders may find their jobs relatively more secure and, therefore, be less sensitive to the level of the unemployment rate in determining wage claims. Simes and Horn (1988) used detrended overtime per worker[14] to capture this internal labour market pressure. In TRYM, this effect is modelled by a change in the unemployment rate term (ΔRNU), where the changing risk of unemployment influences insiders' wage claims. When the economy is in equilibrium and the unemployment rate is stable, wage inflation will be equal to price inflation plus increases in efficiency. In the long run, real wages are assumed to be primarily determined by labour productivity. In the short term, wage adjustments to labour market imbalances play a critical role in determining how the model responds to various shocks.

The difference between the actual rate of unemployment (RNU) and the NAIRU is used as the main explanator of wage pressure. The NAIRU has been estimated from the wage equation using historical data commencing in the early 1970s. A dummy variable (Q741) has been included to account for an apparent shift up in the level of the NAIRU in 1974. Q741 takes a value of one prior to 1974 and zero thereafter.

As mentioned above, there are number of competing theories about why the NAIRU appears to have increased over time. Working at a highly aggregative level, TRYM does not contain the detail to be able to distinguish between these theories. However, as discussed above, it does appear to be possible to distinguish in the model between search effectiveness and wage setting explanations of

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[12] There is some debate about whether the wage equation should be specified in change or levels term. Blanchflower and Oswald (1994) for example argue strongly for a levels specification and conclude that the Phillip's curve is dead although their testing equation is controversial. Also in a model like TRYM it could be argued that the appropriate form for the wage equation is a levels form and that Phillip's curve behaviour will result from the interaction of the price equation and the wage equation. We have experimented with estimating wage level equations in TRYM in the past but with little success, partly because of measurement problems related to productivity growth and estimating after tax wage levels for the private sector. Arguably a wage change specification is an appropriate structural specification in Australia given the nature of the wage bargaining which is to bargain over the size of wage increases. In the steady state in the model the real wage is determined by the employment demand equation (in combination with labour supply) while the wage equation gives the equilibrium unemployment rate.

[13]This unemployment/NAIRU level term enters the wage equation in a non-linear fashion as in the Phillip's curve analysis.

[14]In different versions, Simes and Horn (1988) used both a detrended as well as a truncated asymmetric measure where only *increases* in overtime per worker feed into wage pressure.

the increase in NAIRU at a very broad level by the use of unfilled vacancy data[15]. This is achieved by introducing into the wage equation a variable (RNUST)[16] which can be viewed as a summary measure of the search effectiveness of the unemployed. This attempts to capture the impact on equilibrium unemployment (where the unemployment rate equals the unfilled vacancy rate) of changes in search effectiveness as evidenced by shifts in the Beveridge curve. This, in combination with two wage setting parameters (WS and WSo), determine the level of the NAIRU in the model. The wage setting parameters capture the effect on the NAIRU of factors other than search effectiveness, associated with the wage bargaining process. For example, they may reflect "insider/outsider" factors - where "insiders" are those employed with significant wage bargaining power - in combination with institutional features of the wage bargaining system.

This approach gives the following NAIRU term:

$$NAIRU = (RNUST + WS) \times (1 - Q741) + (RNUST + WSo) \times Q741$$

In the short run, changes in average wages per hour worked, Δln(RWT/NH), are a function of:

- changes in the price of total consumption (PCON) - a homogeneity constraint is imposed so that changes in prices will eventually be fully reflected in wages; and
- changes in the unemployment rate (RNU), weighted for the proportion of employees who are union members (RUM) to reflect the influence of insiders on wages behaviour.

A through-the-year change in an institutional variable (QCC) has also been included to capture the effects of the varying degrees of centralisation of the wage determination system since 1970. Accordingly, changes in the institutional arrangements for wage setting directly influence wages. QCC is assumed to be exogenous. Allowance has also been made for the metal trades wage decision in the third quarter of 1974 by introducing a dummy variable (Q743).

These features result in the following estimated equation:

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[15] The specification of the labour market (in particular the incorporation of unfilled vacancies data) enables TRYM to be used to explore a wide range of issues relating to the link between labour market imbalances and other areas of the economy. For example, if the user establishes or judges that the NAIRU may move in a given set of circumstances (changes in search effectiveness of the unemployed or wage setting factors) the model can be used to examine the macroeconomic implications of these movements. For an example of the use of the model in this way see Stacey and Downes (1995).

[16] The Hansen equilibrium unemployment variable (RNUST) is calculated from the long run part of the Beveridge curve equation by setting the vacancy rate (NVA/NLF) equal to the unemployment rate (RNU) - and solving for RNU (whose value over time then depends on the logistical growth function). If search effectiveness falls, the level of the vacancy rate for any given unemployment rate will rise and the equilibrium unemployment rate (where RNU equals NVA/NLF) will increase. The residuals from the Beveridge curve equation are included in the equilibrium measure so that any unexplained movements in search effectiveness have an immediate effect on the NAIRU.

$$\Delta \ln\left(\frac{RWT}{NH}\right) = \frac{\lambda}{4} + \frac{1}{(1+c_1+c_1^2+c_1^3)} \times \Delta \ln\left(PCON(-1)\right)$$
$$+ \frac{c_1}{(1+c_1+c_1^2+c_1^3)} \times \Delta \ln\left(PCON(-2)\right)$$
$$+ \frac{c_1^2}{(1+c_1+c_1^2+c_1^3)} \times \Delta \ln\left(PCON(-3)\right)$$
$$+ \frac{c_1^3}{(1+c_1+c_1^2+c_1^3)} \times \Delta \ln\left(PCON(-4)\right)$$
$$- (c_2 \times RUM) \times \Delta RNU(-1)$$
$$- c_3 \times \left(QCC - QCC(-4)\right)$$
$$+ c_4 \times \frac{[(RNUST + WS) \times \left(1 - Q741\right) + (RNUST + WSo) \times Q741 - RNU]}{RNU}$$
$$+ c_5 \times Q743$$

Results

Sample: 1971(1) to 1995(4)

Parameter	Interpretation	Estimate	t-Statistic
c1	change in prices	0.796	2.76
c_2	change in RNU	0.014	2.43
c_3	change in centralisation	0.018	2.94
c_4	unemployment level	0.009	2.57
NAIRU	after 1974	6.76 (WS 4.17)	4.41#
	1971 to 1973	4.85 (WSo 2.70)	2.06#
c_5	metal decision 74(3)	0.080	6.02

t-statistics refer to the estimates of WS and WSo.

Diagnostic Statistics

R^2 = 0.62	
SE = 1.2%	
DW = 2.38	
Box-Pierce Q (1-8th order auto correlation)	16.16*
Jarque-Bera Test for Normality	0.55
Chow Test for Parameter Stability	0.79
Ramsey's Reset Test	0.001
Breusch-Pagan Heteroscedasticity Tests:	
Trend	0.53
Y-Hat	0.06
Joint	1.50

* Indicates the test has failed at the 5% confidence level.

Economic Interpretation

The equation implies that the NAIRU for the period 1974 to 1995 was unchanged at 6.8 per cent. This should not be interpreted as a precise point estimate of the current NAIRU. The estimate has a

relatively wide error band, particularly when the equation is estimated over sample periods that exclude more of the earlier years. Moreover, given the changing institutional features of the labour market and product market it may be that the NAIRU has also changed over the 1974 to 1995 period. In terms of the response of wages to various changes in the explanators, the estimated equation implies that:

- if the actual level of unemployment is 10 per cent, wages growth will be 0.3 per cent per quarter lower than if the unemployment rate were at the NAIRU;

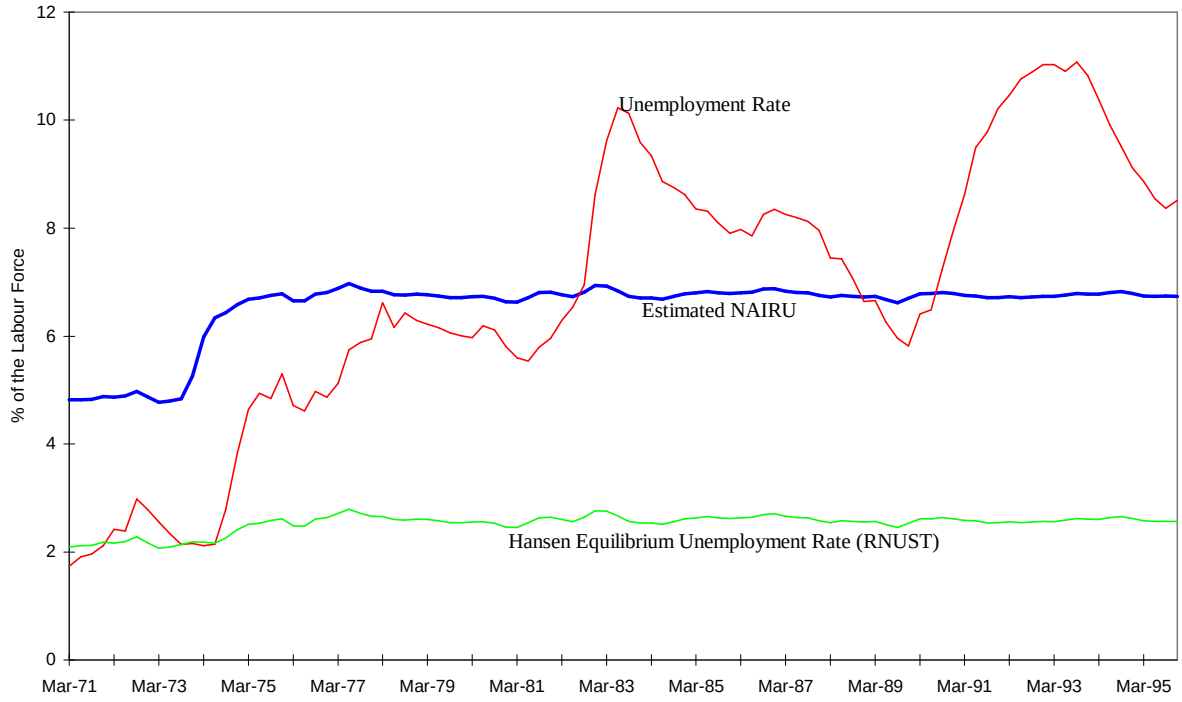
- an increase in prices of 1 per cent will increase wages by 1 per cent after five quarters with a 0.3 per cent increase in the second quarter;

- a 10 percentage point fall in the unemployment rate will add 0.60 of a percentage point to wage growth in the contemporaneous quarter; and

- wages respond to changes in the institutional environment in the wage determination system. The equation implies that shifts to a more decentralised wages system (as in 1981-82) exert upward pressure on wages for a year.

The equation implies that the NAIRU has increased from a little under 5 per cent in the early 1970s to 6.8 per cent in the 1980s and 1990s. The estimate derived from the equation is shown in Figure 6 below. The change in the NAIRU can conceptually be decomposed into a change in the search effectiveness of the unemployed (captured by changes in RNUST) and a change in other factors associated with the wage setting process (captured by WS and WS_o). The estimated value of RNUST (implied by the estimates of WS and WS_o) has risen from levels of around 2.1 per cent prior to 1974 to around 2.6 per cent more recently. That is, reductions in the search effectiveness of the unemployed appear to have increased the unemployment rate by around half of a percentage point since 1974. This compares with the estimated increase in the NAIRU of around 2 percentage points post-1974. However, given the measurement and estimation difficulties involved and the general uncertainty surrounding the NAIRU estimate itself (see later) this decomposition of the change in the NAIRU should be treated with considerable caution.

Figure 6: Estimated NAIRU from TRYM's Wage Equation



Properties of the TRYM Wage Equation

In TRYM, there is no long run hysteresis in the unemployment rate. That is, the constant NAIRU assumption implies that wages will adjust, influencing labour demand and supply, to ensure the unemployment rate returns to the NAIRU in the long run. Both Murphy (1988) and the earlier Treasury National Income Forecasting (NIF88) model also utilised a constant long run NAIRU. Previous to this the NIF10S model (the simulation version of the NIF10 forecasting model) related wages to changes in the unemployment rate, but did not have a stable long run unemployment rate. The adoption of a fixed NAIRU is mainly for computational and theoretical convenience so that there is a unique long run equilibrium in the model, rather than from any view that the NAIRU cannot change over time. Clearly, the NAIRU has changed in the past; however, TRYM does not contain the detailed data on the labour market that would be required to endogenise the NAIRU, for simulations of the future.

The homogeneity constraint placed on prices in the TRYM wage equation implies that the wage equation can be interpreted as a real wage equation. Therefore, a reduction in the NAIRU can be interpreted as real wage restraint. If the unemployment rate is higher than the NAIRU then real wage growth will slow (until the gap is removed). In the long run, however, real wages grow in line with productivity growth.

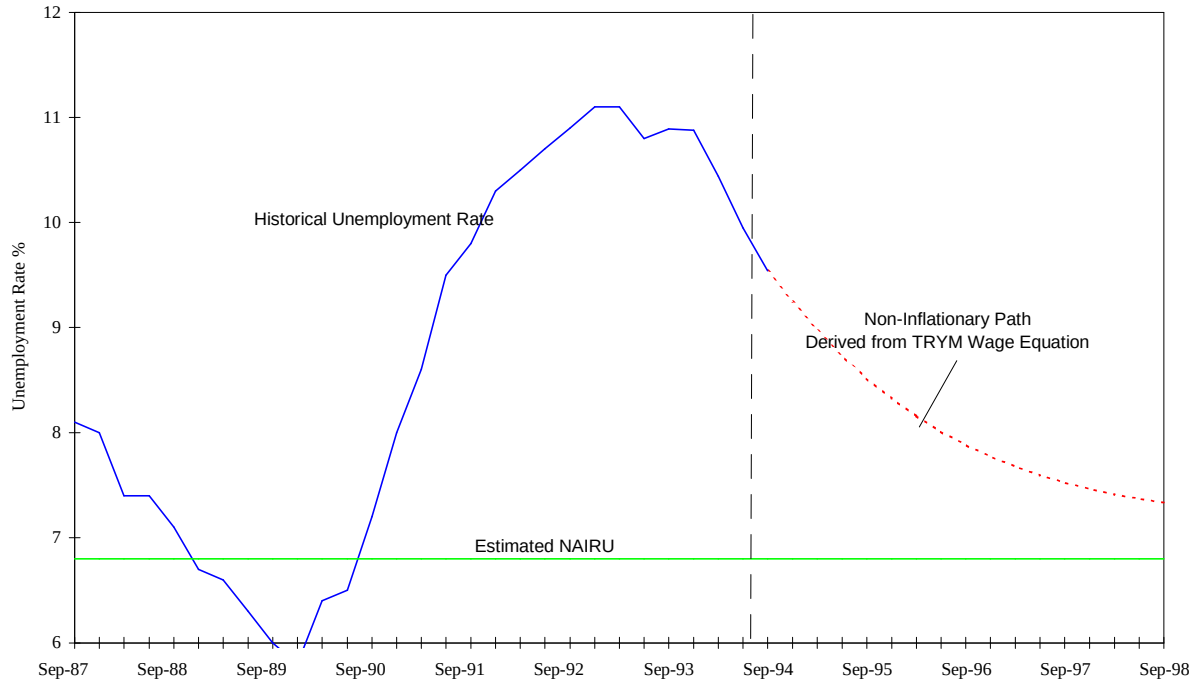
2.2 Short-Run Versus Long-Run NAIRU

2.2.1 Non Inflationary Paths (NIPS)

While TRYM does not have unemployment hysteresis in the long run, there is a form of short-run unemployment hysteresis by insiders (captured by a term for the change in the unemployment rate). The estimated wage equation suggests that even if the unemployment rate is above the estimated

NAIRU, large falls in the unemployment rate can create higher wage pressures. There is therefore, an implicit short-run non-accelerating inflation path (NIP) for unemployment[17]; that is, a dynamic path for the unemployment rate, which does not cause an acceleration in wage inflation in the model[18]. When unemployment is above the NAIRU wages tend to fall relative to prices. However, falling unemployment (rising employment) tends to increase wage inflation. Insiders tend to feel more comfortable when employment is expanding. The point at which the wage pressure coming from falling unemployment equals the wage deflation from unemployment being high can be used to derive a non inflationary path (NIP) for unemployment. This mechanism captures in the wage equation, the apparent persistence of high unemployment rates without market clearing wage adjustment, evident in historical data. An example of a non inflationary paths (NIPs) derived from the TRYM wage equation (starting from an arbitrary point in history) is shown in Figure 7.

Figure 7. TRYM NAIRU and Non Inflationary Path



As usual, the above results should be interpreted with caution. In general, as discussed in the next section, there is a fairly wide error band around the coefficients derived from Australian wage equations (reflecting among other things institutional factors which are hard to quantify and vary over time). As a result, a large degree of judgment needs to be applied in assessing the wage outlook and estimating what the level of the NAIRU might be at any particular time, and in consequence the slope of the non-inflationary path. For example, at the moment there are a number of institutional changes - the ending of the Accord, the move to enterprise bargaining, the effect of

[17] The differentiation between the NAIRU and the NIP is conceptually similar to the differentiation between the "efficiency constrained" and "bottleneck" approaches to the output gap in Commonwealth Treasury (1996).

[18] This path is constructed by inverting the wage equation and solving for the unemployment path given the constraint that wage inflation does not increase relative to price inflation. Strictly speaking, the TRYM wage equation cannot be inverted exactly, as the change in unemployment term is lagged one quarter rather than being contemporaneous. The path calculated above is a close approximation.

workplace reform on productivity growth - which may be bearing on the wage outlook and hence on the results and elasticities discussed above.

The non inflationary path shown in Figure 7 relates to wage inflation, or more specifically whether there is a tendency for wage inflation to accelerate relative to price inflation, and hence, whether it tends to push up or pull down the inflation rate. Price inflation however, is also affected by what is happening to the exchange rate and import prices and what is going on in product markets. Abstracting from exchange rate changes, the demand expansions associated with employment growth will also usually be adding to price pressures in product markets (increasing margins or increasing average costs - depending on market structure and the position and slope of marginal cost curves respectively). Empirically, the direct effects of demand on prices do not, however, appear to be that large in TRYM or in other Australian price equations for underlying consumer prices. Thus, in general the non inflationary path for the economy as a whole would be flatter than that shown in Figure 7 - but not always. For example, if faster unemployment reductions were being driven by a terms of trade improvement the non inflationary path for the economy as a whole might be steeper.

3. MEASUREMENT OF THE NAIRU

There is a range of uncertainty around both estimates of equilibrium unemployment noted above. However, the greatest uncertainty appears to relate to the determinants of wage behaviour and the likely effect of recent and prospective changes to the industrial relations system.

3.1 Uncertainty around Hansen's Equilibrium (RNUST)

The main uncertainties around the Hansen equilibrium derived from the unemployment/vacancy relationship relate to the simplicity of the model used and possible measurement error in the series for unfilled job vacancies. As mentioned above, the need to endogenise any explanators necessitates the choice of a relatively simple model where the reasons for any outward shift are not truly identified, but rather captured by a simple logistic time trend. This raises the questions of why the outward shift in the relationship that was identified above occurred and whether the factors that may have led to the shift have changed in recent times (for example with rising long-term unemployment). That said, the simple equation appears to work reasonably well and there is little sign of recent instability in the relationship

The other uncertainty relates to the time series measure of unfilled job vacancies provided by the ABS (which produces the TRYM data base). This series is compiled by splicing series from three different sources. These are as follows:

- September 1966 to March 1979, from registered vacancies with the Commonwealth Employment Service (CES);
- June 1979 to December 1983, from the ABS survey of job vacancies based on a sample selected from lists of employers subject to payroll tax and lists of government organisations and hospitals; and
- March 1984 onwards, from ABS surveys of job vacancies based on the ABS register of businesses.

Only the last source could be represented as being based on a properly representative survey. The second source is based on a survey drawn from the payroll tax based survey register which excluded small companies (which fell below the payroll tax thresholds). It may be the case that the splicing has introduced some bias into the series so that the most recent levels are not strictly comparable to those in the past. On the other hand, the series produced by the ABS appears to be reasonably consistent with movements in registered vacancies with the CES (data for which continue to be compiled and go back to 1949). Fahrer and Pease (1993) find that re-estimating the Beveridge curve with the CES registered vacancy series makes little difference to the estimated shift in the relationship.

3.2 Uncertainty around the NAIRU

The current TRYM estimate of 6.8 per cent for the NAIRU is consistent with findings of other studies by Simes and Horn (1988) and Murphy (1995) of 6.5 and 7.6 per cent respectively. That said, the TRYM estimate has a large degree of imprecision. A ninety five per cent confidence interval would place the "true" value of the NAIRU somewhere between 8.7 to 4.9 per cent.

The table below compares the estimates from TRYM and the Murphy model with those from selected previous studies.

TABLE: NAIRU ESTIMATES FROM SELECTED AUSTRALIAN WAGE EQUATIONS

AMPS Model (1986)			1966-86
			6.4
NIF88 Model (1988)			1966-88
			6.5
Kawasaki, Hoeller and Poret (1990)			1980-87
			5.1
Layard, Nickell and Jackman (1991)	1960-68	1969-79	1980-88
	2.4	4.0	6.1
Murphy Model (1995)			1976-95
			7.6
Access Economic Model (1995)			1976-94
			7.3
TRYM (1996)		1970-73	1974-95
		4.9	6.8

Both the OECD (Kawasaki et al) and the Layard, Nickell and Jackman study appear to indicate a lower NAIRU for the 1980s than the TRYM and Murphy estimates. This may be because the specifications are more complicated for the former studies and the equations contain additional variables. The TRYM and Murphy equations which are relatively simple may be attributing wage inflation due to other causes to changes in the NAIRU.[19] The Layard, Nickell and Jackman numbers are based on cross-country parameter estimates taking account a wide variety of variables that arguably influence structural unemployment. These paramaters are then applied to the specific time series and institutional variables for Australia to yield the estimates above.

There are a number of important points to make about the Murphy and TRYM estimates:

- *Uncertainty surrounding NAIRU level estimates* - In general, the estimates are not well determined. The standard error around the Murphy estimate is very wide - around plus or minus 3 per cent. The standard error around the TRYM estimate is narrower at around 1.0 percentage point, but still gives a relatively wide range of 4.9 to 8.7 for the 95 per cent confidence interval.[20]

[19] This raises the issue of long-run versus short-run NAIRUs. The NAIRU in the TRYM and Murphy wage equations is essentially a long-run concept as it ties down the steady state. Some factors might arguably increase the NAIRU in the short term without effecting its long run value. For example a reduction in trend productivity growth or an increase in the tax wedge which lowers the price setting curve, might lead to an increase in the NAIRU as estimated in the equations. However, as workers expectations adjust to the lower rate of improvement in living standards implied by the lower productivity growth the wage setting curve should adjust and the NAIRU fall back to its original level.

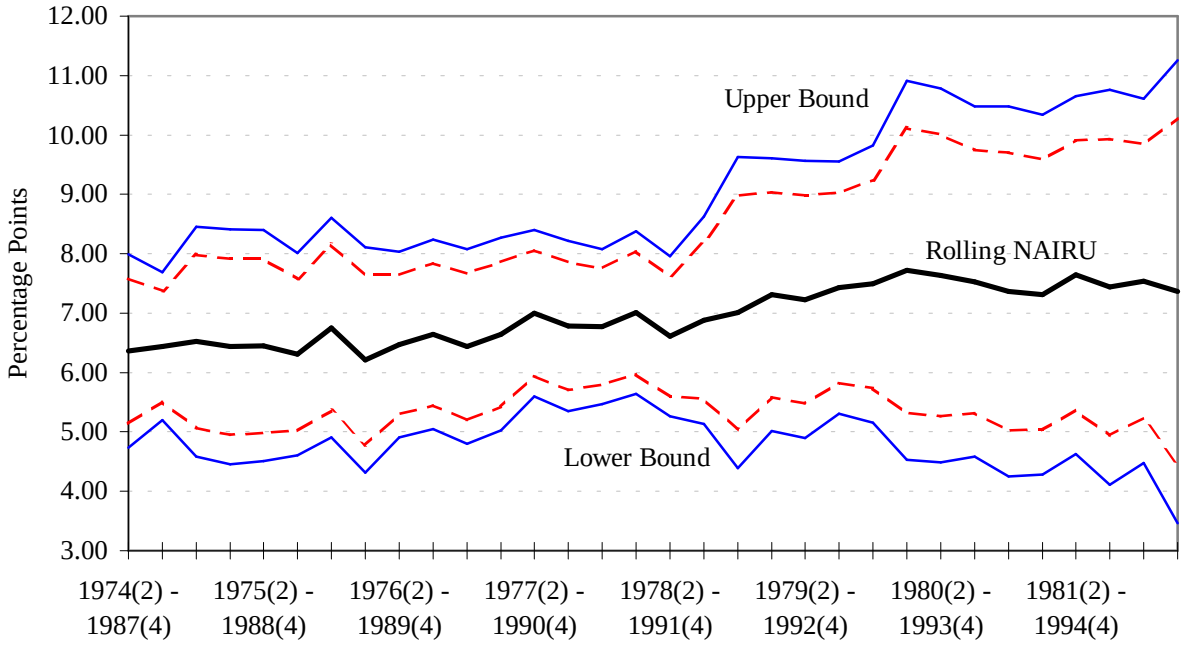
[20] The standard error on Murphy's estimate depends on the co variance between two of his parameters. The large error bands around the NAIRU reflect the fact that wage equations in general are not well determined. (While we are relatively certain about the effect of wages on the economy, we are very uncertain about what determines wages.) The Murphy equation explains only 35 per cent of the quarterly variation in average weekly earnings. The TRYM equation performs better in explaining 59 per of the variation (over a longer time period and using average hourly earnings rather than average weekly earnings) but has the same standard error on the Y estimate at 1.2 per cent. (That is the TRYM equation does no better at hitting the data.) The lower error band around the TRYM estimate of the NAIRU reflects that fact that it is estimated directly using non linear least squares, rather than indirectly as in the Murphy equation.

. *Uncertainty about NAIRU movements* - In addition to the uncertainty over levels, the estimates do not necessarily tell us where the NAIRU is now. Rather they are estimates which explain wage inflation over the whole period - in TRYM's case 1974-95. In this sense they are a little like moving averages - it will not be until we have another five or six years worth of data that we will be able to estimate what the NAIRU is for the current period. Given that the NAIRU appears to move around over time it may be currently much higher or much lower than 7 per cent.

– Figure 8 shows estimates of the NAIRU obtained from a rolling regression of the TRYM wage equation[21] from 1974 to 1994. A 13½ year estimation period is rolled through the data from 1974(2) to 1987(4) through to 1981(2) to 1994(4) and the NAIRU estimated for each period. The 95 per cent confidence intervals are then added to the resulting NAIRU estimates.

– As can be seen the NAIRU estimates derived from the wage equation tend to be unstable and have a very wide confidence interval, particularly towards the end of the period. Not shown in the chart below is the increase in the NAIRU estimate from around 2 per cent in the 1960s to between 4 and 5 per cent in the early 1970s.

Figure 8: Rolling NAIRU Estimates



– The estimated NAIRU is high when the sample period includes both the 1974 and 1981 wage booms; falls when the 1974 wage boom drops out and the number of data points within the Prices and Incomes Accord period increase; and increases when the 1991 increase in real wages enters the estimation period. Attempts to produce rolling estimates of the NAIRU with a shorter 7 year moving sample period yielded unstable estimates (again reflecting the difficulty of modelling wages).

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[21] A version of the TRYM wage equation excluding the centralisation dummy was used (see Treasury (1996)).

- *The change in the unemployment rate is also important* - Both the Murphy and TRYM equations find that the change in the unemployment rate (as well as the level) is a significant determinant of wage pressures. Falling unemployment can lead to wage inflation even when the unemployment rate is high. In Murphy, this is a relatively powerful effect with an almost one for one relation between changes in the unemployment rate and wage inflation (and less effect from unemployment levels).[22] In contrast, the TRYM equation has a larger effect from unemployment levels and a smaller effect from unemployment changes. In TRYM, quarterly wage inflation falls by about 0.1 of a percentage point for every percentage point the unemployment rate is above the NAIRU, while a one percentage point increase in the unemployment rate leads to 0.06 of a percentage point decrease in quarterly wage inflation.

- *The wage equations do not explain why the NAIRU moves* - The wage equations tell us little about why the NAIRU moves or what determines the NAIRU. Judgement on where the NAIRU is now and where the NAIRU is moving depends on the factors the analyst thinks have led to the increase in the NAIRU.

In terms of where the NAIRU is now:

- On the one hand, the Committee on Employment Opportunities (1993) Green Paper canvassed a number of changes in the economy over the 1980s - the floating of the dollar, increased competition in product markets, and the benefits of micro-economic reform (raising the price-setting curve), falling union membership rates, reforms to the industrial relations system, and changes in union attitudes (shifting the wage-setting curve to the right) - which may have acted to reduce the NAIRU.

- On the other hand, the rise in real wages in 1991 (when unemployment was very high and rising) would tend to indicate that the NAIRU was then much higher than 7 per cent.[23]

- Both the TRYM and Murphy equations appear to be currently roughly on track (ie the estimated residuals from the wage equation have been relatively stable). If the NAIRU had fallen to significantly below 7 per cent, then wage inflation should now be much lower than we are experiencing, and contrariwise much higher if it were higher.

In terms of ongoing inflationary pressures, the real question is where the NAIRU will move in the future. Unfortunately, the current wage equations have little to say on this issue other than that wage formation is difficult to model and thus, probably depends on a wide range of factors, the structure of which is changing over time. Therefore, judgement must play a large role. Large uncertainties surround, for example, the pace of micro-economic reform and its effect on product market competition; the likely pace of productivity growth and its effect on wage aspirations; the effect of increases in long-term unemployment; and the effects of the industrial relations reform, the ending of the Accord, and the move to enterprise bargaining.

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[22]Some of this effect may be picked up by the acceleration of business output term in the TRYM equation.

[23]However, this may have been due to the lags caused by the slow spread of negotiated wage increases under the Prices and Incomes Accord arrangements (the "pipeline" effect) in combination with lower than expected inflation rather than an increase in the NAIRU. These lags and surprise effects would not be captured very well by either the TRYM or Murphy equations.

4. POLICIES TO REDUCE THE NAIRU

The following section briefly touches on what the model can tell us about the likely effectiveness of policies to reduce unemployment, in particular:

- Active labour market employment programs, such as direct employment creation and job subsidy schemes.

- Policies to increase the search effectiveness of the unemployed, such as reforms to the unemployment benefits system and training programs for the unemployed.

- Reforms to the wage bargaining system and reductions in the aggregate real wage.

Work sharing schemes and policies designed to reduce labour force participation, such as by early retirement are not discussed. At the broad level, the model produces results which support the Layard, Nickell and Jackman (1991) argument that the reasoning behind these policies suffers from "the lump of output fallacy" and that they are unlikely to have any effect on the unemployment rate in the medium to long run. For example, a permanent negative participation rate shock in the model will lower unemployment temporarily, but will ultimately lower output and employment so that in the medium run the unemployment rate is unchanged. However, the model does show that the flexibility of hours worked - how average hours worked respond to changes in employment demand - can have a significant bearing on the degree to which temporary demand shocks are translated into fluctuations in unemployment.

4.1 Active Labour Market Programs

The effect of active employment programs such as direct job creation or wage subsidy schemes can be broken down into two parts (a) their fiscal expansionary effect and (b) their effect on the search effectiveness of the unemployed (eg by re-integrating the long-term unemployed into the labour market) and hence on the NAIRU. The effects of any possible impact on search effectiveness are discussed inn Section 4.2 below. As an aggregative system the model cannot be used to assess the extent to which any given policy will increase search effectiveness; it only provides information on the macroeconomic effect of an increase in search effectiveness if it occurs. Neither does it have very much to say about the redistributive and equity effects of active labour market programs, although these could be argued to be their greatest impact.

Fiscal Expansion

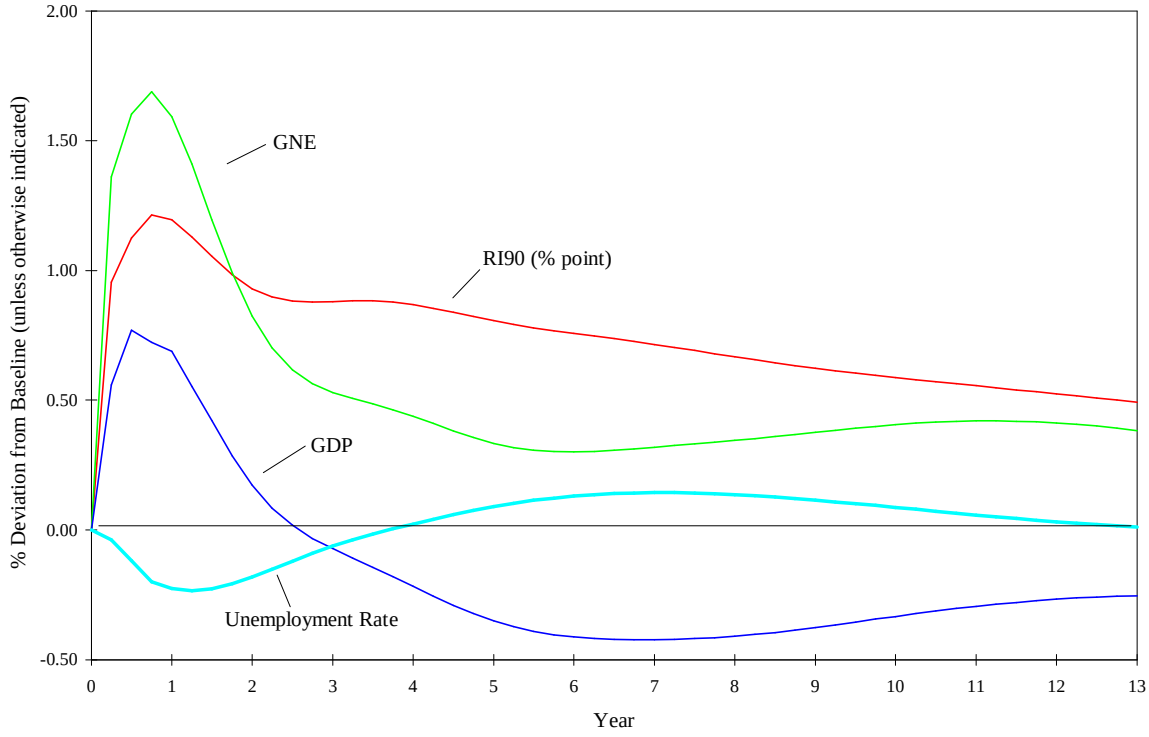
Any increase in government expenditure, whether it is on labour market programs or on items such as health or education, will lead to a temporary expansion of employment and reduction in unemployment. In the case of active labour market programs one would expect the first round effects of the expansion to be more employment intensive than other forms of government expenditure. However, the second and third round effects will be the same, and in the medium term the employment creation effects (abstracting from any effect on search effectiveness and the NAIRU) will be crowded out via interest and exchange rate effects on investment and net exports. It is not clear to what extent the first round effects are more employment intensive than other forms of expenditure. For example, direct job creation requires significant administrative and organisational resources. Wage subsidy programs involve significant displacement effects. Most Australian studies indicate displacement rates of about 70 to 80 per cent or a net job creation effect of about one in four or one in five per subsidised place. As a result, it is not clear that the first

round job creation effect are necessarily significantly greater than for other forms of fiscal expenditure.

Again the model contains no information on which to base an assessment of the relative employment intensity of the first round effects of different forms of expenditure or different programs. However, it does tend to suggest that the final aggregate employment effects may not be greatly different under different assumptions. For example, a fiscal expansion that is weighted towards expenditure on final goods, while having less of an effect on employment in the short term, has roughly the same employment effect in the medium term as an expansion that takes the form of an increase in consumption of labour services (direct increase in public employment).[24]

The effects of a permanent bond-financed expansion of government expenditure equivalent to 1 per cent of GDP is shown in the chart below:

Figure 9: Effect of Fiscal Expansion in TRYM



As can be seen from the figure above, the model conforms to the normal result for a small open economy with free capital flows and a floating exchange rate. While the expansion increases expenditure and activity in the short term the additional activity is quickly crowded out by the effects of higher interest rates and a higher exchange rate. Unemployment falls by a quarter of a percentage point after one year but returns to its original level after around three and a half years.

The results above, of course, should be treated as no more than indicative, as they are sensitive to a number of assumptions and modelling uncertainties, particularly in relation to the treatment of imports and the treatment of the exchange rate. However, the results are similar in magnitude to those derived from other Australian models.

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[24] Any increase in public employment will normally also occasion an increase in public expenditure on final goods and vice versa.

The model has little to say on the relative size of the employment creation effect of direct job creation and wage subsidy programs compared with other forms of fiscal expenditure, although one would assume that it would be marginally greater in the short run than the impact shown for the reasons discussed above. However, unless there were some effect on search effectiveness and the NAIRU the medium run impact would be the same - the effects on employment and unemployment would be unwound.

4.2 Policies to Increase Search Effectiveness

As mentioned above, direct employment creation and wage subsidy programs may have the effect of increasing the search effectiveness of the unemployed, as would policies specifically directed to this end, such as reforms to the unemployment benefit and social security system, training programs, and changes to the industrial relations system to increase relative wage flexibility and hence reduce mismatch. All of these and other changes might be estimated to lead to an increase in search effectiveness of the unemployed. While TRYM provides little on the extent to which any particular policy affects search effectiveness, it can be used to examine the macroeconomic effects of any given (assumed) change to search effectiveness. This can be implemented by reducing the level of the Hansen equilibrium unemployment rate (RNUST). Reducing RNUST will have two direct effects. Firstly, it will reduce the NAIRU by an equivalent amount. Secondly, it will directly yield an increase in employment for any given level of employment demand, although at high levels of unemployment this second effect is relatively small. It becomes far more important when unemployment is at or near the Hansen equilibrium. Given that the second effect is relatively small at current levels of unemployment, the shock is quantitatively little different from the simple NAIRU shock results which are discussed below.

While TRYM has little to say about the impact of any particular policy on search effectiveness, the absolute level of the estimated Hansen equilibrium in the model suggests that there is a limit to what such policies, either of the wage subsidy / training variety or the relative wage flexibility variety[25], could achieve in terms of reducing the NAIRU. As can be seen (Figure 4) the current estimate of RNUST is around 2.6 per cent. Given that the Hansen equilibrium can never fall to zero because of frictional/turnover factors, the current estimated level seems to suggest that it would be difficult for policies designed to increase search effectiveness to directly reduce the NAIRU by more than a percentage point or a percentage point and a half. This in turn suggests that the changes to the wage bargaining system are the more likely to yield large reductions in the NAIRU in the Australian context, and policies that were directed at search effectiveness without any thought to the wage bargaining context and aggregate wage outcomes would be likely to meet with limited success.

4.3 Wage Bargaining System and Real Wages

As argued above, wage bargaining factors and aggregate wage outcomes appear to have played a major role in the increase in Australian unemployment over the last twenty five years. As with policies designed to increase search effectiveness, TRYM does not contain the detail to assess the efficacy of various proposals to improve aggregative wage outcomes whether they be of the incomes policy (Accord) variety or the deregulatory New Zealand approach. What it does suggest is that

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[25] The process of introducing increased relative wage flexibility could of course also be associated with reduced insider power, and reduced leading sector / coordination problems of the sort experienced in 1974 and 1981 thus shifting the wage setting curve to the right, and increasing productivity via more flexible working arrangements, shifting the price setting curve upwards. In combination with any effect on mismatch unemployment these changes would help to reduce the NAIRU. The above comment only relates to the matching function of relative wage movements.

policies that successfully reduce the labour market's tendency to produce wage inflation at high levels of unemployment can have a major impact on macroeconomic outcomes.

One of the surprising outcomes is that reducing unemployment via reducing the NAIRU in TRYM does not require large or lasting reductions to real wages. This is in contrast to the "real wage overhang" debate which was the focus of much Australian discussion in the 1970s and 1980s in relation to the rise in unemployment and whether it was Keynesian (demand driven) or Classical (wage related). By definition the real wage in TRYM is usually reasonably close to equilibrium unless there is a large NAIRU shock, as occurred in the early 1970s. A NAIRU shock may have an influence on real wages for a number of years, but eventually prices will adjust and the real wage will return to near its former equilibrium level. The equilibrium real wage level in turn is largely determined by labour productivity levels. This follows from the assumption that there is no constraint (other than normal lags and adjustment costs) on firm's price setting. The logic of the TRYM result is very close to that described by Layard, Nickell and Jackman (1991) and therefore cuts through the real wage overhang debate and the arguments about whether unemployment is Classical or Keynesian. To quote Layard, Nickell and Jackman:

> "The reason for this is that, while wage determination reveals the demands of wage bargainers at given unemployment, the price setting behaviour of firms governs the real wage that is actually available. The sharpest expression of this point arises with mark-up pricing when the real wage available in the long run is independent of the level of activity. Workers may then press for higher wages as much as they wish. Their quest is wholly unsuccessful, and all that is achieved is higher unemployment". (Ch 8, P.384)

In common with the Layard, Nickell and Jackman framework, TRYM assumes that workers bargain over wages while firms set prices in accordance with input costs, productivity and the state of demand. Workers thus have little control over prices and hence, the real wage in the medium to long term. In the medium to long run, the real wage is almost entirely determined by technology/productivity. In the initial stages an increase in wage pressure due to an increase in the NAIRU will lead to an increase in real wages. Unemployment will appear to be classical. However, as prices and the capital stock adjust the real wage will fall to its original level. The higher unemployment will then appear to be Keynesian even though it has resulted from higher wage pressure. Unemployment is higher consistent with the higher NAIRU but with no significant improvement in the real wage. Moreover, as the government has to increase taxes on a reduced tax base to finance an increase in unemployment benefit pay outs, the after-tax real wage can actually fall.

The two charts below present the unemployment and real wage outcomes of two different sets of model projections, one with the NAIRU set at 8.3 per cent from 1997-98 onwards, and one with the NAIRU set at 5.0 per cent from the same point in the simulation. The projections are purely for the purpose of illustration and should in no way be interpreted as forecasts.

Figure 10: Unemployment Projections with Different NAIRU Assumptions

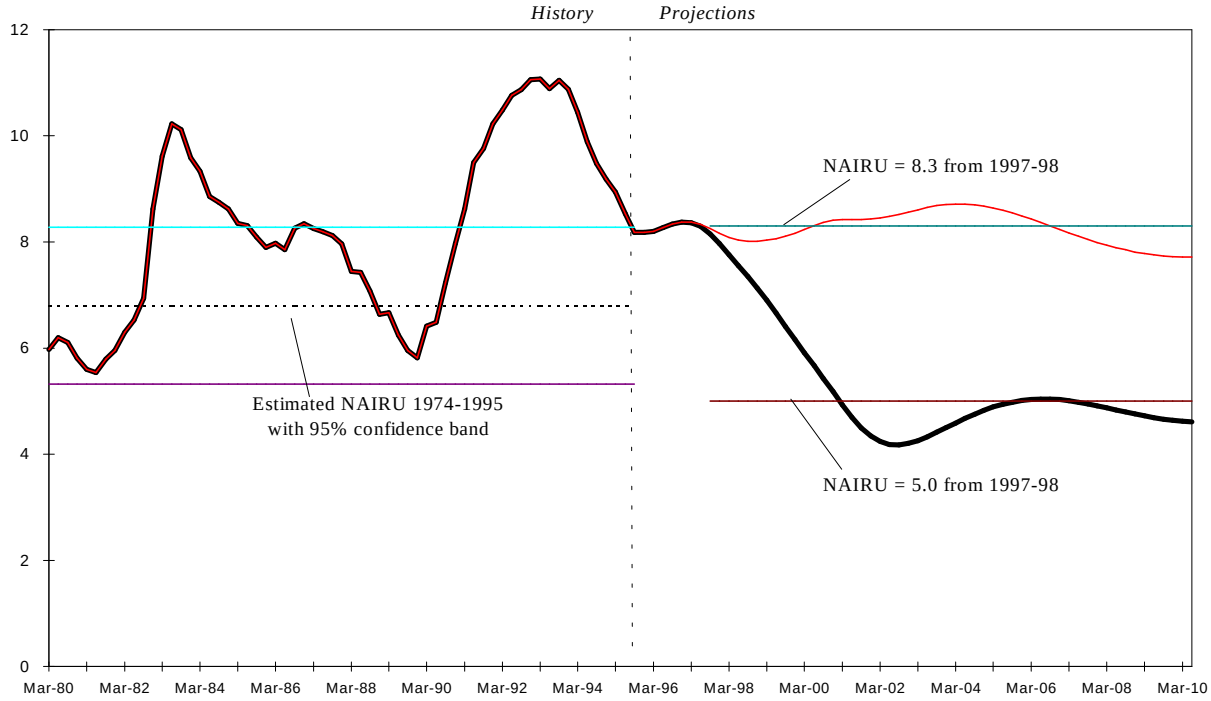
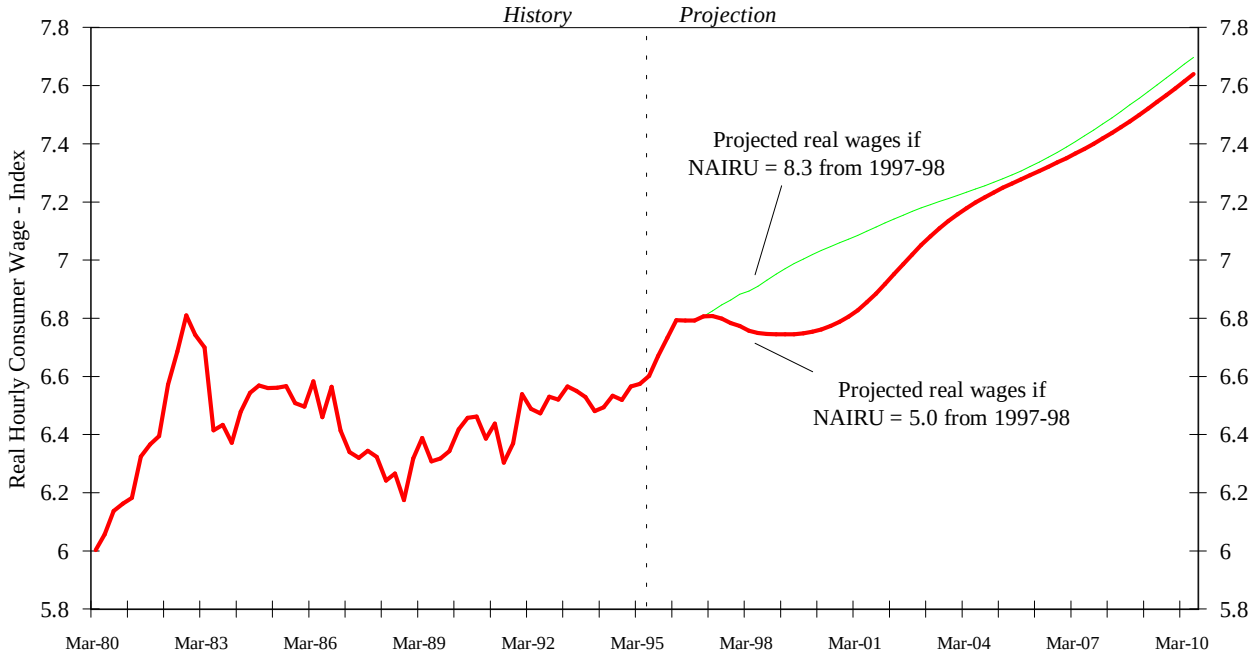


Figure 11: Real Hourly Consumer Wages Under Different NAIRU Assumptions



A 1 per cent reduction in the NAIRU[26] (or the equilibrium rate of unemployment) leads to a roughly proportional increase in labour supply in equilibrium (around 0.8 per cent). The availability of more employment encourages previously discouraged workers to enter the labour market, increasing

[26] As discussed in Section 2, in TRYM, the combination of an unemployment variable adjusted for search effectiveness (RNUST) and two wage setting parameters (WS and WSo) determine the level of the NAIRU. Therefore, it is possible to examine the macroeconomic implications of changes in search effectiveness of the unemployed and wage setting factors separately. In the projections in Figure 10 the reduction in the NAIRU is achieved by lowering the wage setting parameter, WS.

equilibrium labour supply. As a result, employment rises by around two per cent in the long run. The higher level of employment is associated with a similarly higher level of output.[27]

While the long-term effects are driven by the supply side, the short term effects are driven by the demand response to the reduction in inflationary pressures. The initial effect is to lower the inflation rate (for any given level of unemployment). This leads to lower interest rates and a lower exchange rate. It is this interest rate and exchange rate response which initially stimulates investment (and, therefore, GNE) and output growth.[28]

In response to the initial fall in real wages, employers also substitute labour for capital for a given level of output. However, this is a relatively small effect compared to the interest rate and exchange rate effects. Thus, the short term response of employment is much greater than would be thought from simply looking at the short term elasticity of the labour demand curve.

A similar, somewhat counter-intuitive result occurs in the long run. In the long run, the aggregate demand curve is relatively flat for an open economy like Australia. As a small economy, Australia can almost sell as much as it likes on the world market. Small changes in the real exchange rate would be expected to increase net exports in the long run by a significant amount. Thus, output is very elastic with respect to small changes in export prices relative to import prices (and hence output prices relative to consumer prices and changes in the consumer real wage). The elasticity of employment for the economy as a whole in the long run is again much greater than would be apparent from the labour demand equation.

The intuition behind the result of the NAIRU shock is similar to that of an increase in labour supply. In the case of an increase in labour supply due to, say, increased immigration or an increase in the female participation rate, we would expect some short term adjustment costs but no permanent effect on unemployment or the real wage. The real wage would only have to fall if there were some constraint to the supply of some other factor of production leading to a fall in aggregate labour productivity. TRYM's production function contains only two factors of production (homogenous labour and capital) and assumes constant returns to scale. As a result, labour supply and output can be increased proportionally given existing technology without any significant reduction in the real wage. This is partly because, as a small open economy, Australia imports a significant proportion of its investment goods and the supply of capital is highly elastic at a given price in the medium term. The result is complicated slightly by the fact that as a small open economy we also need to sell some proportion of the additional output on the world market. A small fall in the real exchange rate is thus required in the medium to long term to achieve the increase in exports necessary to counterbalance the increased demand for imports. This leads to a small wedge between producer and consumer prices and a small fall in the consumer real wage relative to the producer real wage.

Thus, the NAIRU shock might be considered to be a special case of a labour supply shock. The initial effect of a labour supply shock in TRYM is for an increase in unemployment which leads to downward pressure on wages (and, hence, also inflation, interest rates and the exchange rate) as the additional workers are accommodated into the employed labour force. There is no significant

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[27] The equilibrium price level depends on the monetary policy assumption. In this simulation, monetary policy is assumed to be non-accommodating of the increase in real activity. Hence, the long run price level is lower. A monetary policy setting that accommodated the increase in real activity would lead to an unchanged price level. Inflation would then be the same on average over the period. The initial deflation would be offset by a future inflation.

[28] There is little external "crowding out" of the GNE stimulus and, in fact, there is a slightly positive contribution from net exports.

impact on real wages in the medium term once the additional workers have been accommodated. Similar short term downward adjustments to the real wage occur in a NAIRU shock. The difference with the NAIRU shock is that in the medium term government benefit payments are reduced, while the tax base is increasing leading to a significant improvement in the net PSBR. The improved fiscal position provides room for reductions in tax rates or increased public provision of services and, hence, increased living standards for the population as a whole. (Per capita living standards are unchanged in a population shock.) Similar logic underlies the discussion of the benefits of reducing the NAIRU in the modelling work in the Appendix to Committee on Employment Opportunities (1993) and in the definition of the NAIRU in Box 2.1, p50, of that document where the point is made that the NAIRU is not about real wage levels *per se*, but about the point where nominal wage inflation begins to accelerate.

While there are a large number of caveats to the model's results, the results serve to illustrate how an analysis done in the context of a fully articulated model can provide a very different view from that of a partial analysis that focuses only on selected relationships.

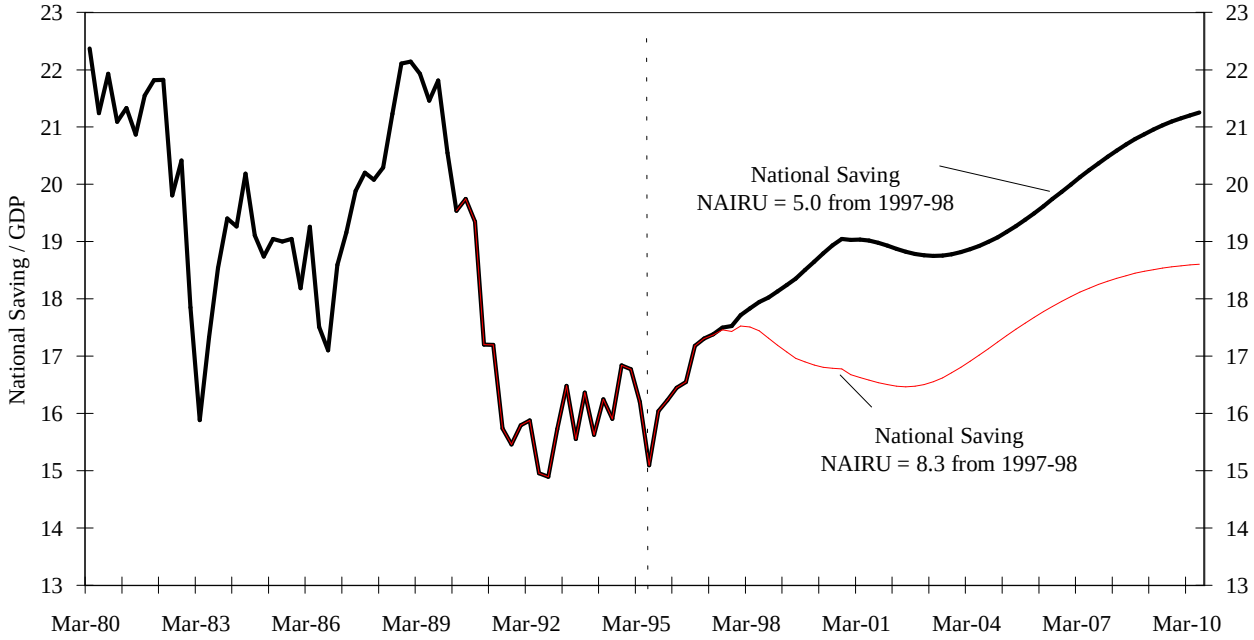
5. MACROECONOMIC EFFECTS OF REDUCING THE NAIRU

5.1 Implications for the net PSBR, Saving, Investment and the CAD

This section briefly discusses the outcomes for the net PSBR, national saving and investment in the two projections discussed in Section 4.3. The first projection assumes that despite the poor initial outlook for wages the NAIRU falls to 5 per cent in 1997-98. The second projection assumes that unemployment has already hit the NAIRU of 8.3 per cent and that the NAIRU will remain at this level for the rest of the decade. As mentioned above the projections are purely for the purpose of illustration and in no way should be interpretted as forecasts. As can be seen below, the contrast between the two sets of numbers is quite stark. The low NAIRU case is characterised by high growth, low interest rates, rising living standards, higher public and national saving and, once unemployment has fallen, a lower CAD. In contrast, the high NAIRU outcome is characterised by low growth, high interest rates, lower saving, higher public deficits and a stagnant CAD.

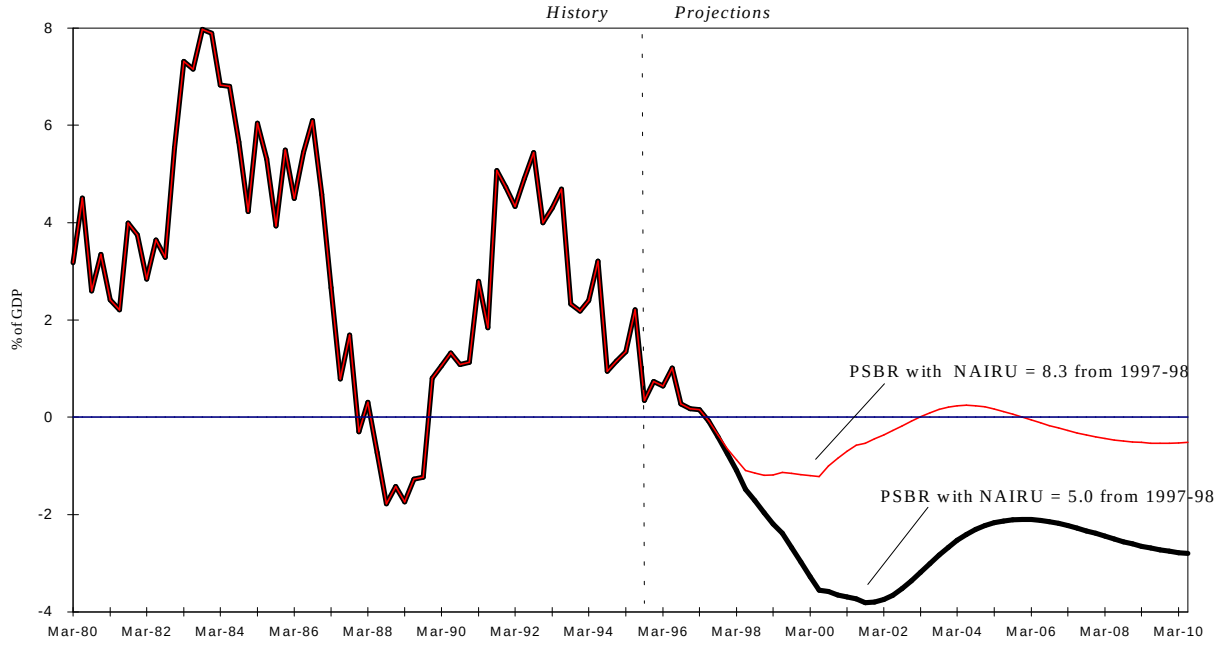
The quickest way to present the two sets of results is by contrast. Perhaps the most surprising difference is between national saving in the two simulations. This is shown below:

Figure 12: National Saving Projections with Different NAIRU Assumptions



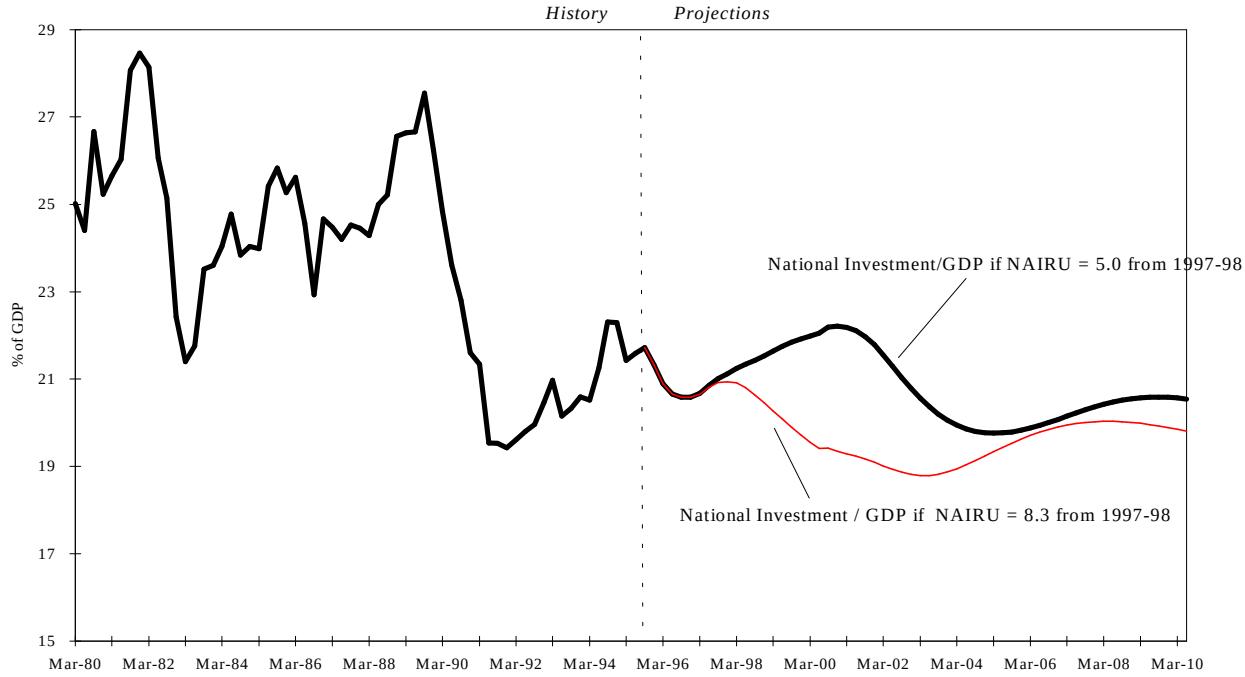
The change in national saving is partly due to the fiscal policy assumption underlying the shock. The fiscal policy assumption is that public final demand (expenditure on goods and services) and tax rates are unchanged as a result of the shock. This means that the net PSBR moves into substantial surplus in the lower NAIRU case due to the activity offsets on the tax base, and the effect of lower unemployment benefit payments on government expenditure.

Figure 13: Net PSBR Projections under Different NAIRU Assumptions



The improvement in the net PSBR leads to a substantial improvement in national saving (there is a small offsetting effect on private saving as the increase in private sector incomes more than outweighs a decline in the savings rate[29]). However, there is a large increase in national investment following from the requirement of the capital stock to adjust to a level compatible with the higher level of output. This necessitates an increase in the level of investment which is unwound once the capital/output ratio has been restored to normal levels (after around seven years).

Figure 14: National Investment Projections under Different NAIRU Assumptions



[29] The improvement in national saving is different to the Ricardian equivalence case where a fall in the deficit (improvement in public saving) due to a reduction in public consumption say is offset by a fall in private saving due to expected future reductions in the tax rate and hence higher expected lifetime income. This can be most clearly seen if the population is split into two groups: employed households who react in the Ricardian way; and unemployed households who do no saving. Even if the employed householders were fully Ricardian they would only partly offset the effects on the PSBR of an increase in structural unemployment. Perhaps this helps to explain the failure of private saving to offset the structural deterioration in public saving over the seventies and eighties in many industrialised countries, (ie the failure of Ricardian equivalence to work even in the medium to long term.).

Figure 15: CAD Projections under Different NAIRU Assumptions

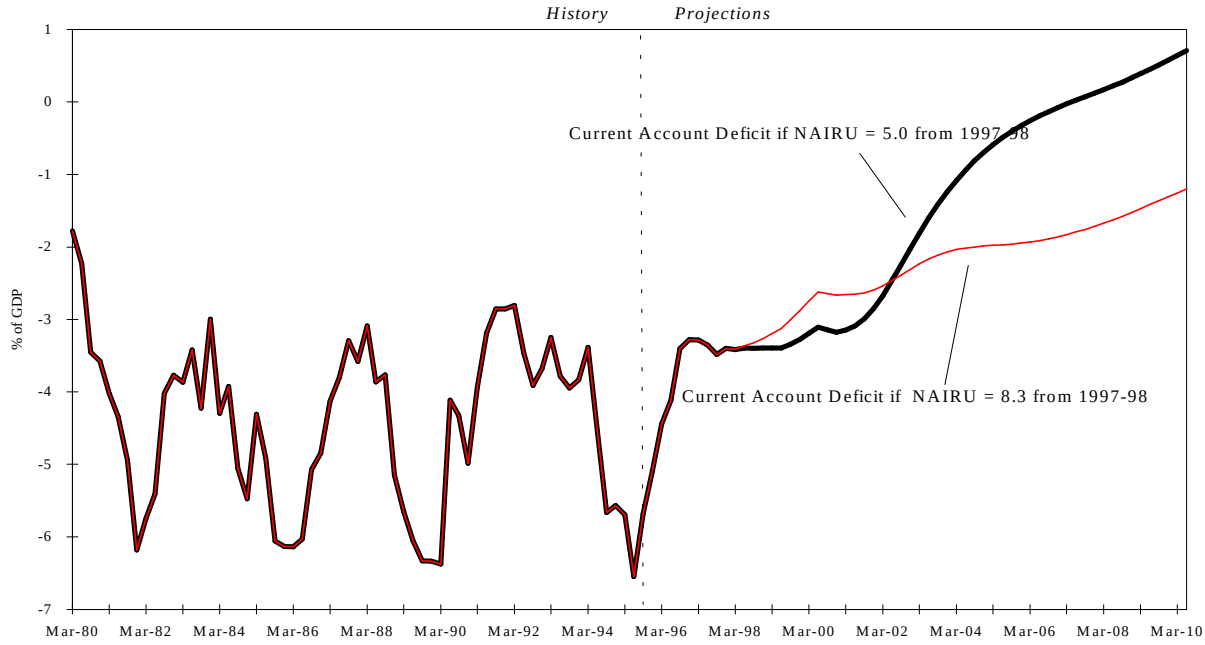
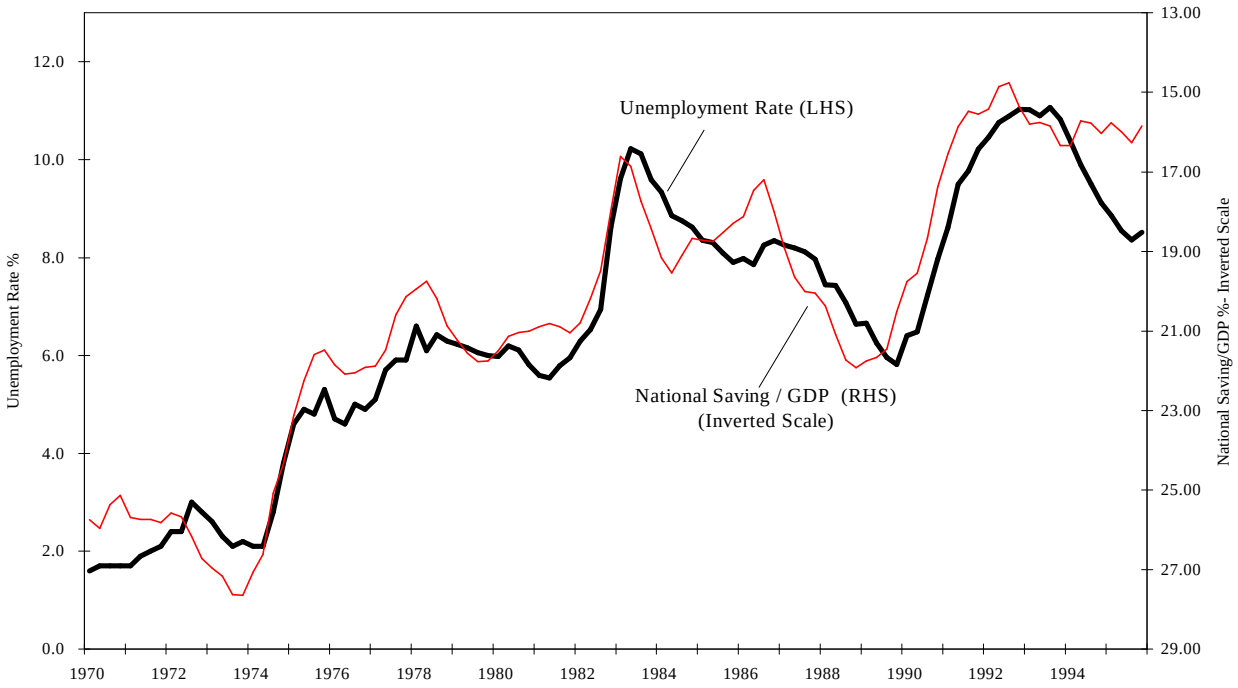


Figure 15 shows that current account deficits are therefore higher initially in the lower NAIRU case as the increase in national investment required for the capital stock adjustment more than offsets the increase in national saving. However, once capital stock adjustment has taken place investment levels fall and the current account improves. In the medium term, there is a substantial improvement in the CAD as a percentage of GDP. The scale of the improvement is almost one for one with the reduction in the NAIRU. However, as always the particular size of the effect in the model should be interpreted with caution as it is dependent on the assumptions used in running the simulation - particularly the fiscal policy assumptions mentioned above.

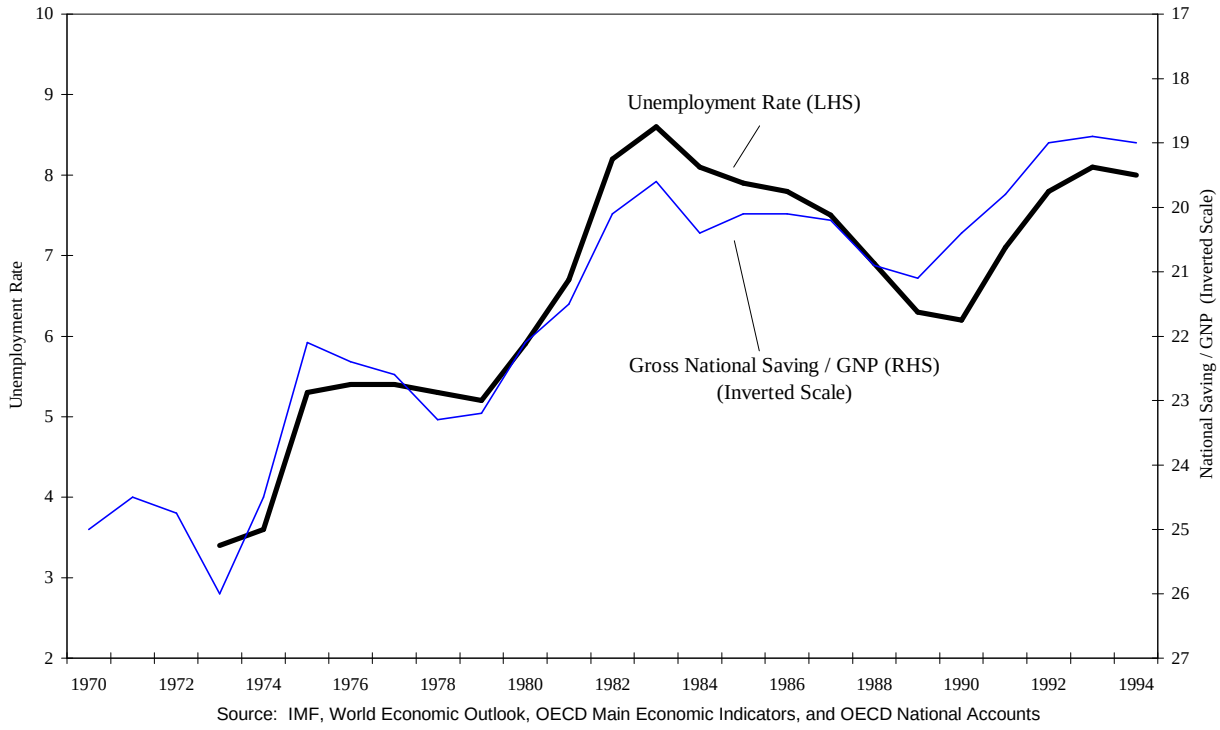
The model results, particularly the linkage between the NAIRU and national saving, while being subject to a range of assumptions and uncertainties, do appear to be broadly in accord with the pattern observable in history. While there are a large number of determinants of national saving, the deterioration in national saving performance in Australia in the 1970s and 1980s did coincide with the increase in the NAIRU and the development of persistently high unemployment.

Figure 16: Movements in Unemployment and National Saving in Australia



It is also interesting to note that rising structural unemployment has been associated with a decline in national saving across the industrialised world as shown in Figure 17 below. Again the coincidence is suggestive that an increase in the NAIRU has deleterious effects on national saving.

Figure 17: Gross National Saving and Unemployment - Industrial Countries

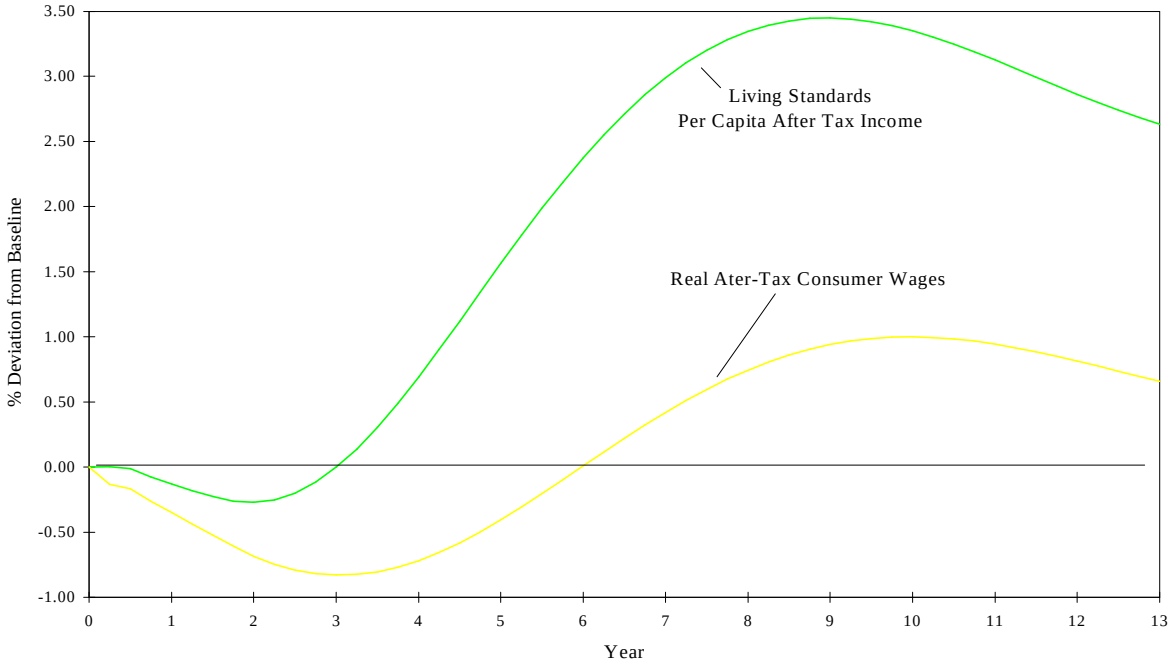


Source: IMF, World Economic Outlook, OECD Main Economic Indicators, and OECD National Accounts

5.2 Implications for Living Standards

The TRYM simulations above illustrate what may happen if discretionary fiscal settings remain unchanged- ie government expenditures on goods and services, tax rates and benefit rates. In these circumstances, per capita living standards rise by around 2 per cent for every 1 per cent reduction in the NAIRU. However, it seems reasonable to assume that elected governments would give back some of the fiscal dividend. In that case the income tax rate would fall and after tax incomes as a measure of living standards would rise by more than 2 per cent for every 1 per cent reduction in the NAIRU. The chart below shows the results for living standards of a "shock" where the NAIRU is reduced by 1 percentage point and where government's target debt to GDP ratio (imposed in the model) is assumed to be unchanged. In this case, after-tax consumer real wages actually increase, as do living standards for the population as a whole which increase by around 3 per cent.

Figure 18: Effect on Living Standards of a Reduction in the NAIRU



This result might be thought of as the long run equilibrium result in the model as ultimately government might be expected to have some target for its debt to GDP ratio.

6. CONCLUSION / SUMMARY

The paper has canvassed a number of reasons for the rise in unemployment using the framework contained in the TRYM model. The paper has made a number of points:

- From a purely aggregative point of view it seems possible to distinguish between search effectiveness and wage settings explanations for the rise in Australian unemployment by using the unemployment/vacancy relationship in combination with the wage equation. This tends to suggest that search effectiveness factors only explain part of the rise in Australian unemployment.

- While wage bargaining factors appear to have played a significant role in the rise in unemployment, there is considerable uncertainty about the determinants of wage behaviour and the level of the NAIRU and, in particular, where the NAIRU will move in the future.

- The *direct* employment creation effects of active labour market programs (abstracting from any impacts on search effectiveness and the NAIRU) are likely to be quickly unwound in a small open economy with a floating exchange rate like Australia.

- Policies designed to increase search effectiveness seem unlikely to have a major impact on the NAIRU, unless they are combined with reforms that lead to improved aggregate wage outcomes.

- That said, large permanent reductions in real wages are not required to reduce unemployment in the model.

- Any reduction in the NAIRU is likely to be associated with considerable fiscal benefits, an increase in national saving and in the medium term a reduction in the current account deficit.

The model results as always should be interpreted with caution as there are a large number of qualifications that need to be made in running the model and significant uncertainties surrounding the specification of some key relationships. However, the model does provide a useful framework for thinking about the NAIRU and in drawing linkages that might not be obvious from partial analysis, such as, the link to national saving and current account deficits, and the wage adjustments required to reduce unemployment. To be useful for drawing more detailed or exact conclusions the model results need to be supplemented by detailed study at the microeconomic level, including into the validity of the assumptions used in generating the results.

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