Centre of Full Employment and Equity

Working Paper No. 01-14

Exploring labour market shocks in Australia, Japan and the USA

William Mitchell[1]

December 2001

Centre of Full Employment and Equity
The University of Newcastle, Callaghan NSW 2308, Australia
Home Page: http://e1.newcastle.edu.au/coffee
Email: coffee@newcastle.edu.au

1. Introduction

High unemployment rates that have persisted in most OECD countries over the last twenty years remain one of the main global economic problems. The worrying fact is that after two decades of supply-side policies, whose collateral damage has included greater job insecurity and rising income inequality (Galbraith, 1998), unemployment rates are quickly increasing again as falling aggregate demand levels push the world economies towards recession. The problem is compounded by a reluctance of most governments to use demand-side policies to attenuate these costly cyclical episodes (Mitchell, 2001b).

Figure 1 shows that since the mid-1970s, the labour market experiences of Australia, Japan and the United States (US) have been distinct. Japan maintained full employment until its recent economic problems have pushed the unemployment rate from 3.2 per cent in 1995 to 5.4 per cent in October 2001 with recent GDP figures recording the 4th official recession in the last decade (Japan Institute of Labour, 2001). Its vacancy rate shows cyclical patterns without any obvious trend decline. The unemployment rates in Australia and the US have been significantly higher with three strong upturns coinciding with demand failures. Both economies experienced strong real output growth and falling unemployment over the last 8 years. Despite this growth Australia's unemployment rate remained stuck at around 6 per cent while the US achieved historically low unemployment rates. With the downturn now apparent, the October figures show that Australia's unemployment rate has risen to 7.1 per cent (ABS, 2001). Similarly, the unemployment rate in the US has jumped to 5.7 per cent in November 2001 after several months of major job losses. This was the highest level since August 1995 (BLS, 2001). The other interesting observation is that Australia's vacancy rate underwent a mean-shift coinciding with the mean increase in the unemployment in the mid-1970s.

To help understand the evolutions of unemployment and vacancies shown in Figure 1, this paper investigates whether the labour markets in Australia, Japan and the US exhibit similar dynamic behaviour when shocks are experienced. The comparison between the three economies is motivated by the perceived differences in the way their respective labour markets operate. The substantially deregulated US economy has been advocated as a model for other countries to follow (OECD, 1994). Conversely, Japan has adopted

active macroeconomic policy and increased regulation to maintain low unemployment rates (OECD, 1996). They have also not embraced widespread supply side reforms, although there are now pressures for labour market, as well as product market and financial market reforms. Australia has adopted a hybrid approach with substantial deregulation and privatisation. It has abandoned full employment as a policy goal (Mitchell, 2001b). In summary, the three economies have adopted a range of policy approaches to the problem of unemployment and they have experienced different outcomes over the past three decades as shown in Figure 1.

The analysis uses two distinct techniques. First, we examine phase diagrams to determine the presence and stability of attractor rates of unemployment and vacancies (Ormerod, 1994). The behaviour of the three economies is sharply contrasting and provides insights into their relative unemployment experiences. Second, we estimate a recursive Vector Autoregressive (VAR) model to examine the relative dynamic impacts on vacancies and unemployment (both expressed as a percentage of the labour force) of various shocks (monetary, output, sector-specific, and external). We extend Genay and Loungani (1997) who study the way that "intrinsic and qualitative differences between the economic, financial, and legal structures of Japan and those of the U.S." condition "the relative importance and propagation of various economic shocks."

The differences in behaviour detected between the countries points to two common conclusions. First, the economies appear to react to conventional demand-side factors and the policy priority has to be to lower the attractor unemployment rates. The raft of supply side policies pursued in Australia over the last two decades has been successful in this regard. Second, policy intervention must aim to prevent rapid rises in unemployment rates that accompany downturns from becoming entrenched.

The paper is laid out as follows. Section 2 examines the relationships between output growth, employment growth and unemployment in Australia, Japan and the US. Section 3 introduces the Beveridge curve framework and argues that the orthodox natural rate approach has limited appeal. Section 4 estimates VAR models for Australia, Japan and the US and compares the way in which the three labour markets react to aggregate and sectoral shocks. Concluding remarks follow.

2. Output and employment growth and unemployment in Australia, Japan and the USA

2.1 An overview

Table 1 presents summary statistics for each of the three economies using quarterly seasonally-adjusted data for the period spanning 1978(1) to 2001(2). The data reveal some interesting similarities between the three economies as well as some notable differences. Japan has experienced a lower real GDP growth over the period compared to Australia and the US, who exhibit virtually identical outcomes. The US economy is more successful at turning output growth into employment growth, although the data hide a range of qualitative issues. Australia and Japan both experienced higher variability in their respective employment growth rates. The US generated a higher average vacancy rate compared to Australia and Japan. Japan's very low average employment growth rate relative to its real output growth implies that it has the strongest overall labour productivity growth (in persons). Its unemployment rate is notably lower although it is also the most variable. The base year for the money wage index (average hourly manufacturing earnings) and the deflator (consumer price index) used to compute the real wage is common to the three economies (1995=100). The mean outcomes for both wage measures are remarkably similar although Japan has more variability in real wages and less variability in money wages. Japan's low inflation rate also separates it from the other two economies as does it low average cash rate. It is apparent that fluctuations in the real effective exchange rate (CPI-based with 1995=100) are greater in Japan although overall its average rate implies a lower level of relative international competitiveness over the period shown.

Figure 2 shows overall percentage change in real output and employment between the start and end of the relevant period for Australia, Japan and the US for decade breakdowns since 1960. Table 2 shows average annual growth rates for the same variables and decades. The comparison is revealing. All countries experiences strong growth in real output during the 1960s with Japan being exceptional. It is interesting to note that subsequent decline in real output growth was relatively smaller for the US than the other economies. Over the next three decades, real output growth and employment

growth in Japan has declined with the 1990s standing in stark contrast to the golden age of the 1960s. In contrast, average real output growth in Australia and the US has been similar and steady between 1970 and 2000, and a step down from the 1960s performance. However, while employment growth in the US has been broadly steady, Australia rate of job generation has slowed significantly in the 1990s.

Table 3 reports the results of Granger-causality tests for output growth linkages between the three economies for the period between 1959:3 and 2001:2. The results show (within the meaning of these tests) that Australian real output growth is driven by real output growth in the US and Japan but there are no feedback effects. Surprisingly, there appears to be no feedback between US and Japanese real output growth.

Figure 3 compares the average annual real GDP growth rates from Table 2 with average unemployment rates for Australia, Japan, and US for decades since 1960 and the overall 1970-2000 period. Japan displays a predictable inverse relationship between real GDP growth and the average unemployment rate. For Australia and the US there is no clear relationship. Ormerod (1994: 149) says "for any given path of economic growth, on the basis of international experience over the past twenty years, the rate of unemployment is indeterminate." Far from being equilibrating systems that revert to trend positions after cyclical episodes, the evidence supports the view that shocks permanently alter the path of the economy unless attenuated by policy. Mitchell (2001b) shows that the unemployment outcomes associated with real GDP growth depend on the way the government conducts fiscal policy and shares the growth benefits. Ormerod (1994: 202) suggests that "a perfectly feasible outcome for the Western economies in the post-war period would have involved a much higher average level of unemployment, with everything else remaining exactly the same … The sole difference would have been that those in employment would have become even better off than they did, at the expense of the unemployed." Mitchell (2001b) shows for Australia that Government policy failure in 1974 locked the economy into a step-rise in unemployment, which subsequent cycles have been unable to reverse. We return to the issue of multiple equilibria in Section 3.

2.2 Public sector employment in Australia, Japan and the US

Mitchell (2001b) argues that the behaviour of public sector employment helps to explain the differences in unemployment outcomes across OECD economies since 1970. Table 4 decomposes the labour force aggregates to demonstrate this proposition. The private employment gap (*PGAP*) is the number of workers that are willing to work but who cannot find private sector employment.[2] If the public sector fails to fill the *PGAP* in any period then the unemployment gap (*UGAP*) reflects demand-deficient unemployment. The *UGAP* thus reflects the policy choices of government.

The relatively low unemployment rate in the US is often attributed to their relatively free labour markets and wage fixing mechanisms (for example, Macfarlane, 1997). The most notable difference between Australia and the US is not in the performance of private employment growth but in the relative public sector employment growth rates. It is clear that since 1970 the public sector employment growth (averaging 1.6 per cent per annum) in the US has nearly tracked labour force growth (averaging 1.8 per cent per annum) and more than closed the *PGAP*. In this sense, public employment growth has complemented the strong private employment growth. Over 1970-1999, Australia's average annual private employment growth was 1.91 per cent whereas the US experienced an average rate of 1.88 per cent. Mitchell (2001b) shows that if public employment growth in Australia had achieved US-proportions, Australia would also have had very low unemployment in 1999. Japan's public employment share is the lowest of all the countries examined by Mitchell (2001b) and has barely changed over the 1970-1999 period. Japan avoided the rise in unemployment in the 1970s and the early 1990s. It is important to note that in both periods, when the private employment growth rate was slower than usual, the public employment growth picked up, thus providing a counter-cyclical offset. Further, in 1995-1999 period, unemployment rose to historically high levels in Japan as public employment growth plummeted to match the parlous state of the private sector labour market. So it is not the size of the public employment share that is important but at which points in the cycle public employment growth increases and decreases.

3. Unemployment and vacancy rate dynamics

3.1 The Beveridge curve framework

A standard analytical framework for examining the dynamics of unemployment and vacancies is the Beveridge curve model, which is summarised in Figure 4 (see Petrongolo and Pissarides, 2001 for an excellent summary of the state of the literature). The diagram plots unfilled vacancies against unemployment both expressed as percentages of the labour force. The orthodox interpretation is that with constant matching effectiveness, a negative cyclical relationship exists between unemployment and vacancies (movements along a given UV curve). Accordingly, cyclical booms lead to higher vacancies (lower unemployment) and downturns lead to lower vacancies and higher unemployment. The entire function shifts (for example, A to D) when the matching effectiveness changes and, consistent with the NAIRU orthodoxy, is considered independent of the state of the cycle (see Layard, Nickell and Jackman, hereafter LNJ, 1991; OECD, 1994). The conventional analysis thus posits that UV_1 is a more efficient matching state than UV_2. A movement along the ray AE is according to this logic a mixture of structural deterioration and demand deficiency. The framework is thus used to distinguish between sectoral shocks (shifts in the UV curve) and aggregate shocks (movements along the UV curve).

LNJ (1991) construe empirical shifts in UV curves in various countries since the 1970s as signifying a failure of the unemployed to seek work as effectively as before. LNJ (1991: 38) say "Either the workers have become more choosey in taking jobs, or firms become more choosey in filling vacancies (owing for example to discrimination against the long-term unemployed or to employment protection legislation." Accordingly, the persistently high unemployment becomes an equilibrium phenomenon (rising natural rates) reflecting maximising decisions by individuals in the context of various anti-competitive institutional arrangements in the labour market (wage setting mechanisms and trade unions) and government welfare policies (encouraging people to engage in inefficient search).

This view has been increasingly difficult to sustain in recent years as longer time series allow for more sophisticated empirical scrutiny (see Mitchell, 2001a for a comprehensive critique of the empirical and conceptual flaws in the NAIRU framework). The problem

with the framework is that it assumes that structural changes are orthogonal to the cycle. If hysteresis is present an initial move down a given UV curve can initiate labour market adjustments which would cause an outwards shift in the curve.

Endogeneity of behaviour also poses the problem of observational equivalence. For example, search time will lengthen when there are large cyclical downturns and the probability of gaining a job decreases. Mitchell (2001a) argues that it is hard to blame individuals for their labour market outcomes when the unemployment to vacancies ratio has averaged 11.1 in Australia since 1974. It becomes a fallacy of composition to conclude that if all individuals reduced their reservation wage to the minimum (to maximise supply-side search effectiveness) unemployment would be significantly lower (given the small estimated real balance effects in most studies). Further, unless growth in labour requirements is symmetrical and labour force growth steady on both sides of the business cycle, the pool of unemployed can rise and remain persistently high (Mitchell, 2001c; Mitchell and Muysken, 2001). The segmented labour market literature long ago identified the endogenous changes that occur to individuals who are deprived of opportunities to work. Doeringer and Piore (1971) outlined the need for vestibule training and other skill development to assist individuals to break out of poverty. But, they only advocated these supply-side policies in the context of a strong economy with sufficient job creation to generate full employment. The latter point cannot be understated.

In seeking an explanation for the rise in unemployment from the 1970s, Ormerod (1994: 126) notes that "Actual unemployment in Europe has risen fourfold in the past twenty years, and most estimates of the 'natural rate' in the various countries have risen by a similar amount. Yet flexibility of labour markets … has not changed markedly over this period … [and has] … not been sufficient to account for the enormous rise in unemployment which Europe has experienced." Recent research finds strong empirical relationships between employment and vacancies growth and the inverse of the unemployment rate, and between investment to GDP ratios and the unemployment rate across many countries. They are difficult to interpret as being driven from the supply-side (Ball, 1999; Modigliani, 2000; Mitchell, 2001a).

Mitchell (2001a) tested for the presence of NAIRU dynamics across a range of OECD economies, including Australia, Japan and the US using a price inflation Phillips curve model and failed to find any evidence of a constant NAIRU operating in any of the countries examined.[3] These results accorded with Fair (2000: 70) who concluded that "One should not think that there is some unemployment rate below which the price level forever accelerates and above it forever decelerates." Other studies have failed to find any clear correlation between changes in the inflation rate and the level of unemployment (Chang, 1997; Mitchell, 2000a). Mitchell (2001a) also finds that the change in the unemployment is highly significant in explaining inflation dynamics in Australia and the US but not for Japan. The result suggests that hysteresis is present in Australia and the US (Mitchell, 1987; Gordon, 1997). It is consistent with other studies that find high degrees of persistence to shocks in unemployment rates (Campbell and Mankiw, 1987, 1989; Mitchell, 1993, 2001c). Further, Akerlof *et al* (2000) find sharp asymmetries in unemployment dynamics over the business cycle such that unemployment rises quickly in a downturn and falls more slowly as growth increases. The results taken together indicate that a deflationary strategy using demand repression (tight monetary and fiscal policy) will be costly in terms of unemployment. Mitchell (2001a) and Mitchell and Muysken (2001) use regression analysis to examine the shifts in the Australian and Dutch Beveridge curves since the mid-1970s. They find that all the shifts coincide with major cyclical downturns rather than autonomous supply side shifts.

In conclusion, the NAIRU framework is not considered helpful in explaining the differences in unemployment outcomes between Australia, Japan and the US.

3.2 Phase diagram analysis

Figures 5 and 6 represent phase diagrams for the unemployment rate and the vacancy rate, respectively. The current values of the respective time series are plotted on the y-axis against the lagged value of the same series on the x-axis. The years noted refer to the current year's unemployment rate. For example, from Figure 5, Australia went from an unemployment rate of 1.4 per cent in 1960 to 3.1 per cent in 1961. We can look at these scatter plots in four distinct ways. First, the charts provide information on whether cycles are present in the data. Second, the presence of "attractor points" (Ormerod, 1994: 154)

can be determined. The points might loosely be construed as the "centre of the ellipses traced out in such a plot" (Ormerod, 1994: 154). Third, the magnitude of the cycles can be inferred by the size of the cyclical ellipses around the attractor points. Fourth, the persistence (strength) of the attractor point can be determined by examining the extent to which it disciplines the cyclical observations following a shock. Weak attractors will not dominate a shock and the relationship will shift until a new attractor point exerts itself.

Figure 5 reveals significant differences between the three countries. Australia shifted its attractor in the 1974-76 period and the two subsequent recessions have oscillated around this higher point with varying cyclical magnitude. The explanation for Australia's persistently high unemployment rate revolves around the factors that generated the shift. It is also clear that the economy takes several years to recover from a large negative shock even if the attractor remains constant. Japan, also shifted its attractor in the period following the first oil shock. The extent of the shift compared to Australia was small. There was also a relatively speedier resolution to the 1980s downturn compared to Australia. The Japanese economy now appears to be seeking a new attractor. The US has fluctuated around an attractor unemployment rate of 5.5 to 6 per cent although the magnitude of the cycles around it has been variable. The early 1990s recession, while significant, did not promote a new attractor. So a major difference between Australia and Japan on one hand, and the US on the other, is the sensitivity of the attractor to cyclical events.

Figure 6 shows vacancy rate relationships. The 1974-75 disturbances in the unemployment rate attractor in Australia also promoted a shift in the vacancy rate attractor, although in this case the movement was downwards. The supply-side analysis interprets the unemployment shift in Figure 5(a) (and Figure 4a) as a decline in labour market efficiency. But the shift in Figure 6 (a) using the same logic would be interpreted as increasing matching efficiency. Clearly, both states cannot hold. A consistent interpretation can be found in the view that the Australian economy has been demand constrained as a result of a regime shift in government policy in the mid-1970s. The rapid rise in unemployment in 1974 was so large that subsequent (lower) growth with on-going labour force and productivity growth could not reverse the stockpile of unemployed

(Mitchell, 2001a). Whatever endogenous supply effects that may have occurred in skill atrophy and work attitudes were not causal but reactive.

For Japan and the US, the vacancy rate attractor has not exhibited any notable shifts over the period examined, although the oil price disturbances in 1974 generated negative but temporary impacts on Japan.

3.3 Shifting the attractor downwards?

The relatively poorer unemployment outcomes in Australia compared to Japan and the US is related to the failure of the Australian economy to maintain a stable unemployment and vacancy attractor. In particular, the data suggests that in the Australian case, the economy reacts more badly to recession. The conduct of macroeconomic policy in Japan and the US has also been less driven by the NAIRU "fight inflation first" rhetoric that has dominated the Australian policy debate (Wray, 1998; Mitchell, 2001b).

The phase diagram analysis suggests that to restore full employment, the economy needs a major positive shock of a sufficient magnitude to shift the current attractor point downwards (Ormerod, 1994: 161). It is almost definite from the earlier analysis and related empirical work reported in Mitchell and Muysken (2001) that this shock has to be aggregate and focused on the demand side. Interestingly, Layard (1997) has recently cast doubt on the supply-side labour market policies that LNJ (1991) initially promoted and which were so zealously taken up by the OECD and governments around the world. Layard (1997: 202) concludes that "If we seriously want a big cut in unemployment, we should focus sharply on those policies which stand a good chance of having a really big effect. It is not true that all polices which are good in general are good for unemployment. There are in fact very few policies where the evidence points to any large unambiguous effect on unemployment and … some widely advocated policies for which there is little clear evidence." He included changes to "social security taxes", changes to "job protection rules", "productivity improvements", and "decentralizing wage bargaining" as "policies whose effects are difficult to forecast". For example, Layard (1997: 192) argues that further cuts in the duration of benefits would only increase employment at the costs of the creation of an underclass with an "ever-widening inequality of wages." He now prefers government job creation, which would allow people to reacquire "work habits …

to prove their working capacity … [and to restore] … them to the universe of employable people. This is an investment in Europe's human capital." (Layard, 1997: 192)[4]

Mitchell (1998) and others (Wray, 1998) argue that the implementation of a Job Guarantee would be sufficient to shift the attractor down to levels consistent with full employment.

4. A VAR model of unemployment and vacancy dynamics in Australia, Japan and the USA

4.1 Introduction

In this section, we estimate recursive VAR models for each country as a basis for comparing how each labour market reacts to shocks. We consider the dynamics of the Beveridge curve broadly by allowing output, monetary, sectoral and external factors to interact with vacancies and unemployment. The most contentious issue concerning this approach is whether identification of structural relationships can be made from the estimated model. Sims (1980) proposed the Choleski decomposition, which restricts the coefficients in the VAR triangularly. Thus, identification is determined by the ordering of the variables in the reduced-form representation. Stock and Watson (2001: 3) conclude that "The fundamental problem that plagued the large macroeconomic models of the 1970s, identifying restrictions that were not compelling … remains with us in VARs. Identification requires compelling theory or institutional knowledge."

While acknowledging these issues, we choose the standard approach in this paper so as to generate results that are comparable between the countries. Rather than adopt the Choleski orthogonalisation and then test for the sensitivity of the ordering, we use the generalised impulse function approach (Pesaran and Shin, 1998). This approach does not require the orthogonalisation of shocks and is invariant to the ordering of the variables in the VAR. In later work, we will tackle this issue more directly by estimating a full VECM structural VAR model.

A further decision has to be made concerning the treatment of stochastic non-stationarity in the variables? Sims (1980) and others recommend against differencing even if the variables contain a unit root because VAR analysis aims to capture the interactions

between the variables rather than estimate the coefficients. Differencing destroys information about the co-movements of the levels and thus integrated variables should not be detrended. The majority of econometricians however argue that the variables should be differenced if there is evidence of stochastic trends in the data. Detrending of trend-stationary series is easily accomplished by the inclusion of a trend function in the VAR. Lütkepohl (1993: 346) argues that "if interest centers on analyzing the original variables rather than the rates of change it is necessary to have models that accommodate the nonstationary features of the data." However, Lütkepohl (1993: 351) adds that "… a VAR … analysis could be performed after differencing … [but] …differencing may indeed distort the relationship between the original variables."

The problem is that variables like the unemployment and vacancy rate are, by construction, stationary, although the low power of the unit root tests and finite samples of the time series will generate test statistics that support the null (see Table 5). In this paper, we are more concerned to ensure that each model is stable and free of serial correlation in the residuals, as a basis for conducting the impulse response analysis rather than rely strictly on the dictates of the low power unit root tests. There is also strong evidence (unreported) that the relationships shown cointegrate. The implications of this are saved for further work.

4.2 The model

We estimate a 7-variable VAR model which includes the unemployment rate, the vacancy rate, a measure of employment reallocation (to capture sectoral shocks), the growth of real output (to capture output shocks), world petroleum prices (to capture external shocks), the short-term rate of interest (to capture monetary shocks), and the real wage. All the variables are in logs except for the interest rate variable. The construction of and sources for all variables are detailed in the Data Appendix.

Output shocks

The quarterly growth in real GDP is used as measure of real aggregate shocks. Genay and Loungani (1997) find that the unemployment rates fall and vacancy rates rise in both countries following an innovation in real output growth. Japan reacts more slowly and the

impact endures for longer than in the US case. They argue that this is consistent with the standard interpretation of the Beveridge curve noted above.

Monetary shocks

With monetary policy working through the setting of a target short-term rate rather than through the control of monetary aggregates, we use innovations (unexpected increases) in this short-term interest rate to capture the labour market response to a change in the monetary instrument (see Eichenbaum and Evans, 1995, Genay and Loungani, 1997). In the VAR, we assume that the central bank takes into account a broad range of labour market, product market and external influences in determining monetary policy and that the cash rate represents discretionary policy decisions (see Dungey and Pagan, 2000). The evidence from other studies is ambiguous and the results are sensitive to the model and shock specification. Leeper, Sims and Zha (1996) conclude that overall monetary shocks have small macroeconomic impacts in the US. Christiano, Eichenbaum, and Evans (1996) show the converse. For Japan, Moreno and Kim (1993) find significant monetary impacts whereas West (1992) finds the opposite. Genay and Loungani (1997: 23) find unemployment rates increase and vacancy rates fall in both countries when monetary policy is tightened. They conclude that "the responses of Japanese labor market indicators to a monetary policy shock are similar to those in the U.S., except their initial responses are more immediate and the estimates are less precise than those in the U.S."

External shocks

The three countries vary in size and openness. Both Japan and the US are large economies although the latter is relatively closed. Australia is both small and open. West (1992, 1993) finds relatively stronger output reactions in Japan than in the US following real exchange rate shocks. Brunello (1990) suggests otherwise when comparing employment responses in Japan and the US. Genay and Loungani (1997) find that an improvement in external competitive is immediately beneficial in the US and last for a year. The response in Japan is stronger but takes longer to manifest. Given the sensitivity that each showed to the OPEC oil price shocks, we use an index constructed by the Australian Treasury for world petroleum product prices.

Employment reallocation shocks

Lilien (1982) and Abraham and Katz (1986) conducted a spirited debate over the relative impact of sectoral effects on steady-state unemployment. Abraham and Katz (1986) argued that slow growth sectors also experience greater cyclical sensitivity. As a result the positive relationship found by Lilien (1982) between the sectoral shocks measure and unemployment was likely to be contaminated by cyclical influences. Borland (1996) derives a measure of sector-specific employment reallocation (a measure of job creation and destruction) that is equivalent to that of Stoikov (1966) and is invariant to aggregate changes. Other authors have used financial market data to construct a dispersion indexes to capture industry-specific shocks (see Genay and Loungani, 1997). Data availability led to our choice of an employment-based dispersion measure of sectoral turbulence.

4.3 Empirical results

Table 6 reports the tests for lag order for each country. The tests typically vary and force the researcher to make considerable judgement about the order of the VAR to estimate. For comparability purposes and noting the relatively short samples available we used VAR(2) models. We tested for serial correlation in each and were satisfied that the models provide the basis for inference.

To gain some further insights, we conducted pairwise Granger-Causality tests using the estimated models for each country. Table 7 reports the results of this analysis. While the tests provide only indicative information to provoke further analysis some interesting points to note from Table 7 include the importance of interest rates in explaining the forecasting performance of the unemployment rate in Australia and the US; the important of real GDP growth in explaining the future path of vacancies in the US, Japan and the unemployment rate in Australia. Significant sectoral shocks and petrol prices are only present in Japan (for the vacancy rate).

Each model was tested for stationarity. In each case, the inverse roots of AR characteristic polynomial were inside the unit circle. We also tested whether the Σ variance matrix in each model was diagonal (that is, for zero contemporaneity of the residual variances) using a standard log-likelihood ratio test. The ordering of the Choleski

orthogonalisation is not an issue if the innovations are contemporaneously uncorrelated. We found strong correlation in each country between the interest rate and the real output growth variable errors and as a result opted to use the generalised impulse response function approach noted above.

Figures 7 to 9 graph the impulse response functions for Australia, Japan and the USA, respectively for the vacancy rate and the unemployment rate. The full response functions are available from the author. The functions show the percentage responses to a generalised one standard deviation innovation in each of the variables in the model. The dotted bands are the 2 standard-error bands and give some idea of the precision of the response functions. Note that the percentage scale on the Australian graphs for the vacancy rate and unemployment rate is different and so care needs to be taken in making graphical comparisons of magnitudes. Table 8 presents the response functions in numerical form for more precision in interpretation. Can we derive any straightforward behavioural interpretations from the charts?

The interest rate shock leads to increases in the unemployment rate and decreases in the vacancy rate in all countries although the magnitudes of the responses are different. Japan shows the smallest effects although they are estimated with the least precision. For Australia, the unemployment rate begins to rise about 4 quarters after the shock and continues to rise for around 10 quarters. Japan's unemployment rate rises after one quarter and continues to rise beyond the 20-quarter horizon shown. The US economy response follows a similar pattern to Australia although it is more immediate.

The three economies also display predictable responses to positive real output shocks although again, Japan's labour market is less sensitive than the labour markets in Australia or the US. For Australia, the vacancy rate responds immediately and the positive stimulus impact lasts for around a year. Similarly, the unemployment rate falls immediately as new jobs are created. The US economy responds in a similar fashion. The Japanese unemployment rate response takes longer to occur, is smaller than the other countries but endures for more than 2 years. The vacancy rate rises are similar in time profile to those of Australia and the US but smaller in magnitude.

All responses are in accord with Keynesian notions that monetary policy is effective although not necessarily immediate in its impact. Real output stimulii also provide favourable outcomes to each economy. The results also accord with the dynamics of the Beveridge curve, where aggregate shocks generate movements along the curve. The real wage reaction in Australia is likely to be a supply-side response given the behaviour of the vacancy rate following a real wage shock.

The petrol price and employment reallocation (sectoral) shocks provide some clue to how far the Beveridge curve shifts (although the petrol price shock may not be invariant to the state of demand). Following a rise in the world petroleum prices, Australia's vacancy rate falls immediately while the rise in the unemployment rate begins to impact after 7 quarters. The impacts are smaller than the aggregate shocks. Japan appears to take around 4 quarters before the vacancy rate falls and the unemployment rate rises. These impacts are notably stronger than for Australia and the US. The US response is more immediate and by far the smallest.

The employment reallocation or sectoral shock also reveals sharp differences between Australia and the US on one hand and Japan on the other. For Japan, the impacts on both labour market variables shown are immediate and substantially larger than for the other economies. The vacancy rate falls continually for over 8 quarters and the unemployment rate rises for over 12 quarters. In stark contrast is the relative insensitivity of the Australian and US labour markets to sectoral shocks. In Australia, there is a small and immediate positive impact on the unemployment rate and a small delayed negative impact on the vacancy rate. The magnitude of the responses in Australia and the US to the sectoral shocks is clearly not sufficient to explain the shifts in the Beveridge curves that have occurred, particularly in the Australian case. The result for Japan should be treated with some caution given the less than satisfactory construction of the dispersion measure. However, overall the results are in accord with the general conclusions of Genay and Loungani (1997).

The real wage response for Australia appears to be a labour supply disturbance reacting to stronger demand conditions, given that both the unemployment rate and the vacancy rate rises. For Japan, the real wage shock has very little impact. In the case of the US, the

real wage shock appears to have more orthodox interpretations in terms of rising labour costs impacting adversely on the vacancy and unemployment rates. The identification problem prevents a clear interpretation in this regard.

Table 9 shows the percentage variance decompositions for each shock in each system for various periods following the shock. The decompositions help us interpret the relative strength of the different shocks in each country. We have not shown the components for the vacancy rate or unemployment rate. To interpret the results we note that the dynamics of Australia are dominated by GDP shocks accounting for 21.31 per cent of the system-wide variation in the unemployment rate after 8 quarters.

In terms of the unemployment rate, real output shocks and interest rate shocks dominate in Australia and the US, whereas, petrol price shocks and the sectoral shocks are more importance in Japan. In terms of the vacancy rate, real output shocks are also dominant in the Australia and the USA, while monetary shocks are less important in Australia. The petrol price and sectoral shocks also dominate in Japan.

Our results for the US and Japan are broadly similar to other studies in that aggregate shocks are more important in the US than in Japan whereas external shocks play a greater role in Japan (West, 1992, 1993; Kaneko and Lee, 1995; and Genay and Loungani, 1997). Our study has added Australia to this comparison. In general, the Australian and US economies react in similar ways and are distinct from the response by the labour market in Japan to shocks.

5. Conclusion

We set out to explore the dynamics of the unemployment rate and the vacancy rate in Australia, the US and Japan in response to a range of shocks. The results are broadly consistent with other comparative and individual studies of labour market behaviour in Japan and the US. By adding Australia to the analysis we have broadened the insights available and provided more evidence of the uniqueness of the Japanese labour market.

The results do not support the view that the rise in unemployment in Australia and worsening trade-off between unemployment and vacancies is consistent with structural shifts. The phase diagrams demonstrate the inconsistency of this argument in terms of the

behaviour of the unemployment rate and the vacancy rate. The VAR analysis has pointed to the dominance of aggregate shocks. The evidence suggests that our relatively worse unemployment performance is explained by the factors that shifted the unemployment attractor up and the vacancy attractor down. Demand side factors play an important role in this regard. The supply side explanation struggles to find timely shifts in micro variables of sufficient magnitude to motivate the displacement of the Australian labour market around 1974-75.

We conclude by restating Layard (1997) who now focuses on public sector job creation as the solution which stands "a good chance of having a really big effect" – in our context – of shifting the unemployment attractor sharply and quickly downwards. That is, a large positive demand shock is required. Attention to inflationary pressures suggests that the Job Guarantee is one viable method to achieve this shift (Mitchell, 1998; Wray, 1998).

6. Data Appendix

Unemployment Rates

OECD Main Economic Indicators Standardised unemployment rates refer to the number of unemployed persons as a percentage of the civilian labour force. The definitions for unemployment and labour force conform to the ILO guidelines.

Vacancies

The vacancy rate measure for Australia and Japan is the percentage of new vacancies relative to the labour force.

Australia: The series is from the ABS TRYM model database.

Japan: The new vacancies series is from the OECD Main Economic Indicators and is the number of new vacancies (000's) registered during the month at the Bureau of Employment Security.

US: The vacancy data is derived from the Help wanted advertising index (1995=100), compiled by The Conference Board. The data is based on the number of help-wanted advertisements published in classified sections of 51 city leading newspapers. The vacancy rate measure is the HWI by 1000 divided by the labour force (in millions).

Sectoral Reallocation

The method for construction is outlined in Borland (1996, Appendix 2) and follows Stoikov (1966). The Stoikov index measures the spread in the rates of growth of employment across industries and is computed as:

$$DIS_t = 100\sum_{i=1}^{p}\left|\left[\left(n_{it} - n_{it-1}\right)/n_{it-1}\right] - \left[\left(N_t - N_{t-1}\right)/N_{t-1}\right]\right|\left(n_{it-1}/N_{t-1}\right)$$

where n_{it} is the employment in industry i at time t and N is total employment. There are p industries in the measure.

Australia: The measure of employment reallocation is derived from ABS industry employment data based on the 17-industry ANZIC. The ABS provided unpublished compilations of pre-November 1984 data based on the ASIC classification and rendered compatible with the 17-industry ANZIC data. This was in two sections - 1978 to 1984 and pre-1978. The construction of the Stoikov index of dispersion revealed that problems remained with the pre-1978 linking and only quarterly data after 1978 has been used.

Japan: The measure was derived from the OECD STAN database. The industry sectors used were Agriculture, hunting, forestry and fishing, Mining and quarrying, Manufacturing, Electricity, gas and water supply, Construction and Total services. The selection allowed the maximum time span available. The data coverage in STAN was for the period 1970-1998. Data after 1998 was derived from the Japan Institute of Labour. The annual data was used to generate the Stoikov index and then quarterly observations were generated by linear interpolation.

US: The measure was derived from Bureau of Labor Statistics industry employment data. The industry sectors used were Mining, Construction, Wholesale trade, Manufacturing, Transportation and public utilities, Retail trade, Finance, insurance, and real estate, Total services, and the Government sector. The quarterly data was based on centred averages of the monthly data.

Prices

The inflation measure is computed as the annual change in the consumer price index published for each country by the OECD Main Economic Indicators.

Australia: The index reference population includes all metropolitan private households living in the six Australian state capital cities, plus Canberra and Darwin. This accounts for around 64 per cent of all Australian private households.

Japan: All households excluding those mainly engaged in agriculture, forestry and fisheries and one-person households are covered.

US: The All items (wage earners), 1995=100, accounting for around 32 per cent of the population and compiled by the Bureau of Labor Statistics was used.

Interest Rates

Australia: The authorised money market dealers deposits (weighted average) rate was taken from the ABS, TRYM model database.

Japan: The official discount rate is the base rate (per cent per annum) and was derived from Bank of Japan data.

US: The Federal Funds rate is the daily effective rate on federal funds (balances that are available immediately to the purchaser to adjust reserve positions or to make payments on a day-to-day basis). It was derived from the OECD Main Economic Indicators.

Real Output

The real output series are derived from the OECD Main Economic Indicators compiled according to SNA93. The GDP growth variable is computed as the annual percentage rate of change in the level of GDP for each country.

Wage Measures

The wage comparisons shown in Table 1 are derived from the OECD Main Economic Indicators Hourly earnings in manufacturing (1995=100) series. Comprehensive definitions of the country-specific variations data series used by the OECD Main Economic Indicators are provided in OECD (2000), *Main Economic Indicators, Sources and Definitions*, OECD, Paris. The VAR models for Japan and the US use the same hourly earnings in manufacturing series whereas for Australia average weekly earnings available from the Australian Bureau of Statistics (ABS) are used as the basis of the real wages measure.

Real effective exchange rates

The real effective exchange rate is an indicator of competitiveness which tales into account both export and import competitiveness. A fall indicates improvement in competitive position. The rates are calculated by the OECD and published in the Main Economic Indicators. The real effective exchange rate indices are chain linked indices with base period 1995.

The measure of external shock used was the index of prices of world petroleum products derived from the ABS TRYM model database.

7. References

Abraham, K.G. and Katz, L.F. (1986) 'Cyclical unemployment: Sectoral shifts and supply disturbances', *Journal of Political Economy*, 94(3), June, 507-22.

Australian Bureau of Statistics (2001) *Labour Force, Australia, Preliminary*, Cat. No. 6202.0, November.

Akerlof, G.E., Dickens, W.T., and Perry, G.L. (2000) 'Near-Rational Wage and Price Setting and the Long-Run', *Brookings Papers on Economic Activity*, 1, 1-61.

Ball, L. (1999) 'Aggregate Demand and Long-Run Unemployment', *Brookings Papers on Economic Activity*, 2, 189-251.

BLS (2001) *The Employment Situation: November 2001*, Bureau of Labor Statistics, Washington.

Borland, J. (2001) 'Job Creation and Job Destruction in Manufacturing Industry in Australia', *The Economic Record*, 72(216), 46-62.

Brunello, G. (1990) 'Real exchange rate variability and Japanese industrial employment', *Journal of Japanese and International Economies*, 4, 121-38.

Campbell, J.Y. and Mankiw, N.G. (1987) 'Are fluctuations transitory?' *Quarterly Journal of Economics*, 102, 875-80.

Chang, R. (1997) 'Is Low Unemployment Inflationary?' *Federal Reserve Bank of Atlanta, Economic Review*, First Quarter,

Christiano, L.J., Eichenbaum, M. and Evans, C. (1996) 'The effects of monetary policy shocks: Evidence from the flow of funds', *Review of Economics and Statistics*, 78(1), 16-34.

Doeringer, P.B. and Piore, M.J. (1971) *Internal Labor Markets and Manpower Analysis*, D.C.Heath, Lexington, Mass.

Dungey, M. and Pagan, A. (2000) 'A Structural VAR Model of the Australian Economy', *The Economic Record*, 76, 321-42.

Eichenbaum, M. and Evans, C.L. (1995) 'Some empirical evidence on the effects of monetary policy shocks on exchange rates', *Quarterly Journal of Economics*, 110(4), 975-1009.

Fair, R. (2000) 'Testing the NAIRU Model for the United States', *The Review of Economics and Statistics*, February, 64-71.

Galbraith, J.K. (1998) *Created Unequal: The Crisis in American Pay*, Free Press: USA,

Genay, H. and Loungani, P. (1997) 'Labor market fluctuations in Japan and the U.S. - How similar are they?' *Federal Reserve Bank of Chicago Economic Perspectives*, 21(3), 15-26.

Gordon, R.J. (1997) 'The Time-Varying NAIRU and its Implications for Economic Policy', *Journal of Economic Perspectives*, 11(1), Winter, 11-32.

Kaneko, T. and Bong-Soo Lee (1995) 'Relative importance of economic factors in the U.S. and Japanese stock markets', *Journal of Japanese and International Economies*, 9(3), September, 290-307.

Japan Institute of Labor (2001) 'Main Labor Economic Indicators', Japan Institute of Labor, Tokyo, available at http://www.jil.go.jp/estatis/eshuyo/200111/econtents.htm.

Layard, R., Nickell, S. and Jackman, R. (1991) *Unemployment, Macroeconomic Performance and the Labour Market*, Oxford University Press, Oxford.

Layard, R. (1997) 'Preventing Long-Term Unemployment', in Phillpott, John (ed.), *Working for Full Employment*, Routledge, London, 190-203.

Leeper, E.M., Sims, C.A. and Tao Zha (1996) 'What does monetary policy do?' *Brookings Papers on Economic Activity*, 2, 1-63.

Lilien, D. (1982) 'Sectoral shifts and cyclical unemployment', *Journal of Political Economy*, 90(4), August, 777-93.

Lutkepohl, H. (1993) *Introduction to Multiple Time Series Analysis*, Springer-Verlag, Berlin.

Macfarlane, I. (1997) 'Monetary Policy, Growth, and Unemployment', *Reserve Bank of Australia Bulletin*, 1-9.

Mitchell, W.F. (1987) 'The NAIRU, Structural Imbalance and the Macroequilibrium Unemployment Rate', *Australian Economic Papers*, 26(48), June, 101-18.

Mitchell, W.F. (1993) 'Testing for Unit Roots and Persistence in OECD Unemployment Rates', *Applied Economics*, 25, 1489-501.

Mitchell, W.F. (1998) 'The Buffer Stock Employment Model and the NAIRU: The Path to Full Employment', Journal of Economic Issues, 32(2), June, 1-9.

Mitchell, W.F. (2000a) 'The Job Guarantee in a small open economy', in Carlson, E. and Mitchell, W.F. (ed.), *The Path to Full Employment*, Economic and Labour Relations Review, Sydney, 89-116.

Mitchell, W.F. (2001a) 'The unemployed cannot find jobs that are not there!' in Mitchell, W.F. And Carlson, E. (ed.), *Unemployment: the tip of the iceberg*, CAER, Sydney, 85-116.

Mitchell, W.F. (2001b) 'Full employment abandoned - the role of the public sector', in Mitchell, W.F. And Carlson, E. (ed.), *Unemployment: the tip of the iceberg*, CAER, Sydney, 193-218.

Mitchell, W.F. (2001c) 'Measuring persistence in unemployment rates', *Centre of Full Employment and Equity Working Paper No. 01-04*, The University of Newcastle, Newcastle, NSW, June.

Mitchell, W.F. and Carlson, E. (eds.) (2001) 'Unemployment: the tip of the iceberg', CAER, Sydney.

Mitchell, W.F. and Muysken, J. (2001) 'Aggregate demand should do the job', *Centre of Full Employment and Equity Working Paper No. 01-06*, The University of Newcastle, Newcastle, NSW, June.

Modigliani, F. (2000) 'Europe's Economic Problems', *3rd Monetary and Finance Lecture Freiburg No.* Carpe Oeconomiam Papers in Economics, April 6.

Moreno, R. and Sun Bae Kim (1993) 'Money, interest rates, and economic activity: Stylized facts from Japan', *Economic Review, Federal Reserve Bank of San Francisco*, 3, 12-24.

Nickell, S. and Quintini, G. (2001) 'The Recent Performance of the UK Labour Market', Paper presented to the Economics Section of the British Association for the Advancement of Science, Glasgow, September.

OECD (1994) *The Jobs Study*, OECD, Paris.

OECD (1996) *Economic Outlook*, OECD, Paris.

Ormerod, P. (1994) *The Death of Economics*, Faber and Faber, London.

Pesaran, M.H. and Shin, Y. (1998) 'Generalised Impulse Response Analysis in Linear Multivariate Models', *Economic Letters*, 58(1), 17-29.

Petrongolo, B. and Pissarides, C.A. (2001) 'Looking into the Black Box: A Survey of the Matching Function', *Journal of Economic Perspectives*, XXXIX, 390-431.

Sims, C.A. (1980) 'Macroeconomics and Reality', *Econometrica*, 48(January), 1-47.

Staiger, D., Stock, J.H., and Watson, M.W. (1997) 'The NAIRU, Unemployment and Monetary Policy', *Journal of Economic Perspectives*, 11(1), 33-49.

Stock, .H. and Watson, M.W. (2001) 'Vector Autoregressions', *Journal of Economic Perspectives*, March, 1-30.

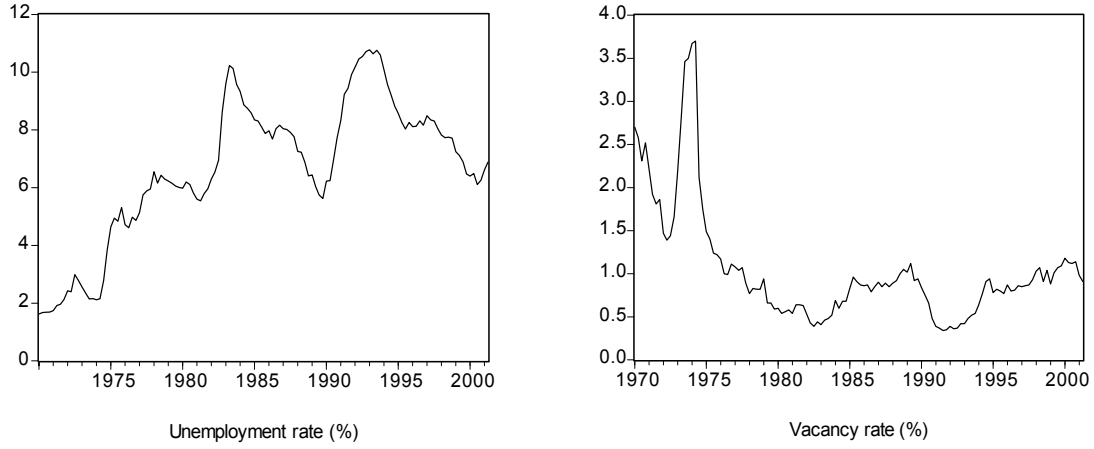
Stoikov, V. (1966) 'Some Determinants of the Level of Frictional Unemployment: A Comparative Study', *International Labour Review*, 93, 530-49.

West, K.D. (1992) 'Sources of cycles in Japan, 1975-1987', *Journal of Japanese and International Economies*, 6, 71-98.

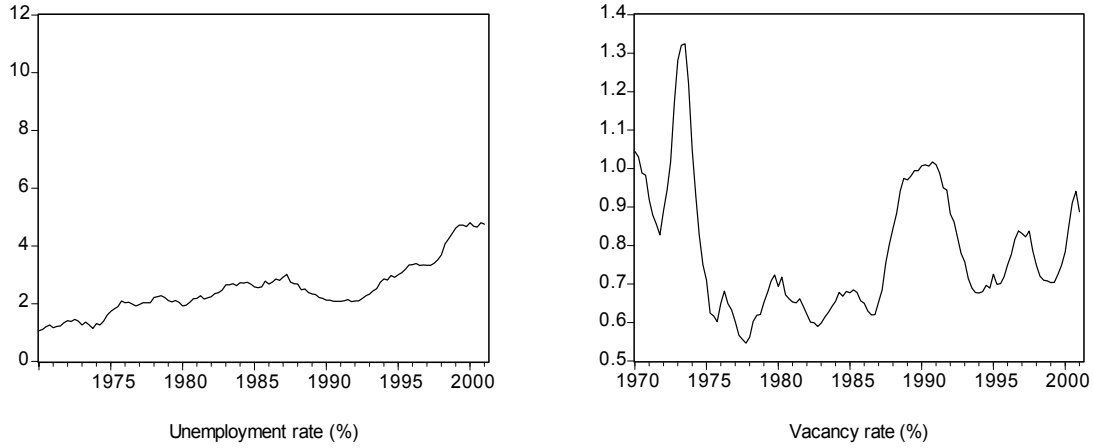
West, K.D. (1993) 'An aggregate demand-aggregate supply analysis of Japanese monetary policy, 1973-1990', in Singleton, Kenneth J. (ed.), *Japanese monetary policy*, University of Chicago Press, Chicago,

Wray, L.R. (1998) *Understanding Modern Money*, Edward Elgar, Northhampton.

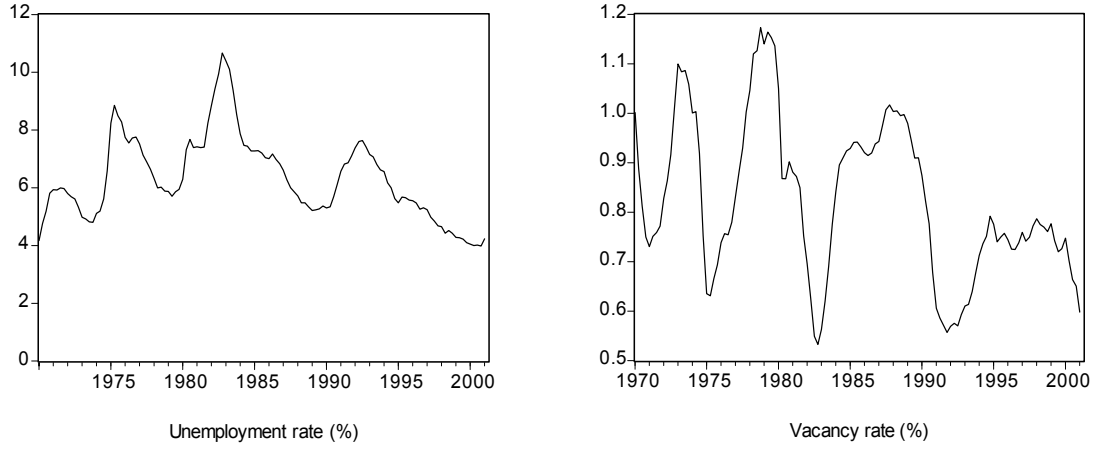
Figure 1 Unemployment and vacancy rates in Australia, Japan and the US, 1970-2001



(a) Australia



(b) Japan



(c) USA

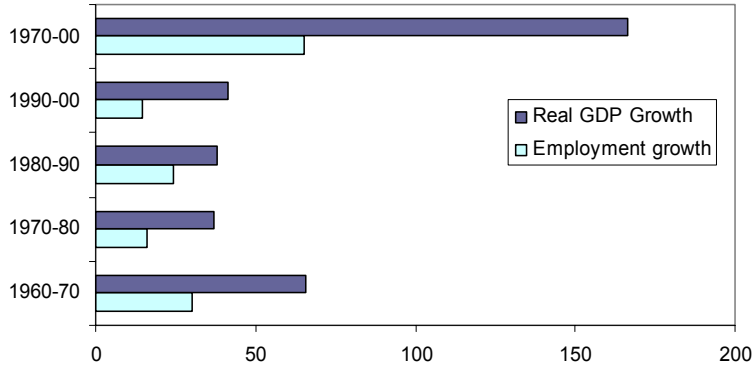
Source: See Data Appendix

Table 1 Summary statistics for Australia, Japan and the US, 1978:1 to 2001:2

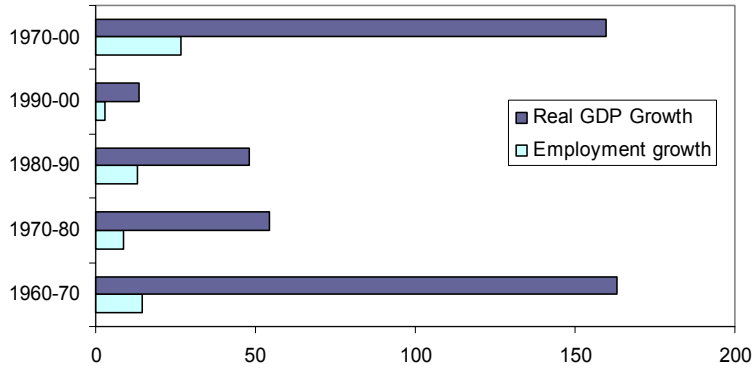
	Real GDP Growth	Jobs Growth	Vacancy Rate	Jobless Rate	Money Wages	Real Wages	Inflation	Cash Rate	Real Exchange Rate
	%pa	%pa	%	%	Index	$/hr	%pa	%	Index
Australia									
Mean	3.2	1.8	0.76	7.7	78.9	1.1	5.96	9.7	101
Std. Dev.	2.2	1.9	0.22	1.6	24.0	0.05	3.57	3.9	5.9
CV	67.3	106.9	29.5	20.2	30.4	5.1	60.0	40.4	5.9
Japan									
Mean	2.9	0.8	0.74	2.7	83.2	0.9	0.02	4.5	74
Std. Dev.	2.2	1.3	0.13	0.7	17.3	0.09	0.02	2.8	14.9
CV	74.2	156.6	17.2	26.4	20.8	9.5	101.4	62.8	20.2
US									
Mean	3.2	2.1	0.82	6.5	83.8	1.1	4.82	7.6	113
Std. Dev.	2.1	1.7	0.16	1.4	19.3	0.05	3.11	3.4	13.4
CV	66.9	80.9	19.6	21.8	23.1	4.7	64.5	44.4	11.8

Source: See Data Appendix. CV is the coefficient of variation computed as the standard deviation divided by the mean and multiplied by 100.

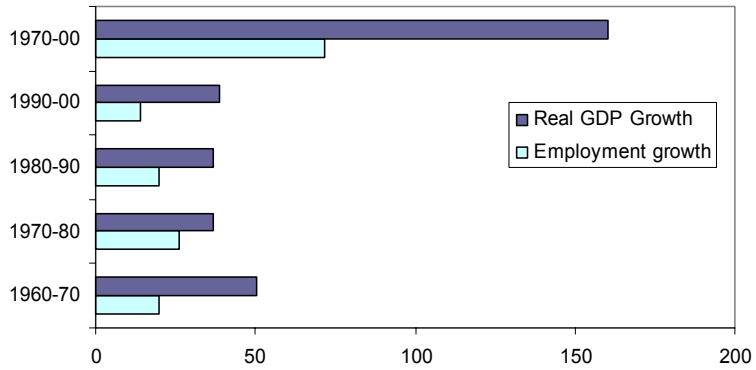
Figure 2 Employment growth and real GDP growth, Australia, Japan, and US



(a) Australia 1970-2000



(b) Japan 1970-2000



(c) United States 1970-2000

Source: OCED, Main Economic Indicators, various years.

Table 2 Compound annual employment and real GDP growth rates, Australia, Japan, and the US, various periods.

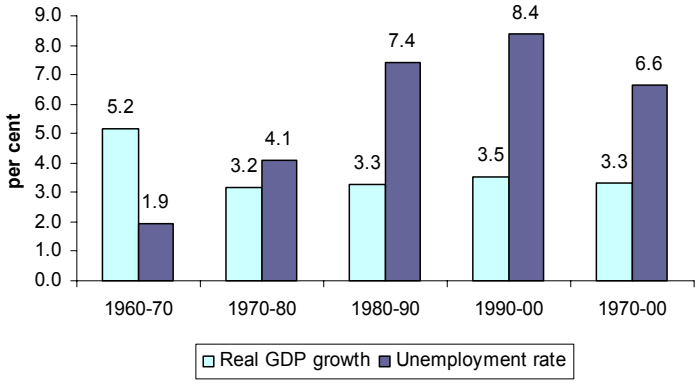
	Australia		Japan		US	
	Employment	Real GDP	Employment	Real GDP	Employment	Real GDP
1960-70	2.7	5.2	1.4	10.2	1.8	4.2
1970-80	1.5	3.2	0.8	4.4	2.4	3.2
1980-90	2.2	3.3	1.2	4.0	1.8	3.2
1990-00	1.4	3.5	0.3	1.3	1.3	3.3
1970-00	1.7	3.3	0.8	3.2	1.8	3.2

Source: OECD Main Economic Indicators

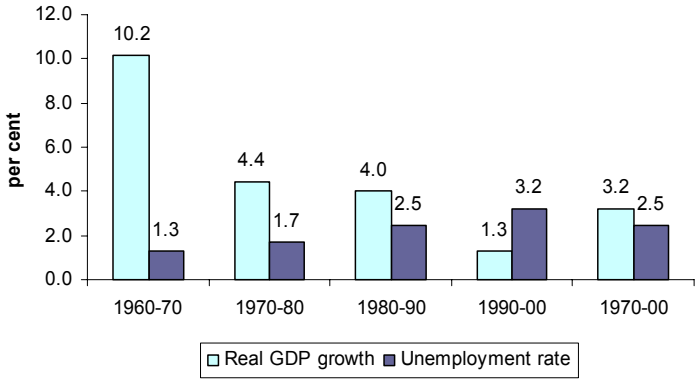
Table 3 Granger-Causality tests for output growth interdependence, 1959:3 to 2001:2

Null and Country	F-Statistic	Probability
Australian real output growth:		
Does not cause Japanese real output growth	0.696	0.59
Does not cause US real output growth	1.327	0.26
Japanese real output growth:		
Does not cause Australian real output growth	4.209	0.00
Does not cause US real output growth	0.583	0.67
US real output growth:		
Does not cause Australian real output growth	4.501	0.00
Does not cause Japanese real output growth	0.186	0.94

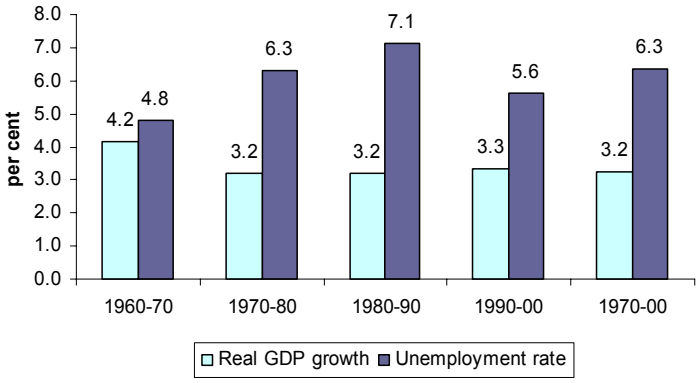
Figure 3 Average real GDP growth and unemployment rates, Australia, Japan, and US



(a) Australia 1970-2000



(b) Japan 1970-2000



(c) United States 1970-2000

Source: OCED, Main Economic Indicators, various years.

Table 4 Annual average growth rates and changes (000's) for various periods

	Public		Private		Total		Labour Force		PGAP	UGAP
	Growth	Change	Growth	Change	Growth	Change	Growth	Change	Change	Change
Australia										
1970-1999	0.6	246	1.9	3100	1.7	3346	1.9	3934	764	519
1970-1975	3.8	250	1.1	239	1.7	489	2.4	704	453	203
1975-1980	2.3	118	1.0	249	1.2	366	1.6	466	209	92
1980-1985	1.6	134	1.5	296	1.5	430	1.8	626	319	185
1985-1990	0.3	29	4.1	1113	3.2	1142	2.9	1132	-1	-30
1990-1995	-1.9	-161	1.7	550	1.0	389	1.3	566	6	167
1995-1999	-2.0	-124	2.4	654	1.6	531	1.2	441	-221	-98
Japan										
1970-1999	1.1	1456	0.8	12218	0.8	13674	0.9	16249	3833	2377
1970-1975	2.8	580	0.3	694	0.5	1274	0.6	1677	963	383
1975-1980	1.5	350	1.1	2792	1.2	3142	1.2	3282	450	100
1980-1985	0.6	160	1.0	2544	1.0	2704	1.1	3131	549	389
1985-1990	0.2	50	1.6	4375	1.5	4425	1.4	4197	-229	-279
1990-1995	1.2	300	0.6	1781	0.7	2081	0.9	2842	1026	726
1995-1999	0.1	16	0.0	32	0.0	48	0.4	1121	1075	1059
United States										
1970-1999	1.6	7600	1.9	47224	1.8	54824	1.8	56573	7177	-423
1970-1975	3.2	2127	1.5	5034	1.8	7162	2.5	10974	5518	3391
1975-1980	2.0	1564	3.1	11910	3.0	13473	2.7	13204	788	-776
1980-1985	0.2	152	1.8	7699	1.5	7851	1.5	8493	468	317
1985-1990	2.2	1912	2.1	9730	2.1	11642	1.7	10389	261	-1651
1990-1995	1.1	987	1.0	5125	1.0	6113	1.0	6459	1085	98
1995-1999	1.1	858	1.8	7726	1.7	8584	1.3	7054	-943	-1801

Source: OECD Economic Outlook Database, 1960-1999.

Figure 4 Unemployment and vacancies, sectoral and aggregate shocks

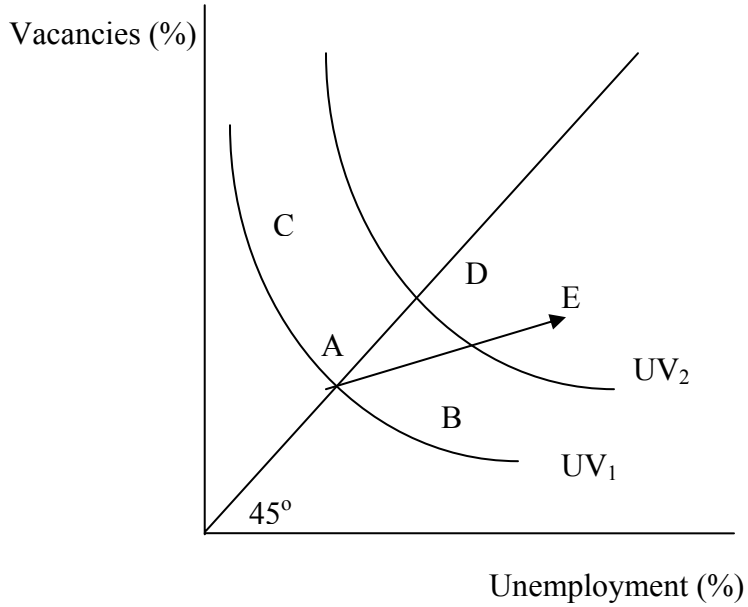
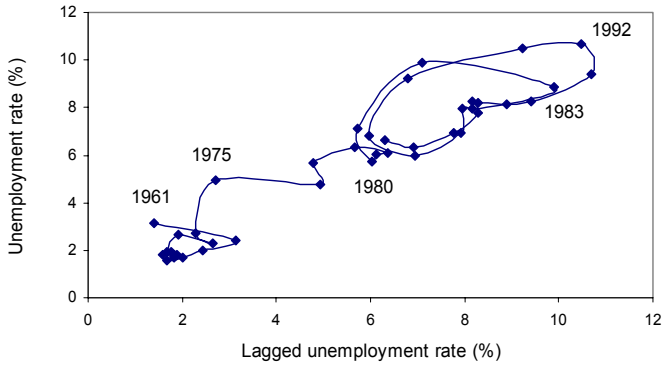
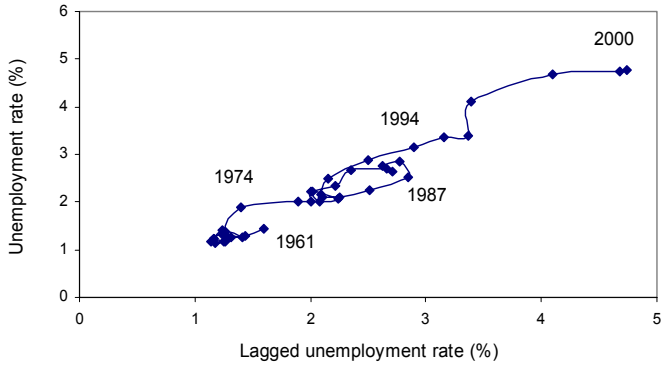


Figure 5 Unemployment rate relationships, Australia, Japan and the US, 1961-2001.



(a) Australia 1961-2000

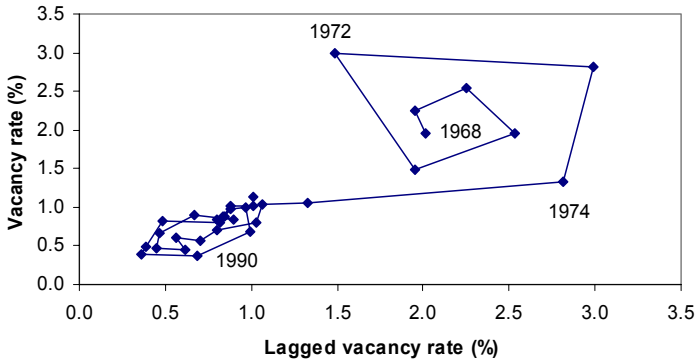


(b) Japan 1970-2000

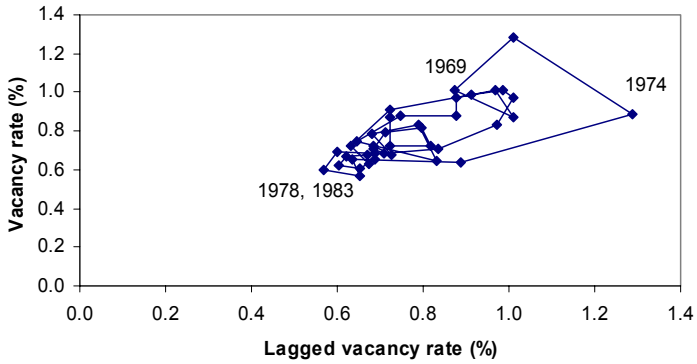
(c) United States 1970-2000

Source: OCED, Main Economic Indicators, various years.

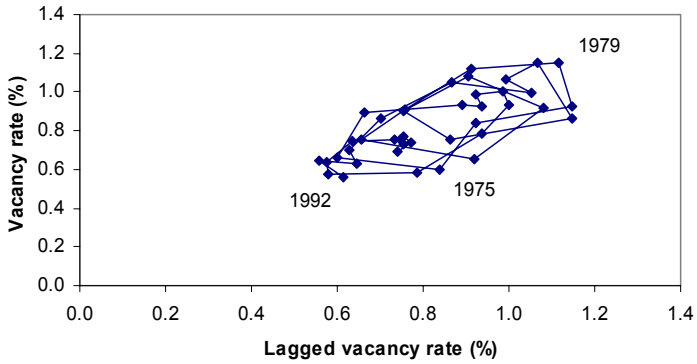
Figure 6 Vacancy rate relationships, Australia, Japan and the US, 1961-2001.



(a) Australia 1967-2000



(b) Japan 1960-2000



(c) United States 1961-2000

Source: OCED, Main Economic Indicators, various years.

Table 5 Unit root tests for Australia, Japan and the USA, 1978:1 to 2001:2

	Level		Difference	
Australia				
Unemployment rate	-3.149		-3.139	
Vacancy rate	-2.613		-3.942	*
Gross Domestic Product	-2.478		-4.921	*
Interest rate	-2.278		-4.936	*
Employment reallocation	-4.912	*		
Real wage	-2.169		-5.678	*
Japan				
Unemployment rate	-1.259		-3.732	*
Vacancy rate	-3.306		-3.693	*
Gross Domestic Product	-0.074		-3.818	*
Interest rate	-3.330		-4.754	*
Employment reallocation	-3.253		-5.357	*
Real wage	-2.441		-9.367	*
United States				
Unemployment rate	-2.523		-3.620	*
Vacancy rate	-2.930		-3.693	*
Gross Domestic Product	-2.844		-4.614	*
Interest rate	-2.778		-5.322	*
Employment reallocation	-4.539	*		
Real wage	-4.146	*		

Note: The ADF regressions each had a trend term and two lags. All variables are in logs except for the interest rate. * signifies rejection of the null at the 5 per cent level. The ADF statistics for world petrol prices were -2.065 (level) and -5.424 (difference).

Table 6 Lag Order Selection Criteria, Australia, Japan, and the USA

Lag	LogL	LR	FPE	AIC	SC	HQ
Australia, 1978:1 to 2001:2						
0	302.3394	NA	4.78E-12	-6.200848	-5.819596	-6.046909
1	826.0407	946.0410	1.77E-16*	-16.40948	-14.69384*	-15.71675*
2	870.9059	74.29298	1.97E-16	-16.32056	-13.27054	-15.08905
3	905.8265	52.56863	2.81E-16	-16.01777	-11.63338	-14.24748
4	955.2424	66.95064*	3.05E-16	-16.02672	-10.30795	-13.71764
5	1008.131	63.69349	3.29E-16	-16.11034	-9.057186	-13.26248
6	1050.644	44.79858	4.85E-16	-15.97083	-7.583299	-12.58419
7	1123.233	65.56493	4.24E-16	-16.47814	-6.756225	-12.55271
8	1197.970	56.25359	4.25E-16	-17.03162*	-5.975327	-12.56741
Japan, 1978:1 to 2000:1						
0	551.3954	NA	1.34E-14	-12.07630	-11.68483	-11.91851
1	1083.183	956.0223	2.62E-19	-22.92546	-21.16384*	-22.21540
2	1162.004	129.3020	1.37E-19*	-23.59559	-20.46383	-22.33327*
3	1190.794	42.69980	2.29E-19	-23.14144	-18.63952	-21.32684
4	1257.456	88.38391	1.71E-19	-23.53834	-17.66628	-21.17148
5	1316.957	69.52872*	1.62E-19	-23.77431	-16.53210	-20.85518
6	1364.584	48.16268	2.24E-19	-23.74347	-15.13111	-20.27207
7	1418.163	45.75228	3.14E-19	-23.84635*	-13.86385	-19.82269
USA, 1978:1 to 2000:1						
0	435.5771	NA	1.81E-13	-9.473643	-9.082173	-9.315853
1	1062.329	1126.746	4.19E-19	-22.45684	-20.69522*	-21.74678*
2	1121.608	97.24276	3.40E-19*	-22.68781	-19.55604	-21.42548
3	1160.304	57.39208	4.53E-19	-22.45626	-17.95435	-20.64167
4	1212.556	69.27800*	4.70E-19	-22.52934	-16.65728	-20.16248
5	1255.151	49.77432	6.51E-19	-22.38542	-15.14321	-19.46629
6	1312.049	57.53731	7.28E-19	-22.56290	-13.95054	-19.09151
7	1386.435	63.52032	6.40E-19	-23.13336	-13.15086	-19.10970
8	1479.707	64.97594	4.61E-19	-24.12824*	-12.77558	-19.55231

Notes: * indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table 7 Pairwise Granger-Causality tests for Australia, Japan and the USA.

	Chi-sq	Prob.	Result
Exclude from Australia – vacancy rate			
Interest rates	0.42	0.81	Accept
Petrol prices	0.15	0.93	Accept
GDP growth	1.34	0.51	Accept
Sectoral shock	0.60	0.74	Accept
Real wages	5.47	0.06	Accept
Exclude from Australia – unemployment rate			
Interest rates	6.76	0.03	Reject
Petrol prices	0.62	0.73	Accept
GDP growth	20.29	0.00	Reject
Sectoral shock	0.41	0.82	Accept
Real wages	2.45	0.29	Accept
Exclude from Japan – vacancy rate			
Interest rates	2.66	0.26	Accept
Petrol prices	8.47	0.01	Reject
GDP growth	4.88	0.09	Reject
Sectoral shock	7.48	0.02	Reject
Real wages	0.07	0.96	Accept
Exclude from Japan – unemployment rate			
Interest rates	2.15	0.34	Accept
Petrol prices	1.03	0.60	Accept
GDP growth	1.15	0.56	Accept
Sectoral shock	1.52	0.47	Accept
Real wages	1.77	0.41	Accept
Exclude from USA – vacancy rate			
Interest rates	17.29	0.00	Reject
Petrol prices	1.86	0.39	Accept
GDP growth	5.58	0.06	Reject
Sectoral shock	0.35	0.84	Accept
Real wages	1.47	0.48	Accept
Exclude from USA – unemployment rate			
Interest rates	5.27	0.07	Reject
Petrol prices	0.05	0.97	Accept
GDP growth	1.83	0.40	Accept
Sectoral shock	0.41	0.81	Accept
Real wages	1.46	0.48	Accept

Notes: Sample for Australia was 1978:1 to 2001:1, and for USA and Japan 1978:1 2000:1. The result shown is for the null of exclusion at the 5 per cent level of significance.

Figure 7 Australia, percentage responses to generalised one S.D. Innovations ± 2 S.E

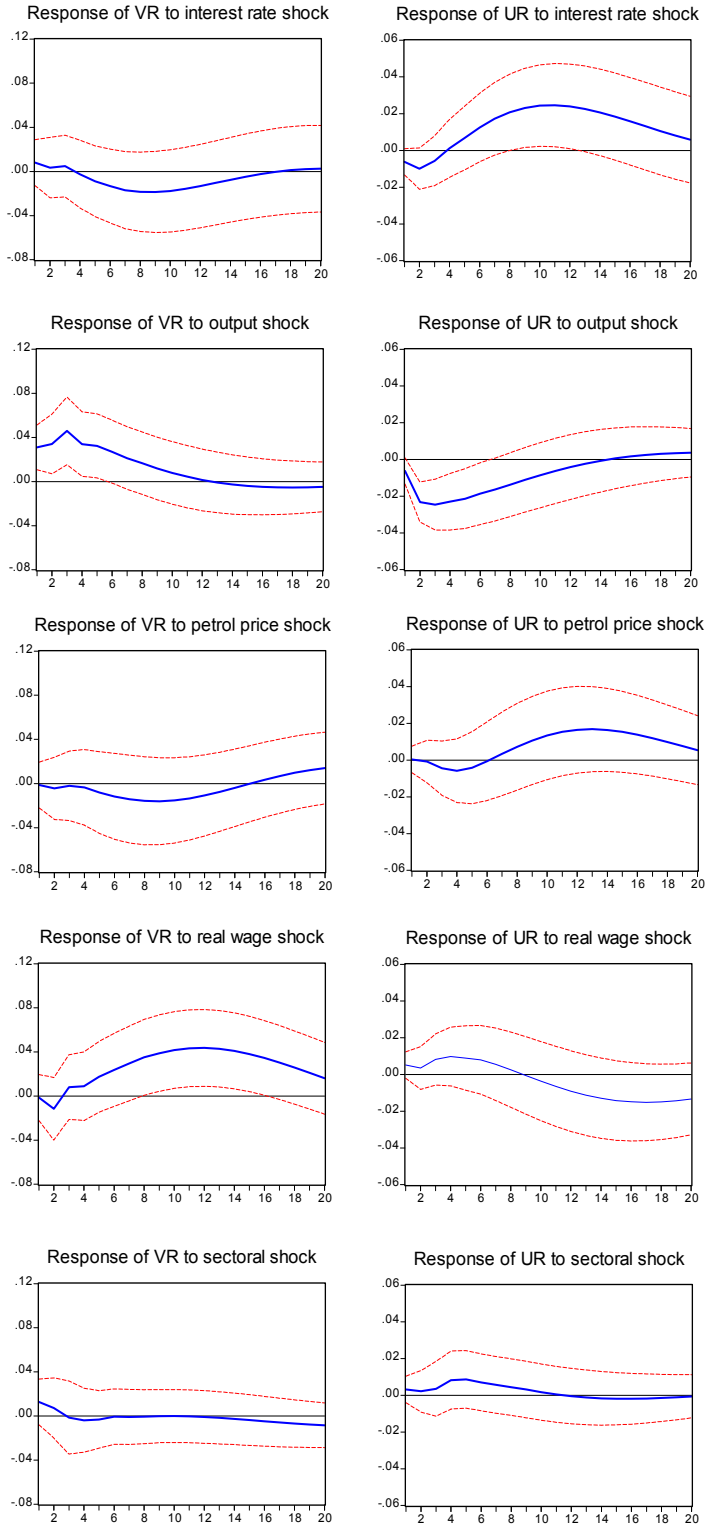


Figure 8 Japan, percentage responses to generalised one S.D. Innovations ± 2 S.E

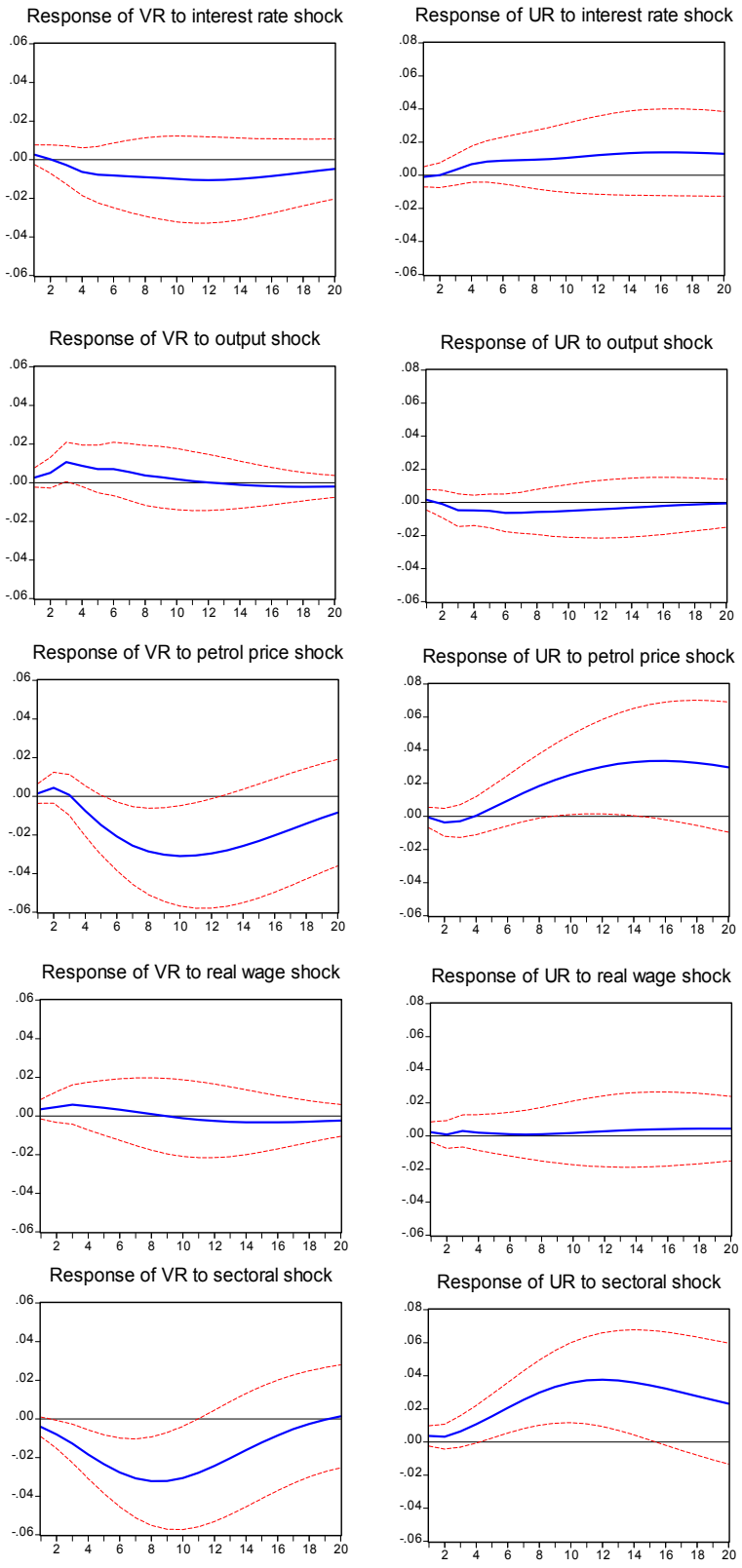


Figure 9 US, percentage responses to generalised one S.D. Innovations ± 2 S.E

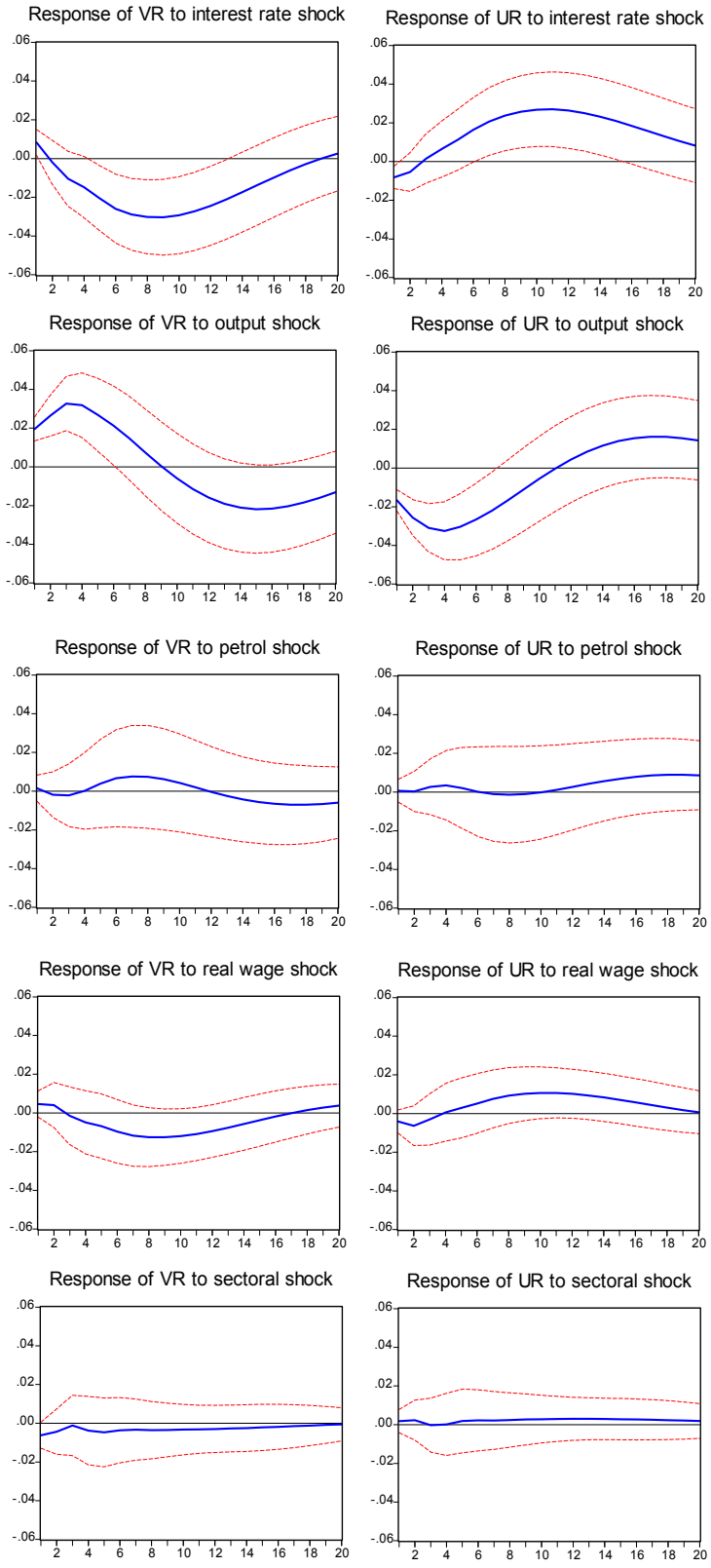


Table 8 Percentage impulse response functions, Australia, Japan and the USA

Period After Shock	Interest rate Shock	Petrol Prices Shock	Real Output Shock	Real Wage Shock	Sectoral Shock
			Australia - vacancy rate		
1	0.0082	-0.0013	0.0312	-0.0013	0.0128
2	0.0036	-0.0044	0.0342	-0.0115	0.0073
3	0.0050	-0.0020	0.0460	0.0082	-0.0013
4	-0.0023	-0.0034	0.0340	0.0090	-0.0038
5	-0.0087	-0.0081	0.0325	0.0175	-0.0031
6	-0.0131	-0.0116	0.0272	0.0238	-0.0006
			Australia - unemployment rate		
1	-0.0061	0.0004	-0.0062	0.0052	0.0032
2	-0.0098	-0.0008	-0.0231	0.0035	0.0022
3	-0.0055	-0.0044	-0.0245	0.0082	0.0036
4	0.0012	-0.0058	-0.0229	0.0098	0.0083
5	0.0068	-0.0041	-0.0212	0.0090	0.0087
6	0.0126	-0.0005	-0.0185	0.0080	0.0070
			Japan - vacancy rate		
1	0.0026	0.0014	0.0027	0.0035	-0.0042
2	0.0003	0.0044	0.0052	0.0046	-0.0080
3	-0.0028	0.0006	0.0107	0.0059	-0.0128
4	-0.0062	-0.0076	0.0088	0.0051	-0.0184
5	-0.0077	-0.0149	0.0071	0.0043	-0.0235
6	-0.0081	-0.0208	0.0071	0.0033	-0.0277
			Japan - unemployment rate		
1	-0.0009	-0.0006	0.0016	0.0023	0.0037
2	0.0001	-0.0036	-0.0009	0.0009	0.0032
3	0.0033	-0.0028	-0.0047	0.0030	0.0064
4	0.0067	0.0004	-0.0048	0.0020	0.0107
5	0.0083	0.0050	-0.0051	0.0015	0.0156
6	0.0088	0.0095	-0.0063	0.0011	0.0206
			USA - vacancy rate		
1	0.0084	0.0016	0.0197	-0.0062	0.0046
2	-0.0019	-0.0018	0.0265	-0.0043	0.0041
3	-0.0104	-0.0021	0.0327	-0.0011	-0.0015
4	-0.0147	0.0002	0.0319	-0.0038	-0.0049
5	-0.0204	0.0040	0.0270	-0.0047	-0.0068
6	-0.0258	0.0067	0.0213	-0.0036	-0.0096
			USA - unemployment rate		
1	-0.0080	0.0007	-0.0166	0.0019	-0.0041
2	-0.0053	0.0004	-0.0255	0.0023	-0.0063
3	0.0016	0.0028	-0.0308	-0.0003	-0.0030
4	0.0066	0.0036	-0.0324	0.0002	0.0007
5	0.0113	0.0022	-0.0302	0.0019	0.0030
6	0.0165	0.0003	-0.0265	0.0022	0.0052

Notes: see text description for Figures 7 to 9.

Table 9 Percentage variance decompositions, Australia, Japan, and the USA

Period after Shock	Interest Rate Shock	Petrol Price Shock	GDP Growth Shock	Real Wage Shock	Sectoral Shock
			Australia - vacancy rate		
1	0.66	0.07	9.11	1.32	0.52
2	0.45	0.19	11.67	3.75	0.31
4	0.35	0.16	16.80	2.18	0.60
8	1.95	0.96	16.10	5.64	0.47
			Australia - unemployment rate		
1	3.11	0.17	2.32	5.15	2.99
2	4.48	0.09	17.18	6.51	3.01
4	2.24	0.69	22.92	10.08	4.30
8	7.19	0.66	21.31	8.17	4.59
			Japan - vacancy rate		
1	1.13	0.08	1.10	1.56	3.19
2	0.49	1.54	1.99	1.40	6.71
4	1.45	1.61	6.69	2.27	15.40
8	2.96	16.90	5.42	3.07	29.90
			Japan - unemployment rate		
1	0.10	0.01	0.37	0.67	1.65
2	0.06	0.99	0.22	0.66	1.83
4	1.83	1.07	1.51	1.12	5.96
8	4.31	5.71	3.40	0.58	24.74
			USA - vacancy rate		
1	6.80	0.01	33.57	2.92	0.09
2	2.48	0.08	36.52	2.06	0.31
4	5.15	0.11	45.15	1.83	0.36
8	21.19	3.03	36.91	3.68	1.64
			USA - unemployment rate		
1	8.09	0.47	30.23	0.09	0.40
2	4.03	0.23	37.41	0.24	0.94
4	2.19	0.30	47.20	0.18	0.47
8	11.83	0.49	45.82	1.46	0.89

Notes

[1] Professor of Economics and Director of Centre of Full Employment and Equity, University of Newcastle.

[2] The PGAP is 98 per cent of the labour force to account for an arbitrary 2 per cent frictional unemployment level.

3 The literature has now mostly abandoned the constant NAIRU concept in favour of the Time-Varying or TV-NAIRU (Gordon, 1997). This has led to a new outbreak of econometric modelling to capture the time-path of the elusive TV-NAIRU. The use of univariate filters (Hodrick-Prescott filters) with no economic content and Kalman Filters with little or no economic content has ensured the TV-NAIRU concept is now relatively arbitrary.3 More damaging are the revelations that the NAIRU estimates have very large standard errors and as such are meaningless for policy analysis (Staiger, Stock and Watson, 1997; Chang, 1997). Finally, most modern studies include a host of other variables, which influence the inflation rate independently of the unemployment gap. In this case, the NAIRU hypothesis, if valid at all, loses policy relevance (see Mitchell, 2001a for a detailed analysis).

4 Another member of the LNJ team, Stephen Nickell recently wrote (Nickell and Quintini, 2001: 5) in relation to the United Kingdom that "simply because a change in the benefit system reduces equilibrium unemployment … [by making unemployment less attractive] ... it does not necessarily imply that it is a good thing. It is arguable, for example, that the current benefit system is simply too mean. In fact, to have a system which operates well, it is not necessary to plunge households into poverty should the sole breadwinner lose his or her job."