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Labour market asymmetries and inflation

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1. Introduction

Most central banks now employ inflation targetting and adjust short-term interest rate to ensure that inflation remains within their target range. This approach, common since the 1980s, has been accompanied by tight, passive fiscal policy in the pursuit of budget surpluses. This counter-inflation policy has been associated with persistently high unemployment in most OECD economies and some economists would say that it has caused the chronic lack of jobs (Modigliani, 2000; Mitchell, 2001a, Mitchell and Muysken, 2002a). Australia, for instance, did not approach full employment despite the 1990s growth period and trend unemployment is positive. The low point unemployment rate ratcheted upwards over successive cycles since 1976.[2] The problem is worse when broader measures of labour underutilisation are considered (Mitchell and Carlson, 2001).

Underpinning the shift from fiscal activism is a belief, held by many economists, that a unique (natural) level of economic activity exists (the so-called NAIRU) which is consistent with low inflation.[3] Policy makers constrain their economies to achieve this (assumed) cyclically invariant benchmark. The NAIRU is not observed and a range of techniques are used to estimate it (Mitchell, 2001a). Yet, despite its centrality to policy, the NAIRU evades accurate estimation and the case for uniqueness and cyclical invariance is weak (Chang, 1997; Staiger, Stock and Watson, 1997; Fair, 2000; Mitchell, 2001a). Given these vagaries, its use as a policy tool is highly contentious.

The Reserve Bank of Australia (RBA) (2002) admits there are short-term costs of inflation targetting (lost output and rising unemployment) but argues that medium- to long-run real output growth is higher as a result.[4] They say the benefits of low inflation justify the temporary losses. The view that these costs are ephemeral and trivial is one of the most contentious issues in macroeconomics. The history of OECD economies since inflation targetting became the norm does not support the view that a low inflation environment generates sustained low unemployment (Mitchell, 2001a). Unemployment also behaves asymmetrically (see Rothman, 1998; Skalin and Teräsvirta, 2002; Mitchell, 2002) rising sharply in downturns and declining slowly as growth resumes. Disinflation thus imposes greater costs than has been previously estimated using linear models, which themselves are prone to inaccuracies, like imprecise NAIRU estimation (Mitchell, 2002).

There is clearly a need to model the costs of inflation targetting using robust models that allow for asymmetry and which can also distinguish between short- and long-run cost horizons. In this paper, as a start, we aim to develop a model which will help us explain some outstanding stylised facts that describe the behaviour of the Australian labour market. We argue that the orthodox NAIRU paradigm cannot explain these stylised facts and hence monetary policy that is based on the NAIRU concept is flawed. In addressing the stylised facts we aim to integrate an explanation of the labour market dynamics with a segmented labour market theory of wage determination. The stylised facts we address are: (a) the Australian economy has been demand constrained since 1975 and fails to generate sufficient employment; (b) Unemployment is highly persistent and asymmetric; (c) the cyclical behaviour of short- and long-term unemployment is similar and the latter does threaten a low inflation expansion; (d) active labour market programs are largely ineffective; (e) gross flows are reveal large inertia in all labour force categories; and (f) outflow rates are remarkably stable over time but show the expected cyclical behaviour.

First, we outline a model from Ball (1999) and enhanced by Mitchell and Muysken (2002a), which sources unemployment asymmetry in the behaviour of labour market flows. We conclude that in a period of persistent demand deficiency the stock-flow relations required to generate the asymmetry fail because of the persistence in short-term unemployment. Second, we develop asymmetries in terms of product market behaviour and focus on irreversibilities in investment which lead business firms to be reluctant to embark on new projects after a recession until they are certain that demand conditions (and capacity utilisation) are back to 'normal' (Dixit and Pindyck, 1994). The labour market asymmetries then occur in response to the way in which employment, unemployment and labour productivity react to the spending asymmetries. We introduce a segmented labour market model to reconcile two claims: (a) short-term and long-term unemployment display similar cyclical behaviour; and (b) the latter does not condition the inflation process. In the secondary labour market, employment opportunities consist mostly of part-time jobs and employers are relatively indifferent to the characteristics of the labour force. As a consequence, the long-term unemployed can gain access to these positions. Since the primary and secondary markets are complementary in their reaction to changes in output, similarities in variation over time in short- and long-term unemployment are explained. But the primary labour market is the wage leader and so short-term unemployment determines wage setting behaviour.

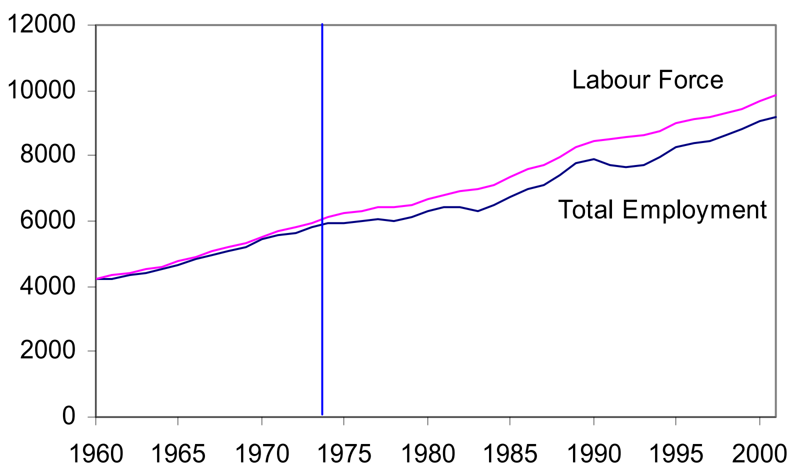
Section 2 outlines some stylised facts about the Australian economy, while Section 3 sketches two theoretical models that attempt to explain them. In Sections 4, 5 and 6 we examine whether the theories have any empirical content. Specifically, we examine non-linearities in the Okun relationship and test for the existence of a NAIRU in a Phillips curve model. We conclude that the labour market exhibits marked cyclical asymmetries and that inflation is more sensitive to movements in the short-run unemployment rate rather than unemployment overall given other factors like import prices.

2. The Stylised facts that confound orthodoxy

2.1 Demand constraints

In the midst of the on-going debates in Australia about labour market deregulation, minimum wages and taxation reform, the most salient, empirically robust fact that has pervaded the last two and a half decades is that actual GDP growth has rarely reached the rate required to achieve and maintain full employment (see Figure 1).[5] On average there have been 11.1 unemployed persons per unfilled vacancy since June 1974 (Mitchell and Carlson, 2001). Mitchell (2001a) shows that shifts in the Australian Beveridge curve cannot be explained in terms of shifts in search effectiveness (Layard *et al*, 1991).

Figure 1 The employment gap in Australia, 1960-2001

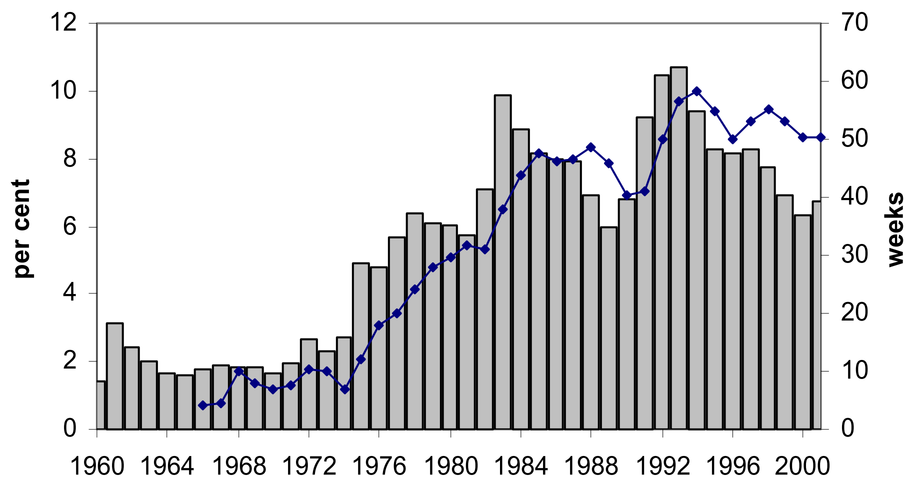


Source: ABS, The Labour Force, Australia, 6203.0, various issues.

Substantial hidden unemployment and a rising incidence of underemployment reveal that labour underutilisation in Australia is actually worse than the official unemployment figures show. The ratio of part-time to total employment has risen from 15 per cent to over 28 per cent since 1978. Over 54 per cent of all jobs created since 1978 have been part-time and the percentage of part-time employees who prefer to work but cannot find more hours has risen markedly over that time (Mitchell and Carlson, 2001).

One might argue that labour market flows are such that few workers remain unemployed for very long. The rate and average duration of unemployment for Australia are shown in Figure 2. Average duration, which was 3 weeks in 1966, is now around 51 weeks.

Figure 2 Unemployment Rate and Average Duration of Unemployment, Australia, 1959-2001



Source: Mitchell and Carlson (2001). Average duration (weeks) is represented by the line (RHS axis) and the unemployment rate (per cent) by the columns (LHS axis).

2.2 Persistence and asymmetry

Mitchell (1993) showed that unemployment rates from 15 OECD countries exhibit high degrees of persistence following negative output shocks. Further evidence is provided in Table 1 taken from Mitchell (2001c). The summary persistence measures (coefficients on the lagged unemployment rate) have increased over time and in most cases indicate high degrees of persistence.[6] Mitchell (2001c) computes the persistence measure proposed by Campbell and Mankiw (1987), Cochrane (1988), and Andrews (1993), which confirm the high degrees of persistence in OECD unemployment rates.

Macroeconomic orthodoxy eschews stabilisation because it assumes that demand shocks are transitory and do not impede progress along the supply-determined long run path (for example, Kydland and Prescott, 1980). However, the evidence of high degrees of persistence is consistent with several studies that 'have rejected the traditional view that output shocks have little or no permanent effect' (Campbell and Mankiw, 1987).[7] This also questions the usefulness of the NAIRU as a reliable policy tool (for example, Chang, 1997; Akerlof, Dickens, and Perry, 2000; Fair, 2000; Mitchell, 2001a). Non-intervention following a negative shock is very costly when the shocks are highly persistent.

Table 1.6 Shifting autoregressive parameters for OECD unemployment rates

	Full Sample		Pre-oil 61:4 73:1	Post-oil 74:1 89:4	1970s 70:1 79:4	1980s 80:1 89:4	1990s 90:1 00:4
Australia	1961:4 2000:4	0.970	0.760	0.900	0.980	0.963	0.940
Austria	1961:4 2000:4	0.995	0.974	0.987	0.825	0.942	0.911
Belgium	1980:4 2000:4	0.919				0.850	0.969
Canada	1961:4 2000:4	0.988	0.959	0.947	0.894	0.954	0.990
Denmark	1971:4 2000:4	0.961		0.824	0.956	0.845	1.026
Finland	1961:4 2000:4	0.984	0.918	0.961	0.990	1.098	0.917
France	1980:1 2000:4	0.947				0.927	0.973
Germany	1963:4 2000:4	0.989	0.909	0.927	0.970	0.918	0.967
Italy	1961:4 2000:4	0.986	0.937	0.982	0.918	0.954	0.808
Japan	1961:4 2000:4	1.005	0.697	0.885	0.949	0.922	1.008
Netherlands	1971:4 2000:4	0.948		0.888	0.895	0.939	1.037
Norway	1973:4 2000:4	0.954		0.929	0.554	0.959	0.972
Portugal	1985:1 2000:4	0.945				0.976	0.947
Spain	1966:1 2000:4	0.991	1.046	0.964	1.002	0.884	1.020
Sweden	1971:4 2000:4	0.991		0.975	0.910	0.992	0.922
Switzerland	1984:4 2000:4	0.989				1.039	0.936
United Kingdom	1961:4 2000:4	0.987	0.925	0.949	0.969	0.910	1.028
United States	1961:4 2000:4	0.988	0.949	0.939	0.855	0.984	1.018

Source: OECD Main Economic Indicators. The full samples are defined in column 2. In terms of the samples indicated in columns 4 to 8, starting dates for estimation are determined from the full sample starting dates. For example, for Switzerland, the 1980s starts at 1984:4. Missing values indicate no data for that sample. Some results were not reported because of too few observations (Switzerland and Portugal in the 1980s). The regressions included a constant term.

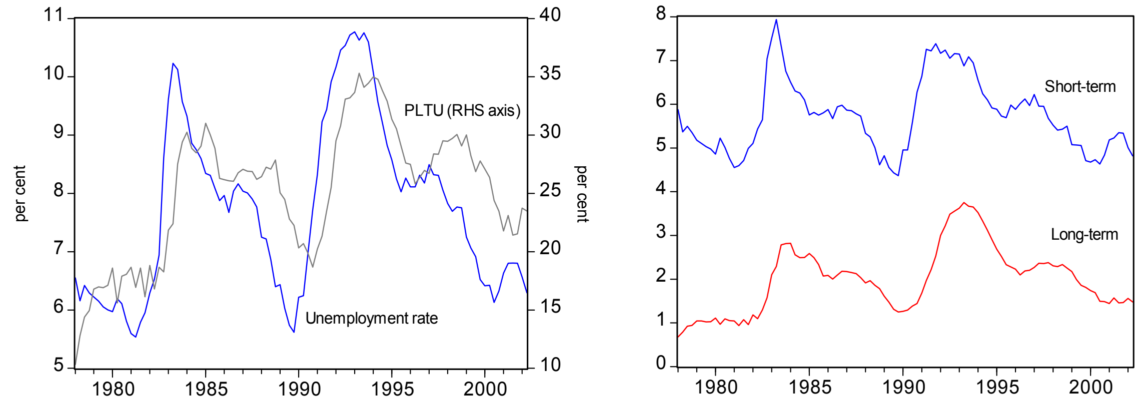
Marked cyclical asymmetries are also evident in the behaviour of many macroeconomic time series including unemployment. This places the usefulness of standard macroeconomic models (incorporating NAIRU-determined supply components) which usually employ smooth functions with some allowance for persistence in severe doubt (Holly and Stannett, 1995). A number of nonlinear models have been fitted to macroeconomic time series and found them superior to linear representations (Beaudry and Koop, 1993; Parker and Rothman, 1997; Pfann, 1993 provides a survey). There has also been substantial development of the threshold autoregressive (TAR) class of models (see Hansen, 1997) and the smooth transition autoregressive (STAR) class of models (see Skalin and Teräsvirta, 2002). Mitchell (2002) and Mitchell and Muysken (2002d) find evidence of non-linearity in unemployment rates for Australia and The Netherlands.

2.3 Duration facts

Following the OECD Jobs Study (1994), many governments now emphasise active labour market programs as their response to persistently high unemployment. Mitchell (2001b) argues that full employability has replaced full employment as the lodestar of labour market policy. The individuals are now blamed for what are systemic macro failures. The whole thrust of active labour market policy is predicated on the belief that the long-term unemployed represent a structural bottleneck that can only be addressed by supply initiatives like training and welfare reform (OECD, 1994, 2001). Layard (1998: 27) argues that "in the very bad old days, people thought that unemployment could be permanently reduced by stimulating aggregate demand … This belief has died everywhere … these ideas did not address the fundamental problem … The only way to address this problem is to make all the unemployed attractive to employers … Nothing else will do the trick."[8] In Figure 3, the behaviour of the official unemployment rate, the proportion of long-term unemployment in total unemployment (PLTU), and its short- and long-term components are shown.[9] The evolution of PLTU is strongly influenced by cyclical fluctuations in Australia over the last 25 years and several studies have found that a rising proportion of long-term unemployment is not a separate problem from that of a rise in unemployment *per se* (Chapman *et* al., 1992; EPAC, 1996; and Mitchell, 2001a). The cyclical behaviour of short-term and long-term unemployment seems to be very similar. In our flows analysis below we find strong evidence to support this conclusion.

This casts doubt on the supply-side OECD policy emphasis. While Layard (1998) may wish to abstract from the problem of a lack of employment opportunities, it is highly probable that long-term unemployment responds to exogenous (policy-driven) demand expansion. The evidence from the 1990s expansion in Australia and the USA very clearly shows that while trend inflation remained low the proportion of long-term unemployment fell in lock step with the declines in the official unemployment rate (although underemployment rose, see Mitchell and Carlson, 2001). The strong demand led contraction in long-term unemployment provided no adverse inflationary impacts.

Figure 3 Unemployment rate, PLTU, short-term and long-term unemployment rates



(a) Unemployment rate and PLTU

(b) STUR and LTUR

Source: ABS, Labour Force, Cat 6203.0. PLTU is the proportion of long-term unemployment in total unemployment, STUR is short-term unemployment rate and LTUR is the long-term unemployment rate.

2.4 The failure of active labour market programs

A major OECD report came out in 2001 endorsing the Australian government's supply-side approach (OECD, 2001) saying that Australia has lead the way in introducing "market-type mechanisms into job-broking and related employment services" (OECD, 2001: 11). The OECD (2001: 14) concludes that in terms of labour market policies Australia "has been among the OECD countries complying best" with the OECD Jobs Strategy (see OECD, 1994). Cowling and Mitchell (2002) argue that the plethora of active labour market programs has delivered very poor results in Australia (see Table 2). Three months after completing Intensive Assistance (B), just 11.3 per cent of individuals were in full-time work while 63.3 per cent remained in unemployment or had left the labour force. Half of the individuals who commenced Intensive Assistance in this period had been in the program at least once before (Senate Employment, Workplace Relations and Education Committee, 2002: 136). In addition, the Productivity Commission (2002: Chapter 9) found that the payments structure to Job Network providers has led to a substantial proportion of Intensive Assistance clients being 'parked' while providers concentrate their efforts on job seekers who are easier to place in employment.

Outcomes for the Work for the Dole program are similarly poor. Three months after completing the program just 11.8 per cent of participants were in full-time work and less than one quarter were in any form of employment. Additional data obtained from the Department of Employment and Workplace Relations highlights the precarious nature of any work attained with 65 per cent of employment exits from Work for the Dole between 1 July 2000 and 30 June 2001 going into temporary, casual and seasonal work (Senate Employment, Workplace Relations and Education Committee, 2002, Question 71).

Table 2 Post assistance labour market outcomes, Year ending September 2001

Program	Employed			Unemployed	NILF	Education Outcomes
	F/T	P/T	Total			
	(%)	(%)	(%)	(%)	(%)	(%)
Work for the Dole	11.8	12.8	24.6	44.0	8.3	11.6
Job Matching	38.2	28.0	66.2	28.8	5.0	12.0
Job Search Training	20.6	20.8	41.4	46.3	5.2	12.9
Intensive Assistance A	18.4	25.5	43.8	36.0	12.5	8.3
Intensive Assistance B	11.3	17.8	29.1	45.5	17.8	7.5

Source: The DEWR Post Program Monitoring Survey conducted three months after job seekers cease assistance. See Cowling and Mitchell (2002) for a complete explanation. The difference between Intensive Assistance A and B relates to the level of disadvantage identified after interview. NILF denotes not in the labour force.

The poor results for labour market programs beg the question as to why should we expect anything better in the absence of policy measures designed to address the quantum of jobs. Improving employability does not increase the level of aggregate labour demand. In isolation, supply side measures merely shuffle the jobless queue.

2.5 Gross labour market flows in Australia

The Australian Bureau of Statistics (ABS) has published estimates of labour force status and gross changes (flows) derived from matched records on a monthly basis since February 1980. We initially aggregated the data into employed (*E*), unemployed (*U*) and not in the labour force (*N*) for all persons aged 15 years and older. Hence the flow *EN* (in thousands) captures the number of persons who were employed in period *t* and are now not in the labour force in period t+1 (for example, as a result of retirement). Similarly, the flow *UU* refers to all persons who were unemployed in both periods. The flows are summarised in Table 3. Mitchell and Muysken (2002a) provide a full description of the data and the transformations that were made to reconcile sample with population and convert the flows into quarterly frequency compatible with the quarterly stocks.

Table 3 Flows on the labour market with short- and long-term unemployment

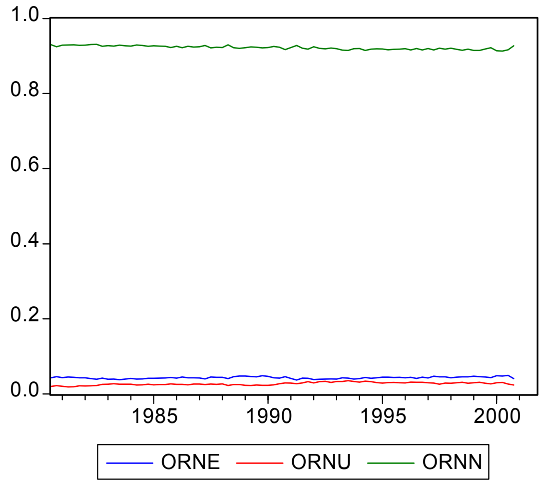
	E_{t+1}	US_{t+1}	UL_{t+1}	N_{t+1}	Death and emigration*
E_t	*EE*	*EU*	*0*	*EN*	*ED*
US_t	*USE*	*USUS*	*USUL*	*USN*	*mUS*
UL_t	*ULE*	*0*	*ULUL*	*ULN*	*mUL*
N_t	*NE*	*NU*	*0*	*NN*	*ND*
Birth and immigration*	*BE*	*BU*	*0*	*BN*	

* These are flow variables from and to outside the working age population.

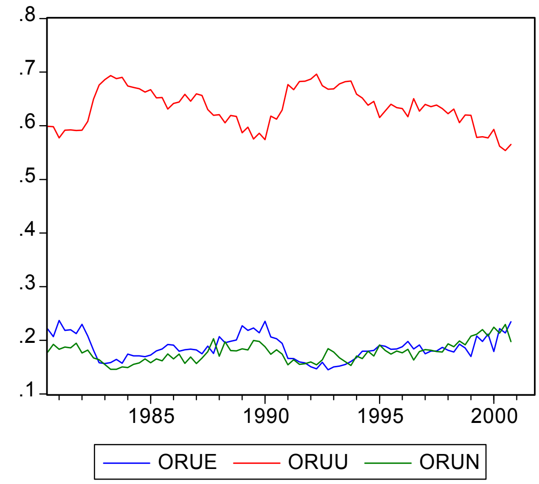
The ABS data does not break down the flows into and out of short- and long-term unemployment. Additional assumptions were made to infer them from the available flow data and the stock figures for these variables. Since the inflow into unemployment from employment, not in the labour force and births and immigration by definition goes through short-term unemployment, we could identify the corresponding flows directly from our data. This also implies that the short-term unemployed that remain in that category per period, $USUS_t$ can be identified from the data. The remaining flows, U^SE_t, U^LE_t, $U^SU^L{}_t$, $U^LU^L{}_t$, U^SN_t and U^LN_t cannot be identified without further assumptions.

To identify these flows two scenarios were created with respect to the outflow from unemployment to not in the labour force, reflecting two extreme assumptions. In Scenario 1, all outflow is assumed to occur through long-term unemployment, that is $U^SN_t = 0$ and $U^LN_t = UN_t$. Scenario 2 adopts the other extreme that the outflow rate from short-term unemployment is equal to that of long-term unemployment. These scenarios allow us to calculate the flows U^SE_t, U^LE_t, $U^SU^L{}_t$ and $U^LU^L{}_t$. They will be denoted by the subscripts 1 and 2, respectively.

Figure 4 Outflow rates from not in the labour force and unemployment



(a) From Not in the Labour Force



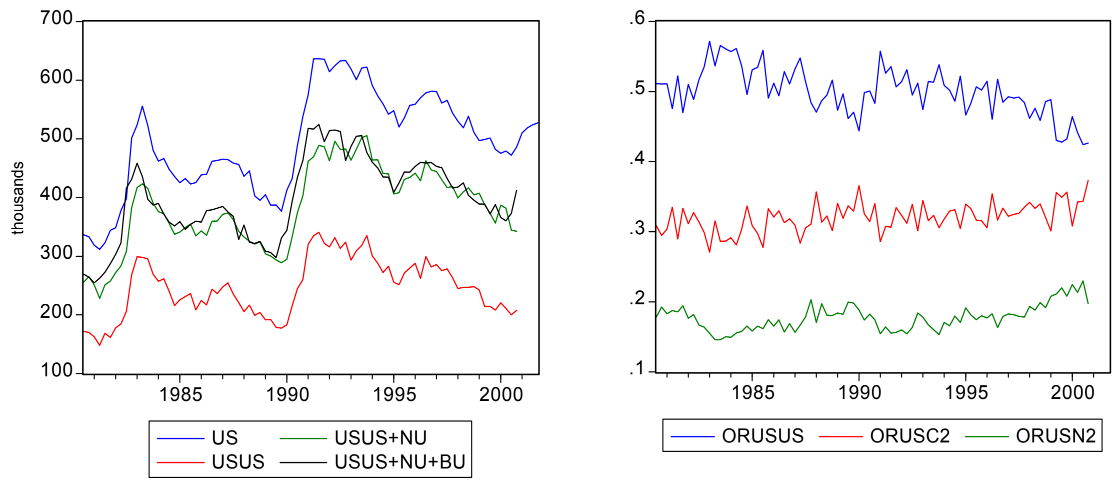
(b) From Unemployment

The outflow rates from not in the labour force (NILF) and from unemployment to employment, unemployment and not in the labour force are shown in Figures 4(a) and 4(b), respectively. The outflow rates from both states (not in the labour force and unemployment) are very similar in terms of their inertia. One sees that the incidence of persons remaining in the same state between periods is very high. From Figure 4(b) the unemployment hysteresis is pronounced (the probability of an unemployed person remaining remain unemployed is very high – varying between 60 and 70 per cent). This probability also displays clear counter-cyclical movement, which provides evidence against a rigid NAIRU characterisation (Mitchell, 2001a). The outflow rates into employment and into NILF from unemployment are both around 20 per cent and vary pro-cyclically. Finally, the outflow rates from employment are very similar to those from NILF as shown in Figure 4(a).

Short-term unemployment makes up the largest part of unemployment (around 75 per cent on average). In Figures 5(a) and 5(b) we consider the flows in and out of this state in more detail. It is remarkable that all outflow rates are quite stable over time despite of the strong fluctuations in short-time unemployment. The outflow rate from short-term unemployment is around 50 per cent. Outflow to employment and LTU is about 30 per cent with the remainder going into NILF (in Scenario 2). When we compare the outflow to employment and LTU to the outflow rate of total unemployment to employment in

Figure 4(b) it is very striking that the latter is always lower over this sample. This implies that even in the most optimistic scenario, employment growth has never been sufficient to absorb the outflow from short-term unemployment. Thus a crucial assumption of Ball's analysis, which we discuss below, is inconsistent with our observations. This is consistent with the first stylised fact noted above – that the Australian economy has operated within the constraints of major demand deficiency since the mid-1975s and even when employment growth is 'strong' it is not strong enough!

Figure 5 Inflows into and outflows from short-term unemployment



(a) Inflows into STU (b) Outflow rates from STU

STU refers to short-term unemployment. The inflows are in thousands and the outflows are in rates (probabilities). ORUSC2 is the outflow rate from STU to employment and LTU under Scenario 2 and ORUSN2 is the outflow rate from STU to NILF under Scenario 2.

3. Non-linear models of labour market dynamics and inflation

The stylised facts outlined in Section 2 pose considerable difficulties for the standard macroeconomic models of time series behaviour (that underpin the NAIRU concept). In this section we outline two models which do not generate a unique NAIRU, yet consider asymmetric behaviour with a focus on how the labour market conditions the inflation process. First, Ball (1999) presents a model which focuses solely on labour market behaviour. Short-term unemployment is the wage pressure variable in his expectations-augmented Phillips curve. A unique level of short-term unemployment consistent with stable inflation may exist, but total unemployment can take on any value. The NAIRU, as defined in the conventional sense, is thus undetermined. Moreover, employment shocks impact asymmetrically on inflation via their non-linear impacts on short-term unemployment. Mitchell and Muysken (2002a) extend the model by incorporating the impact of cyclical changes in the labour force to derive an extra channel through which changes in employment affect both short-run unemployment and the rate of inflation; and by developing a more sophisticated Phillips curve.

Second, we develop a growth model which explains cyclical asymmetries but which is driven by product market developments. The components of our Post Keynesian model are investment uncertainty operating with a segmented labour market where employment in both labour segments behaves similarly but where the primary labour market conditions the wage determination process.

3.1 Labour market dynamics in Ball (1999) and Mitchell and Muysken (2002a)

Ball (1999) develops a model based on annual periods to show that symmetrical aggregate demand movements have asymmetric impacts on short-term unemployment, defined as a spell of unemployment up to 12 months in duration. With the labour force constant, employment growth ensures that short-term unemployment equals the normal net flows in and out of employment (separations and hires). However, when employment changes are negative these net flows are supplemented by job losses. Due to the annual periods, all hires in this model are from long-term unemployment.

Mitchell and Muysken (2002a) convert the model into quarterly periods and derive the impact of cyclical labour force participation rate changes on short-term unemployment by including flows from employment (*E*) and unemployment (*U*) to not in the labour force (*N*) (that is, retirements, discouraged workers, quits). The labour force, *LF* in any quarter is given as $LF_t = LF_{t-1} - qE_{t-1} - vU_{t-1} + X$ with q the *EN* flow and v the *UN* flow. We define X as an exogenous labour force change (for example, due to demographic changes, migration). The maximum capacity of employment to absorb X is given by $\Delta E_t + qE_{t-1}$, given that retirements free up existing jobs (qE_{t-1}). As $X = \Delta LF_t + qE_{t-1} + vU_{t-1}$ (from the labour force equation), we conclude that unemployment will rise unless $\Delta E_t + qE_{t-1} \geq X$. The demarcation between growth and contraction is thus $\Delta E_t \geq \Delta LF_t + vU_{t-1}$, which says that the change in employment has to equal the change in labour force plus the number of unemployed who dropped out of the workforce.

Unemployment in any quarter is given by the following stock-flow accounting expressions depending on which regime (expansion or contraction) binds:

(1a) If $\Delta E_t \geq \Delta LF_t + vU_{t-1}$ $\quad U = U_{t-1} + sE_{t-1} - (r+v)U_{t-1} = sE_{t-1} + \left(1-r-v\right)U_{t-1}$

(1b) If $\Delta E_t < \Delta LF_t + vU_{t-1}$ $\quad U = sE_{t-1} + \left(\Delta LF + vU_{t-1} - \Delta E_t\right) + \left(1-r-v\right)U_{t-1}$

where *s* is the flow from *E* to *U* and *r* is the flow from *U* to *E*. If we consider the labour market flows in quarterly terms yet define the stock of short-term unemployment in annual terms, then the extra short-term unemployment in each quarter is given as $max\left[sE_{t-1}, sE_{t-1} + (\Delta LF_t + vU_{t-1} - \Delta E_t)\right]$. Recursive substitution from Equations (1a) and (1b) then gives short-term unemployment as:[10]

(2) $$\sum_{j=1}^{4} max \begin{cases} s(1-r-v)^{j-1}E_{t-j}, \\ s(1-r-v)^{j-1}E_{t-j} + (1-r-v)^{j-1}(\Delta LF_{t+1-j} + vU_{t-j} - \Delta E_{t+1-j}) \end{cases}$$

Equation (2) shows that employment shocks have asymmetric impacts on short term unemployment which intensify once the impacts on the labour force are included.

This model thus yields the following predictions which can be empirically tested:

1. There are distinct regimes given by Equation (2) where short-term unemployment behaves asymmetrically in relation to an employment shock;
2. Employers hire by initially exhausting the short-term unemployed (except separations) and then begin to employ the long-term unemployed; and
3. Mitchell and Muysken (2002a) also show how this model of labour market dynamics when combined with a typical "battle of the mark-ups" Phillips curve predicts only short-term unemployment matters for inflation and this is determined by employment growth. Long-term unemployment can take any value, without having an impact on inflation. In other words, there is no unique NAIRU.

The discussion in Section 2.5 concerning the relative magnitudes of gross flows, in particular, the flows from short-term unemployment to employment compared to those from total unemployment reject prediction 2 and by implication prediction 1. Prediction

3, which is also consistent with our alternative model developed in the Section 3.2, is tested in Section 5.

3.2 Investment driven growth with cyclical asymmetries

In this section we outline an alternative model, which consistently accounts for these facts and shows how product market asymmetries, driven by investment irreversibility, transmit into a segmented labour market. The cyclical employment response in both segments is positive but asymmetric and primary labour market wage setting conditions overall wage movements (see Mitchell and Muysken, 2002c). Adopting an environment of investment uncertainty, Mitchell and Muysken (2002c) show that the rate of capacity utilisation drives asymmetric movements in investment. This relationship recalls the asymmetric multiplier-accelerator models developed by Goodwin in the early 1950s (see Allen, 1968). The model is simplistic in that output shocks drive investment with no role allowed for relative prices or Tobin's *q*. Our *q* is the rate of capacity utilisation. Our aim is to highlight a typically ignored mechanism – the impact of capacity utilisation on investment and the consequences for the output dynamics.

The puzzle that has to be addressed is this:

- Both the employment prospects of the short-term and long-term unemployment improve in the upturn. There is no evidence to suggest that economic growth comes up against a bottleneck imposed by intractable pools of long-term unemployed;
- Both pools of unemployment behave asymmetrically which points to policy that should avoid prolonged and/or deep cyclical swings;
- The inflation restraint is provided by the short-term unemployed and the underemployed, rather than the long-term unemployed; and
- Active labour market programs do not reduce unemployment in isolation of strong economic growth.

In this paper, we sketch the model. Production capacity Y_t increases with investment I_t, such that:

(3) $$\Delta Y_t = -\delta Y_{t-1} + vI_t$$

where δ is the depreciation rate and v is the productivity of investment. Actual output X_t cannot exceed capacity output.

We assume that investors facing endemic uncertainty make large irreversible capital outlays, which leads them to be cautious in times of pessimism and to use broad safety margins. They form expectations of future profitability by considering the current q against their 'normal q'. Accordingly, firms only invest when capacity utilisation, $q = X / Y$ exceeds its normal level $q^* < 1$. In that case investors make up for the lack of capacity at a rate λ, which gives the following investment function:

$$(4) \qquad \begin{aligned} I_t / Y_{t-1} &= (1/v)\delta + (\lambda / v)\left(q_{t-1} - q^*\right) \qquad && q_{t-1} > q^* \\ &= (1/v)\delta && q_{t-1} \leq q^* \end{aligned}$$

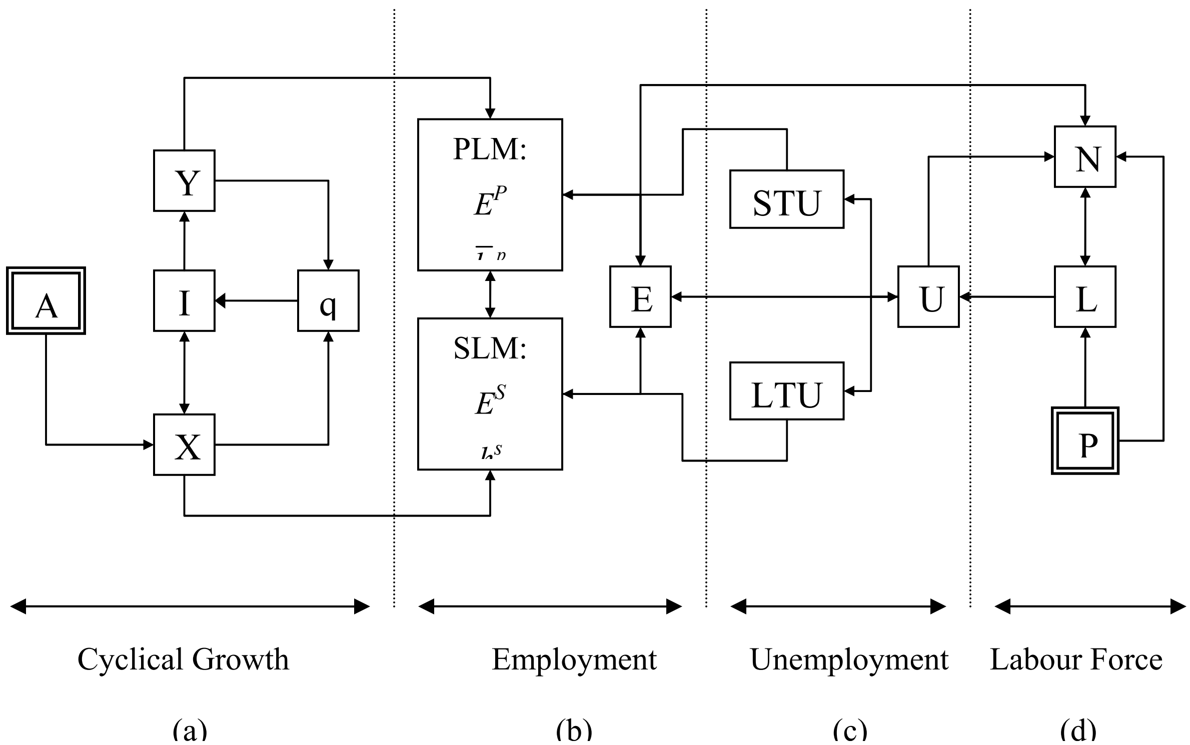
So investment varies with capacity utilisation within bounds and therefore productive capacity grows at rate which is bounded from below and above. The asymmetric investment behaviour thus generates asymmetries in capacity growth because productive capacity only grows when there is a shortage of capacity ($q > q^*$) and Equations (3) and (4) imply that productive capacity grows at a rate:

$$(5) \qquad \begin{aligned} g_{yt} &= \Delta Y_t / Y_{t-1} = \lambda\left(q_{t-1} - q^*\right) \qquad && q_{t-1} > q^* \\ &= 0 && q_{t-1} \leq q^* \end{aligned}$$

In analysing output growth, we employ a simple Keynesian savings function but that all groups, consumers, firms and government can save. Firms and consumers will invest when investment is attractive and dissave their hoardings. When investment is not feasible, they will hoard their net savings (hold cash balances as a time vehicle against uncertainty).

In the case of capacity shortage, output growth exceeds capacity growth and as the economy reaches full capacity, output growth slows to the rate that binds capacity growth. The corresponding fall in investment causes output to decrease, such that utilisation falls below normal capacity. At that point, net investment stalls, capacity output is hardly growing and output growth can catch up until normal capacity is again reached. Autonomous expenditures (A) can accelerate this process. Then the cycle starts again. The reaction of output to changes in the rate of capacity utilisation is also asymmetric, due to the investment asymmetries. The above process is summarised in Figure 6a. In this model, macroeconomic policy works through A. If there are public surpluses, increases in capacity utilisation and productive capacity require the private sector to become increasingly indebted. This growth path is unsustainable as private agents will ultimately seek to restore the quality of their balance sheets by increasing their saving (see Mitchell and Mosler, 2002; Mitchell and Reedman, 2002). Asymmetry can also enter via a treasury reaction function conditioned by an obsessive pursuit of public surpluses. If investment falls, the cyclical deficit will increase. If the government reacts by tightening fiscal policy to push the budget back towards surplus, then non-linear spending effects will emerge.

Figure 6 An aggregate demand model of with asymmetric labour market responses



What are the labour market dynamics in this model? We distinguish between primary labour market (PLM) and secondary labour market (SLM) employment, E_p and *Es*, respectively. Both labour markets are functionally linked with the SLM contracting and expanding to meet the flux and uncertainty of aggregate demand. This allows PLM employers to offer more attractive work conditions, including stability of tenure, which is cost effective to these firms given that they incur training costs to ensure workers have job-specific skills.

Total employment in persons is:

(6) $E = E_p + E_s$

Total hours worked (where *h* denotes hours worked per person) is:

(7) $hE = h_p E_p + h_s E_s$

Here h_p measures the standard working week, reflecting the assumption that primary workers are predominantly full-time workers. Given the part-time nature of likely secondary jobs in the service sector we consider $h_s < h_p$, allowing underemployment to exist.

Firms treat primary jobs as quasi-fixed due to positive adjustment costs and hire in proportion to normal productive capacity, given labour productivity a_t^p per hour:

(8) $E_p = a_t^p Y_t$

For simplicity, the growth in labour productivity a_t^p is secular and above aggregate labour productivity per hour a_t, which is a weighted average of a_t^p and a_t^s, second labour productivity. Secondary workers are employed in proportion with actual output given that they have no tenure:

(9) $E_s = a_t^s X_t$

Aggregate labour productivity thus varies pro-cyclically with capacity utilisation, around the same secular trend. The cyclical variation is caused by adjustment costs in employment. The employment equations highlight the role of capacity utilisation and can be extended to include labour costs, although we consider that income effects dominate substitution effects.

Capacity utilisation has a pro-cyclical impact on both primary and secondary employment although the former is less sensitive to cyclical variations. Both types of employment show asymmetric cyclical responses. Firms adjust h_s, E_s, h_p, E_p in that order. Since primary workers are assumed to work the standard work week, employment measured in persons and total hours exhibits similar variations and is fairly stable. Some hoarding of primary workers is expected in a downturn. In contrast, firms may quickly adjust part-time working hours and layoff secondary workers as actual output falls. As a consequence, hours worked per secondary worker exhibit pro-cyclical fluctuations and capacity utilisation bears part of the employment adjustment costs. However, the cyclical sensitivity of hours worked per person is below that of total hours worked. Thus, the demand for persons in the secondary labour market fluctuates asymmetrically with the cycle. The asymmetry may exist but be less pronounced for primary workers. This process is summarised in Figure 6b.

Mitchell and Muysken (2002a) establish that the labour force participation rate responds symmetrically to employment shocks and thus changes in the labour force result from both shocks in employment growth and in population growth (*P*) (Figure 6d). So the asymmetries in employment demand are reinforced by labour force sensitivity which makes it harder to reduce unemployment after a severe trough. Changes in capacity utilisation thus impact on unemployment through two channels. First, an increase in capacity utilisation will increase employment (Figure 6b). Second, increased employment will induce a higher participation rate and a larger labour force (Figure 6d). Since the latter indirect effect is weaker than the initial direct effect, unemployment will decrease.

This model generates the stocks in N, E_p, E_s and *U*. In Figure 6c the interaction of output (employment) demand and the labour force dynamics determines total unemployment (*U*), which is divided by duration into short-term (*STU*) and long-term (*LTU*) components. This can be married to the labour market flow dynamics (see Table 3 above) to explore and simulate the dynamics of unemployment in more detail. In particular, we model the relevant outflow rates and use the primary and secondary employment distinction to generate short- and long-term unemployment. We hypothesise that the *LTU* will more likely be low-skilled with unstable work histories and most exposed to cyclical variations because they typically work in secondary jobs when employed. The *STU* compete for jobs in both labour markets but generally prefer to work in primary jobs.

Both labour markets expand with positive investment spending and so both unemployment pools contract. However, primary labour market workers dominate the determination of wage outcomes in the economy with secondary market wages following.

Since only short-term unemployment is relevant in the primary market, wages will react primarily to short-term unemployment instead of total unemployment.

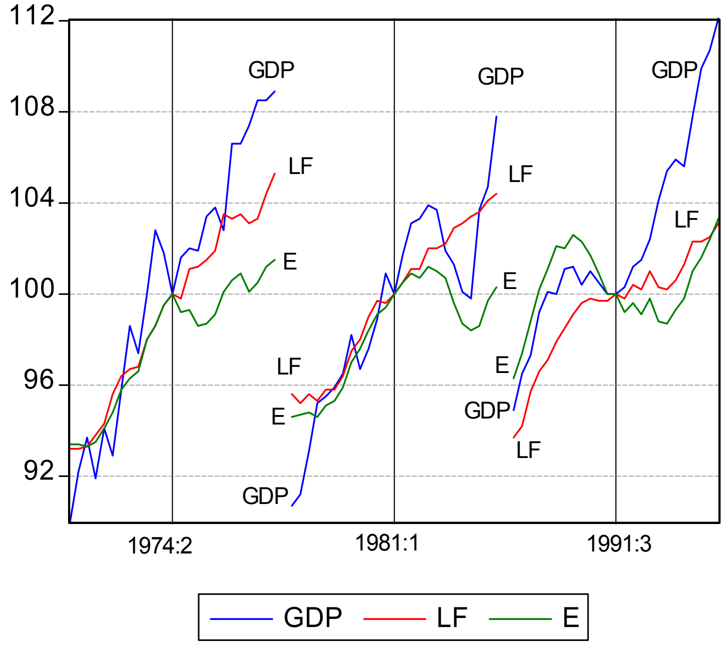
The final puzzle is then explained. This is the basis of the Phillips curve estimated by Mitchell (2001a, 2002), Mitchell and Carlson (2002) and Mitchell and Muysken (2002a) examined below. Long-term unemployment is sensitive to capacity utilisation and capacity growth but does constrain inflation. Ball (1999: 240) says "hysteresis is reversible: a demand expansion can reduce the NAIRU" because "they … [employers] … would rather pay the training costs than leave the jobs vacant" (Ball, 1999: 230). A similar observation underpins the hysteresis models in Mitchell (1987, 1993). In a high pressure economy, firms lower hiring standards and address any skill deficiencies by offering on-the-job training.

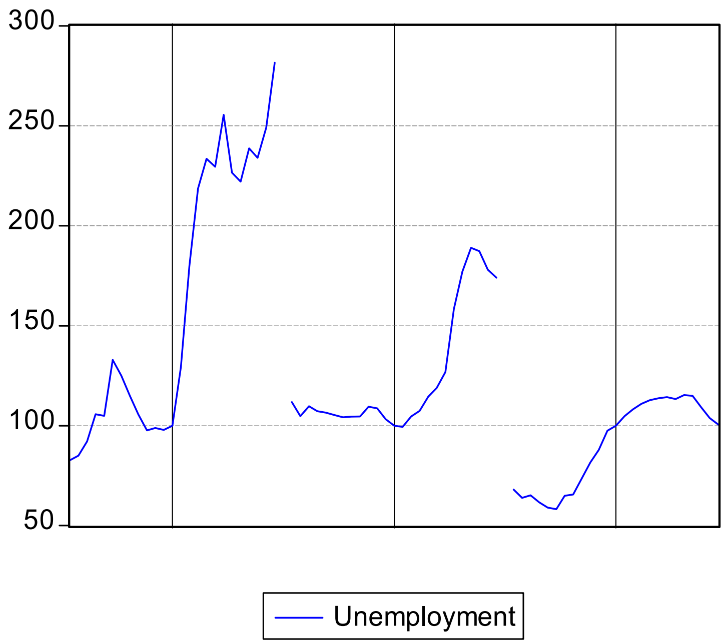
4. Recovery Response Analysis

Since cyclical asymmetries play an important role in our analysis it is useful to more closely examine the behaviour of unemployment and other Okun aggregates (real output growth, labour force growth and employment growth) over the last three business cycles in Australia. We summarise the results in Figure 7. The three troughs were June 1974, March 1981 and September 1991, respectively (see Mitchell, 2001a for an explanation of the derivation). The time series shown are indexed to take the value of 100 at each trough. The charts then are of the evolution of the respective index numbers from 12 quarters before the trough and then to 12 quarters after the trough. The relationship between output growth and unemployment is then more clearly seen.

We observe asymmetric behaviour in unemployment over each cycle. In 1974 and 1981, unemployment was relatively constant but increased sharply afterwards, the magnitude determined by the relationship between real output, labour force and employment growth. In 1974, the labour force continued to grow and had not become as cyclically-sensitive as it is now (the rise in married female participants had just begun). However, the firms shed significant numbers of workers they had been hoarding and the employment growth rate was negative to low for several quarters after the trough.

Figure 7 Business cycle responses in Australia, Index (Trough = 100)





In 1981, a similar pattern unfolded although the firms were already lean and so employment growth was higher in the upturn. In both cycles, real output growth behaved similar before and after the trough. In the 1991 downturn, real output growth showed a typical pattern but the growth in unemployment was significantly reduced largely due to the labour force growth rate had slowed substantially. However, employment growth remained sluggish as in the previous recoveries. The evidence depicted in Figure 7 thus suggests that the Australian labour market is prone to slow recoveries even when real output growth is positive after the trough. There is a high degree of persistence in unemployment once shocked and employment takes a significant period to recover from the negative demand shock.

5. Non linear Okun relationships in Australia

The model developed in Section 3 suggests that output dynamics drive asymmetric changes labour underutilisation while the analysis presented in Section 4 suggests that the Okun relationship in Australia is non-linear. Watts and Mitchell (1991) estimated the steady-state unemployment via a cointegration equation and simulated estimated steady-state unemployment rates for different time periods dependent on the average values taken by the explanatory variables including the rate of capacity utilisation, the degree of structural mismatch and the rate of growth of overall productive capacity. They showed the dominance of cyclical factors in explaining the shift of the NAIRU over the sample period. The accompanying estimated short-run error correction (ECM) model found strong evidence of hysteresis in the shifting Okun relation. They did not however consider an asymmetric relationship. More recently, Shorderet (2001) and Virén (2001) have modelled asymmetric effects in an Okun model, although their approaches differ. However, both use a cointegration ECM framework to show that the unemployment rate reacts in a non-symmetric manner to positive and negative changes in real output.

To provide some empirical content to the model sketched in Section 3 we estimate an asymmetrical Okun-type model after using a grid search to detect the rate of real GDP growth that triggers the asymmetry in its impact on the labour market. Our model builds on Watts and Mitchell (1991) and Shorderet (2001). We find that the best demarcation occurs between positive and negative real GDP growth rates. Watts and Mitchell (1991) argued that Okun's law as originally specified ignored the movements in the trend rate of potential output growth. Slower capacity growth can be expected to lead to a rise in the rate of unemployment, in the long run, even if capacity utilization remains constant. This would suggest that the unemployment rate is influenced by long-run cyclical factors, in addition to short-run variations in capacity utilisation. Further, the process of structural change which affects the industrial composition of employment and its composition by sex and part-time and full-time status would also be expected to influence the unemployment/capacity utilization nexus in the long run.

5.1 The Model

We begin with a simple (linearised) model of unemployment:

$$(10) \quad u_t = \alpha + \beta y_t + \gamma z_t + e_t \qquad \beta < 0$$

where u is the unemployment rate, y is the log of real output, z is a vector of other factors influencing the unemployment rate (including growth in capacity output and also structural change in the labour market), and e is a white-noise error term. A steady-state value of u in Equation (10) can thus be derived conditional on the values taken by the explanatory variables (see Watts and Mitchell, 1991).

We hypothesise that the growth in real output (Δy) impacts asymmetrically on the unemployment rate according to the following regimes:

$$(11) \quad \beta = \begin{cases} \beta^{+} & if\, \Delta y_t > s \\ \beta^{-} & if\, \Delta y_t < s \end{cases}$$

where s is some switching point (we report only the demarcation between positive and negative output growth rates). The stylised facts and the relations implied by the theoretical model outlined in Section 3 would suggest that:

$$(11a) \quad \left|\beta^{+}\right| < \left|\beta^{-}\right|$$

Unemployment dynamics are thus specified as:

$$(12) \quad \Delta u_t = c_0 + \sum_{i=1}^{m} \alpha_i \Delta u_{t-i} + \sum_{j=0}^{n} \beta_j^{+} I_P \Delta y_{t-j} + \sum_{j=0}^{n} \beta_j^{-} I_N \Delta y_{t-j} + \sum_{j=0}^{n} \gamma_j \Delta z_{t-j} + v_t$$

The indicator functions I_P and I_N are designed to switch regimes and allow for asymmetry. They are specified as:

$$(13) \quad I_P = \begin{cases} 1 & if\, \Delta y_{t-i} > s \quad i = 0,\ldots,p \\ 0 & if\, \Delta y_{t-i} < s \quad i = 0,\ldots,p \end{cases} \qquad I_N = \begin{cases} 0 & if\, \Delta y_{t-i} > s \quad i = 0,\ldots,p \\ 1 & if\, \Delta y_{t-i} < s \quad i = 0,\ldots,p \end{cases}$$

Shorderet (2001) uses $u_t = u_0 + \sum_{i=1}^{t-1} \Delta u_{t-i}$ to show that Equation (10) can be rewritten as:

(10a) $u_t = \alpha + \beta^+ y_t^+ + \beta^- y_t^- + \gamma z_t + e_t$

where $\alpha = u_0 - yz_0$, , $y_t^+ = \sum_{j=0}^{t-1} I_P \Delta y_{t-j}$, and $y_t^- = \sum_{j=0}^{t-1} I_N \Delta y_{t-j}$.

Equation (10a) raises some issues. Given that the unemployment rate is bounded one could assume *a priori* it is stationary (see Mitchell, 1993). In this case, to balance Equation (10a) there would have to be cointegration among the other integrated variables (like y^+, y_t^-, both of which appear to be *I*(1) after unit root testing). Given the hysteresis, the unemployment rate exhibits a strong trend. Yet after de-trending, it still appears to be non-stationary. Equation (10a) can thus be interpreted as a cointegrating regression if the residuals are stationary. We can then test Equation (12) in error correction form. Unit root also showed that the growth in productive capacity (DPG) was *I*(1). The measure of structural change was not significant in any regression and is not discussed further.

5.2 Estimation Results

The results for Equation 10(a) are shown in Table 4 and provide tentative support for the contention that the Okun relation in Australia is non linear.

Table 4 Non linear Okun regression, Dependent variable *UR* (%), 1961:3 2002:2.

Variable	Coefficient	*t*-stat
Constant	0.145	17.9
Y^+	-0.071	11.4
Y^-	-0.463	15.0
Potential capacity growth	-2.418	17.3
Time	0.001	8.8
R^2	0.93	
S.E. as % mean Dep Var.	13.8	
DW	0.184	

Note: Potential capacity growth is the log of the current value divided by the fourth lagged value (see Mitchell, 2001a for the derivation). Time is a linear time trend. A dummy in 1982:4 was included to account for an outlier. The dependent variable was the unemployment rate.

The residuals were tested for stationarity using the ADF and KPSS tests. The ADF test statistic was -3.336444 (5 per cent critical value = -2.879155) and the KPSS test statistic was 0.079060 (5 per cent critical value = 0.146). We thus cannot reject the null of cointegration.

We then added the lagged residuals from the estimated Equation (10a) to Equation (12) and tested down. The results are shown in Table 5.

Table 5 Okun adjustment function, Dependent Variable Δ*UR*, 1961:4 to2002:2

Variable	Coefficient	*t*-stat
Constant	-0.000	0.85
$\Delta Y^{+}(-1)$	-0.001	0.21
ΔY^{-}	-0.24	4.16
$\Delta UR(-1)$	0.27	3.52
$ECM\ (-1)$	-0.05	1.87
R^2	0.39	

If the dependent variable is the annual change in the unemployment rate the results improve somewhat and both output growth terms are significant. The error correction term is marginally significant and correctly signed The results in Table 5 are indicative only. We also tested for cointegration between y^{+}, y_t^{-} and found marginal evidence for that. This means that the results in Table 4 are relatively insensitive to our assumption about the order of integration of the unemployment rate. Mitchell and Carlson (2002) provide more development of this model and compare it to an asymmetric structural VAR representation.

In conclusion, the results presented in this section are supportive of the idea that hysteresis and asymmetry in unemployment are driven by output shocks.

6. Phillips curve analysis

The model sketched in Section 3 suggests that the long-term unemployed do not put pressure on inflation yet their employment prospects respond to demand stimulus. Ball (1999: 240) says "hysteresis is reversible: a demand expansion can reduce the NAIRU" because "they … [employers] … would rather pay the training costs than leave the jobs vacant" (Ball, 1999: 230). A similar observation underpins the hysteresis models in Mitchell (1987, 1993). In a high pressure economy, firms lower hiring standards and address the skill deficiencies of the long-term unemployment by offering on-the-job training. If the long term unemployed do not place pressure on inflation, then, at best only a unique level of short-term unemployment consistent with stable inflation may exist. The uniqueness of this level depends on other behavioural aspects of the inflationary process, in particular whether the estimated models are homogenous with respect to expectations and whether hysteresis is present or not (see Fair, 2000; Mitchell, 2001a).

In this section, we thus examine four major contentions:

1. Does the short-term unemployment rate provide a stronger constraint on the annual inflation rate relative to the overall unemployment rate?
2. Does the long-term unemployment rate exert any statistically significant impact on the annual inflation rate? We expect the coefficient on the long-term unemployment rate in a Phillips curve model to be statistically insignificant.
3. Does the TV-NAIRU model of the evolution of excess demand provide an inferior explanation of the inflation process compared to the models developed under hypothesis (1)? We expect an inflation models using the gap between the short-term unemployment and its filtered trend to be superior to that which uses the gap between the official unemployment rate and its filtered trend as the excess demand measure. The latter variable is typically used in TV-NAIRU studies (see Mitchell, 2001a).
4. Does the estimated Phillips curve exhibit NAIRU dynamics? Fair (2000) and Mitchell (2001a) present tests based on the coefficients on the lagged dependent inflation variable to determine whether the inflation dynamics are consistent with a constant NAIRU model. The test is a simple homogeneity test on the lagged inflation terms.

We use a general autoregressive-distributed lag Phillips curve representation like:

$$(14) \qquad \dot{p}_t = \alpha + \sum_{i=1}^{n} \delta_i \dot{p}_{t-i} + \sum_{i=0}^{m} \beta_i u_{t-i} + \sum_{i=0}^{q} \gamma_i z_{t-i} + \varepsilon_t$$

where $\dot{p}_t$ is the rate of inflation at time *t*, *u* is the unemployment rate, *z* is a cost shock variables (like import price inflation, capital costs), and the ε is a white-noise error term.

In addition, the *u* variable can take the form of the aggregate unemployment rate or the short-term unemployment rate to facilitate the testing of the hypotheses (1) to (3) outlined above. In the case of hypothesis (3) we compute *UR** and *STUR** using a Hodrick-Prescott (HP) filter on the official unemployment rate, UR and the short-term unemployment rate, STUR, respectively. The variables (*UR* - *UR**) and (*STUR* - *STUR**) are the original series less the HP filtered trend series in each case.

Further, if the δ coefficients sum to unity, the model gives a constant NAIRU of $-\alpha \big/ \sum_{i=0}^{m} \beta_i$. At this unemployment rate, the inflation rate will only exhibit short-run changes due to changes in changes in *z* and/or random shocks (changes in ε). So we can test hypothesis (4) by testing for homogeneity.

We initially develop a Phillips curve model for Australia using Equation (14) using 4 lags on the annualised inflation terms (*D4LP*) and import prices (*D4LPM*), the level of the unemployment rate, a dummy variable, *DGST* (defined as 1 in 2000:3 and zero otherwise) to take into account the introduction of the Goods and Services Tax system in Australia in July 2000, and other variables capturing the cost of capital, interest spread, and payroll taxes and the like. The other variables were not retained in the final tested-down specification. Sequential testing down from the general equation using different measures of the unemployment variable yielded the results shown in Table 6. In each case, the dynamics were so close and the coefficient estimates for the other variables were highly stable that a common specification is employed, which aids comparison considerably. The diagnostics of all equations were satisfactory.

Equation (6.1) in Table 6 describes a typical Phillips curve using the aggregate unemployment rate (*UR*). The unemployment rate exerts a negative influence on the rate of inflation (-0.18). A comparison with Equation (6.2) which splits the unemployment rate into short-term and long-term components shows that the *LTUR* is not statistically significant. Further, the degree of negative pressure on inflation exerted by the highly significant *STUR* rises to -0.53, substantially above that estimated for *UR*. Equations (6.3) and (6.4) are inferior specifications and warrant no specific comment.

Mitchell (2002) argues that the NAIRU concept remains on shaky theoretical grounds. Importantly, the original theory underpinning the NAIRU provides no guidance about its evolution although, we would be looking to the evolution of unspecified structural factors to remain faithful to that theory. In this theoretical void, econometricians have used techniques that allow for a smooth evolution although there is no particular correspondence with any actual economic factors. Some authors assert that a Hodrick-Prescott filter through the actual series captures the TV-NAIRU (for example Boone, 2000 among many). Of-course, the Hodrick-Prescott filter merely tracks the underlying trend of the unemployment and follows it down just as surely as it follows it up. The unemployment rate is highly cyclical and the TV-NAIRU proponents are silent on this apparent anomaly – why do the alleged structural factors cycle with the actual rate?

Equations (6.5) and (6.6) use the alternative form of the unemployment variables in terms of the actual value (of *UR* and *STUR*) being expressed as gaps on their respective filtered trend values. These regressions constitute an improvement on (1) to (4). Equation (6.5) is thus in the TV-NAIRU vein and performs reasonably in statistical terms. The coefficient on the demand pressure gap (*UR* - *UR**) is -0.409, substantially higher than that estimated for Equation (6.1). However, Equation (6.5) is inferior to Equation (6.6) that replaces (*UR* - *UR**) with the short-term unemployment rate gap (*STUR* - *STUR**). This has a lower standard error of estimate and the deviation of *STUR* from its current (shifting) HP-filtered value, *STUR** is -0.648. In other words, a 1 per cent deviation above the filtered value leads to a 0.64 per cent slowdown in the annualised inflation rate. It is interesting to consider the different values of the coefficients on the STUR and UR variables. The following dynamics are suggested. A downturn increases short-term unemployment sharply, which reduces inflation because the inflow into short-term unemployment is comprised of those currently employed and active in wage bargaining processes. As the downturn continues, the duration of unemployment rises and the pressure exerted on the wage setting system by unemployment overall falls. This requires higher levels of short-term unemployment being created to reach low inflation targets with the consequence of increasing proportions of long-term unemployment being created.

The results taken together provide strong support for the hypotheses (1) to (3) outlined above and for the theoretical model developed in Section 3.

Table 6 Phillips curve regressions, Australia, 1978:1 to 2001:4

	(6.1)	(6.2)	(6.3)	(6.4)	(6.5)	(6.6)
	UR	STUR-LTUR	STUR	LTUR	URGAP	STURGAP
Constant	0.02	0.02	0.02	0.01	0.00	0.00
	(2.96)	(3.77)	(3.53)	(1.91)	(1.62)	(1.21)
Δ4LP(-1)	0.88	0.93	0.90	0.88	0.89	0.91
	(29.4)	(25.6)	(32.9)	(25.4)	(32.9)	(35.1)
UR	-0.18					
	(2.84)					
UR-UR*					-0.409	
					(4.10)	
STUR		-0.53	-0.35			
		(3.22)	(3.42)			
STUR-STUR*						-0.648
						(4.53)
LTUR		0.30		-0.25		
		(1.36)		(1.72)		
Δ4LPM	0.05	0.05	0.05	0.05	0.06	0.06
	(4.13)	(4.31)	(4.26)	(3.94)	(4.98)	(4.83)
DGST	0.02	0.02	0.02	0.02	0.02	0.02
	(2.46)	(2.49)	(2.43)	(2.60)	(2.63)	(2.72)
R-Squared	0.94	0.95	0.94	0.94	0.95	0.95
S.E. of regression	0.00814	0.00796	0.00821	0.00836	007806	0.00767
se % mean	15.0	14.7	15.1	15.4	14.4	14.1
SC LM(1)	2.24	0.35	0.47	3.51	0.50	0.06
ARCH 4)	0.49	0.99	0.70	0.38	0.51	0.88
RESET(2) F	0.10	0.09	0.04	0.12	0.35	0.19
NAIRU dynamics test						
F-statistic	14.9	3.3	15.3	11.0	16.3	13.1
d.f.	(1,90)	(1, 90)	(1, 92)	(1, 91)	(1,91)	(1,91)
Prob-value	0.0000	0.0711	0.0002	0.0013	0.0001	0.0005

Notes: SC LM(1) is a Breusch-Godfrey Serial Correlation 1st order LM Test, ARCH(4) is a 4th order test for Autoregressive conditional heteroscedasticity, RESET(2) is the Ramsey RESET test with 2 added terms, *t*-statistics are in parentheses. UR* and STUR* were computed using a Hodrick-Prescott filter on the UR and STUR, respectively. The variables UR-UR* and STUR-STUR* are the original series less the HP filtered trend series in each case.4.

An additional finding is that a long-term trade-off between unemployment and inflation is implied in all regressions. The NAIRU dynamics test statistic shown in Table 6 allows us to easily reject the null that the sum of the coefficients on the lagged inflation terms is unity in all regressions. In that sense, we would reject the constant NAIRU hypothesis.[11] So even though the short-term unemployment rate is relatively more effective in controlling inflation, there is no convergence to a constant equilibrium rate of short-term unemployment after an employment shock. The transitory equilibrium short-term unemployment rate is contingent on the evolution of employment growth and demand in general. Combined with the other findings relating to hypotheses (1) to (3) and the underlying model in Section 3, we interpret these results as being consistent with a hysteretic vision of the inflationary dynamics in Australia. The results indicate that a deflationary strategy using demand repression (tight monetary and fiscal policy) will be costly in terms of unemployment.

4. Conclusion

In this paper we have considered two theoretical models in relation to the key stylised facts of the Australian labour market. The model motivated by Ball (1999) and enhanced by Mitchell and Muysken (2002a), while developing asymmetries and the importance of employment shocks, fails because of the extent of demand deficiency that is evident in the Australian economy. In others, the persistence of unemployment and the bias in short-term unemployment towards long duration means that the constrained employment growth cannot generate sufficient flows out of unemployment. Part of the problem with Ball's analysis is that the source of asymmetry is confined to the labour market (employment shocks). The alternative model sketched emphasises investment asymmetries driven by product market shocks which interact with a segmented labour market. This model embraces demand deficiency and explains the other stylised facts more easily. It also reconcile the two facts that short-term and long-term unemployment behave similarly over the cycle, yet only short-term unemployment appears to discipline the inflation process. Our model poses major problems for the supply-side orthodoxy, which posits that the long-term unemployed represent a structural bottleneck and only supply initiatives like training and welfare reform can be effective.

The initial empirical modelling provides support for the theoretical model and suggests further research is needed to more precisely estimate the asymmetries (see Mitchell, 2002). The Okun relation linking output shocks to the labour market is non-linear (asymmetric) but more work is needed to estimate the dynamics of the model.

Data Appendix

Gross Domestic Product

Real Gross Domestic Product at 1999/00 prices taken from the ABS TRYM database.

Investment

Private Final Capital Expenditure at 1999/00 prices is the sum of total expenditure on Plant and Equipment, Other Building and Construction, and Intangible Fixed Assets all taken from the ABS TRYM database.

Inflation measures

The annual inflation rate is expressed as the four-quarter log change in the Consumer Price Index. The alternative inflation measure is the Final Consumption Deflator from the National Accounts. Both time series are taken from the ABS TRYM database

Import price index

The import price index is expressed as the four-quarter log change in the TRYM Model Import Price Index (1990/91 = 1) taken from the ABS TRYM database.

Labour Market Variables

All the labour force data are taken from the ABS Time Series Service available via AUSSTATS. The short-term unemployment rate is computed as official unemployment minus long-term unemployment expressed as a percentage of the labour force. Long-term unemployment is defined as a spell of unemployment longer than 52 weeks. The derivation of the underemployment measure is explained in Carlson and Mitchell (2001, Chapter 2).

Unit Root Tests

The time series properties of the data are presented in Tables A1 and A2 using Augmented Dickey-Fuller (ADF) tests and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests, respectively.

Table A1 Augmented Dickey Fuller Tests, unit root null

Variable	Sample period	ADF Test Statistic	Prob Value
UR	1960:2 2002:2	-2.273315	0.4458
ΔUR	1960:2 2002:2	-5.841232	0.0000
STUR	1978:4 2002:2	-3.134663	0.1044
ΔSTUR	1978:4 2002:2	-4.271421	0.0053
LTUR	1978:4 2002:2	-3.225853	0.0857
ΔLTUR	1978:4 2002:2	-3.559033	0.0390
LGDP	1959:4 2002:2	-2.236085	0.4662
Δ1LGDP	1960:1 2002:2	-13.58206	0.0000
Δ4LGDP	1964:1 2002:2	-3.092182	0.1119
ΔΔ4LGDP	1963:4 2002:2	-6.728708	0.0000
Δ4LGDP+	1962:4 2002:2	-3.113124	0.1068
ΔΔ4LGDP+	1962:3 2002:2	-8.215189	0.0000
Δ4LGDP-	1960:4 2002:2	-6.025852	0.0000
ΔΔ4LGDP-	1961:4 2002:2	-10.39052	0.0000
LSTOIKOV	1967:4 2002:2	-6.276242	0.0000
LCPI	1970:2 2001:3	-0.188963	0.9927
Δ1LCPI	1970:2 2001:3	-4.685111	0.0012
Δ4LCPI	1971:4 2002:4	-3.052257	0.1227
ΔΔ4LCPI	1971:4 2002:4	-6.651723	0.0000
LIPD	1960:4 2002:2	-2.023077	0.5841
Δ1LIPD	1960:4 2002:2	-1.916006	0.6417
Δ4LIPD	1963:1 2002:2	-1.971998	0.6117
ΔΔ4LIPD	1963:1 2002:2	–4.074648	0.0084

Table A2 Kwiatkowski-Phillips-Schmidt-Shin Tests, trend stationary null

Variable	Sample period	LM test statistic	5 per cent significance
UR	1959:3 2002:2	0.201383	
ΔUR	1959:4 2002:2	0.072614	*
STUR	1978:1 2002:2	0.118303	*
ΔSTUR	1978:2 2002:2	0.041691	*
LTUR	1978:1 2002:2	0.157232	
ΔLTUR	1978:2 2002:2	0.041400	*
LGDP	1959:3 2002:2	0.261209	
Δ1LGDP	1959:4 2002:2	0.105416	*
Δ4LGDP	1960:3 2002:2	0.114089	*
ΔΔ4LGDP	1960:4 2002:2	0.246493	
Δ4LGDP+	1960:3 2002:2	0.118997	*
ΔΔ4LGDP+	1960:4 2002:2	0.135401	*
Δ4LGDP-	1960:3 2002:2	0.066682	*
ΔΔ4LGDP-	1960:4 2002:2	0.500000	
LSTOIKOV	1967:3 2002:2	0.178558	
LCPI	1969:3 2001:3	0.340900	
Δ1LCPI	1969:4 2001:3	0.123388	*
Δ4LCPI	1970:3 2002:2	0.110269	*
ΔΔ4LCPI	1970:4 2002:2	0.101229	*
LIPD	1959:3 2002:2	0.244531	
Δ1LIPD	1959:4 2002:2	0.315417	
Δ4LIPD	1960:3 2002:2	0.317807	
ΔΔ4LIPD	1960:4 2002:2	0.064296	*

Source: Critical value at 5 per cent significance = 0.146 under the null of trend stationarity (Kwiatkowski-Phillips-Schmidt-Shin, 1992, Table 1)

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Notes

[1] The authors are Professor of Economics and Director of the Centre of Full Employment and Equity, The University of Newcastle; and Professor of Economics and Director, CofFEE-Europe, respectively.
[2] In the last four economic cycles the low point (seasonally adjusted) unemployment rates have been 4.6 per cent (June 1976), 5.5 per cent (June 1981), 5.6 per cent (November 1989) and 6.0 percent in September 2000 (Mitchell and Carlson, 2001).
[3] NAIRU stands for Non Accelerating Inflation Rate of Unemployment.
[4] The Reserve Bank of Australia is the central bank.
[5] The benchmark requires that output growth must be approximately equal to the sum of labour productivity and labour force growth for unemployment to remain unchanged. Following a negative output shock, real output growth must exceed this benchmark rate for the economy to return to full employment.
[6] The results derived from recursive least squares are indicative only as the AR(1) models may not be the best characterisation of the underlying data generating processes.
[7] These studies include Campbell and Mankiw (1987, 1989), Cochrane (1988).
[8] Layard (1998) underpins his argument with a major assertion that new jobs follow an increase in the effective labour supply. In what represents a modern restatement of Say's Law and the efficacy of the real balance effect, he says (1998: 26) "the mechanism is simple enough. If the labour supply increases and the number of jobs does not, inflation starts to fall; this makes possible an increase in aggregate demand in the economy, which in turn increases employment in line with the increase in the labour supply." It is a pity that OECD economies in general have not witnessed these dynamics over the last 25 years.
[9] Long term unemployment is defined as spells of unemployment in excess of 52 weeks.
[10] Due to the interaction between various labour markets, the regime change in the labour market will likely be less strict than indicated by the demarcation $\Delta LF + qLF_{t-1} = \Delta E$. We ignore this complexity in this paper.
[11] Mitchell (2001a) tested for NAIRU dynamics in similarly derived Phillips curve models for Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States. There was no evidence of a constant NAIRU operating in these countries. In each case, there is evidence of a non-vertical long-run Phillips curve although for Canada, France, and Italy, the findings are weak. Further, in the case of the United Kingdom and the United States, the change of unemployment is statistically significant indicating that hysteretic forces are present.