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Abstract

This paper presents an analysis of labour market dynamics, in particular of flows in the labour market and how they interact and affect the evolution of unemployment rates and participation rates, the two main indicators of labour market performance. Our analysis has two special features. First, apart from the two labour market states - employment and unemployment - we consider a third state – out of the labour force. Second, we study net rather than gross flows, where net refers to the balance of flows between any two labour market states. Distinguishing a third state is important because the labour market flows to and from that state are quantitatively important. Focussing on net flows simplifies the complexity of interactions between the flows and allows us to perform a dynamic analysis in a structural vector-autoregression framework. We find that a shock to the net flow from unemployment to employment drive the unemployment rate and the participation rate in opposite directions while a shock to the net flow from not in the labour force to unemployment drives the rates in the same direction.

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1 Introduction

Studying the interaction between labour market stocks and flows improves our understanding of how labour market dynamics affect labour market performance. This framework arises naturally because inflows and outflows affect the evolution of stocks and because labour market flows tend to be influenced by labour market stocks. For example, during periods of high unemployment, the duration of job search lengthens and some unemployed workers may be sufficiently discouraged to leave the labour market. In contrast, when employment is high, some non-participants might be persuaded to enter the labour market and accept a job.

Our analysis of labour market dynamics has two special features. First, in addition to the two states - employment and unemployment - we consider the third state "out of the labour force" (i.e. non-participation). Second, we focus on net rather than gross flows, where net refers to the balance of flows between any two labour market states.¹

Introducing non-participation as a separate state and analysing net flows between the labour market states provides a rich framework for analysis. First, the concept of steady-state equilibrium is changed. In a model with two labour market states (employment and unemployment), steady-state equilibrium occurs when the flow from unemployment to employment is equal to the flow from employment to unemployment (in other words, the net flow between employment and unemployment is equal to zero). The situation changes when we recognise the existence of three labour market states. In this case, as we will show in the next section of the paper, for steady-state equilibrium the flow from unemployment to employment need not be equal to the flow from employment to unemployment (in other words, the net flow between employment and unemployment need not be equal to zero).

Second, a focus on net rather than gross flows between three states may be particularly insightful given empirical regularities apparent in the data. As we discuss in more detail below we find for Australia that one direction of the gross flow dominates the other regardless of the phase of the business cycle. Specifically, flows from unemployment to employment exceed flows from employment to unemployment (and this is the case even in recessions); flows from employment to not in the labour force exceed flows from not in the

¹The availability of data on gross flows between states allows researchers to examine the balance of flows between labour market states. However, this is rarely done. One of very few attempts to study net flows is that by the European Commission (2009) which examines the size of the net flows in the EU in order to assess the relative size of "good transitions" (flows into employment) compared with "bad transitions" (flows out of employment).

labour force to employment (and this is the case even in booms), and; flows from not in the labour force to unemployment exceed flows from unemployment to not in the labour force (in both booms and recessions). In other words, over a long period of time, there are positive net flows from unemployment to employment; positive net flows from employment to non-participation and positive flows from non-participation to unemployment. Our findings suggest that for pedagogical purposes we might usefully ‘picture’ the system in terms of a representative worker’s life cycle from entering the labour market to search for work, then finding employment and ultimately leaving employment through retirement.

Third, focussing on net flows means that dynamic interactions between the three labour market states can be effectively analysed by modelling the three net flows rather than the six gross flows. The complexity of interactions is simplified and dynamic analysis rendered more tractable and amenable and can be conveniently studied in a vector-autoregression (VAR) framework.²

Fourth, introducing non-participation as a separate labour market state also means that we can analyse the relationship between the unemployment rate and the participation rate (and by extension the employment rate – by which we mean the employment-population ratio) in one easy to understand and coherent framework which incorporates net flows.

The relationship between the unemployment rate and the participation rate is an important area of study and one which at present is little understood. To take just one example, in his 2007 review of research on US labour market dynamics, Eran Yashiv writes that “[t]he picture of US labour market dynamics and its implications for the study of business cycles remain disturbingly opaque” (Yashiv (2007), p 779) and he ends his paper with a plea for further work to be undertaken on the flows involving those not in the labour force, and especially the flows between not in the labour force and employment.

Our contribution is thus to examine the dynamics of the effect of shocks to labour market flows on the unemployment rate, the participation rate and the employment rate using data on the *net* flows of workers between three labour market states (employed,

²Recent papers on gross flows include Elsby et al. (2009), Elsby et al. (2013), Fujita and Ramey (2009), Petrongolo and Pissarides (2008) and Shimer (2012). The main purpose of these papers is to assess the relative contribution of fluctuations in unemployment inflow and outflow rates to unemployment variation. Our approach differs in that not only are we viewing labour market dynamics (including unemployment fluctuations) using net rather than gross flows but also in that we are interested in the impacts of shocks to the (net) flows on the participation rate and the employment population ratio in addition to the unemployment rate.

unemployed and not in the labour force (aka ‘inactive’). We provide a framework to study the three net flows, including their effect on the unemployment and participation rates. Limiting the number of potential interactions allows us to state more decisively patterns and regularities that would be masked by more complex interactions. Furthermore, the integrated framework facilitates a VAR impulse response analysis to investigate how net flows affect the evolution of unemployment rates and participation rates, the two main indicators of the labour market performance.

In the next section we explain exactly what we mean by net flows between labour market states and show how changes in the each of the net flows (perhaps following a policy shock/intervention) can impact upon the unemployment rate and the participation rate. In section 3 of the paper we look at data for net flows in Australia over the period 1979-2013, their relative sign and size and how they vary over the cycle. In section 4 we use VAR analysis to examine the relationship between the net flows aiming to improve our understanding of the effect of shocks to the net flows on the unemployment rate and the participation rate. We also discuss some policy implications of our findings. Section 5 concludes.

2 Net flows between states

The working-age population is made up of three mutually exclusive labour states - employed, unemployed and not in the labour force. We denote the numbers of people in these states as E , U and N respectively. Furthermore labour force $L = E + U$ and population $P = L + N$. To assess the performance of the labour market we use three indicators, the unemployment rate $u (= U/L)$, the participation rate $p (= L/P)$ and the employment rate $e (= E/P)$. These three indicators are obviously not independent as $e = p(1 - u)$ but, collectively, they provide a complete assessment of labour market performance.

The gross flow of people from unemployment to employment is represented by UE and the gross flow of people from employment to unemployment by EU . Likewise, the notation EN , NE , UN and NU represent the other gross flows between the three states E , U and N . As illustrated in Figure 1 there are 6 gross flows in the labour market. We define net flows as the difference in the gross flows between two labour market states. This is also illustrated in Figure 1. It is important to note that we use the phrase “net flow” to refer to the balance of flows between any two states, not the change in the

number of people in any one state in any period.

Figure 1 about here

Let the net flow from unemployment to employment from time $t - 1$ to time t , be $\underline{UE}_t = UE_t - EU_t$. This net flow and the relative size of its two components has been the subject of some discussion, especially given the evidence that in recessions both EU and UE rise.³ Similarly, we define the net flow from employment to out of the labour force as: $\underline{EN}_t = EN_t - NE_t$ and the net flow from out of the labour force to unemployment as: $\underline{NU}_t = NU_t - UN_t$. The relationship between changes in the number of people in each state and the net flows is as follows:

$$\begin{aligned}\Delta U_t &= U_t - U_{t-1} = (NU_t - UN_t) - (UE_t - EU_t) = \underline{NU}_t - \underline{UE}_t \\ \Delta E_t &= E_t - E_{t-1} = (UE_t - EU_t) - (EN_t - NE_t) = \underline{UE}_t - \underline{EN}_t \\ \Delta N_t &= N_t - N_{t-1} = (EN_t - NE_t) + (NU_t - UN_t) = \underline{EN}_t - \underline{NU}_t\end{aligned}$$

For completeness, since the labour force is the sum of the employed and the unemployed, we can also express changes in the labour force in terms of net flows as:

$$\Delta L_t = L_t - (E_{t-1} + U_{t-1}) = (NU_t - UN_t) - (EN_t - NE_t) = \underline{NU}_t - \underline{EN}_t$$

Since population grows over the period, it is common practice to standardise these flows by dividing each one by the population or the labour force. We show next how dividing by the labour force allows us to formulate a coherent framework that permits making a priori statements about regularities as well as being convenient for empirical analysis.

2.1 Net flows, unemployment and participation rates

The change in the unemployment rate is defined as:⁴

$$\Delta u_t = \frac{U_t}{L_t} - \frac{U_{t-1}}{L_{t-1}} = \frac{\Delta U_t - \frac{\Delta L_t}{L_{t-1}} U_{t-1}}{L_t} \quad (1)$$

The first term in the numerator is the balance of inflows into and outflows from unemployment over any period and is equal to the observed change in the number unemployed over

³Schettkat (1996) provides a neat discussion of this.

⁴This sub-section draws upon some ideas in Dixon et al. (2011).

the period. The second term measures the extent to which the number of unemployed can change when there is a growing labour force and yet the unemployment rate stay constant. Thus, the direction of change in the unemployment rate, Δu_t , is determined by whether ΔU_t is greater than, equal to, or less than $\frac{\Delta L_t}{L_{t-1}}U_{t-1}$.

The definition in (1) highlights the fact that, even when the inflow equals the outflow (i.e. $\Delta U_t = 0$), the unemployment rate can rise or fall depending on the rate of growth of the labour force. If the labour force is (say) rising over time then the number unemployed must rise at the same rate to keep the ratio between the two, the unemployment rate, constant. For the number unemployed to rise over time the net inflow into unemployment must be positive.

Using net flows and normalizing with respect to the labour force, (1) becomes

$$\Delta u_t = \underline{nu}_t - \underline{ue}_t - \frac{\Delta L_t}{L_t}u_{t-1} \quad (2)$$

where $\underline{nu} = \underline{NU}/L$ and $\underline{ue} = \underline{UE}/L$. Now, recognising that the change in the labour force is itself a result of a net flow ($\frac{\Delta L_t}{L_t} = \underline{nu}_t - \underline{en}_t$, where $\underline{en} = \underline{EN}/L$), we have an expression for the change in the unemployment rate which is entirely in terms of state variables and net flows. It is

$$\Delta u_t = \underline{nu}_t(1 - u_{t-1}) - \underline{ue}_t + \underline{en}_t u_{t-1} \quad (3)$$

Equation (3) shows that flows between *all* three states are relevant for the determination of the unemployment rate. If the net flow between employment and unemployment rises, then (ceteris paribus) this increases the number unemployed with the labour force constant so the impact of this change on the unemployment rate is positive. If the net flow between not in the labour force and unemployment rises then (ceteris paribus) this increases by equal amounts the number unemployed and the size of the labour force. Since the number unemployed is less than the size of the labour force, this means that the impact on the unemployment rate is positive. If the net flow between not in the labour force and employment rises then (cet par) this increases the size of the labour force with the number unemployed constant and so the impact on the unemployment rate is negative.

For completeness, we can also define the participation rate in terms of net flows under the condition that the population is constant.⁵ The change in the labour force

⁵The data we use is based on matching records (responses to survey questions by the same respond-

participation rate during each period can then be expressed in terms of net flows as:

$$\Delta p_t = \frac{\Delta L_t}{P} = \frac{\Delta L_t}{L_t} \frac{L_t}{P} = (\underline{nu}_t - \underline{en}_t)p_t \quad (4)$$

2.2 Equilibrium and the net flows

Equations (3) and (4) highlight an important insight about equilibrium in labour markets, which we take to hold when the size of the net flows are such that both the unemployment rate and the participation rate (and, by implication, the employment rate) are constant. Taking equations (3) and (4) together shows that for a stationary equilibrium with $\Delta u_t = \Delta p_t = 0$ we require all three net flows $\underline{ue}_t, \underline{en}_t, \underline{nu}_t$ to be equal.

Notice also two things. First, that (unlike the simple, two-state separation and finding rate model), the net flows (including the net flow between employment and unemployment) need not be zero in equilibrium. Second, that the ‘normal’ balancing function of the labour market may be satisfied with simultaneous positive⁶ net flows between N and U, between U and E and also between E and N.

2.3 The dynamics of the system

Three conclusions can be drawn from a comparison of equations (3) and (4) under *ceteris paribus* conditions. One, a change in the net flow between employment and unemployment, \underline{ue}_t can alter the unemployment rate but not the participation rate. Two, a change in the net flow between employment and not in the labour force, \underline{en}_t , can alter both the labour force participation rate and the unemployment rate but in opposite directions. Three, a change in the net flow between unemployment and not in the labour force, \underline{nu}_t , can alter both the unemployment rate and the participation rate and in the same direction.

These relationships show the direct linkages between the flows and the rates, but the potential dynamics that link the stocks with the flows and the flows with each other, be

ents) over two successive periods, and hence by construction the population at the beginning and end of the period must be the same. This assumption is relaxed in the empirical section because our data set over time is adjusted to be stock-consistent which includes the effect of population changes.

⁶In principle the equilibrium condition may also be satisfied if all net flows are zero or negative (and equal). We focus on the case where the net flows are positive for two reasons. First, as we shall see in the next section, this is actually the case in the data we consider. Second, if all the net flows are negative (and equal) this would suggest that the dominant source of increases in employment is the (direct) flow from N to E. Empirically it would seem to be the case that the dominant net flow into E in any period is from U.

they direct or indirect, are not yet taken into account. There are compelling reasons why we should consider these relationships. To take just one example, if we think of a positive employment shock as a shock that raises (say) flows into employment from the other two states - unemployment and not in the labour force (i.e. it lowers \underline{eu} and raises \underline{ne}), it will tend to *lower* the unemployment rate and *raise* the participation rate. However, this argument does not take into account any indirect connections between all three flows and especially ‘indirect’ impacts of any shock to employment on the flow between not in the labour force and unemployment (\underline{nu}).

For some time the literature on participation and unemployment has identified a ‘discouraged’ worker effect⁷ whereby the greater (lesser) prospect of becoming employed induces both the unemployed to stay longer (shorter) in that state before moving out of the labour force i.e. ceasing to search for work, and may at the same time induce more (fewer) people who are not in the labour force to become active and search for work and thus become unemployed.⁸ So there is reason to believe that the net flow between not in the labour force and unemployment will not be unaffected by a shock to employment - especially if it raises the probability that an unemployed person will gain employment.⁹ This (possible) interaction needs to be allowed for in any study of the effect of shocks to the net flows on the unemployment and participation rates. If, as a result of a positive employment shock, the unemployment rate tends to fall (cet par) there is likely to be a rise in the net flow from not in the labour force to unemployment. By itself, this will tend to raise both the unemployment rate and the participation rate. To the extent that it leads to a rise in the participation rate it will simply reinforce the effects mentioned in the previous paragraph. However, to the extent that it also leads to a rise in the unemployment rate it will work against the effects mentioned in the previous paragraph. There the positive employment shock was working to lower the unemployment rate, here we have an indirect effect which is working to raise the unemployment rate. This effect will either be weak or strong. If it is weak and it will tend to ‘mute’ the fall in the unemployment rate, in which case the positive employment shock still leads to a fall in the unemployment rate coupled with a rise in the participation rate. If it is strong, it may tend to completely offset the fall in the unemployment rate, in which case the positive employment shock leads to little change or even a rise in the unemployment rate coupled

⁷See for example Mincer (1966), Lundberg (1985) and Stephens Jr (2002).

⁸Or directly becoming employed without moving for any measured time in the state of being unemployed.

⁹An example might be a shock to employment due to an expansion in government spending along the lines discussed in Monacelli et al. (2010) and Brückner and Pappa (2012).

with a rise in the participation rate.

All of which is to say that the (possible) interactions between the three net flows and between the flows and the stocks needs to be allowed for in any study of the effect of shocks on the unemployment and participation rates. The sections of the paper which follow are devoted to modelling the inter-connections between all three net flows (including contemporaneous and lagged feedbacks) and their relationship with the unemployment and participation rates. The aim is to ascertain the pattern of causality and the relative strength of these relationships to analyse the impact of shocks to each of the net flows on the rates. We begin with evidence on the size and direction of the three net flows at various stages of the cycle.

3 Australian net flows over the business cycle

3.1 Data

Australian data on gross flows is only available from September 1979. Until March 2003 it is available from the tables of “Estimates of labour force status and gross changes (flows) derived from matched records ...” published in the ABS publication Labour Force: Australia, Cat No 6203.0. Raw data for March 2003 on is taken from the ABS datacube 6291.0.55.001, series GM. Detailed discussions of the Australian gross flows data and its limitations can be found in Foster (1981) and Borland (1996).

Measures of gross flows between two months are compiled from data collected as part of the monthly Labour Force Survey and reflect the matching of responses by individuals in the second month’s survey with responses by the same individuals in the first month’s survey. These matched records are then ‘expanded up’ to yield population estimates which, for various reasons, typically ‘represent’ around 78 per cent of the total civilian population aged 15 years and over.¹⁰ This means that the balance of flows given in the published flows data will not equal recorded changes in ‘stocks’ (such as the change in the total number unemployed). Given the purpose of this paper, it is desirable to adjust the raw flows data so that the sums of rows and columns in the flow tables equal their stock counterparts.¹¹

¹⁰The reasons why the ‘population represented by the matched records’ is less than 100% of the total civilian population aged 15 years and over are explored in some detail in Dixon et al. (2002).

¹¹The raw data for stocks is taken from the ABS Labour force published ‘stock’ data (original, not seasonally adjusted). Seasonal adjustment was performed after the flows were made stock consistent using EViews v.7.

The data set used in this paper is based on computed flows between 3 states (employed, unemployed and not in the labour force). An iterative ‘raking’ method has been applied to the published gross flows data to force the flow column and row totals to be exactly equal to the change in the relevant stock of employed, unemployed and not in the labour force (as reported in the monthly Labour Force survey).¹² The adjustment ensures that the relative magnitude of the flows during the month are consistent with the observed change in stock figures for the unemployment rate and the participation rate between months. Thus our ‘stock consistent’ flows data implies that an empirical analysis of the behaviour of the net flows between the three states is equivalent to an enquiry into changes in the stocks, and by extension, equivalent to an enquiry about the rates (unemployment, participation and employment).

3.2 Unemployment and Participation rates: 1979:08 – 2013:04

Figure 2 shows the evolution of the unemployment rate (and the participation rate) over the period 1979:08 to 2013:04. It is convenient to distinguish between various sub-periods reflecting different phases of the business cycle. One reason is that we are interested in what makes the sub-periods different from each other, and in particular whether there are any patterns associated with the different phases of the business cycle. Also, since the raw data on flows is extremely noisy, we work with averages of (monthly) seasonally adjusted data to facilitate identification of the ‘typical’ size of the flows in the various sub-periods.

Figure 2 about here

We will define the cycle in terms of turning points in relation to the direction of movement of the unemployment rate. Amongst the turning points evident in the data (see Figure 2) are the three major recession episodes, during which unemployment was rising markedly. These may be dated as occurring over the periods 1981:06-1983:08, 1989:11-1993:06 and 2008:03-2009:08. The sub-period between the start of our data set and the onset of the first major recession was a period of falling unemployment (1979:08-1981:06). The periods between the three major recessions can be thought of as recovery periods, but both were punctuated by short-lived episodes in which there was a ‘small’ rise in the unemployment rate. We will refer to these episodes as ‘pauses’. The pause

¹²For more information on ‘raking’ see Abowd and Zellner (1985) and Frazis et al. (2005). See the Appendix for details on the raking procedure used.

in the period between the end of the first recession and the start of the second may be dated as 1986:06-1987:04. Either side of that pause were periods which we will describe as periods of ‘recovery’. Recovery periods between the first two recessions were 1983:08-1986:06 and 1987:04-1989:11. After the end of the second major contraction in 1993:06 we saw falling unemployment except for two pauses. Thus, we divide the period between the second and third major recessions into periods of recovery 1993:06-1995:07, a pause 1995:07-1996:12, the resumption of the recovery over 1996:12-2000:10, another pause 2000:10-2001:10 and, finally, a period of further recovery, 2001:10-2008:02. There was then a recession associated with the Global Financial Crisis (2008:03-2009:08) followed by a short period of recovery (i.e. falling unemployment) 2009:09-2011:03. Note that compared with the previous two Australian recessions covered by our data set and also compared with events in the USA and Europe, in Australia the recession associated with the Global Financial Crisis was relatively mild. The period between 2011:4 and the end of our sample period (2013:04) has seen a slight rise in unemployment which we label a ‘pause’.

3.3 Net flows between the three labour states

Figure 3 shows the monthly average gross flows and net flows in Australia over our sample period. The gross flows between employment and unemployment are about 1 to 1.5% of the labour force, the gross flows between unemployment and out of the labour force are somewhat higher. The largest gross flows are between employment and out of the labour force which are approximately 2.5%. Figure 3 clearly illustrates the importance of distinguishing out of the labour force as a separate state. A larger share of the outflow from employment goes to out of the labour force rather than to unemployment. A higher share of the inflow into unemployment comes from out of the labour force rather than from out of unemployment. Figure 3 also shows the net flows. These are over the period of about 25 years, and are all clearly different from zero. The net flow from unemployment to employment, the net flow from out of the labour force to unemployment and the net flow from employment to out of the labour force are all about 0.2-0.3% (per month).

Figure 3 about here

Since the size of the net flows between all three of the states are of interest in their own right it is worthwhile bringing this information together in one table so that we may look

at the relative signs and size of each of them and examine their behaviour over various phases of the cycle.¹³ Table 1 sets out information on the average (mean) monthly value of the change in the unemployment rate for each of the 14 sub-periods (determined by the observed turning points in the unemployment rate). Clearly the first recession was ‘deeper’ than the second and third (a mean rise in the unemployment rate of 0.16 of 1% per month compared with 0.09 of 1% per month in the second and third) but the second was far more prolonged than the first and third (43 months compared with 26 and 18 months respectively). Table 1 also contains the average (mean) monthly value of the net flows as percentages of the labour force.

Table 1 about here

We note four stylized facts about net flows in the Australian labour market.¹⁴ First, the (average) net flows between not in the labour force and unemployment and between unemployment and employment are roughly equal in size and are both higher, on average, than the net flow between employment and not in the labour force. Second, in every sub period the net flow from ‘not in the labour force’ to unemployment is positive (that is, flows from not in the labour force to unemployment exceed flows from unemployment to not in the labour force in every period). Third, in every sub period the net flow from unemployment to employment is positive (that is, flows from unemployment to employment exceed flows from employment to unemployment in every period). This is perhaps the most striking feature of the data. Notice that this implies that *even in recessions* when unemployment is rising markedly and persistently, (mean) flows from unemployment to employment exceed (mean) flows from employment to unemployment. Fourth, in every sub period the net flow from employment to not in the labour force is positive (that is, flows from employment to not in the labour force exceed flows from not in the labour force to employment in every period). Our findings suggest that for pedagogical purposes we might usefully ‘picture’ the system in terms of a life cycle from entering the labour market to search for work, then finding employment and ultimately leaving employment through retirement.

¹³The flows even when expressed relative to a stock are very noisy. For this reason the measures using grouped data may better reveal the underlying relationships.

¹⁴Tables of gross flows reported for the USA and the UK show that net flows are in the same direction as that reported here. See for example studies of US data by Blanchard and Diamond (1990) and Boon et al. (2008) who report average flows for the years (1968-1986) and (1990-2006) respectively. For the UK see for example Bell and Smith (2002) and Gomes (2012) who report average flows for the years (1996-2001) and (1996-2010) respectively.

Information about the (contemporaneous) correlation of the net flows with each other and with (changes in) the unemployment rate are given in Table 2.

Table 2 about here

The correlations of the net flows with the changes in the unemployment rate mirrors the information contained in equations (3) and (4). More specifically, changes in the unemployment rate (Δu) are: positively correlated ($r = 0.694$) with the net flows between not in the labour force and unemployment nu ; negatively correlated ($r = -0.773$) with net flows between unemployment and employment ue ; but insignificantly correlated with net flows between employment and not in the labour force en .

Contemporaneous correlations and comparisons of average values across sub-periods by themselves are not informative about causation and dynamics. To obtain further insights into the dynamics between the flows and the measures of labour market performance (the unemployment and participation rates) we turn to an empirical analysis utilising a structural vector-autoregression model.

4 SVAR analysis of the net flows

4.1 The model

The discussion thus far suggests that the three net flows and the unemployment, participation, and by inference employment, rates are related in a dynamic way, both contemporaneously and lagged. The contemporaneous relationships between the rates and the net flows are described in equations (3) and (4). The net flows (nu_t, ue_t, en_t) are all stationary I(0) variables¹⁵, and their correlograms show strong evidence of autocorrelation, suggesting that these variables may themselves be modelled as autoregressive processes. Furthermore, contemporaneous interactions between the net flows are likely, given the significant correlations between them. The lagged relationship is also likely to be at least of order 2, given the potential influence of the lagged effect of a change in the unemployment rate Δu_t on labour flows between the states. All of which is to suggest that a structural vector-autoregression model (SVAR)¹⁶ may be appropriate to

¹⁵The Augmented Dickey-Fuller statistics are: nu (-18.3), ue (-6.8) and en (-27.9). The 5% critical value is -1.9 and so the null of non-stationarity is rejected.

¹⁶Sims (1980) advocated the use of the VAR approach to model linear interdependencies among multiple time series as a way of capturing dynamic relationships without imposing strong structure. The SVAR approach allows for contemporaneous relationships, a feature absent in the traditional VAR.

examine empirically, the effect of shocks to the net flows between the three states (employment, unemployment and not in the labour force) on the unemployment rate u_t , the participation rate p_t and, by inference, the employment rate e_t .

The SVAR model is:

$$\begin{aligned} A_0 X_t &= A_1 X_{t-1} + \dots A_k X_{t-k} + \varepsilon_t; \quad \varepsilon_t \sim N(0, \Sigma) \\ u_t &= (\underline{nu}_t - \underline{ue}_t) + (1 - \underline{nu}_t + \underline{en}_t)u_{t-1} \\ p_t &= p_{t-1}/(1 - \underline{nu}_t + \underline{en}_t) \\ e_t &= (1 - u_t)p_t \end{aligned}$$

where X_t is a 3x1 vector, at time t containing the 3 *demeaned* net flows ($\underline{en}_t, \underline{nu}_t, \underline{ue}_t$). The terms A_0, A_1, \dots, A_k are matrices of coefficients corresponding to the lags, up to order k . The term ε is a 3x1 vector containing the shocks associated with each net flow at time t . For completeness, the framework includes the identities linking the net flows and the unemployment rate u , the participation rate p and the employment rate e . Matrix A_0 captures the contemporaneous relationships between the net flows while matrices A_1, \dots, A_k capture the influence of inertia as well as feedback lagged influences (including indirectly, the influence of the labour market indicators (u_t, p_t, e_t) on the net flows, since as shown these variables constitute the change in the rates).¹⁷

The model is a simultaneous system of equations, and at least six exclusion restrictions are necessary to ensure identification. Since the SVAR is an a-theoretical framework, we relied on the tests of significance to identify the relevant variables. The preferred maximum likelihood results containing only the significant coefficients (together with their standard errors) are shown below. Diagnostic tests on the residuals show that they are not autocorrelated and a model of lag-order 2 is sufficient to capture the dynamics.¹⁸

$$\begin{bmatrix} 1 & 1.212 & 0.504 \\ & (0.346) & (0.204) \\ 0.169 & 1 & 0 \\ (0.071) & & \\ 0.231 & 0.774 & 1 \\ (0.108) & (0.269) & \end{bmatrix} \begin{bmatrix} \widehat{en} \\ \widehat{nu} \\ \widehat{ue} \end{bmatrix} = \begin{bmatrix} -0.240 & 0 & 0 \\ (0.050) & & \\ 0 & -0.208 & 0 \\ & (0.055) & \\ 0 & 0 & 0.145 \\ & & (0.044) \end{bmatrix} \begin{bmatrix} \widehat{en} \\ \widehat{nu} \\ \widehat{ue} \end{bmatrix}_{t-1} + \begin{bmatrix} 0 & 0.201 & 0 \\ & (0.064) & \\ 0.038 & 0 & 0 \\ (0.019) & & \\ 0 & 0 & 0.232 \\ & & (0.053) \end{bmatrix} \begin{bmatrix} \widehat{en} \\ \widehat{nu} \\ \widehat{ue} \end{bmatrix}_{t-2}$$

The estimated model shows that the net flows are simultaneously determined; with one exception: \underline{nu} has a contemporaneous effect on \underline{ue} , but not vice versa. Furthermore, the

¹⁷We tested an alternative specification where the SVAR contained a mixture of net flows and change in rates rather than lagged netflows. The likelihood of that model is less than the one presented here.

¹⁸The Ljung-Box Q-statistics for first-order autocorrelation (p-values in parenthesis) are: 0.611 (0.434); 1.010 (0.315) 0.630 (0.427).

net flows have ‘echo’ or lagged effects involving damped cycles. The lagged responses are predominantly to own lags except for the case where \underline{nu} (lag2) affects \underline{en} and \underline{en} (lag2) affects \underline{nu} .

The existence of the contemporaneous effects means that there will be contemporaneous effects on *all* the net flows, regardless of which net flow receives a shock. By implication the unemployment rate and the participation rate will both be affected by shocks to any one of the three net flows. A convenient way to think about the impulse responses and especially the impact effects, is to re-write the structural form in its equivalent reduced-form:

$$\begin{aligned} X_t &= A_0^{-1}A_1X_{t-1} + A_0^{-1}A_2X_{t-2} + A_0^{-1}\varepsilon_t \\ &= B_1X_{t-1} + B_2X_{t-2} + B_0\varepsilon_t \end{aligned} \quad (5)$$

$$\begin{bmatrix} \widehat{en} \\ \widehat{nu} \\ \widehat{ue} \end{bmatrix} = \begin{bmatrix} -0.322 & 0.229 & -0.098 \\ 0.054 & -0.247 & 0.017 \\ 0.032 & 0.138 & 0.155 \end{bmatrix} \begin{bmatrix} \widehat{en} \\ \widehat{nu} \\ \widehat{ue} \end{bmatrix}_{t-1} + \begin{bmatrix} -0.042 & 0.270 & -0.157 \\ 0.045 & -0.045 & 0.026 \\ -0.025 & -0.027 & 0.247 \end{bmatrix} \begin{bmatrix} \widehat{en} \\ \widehat{nu} \\ \widehat{ue} \end{bmatrix}_{t-2} + \begin{bmatrix} 1.342 & -1.103 & -0.677 \\ -0.226 & 1.186 & 0.114 \\ -0.135 & -0.663 & 1.068 \end{bmatrix} \begin{bmatrix} \widehat{\varepsilon_{en}} \\ \widehat{\varepsilon_{nu}} \\ \widehat{\varepsilon_{ue}} \end{bmatrix}_t$$

Then, assuming we start the impulse analysis, with initial condition: $\widehat{en}_0 = \widehat{nu}_0 = \widehat{ue}_0 = 0$, we can see that the terms in the $B_0 = A_0^{-1}$ matrix provide information about the impact effects of shocks and in particular the diagonal terms show that own shocks have the greatest effects. More explicitly, a shock to (say) \underline{en} ($\widehat{\varepsilon_{en}}$), with all other shocks set to zero ($\widehat{\varepsilon_{nu}} = \widehat{\varepsilon_{ue}} = 0$), impacts on \underline{en} by a factor of 1.342, on \underline{nu} by a negative factor of 0.226 and on \underline{ue} by a negative factor of 0.135. The negative relationships conform with the negative correlations noted above.

For completeness, note that $\widehat{\varepsilon_{nu}}$ has an impact effect on \underline{nu} of 1.186, and on the other two net flows, \underline{en} and \underline{ue} , by negative factors of 1.103 and 0.663 respectively. The strong negative response of \underline{en} following a shock to \underline{nu} is worth noting. The shock, $\widehat{\varepsilon_{ue}}$, has an impact effect on \underline{ue} of 1.068, on \underline{en} by a negative factor of 0.677 and on \underline{nu} by a positive factor of 0.114.

4.2 Impulse responses and policy implications

In this sub-section we examine the impulse responses to ascertain the effects of the shocks to each of the net flows upon the unemployment rate, the participation rate and the employment rate. We shall discuss each shock in turn. Although there is not a one-to-one relationship between shocks to net flows and policy interventions, the potential policy implications of the findings are important and for that reason, we have discussed

the results of the impulses in a policy context.

It is conventional to generate impulses assuming shocks that are one standard deviation in magnitude, but this would mean that each scenario would be based on a shock which implies a different number of persons moving between states (specifically one standard deviation shock to $\widehat{\varepsilon}_{en}$ involves a netflow of around 24,500 persons, one standard deviation shock to $\widehat{\varepsilon}_{nu}$ involves a netflow of around 13,600 persons and one standard deviation shock to $\widehat{\varepsilon}_{ue}$ involves a netflow of around 14,700 persons). To facilitate comparisons, we opted to consider shocks that involved a flow of 20,000 persons (about 0.2 per cent of the working population, a magnitude which is consistent with average monthly net flows). In other words, we compare the impulses for the unemployment, participation and employment rates following 3 separate shocks, each involving the same netflow. The impulses shown in Figure 4 (on the right-hand-side) are based on 3000 bootstrapped simulations. The solid lines are the mean responses and the shaded areas are the 90% bootstrapped confidence intervals.

The charts in Figure 4 show the impulse responses of the net flows and the rates in response to shocks to \underline{en}_t , \underline{nu}_t , and \underline{ue}_t respectively. The impulses for the net flows are on the left-hand side, while the responses of the unemployment, participation and employment rates are on the right-hand side. In general, we see that the system is stable, with damped responses and with the (by far) dominant change occurring in the initial periods.

For ease of comparison, the impulses on the netflows have been presented on the same scale. The effect of shocks on the net flows are not large, but they are by no means trivial, since the means and standard deviations of the netflows are: \underline{en} , (0.18, 0.30); \underline{nu} (0.25, 0.16) and \underline{ue} (0.26, 0.15).

For convenience of exposition, we have also set the initial values of the unemployment, participation and employment rates at their sample means and, in the Australian case, a change of 0.1 percentage-point is equivalent to about 10,000 persons. By design, as the effects of the shocks dissipate, the changes in the rates $(\Delta u_t, \Delta p_t, \Delta e_t)$ converge to zero, and the level of the rates (u_t, p_t, e_t) settle at their new levels.

Figure 4 about here

4.2.1 Shock to \underline{en}

A positive shock to the net flow from employment to not in the labour force \underline{en} also results in a fall in both the net flow from not in the labour force to unemployment

nu and the net flow from unemployment to employment ue . The participation rate is affected directly by the flow out of the labour force and it falls. In contrast the effect on the unemployment rate is muted because it is subjected to two opposing forces. On the one hand, the fall in nu would tend to lower the unemployment rate, while on the other hand, the fall in ue would tend to raise the unemployment rate. The net outcome for the unemployment rate is negligible. Since the ‘large’ and negative direct effect on the participation rate dominates the small change in the unemployment rate, the employment rate falls markedly as a result of this shock.

The net flow between employment and not in the labour force will vary over time as the economy experiences labour demand and supply shocks. It will also be influenced by policy. For example, a positive shock to the net flow from employment to not in the labour force could be interpreted as an increase in early retirement. This could be caused by early retirement benefits becoming more generous or by lowering the minimum age of retirement. In their chapter on early retirement plans, Boeri and van Ours (2013) show that the average effective retirement age in OECD countries went down for men from 68 in the early 1970s to 63 in the early 2000s to rise slightly in the first decade of the 2000s. The effective retirement age for women shows the same evolution albeit that women on average retire about two years earlier. The actual retirement decisions have been closely following the evolution of early retirement rules. In many countries early retirement was stimulated in the 1980s as response to increasing unemployment rates. Now that unemployment rates have risen due to the Great Recession, some politicians advocate early retirement programmes often as a solution to youth unemployment. The argument that early retirement will reduce youth unemployment is based on the erroneous assumption that there is a ‘lump of labour’ such that jobs may be redistributed from old workers to young ones without costs. Indeed, rather than creating jobs for young workers early retirement programmes may have adverse effects on workers approaching the retirement age as older unemployed workers have less incentive to look for a job. Hairault et al. (2010) for example find that early retirement reduces employment rates of near-to-retirement workers. Our impulse-response analysis confirms the (net) adverse effects of early retirement programmes. A positive shock to the net flow from employment to non-participation raises the unemployment rate and lowers the employment rate.

4.2.2 Shock to \underline{nu}

A positive shock to the net flow from not in the labour force to unemployment \underline{nu} results in a fall in the net flow from employment to not in the labour force \underline{en} and a small rise in the net flow from unemployment to employment \underline{ue} . This shock causes a rise in both the unemployment rate and the participation rate with the result that, on balance, the effect on the employment rate is negligible. This is not surprising as the shock is essentially about increasing the number of active job searchers but who remain unemployed.

Examples of a shock to the net flow from not in the labour force to unemployment could be the consequence of changes to laws governing the minimum school leaving age or a labour market policy that makes it more attractive for individuals to enter the labour force. For example, it could be that youngsters leave school earlier or women find it more beneficial to enter the labour market. The labour market could become more attractive for youngsters for example if youth minimum wage increases. Then, entering the labour market may be preferred to staying in education.¹⁹ The flow from inactivity to unemployment will also vary over time with the state of the labour market as school leavers, immigrants and others entering the labour force are faced with time-varying probabilities of finding a job.

4.2.3 Shock to \underline{ue}

A positive shock to the net flow from unemployment to employment \underline{ue} also results in falls in the net flow from not in the labour force to unemployment \underline{nu} , and in the net flow from employment to not in the labour force \underline{en} . This shock, as expected, lowers the unemployment rate (markedly) and raises the participation rate. The result is a marked rise in the employment rate.

An important corollary follows from this result. When the shock is negative (as in a recession), the net flows are such that \underline{ue} falls, \underline{nu} falls, and \underline{en} rises resulting in a rise in the unemployment rate, a fall in participation rate and a fall in the employment rate. This is an example of the discouraged worker effect.

The net flow from unemployment to employment will vary over time as the economy experiences productivity and aggregate demand shocks. It will also be influenced by policy. For example a positive shock to the net flow from unemployment to employment may occur because the unemployed are ‘activated’. Activation policies put requirements

¹⁹Of course an increase in the youth minimum wage also has an effect on labour demand. See Boeri and van Ours (2013) for an overview of youth minimum wage studies.

and obligations on unemployment benefit recipients, such as the obligations to attend intensive interviews with employment counsellors, search actively for a new job, and accept job offers (see Boeri and van Ours (2013) for an overview of activation policies and related studies). Activation policies may make it less attractive for unemployed workers to collect benefits. Graversen and van Ours (2011) for example find that mandatory activities imposed on Danish unemployed workers reduced unemployed durations substantially because workers returned to work more quickly. Boone and van Ours (2009) provide a cross-country time-series analysis of the effectiveness of active labour market policies.

4.3 Employment shocks

An issue which has been prompted by the persistent high unemployment in many advanced economics is whether fiscal expansion will likely reduce the unemployment rate (even in the short run) given that the participation rate may be endogenous. See, for example, Brückner and Pappa (2012) who conduct an empirical study of the effects of fiscal policy on unemployment in OECD countries and find that for many countries increased government spending can actually increase both employment and the unemployment rate simultaneously by inducing increases in the labour force participation. On the other hand Monacelli et al. (2010) estimate a negative and significant impact of a (positive) government spending shock on the unemployment rate in the US. Clearly these are at heart issues about the impact of an employment shock on flows between the three states of the labour market. Our analysis thus allows us to consider the impact of a positive shock to employment as might be associated with a stimulus package. Since flows into employment originate not only from unemployment but also from not in the labour force to evaluate a positive employment shock we need to consider the simultaneous impact of a rise in labour demand (employment) on the net flow from unemployment to employment (\underline{ue} , this will experience a positive shock) and on the net flow from employment to not in the labour force (\underline{en} , this will experience a negative shock). Bringing together the results in section 4.2.1 and 4.2.3 above (and remembering that in this connection we are imagining the shock to \underline{en} is negative) we can say that the effect of the positive employment shock will be to lower the unemployment rate, raise the participation rate and raise the employment rate. Further, since the impact of a positive shock to \underline{ue} on the employment rate is in the same direction as a negative shock to \underline{en} , our conclusions about the employment rate hold good, regardless of the proportions in which the rise in employment is sourced from the unemployed or the inactive.

5 Concluding Remarks

The analysis of gross flows between labour market states is often restricted to flows from unemployment to employment and vice versa. Adding the third labour market state of non-participation enriches the analysis of labour market dynamics. Whereas equilibrium with two market labour market states requires the two gross flows to be of equal size – and thus the net flow to be zero, with three labour market states the gross flows between any two states need not be of equal size – and thus the net flows need not be (and typically will not be) zero.

However, introducing a third labour market state also introduces complexity. With three labour market states there are six labour market (gross) flows. With six labour market flows there are fifteen possible interactions between these flows. Our analysis is based on net flows between three labour market states, i.e. the balance of flows between these states. This enriches the analysis without introducing a lot of complexity. With three labour market states there are three net flows and between these net flows there are only three possible interactions.

An examination of data on net flows in the Australian labour market we find, amongst other things, that: flows from unemployment to employment exceed flows from employment to unemployment and this is the case even in recessions; flows from employment to not in the labour force exceed flows from not in the labour force to employment and this is the case even in booms, and; flows from not in the labour force to unemployment exceed flows from unemployment to not in the labour force and that this is the case even in recessions. This lends support to an analysis of net flows.

While an inspection of correlations and averages based on grouped data can give some insight into the relationships we are interested in, they cannot adequately address issues related to the dynamics of the relationship, causality and the relative strengths of the relationships. In order to do this we used a more formal econometric approach involving Vector AutoRegression. From this analysis, we learn that the direct effects of the shocks dominate and so the dominant effects of shocks to the net flows upon the unemployment rate and the participation rate are unambiguous in sign and readily explicable (this is a benefit of working with the net flows). Furthermore, a shock to the net flow from unemployment to employment drives the unemployment rate and the participation rate in the opposite directions while a shock to the net flow from not in the labour force to unemployment drives them both in the same direction. Finally, we find that the relative quantitative magnitude of the direct and indirect effects of (say) a positive shock to the

net flow from unemployment to employment is to raise the employment rate markedly, despite the fact that the fall in the unemployment rate consequent upon the shock induces a rise in the participation rate. The ease with which the impacts of the shocks can be studied and explained also lends support to an analysis of net flows.

As to how the shocks to net flows are to be interpreted in terms of policy implications we indicate that there is not a one-to-one relationship between shocks to net flows and policy interventions. Nevertheless, we can still derive some potential policy implications of the various shocks to the net flows. We suggest that a shock to the net flow from employment to non-participation could be representative of an early retirement program. Clearly, this has adverse effects on employment rates and unemployment rates. A shock to the net flow from non-participation to unemployment induced by for example an increase in youth minimum wages or more generous family policies may have adverse effects on the employment rate. Finally, a shock to the net flow from unemployment to employment caused by activating unemployed workers may have positive effects on employment rates as it decreases unemployment rates and increasing labour force participation rates.

References

- Abowd, J. and A. Zellner (1985). Estimating gross labor-force flows. *Journal of Business and Economics Statistics* 3, 254–293.
- Bell, B. and J. Smith (2002). *On gross worker flows in the United Kingdom: evidence from the Labour Force Survey*. Bank of England.
- Blanchard, O. J. and P. Diamond (1990). The cyclical behavior of the gross flows of US workers. *Brookings Papers on Economic Activity* 1990(2), 85–143.
- Boeri, T. and J. C. van Ours (2013). *The economics of imperfect labor markets; second edition*. Princeton University Press.
- Boon, Z., C. M. Carson, R. J. Faberman, and R. E. Ilg (2008). Studying the labor market using BLS labor dynamics data. *Monthly Labor Review* 131, 3.
- Boone, J. and J. C. van Ours (2009). Bringing unemployed back to work: Effective active labor market policies. *De Economist* 157(3), 293–313.
- Borland, J. (1996). Labour market flows data for Australia. *Australian Economic Review* 29(2), 225–235.
- Brückner, M. and E. Pappa (2012). Fiscal expansions, unemployment, and labor force participation: theory and evidence. *International Economic Review* 53(4), 1205–1228.
- Dixon, R. (2001). Australian labour force data: how representative is the population represented by the matched sample? *Economic and Labour Relations Review* 2(2), 303–330.
- Dixon, R., J. Freebairn, and G. C. Lim (2011). Net flows in the US labor market, 1990–2010. *Monthly Labor Review* 134(2), 25–32.
- Dixon, R., G. C. Lim, and J. Thomson (2002). Australian gross flows data: the labour force survey and the size of the population represented by the matched sample. *Australian Journal of Labour Economics* 5, 1–21.
- Elsby, M., B. Hobijn, and A. Sahin (2013). Unemployment dynamics in the OECD. *Review of Economics and Statistics* 95(2), 530–548.
- Elsby, M., R. Michaels, and G. Solon (2009). The ins and outs of cyclical unemployment. *American Economic Journal: Macroeconomics* 1(1), 84–110.
- European Commission (2009). *Employment in Europe 2009*. Office for Official Publications of the European Communities.
- Foster, W. (1981). Gross flows in the Australian labour market a first look. *Australian Economic Review* 14(4), 57–64.
- Frazis, H. J., E. L. Robison, T. D. Evans, and M. A. Duff (2005). Estimating gross flows consistent with stocks in the CPS. *Monthly Labor Review* 128, 3.

- Fujita, S. and G. Ramey (2009). The cyclicalty of separation and job finding rates. *International Economic Review* 50(2), 414-430.
- Gomes, P. (2012). Labour market flows: facts from the United Kingdom. *Labour Economics* 19(2), 165-175.
- Graversen, B. K. and J. C. van Ours (2011). An activation program as a stick to job finding. *Labour* 25(2), 167-181.
- Hairault, J., F. Langot, and T. Sopraseath (2010). Distance to retirement and older workers' employment: The case for delaying the retirement age. *Journal of the European Economic Association* 8, 1034-1076.
- Lundberg, S. (1985). The added worker effect. *Journal of Labor Economics* 3(1), 11-37.
- Mincer, J. (1966). Labor force participation and unemployment: a review of recent evidence. *Prosperity and unemployment*, 73-112.
- Monacelli, T., R. Perotti, and A. Trigari (2010). Unemployment fiscal multipliers. *Journal of Monetary Economics* 57(5), 531-553.
- Petrongolo, B. and C. Pissarides (2008). The ins and outs of European unemployment. *American Economic Review* 98(2), 256-262.
- Schettkat, R. (1996). Labor market flows over the business cycle: an asymmetric hiring cost explanation. *Journal of Institutional and Theoretical Economics*, 641-653.
- Shimer, R. (2012). Reassessing the ins and outs of unemployment. *Review of Economic Dynamics* 15(2), 127-148.
- Sims, C. (1980). Macroeconomics and reality. *Econometrica* 48(1), 1-48.
- Stephens Jr, M. (2002). Worker displacement and the added worker effect. *Journal of Labor Economics* 20(3), 504-537.
- Yashiv, E. (2007). US labor market dynamics revisited. *The Scandinavian Journal of Economics* 109(4), 779-806.

Appendix: Estimating gross flows consistent with stocks

The net flows are computed using estimates of the gross flows which are compiled from data collected as part of the monthly Labour Force Survey (LFS) and which reflect information obtained only from those individuals whose survey responses can be matched across two consecutive months. For various reasons (including sample rotation, changed residence, absences and refusals to participate in the survey) the matched records typically ‘represent’ around 78 per cent of the total civilian population aged 15 years and over. This means that the balance of flows given in the published flows data will not equal recorded changes in ‘stocks’ (such as the change in the total number unemployed).

Creating a consistent series of labour market stocks and flows entails an ‘iterative raking’ method as discussed in Frazis et al. (2005).²⁰ We begin with the data for those records which can be matched organised in the form of a square table for each month with each cell recording the flows between states and the ‘stay-puts’ – see below (gross flows are italicised).

		Second month		
		State	E	U
First month	E	<i>EE</i>	<i>EU</i>	<i>EN</i>
	U	<i>UE</i>	<i>UU</i>	<i>UN</i>
	N	<i>NE</i>	<i>NU</i>	<i>NN</i>

In the first round of the adjustment process all row entries are adjusted upwards by expressing the value given in each cell across the rows of the flows table for the matched records as a proportion of the raw data’s row totals and then multiplying each of those proportions by the relevant stock figures (i.e. the total number in Australia who are employed, unemployed and not in the labour force) for the first of each pair of months. This ensures (i) that the sum of the entries across the rows of the ‘new’ flows table sum to the total number in each labour market state in the first of each pair of months as reported for Australia as a whole in the LFS, and (ii) that the implied unemployment and participation rates in the rows of the ‘new’ flows table correspond exactly to those rates given for Australia as a whole in the LFS for the first of each pair of months. However, it

²⁰Since reinterviews do not take place in Australia we are unable to use that information to adjust for classification errors. Hence the only adjustment we can make is for “margin error”. For more information on the margin errors and ‘iterative raking’ see Abowd and Zellner (1985) and Frazis et al. (2005).

is important also that the column totals and any ratios involving the column totals (e.g. the unemployment rate) be consistent with the stock proportions for the second of each pair of months. Mere adjustment across the rows will not achieve this. Instead, we now need to carry out the same procedure adjusting the ‘new’ figures in each column to make them consistent with the distribution of the population across states in the second of each pair of months. We continue in this manner, iterating²¹ by making adjustments across rows and then across columns until: (i) sums of each of the rows and columns are equal to the relevant population given by the ‘stock’ data for the second of each pair of months and (ii) any ratios involving the row or column totals (e.g. the unemployment rate) differ from the published ratios given in the LFS for their respective months (rows for the first month in each pair and columns for the second month in each pair) by less than 0.001.²² The effect of the adjustments is to successfully deal with the biases in the raw gross flows data identified in Dixon (2001). With respect to the flows themselves and transition probabilities the main effects (all of which are ‘small’) are to raise the proportion of those initially unemployed who remain unemployed, to lower the proportion of those initially unemployed who flow to not in the labour force and to lower the proportion of those initially unemployed who flow from unemployment to employment.²³

²¹Frazis et al. (2005) provide a neat discussion of the procedure as applied by the BLS (especially page 6).

²²We used 10 ‘complete’ iterations which in fact went well beyond the requirement stated here for most months.

²³Table 2 of Frazis et al. (2005) shows that these changes are also present in the adjusted data for the US.

Table 1: Mean (monthly) values for each sub-period

<i>Sub-period</i>	<i>Description</i>	Δu	\underline{nu}	\underline{ue}	\underline{en}	$\Delta L/L$
1979:08 1981:06	Recovery period	-0.050	0.266	0.305	0.205	0.061
1981:06 1983:08	1st recession episode	0.156	0.276	0.113	0.298	-0.022
1983:08 1986:06	Recovery period	-0.099	0.286	0.361	0.174	0.112
1986:06 1987:04	Pause	0.031	0.297	0.258	0.215	0.082
1987:04 1989:11	Recovery period	-0.099	0.243	0.326	0.142	0.101
1989:11 1993:06	2nd recession episode	0.092	0.250	0.147	0.245	0.005
1993:06 1995:07	Recovery period	-0.108	0.234	0.323	0.112	0.122
1995:07 1996:12	Pause	0.002	0.240	0.233	0.240	0.000
1996:12 2000:10	Recovery period	-0.056	0.211	0.266	0.189	0.022
2000:10 2001:10	Pause	0.071	0.308	0.224	0.269	0.039
2001:10 2008:03	Recovery period	-0.037	0.260	0.296	0.196	0.064
2008:03 2009:08	3rd recession episode	0.094	0.286	0.188	0.261	0.025
2009:08 2011:03	Recovery period	-0.044	0.257	0.300	0.193	0.064
2011:03 2013:04	Pause	0.020	0.258	0.234	0.249	0.009
Overall means		-0.012	0.256	0.260	0.207	0.049

Table 2: Correlations between net flows and changes in the unemployment rate

variables	\underline{en}	\underline{nu}	\underline{ue}	Δu
\underline{en}	1			
\underline{nu}	-0.360*	1		
\underline{ue}	-0.196*	-0.136*	1	
Δu	0.003	0.694*	-0.773*	1

* significant at the 5% level

Figure 1: Gross flows and net flows in the labour market

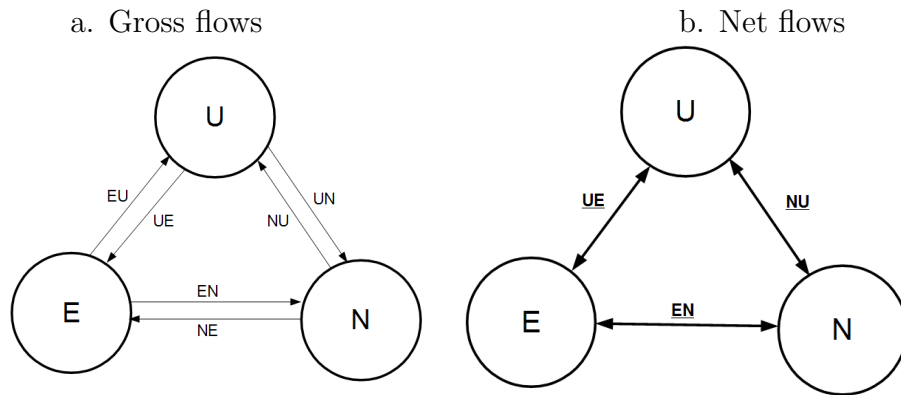


Figure 2: Unemployment rates and participation rates; Australia 1979:08 – 2013:04

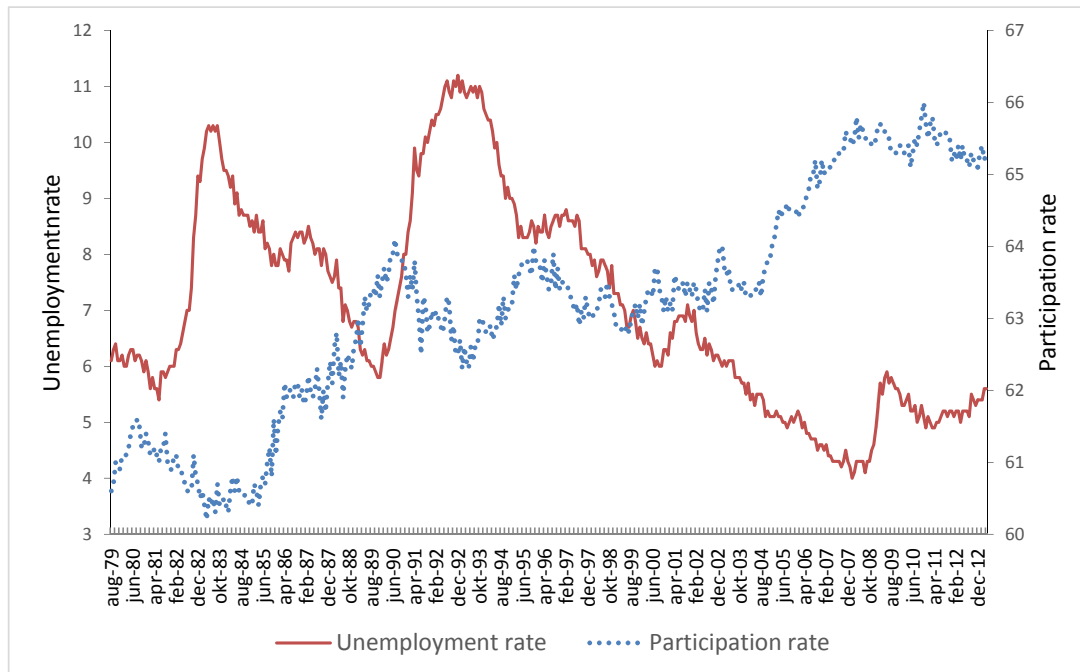


Figure 3: Monthly gross and net flows in the Australian labour market; 1979:08 – 2013:04 (percentages of the labour force)

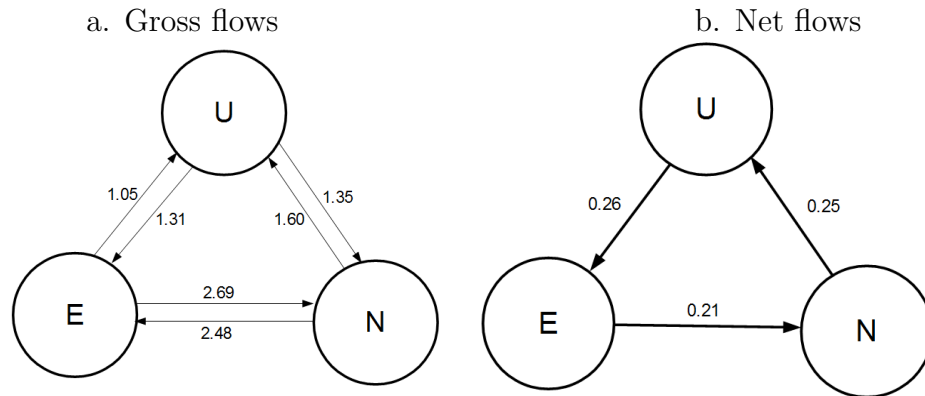


Figure 4: Impulse responses

