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A FRAMEWORK FOR UNDERSTANDING CHANGES IN THE UNEMPLOYMENT RATE IN A FLOWS CONTEXT: AN EXAMINATION NET FLOWS IN THE AUSTRALIAN LABOUR MARKET

by

Robert Dixon
&
John Freebairn
&
G. C. Lim

Department of Economics
The University of Melbourne
Melbourne Victoria 3010
Australia.

A Framework for Understanding Changes in the Unemployment Rate in a Flows Context: An Examination of Net Flows in the Australian Labour Market*

Robert Dixon, John Freebairn and G. C. Lim
Department of Economics
The University of Melbourne
Melbourne Vic. 3010

Please treat Robert Dixon as the corresponding author (postal address is given above, email is r.dixon@unimelb.edu.au, telephone 03-8344-5352 and fax 03-8344-6899)

Abstract

In this paper we develop a framework which is appropriate for the systematic investigation of the relationship between net (and gross) flows between different labour market states and movements in the unemployment rate. We use that framework to investigate the behaviour of net flows of persons between employment, unemployment and not in the labour force in Australia between 1979-2003 and the relationship of these flows to changes in the unemployment rate over that period. We find that: flows from unemployment to employment exceed flows from employment to unemployment and that 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 that 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 even in recessions. Another important finding is that the reason why the participation rate is negatively correlated with the unemployment rate is because net flows from employment to both unemployment and to not in the labour force are highly correlated. It cannot be explained by flows occurring between unemployment and not in the labour force.

Keywords: Worker Flows Business Cycle Unemployment Participation Rate

JEL Codes: J64 E24 J21

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1. Introduction

We develop a framework for the systematic investigation of the relationship between net (and gross) flows between different labour market states and movements in the unemployment rate. We use that framework to investigate the behaviour of net flows of persons between employment, unemployment and not in the labour force in Australia over the period 1979-2003[1] with the aim of increasing our understanding of the evolution, and causes, of unemployment. Amongst other things, the paper examines changes in the size and direction of the net flows between different labour market states over the course of the business cycle. We also evaluate the contribution of each of the net flows to changes in the unemployment rate. Our approach explicitly considers and quantifies links between changes in the unemployment rate and changes in the participation rate. We conclude that much that has been said about the relationship between the two in Australia is wrong.

Although a number of people have examined flow probabilities between various labour market states (Fahrer & Heath (1992), Leeves (1997), Dixon et al (2003)) there does not seem to be an examination of net flows between states, at least over long periods.[2] To keep things straight-forward we look only at seasonally adjusted data for persons.[3] The next section of the paper sets out how the data set has been constructed and its origins.

2. Data

The raw data on gross flows until March 2003 is taken 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. An example of a gross flows table showing how it is organized by rows and columns is given in Figure 1. Raw data for March 2003 on is taken from the ABS datacube 6291.0.55.001 series GM. Where data was missing due to a new sample being rotated in, unpublished data was obtained from ABS microfiche and we have used that as the raw data for those periods.[4] The use of unpublished

[1] Although our framework is used in this paper to study changes in the unemployment rate it can easily be applied with minor modifications to the study of changes in other ratios such as the employment rate, the participation rate etc. For this reason we see that paper's contribution as extending beyond mere 'description'.
[2] Foster (1981), Foster & Gregory, 1984, Fahrer & Heath (1992) and Borland (1996) and others have – inter alia - looked at the absolute size of the gross flows for very short periods.
[3] An important next step in our research will be to compute and analyse flows disaggregated by gender and employment type (full or part time).
[4] See Dixon et al (2002) for a detailed discussion of the reasons for the various gaps in the published data. Although in these periods the matched sample is smaller than it would otherwise be the relative size of flows do not appear to be at all unusual.

data means that we do not have to worry about there being periodic gaps in our data set. Detailed discussions of the gross flows data and its limitations can be found in Foster (1981), Borland (1996) and Dixon et al (2002).

[FIGURE 1 NEAR HERE]

Data on gross flows between various labour market states has been published on a monthly basis by the ABS since February 1980.[5] Measures of gross flows between two months are compiled from data collected as part of the monthly Labour Force Survey (LFS) 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 of the total civilian population aged 15 years and over.[6] This means that the balance of flows given in the published flows data will not equal recorded changes in 'stocks' (such as the total number unemployed). It is desirable to adjust the raw flows data so as to ensure that net flows and sums of rows and columns in the flow tables are equal to their stock counterparts.

The data set used in this paper is based on computed flows between 3 states (employed, unemployed and not in the labour force). The 'RAS' method has been applied to the published gross flows data to force the flow column and row totals (and thus ratios like the unemployment rate) to be exactly equal to that of the labour force survey stocks data.[7] The approach entails an iterative method. Initially all row entries are adjusted upwards by first 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 (ie the total number in Australia who are employed, unemployed and not in the labour force) for the first of each pair of months.[8] This ensures

[5] The Gross Flows data reported in the ABS publications 6202.0 and 6203.0 February 1980 between them covered the period from August 1979 through February 1980. Initially three origin and destination states were identified—employed, unemployed and not in the labour force—but commencing in August 1980 flows between four states have been recorded—employed full-time, employed part-time, unemployed and not in the labour force.

[6] The 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.

[7] The RAS method (which we have used here) is common procedure by which input-output tables are up-dated. An excellent description of this method can be found in Appendix A to any recent set of input-output tables for Australia, see ABS *Australian National Accounts: Input-Output Tables*, Cat No 5209.0.

[8] The raw data for stocks is taken from ABS Labour force published 'stock' data (original, not seasonally adjusted).

(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 is important that the column totals and any ratios involving the *column* totals (eg 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.[9] We continue in this manner, iterating 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 (eg 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.[10]

Compared with calculations based on the 'raw' flows data, the effect of the adjustments is to raise the unemployment rate and lower the participation rate- these are consistent with biases in the raw data identified in Dixon (2001). With respect to the flows themselves and the transition probabilities, the main effect is to lower the proportion of those initially unemployed who flow from unemployment to employment, and to raise the proportion of those initially unemployed who remain unemployed. Other changes (which are smaller in magnitude) are: (i) to raise the proportion of those initially employed who flow from employment to not in the labour force and to lower the proportion of those initially employed who remain employed, and (ii) to lower the proportion of those initially not in the labour force who flow from not in the labour force to employment and to raise the proportion of those initially not in the labour force who remain not in the labour force.

The most important feature of the adjustment is that it forces the relative magnitude of the flows during the month to be consistent with the observed change in stock figures for the

[9] The population is standardized for the second of each pair of months because the 'expansion factors' used by the ABS to expand their survey figures for flows up to yield estimates for the 'population' "were those applying to the second of each pair of months" (ABS, Labour Force: Australia, Cat No 6203.0, February 2003, p 63)

[10] We used 10 'complete' iterations which in fact went well beyond the requirement stated here for most months.

unemployment rate and the participation rate between months. Amongst other things, this means that when we enquire into the 'source' of changes in (say) the unemployment rate we can be sure that the sum of the (net) flows will be exactly equal to the changes in the stocks.[11]

Because we are interested in sub-periods, reflecting different phases of the business cycle, and these do not contain exactly the same set of months, we work with (seasonally adjusted) monthly data. Also, as people who work with flows data are well aware, the data is extremely noisy (Dixon et al 2002 & 2003). As a result we cast our discussion in terms of the mean values of seasonally adjusted flows for each sub-period. The patterns in the data are quite clear and are entirely at one with the findings of researchers looking at flows data for other countries as well as previous researchers who have looked at Australian data.

3. The unemployment rate in Australia over the period 1979:08 – 2003:12

The 'unemployment rate' is defined as the ratio of the number who are unemployed (*U*) to the total labour force (*LF*). Figure 2 shows the evolution of the unemployment rate over the period 1979:08 2003:12. The two recessions are clearly evident as are the recoveries and the 'pauses' which have been observed during the recoveries. It is convenient to distinguish between various sub-periods. 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 business cycle. Also, since the raw data on flows is extremely noisy a useful way to deal with the noise is to work with averages of (monthly) seasonally adjusted data for each sub-period.

Identifying turning points in relation to the direction of movement of the unemployment rate, the following turning points are evident in the data (see Figure 2). First, the two major recession episodes, during which unemployment was rising dramatically, may be dated as occurring over the periods 1981:06-1983:08 and 1989:11-1993:06. 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 two major recessions and after the end of the second contraction can be thought of as recovery periods, but both were punctuated by episodes in which unemployment rose. We will refer to these episodes as

[11] In passing, it should be noted that for the 'qualitative' findings in this paper, that is findings which are to do with the relative size of flows between any two states, we would reach the same conclusions from the unadjusted gross flows data as published by the ABS.

'pauses'. The pause 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 two recession were 1983:08-1986:06 and 1987:04 1989:11. Since the end of the second major contraction in 1993:06 we have seen falling unemployment except for two pauses. Thus, we divide the post recession period 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, 2001:10-2003:12. Table 1 sets out the chronology we will use, our description of each sub-period and the mean change in the unemployment rate in each sub-period.[12] Clearly the first recession was 'deeper' than the second (a mean rise in the unemployment rate of 0.16 of 1% per month compared with 0.09 of 1% per month) but the second was more prolonged (43 months compared with 26 months).

[FIGURE 2 & TABLE 1 NEAR HERE]

While we will set out data (in the form of mean values) separately for all of the sub-periods identified in Table 1 we concentrate our discussion on: (i) features common across all sub-periods, (ii) features of periods of recession and pause compared with periods of recovery, and (iii) changes in net flows over the business cycle.[13]

4. Changes in the unemployment rate and inflow and outflow

We begin with a very simple but also very general framework which relates movements in the unemployment rate to the size of flows into and out of the unemployment pool. We will gradually expand the model to incorporate more details of the flows. As previously noted, this paper concentrates on the flows for persons, and on net flows between three states,

[12] Note that all figures in the tables are where the proportions have all been multiplied by 100 to put them in terms of percentages of the labour force.

[13] The 11 sub-periods used in this paper are determined by the observed turning points in the unemployment rate. One alternative would be to neglect the 'pause' sub-periods and simply work with two recession episodes and three recovery episodes, one the period prior to the first recession, a second spanning the whole of the period between the two recessions and the third covering all of the period since the second recession. None of our conclusions are altered if this way of defining the sub-periods is used. In fact those flows which we report are highly correlated using our 11 sub-periods become even more highly correlated when only 5 sub-periods are used while those flows which we report have low correlation using our 11 sub-periods have even lower correlation when only 5 sub-periods are used. As a result, the conclusions we reach using our 11 sub-periods in relation to the reasons for the endogeneity of the participation rate are given even more force if only 5 sub-periods are used.

employed, unemployed and not in the labour force. Clearly this is but a first step towards a more disaggregated and detailed analysis. The model can readily be generalised to explore the relationship between changes in any ratio and net or gross flows and to disaggregation by gender, age and other categories.

The change in the unemployment rate is defined as: [14]

$$\Delta\left(\frac{U}{LF}\right)=\frac{U_{+1}}{LF_{+1}}-\frac{U}{LF} \tag{1}$$

Any change in the number unemployed ($U_{+1} - U$) must reflect the balance between two flows, an inflow into unemployment (*IN*) and an outflow from unemployment (*OUT*). Amongst other things, this implies that:

$$U_{+1} = U + IN - OUT$$

Given the above, equation (1) may be written as:

$$\Delta\left(\frac{U}{LF}\right)=\frac{(IN-OUT)}{LF_{+1}}-\frac{U}{LF}+\frac{U}{LF_{+1}}=\frac{(IN-OUT)}{LF_{+1}}-\frac{U}{LF}+\left(\frac{U}{LF}\frac{LF}{LF_{+1}}\right) \tag{2}$$

Collecting like terms together and rearranging a little, gives the following expression for the first difference in the unemployment rate (note that $\Delta LF = LF_{+1} - LF$):

$$\Delta\left(\frac{U}{LF}\right)=\frac{(IN-OUT)}{LF_{+1}}-\frac{(\Delta LF/LF)U}{LF_{+1}} \tag{3}$$

Note that the two terms in the numerator on the RHS of (3) may be given a rather interesting interpretation. The last term, *[(ΔLF/LF)U]*, measures the extent to which the number unemployed can change when there is a growing labour force and yet the unemployment rate stay constant.[15] The first term *(IN – OUT)* is simply the balance of inflows into and outflows from unemployment over any period and is equal to the observed (i.e. the actual) change in the number unemployed over the period. Clearly, if the first term in the numerator of the above (i.e. *(IN – OUT)*, the actual change) exceeds the second (i.e. *(ΔLF/LF)U*, the change consistent with the unemployment rate remaining constant), the unemployment rate will rise. If the first term is exactly equal to the second, the

[14] Note that *U* and *LF* are beginning of period measures, U_{+1} and LF_{+1} are end of period measures and that the symbol *Δ* is being used for a first difference.

[15] We may see this as follows: For the employment rate to be constant over time we require the rate of growth in unemployment to equal the rate of growth in the labour force. That is, we require: *ΔU/U = ΔLF/LF*. This in turn implies that *ΔU* is such that it is exactly equal to the product *(ΔLF/LF)(U)*.

unemployment rate will stay constant. If the first term is less than the second then the unemployment rate will fall.

It may be thought that *(IN – OUT)* must be equal to zero in order for equilibrium to be established (that is, for the unemployment rate to be constant over time). However, equation (3) shows that it is possible for the inflow to equal the outflow and yet for the unemployment rate to be rising or falling depending on the value of the rate of growth of the labour force. There should be nothing surprising about this. 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 (this is the unemployment rate, (*U/LF*)) constant. However, for the number unemployed to rise over time there must be a net inflow into unemployment, that is, *(IN – OUT)* must be positive and equal to (*U(ΔLF/LF*), not zero.

Table 2 sets out information on the average (mean) monthly value of the three components of equation (3) for each of our sub-periods.[16] Note that in all the tables the figures have all been expressed as percentages of the labour force.

[TABLE 2 NEAR HERE]

In every sub-period in which the unemployment rate rose, the net inflow into unemployment was positive. In recessions and pauses the change in the unemployment rate is greater than zero (and above average) while in recoveries it is less than zero (and below average) - not that this is any surprise, the sub-periods have been chosen to make this so. In recessions and pauses the net inflow into unemployment is greater than zero (and above average) while in recoveries it is less than zero (and below average). As a result there is a very high and positive correlation between the change in the unemployment rate and the size of the net inflow into unemployment across sub-periods, with r = 0.99.[17] The term involving the product of the labour force growth rate and the unemployment rate (this is the second term on the RHS of (4) appears not to be related in any simple way to the state of the economy. While it is below average for both recessions, it is above average in a majority of the pauses and it is above average in half of the recoveries. As a result, there is only a moderate (negative) correlation between the change in the unemployment rate and the term

[16] The tables report the means of *seasonally adjusted* data to allow for the fact that the sub-periods do not span the same months of the year.

[17] The correlation coefficients are "weighted Pearson product-moment correlation coefficients" where the weighted covariance is divided by the square root of the weighted variances.

involving the product of the labour force growth rate and the unemployment rate across sub-periods, with r = -0.73. (In a later section of the paper we look at the relationship between labour force growth – taken alone - and changes in the unemployment rate.)

Comparing the figures in the various columns of Table 2 suggests that the main determinant of variations in the unemployment rate is variations in the net inflow into unemployment (the first term on the RHS of (3)). One way to formally assess the relative importance of the two components on the RHS of (3) as determining the variability of the mean change in the unemployment rate across sub-periods is to calculate the size of the (weighted) standard deviation of the (mean) values of each of the components in each sub-period around their mean value for the whole period.[18] If we do this for the data in Table 2 we find that the standard deviation of the change in the unemployment rate is 0.087 while the standard deviation of the net inflow into unemployment is 0.084 and the standard deviation of the product of the labour force growth rate and the unemployment rate is 0.004, so the dominant source of variations in the change in the unemployment rate across sub-periods is that of variations in the size of the net inflow into unemployment.[19]

While equation (3) is a nice place to start and can teach us a little, it is only that, a starting place. There are two reasons why we should go beyond equation (3). First, the change in the labour force is itself a result of a net flow (between employment and unemployment on the one hand and not in the labour force on the other) and we should make this explicit (this also allows us to better understand the reasons for changes in the participation rate). Also, flows from employment to not in the labour force can lead to a change in the labour force and thus in the unemployment rate even if the number unemployed remains constant. A second reason is that it is of interest to disaggregate the net flow into unemployment into the part which reflects the net flows in relation to employment and the net flows in relation to not in the labour force (this also allows us to better understand the reasons for changes in the unemployment pool). We begin with the second of these explorations.

[18] The weighted standard deviation is where the squared difference between the mean of the sub-period and the mean for the whole period is multiplied by the proportion of total months spent in that sub-period before being summed.

[19] This is not surprising as the last term involves multiplying two small numbers together.

5. Flows between unemployment and the other states

By definition flows into and out of unemployment involve flows to and from employment and not in the labour force, so we may write that

$$\left[\left(IN-OUT\right)/LF_{+1}\right]=\left[\left(ETU-UTE\right)/LF_{+1}\right]+\left[\left(NTU-UTN\right)/LF_{+1}\right] \quad (4)$$

where *ETU* is the flow from employed to unemployed, *UTE* is the flow from unemployed to employed, *NTU* is the flow from not in the labour force to unemployed, and *UTN* is the flow from unemployed to not in the labour force.

Table 3 sets out information on the average (mean) monthly value of the three components of equation (4) for each of our sub-periods. Perhaps the most striking feature of Table 3 is that the net flow between not in the labour force and unemployment is positive in every sub-period while the net flow between employment and unemployment is negative in every sub-period. Notice that this implies that even in recessions (mean) flows from unemployment to employment exceed (mean) flows from employment to unemployment.

[TABLE 3 NEAR HERE]

The first term on the RHS of (4) concerns the behaviour of the net inflow into unemployment from employment. In recessions and pauses the net inflow into unemployment from employment is greater than average while in all of the recoveries except one it is below average. As a result there is a very high and positive correlation between the change in the unemployment rate and the size of the net inflow into unemployment from employment across sub-periods, r = 0.95. The second term on the RHS of (4) concerns the behaviour of the net inflow into unemployment from not in the labour force. This component was above average in one of the recessions and (slightly) below average in the other. It was above average in two of the pauses while being below average in the other. It was below average in four of the recoveries and above average in the other two.[20] It is not surprising, then, to find only a weak (but positive) correlation between the change in the unemployment rate and the net inflow into unemployment from not in the labour force across sub-periods, r = 0.32.

[20] It is likely that there is a downwards trend in the net inflow into unemployment from not in the labour force which might account for the mixed results.

A scan down the columns of Table 3 suggests that the major source of variation in the net inflow into unemployment is variations in the net flow between employment and unemployment. The (weighted) standard deviation of the net inflow into unemployment is 0.084 while the standard deviation of the net flow between employment and unemployment is 0.079 and the standard deviation of the net flow between not in the labour force and unemployment is only 0.027. Overall then it is clear that the main influence on variations in the net inflow into unemployment across sub-periods is variations in the size of the net flow between unemployment and employment.

Earlier it was noted that the last term on the RHS of equation (3) could itself be expressed in terms of (net) flows. The next section of the paper explores this.

6. Labour force growth

By definition the extent of any change in the size of the labour force (ΔLF) will reflect the size of flows between both employment and unemployment on the one hand and not in the labour force on the other, so we may write

$$\left[\Delta LF/LF_{+1}\right]=\left[\left(NTE-ETN\right)/LF_{+1}\right]+\left[\left(NTU-UTN\right)/LF_{+1}\right] \qquad (5)$$

where *NTE* is the flow from not in the labour force to employed, *ETN* is the flow from employed to not in the labour force, *NTU* is the flow from not in the labour force to unemployed and *UTN* is the flow from unemployed to not in the labour force.

Table 4 sets out information on the average (mean) monthly value of the three components of equation (5) for each of our sub-periods. Perhaps the most striking feature of Table 4 is that the net flow between not in the labour force and unemployment is positive in every sub-period while the net flow between not in the labour force and employment is negative in every sub-period.[21]

[TABLE 4 NEAR HERE]

The first term on the RHS of (5) concerns the behaviour of the net flow from not in the labour force to employment. In both recessions and in two of the three pauses the net flow from not in the labour force to employment is below average while in all of the recoveries

except one it is above average. As a result there is a very high and negative correlation between the change in the unemployment rate and the size of the net flow from not in the labour force to employment, r = -0.92. The second term on the RHS of (5) concerns the behaviour of the net inflow into unemployment from not in the labour force. We dealt with this in the previous section and noted that there was only a weak (but positive) correlation between the change in the unemployment rate and the net inflow into unemployment from not in the labour force, r = 0.32.

The two terms on the RHS of (5) are negatively but only moderately correlated with each other (r = -0.42), indicating that there is a weak tendency for the net inflow into unemployment from not in the labour force to rise as the net flow from not in the labour force to employment falls. The rate of growth in the labour force is very highly correlated with the net flow between not in the labour force and employment (r = 0.84) but only weakly correlated with the net flow between not in the labour force and unemployment (r = 0.14).

The major source of variation in the rate of growth in the labour force is, as an inspection of the columns of Table 4 suggests, the net flow between not in the labour force and employment. The standard deviation of the rate of growth in the labour force is 0.046, the standard deviation of the net flow between not in the labour force and employment is 0.051 while the standard deviation of the net flow between not in the labour force and unemployment is only 0.027. Overall it is clear that the main influence on variations in the labour force growth rate across sub-periods is that of variations in the size of the net flow between not in the labour force and employment.[22]

7. The net flows between all three states

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. This information is given in Table 5. We see that[23]

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[21] Notice that even when unemployment rate is very low (at its lowest) flows from employment to not in the labour force exceed flows from not in the labour force to employment.

[22] Blanchard & Diamond (1990) noted the relative unimportance of the flow between unemployment and not in the labour force as a determinant of cyclical variations in labour force growth in the USA while Barkume & Horvath (1995) stress the importance of examining flows between employment and not in the labour force for an understanding of variations in labour force growth.

[23] Tables of gross flows reported in the articles by Leeves (1997), Blanchard & Diamond (1990) and Bell & Smith (2002) show that net flows are in the same direction as that reported here for Australia (1980-92), the USA (1968-86) and the UK (1996-2001), respectively.

- The average size of the net flows between not in the labour force and unemployment and between unemployment and employment are higher, on average, than the net flow between employment and not in the labour force.
- The net flow between unemployment and employment shows the most variability across sub-periods (this series has a standard deviation of 0.079), with net flows between employment and not in the labour force the next most variable (a standard deviation of 0.051) and with net flows between not in the labour force and unemployment showing relatively small variability (standard deviation is only 0.027).
- As for their relation with the business cycle, as evidenced by their correlation with changes in the unemployment rate, we find: Net flows between not in the labour force and unemployment are moderately and positively correlated with changes in the unemployment rate, $r = 0.32$; Net flows between unemployment and employment are highly and negatively correlated with changes in the unemployment rate, $r = -0.95$; while Net flows between employment and not in the labour force are highly and positively correlated with changes in the unemployment rate, $r = 0.92$.
- 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).
- 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).
- 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).

This suggests that a summary of labour market net flows would be akin to a life-cycle of movement from not in the labour force to unemployment, then from unemployment to employment and then from employment to not in the labour force.

[TABLE 5 NEAR HERE]

It is worth recapitulating what we have found about the correlations of the net flows between the three states. Net flows between not in the labour force and unemployment (column 1) are only very weakly and negatively correlated with the size of net flows between unemployment and employment (column 2), r = -0.02. There is only a moderate and positive correlation (r = 0.42) between the size of net flows between not in the labour force and unemployment (column 1) on the one hand and the size of net flows between employment and not in the labour force (column 3) on the other. Finally, and most significantly in our view, there is a very high and negative correlation between fluctuations in the size of net flows between unemployment and employment (column 2) on the one hand and between employment and not in the labour force (column 3) on the other, r = -0.83. In other words there is a high and positive correlation between the size of net flows between employment and unemployment on the one hand and the size of net flows between employment and not in the labour force on the other. This is, as we shall explain in the next section, the key to understanding the endogeneity of the participation rate over the business cycle.

8. Why is it that changes in the unemployment rate and the participation rate are negatively correlated?

Comparing the data for labour force growth in Table 4 with the data for the change in the unemployment rate in Table 2, suggests that the two are negatively related and this is consistent with the notion that the participation rate is endogenous. In both recessions and in two of the three pauses the rate of growth in the labour force is below average while in one-half of the recoveries it is above average and in half below average. The correlation coefficient between the change in the unemployment rate and the rate of growth in the labour force, and thus the participation rate,[24] across sub-periods is (r =) -0.81. Why is it that changes in the participation rate (specifically, the rate of growth in the labour force) and changes in the unemployment rate are negatively correlated?

[24] We can move directly from information on the rate of growth of the labour force to movements in the participation rate for two reasons. One is that population is nowhere near as volatile as the labour force over the cycle. The second reason is that by construction the population is held constant between the start and the end of a 'flows month'. Observed changes in the labour force must for that reason translate one to one into changes in the participation rate.

In the previous section of the paper it was shown that the net flow between employment and not in the labour force is highly and positively correlated with the net flow between employment and unemployment (r = 0.83) and that each of these flows is highly correlated with the change in the unemployment rate. This means that as the unemployment rate (say) rises, the net flow from employment to not in the labour force increases (and we can see from Table 5 that it increases 'a lot') while at the same time the net flow from employment to unemployment is also rising (and we can see from Table 5 that it also increases 'a lot'). Both of these events are acting to raise the unemployment rate (the latter raises unemployment with the labour force held constant while the former lowers the labour force with unemployment held constant) while the former is also acting to lower the participation rate.[25]

Essentially, the participation rate is negatively correlated with the unemployment rate because net flows between employment and not in the labour force and net flows between employment and unemployment are highly and positively correlated. None of this is to deny that there are 'discouraged-workers' or 'discouraged-unemployed workers', but it would appear that their presence is unimportant as a determinant of the observed negative relationship between participation and unemployment.[26] It is unimportant not least because to the extent that there is any correlation between the net flow from not in the labour force to unemployment on the one hand and changes in the unemployment rate on the other, it is positive.[27] This cannot then explain why it is that as the unemployment rate rises the participation rate tends to fall and yet this is commonly given as the explanation.[28]

9. Changes in the unemployment rate (again)

We turn now to consider the role of net flows between all three states in influencing the size and direction of any movement in the unemployment rate. Combining (4), (5) and (3) and

[25] While this is going on there is a slight tendency for the net flow from not in the labour force to unemployment to increase which tends to raise the unemployment rate above what it would otherwise be and to mute the rise in the participation rate.

[26] In other words, we are not denying that the *gross* flow from unemployment to not in the labour force increases in recessions. It does. But so also does the *gross* flow from not in the labour force to unemployment. The balance between the two flows is such that the *net* flow from unemployment to not in the labour force does not tend to increase in recessions.

[27] Besides, we have already seen that flows from not in the labour force to unemployment exceed flows from unemployment to not in the labour force in every period.

[28] For example: "Labour force growth [is] cyclically sensitive. In particular, labour force participation rates increase during the growth phase and decline during the slowdown phase. Discouraged workers leave the

collecting like terms together gives an alternative expression to (3) and an expression which is entirely in terms of state variables and net flows. It is

$$\Delta\left(\frac{U}{LF}\right)=\left(\frac{ETU-UTE}{LF_{+1}}\right)+\left(\left(\frac{NTU-UTN}{LF_{+1}}\right)\left(1-\frac{U}{LF}\right)\right)-\left(\left(\frac{NTE-ETN}{LF_{+1}}\right)\left(\frac{U}{LF}\right)\right) \qquad (6)$$

Equation (6) shows, as we would expect, that flows between all three states (not just those involving unemployment) are relevant for the determination of the unemployment rate but that, although all three are relevant, they are not equally important. If the net flow between employment and unemployment rises, then this increases the number unemployed with the labour force constant so the impact of this change is positive (and 'large'). If the net flow between not in the labour force and unemployment rises then this increases the number unemployed and the size of the labour force so impact is positive (but 'small') while if the net flow between not in the labour force and employment rises then this increases the size of the labour force with unemployment constant and so the impact on the unemployment rate is negative.

Table 6 sets out information on the average (mean) monthly value of the four components of equation (6) for each of our sub-periods. The first term on the RHS of (6) is above average in both recessions and in two out of the three pauses. Not surprisingly, it is very highly and positively correlated with changes in the unemployment rate (r = 0.95). The second term on the RHS of (6) is above average in one recession and in two out of the three pauses and (slightly) below average in the other recession and one of the pauses. It is however below average in five out of the six recoveries. As a result, we find it is only weakly but positively correlated with changes in the unemployment rate (r = 0.32). Turning to the last term on the RHS of (6), we see that it is below average in both recessions and in all of the pauses while it is above average in all of the recoveries. As we would expect then it is strongly but negatively correlated with changes in the unemployment rate (r = -0.92).

[TABLE 6 NEAR HERE]

A comparison of the figures in the columns of Table 6 suggests that the major source of variation in the change in the unemployment rate is the net flow between employment and unemployment. The standard deviation of the change in the unemployment rate is 0.087, the

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labour force as unemployment increases and return to the labour force when job vacancies increase" (Burgess & Green, 2000, p 135f).

standard deviation of the net flow between employment and unemployment is 0.079, the standard deviation of the term including the net flow between not in the labour force and unemployment is 0.025 while the sum of squares in the term including the net flow between not in the labour force and employment is only 0.004. Overall, the dominant influence on variations in the change in the unemployment rate across sub-periods is that of variations in the size of the net flow between employment and unemployment.

10. Conclusions

In this paper we developed a framework which is appropriate for the systematic investigation of the relationship between net (and gross) flows between labour market states and movements in the unemployment rate. We used that framework to investigate the behaviour of net flows of persons between employment, unemployment and not in the labour force in Australia over the period 1979-2003 and their relationship to changes in the unemployment rate. Amongst other things, we find 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 even in recessions. Another important finding is that the reason why the participation rate is negatively correlated with the unemployment rate is because net flows from employment to both unemployment and to not in the labour force are highly correlated. It cannot be explained by flows occurring between unemployment and not in the labour force. This suggests that the so-called 'discouraged-unemployed-worker' effect is not a credible explanation for the endogeneity of the participation rate. We also hope to have shown that the study of *net* flows can be worthwhile.

One way in which our approach to changes in the unemployment rate differs from that of other researchers is that they tend to disregard the changing labour force as an element 'in the equation' and so they work only with the first term on the RHS of (3). We think this is a mistake, for two reasons. First, it is not wise to simply postulate ex-cathedra as (say) Pissarides does that it is "very small" (1986, p 505). An inspection of Table 4 shows that in some periods the labour force growth rate is as large as some of the net flows expressed as proportions of the labour force and so, on this criteria, it could not be said to be

so small as to be disregarded. Second, and far more importantly, by leaving the term in we are more likely to see changes in the unemployment rate and the participation rate (labour force growth) as interrelated and be better able to identify and understand the connection between the two.

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Table 1 Chronology and the average (mean) monthly value of the change in the unemployment rate for each sub-period 1979:08 - 2003:12

Sub-period	*Δ(U/LF)*	*Description*
1979:08 1981:06	-0.050	Recovery period
1981:06 1983:08	0.156	First recession episode
1983:08 1986:06	-0.099	Recovery period
1986:06 1987:04	0.031	Pause
1987:04 1989:11	-0.099	Recovery period
1989:11 1993:06	0.092	Second recession episode
1993:06 1995:07	-0.108	Recovery period
1995:07 1996:12	0.002	Pause
1996:12 2000:10	-0.056	Recovery period
2000:10 2001:10	0.071	Pause
2001:10 2003:12	-0.063	Recovery period

Note: The figures for the change in the unemployment rate, Δ(U/LF), are calculated as the difference in the unemployment rate between the beginning and end of each month expressed as a percentage of the labour force.

Table 2 Mean values of the three terms in equation (3) for each sub-period

Sub-period	*Description*	$\Delta(U/LF)$	$(IN - OUT)/LF_{+1}$	$(\Delta LF/LF_{+1})(U/LF)$
1979:08 1981:06	Recovery period	-0.050	-0.046	0.004
1981:06 1983:08	1st recession episode	0.156	0.155	-0.001
1983:08 1986:06	Recovery period	-0.099	-0.088	0.011
1986:06 1987:04	Pause	0.031	0.039	0.008
1987:04 1989:11	Recovery period	-0.099	-0.093	0.006
1989:11 1993:06	2nd recession episode	0.092	0.093	0.001
1993:06 1995:07	Recovery period	-0.108	-0.095	0.014
1995:07 1996:12	Pause	0.002	0.004	0.002
1996:12 2000:10	Recovery period	-0.056	-0.052	0.004
2000:10 2001:10	Pause	0.071	0.076	0.006
2001:10 2003:12	Recovery period	-0.063	-0.059	0.003
1979:08 - 2003:12	Mean	-0.017	-0.012	0.005
	(Weighted) Std. Dev.	0.087	0.084	0.004

Notes: In all the tables the figures have been expressed as percentages (of the labour force) per month.

$$\Delta\left(\frac{U}{LF}\right)=\frac{(IN-OUT)}{LF_{+1}}-\left(\frac{\Delta LF}{LF}\right)\left(\frac{U}{LF_{+1}}\right)$$

Table 3 Mean values of the three terms in equation (4) for each sub-period

Sub-period	*Description*	*(IN – OUT)/LF$_{+1}$*	*(ETU – UTE)/LF$_{+1}$*	*(NTU – UTN)/LF$_{+1}$*
1979:08 1981:06	Recovery period	-0.046	-0.302	0.256
1981:06 1983:08	1st recession episode	0.155	-0.111	0.265
1983:08 1986:06	Recovery period	-0.088	-0.361	0.273
1986:06 1987:04	Pause	0.039	-0.254	0.293
1987:04 1989:11	Recovery period	-0.093	-0.323	0.230
1989:11 1993:06	2nd recession episode	0.093	-0.146	0.239
1993:06 1995:07	Recovery period	-0.095	-0.325	0.230
1995:07 1996:12	Pause	0.004	-0.230	0.234
1996:12 2000:10	Recovery period	-0.052	-0.248	0.195
2000:10 2001:10	Pause	0.076	-0.213	0.289
2001:10 2003:12	Recovery period	-0.059	-0.288	0.229
1979:08 - 2003:12	Mean	-0.012	-0.253	0.241
	(Weighted) Std. Dev.	0.084	0.079	0.027

Note: $\left[\left(IN-OUT\right)/LF_{+1}\right]=\left[\left(ETU-UTE\right)/LF_{+1}\right]+\left[\left(NTU-UTN\right)/LF_{+1}\right]$

Table 4 Mean values of the three terms in equation (5) for each sub-period

Sub-period	*Description*	$\Delta LF/LF_{+1}$	$(NTE - ETN)/LF_{+1}$	$(NTU - UTN)/LF_{+1}$
1979:08 1981:06	Recovery period	0.068	-0.188	0.256
1981:06 1983:08	1st recession episode	-0.009	-0.274	0.265
1983:08 1986:06	Recovery period	0.130	-0.143	0.273
1986:06 1987:04	Pause	0.106	-0.187	0.293
1987:04 1989:11	Recovery period	0.106	-0.124	0.230
1989:11 1993:06	2nd recession episode	0.022	-0.217	0.239
1993:06 1995:07	Recovery period	0.144	-0.086	0.230
1995:07 1996:12	Pause	0.021	-0.213	0.234
1996:12 2000:10	Recovery period	0.056	-0.139	0.195
2000:10 2001:10	Pause	0.080	-0.209	0.289
2001:10 2003:12	Recovery period	0.057	-0.171	0.229
1979:08 - 2003:12	Mean	0.070	-0.172	0.241
	(Weighted) Std. Dev.	0.046	0.051	0.027

Note: $\left[\Delta LF/LF_{+1}\right]=\left[\left(NTE-ETN\right)/LF_{+1}\right]+\left[\left(NTU-UTN\right)/LF_{+1}\right]$

Table 5 Mean values of the net flows between the three states for each sub-period

Sub-period	*Description*	$(NTU - UTN)/LF_{+1}$	$(UTE - ETU)/LF_{+1}$	$(ETN - NTE)/LF_{+1}$
1979:08 1981:06	Recovery period	0.256	0.302	0.188
1981:06 1983:08	1st recession episode	0.265	0.111	0.274
1983:08 1986:06	Recovery period	0.273	0.361	0.143
1986:06 1987:04	Pause	0.293	0.254	0.187
1987:04 1989:11	Recovery period	0.230	0.323	0.124
1989:11 1993:06	2nd recession episode	0.239	0.146	0.217
1993:06 1995:07	Recovery period	0.230	0.325	0.086
1995:07 1996:12	Pause	0.234	0.230	0.213
1996:12 2000:10	Recovery period	0.195	0.248	0.139
2000:10 2001:10	Pause	0.289	0.213	0.209
2001:10 2003:12	Recovery period	0.229	0.288	0.171
1979:08 - 2003:12	Mean	0.241	0.253	0.172
	(Weighted) Std. Dev.	0.027	0.079	0.051

Table 6 Mean values of the four terms in equation (6) for each sub-period

Sub-period	*Description*	*Δ(U/LF)*	*A*	*B*	*C*
1979:08 1981:06	Recovery period	-0.050	-0.302	0.241	-0.011
1981:06 1983:08	1st recession episode	0.156	-0.111	0.245	-0.021
1983:08 1986:06	Recovery period	-0.099	-0.361	0.250	-0.013
1986:06 1987:04	Pause	0.031	-0.254	0.270	-0.015
1987:04 1989:11	Recovery period	-0.099	-0.323	0.214	-0.010
1989:11 1993:06	2nd recession episode	0.092	-0.146	0.218	-0.019
1993:06 1995:07	Recovery period	-0.108	-0.325	0.208	-0.008
1995:07 1996:12	Pause	0.002	-0.230	0.215	-0.017
1996:12 2000:10	Recovery period	-0.056	-0.248	0.181	-0.011
2000:10 2001:10	Pause	0.071	-0.213	0.270	-0.014
2001:10 2003:12	Recovery period	-0.063	-0.288	0.214	-0.011
1979:08 - 2003:12	Mean	-0.017	-0.253	0.223	-0.014
	(Weighted) Std. Dev.	0.087	0.079	0.025	0.004

Note: $\Delta(U/LF) = A + B - C$, where $A = \left(\frac{ETU - UTE}{LF_{+1}}\right)$, $B = \left(\frac{NTU - UTN}{LF_{+1}}\right)\left(1 - \frac{U}{LF}\right)$ and $C = \left(\frac{NTE - ETN}{LF_{+1}}\right)\left(\frac{U}{LF}\right)$

Figure 1 Gross Flows Table as reported in ABS, The Labour Force, October 2001

TABLE 28. ESTIMATES OF LABOUR FORCE STATUS AND GROSS CHANGES (FLOWS) DERIVED FROM MATCHED RECORDS SEPTEMBER 2001 AND OCTOBER 2001
('000)

Labour force status in September 2001	*Labour force status in October 2001*			
	Employed full time	*Employed part time*	*Unemployed*	*Not in the labour force*
MALES				
Employed full time	3,410.2	94.4	30.9	39.7
Employed part time	80.0	430.3	20.9	46.9
Unemployed	31.2	25.9	199.2	51.5
Not in the labour force	21.6	36.8	50.1	1,424.6
MARRIED FEMALES				
Employed full time	964.5	102.3	4.1	23.6
Employed part time	80.5	804.6	8.5	55.4
Unemployed	4.2	13.1	41.4	20.8
Not in the labour force	11.7	39.7	23.7	1,413.8
ALL FEMALES				
Employed full time	1,632.8	144.6	9.9	31.6
Employed part time	126.1	1,252.1	18.7	87.6
Unemployed	10.9	30.6	126.1	56.5
Not in the labour force	17.7	67.9	58.8	2,499.3
PERSONS				
Employed full time	5,042.9	239.1	40.8	71.3
Employed part time	206.1	1,682.4	39.6	134.5
Unemployed	42.2	56.5	325.3	108.0
Not in the labour force	39.3	104.7	108.9	3,923.9

Figure 2 Unemployment rate (%), persons, Australia: 1979:08 – 2003:12