Net flows in the U.S. labor market, 1990–2010

Except in the most recent recession, net flows were from unemployment to employment (even in previous recessions), from employment to not in the labor force (even in booms), and from not in the labor force to unemployment; changes in the unemployment rate across subperiods varied chiefly with the size of the net flow between employment and unemployment

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This article presents a simple framework for the systematic investigation of the relationship between net (and gross) flows among different labor market states and movements in the unemployment rate. The framework is then used to investigate the behavior of net flows of persons among employment, unemployment, and departure from the labor force (not in the labor force) in the United States over the 1990–2010 period. Understanding this behavior increases economists' understanding of the progression of unemployment over the business cycle and aids in identifying the characteristics that make the most recent recession different from previous ones.[1] The article contributes to the literature on gross flows[2] and flow probabilities among various labor market states by investigating *net flows* between states over long periods.

Stock-consistent worker flow data

The data that follow on worker flows are derived from the Current Population Survey (CPS), a monthly sample survey of approximately 60,000 households that is carried out by the U.S. Census Bureau for the U.S. Bureau of Labor Statistics (BLS, the Bureau). Each month, the CPS is administered to about three-quarters of the households that also were in the survey during the previous month. This month-to-month overlap allows the Bureau to track individuals who change their labor force status from one month to the next. In any given month, a person is in one of three labor force states: employed (*E*), unemployed (*U*), or not in the labor force (*N*). The next month, the person either remains in the same state or changes to one of the other two states. Changes (flows) are denoted by pairs of letters; the first letter indicates the labor force status of an individual in the previous month, and the second letter indicates the state of the same individual in the current month. Thus, there are six possible flows associated with changing states: *EU*, *EN*, *UE*, *UN*, *NE*, and *NU*. The Bureau makes available seasonally adjusted monthly estimates of these flows (also known as "gross flows") back to 1990. Although data on the six flows have been available from the CPS for some time, discrepancies existed between the labor force stock changes implied by the flows and the net changes derived from the reported monthly stock estimates. Recently however, BLS researchers developed methods for reconciling the flows and the stock data;

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consequently, it is these stock-consistent data that are used in this article.[3]

The unemployment rate from 1990 to 2010

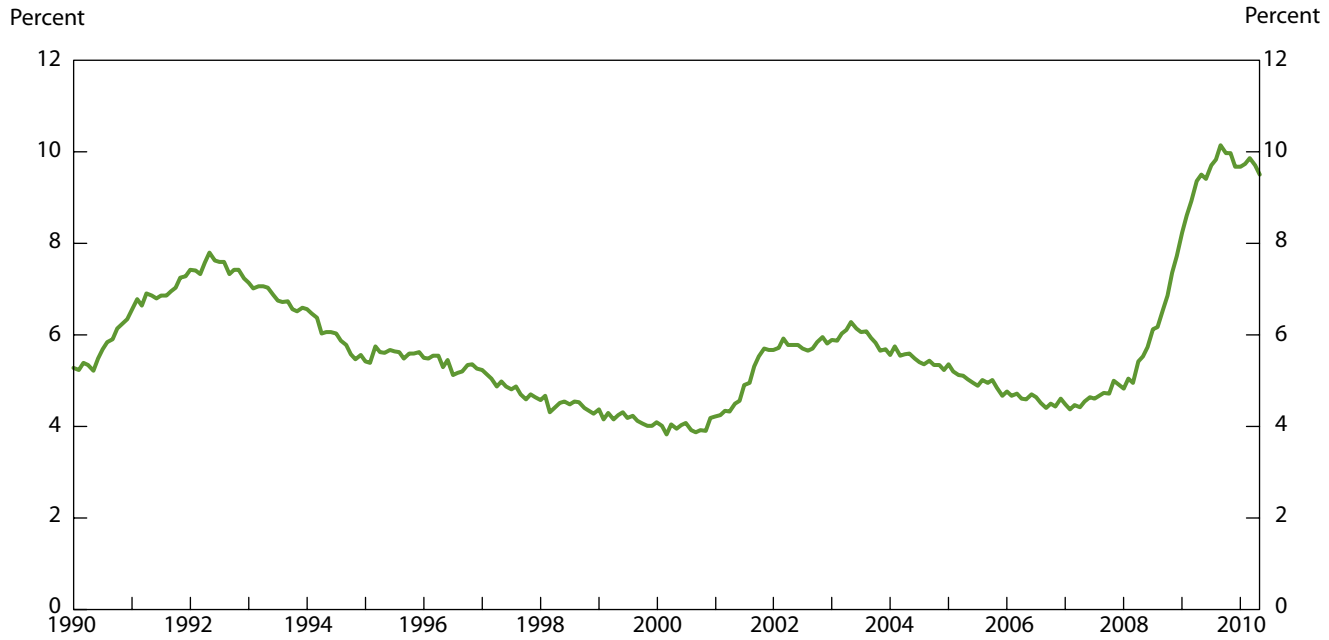
The unemployment rate is defined as the ratio of the number of unemployed to the total labor force. Chart 1 shows the trend in the unemployment rate from February 1990 to June 2010. The three recessions which occurred during that period are clearly visible, as are the recoveries from the first two recessions and the beginning of the recovery from the most recent recession. The analysis that follows examines the similarities and differences among selected subperiods, with an eye toward determining whether any systematic patterns are associated with periods of rising unemployment. Because the raw data on flows are extremely "noisy," averages of (monthly) seasonally adjusted data are presented for meaningful comparisons.

Several subperiods can be identified in the chart, based on the turning points in the unemployment rate. First, the aforementioned three recessions are clearly identifiable, defined for the purposes of this article as periods during which the unemployment rate was rising in a sustained fashion.[4] These recessions may be dated as having occurred over the periods June 1990 to June 1992, January 2001 to June 2003, and April 2007 to October 2009.[5] The periods between the recessions (July 1992 to December 2000 and July 2003 to March 2007) and after October 2009 can be thought of as economic recovery periods, although the most recent one should be regarded as not yet completed (indicated in note 1 in the tables that follow). An inspection of chart 1 suggests that the first recovery period can be usefully broken up into two subperiods, with unemployment falling at a faster rate in the first subperiod (July 1992 to March 1995) than in the second (April 1995 to December 2000).

Changes in the unemployment rate

This section discusses features that are common across all subperiods, features common to recessions, changes in net flows over the business cycle, and particular characteristics of the most recent recession. The discussion begins with the presentation of a simple, but general, framework that relates movements in the unemployment rate to the sizes of flows into and out of the unemployment pool. Gradually, the model is expanded to incorporate more details of the flows. As previously noted, the focus is on flows of persons and on net flows between three states: employed, unemployed, and not

Chart 1. U.S. unemployment rate, 1990–2010



in the labor force. Clearly, this is but a first step toward a more disaggregated and detailed analysis, but the model can readily be generalized to explore the relationship between changes in any ratio and net or gross flows and to disaggregate data by gender, age, and other categories.

The change in the unemployment rate is defined as

$$\Delta\left(\frac{U}{\text{LF}}\right)=\frac{U_{+1}}{\text{LF}_{+1}}-\frac{U}{\text{LF}}, \quad (1)$$

where U and LF denote the beginning of the period in question, U_{+1} and LF_{+1} designate the end of the period, and the symbol Δ represents a first difference. Any change in the number of unemployed ($U_{+1} - U$) must reflect the balance between two flows: an inflow into unemployment (IN) and an outflow from unemployment (OUT); thus,

$$U_{+1} = U + \text{IN} - \text{OUT}.$$

Given the preceding formula, equation (1) may be written as

$$\Delta\left(\frac{U}{\text{LF}}\right)=\frac{(\text{IN}-\text{OUT})}{\text{LF}_{+1}}-\frac{U}{\text{LF}}+\frac{U}{\text{LF}_{+1}}=\frac{(\text{IN}-\text{OUT})}{\text{LF}_{+1}}-\frac{U}{\text{LF}}+\left(\frac{U}{\text{LF}}\right)\left(\frac{\text{LF}}{\text{LF}_{+1}}\right). \quad (2)$$

Collecting like terms and rearranging gives the following expression for the first difference in the unemployment rate (with the definition $\Delta\text{LF} = \text{LF}_{+1} - \text{LF}$):

$$\Delta\left(\frac{U}{\text{LF}}\right)=\frac{(\text{IN}-\text{OUT})}{\text{LF}_{+1}}-\frac{(\Delta\text{LF}/\text{LF})U}{\text{LF}_{+1}}. \quad (3)$$

Note that the numerators on the right-hand side of equation (3) may be given a rather interesting interpretation. The rightmost numerator, $(\Delta\text{LF}/\text{LF})U$, measures the extent to which the number of unemployed can change when there is a growing labor force and yet the unemployment rate stays constant,[6] while the numerator (IN − OUT) denotes the balance of inflows into and outflows from unemployment over any period and is equal to the observed (that is, the actual) change in the number of unemployed over the period. Clearly, (1) if (IN − OUT) exceeds $(\Delta\text{LF}/\text{LF})U$, then the unemployment rate will rise, (2) if the two numerators are equal, then the unemployment rate will stay constant, and (3) if (IN − OUT) is less than $\Delta\text{LF}/\text{LF})U$, then the unemployment rate will fall.

It might be thought that (IN − OUT) (that is, ΔU) must be equal to zero in order 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 rate of growth of the labor force. The reason is that if the labor force is (say) rising over time, then the number of unemployed must rise at the same rate in order to keep the ratio between the two (the unemployment rate U/LF) constant. However, for the number of unemployed to rise over time, there must be a net inflow into unemployment; that is, (IN − OUT) must be *positive*, not zero.

Table 1 sets out information on the average (mean) monthly value of the three terms in equation (3) for each of the subperiods examined. The first three columns of the table respectively set out the chronology, the description of each subperiod, and the mean change in the unemployment rate in each subperiod. The first recession was slightly "deeper" than the second (a mean rise in the unemployment rate of nine one-hundredths of 1 percent per month, compared with seven one-hundredths of 1 percent), but the second was slightly more prolonged (30 months, compared with 25). The most recent recession was by far the sharpest of the three, with a mean rise in the unemployment rate of seventeen one-hundredths of 1 percent per month.

Not surprisingly, in the subperiods in which the unemployment rate rose, the net inflow into unemployment was positive. In recessions the change in the unemployment rate is greater than zero (and above average), while in recoveries it is less than zero (and below average). Similarly, in recessions 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 positive correlation (Pearson's $r = 0.99$) between the change in the unemployment rate and the size of the net inflow into unemployment across subperiods.[7]

A comparison of the numbers in the various columns of table 1 suggests that the main determinant of variations in the unemployment rate is variations in the net inflow into unemployment (the first term on the right-hand side of equation (3)). One way to formally assess the relative importance of the two terms on the right-hand side of equation (3) in determining the variability of the mean change in the unemployment rate across subperiods is to calculate the size of the (weighted) standard deviation of the (mean) values of each of the components in each subperiod around the mean value of that component for the whole period.[8] Doing this for the data in the table reveals that the standard deviation of the change in the unemployment rate is 0.098 while the standard deviation of the net inflow into unemployment is 0.097 and the standard deviation of the product of the labor force growth rate and the unemployment rate is 0.001. There is no doubt, then, that the dominant source of variations in the change in the unemployment rate across subperiods is variations in the size of the net inflow into unemployment.

Table 1. Mean values of the three terms in equation (3) for each subperiod, 1990–2010

[Percentage of the labor force]

Subperiod	Description	$\Delta(U/\text{LF})$	$(\text{IN}-\text{OUT})/\text{LF}_{+1}$	$(\Delta\text{LF}/\text{LF})(U/\text{LF}_{+1})$
July 1990–June 1992	First recession	0.092	0.094	0.002
July 1992–March 1995	Recovery period 1 ..	–.087	–.086	.000
April 1995–December 2000	Recovery period 2 ..	–.033	–.033	.001
January 2001–June 2003	Second recession....	.066	.067	.001
July 2003–March 2007	Recovery period 3 ..	–.056	–.054	.002
April 2007–October 2009	Third recession	.174	.172	–.002
November 2009–June 2010	Recovery period 4[1].	–.086	–.088	–.003
July 2009–October 2009:				
Mean	…	.008	.009	.001
Weighted standard deviation	…	.098	.097	.001

[1] Not yet completed.

NOTE: $\Delta\left(\frac{U}{\text{LF}}\right)=\frac{(\text{IN}-\text{OUT})}{\text{LF}_{+1}}-\frac{(\Delta\text{LF}/\text{LF})U}{\text{LF}_{+1}}$. Row values may not sum to totals because of rounding.

Although equation (3) is a convenient place to begin examining net flows into and out of unemployment, it is possible to examine the flows in more detail than is captured by that equation. There are two reasons we should do so. First, the change in the labor force is itself a result of a net flow (between employment and unemployment, on the one hand, and between employment and not in the labor force, on the other), and this fact should be made explicit. Note also in this regard that flows from employment to not in the labor force can lead to a change in the labor force, and thus in the unemployment rate, even if the number of unemployed remains constant. Second, it is of interest to disaggregate the net flow into unemployment into the part that reflects the net flows in relation to employment and the part that reflects the net flows in relation to not being in the labor force, because doing so affords a better understanding of the reasons for changes in the size of the unemployment pool. The next section explores the consequences of this disaggregation.

Flows into and out of unemployment

By definition, flows into and out of unemployment involve flows to and from employment and flows to and from not in the labor force. Mathematically,

$$\left[(\text{IN}-\text{OUT})/\text{LF}_{+1}\right]=\left[(EU-UE)/\text{LF}_{+1}\right]+\left[(NU-UN)/\text{LF}_{+1}\right], \quad (4)$$

where EU is the flow from employed to unemployed, UE is the flow from unemployed to employed, NU is the flow from not in the labor force to unemployed, and UN is the flow from unemployed to not in the labor force.

Table 2 sets out information on the average (mean) monthly value of the three terms of equation (4) for each subperiod examined. The first term on the right-hand side of the equation concerns the behavior of the net inflow into unemployment from employment. The table shows that, in all of the recessions, the net inflow into unemployment from employment is greater than average.[9] The second term on the right-hand side of the equation concerns the behavior of the net inflow into unemployment from not in the labor force. As the table shows, values of this term, too, are above average in the recessions.[10]

A scan down the columns of table 2 suggests that the dominant influence on variations in the net inflow into unemployment across subperiods (and thus across phases of the business cycle) is variations in the size of the net flow between employment and unemployment. The (weighted) standard deviation of the net inflow into unemployment is 0.097, and the standard deviation of the net flow between employment and unemployment is 0.089, while the standard deviation of the net flow between not in the labor force and unemployment is a lesser 0.023.

Perhaps the most striking feature of table 2 is that the net flow between not in the labor force and unemployment is positive in every subperiod whereas the net flow between employment and unemployment is negative in every subperiod, except during the most recent recession. Scanning across the "recession rows" of the table reveals that the severity of the most recent recession is due primarily to the dramatic rise in the size of the net flow from employment to unemployment. Also, this (net) flow is considerably higher than it was in the previous two recessions. To illustrate the striking nature of the change in the net flow, table 3 shows the net flow from employment to unemployment in the various subperiods, together with the corresponding gross flows. Comparing the flows for the 2007–09 recession with those for the 2003–07 recovery indicates that the main reason the net flow into unemployment was so high during the recession was the aforementioned marked increase in the gross flow from employment to unemployment. BLS research shows that the increase was due to a

Table 2. Mean values of the three terms in equation (4) for each subperiod, 1990–2010

[Percentage of the labor force]

Subperiod	Description	(IN – OUT)/LF_{+1}	(*EU* – *UE*)/LF_{+1}	(*NU* – *UN*)/LF_{+1}
July 1990–June 1992	First recession	0.094	–0.084	0.179
July 1992–March 1995	Recovery period 1 .	–.086	–.222	.136
April 1995–December 2000	Recovery period 2 .	–.033	–.178	.145
January 2001–June 2003	Second recession...	.067	–.074	.142
July 2003–March 2007	Recovery period 3 .	–.054	–.158	.104
April 2007–October 2009	Third recession	.172	.031	.141
November 2009–June 2010	Recovery period 4[1]..	–.088	–.162	.075
July 2009–October 2009:				
Mean	…	.009	–.129	.138
Weighted standard deviation	…	.097	.089	.023

[1] Not yet completed.

NOTE: $\left[(\text{IN-OUT})/\text{LF}_{+1}\right]=\left[(EU-UE)/\text{LF}_{+1}\right]+\left[(NU-UN)/\text{LF}_{+1}\right]$. Row values may not sum to totals because of rounding.

Table 3. Mean values of the EU and UE gross flow rates for each subperiod, 1990–2010

[Percentage of the labor force]

Subperiod	Description	(*EU* – *UE*)/LF_{+1}	*EU*/LF_{+1}	*UE*/LF_{+1}
July 1990–June 1992	First recession	–0.084	1.560	1.644
July 1992–March 1995	Recovery period 1	–.222	1.445	1.667
April 1995–December 2000	Recovery period 2	–.178	1.241	1.419
January 2001–June 2003	Second recession.....	–.074	1.331	1.406
July 2003–March 2007	Recovery period 3	–.158	1.209	1.367
April 2007–October 2009	Third recession	.031	1.413	1.382
November 2009–June 2010	Recovery period 4[1]...	–.162	1.497	1.659
July 1990–October 2009:				
Mean	…	–.129	1.331	1.460
Weighted standard deviation	…	.089	.131	.129

[1] Not yet completed.

dramatic rise in the rate of job losses and a dramatic fall in the rate of job openings and hires.[11] Note also that the *EU* flow is higher now, in the postrecession recovery, than it was during the recession, signaling that the rate of job destruction is continuing at a high level and that the recovery likely involves considerable job restructuring.

Net flows among all three states

Thus far, the analysis has examined net flows between employment and unemployment and between not in the labor force and unemployment. Not yet considered are net flows between employment and not in the labor force. Because the sizes 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 in order to examine the relative signs and sizes of the flows. This information is shown in table 4; the following conclusions may be drawn from the data:

- With the exception of the most recent recession, the net flow from employment to unemployment was negative (that is, flows from unemployment to employment exceeded flows from employment to unemployment) in every subperiod. The net flow from employment to unemployment was positive in the most recent recession.

- The two most recent subperiods are unusual in that the net flow from employment to not in the labor force was larger than the net flow from not in the labor force to unemployment. In other words, the net flow between the labor force and not in the labor force was negative in both periods, signaling a falling labor force participation rate.

- The net flow from not in the labor force to unemployment was positive in every subperiod. (That is, flows from not in the labor force to unemployment exceeded flows from unemployment to not in the labor force in every subperiod.)

- The net flow from employment to not in the labor force was positive in every subperiod. (That is, flows from employment to not in the labor force exceeded flows from not in the labor force to employment in every period.)

Table 4. Mean values of the net flows among the three states for each subperiod, 1990–2010

[Percentage of the labor force]

Subperiod	Description	$(EU - UE)/LF_{+1}$	$(NU - UN)/LF_{+1}$	$(EN - NE)/LF_{+1}$
July 1990–June 1992	First recession	–0.084	0.179	0.151
July 1992–March 1995	Recovery period 1	–.222	.136	.129
April 1995–December 2000	Recovery period 2	–.178	.145	.128
January 2001–June 2003	Second recession..	–.074	.142	.126
July 2003–March 2007	Recovery period 3.	–.158	.104	.066
April 2007–October 2009	Third recession	.031	.141	.152
November 2009–June 2010	Recovery period 4[1]	–.162	.075	.099
July 1990–October 2009:				
Mean	…	–.129	.138	.121
Weighted standard deviation	…	.089	.023	.033

[1] Not yet completed.

- The net flow between employment and unemployment shows the most variability (a standard deviation of 0.089) across subperiods, with the net flow between employment and not in the labor force the next most variable (a standard deviation of 0.033) and the net flow between not in the labor force and unemployment showing relatively little variability (a standard deviation of 0.023).

- The net flow between employment and unemployment exhibits a high positive correlation with changes in the unemployment rate (r = 0.97), the net flow between not in the labor force and unemployment shows a moderate positive correlation with changes in the unemployment rate (r = 0.47), and the net flow between employment and not in the labor force displays a moderate positive correlation with changes in the unemployment rate (r = 0.59). If changes in the unemployment rate may be taken as a proxy for phases of the business cycle, then the three correlations found serve to indicate the relation of the respective flows to those same business-cycle phases.

- Recessions tend to be associated with higher (net) flows from employment to unemployment (E to U), from employment to not in the labor force (E to N), and from not in the labor force to unemployment (N to U) (but *not* with higher flows from unemployment to not in the labor force (U to N)).

- The net flow between not in the labor force and unemployment (column headed "$(NU - UN)/LF_{+1}$") shows a weak positive correlation (r = 0.25) with the net flow between employment and unemployment (column headed "$(EU - UE)/LF_{+1}$"), and there is a moderate positive correlation (r = 0.42) between fluctuations in the net flow between employment and unemployment (column headed "$(EU - UE)/LF_{+1}$"), on the one hand, and fluctuations in the net flow between employment and not in the labor force (column headed "$(EN - NE)/LF_{+1}$"), on the other. By contrast, there is a strong positive correlation (r = 0.88) between net flows between not in the labor force and unemployment (column headed "$(NU - UN)/LF_{+1}$"), on the one hand, and net flows between employment and not in the labor force (column headed "$(EN - NE)/LF_{+1}$"), on the other.

Changes in the unemployment rate (again)

Net flows among all three states influence the size and direction of movements in the unemployment rate. To trace the course of that influence, note that the change in the labor force (that is, the right-hand side of equation (3)) is itself the result of a net flow (between being in the labor force and not being in the labor force), and that fact should be made explicit.

By definition, the extent of any change in the size of the labor force (ΔLF) will reflect the size of flows between employment and the labor force, on the one hand, and between unemployment and the labor force, on the other, or, mathematically,

$$\left[\Delta LF/LF_{+1}\right] = \left[(NE - EN)/LF_{+1}\right] + \left[(NU - UN)/LF_{+1}\right], \qquad (5)$$

where NE is the flow from not in the labor force to employed, EN is the flow from employed to not in the labor force, NU is the flow from not in the labor force to unemployed, and UN is the flow from unemployed to not in the labor force. Combining equations (4), (5), and (3) and collecting like terms gives

Table 5. Mean values of the four terms in equation (6) for each subperiod, 1990–2010

[Percentage of the labor force]

Subperiod	Description	Δ(*U*/LF)	*A*	*B*	*C*
July 1990–June 1992	First recession	0.092	–0.084	0.167	–0.010
July 1992–March 1995	Recovery period 1	–.087	–.222	.127	–.009
April 1995–December 2000	Recovery period 2	–.033	–.178	.138	–.006
January 2001–June 2003	Second recession	.066	–.074	.134	–.006
July 2003–March 2007	Recovery period 3	–.056	–.158	.098	–.004
April 2007–October 2009	Third recession	.174	.031	.132	–.010
November 2009–June 2010	Recovery period 4[1]	–.086	–.163	.067	–.010
July 1990–October 2009:					
Mean	…	.008	–.129	.130	–.007
Weighted standard deviation	…	.098	.089	.022	.003

[1] Not yet completed.

NOTE: $\Delta(U/\mathrm{LF}) = A + B - C$, where $A = \left(\frac{EU - UE}{\mathrm{LF}_{+1}}\right)$, $B = \left(\frac{NU - UN}{\mathrm{LF}_{+1}}\right)\left(1 - \frac{U}{\mathrm{LF}}\right)$, and $C = \left(\frac{NE - EN}{\mathrm{LF}_{+1}}\right)\left(\frac{U}{\mathrm{LF}}\right)$.

$$\Delta\left(\frac{U}{\mathrm{LF}}\right) = \left(\frac{EU - UE}{\mathrm{LF}_{+1}}\right) + \left(\left(\frac{NU - UN}{\mathrm{LF}_{+1}}\right)\left(1 - \frac{U}{\mathrm{LF}}\right)\right) - \left(\left(\frac{NE - EN}{\mathrm{LF}_{+1}}\right)\left(\frac{U}{\mathrm{LF}}\right)\right), \quad (6)$$

an expression that is entirely in terms of state variables and net flows.

Equation (6) shows, as one would expect, that flows among all three states (not just those involving unemployment) are relevant to the determination of the unemployment rate, but that they are not equally important. First, if the net flow between employment and unemployment rises (becomes less negative), then if the labor force remains constant, the number of unemployed increases, so the impact of this change is positive. Second, if the net flow between not in the labor force and unemployment rises, then both the number of unemployed and the size of the labor force increase, so the impact on the unemployment rate is positive. Finally, if the net flow between not in the labor force and employment rises, then if unemployment remains constant, the size of the labor force increases, so the impact on the unemployment rate is negative.

Table 5 sets out information on the average (mean) monthly value of the four terms in equation (6) for each of the subperiods examined. The first term on the right-hand side of the equation (*A* in the table) is above average (that is, less negative than the average) in all three recessions and below average (that is, more negative than the average) in all of the recovery periods. Not surprisingly, then, this term shows a very high positive correlation with changes in the unemployment rate (r = 0.97). The second term on the right-hand side of the equation (*B* in the table) is above average in all three recessions and below average in two of the three completed recovery periods. As a result, this term exhibits a moderate positive correlation with changes in the unemployment rate (r = 0.45). Finally, the last term on the right-hand side of the equation displays a moderate negative correlation with changes in the unemployment rate (r = –0.57).

A comparison of the numbers in the columns of table 5 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 0.098, that of the net flow between employment and unemployment is 0.089, that of the term which includes the net flow between not in the labor force and unemployment is 0.022, and that of the term which includes the net flow between not in the labor force and employment is 0.003. Clearly then, overall, the dominant influence on variations in the change in the unemployment rate across subperiods is variations in the size of the net flow between employment and unemployment.

IN THIS ARTICLE, BLS data on stock-consistent worker flows have been used to study net flows between labor market states over the period 1990–2010. An examination of net flows reveals that, with the exception of the most recent recession, (1) net flows were from unemployment to employment; (2) net flows were from employment to not in the labor force, even during booms, and (3) net flows were from not in the labor force to unemployment, even during recessions. Another important finding is that, overall, the dominant influence on variations in the change in the unemployment rate across subperiods is variations in the size of the net flow between employment and unemployment. The data on net flows indicate that the most recent recession was unusually sharp and different from previous recessions in terms of the magnitude of the flows from employment to unemployment. □

Notes

[1] Although the framework presented is used here to study changes in the unemployment rate, it can easily be applied, with minor modifications, to study changes in other ratios, such as the employment rate and the labor participation rate.

[2] Studies of gross flows include Anthony J. Barkume and Francis W. Horvath, "Using gross flows to explore movements in the labor force," *Monthly Labor Review*, April 1995, pp. 28–35; Hoyt Bleakley, Ann E. Ferris, and Jeffrey C. Fuhrer, "New Data on Worker Flows During Business Cycles," *New England Economic Review*, July–August 1999, pp. 49–76; Randy Ilg, "Analyzing CPS data using gross flows," *Monthly Labor Review*, September 2005, pp. 10–18; Zhi Boon, Charles M. Carson, R. Jason Faberman, and Randy E. Ilg, "Studying the labor market using BLS labor dynamics data," *Monthly Labor Review*, February 2008, pp. 3–16; and Harley J. Frazis and Randy E. Ilg, "Trends in labor force flows during recent recessions," *Monthly Labor Review*, April 2009, pp. 3–18.

[3] Further information on the stock-consistent dataset is found in Harley J. Frazis, Edwin L. Robison, Thomas D. Evans, and Martha A. Duff, "Estimating gross flows consistent with stocks in the CPS," *Monthly Labor Review*, September 2005, pp. 3–9. For CPS flows data, see "Research series on labor force status flows from the Current Population Survey," *Labor Force Statistics from the Current Population Survey*, on the Internet at **www.bls.gov/cps/cps_flows.htm**.

[4] The dating of recessions in this manner is because the focus of the article is on the (relative) sizes of flows associated with periods of rising (or falling) unemployment and the beginnings and end points of those periods need to be identified. Because unemployment rate peaks and troughs lag behind those in the aggregate level of production, the recession dates given here differ from the official ones determined by the U.S. National Bureau of Economic Research.

[5] The dataset underlying the chart begins in February 1990, but the 5-month period between the start of the data and the onset of the first recession was so short that it is not included in the analysis. Likewise, in computing means, standard deviations, and correlations, the incomplete recovery period at the end of the data (from November 2009 to June 2010) is not included, but because behavior over this most recent period will likely be of interest to readers, the relevant information is given in each of the tables in this article.

[6] This may be seen as follows: for the unemployment rate to be constant over time, the rate of growth of unemployment must equal the rate of growth of the labor force; that is, $\Delta U/U = \Delta LF/LF$. But this in turn implies that $\Delta U = (LF/LF)(U)$.

[7] The correlation coefficients reported in this article are weighted Pearson product-moment correlation coefficients, where the weighted covariance is divided by the square root of the weighted variances. The weight in each case is the proportion of total months spent in the subperiod in question, and the observation is the means for each subperiod.

[8] The weighted standard deviation is calculated as the sum of the squared differences between the means of the subperiods and the mean for the whole period, multiplied by the proportion of total months spent in the subperiod.

[9] Recall that there is a very high positive correlation between the change in the unemployment rate and the size of the net inflow into unemployment from employment across all subperiods ($r = 0.97$).

[10] Here, there is a moderate positive correlation between the change in the unemployment rate and the net inflow into unemployment from not in the labor force across subperiods ($r = 0.47$).

[11] This relationship is revealed in the BLS Job Openings and Labor Turnover (JOLTS) data. (See Mark deWolf and Katherine Klemmer, "Job openings, hires, and separations fall during the recession," *Monthly Labor Review*, May 2010, pp. 36–44; and Steven F. Hipple, "The labor market in 2009: recession drags on," *Monthly Labor Review*, March 2010, pp. 3–22.)