Scientific Research

# Using Labor Market Stocks to Identify Labor Market Flow

**Ben-David Nissim**

*Department of Economics and Management, The North Academy, Emek Yezreel, Israel*
*E-mail: NissimB@yvc.ac.il*

## Abstract

A technique that permits the calculation of the flow of agents between and within labor market states is presented. A statistical agency having collected data on those flows easiest to collect and together with data on employment, unemployment and being out of the labor force, will be able to calculate the rest of the flows. The contribution of this paper is in suggesting an easy process which overcomes the difficulties statistical agencies usually have in collecting flow data.

## 1. Introduction

Much of the interest in gross employment flow is due to the work of [1] and, even more so, [2,3] and [4], who exploited a large dataset based on U.S. manufacturing plants. [5] presented a comprehensive view of the results on U.S. data. Also notable are studies presenting results for Germany by [6,7].

Starting with the work of [8], economists began to make extensive use of micro-data to study employment behavior at the firm level in order to explain the dynamics of aggregate employment. Job flow measure the gross creation and destruction of jobs, reflecting the expansion and contraction of establishments. Within a certain time period, a firm may employ new workers while separating from other workers. This could arise from workers quitting and being replaced, and/or simultaneous hiring and firing by employers to improve the quality of their workforce or to reconfigure their skill mix.

Statistical agencies in many countries mainly publish data of labor market stocks, although in several countries flow data are calculated by using a firm's panel data-sets. Although different authors have calculated American labor market flows on the basis of raw CPS data, the flows turn out not to be the same, and large disparities across studies which use the same data source were found (See [9]).

[10,11] found that the amplitude of fluctuations in the flow out of employment is larger than that of the flow into employment, implying that changes in employment are dominated by movements in job destruction rather than in job creation. [12] reported that the net drop in employment during recessions is clearly dominated by job separations. [13] too, stresses the importance of separations for cyclical dynamics. [14] found that the flow due to voluntary quits declines fairly sharply during recessions, consistent with the notion that quits are largely motivated by the prospects of finding another job. "Involuntary" separations—both layoffs and terminations—rise sharply during recessions and gradually taper off during the expansions that follow.

Recently, [15] and [16] claimed that separation rates are not as volatile as job-finding rates and that they can be taken, roughly, as constant (in detrended terms).

Both concluded that the results contradict the conventional wisdom of the last 15 years. If one wants to understand fluctuations in unemployment, one must understand fluctuations in the transition rate from unemployment to employment, not fluctuations in the separation rate. [15] reported that the job-finding probability is strongly procyclical while the separation probability is nearly acyclical, particularly during the last two decades.

[17] construct a decomposition of unemployment variability which contradicts [15] conclusions. They find that separation rates are highly countercyclical under alternative cyclical measures and filtering methods and that fluctuations in separation rates contribute substantially to overall unemployment variability. [18] show that even with [15] methods and data there is an important role for countercyclical inflows into unemployment.

The controversy over the strength of labor market flows during the business cycle is surprising since flow data are easy to analyze. However, since the flows are calculated by using various data sets, different distinguished researchers do not agree which flows are dominant during recession and prosperity.

The main aim in this paper is to present a technique that will reduce the number of flows that should be collected by a statistical agency. The statistical agency should focus on collecting data about flows that are highly accurate and calculate the rest of the flows analytically.

This paper is organized in the following manner: The model structure and an example are laid down in Section 2, and Section 3 presents the summary.

## 2. The Model

### 2.1. Translating Stocks into Flows

Let us define three possible states for agents in the labor market: employed, unemployed and out of labor force agents. Within a certain time period, agents might move from one state to another or stay in the same state, as depicted in **Figure 1**.

In time 0 and in time 1 the statistical agencies publish data of:

$E_0$ - the number of employed workers in time 0.

$U_0$ - the number of unemployed agents in time 0.

$O_0$ - the number of out of labor force agents in time 0.

$E_1$ - the number of employed workers in time 1.

$U_1$ - the number of unemployed agents in time 1.

$O_1$ - the number of out of labor force agents in time 1.

The agents in each state may stay in their position or flow into another possible state.

The possible flows for agents employed in time 0 are: $F_{E-E}$ staying employed, $F_{E-U}$: moving out of a job into unemployment or $F_{E-O}$: moving out of a job into out of labor force. We get:
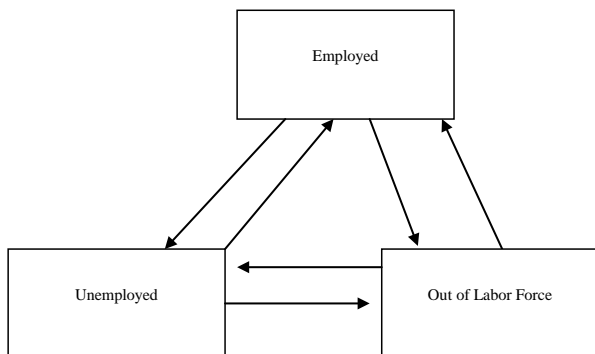


**Figure 1. Labor market stocks and flows.**

$$E_0 = F_{E-E} + F_{E-U} + F_{E-O} \qquad (1)$$

The possible flows for agents who are unemployed in time 0 are: $F_{U-E}$: a flow from unemployment into a new job, $F_{U-O}$: a flow from unemployment into out of the labor force or $F_{U-U}$: staying unemployed in time 1, and we get:

$$U_0 = F_{U-EN} + F_{U-O} + F_{U-U} \qquad (2)$$

The possible flows for agents who are out of the labor force in time 0 are: $F_{O-E}$: a flow from out of the labor force into a new job, $F_{O-U}$: a flow from out of the labor force into unemployment or $F_{O-O}$: staying out of the labor force in time 1, and we get:

$$O_0 = F_{O-EN} + F_{O-U} + F_{O-O} \qquad (3)$$

The agents in each position at time 1, arrived from a certain position in time zero, or are agents newly of working age.

Let us define:

$\Delta L$ —The change in the number of agents of the working age.

$\delta_1 * \Delta L$ —The number of agents who become of working age and enter directly into a state of being employed, ($0 \le \delta_1 \le 1$).

$\delta_2 * \Delta L$ —The number of agents who become of working age and enter directly into a state of being unemployed, ($0 \le \delta_2 \le 1$).

$(1-\delta_1-\delta_2) * \Delta L$ —The number of agents who become of working age and enter directly into a state of being out of the labor force.

Summing up the flows that arrive, in time 1, into a state of employment, into a state of unemployment and into a state of out of the labor force we get:

$$E_1 = F_{E-E} + F_{U-E} + F_{O-E} + \delta_1 * \Delta L \qquad (4)$$

$$U_1 = F_{O-U} + F_{E-U} + F_{U-U} + \delta_2 * \Delta L \qquad (5)$$

$$O_1 = F_{O-O} + F_{E-O} + F_{U-O} + (1-\delta_1-\delta_2) * \Delta L \qquad (6)$$

**Table 1** describes the possible flows:

The size of $\delta_1$, the proportion of new agents of working age who go directly into employment within a certain year may be considered as equal to $E_0/E_0 + U_0 + O_0$,

**Table 1. Labor market flows.**

|        |            | Time 1           |                  |                                  |
| ------ | ---------- | ---------------- | ---------------- | -------------------------------- |
|        |            | $E_1$            | $U_1$            | $O_1$                            |
| Time 0 | $E_0$      | $F_{E-E}$        | $F_{E-U}$        | $F_{E-O}$                        |
|        | $U_0$      | $F_{U-E}$        | $F_{U-U}$        | $F_{U-O}$                        |
|        | $O_0$      | $F_{O-E}$        | $F_{O-U}$        | $F_{O-O}$                        |
|        | $\Delta L$ | $\delta_1 * \Delta L$ | $\delta_2 * \Delta L$ | $(1-\delta_1-\delta_2) * \Delta L$ |

*ME*

while the size of $\delta_2$, the proportion of new agents of working age who go directly into unemployment within a certain year may be considered as equal to $U_0 / E_0 + U_0 + O_0$ [1].

## 2.2. Identification of the Flows

It is impossible to identify the 9 flows—$F_{E\text{-}E}$, $F_{E\text{-}U}$, $F_{E\text{-}O}$, $F_{U\text{-}E}$, $F_{U\text{-}U}$, $F_{U\text{-}O}$, $F_{O\text{-}E}$, $F_{O\text{-}U}$, $F_{O\text{-}O}$ by directly solving Equations (1) to (6), since we have only 6 equations.

We must empirically measure some flows in order to identify the rest.

Given that n is the number of possible stocks states we must empirically measure $n^2 - (2n-1)$ flows in order to identify all other flows.

In our case with $n = 3$ possible states in each period, we must measure empirically $n^2 - (2n-1) = 3^2 - (2*3-1) = 4$ flows.

Assuming that in each period we measure $F_{U\text{-}U}$, $F_{U\text{-}O}$, $F_{O\text{-}U}$, $F_{O\text{-}O}$ [2] we can identify rest of the flows.

Using a matrix notation we can write Equations (1) - (6) as follows:

$$
\begin{pmatrix}
1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\
1 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & \delta_1 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 & \delta_2 \\
0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 & 1-\delta_1-\delta_2 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1
\end{pmatrix}
\begin{pmatrix}
F_{EE} \\ F_{EU} \\ F_{EO} \\ F_{UE} \\ F_{OE} \\ F_{UU} \\ F_{UO} \\ F_{OU} \\ F_{OO} \\ \Delta L
\end{pmatrix}
=
\begin{pmatrix}
E_0 \\ U_0 \\ O_0 \\ E_1 \\ U_1 \\ O_1 \\ \Delta L + F_{UU} \\ \Delta L + F_{UO} \\ \Delta L + F_{OU} \\ \Delta L + F_{OO}
\end{pmatrix}
\tag{7}
$$

Or, $AX = Y$.

Notice that the last 4 rows of Equation (7) are auxiliary rows that assist in squaring $X$.

Given the vector $Y$ and given $\delta$, we get that: $X = A^{-1}Y$,

**Table 2** presents U.S.A employment, unemployment and out of labor force data, collected by the Bureau of Labor Statistics.

Labor Force Statistics from the Current Population Survey

Let assume, only for simulation purposes, that statistical agency collected data of the flows $F_{U\text{-}U}$, $F_{U\text{-}O}$, $F_{O\text{-}U}$, $F_{O\text{-}O}$ as is presented in **Table 3**.

I will apply the suggested technique on the data presented in **Table 2** and **Table 3** for calculating the matrix $A$ in (7) and then will calculate $X = A^{-1}Y$, where $X$ is the vector of calculated flow.

Assuming that $\delta_1 = 0.61, \delta_2 = 0.047, (1-\delta_1-\delta_2) = 0.343$ [3] the matrix $A$ is:

$$
A =
\begin{pmatrix}
1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\
1 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0.047 \\
0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 & 1 & 0.343 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1
\end{pmatrix}
\cdot
$$

---

[1] By using this ratio, we assume that the probability an out of labor force agent joining employment is equal to the ratio between the size of total employment relative to the size of the working-age population while the probability s/he would join unemployment is equal to the ratio between the size of total unemployment relative to the size of the working-age population.

[2] We can choose to measure the flows that are easiest to measure by the statistical agencies.

[3] I assumed $\delta_1 = E_{2008}/E_{2008} + U_{2008} + O_{2008} = 0.61$ while

$\delta_1 = E_{2008}/E_{2008} + U_{2008} + O_{2008} = 0.61$

**Table 2. Employment, Unemployment and out of labor force in U.S.A.**

| Year | $O$ | $U$ | $E$ |
|---|---|---|---|
| **12.1999** | 68 730.11 | 5 653.00 | 134 523.00 |
| **12.2000** | 70 554.99 | 5 634.00 | 137 614.00 |
| **12.2001** | 72 044.33 | 8 258.00 | 136 047.00 |
| **12.2002** | 73 736.41 | 8 640.00 | 136 426.00 |
| **12.2003** | 75 924.50 | 8 317.00 | 138 411.00 |
| **12.2004** | 76 613.23 | 7 934.00 | 140 125.00 |
| **12.2005** | 77 273.76 | 7 219.00 | 142 783.00 |
| **12.2006** | 77 258.24 | 6 688.00 | 145 989.00 |
| **12.2007** | 79 248.33 | 7 541.00 | 146 294.00 |
| **12.2008** | 80 631.63 | 11 108.00 | 143 338.00 |

**Table 3. Assumed labor market flows.**

|      | FUU     | FUO     | FOU     | FOO       |
|------|---------|---------|---------|-----------|
| 2000 | 1690.20 | 563.40  | 2822.20 | 63 499.49 |
| 2001 | 2477.40 | 825.80  | 2881.77 | 64 839.89 |
| 2002 | 2592.00 | 864.00  | 2949.46 | 66 362.77 |
| 2003 | 2495.10 | 831.70  | 3036.98 | 68 332.05 |
| 2004 | 2380.20 | 793.40  | 3064.53 | 68 951.91 |
| 2005 | 2165.70 | 721.90  | 3090.95 | 69 546.38 |
| 2006 | 2006.40 | 668.80  | 3090.33 | 69 532.42 |
| 2007 | 2262.30 | 754.10  | 3169.93 | 71 323.50 |
| 2008 | 3332.40 | 1110.80 | 3225.27 | 72 568.46 |

While its inverse is:

$$A^{-1} = \begin{pmatrix}
4.61 & 3.61 & 3.61 & -3.61 & -4.61 & -4.61 & 1 & 1 & 1 & 1 \\
-1.953 & -1.953 & -1.953 & 1.953 & 2.953 & 1.953 & -1 & 0 & -1 & 0 \\
-1.657 & -1.657 & -1.657 & 1.657 & 1.657 & 2.657 & 0 & -1 & 0 & -1 \\
-2 & -1 & -2 & 2 & 2 & 2 & -1 & -1 & 0 & 0 \\
-2 & -2 & -1 & 2 & 2 & 2 & 0 & 0 & -1 & -1 \\
1 & 1 & 1 & -1 & -1 & -1 & 1 & 0 & 0 & 0 \\
1 & 1 & 1 & -1 & -1 & -1 & 0 & 1 & 0 & 0 \\
1 & 1 & 1 & -1 & -1 & -1 & 0 & 0 & 1 & 0 \\
1 & 1 & 1 & -1 & -1 & -1 & 0 & 0 & 0 & 1 \\
-1 & -1 & -1 & 1 & 1 & 1 & 0 & 0 & 0 & 0
\end{pmatrix}$$

The vector $Y$ for the period 12.1999 - 12.2000 is:

$$Y = \begin{pmatrix} E_0 \\ U_0 \\ O_0 \\ E_1 \\ U_1 \\ O_1 \\ \Delta L + F_{UU} \\ \Delta L + F_{UO} \\ \Delta L + F_{OU} \\ \Delta L + F_{OO} \end{pmatrix} = \begin{pmatrix} 134\,523.00 \\ 5653.00 \\ 68\,730.11 \\ 137\,614.00 \\ 5634.00 \\ 70\,554.99 \\ 8840.67 \\ 5460.27 \\ 7719.07 \\ 68\,396.36 \end{pmatrix}$$

where

$$\Delta L = E_1 + O_1 + U_1 - E_0 - O_0 - U_0 = 4896.87.$$

We get that the flows in year 2000 are:

*ME*

**Table 4. Calculated flows for the years 2001-2008.**

| | DL | FOO | FOU | FUO | FUU | FOE | FUE | FEO | FEU | FEE |
|---|---|---|---|---|---|---|---|---|---|---|
| **2000** | 4896.87 | 63 499.49 | 2822.20 | 563.40 | 1690.20 | 2408.42 | 3399.40 | 4812.47 | 891.45 | 128 819.08 |
| **2001** | 2546.34 | 64 839.89 | 2881.77 | 825.80 | 2477.40 | 2833.32 | 2330.80 | 5505.24 | 2779.15 | 129 329.61 |
| **2002** | 2453.09 | 66 362.77 | 2949.46 | 864.00 | 2592.00 | 2732.10 | 4802.00 | 5668.23 | 2983.25 | 127 395.52 |
| **2003** | 3850.09 | 68 332.05 | 3036.98 | 831.70 | 2495.10 | 2367.38 | 5313.20 | 5440.17 | 2603.97 | 128 381.87 |
| **2004** | 2019.73 | 68 951.91 | 3064.53 | 793.40 | 2380.20 | 3908.07 | 5143.40 | 6175.16 | 2394.34 | 129 841.50 |
| **2005** | 2603.53 | 69 546.38 | 3090.95 | 721.90 | 2165.70 | 3975.90 | 5046.40 | 6112.47 | 1839.98 | 132 172.55 |
| **2006** | 2659.48 | 69 532.42 | 3090.33 | 668.80 | 2006.40 | 4651.01 | 4543.80 | 6144.82 | 1466.27 | 135 171.90 |
| **2007** | 3148.09 | 71 323.50 | 3169.93 | 754.10 | 2262.30 | 2764.81 | 3671.60 | 6090.94 | 1960.81 | 137 937.26 |
| **2008** | 1994.29 | 72 568.46 | 3225.27 | 1110.80 | 3332.40 | 3454.61 | 3097.80 | 6268.32 | 4456.60 | 135 569.08 |

$$X = A^{-1}Y = \begin{pmatrix} 4.61 & 3.61 & 3.61 & -3.61 & -4.61 & -4.61 & 1 & 1 & 1 & 1 \\ -1.953 & -1.953 & -1.953 & 1.953 & 2.953 & 1.953 & -1 & 0 & -1 & 0 \\ -1.657 & -1.657 & -1.657 & 1.657 & 1.657 & 2.657 & 0 & -1 & 0 & -1 \\ -2 & -1 & -2 & 2 & 2 & 2 & -1 & -1 & 0 & 0 \\ -2 & -2 & -1 & 2 & 2 & 2 & 0 & 0 & -1 & -1 \\ 1 & 1 & 1 & -1 & -1 & -1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 1 & -1 & -1 & -1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 1 & -1 & -1 & -1 & 0 & 0 & 1 & 0 \\ 1 & 1 & 1 & -1 & -1 & -1 & 0 & 0 & 0 & 1 \\ -1 & -1 & -1 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \end{pmatrix} * \begin{pmatrix} 134{,}523.00 \\ 5{,}653.00 \\ 68{,}730.11 \\ 137{,}614.00 \\ 5{,}634.00 \\ 70{,}554.99 \\ 8{,}840.67 \\ 5{,}460.27 \\ 7{,}719.07 \\ 68{,}396.36 \end{pmatrix}$$

and $\quad Y = \begin{pmatrix} F_{EE} \\ F_{EU} \\ F_{EO} \\ F_{UE} \\ F_{OE} \\ F_{UU} \\ F_{UO} \\ F_{OU} \\ F_{OO} \\ \Delta L \end{pmatrix} = \begin{pmatrix} 128\ 819.08 \\ 891.45 \\ 4812.47 \\ 3399.40 \\ 2408.42 \\ 1690.20 \\ 563.40 \\ 2822.20 \\ 63\ 499.49 \\ 4896.87 \end{pmatrix}$

In the same manner I calculated the flows for the years 2001-2008, as presented in **Table 4**.

## 3. Summary

The analysis of gross flows in the labor market has attracted much attention by labor economists and macroeconomists in recent years. U.S. studies revealed a large degree of job reallocation in all sectors, all regions and all periods—a result which was confirmed by later European studies. The main advantage of looking at gross rather than net employment changes is that gross flows uncover patterns of job creation and job destruction and so reveal important information about the underlying forces that lead to changes in employment in the aggregate.

Most statistical agencies publish data mainly on stocks of employed, unemployed and out of the labor force agents, at the beginning and end of each time period. Data on flow between labor market states are rare because of the difficulties in collecting them.

This paper presents a technique that permits the calculation of flow between labor market states. Given stocks at time 0 and at time 1, and given measurement of part of the flows which are easiest to collect, the rest of labor market flows can be calculated.

## 4. References

[1] T. Dunne, M. J. Roberts and L. Samuelson, "Plant Turnover and Gross Employment Flows in the U.S. Manufacturing Sector," *Journal of Labor Economics*, Vol. 7, No. 1, January 1989, pp. 48-71. doi:10.1086/298198

[2] S. Davis and J. Haltiwanger, "Gross Job Creation and Destruction: Microeconomic Evidence and Macroeco-

*ME*

nomic Implications," *NBER Macroeconomics Annual*, 1990, pp. 123-168.

[3] S. Davis and J. Haltiwanger, "Gross Job Creation, Gross Job Destruction, and Employment Reallocation," *Quarterly Journal of Economics*, Vol. 107 No. 3, August 1992, pp. 81964. doi:10.2307/2118365

[4] S. Davis, Steven, J. Haltiwanger and S. Scott, "Job Creation and Destruction," MIT Press, Cambridge, 1996.

[5] S. Davis, J. Haltiwanger and S. Schuh, "Job Creation and Destruction in U. S. Manufacturing 1972-1988 Monograph," University of Chicago, Chicago, 1994.

[6] T. Boeri and U. Cramer, "Employment Growth, Incumbents, and Entrants: Evidence from Germany," *International Journal of Industrial Organization*, Vol. 10, No. 4, December 1992, pp. 545-465.

[7] J. Leonard, S. Jonathan and M. A. Van Audenrode, "Corporatism Run Amok: Job Stability and Industrial Policy in Belgium and the United States," *Economic Policy*, Vol. 8, No. 17, October 1993, pp. 355-400. doi:10.2307/1344532

[8] J. Leonard and S. Jonathan, "In the Wrong Place at the Wrong Time: The Extent of Frictional and Structural Unemployment," In: K. Lang and J. Leonard, Eds., *Unemployment and the Structure of Labor Markets*, Basil Blackwell, New York, 1987.

[9] E. Yashiv, "U.S. Labor Market Dynamics Revisited," *Scandinavian Journal of Economics*, Vol. 109, No. 4, 2008, pp. 779-806.

[10] O. J. Blanchard and P. Diamond, "The Beveridge Curve," *Brookings Papers on Economic Activity*, Vol. 1989, No. 1, 1989, pp. 1-76. doi:10.2307/2534495

[11] O. J. Blanchard and P. Diamond, "The Cyclical Behavior of the Gross Flows of U.S. Workers," *Brookings Papers on Economic Activity*, Vol. 1990, No. 2, 1990, pp. 85-155.

[12] R. J. Ritter, "Measuring Labor Market Dynamics: Gross Flows of Workers and Jobs," *Review of the Federal Reserve Bank of St. Louis*, November Issue, 1993, pp. 39-57.

[13] R. E. Hall, "Lost Jobs," *Brookings Papers on Economic Activity*, Vol. 1995, No. 1, 1995, pp. 221-273. doi:10.2307/2534575

[14] H. Bleakley, A. E. Ferris and J. C. Fuhrer, "New Data on Worker Flows during Business Cycles," *New England Economic Review*, July Issue, 1999, pp. 49-76.

[15] R. Shimer, "Reassessing the Ins and Outs of Unemployment," University of Chicago, Chicago, 2007.

[16] R. E. Hall, "Job Loss, Job Finding, and Unemployment in the U.S. Economy over the Past Fifty Years," In: M. Gertler and K. Rogoff, Eds., *NBER Macroeconomics Annual*, MIT Press, Cambridge, 2005, pp. 101-137.

[17] S. Fujitaand and G. Ramey, "The Cyclicality of Job Loss and Hiring," Working Paper No. 06-17, Federal Reserve Bank of Philadelphia, 2006.

[18] M. Elsby, R. Michaels and G. Solon, "The Ins and Outs of Cyclical Unemployment," NBER Working Paper No. 12853, 2007.