Firing and Hiring

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Abstract

Hiring largely reflects churn, where workers separate and the firm replaces them with an equal number of others. Workers leave firms when it is efficient for them to move to alternatives, and firms hire when they need to replace separated workers. Hiring is driven by the need to fill vacant slots. Equivalently, separation is driven by the desire to move current workers to better alternatives, which can take the form of workers quitting to move to more desirable jobs or firms firing workers to replace them with better alternatives.

A model of efficient separations is proposed in this paper. In its simplest form, the model yields several empirically testable predictions: firms and workers vary in their propensity to hire and separate, depending on the costs of and benefits of turnover, as well as on the shape of the productivity distribution. The model is then enhanced with exogenous demand shocks, which yields procyclical hires, separations, and churn.

Using the LEHD microdata, it is found that the model explains churn hiring quite well. Consistent with the model, high wage individuals and establishments, where the cost of mobility is large, are less likely to see high rates of hires, separations, and churn. Labor markets in which the wage variance is large, reflecting worker heterogeneity and higher values of sorting workers to firms, have a tendency to exhibit higher churn rates. The model and the data are also in accordance regarding the business cycle behavior of hires, separations, and churn.

How do firms decide how many workers to hire and fire? Among the key issues in personnel economics, none is more important than understanding the factors behind the hiring and separation decisions. There are two potential questions. The first, which is the subject of this paper, is "how many workers does a firm choose to hire in any given time period?" The second, which is not addressed here, is "how does a firm choose which workers to hire once the number of hires has been determined?"

As has been discussed in earlier papers, much of hiring and separation reflects churn. Firms separate workers when it is cheap to rehire and firms hire when they have a slot vacated by separation. Churn is defined as the simultaneous hiring and separation within a business. Data from the LEHD reveal that almost three-quarters of hiring and of separation reflects churn, not expansion nor contraction.[1] Hiring and separation are opposites of the same coin and they relate to replacement rather than to changes in firm size.

The view adopted here is that hiring and separation serves to move workers to their most efficient use, taking into account the cost of turnover. A worker is let go when the expected value of alternatives elsewhere exceed the value to the current firm by more than the transactions cost of being hired. Putting this differently and equivalently in equilibrium, a replacement hire is contemplated when the current worker's productivity is lower than the expected productivity of a new hire, net of hiring costs. Consequently, to understand hiring, it is important to understand the determinants of separation, and vice versa. Specifically, differences in hiring rates, or equivalently, separation rates, over time and across establishments must be related to differences in the cost of and benefits from reallocation of workers, both over time and across establishments.

[1] LEHD stands for Longitudinal Employer Household Dynamics. This data is described in section II.

There already exists a literature that documents the empirical relation of churn to total hiring. Early papers that use the empirical logic employed below are Hamermesh, Hassink, and Van Ours (1996) and Albaek and Sorensen (1998), who examine the proportion of hires that occur in firms with decreasing or constant employment, added to the separations in firms with expanding employment. Burgess, Lane and Stevens (2000, 2001) focus directly on churn hiring as a proportion of the total. The authors make the point that most job flows are accounted for by churn. Picot, Heisz and Nakamura (2000) perform a similar exercise using Canadian data. Abowd, Corbel and Kramarz (1999) use French data to examine the relation of skill level to hiring and separation, and find simultaneous entry and exit is a decreasing function of skill level. Although a similar empirical result will be found below for the US, this is not an automatic consequence of the theory because both costs and benefits of mobility vary with skill level and those two factors push in opposite directions.

The emphasis in this work differs from the earlier papers in two respects. First, we provide a microeconomic theory that relates hiring to separation. Second, the goal is to use the theory to understand patterns of hiring and separation and to explain differences in churn rates across establishments and over time. Variation in the costs of and benefits from worker mobility is the key driver. Establishment-level data on hiring and separations are used to test the predictions.

Let us begin with a few basic facts from the published JOLTS data.[2] In the average quarter between 2001 and 2012, 13.21 million workers were hired and 13.19 million workers were separated from their jobs. The average net employment change was minuscule by comparison, at 20,000 per quarter. The time series correlation between aggregate hiring and

[2] JOLTS stands for Job Openings and Labor Turnover Survey. We use published private sector data from the Bureau of Labor Statistics website, and transform the statistics from monthly to quarterly.

separations is about .89, suggesting that hiring and separations move together closely. The same pattern is observed if the data are broken down by industry. Each industry experiences significant hiring and separation, but the net is small relative to the gross and the time series correlations by industry tend to be quite positive. The well-known work by Davis, Faberman, and Haltiwanger (2006) has already documented this pattern.[3] Lazear and Shaw (2009) report that high rates of turnover are pervasive not only in the U.S., but in all other developed economies studied. Recoveries, like the one that began in 2009, stall (as in 2010) when hiring stays at low levels.[4] But the majority of hiring and separation appears to be churn, not expansion or contraction.

The main point was made a couple of decades ago in the context of layoff restrictions, especially in European countries. In Lazear (1990) and Bentolila and Bertola (1990), it was argued and demonstrated empirically that requiring firms to offer severance pay when a worker is separated has an adverse effect on hiring. Firms are reluctant to hire workers who they can not fire.[5]

In what follows, a theory of churn will be presented and contrasted with expansion/contraction hiring that results from demand or supply shocks. It will be shown that hires and separations are positively correlated, and the amount of hiring and separation, and thus

[3] Davis, Faberman and Haltiwanger (2006) discuss the nature of net flows to gross flows, but earlier work by Davis and Haltiwanger (1992) and by Anderson and Meyer (1994) also speaks to this point.

[4] See Hall (2011). See Lazear and Spletzer (2012) for a discussion of the relation of hiring and separation rates to net employment growth over the business cycle. When the economy declines, churn turns into employment-reducing separations as departing workers are not replaced. Increases in net employment growth, from large negative levels to somewhat positive levels between 2009 and 2011, reflects a decline in layoffs rather than a rise in hiring, which the JOLTS data make clear.

[5] The emphasis here, both at the conceptual and empirical level, is the opposite of that in Faberman and Nagypal (2008). They focus on expansion and contraction hiring and model transitions from one firm to another that occur when one firm experiences a shock in productivity (or demand) relative to others in the economy. As a result, workers move from one firm to another and the convex mobility costs place a limit on that movement. Here, the story is about churn, not expansion or contraction hiring. The argument is that expansion and contraction are a relatively minor part of the story and to understand hiring and firing, sorting of workers to various firms is crucial. Churn occurs when a worker (not the entire firm) is idiosyncratically better suited to another firm and moves. The matching framework, originally introduced by Jovanovic (1979), is better suited to explaining this phenomenon.

churn, depends on the cost of turnover as well as the shape of the productivity distribution. The theory also shows that churn is procyclical, which is one of the main findings of Lazear and Spletzer (2012). These predictions are confirmed with the LEHD data.

I. The Model

The idea to be captured is that hiring and separation are used primarily to allocate workers to their most productive uses. Separation is modeled to be efficient and the theory abstracts (mostly) from the distinction between quits and layoffs.[6] Further, the model ignores unemployment and concentrates primarily on the number of separations and hires, rather than on the amount of time that it takes to find a job.

The structure is of the standard overlapping-generations type. The model is highly stylized, but captures the essence of firing for allocation reasons and hiring for replacement.

In every period, N workers are born, and each lives for two periods. Every firm, of which there are 2N, employs one worker, exhausting the full supply of labor. In any period there are 2N workers, half of whom are young and half are old. There is full employment in each period.

The production function is one of extreme diminishing productivity. Output of the first worker is a random variable because workers vary in their productivity. To make this simple, output of a second worker is zero, say, because each firm (optimally) has only one machine and production requires the combination of a worker and a machine.

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[6] As modeled, separation is efficient, so the difference between a quit and layoff seems vacuous. As economists know, a layoff can be turned into a quit by adjusting the wage appropriately, and vice versa. See McLaughlin (1991), who was among the first to investigate the distinction between quits and layoffs. The empirical work focuses on total separations, since the LEHD data has no information on quits versus layoffs.

Although each firm faces the same distribution of worker productivity, the productivity of the worker in each firm is independent of that in all other firms. A worker's productivity in firm i is V_i and in firm j, $i \neq j$, is V_j. V_i and V_j are defined as

$$(1) \qquad V_i = V + \varepsilon_i \qquad \text{and} \qquad V_j = V + \varepsilon_j$$

where ε_i and ε_j are i.i.d., each being governed by the density functions and distribution functions $f(\varepsilon)$ and $F(\varepsilon)$, respectively.[7]

A worker's productivity is unknown when he joins the firm. After one period, productivity at the current firm is known to be equal to V_i, but productivity in the other firms remains unknown because ε_i and ε_j are i.i.d. When the worker is middle-aged, he receives one and only one offer from another firm, j.

Let the cost of hiring be given by η. Efficient separation implies that a middle-aged worker, i.e., one who has worked one period, should leave his current firm i and move to a different firm j, $i \neq j$, when the expected output, net of hiring cost, exceeds V_i, or when

$$(2) \qquad V + \varepsilon_i < E(V_j) - \eta \, .$$

Using (1), the condition for efficient separation can be written as

$$(2') \qquad \varepsilon_i < -\eta \, .$$

The probability that a middle-aged worker is separated is therefore $F(-\eta)$. Consequently, in each period, N workers retire and $N\,F(-\eta)$ workers separate because their output at their

[7] At this point, V could be assumed to be equal to zero, but it will be useful to allow it to take on other values later to consider expansion, contraction, and business cycle effects.

current firm is lower than the expected output, net of turnover costs, at the alternate firm. The expected number of separations in any period is then

(3) $S = N\,(1 + F(-\eta))$.

Consider firms' replacement hiring. Each period N workers retire, creating N job openings. At the same time, $N\,F(-\eta)$ of the middle-aged workers separate from their firms creating another $N\,F(-\eta)$ job openings. The number of workers available to be hired consists of N new entrants to the labor market, plus the $N\,F(-\eta)$ middle-aged workers who separated from their firms. The number of job openings equals the number of workers available for hire and, absent frictions, the number of hires is therefore

(4) $H = N\,(1 + F(-\eta)) = S$.

Hiring occurs to replace workers who separate efficiently. The condition in (2), that workers separate when their expected productivity, net of turnover costs, is greater elsewhere than at the current firm, is equivalent to stating that separation occurs to make room for a worker who is expected to be better than the incumbent. A firm chooses to hire for replacement when the incumbent is less productive than the expected value of the replacement, net of turnover costs, or when

$$V + \varepsilon_i < E(V_i) - \eta \,.$$

Because $E(V_i) = V$, the condition is

$$\varepsilon_i < -\eta \,.$$

This is the same as (2'). One can think of hiring as occurring for the purpose of replacement or of separation as occurring to allow new hiring. They are equivalent. Both phenomena reflect movement of labor to their most efficient use and it is variations in η and in F(ε) that drive both.

It follows immediately from equation (4) that

$$(5) \qquad {}^{\partial H}/_{\partial \eta} = {}^{\partial S}/_{\partial \eta} = -N\, f(-\eta)$$

which is negative. An increase in the cost of hiring, η, leads to a decrease in the number of hires and separations. This works through a decrease in churn of middle-aged workers rather than through changes in the retirement of older workers.

Equations (4) and (5) describe the primary features of the labor market. First, hiring equals separations, both for the labor force as a whole and for each particular firm. The model so far is one of pure churn, where all firms remain at their initial size. Although this is obviously not realistic, it is not too far-fetched since, as documented below, 73 percent of quarterly hires and separations in the LEHD microdata reflects churn. Second, the amount of hiring and separation depends on the cost of turnover, η, and on the shape of the productivity distribution function, F(ε). Individuals or firms with a high η should exhibit less churn.. The empirical work below analyzes how churn varies across individual and job characteristics that proxy for the cost of hiring. Additionally, because the amount of mobility at middle age equals N F(-η), the shape of the productivity distribution F(ε) also determines mobility. As discussed in more detail in the empirical section, a fatter lower tail to the distribution implies more churn.[8]

[8] The efficient separations model and the resulting separation probability F(-η) are not new, but novel here is a focus on how the distribution of productivity affects the probability of separation.

Labor Market Structure

The existence of a turnover cost, η, means that an alternative firm cannot offer as much as the current firm can pay. Does this create the possibility of inefficient separation? For inefficient separation to occur, it would be necessary either for the wage to be too low to retain the worker or for the wage to be so high that the firm chooses to fire the worker.

First consider whether the wage can be so low that the worker quits even when it is inefficient to do so. Inefficient separation is defined as separation when $V + \varepsilon_i > V + E(\varepsilon_j) - \eta$ or when $\varepsilon_i > -\eta$. Now, the current firm is always willing to pay up to $V + \varepsilon_i$. An alternative firm j can never pay more than $V - \eta$. For firm j to offer enough to attract the worker, it would have to be the case that $V - \eta > V + \varepsilon_i$ or that $\varepsilon_i < -\eta$, which violates the requirement for inefficient separation.

It is also impossible that the wage is bid so high that the firm fires the worker when it is inefficient to do so. The alternative firm will pay no more than $V - \eta$ and the current firm will retain the worker as long as productivity exceeds the wage. For the wage to be so high that the firm would fire the worker, it would have to be the case that $V - \eta > V + \varepsilon_i$ or that $\varepsilon_i < -\eta$ which, again, violates the definition of inefficient separation.

The converse is also true. Separation always occurs when it is efficient. A separation is efficient when $\varepsilon_i < -\eta$. The maximum wage that the current firm can pay is $V + \varepsilon_i$. An alternative firm can pay up to $V - \eta$. Thus, a worker will quit whenever the outside wage exceeds the maximum current wage or whenever $V - \eta > V + \varepsilon_i$, which is the same as whenever $-\eta > \varepsilon_i$. But if $-\eta > \varepsilon_i$, then separation is efficient by (2'). Thus, a competitive labor market ensures efficient turnover even when hiring costs create a wedge between the amount that the current firm and others can pay.[9]

Churn, Expansion, and Contraction

The model can be extended to allow for expansion hiring and contraction separation as well as churn. This is introduced via a neutral demand shock, in which all firms experience an increase or decrease in demand, say, during recessions or recoveries.

What happens when the demand for labor changes, say, as a result of a shock that causes a downturn in economic activity? This implies a change in the value of V, which shifts the distribution of values in all firms identically.

The decline in demand affects the equilibrium number worked because it reduces the value of work and therefore the number of workers who opt to enter the workforce. In the context of the current model, this takes the form of changes in the number "born" each period, which was previously assumed to be exogenously fixed at N. Instead, let the per-period alternative value of time be given by A with density $g(A)$ and with distribution function $G(A)$. A person enters the workforce if the two period expected earnings exceed two periods of alternative value,[10] or if[11]

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[9] This result also holds in the presence of bargaining. The productivity of a given middle aged worker is $V + \varepsilon_i$, but the alternative firm can offer at most $V - \eta$. Consequently, allowing λ to be the rent-sharing parameter that results from whatever bargaining game characterizes the negotiation with $0 \leq \lambda \leq 1$, the wage of a worker who stays is given by $\lambda (V + \varepsilon_i) + (1 - \lambda)(V - \eta)$, or

$$\text{Wage of a stayer} = V - \eta + \lambda (\varepsilon_i + \eta).$$

Workers who stay at their job have $\varepsilon_i > -\eta$, and thus the wage of a stayer can never be below the alternative offered wage of $V - \eta$. Alternative firms can never outbid the current firm.

[10] The per-period expected value of entering for the entire lifetime exceeds the value of entering for only one period so the possibility of entering at mid-life is ignored. To avoid having some individuals drop out of the labor force at middle age (and some job leavers might opt to do so), it is assumed that once the decision is made when young to enter the labor force, the non-market alternative A depreciated to zero. It is possible to allow some retirement among those who are unlucky in their first industry, but doing so adds notation without any particular insight, merely enlarging the retirement pool and the amount of replacement hiring. The empirical work below relaxes this assumption and examines the age pattern of the entering and exiting cohorts across the business cycle.

$$2A < [V - \eta + V + E(\varepsilon \mid \varepsilon > -\eta)]\,(1 - F(-\eta)) + [2\,(V - \eta)]\,F(-\eta)\,.$$

There is a 1-F(η) probability that the worker stays in the initial firm, receiving the expected wage

$$V + E(\varepsilon \mid \varepsilon > -\eta)$$

as an older worker and V-η as a young worker. There is a F(-η) probability that the worker moves to a different firm, bearing hiring costs η and receiving wage V as an old worker because V is the value of a worker ex ante, given the i.i.d. assumption. Write

$$V^s \equiv V + E(\varepsilon \mid \varepsilon > -\eta)$$

Then the entry condition can be written as

$$A < \tfrac{1}{2}\,(V - \eta + V^s)\,(1 - F(-\eta)) + (V - \eta)\,F(-\eta)$$

so

$$G[\tfrac{1}{2}\,(V - \eta + V^s)\,(1 - F(-\eta)) + (V - \eta)\,F(-\eta)]$$

is the probability that a person enters the labor force.

To be consistent with the previous analysis,

$$N = (\text{Cohort size})\; G[\tfrac{1}{2}\,(V - \eta + V^s)\,(1 - F(-\eta)) + (V - \eta)\,F(-\eta)] \tag{6}$$

because this is the number of young individuals (each period) who have *A* below the expected value of work.

[11] For simplicity of notation, it is assumed that all rents go to the worker.

Given that supply is now endogenous, consider what happens when demand changes. A demand change is reflected here in a decrease in the value of each worker from V to V*, which could occur, say, because of recession that results in a decline in world demand for a country's output. Using (6) and defining

$$V^{s*} \equiv V^* + E(\varepsilon \mid \varepsilon > -\eta),$$

the new number of entrants to the labor market is

$$N^* = (\text{Cohort size})\ G[\tfrac{1}{2}(V^* - \eta + V^{s*})(1 - F(-\eta)) + (V^* - \eta) F(-\eta)].$$

Because V > V* and G' is positive, N > N*. The decrease in the value of work lowers the number of young workers who decide to enter the labor force.[12] Since supply must equal demand, the decrease in hiring of young workers is

$$N - N^* = (\text{Cohort size}) \{ G[\tfrac{1}{2}(V - \eta + V^{s})(1 - F(-\eta)) + (V - \eta) F(-\eta)] - G[\tfrac{1}{2}(V^* - \eta + V^{s*})(1 - F(-\eta)) + (V^* - \eta) F(-\eta)] \}.$$

What happens to hires and separations during the recession? Hiring during the initial recession period consists of replacing the middle-aged workers who move to other firms and new hires from the entering cohort, or

(7) Hires during initial recession period = N* + F(- η) N.

[12] The decrease in the value of each worker from V to V* does not change the separation probability F(-η) for middle aged workers. A middle-aged worker changes jobs if $V^*+\varepsilon_i<V^*-\eta$, which is equation (2). This deviates both from the argument and findings of Lazear and Spletzer (2012) and from the data below, where the probability of separating from the current job decreases during recessions (according to the JOLTS data, layoffs increase during recessions but the decline in quits is greater, and thus total separations are initially flat and then decreasing during the 2007-09 recession). This decreased probability reflects the increased likelihood of a long unemployment spell, whereas our model does not have unemployment. Mechanically, the separation probability is constant because of the search technology and distributional assumptions. Even during recessions, the worker is assumed to receive one and only one offer and the density of ε is assumed to be unchanged.

During subsequent recession periods, replacement hiring declines as a result of a decline in the size of entering cohorts who become middle aged, and total hiring is

(8) Hires during other recession periods = $N^* (1 + F(-\eta))$.

Separations during the initial recession period consists of those who retire plus middle-aged workers who move to other firms, or

(9) Separations during initial recession period = $N (1+ F(-\eta))$.

After final adjustment, separations equal[13]

(10) Separations during recession equilibrium = $N^* (1 + F(-\eta))$.

Churn hiring occurs when a firm hires to replace a separating worker. In this model where firms have one worker, churn at the level of the firm is the minimum of hires and separations by that firm. For the economy as a whole, during the initial recession period, churn is

(11) Churn during initial recession period = $N^* + F(-\eta) N$.

During all subsequent recession periods, the level of churn is

(12) Churn during other recession periods = $N^* (1 + F(-\eta))$.

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[13] There are two transition periods. The middle period has N^* middle aged workers changing jobs and N retirees, so separations in the middle period are $N+F(-\eta)N^*$.

The economy requires two periods to transition from the initial level of employment of 2N to the new level of employment of 2N*.[14] Churn hiring also declines during these two periods, from the level that prevails during normal times (given by equation 4), to the interim level given by equation 11 to the new recessionary level given by equation 12. The decline in the first period results from a fall in the size of the entering cohort, and the decline in the second period results from this smaller cohort reaching middle age and thus a smaller number of middle aged workers changing jobs.

Equations (7) - (12) provide a number of implications that are consistent with the facts. First, as mentioned above, churn is procyclic, falling from $N(1+F(-\eta))$ during normal times (eq. 4) to $N^*(1+F(-\eta))$ during recessions (eq. 12).[15] This is documented below with the LEHD data, and is also one of the main findings of Lazear and Spletzer (2012).

Second, hires and separations move together over the business cycle. During normal times, both hires and separations equal $N(1+F(-\eta))$ from (4). During recessions, both hires and separations equal $N^*(1+F(-\eta))$ from (8) and (10). Recall that $N^*<N$, which implies not only that there are fewer hires during recessions, but also, consistent with the facts, that there are fewer separations during recessions.

Third, although separations and hires are correlated over the business cycle, during the transition from normal times to recession, separations exceed hires. From (7), hires during the initial recession period equal $N^*+F(-\eta)N$, and from (9), separations during the initial recession period equal $N+F(-\eta)N$. During the second period of the transition to the recessionary equilibrium, hires are $N^*+F(-\eta)N^*$ (see eq. 8) and separations are $N+F(-\eta)N^*$. Since $N^*<N$, separations during the initial two periods of the recession exceed hires, which is by definition

[14] The net employment change in each transition period is hires minus separations equal to N^*-N.
[15] This fall in churn is in levels but not in rates.

necessary for employment to decline during the recession. Again, this is consistent with the LEHD data as shown below in Figure 3, as well as consistent with the published JOLTS data.[16]

Fourth, although there is no unemployment in this model (because supply equals demand), the young workers are the ones who bear the brunt of reductions in employment. During the initial period of the recession, employment among the middle age remains at N, whereas employment among new entrants falls from N to N*. This is consistent with the published data that describes employment levels by age group, showing a large decline of young workers relative to older workers (employment levels fall for all age groups). The empirical section below explicitly tests this using employment inflow and outflow rates calculated from the LEHD microdata.

II. Published Hires and Separations Data

The empirical analysis begins with an analysis of published hires and separations data. There are two sources of hires and separations data published by the U.S. government: the JOLTS and the LEHD.

The Job Openings and Labor Turnover Survey (JOLTS) is a monthly survey of 16,000 establishments that produces data on hires, separations, and job openings (for information on the JOLTS, see http://www.bls.gov/jlt/). The JOLTS statistics on hires and separations from December 2000 to the present can be downloaded from the BLS website. The analysis here uses quarterly data created from the monthly JOLTS statistics, restricted to the private sector, with a time series that begins in 2001:Q1.

[16] The dynamics of JOLTS hires and separations across the business cycle can be seen in Chart 3 of http://www.bls.gov/web/jolts/jlt_labstatgraphs.pdf, as well as in Figure 1 of Lazear and Spletzer (2012).

The Longitudinal Employer Household Dynamics (LEHD) is a longitudinally linked employer-employee dataset created by the U.S. Census Bureau as part of the Local Employment Dynamics federal-state partnership. The data are derived from state-submitted Unemployment Insurance (UI) wage records and the Quarterly Census of Employment and Wages (QCEW) data, and are enhanced by the Census Bureau with information about worker demographics (age, gender, race and ethnicity, and education) and the firm (firm age and firm size). Abowd et al. (2009) provide a thorough description of the source data and the methodology underlying the LEHD data and one of its main public use data products, the Quarterly Workforce Indicators (QWI). The analysis in this section uses quarterly measures of hires and separations downloaded from the Cornell Virtual Research Data Center (RDC). Because states have joined the LEHD program at different times, and have provided various amounts of historical data upon joining the LEHD program, the length of the time series of LEHD data varies by state. The data used here are private sector QWI data from the 30 states that have data available from 1998:Q2 through 2010:Q4. These 30 states account for about 65 percent of national employment.[17]

Figure 1 presents the seasonally adjusted time series of quarterly hires and separations from the JOLTS and the LEHD.[18] The levels of hires and separations are clearly different across the two data sources, but this is not a serious concern. There is evidence that the JOLTS misses establishments with large expansions and large contractions (see Davis et al. 2010), which would lead to lower JOLTS hires and separations rates. The secular decline in the hires and separations rates that is evident in both the JOLTS and the LEHD is analyzed by Hyatt and Spletzer (2013). What is important to the analysis here is the strong positive correlation that is evident between

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[17] The 30 states are CA, CO, CT, FL, GA, HI, ID, IL, IN, KS, LA, MD, ME, MN, MO, MT, NC, ND, NJ, NM, NV, PA, RI, SC, SD, TN, TX, VA, WA, and WV.

[18] The definition of hires and separations warrants mention. Hires and separations in the JOLTS are from the survey questionnaire found at http://stats.bls.gov/jlt/jltc1.pdf. Hires and separations in the LEHD refer to the appearance or disappearance of earnings for a worker-employer combination in the administrative records; see Abowd et.al. (2009). Hires and separations in both data sources are measured at the establishment level.

hires and separations in both series. The correlation between the LEHD hires and separations measures in Figure 1 is .985, and the correlation for the JOLTS measures is .866.

One of the implications from the theory above is that hires and separations move together over the business cycle. During normal times, both hires and separations equal $N(1+F(-\eta))$ from equation (4). During the early quarters of a recession, separations exceed hires, as seen in equations (7) and (9). During recessions, both hires and separations equal $N^*(1+F(-\eta))$ from equations (8) and (10), and since $N^*<N$, hires and separations are lower during recessions. Each of these theoretical predictions is evident in Figure 1.[19]

It is possible that the strong positive correlation between hires and separations simply reflects reallocation of labor across industries, as some industries and expanding and some are contracting in any given quarter. Figure 2 plots industry hiring and separation rates from the published JOLTS and the LEHD data, where each industry's data point is the hires and separations rate averaged across quarters.[20] The scatterplot makes clear that there are high turnover industries and low turnover industries. The leisure and hospitality industry has the highest hires and separations rates in each data source, whereas manufacturing has the lowest hires and separations rates in each data source. The scatterplot also shows there is a strong positive correlation between hires and separations within each industry – each industry has its ten-year average hires rate approximately equal to its ten-year average separations rate.

Table 1 provides some basic regressions that speak to the positive correlation between hires and separations. Using the published data for the total private sector, a regression of the hiring rate on the separation rate yields a coefficient of 0.9983 in the JOLTS data and a

[19] The theoretical predictions refer to levels, whereas Figure 1 presents rates.
[20] The JOLTS website provides information for 15 private sector industries. The Cornell Virtual RDC provides information for 19 private sector industries. We have aggregated each to the 11 industries in common: Mining, Construction, Manufacturing, Wholesale and Retail Trade, Transportation and Utilities, Information, Financial Activities, Professional and Business Services, Education & Health Services, Leisure and Hospitality Services, and Other Services. Averages are computed over the quarters in common to both data: 2001:Q1 – 2010:Q4.

coefficient of 1.0818 in the LEHD data. Each coefficient is statistically different from zero at conventional levels of significance. This regression, which is identified from the quarterly time-series variation, shows that hires and separations move together over the business cycle. This merely repeats the obvious visual finding from Figure 1.

Turning to industry level data, the regressions of the hiring rate on the separations rate show similar coefficients. Columns (2) and (3) of Table 1 use the JOLTS published industry data, and columns (5) and (6) use the LEHD published industry data. In the regressions with industry fixed effects, the coefficients show highly correlated hires and separations within industries. These regressions, using publicly available data, provide evidence on the importance of industry-level churn. The churn model implies a positive correlation between hiring and separation, both across industries and also over time. When an industry is experiencing high separation rates, it tends to hire more workers to replace them. Or conversely, when an industry is hiring many workers, it also should be separating many workers because the matching nature of the relationship means that separation will be necessary to weed more workers out during periods of more hiring.

This implication is quite different from one that would come from the expansion/contraction view of hires and separations. If most hiring and separation is based on expansion and contraction, industries that have high hiring rates should also have low separation rates, and vice versa. There should be a negative correlation between hiring and separation rates across industries and over time. Labor in industries that are shrinking should be taken up by industries that are growing. Shrinking industries separate workers and do not hire; growing industries hire workers and do not separate them. Similarly, in strong economic times, there should be many hires and few separations; the reverse should be true in weak economic times. This expansion/contraction view is clearly not supported in the published industry-level data.

The evidence in Table 1, and also in Figures 1 and 2, shows that the hires rates and the separations rates are very highly correlated across industries and over time. However, access to the underlying microdata is necessary to examine the competing hypotheses of whether this correlation measures reallocation of labor across businesses within industries, or whether this correlation measures churn at the level of the firm or the establishment.

III. Establishment-Level Hires, Separations, and Churn

The empirical analysis continues in this section with an examination of churn in the LEHD microdata. Knowing how many hires and separations an establishment has in a given quarter allows us to identify whether the establishment is expanding or contracting, as well as how much of the establishment's hires and separations is churn. The following accounting framework, taken from Lazear and Spletzer (2012), formalizes the definition of establishment-level churn.

Hires can occur in businesses that are expanding, contracting, or staying the same size. Define H_E, H_C, and H_Z as hiring in expanding, contracting, and zero change businesses. Thus total hires H equals

$$H = H_E + H_C + H_Z.$$

Similarly, separations can occur in businesses that are expanding, contracting, or staying the same size, such that total separations equals

$$S = S_E + S_C + S_Z.$$

In expanding businesses, hires can be decomposed into growth hires $H^G{}_E$ and replacement hires $H^R{}_E$. For example, a business that expands by three may hire seven workers and lose four workers to quits, layoffs, or retirement. The four workers hired to replace the separating workers are replacement hires ($H^R{}_E$), and the remaining three workers are hires to grow the business (H^G_E). Note that growth hiring in expanding businesses is the same as job creation. Also note that the number of replacement hires in expanding businesses H^R_E is equal to the number of separating workers in expanding businesses S_E.

In contracting businesses, separations can be decomposed into separations that reduce the size of the business S^D_C and separations that are replaced by hired workers S^R_C. The number of replacement separations in contracting businesses is the same as the number of workers hired in contracting businesses, $S^R_C=H_C$, and separating workers to decrease employment in the business (S^D_C) is the same as job destruction. To complete the accounting framework, the number of hires in zero growth businesses, H_Z, is identical to the number of separations in zero growth businesses, S_Z.

Churn is defined as the hires and separations that offset each other within a business. Define CH_E, CH_C, and CH_Z as churn in expanding, contracting, and zero change businesses:

$$CH_E = H^R_E = S_E$$

$$CH_C = H_C = S^R_C$$

$$CH_Z = H_Z = S_Z.$$

Total churn in the economy is $CH = CH_E + CH_C + CH_Z$. Additionally,

$$H = H^G_E + CH$$

$$S = S^D_C + CH,$$

which says that the net change in employment is $H - S = H^G_E - S^D_C$.

Evidence

The goal in the theoretical section above was to provide a framework for understanding hires, separations, and churn, and to provide predictions for variations in each, over time and across establishments.

Figure 3 presents the seasonally adjusted time series of quarterly hires, separations, and churn from the LEHD microdata. Churn is defined as in the accounting framework above. During the mid-2000s, the hires rate and the churn rate were roughly constant at 22.8 percent and 16.6 percent, respectively. These statistics imply that 73 percent of all quarterly hiring was churn, that is, hiring associated with replacing separated workers, whereas just one-quarter of hiring is to expand the establishment.[21] In the quarters following the 2007-2009 recession, 69 percent of quarterly hiring is churn.

During the mid 2000s, the churn-to-separations ratio from the LEHD data is 74 percent. This is essentially the same as the churn-to-hires ratio, which is not surprising given that total hires essentially equals totals separations – see Figure 3. The interpretation is that roughly three-quarters of separations are replaced by a new hire during the same quarter, and just one-quarter of separations leads to a contraction of the establishment.

Lazear and Spletzer (2012), using the JOLTS microdata, reported that variations in churn hiring account for the bulk (79 percent) of total hiring *change* during the 2007-09 recession. Not only is churn an important component of hiring, but it is also the main driver of cyclic hiring variation. Lazear and Spletzer state that both churn and hiring decline during recessions because separations, which during good times would have been associated with a replacement hire, are allowed to go unfilled during recessions. Furthermore, workers become reluctant to quit their jobs during recessions, and in response businesses reduce their replacement hiring. These declines are confirmed with the LEHD microdata. During the 2007:Q4 to 2009:Q2 time period, the hires rate fell from 21.7 percent to 16.0 percent, and the churn rate fell from 15.8 percent to

[21] This finding is similar to the existing literature. Looking at quarterly statistics from the U.S. labor market, Anderson and Meyer (1994, Table 13) find that 69 percent of hiring is churn, Burgess, Lane, and Stevens (2000, Tables 1 and 2) find that roughly 70 percent of hiring is churn, and Lazear and Spletzer (2012) find that 65 percent of hiring is churn.

11.1 percent. The LEHD data state that the decline in churn during the 2007-09 recession accounts for 84 percent of the decline in hires.

Figure 3 provides evidence that establishment-level churn is an important component of hiring. This is reinforced with further statistical evidence in Table 2, which presents OLS regressions of the establishment-level hires rates on the establishment-level separations rate. The sample here is over 248 million establishment-quarter observations (roughly 4.88 million establishments in each of the 51 quarters 1998:Q2 – 2010:Q4). The first two specifications in Table 2 replicate the specifications from Table 1: a simple one-variable regression and a regression with industry fixed effects. The third specification in Table 2 includes establishment fixed effects. The estimated coefficient in this third specification is .9259, which states that the hiring rate is very similar to the separations rate within establishments. In quarters when an establishment's separations rate is high, its hiring rate is also high, and vice-versa.

Establishment Level Characteristics of Churn

The LEHD microdata provide an opportunity to analyze how churn varies with establishment characteristics. Table 3 provides descriptive statistics of hires, separations, and churn by industry.[22] Churn is important in all industries, ranging from a low of 58 percent of hires in the utilities industry to a high of 83 percent in the administrative services industry (the administrative services industry includes temporary help services). Perhaps not surprisingly, the churn-to-hires ratio is positively correlated with the hires rate. In industries with a lot of turnover, such as construction and accommodation and food services, establishments are more likely to be hiring for replacement purposes rather than for expansion, whereas in low turnover

[22] This table uses the 19 industries defined at http://www.census.gov/cgi-bin/sssd/naics/naicsrch?chart=2007.

industries such as manufacturing, hiring is relatively more likely for expansion than for replacement.

Tables 4 and 5 presents the hires, separations, and churn rates by firm size and firm age, respectively. The well-known result that hires and separations rates are declining with firm size and with firm age is evident. The churn-to-hires ratio is increasing with firm size and with firm age.

Table 6 presents the hires, separations, and churn rates by deciles of the average earnings level of the establishment. The earnings deciles are computed as follows: define average earnings in the establishment as total quarterly payroll divided by employment, define the distribution of this measure for each industry and each quarter, and find which decile of this industry-quarter distribution contains the establishment's earnings measure.[23] Hires and separations are monotonically declining in the first eight deciles, which should not be surprising given low wage workers have, on average, lower η and higher turnover. Employer pay practices could also explain this result. The churn-to-hires ratio is monotonically declining in the last eight deciles, which suggests that hiring is more likely to be for replacement purposes in low-wage establishments than in high-wage establishments.

Costs and Benefits of Turnover

If hiring is primarily for the purpose of replacement, then anything that increases the cost of turnover on the hiring or firing side will result in less churn and both lower hiring and

[23] The definition of employment used here induces some measurement error into this average earnings measure. Employment is defined as the average of "beginning of quarter" and "end of quarter" employment, where beginning of quarter employment is the number of workers who are employed at the establishment in both the current and the previous quarter, and end of quarter employment is defined as the number of workers who are employed at the establishment in both the current and the following quarter. As a result, for two establishments with identical quarterly payroll, the establishment with more short-duration jobs will have lower employment and higher average earnings than the establishment with a more stable workforce.

separation rates. Conversely, anything that increase the benefits from a worker moving to a higher valued use will increase churn.

There are no clear measures of the cost of turnover. Neither industry nor government sources publish data on estimates of hiring or separation costs. It is not even clear how these numbers would be defined. The time cost associated with job search is likely to be a major component of turnover costs, so high wage workers face larger turnover costs than low wage ones for any given amount of time spent looking for a job.[24]

At the empirical level, the issue is more complex because there may be a correlation between η, the cost of relocating, and the value of relocating. It might be relatively cheap for low skilled workers to relocate because foregone earnings are low and the amount of time necessary to find an equivalent or better job is short. For more specialized workers, being out of work carries with it a higher cost per unit of time, but also a greater return to finding a job to which the worker is well-suited. The difficulty is that although the costs of finding a new job may be higher for a highly skilled, heterogeneous group of workers, the gains from sorting may be larger for this group as well. It is costly to find a good job in the presence of heterogeneity precisely because matching is more important in a heterogeneous environment. The empirical implication is that η is higher and churn lower in jobs that have higher average wages because the cost of moving from one job to another is increasing in the wage.

Higher wage workers may also be more heterogeneous workers so it is necessary to examine the effect of heterogeneity on the benefit from mobility. This relates to the shape of the $f(\varepsilon)$ density, which provides the ingredients for determining the expected gain associated with a move from one job to another. Recall equation (1):

[24] Those with higher time costs will economize on search, but the cost of search still rises with the wage, even if total expenditures on search do not.

(1) $V_i = V + \varepsilon_i$ and $V_j = V + \varepsilon_j$

where ε_i and ε_j are i.i.d. Recall that from (2), a move occurs only when $\varepsilon_i < -\eta$.

The expected gain from a move is therefore $E(V + \varepsilon_j - V - \varepsilon_i \mid \varepsilon_i < -\eta)$, or

(13) Expected gain from move = $E(-\varepsilon_i \mid \varepsilon_i < -\eta)$

because ε_j is independent of ε_i and has an expectation of zero. Eq. (13) can be written as

(14) Expected gain from move = $\frac{1}{F(-\eta)} \int_{-\infty}^{-\eta} -\varepsilon f(\varepsilon) \partial\varepsilon.$

It can be shown that for a number of distributions, the expected gain from a move increases in heterogeneity, appropriately defined. The first task is to show that the expected gain in (14) is increasing in heterogeneity. To do this, the meaning of heterogeneity must be made specific and the distribution must be specified. Suppose that ε is distributed normally, with mean μ and variance σ. Then it is straightforward to show (numerically) that the expected gain defined as in (14) increases in σ for any μ and η. It is also possible to show this analytically for some distributions (e.g., uniform and exponential).[25] Empirically, the prediction is that the positive jump in wages among movers should be greater when the underlying distribution of wages is more disperse. This is testable with the LEHD data, and will be in the next draft of this paper.

More important for the purposes here is determining what happens to churn as the spread in the distribution of ε increases. It is easy to show that under quite general conditions (i.e., well-

[25] The uniform distribution that goes from -d to +d has mean zero and standard deviation $(2d/\sqrt{12})$. As a result, *d* is a sufficient parameter for the standard deviation. The standard deviation of ε and therefore of worker value increases when and only when d increases. For the exponential distribution, $f(x)=1/2d$ for $-d<x<d$ and $f(x)=0$ otherwise, and $F(x)=(½ - x/2d)$. Substituting this into (14) yields the expected gain from move is $(\eta+d)/2$, which is increasing in *d*. The higher the standard deviation in underlying productivity, the greater are the expected gains from moving, given a move.

behaved symmetric distributions), an increase in spread in the distribution also implies an increase in separation probabilities.

To see this, consider a distribution H(ε) where h(0) < f(0) and where there are two crossing points as shown in figure 4. If -η < A, then it is clear that H(-η) > F(-η), which means that separation probabilities are higher with h(x) than with f(x). It is also true that for A < -η < 0, H(-η) > F(-η). This follows from noting that H(0)=F(0) and that f(x)>h(x) for A<x<0. Consequently, separations rise when the spread in the underlying distribution increases.

To the extent that the standard deviation of wages proxies spread as defined here, the implication is that churn should be increasing in the standard deviations of wages. This proposition is testable using the LEHD microdata.

The creation of the wage distribution requires some discussion. The theory has assumed, for simplicity, that all individuals are homogeneous. But when taking the theory to the data, the wage distribution for a teenager is not the same as the wage distribution for a college educated middle-aged person. To account for this heterogeneity, the empirical work assumes that an individual's labor market in a given quarter can be defined by the gender, age, education, industry, and state of that individual. The mean and standard deviation of the wage distribution for a given individual, $\bar{W}$ and sd($\bar{W}$), respectively, are computed in each quarter from the earnings of all individuals with the same gender, age, education, industry, and state.[26]

[26] There are 2 genders, 8 age categories, 4 education categories, 19 industries, and 28 states. Thus 34,048 earnings distributions are created for every quarter in the dataset (1998:Q2 – 2010:Q4). Some technical details warrant mentioning. First, the quarterly earnings microdata have been winsdorized at 99% of the state-year-quarter distribution to control for outliers that do affect the mean and the standard deviation. Second, all earnings measures are in real terms (2010:Q4=100) and in natural logs. And third, only "full quarter earnings" are used in the calculation, where full quarter earnings are those earnings where an individual works for the current employer in both the previous and the following quarter. Since the LEHD measures quarterly earnings but does not measure hours or weeks worked, this full quarter earnings restriction assumes that the individual works for the employer all 13 weeks of the quarter.

The individual's wage W and the standard deviation of its relevant distribution, sd($\overline{W}$), are the key explanatory variables in the job separation regressions. The expectation is that job separation, of which about three-quarters is churn, should be negatively related to the wage level and positively related to the standard deviation. We enter the wage level as two variables, motivated by the simple identity that W = $\overline{W}$ + (W-$\overline{W}$). The first term $\overline{W}$ controls for the heterogeneity of various labor markets (teenagers versus college educated middle aged workers), and the second term (W-$\overline{W}$) controls for where the individual is relative to his peers. We expect both wage levels to have a negative effect on job separation.

Table 7 reports the results. The dependent variable in the linear probability regressions is an indicator if the individual separates from their job in the next quarter.[27,28] The first specification in Table 7 looks at the probability of job separation as a function of demographic characteristics. The results from the LEHD microdata mimic results from the literature: the point estimates show that there is no economically significant difference by gender,[29] younger workers have a higher probability of separating, and less educated persons have a higher probability of separating.

In Table 7, the main results linking back to the theory are clear. There is a clear negative relation of job separation, and thus churn, to the wage. The higher is the time cost of separation, the lower is the likelihood of turnover. There is also a strong likelihood for turnover to rise with

[27] As mentioned in the previous footnote, the data in Table 7 are based on full-quarter earnings data, where the individual works for the same employer for three consecutive quarters and earnings is measured in the middle quarter. This is done because measuring quarterly earnings in the quarter of hire or separation is essentially meaningless – someone may separate in the first week or the thirteenth week of the quarter. Using full quarter data, a separation is measured if the individual leaves the employer in the following quarter.

[28] The job separation regressions in Table 7 use individual-level microdata. If the microdata are aggregated to the labor market level (where labor market refers to the gender, age, education, industry, state, and quarter of the observation), the point estimates of the coefficients are identical. Of course, (W-$\overline{W}$) aggregates to zero and is not included in such a labor-market aggregated regression.

[29] The sample size is 2.9 billion observations, which leads to extremely small standard errors and large t-statistics. The text thus focuses on economic significance, which is measured by the magnitude of the marginal effect relative to the mean.

heterogeneity. The regression results support the view, expressed by the theory, that separations are a function of the costs of and benefits from mobility. As the wage rises, measured by both the average market wage $\overline{W}$ and by the wage of the individual relative to one's peers (W-$\overline{W}$), the cost of turnover rises and separation becomes less common. The regression results also show that as the standard deviation of wages rise, the benefit from turnover rises and is more common. This is consistent with the theory, where job separation is related to the shape of the productivity distribution function F(ε), in that a fatter tail to the distribution implies more churn.

*Business Cycle Estimates of N and N**

The theory also predicts that young workers are the ones who bear the brunt of reductions in employment during recessions. To test this, employment entry and exit rates are created from the LEHD microdata. The employment entry rate in quarter t is defined as the percent of individuals who don't work for any private sector firm in the state for four consecutive quarters, and then begin work in quarter t. The employment exit rate in quarter t is defined as the percent of individuals who are working in quarter t, and then don't work for any private sector firm in the state for four consecutive quarters.[30]

The seasonally adjusted time series of employment entry and exit rates are presented in Figure 5. The two rates average about 2.6 percent per quarter, and the employment entry rate exhibits more time series variation than the employment exit rate. More interesting to the purposes here are the employment entry rates by age in Figure 6. The employment entry rates for young persons aged 16-24 appear to be much more cyclically sensitive than for middle-aged

[30] Restricting to four quarters of non-employment within the state, rather than across states, makes the computational burden much easier; this restriction will be relaxed in the next draft of this paper. The next draft will also contain an analysis of whether the results are sensitive to defining employment entry and exit based upon four consecutive quarters of no work, relative to alternative definitions such as eight or twelve quarters. Population data for the denominator of each rate are national data from www.bls.gov/cps, multiplied by .65 to reflect their use in a 28 state sample.

persons. In the mid-2000s, the percentage of young persons (aged 16-24) entering employment in any given quarter averages 6.5 percent. This falls to 4.4 percent at the end of the 2007-09 recession. This absolute decline of 2.1 percentage points is much greater than for any other age group. When expressed as a relative basis, young workers (aged 16-24) have a 31 percent decline, whereas middle age workers (aged 25-34, 35-44, and 45-54) have declines of 24 to 26 percent.

IV. Conclusion

Most hiring and separations are for the purpose of churn. Using the LEHD microdata, it is estimated that about 3/4 of hiring is for the purpose of replacement. Hiring for expansion and separation for contraction occur in the labor market, but most hiring and separation reflects steady-state mobility, not the growth or decline of businesses. The framework in this paper is one of efficient separations: workers separate and move to better jobs when the benefit of doing so is positive, and firms hire to replace separated workers and lay off workers when the productivity of a new worker, net of hiring costs, exceeds that of the incumbent.

The theory presented here links hiring to separation in a direct way. Using a matching framework, the model predicts that hiring and separation are linked and move together. Labor markets where the cost of turnover is low or the benefits from turnover are high experience more mobility optimally. Workers separate and firms rehire to replace them as a function of the relocation cost and of the benefits from relocating, which depend on the amount of gain from optimal matching.

If churn is the bulk of hiring and separation, then hiring and separation are opposite sides of the same coin. Consequently, hiring and separation should be positively correlated over time in aggregate, within industries over time, and even within establishments over time. On the other hand, if hiring is for expansion and separation for contraction, then the two should be negatively correlated . The data clearly show that hiring and separations move together in the aggregate, within industries, and within establishments.

Additionally, the empirical analysis in this paper shows that both hiring and separation rates are low when the cost of moving from one job to another is high, with the converse being true when the costs of mobility are low. Additionally, when the benefit to relocation is high because the spread in wages is great, theory predicts that mobility will be high. The evidence presented strongly suggests that this is also the case.

The strong positive correlations between hiring and separation rates is evidence supporting the view that separation causes hiring and hiring generates separation. Hiring rates are high when the cost of separation is low and where the benefits from mobility is great. Separation rates are high when it is cheap to rehire and when there are substantial expected gains from replacing incumbents with new workers. The churn view of the labor market seems to be more powerful in explaining cross-section and time series variations than does the expansion-contraction view.

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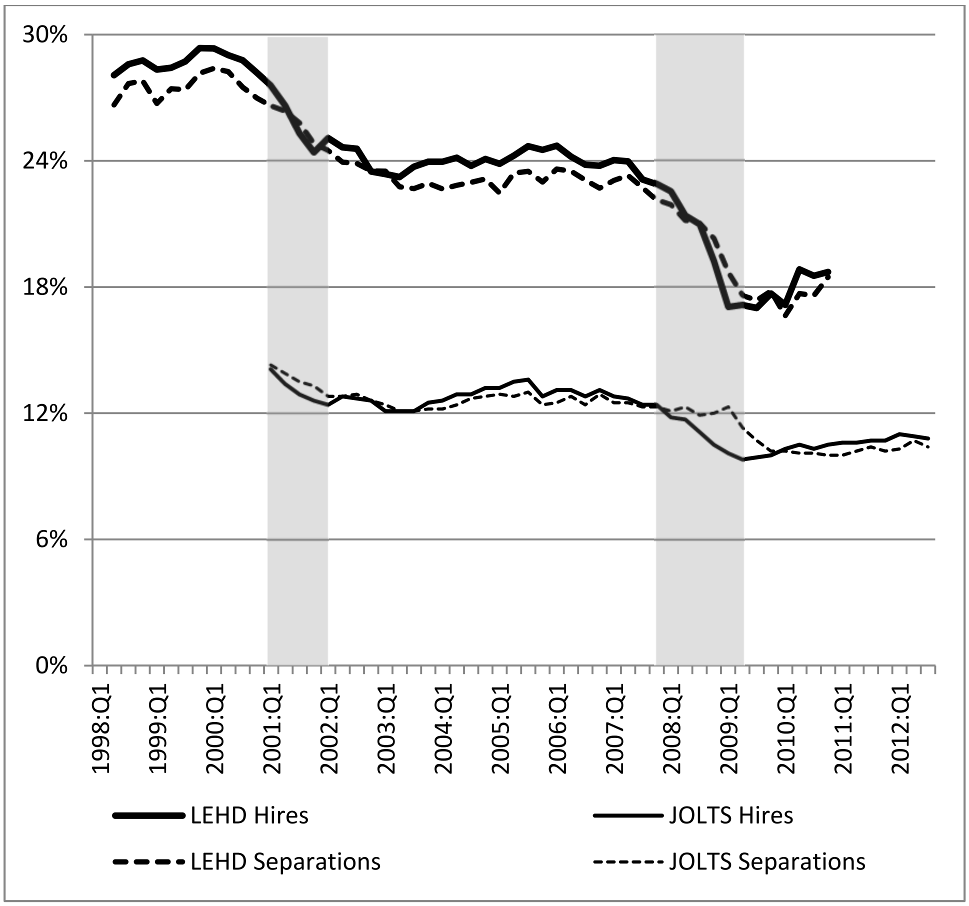
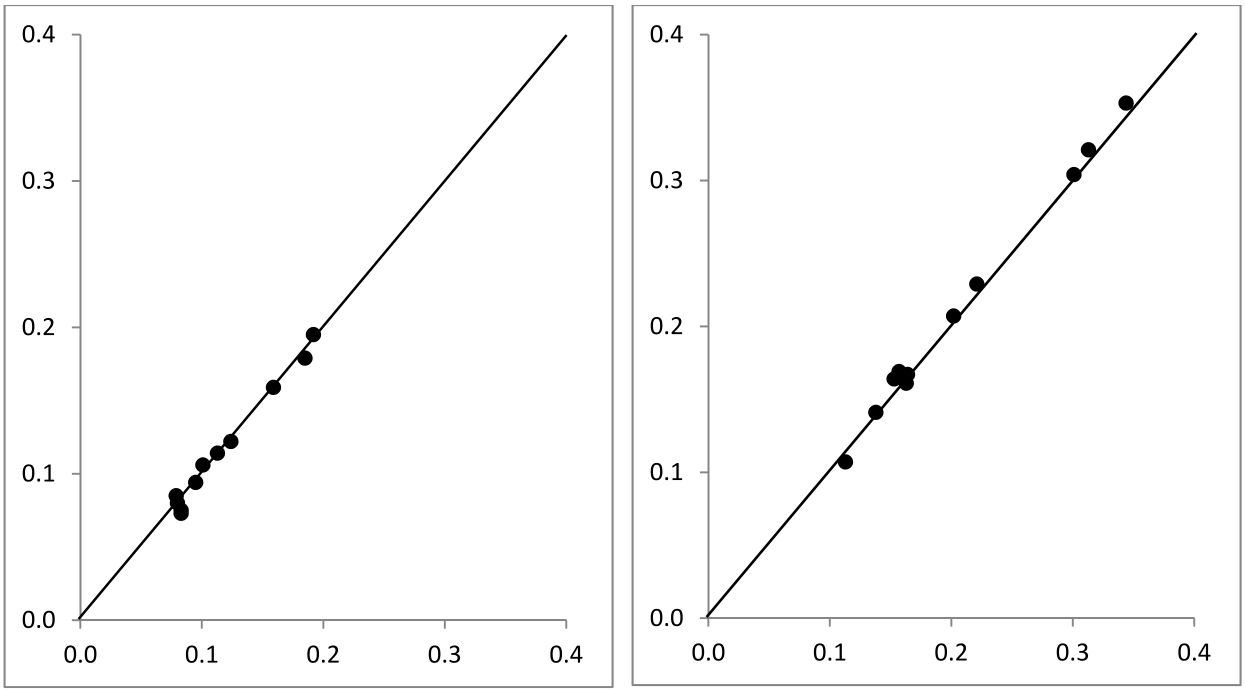
Figure 1: Quarterly Hires and Separations Rates
JOLTS Data, 2001:Q1 – 2012:Q3
LEHD Data, 1998:Q2 – 2010:Q4



JOLTS national data were downloaded from the BLS website and converted to a quarterly frequency.
LEHD data for 30 states were downloaded from the Cornell Virtual RDC.
All data are private sector and seasonally adjusted.

Figure 2: Quarterly Hires and Separations Rates, by Industry
JOLTS Data (left panel), Averages 2001:Q1 – 2010:Q4
LEHD Data (right panel), Averages 2001:Q1 – 2010:Q4



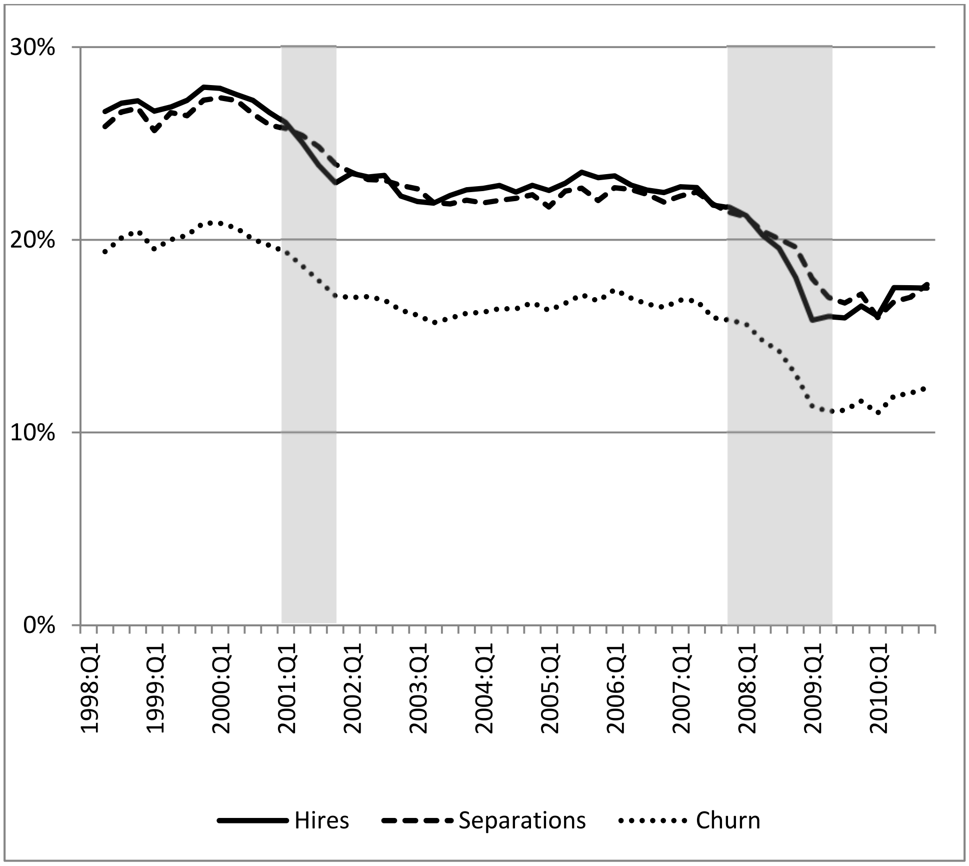
JOLTS national data were downloaded from the BLS website and converted to a quarterly frequency.
LEHD data for 30 states were downloaded from the Cornell Virtual RDC.
All data are private sector and seasonally adjusted.

Table 1: OLS Regressions of Hires Rate on Separation Rate
JOLTS Data, Quarterly, 2001:Q1 – 2010:Q4
LEHD Data, Quarterly, 2001:Q1 – 2010:Q4

	JOLTS			LEHD		
	(1)	(2)	(3)	(4)	(5)	(6)
Coefficient	.9983	.9999	.9054	1.0818	1.0333	1.0491
(Std. Error)	(.1005)	(.0110)	(.0304)	(.0424)	(.0057)	(.0149)
Number of Observations	40	440	440	40	440	440
Fixed Effects: Industry		No	Yes		No	Yes

JOLTS national data were downloaded from the BLS website and converted to a quarterly frequency.
LEHD data for 30 states were downloaded from the Cornell Virtual RDC.
All data are private sector and seasonally adjusted.
All regressions are employment weighted.
Simple OLS standard errors reported.
N=40 represents the number of quarters 2001:Q1 – 2010:Q4.
N=440 represents 11 industries * 40 quarters.

**Figure 3: Quarterly Hires, Separations, and Churn Rates
LEHD Data, 1998:Q2 – 2010:Q4**



LEHD microdata for 28 states, private sector.
Each series is seasonally adjusted.

Table 2: OLS Regressions of Hires Rate on Separation Rate LEHD Data, Quarterly, 1998:Q2 – 2010:Q4

	(1)	(2)	(3)
Coefficient	.9425	.9413	.9259
(Std. Error)	(.0000)	(.0000)	(.0000)
Fixed Effects:			
Industry	No	Yes	
Establishment	No	No	Yes

LEHD microdata for 28 states, private sector.
All regressions are employment weighted.
Simple OLS standard errors reported (not adjusted for clustering).
Sample size is 248,661,653 establishment-quarter observations.

Table 3: Hires, Separations, and Churn Rates, by Industry
LEHD Data, 1998:Q2 – 2010:Q4 Quarterly Averages

	Hires	Separations	Churn	Churn/Hires
Agriculture & Forestry	0.6195	0.6206	0.4505	0.7272
Mining	0.1521	0.1480	0.1001	0.6581
Utilities	0.0615	0.0622	0.0356	0.5789
Construction	0.3000	0.3013	0.2037	0.6790
Manufacturing	0.1081	0.1159	0.0734	0.6790
Wholesale Trade	0.1326	0.1322	0.0836	0.6305
Retail Trade	0.2378	0.2357	0.1791	0.7532
Transport & Warehousing	0.1791	0.1794	0.1285	0.7175
Information	0.1698	0.1717	0.1231	0.7250
Finance & Insurance	0.1138	0.1129	0.0716	0.6292
Real Estate and Rental	0.2018	0.2000	0.1359	0.6734
Prof, Scient, & Tech Services	0.1817	0.1754	0.1124	0.6186
Management of Companies	0.1262	0.1283	0.0929	0.7361
Administrative Services	0.5237	0.5206	0.4340	0.8287
Educational Services	0.2028	0.1929	0.1389	0.6849
Health Care & Social Asst	0.1568	0.1505	0.1124	0.7168
Arts, Entertainment, & Rec	0.3308	0.3258	0.2099	0.6345
Accom and Food Services	0.3591	0.3556	0.2849	0.7934
Other Services	0.2216	0.2169	0.1422	0.6417

LEHD microdata for 28 states, private sector.

Table 4: Hires, Separations, and Churn Rates, by Firm Size
LEHD Data, 1998:Q2 – 2010:Q4 Quarterly Averages

	Hires	Separations	Churn	Churn/Hires
Firm Size <5	0.3123	0.2850	0.1605	0.5139
Firm Size 5-9	0.2546	0.2512	0.1592	0.6253
Firm Size 10-19	0.2500	0.2492	0.1717	0.6868
Firm Size 20-49	0.2492	0.2496	0.1835	0.7364
Firm Size 50-99	0.2415	0.2412	0.1825	0.7557
Firm Size 100-249	0.2338	0.2345	0.1807	0.7729
Firm Size 250-499	0.2367	0.2371	0.1852	0.7824
Firm Size 500-999	0.2254	0.2265	0.1767	0.7839
Firm Size 1000+	0.1936	0.1950	0.1510	0.7800

LEHD microdata for 28 states, private sector.

Table 5: Hires, Separations, and Churn Rates, by Firm Age
LEHD Data, 1998:Q2 – 2010:Q4 Quarterly Averages

	Hires	Separations	Churn	Churn/Hires
Firm Age =0	0.6041	0.3984	0.2926	0.4844
Firm Age =1	0.3851	0.3736	0.2618	0.6798
Firm Age =2	0.3421	0.3432	0.2420	0.7074
Firm Age =3	0.3268	0.3292	0.2344	0.7173
Firm Age =4	0.3099	0.3146	0.2242	0.7235
Firm Age 5-9	0.2873	0.2921	0.2110	0.7344
Firm Age 10-19	0.2521	0.2556	0.1884	0.7473
Firm Age 20+	0.1790	0.1811	0.1348	0.7531

LEHD microdata for 28 states, private sector.

Table 6: Hires, Separations, and Churn Rates
By Deciles of Average Establishment-Level Payroll per Worker
LEHD Data, 1998:Q2 – 2010:Q4 Quarterly Averages

	Hires	Separations	Churn	Churn/Hires
Lowest Earnings Decile	0.3957	0.3948	0.2718	0.6869
2nd Earnings Decile	0.3642	0.3657	0.2785	0.7647
3rd Earnings Decile	0.3356	0.3359	0.2665	0.7941
4th Earnings Decile	0.2816	0.2817	0.2221	0.7887
5th Earnings Decile	0.2379	0.2374	0.1845	0.7755
6th Earnings Decile	0.2061	0.2048	0.1568	0.7608
7th Earnings Decile	0.1785	0.1766	0.1327	0.7434
8th Earnings Decile	0.1638	0.1609	0.1154	0.7045
9th Earnings Decile	0.1668	0.1644	0.1091	0.6541
Highest Earnings Decile	0.2156	0.2131	0.1302	0.6039

LEHD microdata for 28 states, private sector.
Deciles are defined in each quarter from the industry distribution of (Payroll/Employment).

Figure 4: Two Hypothetical Wage Densities

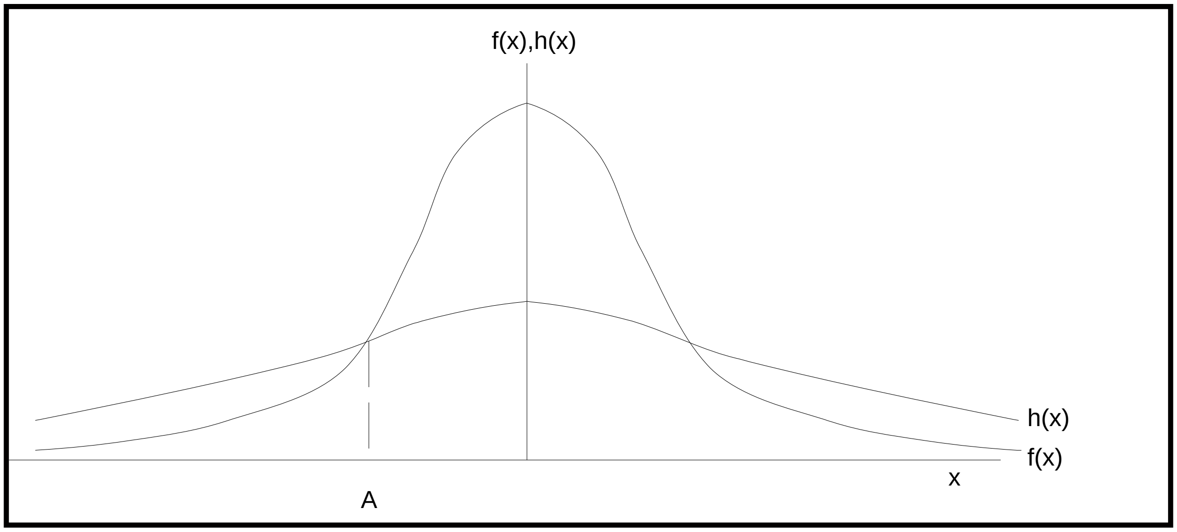
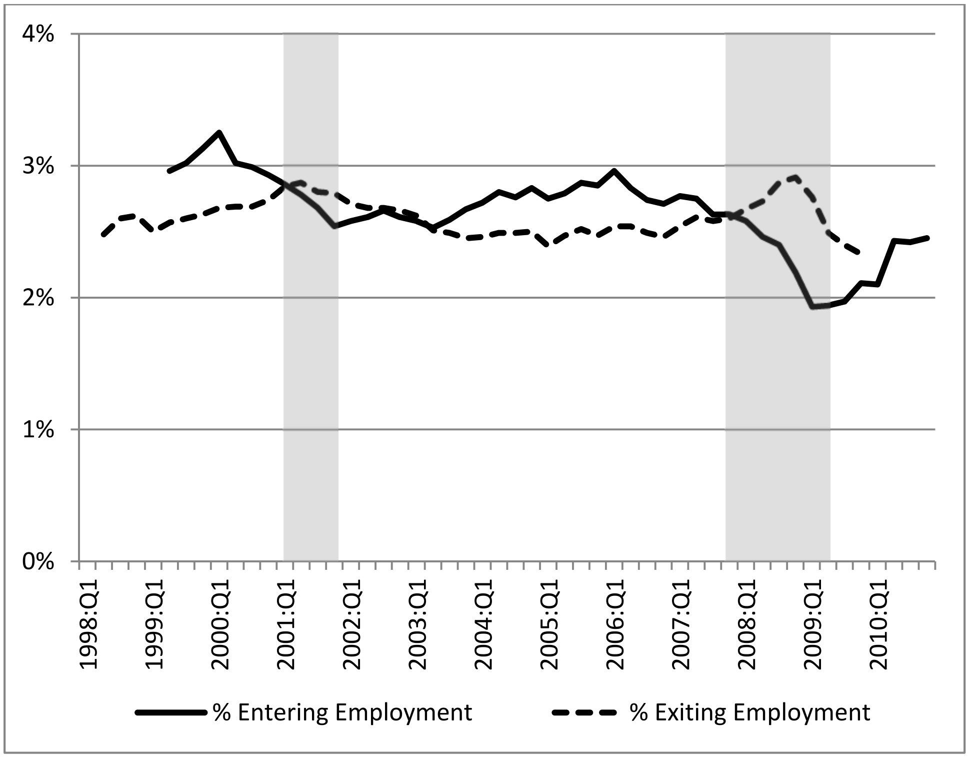


Table 7: Job Separation Regressions
LEHD "Full Quarter" Data, 1998:Q3 – 2010:Q3

	Mean	(1)	(2)	(3)	(4)	(5)	(6)
Female	.4747	-.0001					-.0010
		(.0000)					(.0000)
Age 14-18	.0286	.1422					.1420
		(.0000)					(.0000)
Age 19-21	.0483	.1159					.1160
		(.0000)					(.0000)
Age 22-24	.0591	.0777					.0814
		(.0000)					(.0000)
Age 25-34	.2229	.0303					.0331
		(.0000)					(.0000)
Age 45-54	.2261	-.0155					-.0157
		(.0000)					(.0000)
Age 55-64	.1196	-.0160					-.0187
		(.0000)					(.0000)
Age 65-99	.0360	.0078					-.0055
		(.0000)					(.0000)
Education <HS	.1399	.0273					.0369
		(.0000)					(.0000)
Education HS graduate	.2786	.0116					.0187
		(.0000)					(.0000)
Education some college	.3158	.0074					.0117
		(.0000)					(.0000)
$\bar{W}$	9.972		-.0160		-.0160	-.0161	.0016
	(1.024)		(.0000)		(.0000)	(.0000)	(.0000)
$(W - \bar{W})$	0.000			-.0391	-.0391	-.0391	-.0391
	(0.962)			(.0000)	(.0000)	(.0000)	(.0000)
$sd(\bar{W})$	0.931					.0470	.0643
	(0.242)					(.0000)	(.0000)
R-Squared		.0169	.0025	.0133	.0159	.0171	.0324

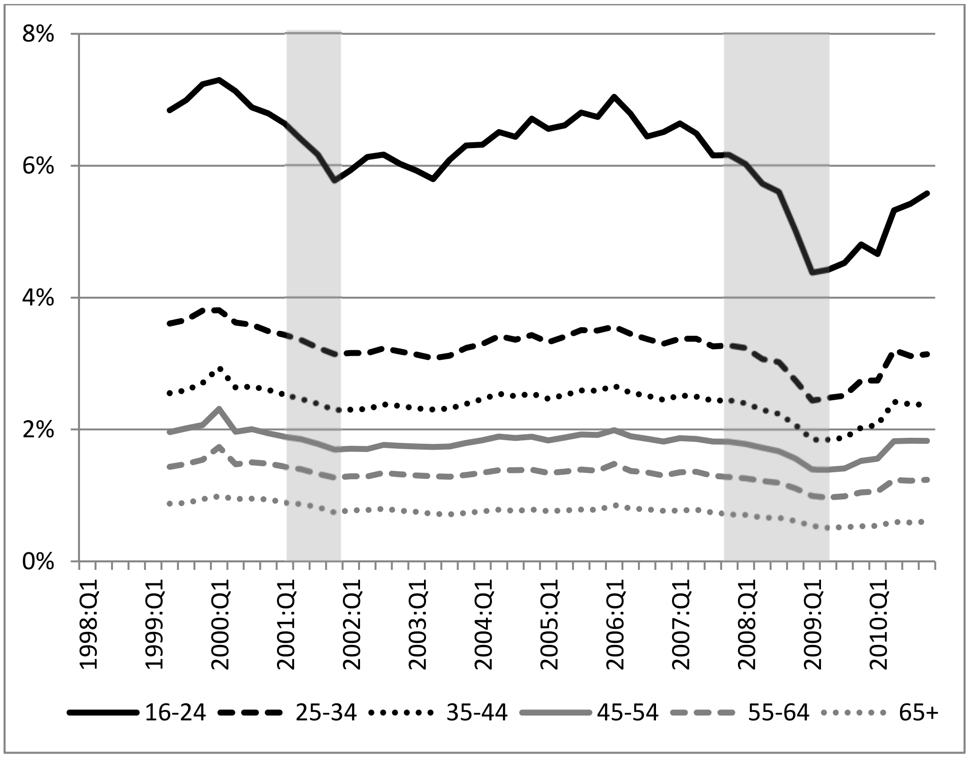
LEHD data from 28 states, private sector.
Linear probability regressions. Simple OLS standard errors in parentheses.
The dependent variable is 1 if individual leaves the full quarter job next quarter, 0 if stays; mean=.1205.
Sample size is 2.9 billion observations (approx 58 million full quarter jobs each quarter; 1998:Q3 – 2010:Q4).
The omitted demographic groups are male, age 35-44, and education college or greater.
$\bar{W}$ is defined in the text.

Figure 5: Quarterly Employment Entry and Exit Rates, by Age
LEHD Data, 1998:Q2 – 2010:Q4



LEHD microdata for 28 states, private sector.
Each series is seasonally adjusted.
Entry and exit rates are defined in the text.

Figure 6: Quarterly Employment Entry Rates, by Age
LEHD Data, 1998:Q2 – 2010:Q4



LEHD microdata for 28 states, private sector.
Each series is seasonally adjusted.
Entry rates are defined in the text.