Hires and Separations as Two Sides of the Same Coin

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Abstract

Hiring largely reflects churn, where workers separate and are replaced by an equal number of others. Hiring occurs to fill vacant slots or, equivalently, separation occurs to move workers to better alternatives. A model of efficient separations yields several testable predictions. Churn is most likely when wages are low and the variance in wages is high. Additionally, churn, which accounts for the majority of hiring, decreases during recessions, hires and separations are correlated over time, and hires fall at the beginning of recessions, with separations declining later to match hiring. These predictions are borne out in the LEHD microdata.
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 analysis 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 Longitudinal Employer Household Dynamics (LEHD) reveal that almost three-quarters of hiring and of separation reflects churn, not expansion nor contraction. 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 separates when the expected value of alternatives elsewhere exceeds 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

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1 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. Lazear and Spletzer (2012) document the variation over the business cycle.
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.

The emphasis here differs from earlier work in two respects. First, much of the focus is on providing theory that links hiring to separation. Second, using establishment-level data on hiring and separation, the theory is tested and applied across establishments and firms and over time. Variation in the costs of and benefits from worker mobility is the key driver.

Let us begin with a few basic facts from the published Job Openings and Labor Turnover Survey (JOLTS) data. During 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 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. 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. But the majority of hiring and separation appears to be churn, not expansion or contraction.

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2 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.

3 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.
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.\footnote{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.}

In what follows, a theory of churn is presented and contrasted with expansion/contraction hiring that results from demand or supply shocks. The main theoretical results are that hires and separations are positively correlated, and both are related to the level and variation in wages. The theory also implies that churn is procyclical, which is one of the main findings of Lazear and Spletzer (2012), that hires lead separations during recessions, and that decreases in employment during recessions are borne disproportionately by young workers. These predictions are confirmed with the LEHD data, as well as the primary finding that churn accounts for a large fraction of hiring and separations, even at the level of the establishment or firm.

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.\footnote{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.} 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 separation 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.

Each firm faces the same distribution of worker productivity. 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

$$V_i = V + \varepsilon_i \quad \text{and} \quad V_j = V + \varepsilon_j$$

where $\varepsilon_i$ and $\varepsilon_j$ are i.i.d., each being governed by the density functions and distribution functions $f(\varepsilon)$ and $F(\varepsilon)$, respectively.\(^6\)

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 $\varepsilon_i$ and $\varepsilon_j$ are i.i.d. When the worker is middle-aged, he receives one and only one offer from another firm, j.

\(^6\) 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.
Let the cost of hiring be given by $\eta$. Efficient separation\(^7\) 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

\begin{equation}
V + \varepsilon_i < E(V_j) - \eta.
\end{equation}

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

\begin{equation}
\varepsilon_i < -\eta.
\end{equation}

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 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

\begin{equation}
S = N (1 + F(-\eta)).
\end{equation}

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

\begin{equation}
H = N (1 + F(-\eta)) = S.
\end{equation}

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\(^7\) This structure derives from the basic matching model, first set out in Jovanovic (1979).
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 \( \eta \) and in \( F(\varepsilon) \) that drive both.

It follows immediately from equation (4) that

\[ \frac{\partial H}{\partial \eta} = \frac{\partial S}{\partial \eta} = -N f(-\eta) \]

which is negative. An increase in the cost of hiring, \( \eta \), 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, roughly 75 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, \( \eta \), and on the shape of the productivity distribution function, \( F(\varepsilon) \). Individuals or firms with a high \( \eta \) 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 \( N F(-\eta) \), the shape of the productivity distribution \( F(\varepsilon) \) also determines mobility. As discussed in more detail in the empirical section, a fatter lower tail to the distribution implies more churn.\(^8\)

\textit{Labor Market Structure}

The existence of a turnover cost, \( \eta \), 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

\(^8\) The efficient separations model and the resulting separation probability \( F(-\eta) \) are not new, but novel here is a focus on how the distribution of productivity affects the probability of separation.
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 $V - \eta > V + \epsilon_i$ or that $\epsilon_i < -\eta$ 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 $\epsilon_i < -\eta$. The maximum wage that the current firm can pay is $V + \epsilon_i$. 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 $V - \eta > V + \epsilon_i$, which is the same as whenever $-\eta > \epsilon_i$. But if $-\eta > \epsilon_i$, 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.\(^9\)

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**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

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\(^9\) This result also holds in the presence of bargaining. The productivity of a given middle aged worker is $V + \epsilon_i$, but the alternative firm can offer at most $V - \eta$. Consequently, allowing $\lambda$ 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 $\lambda (V + \epsilon_i) + (1 - \lambda) (V - \eta)$, or

Wage of a stayer $= V - \eta + \lambda (\epsilon_i + \eta)$. Workers who stay at their job have $\epsilon_i > -\eta$, 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.
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,\(^\text{10}\) or if\(^\text{11}\)

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

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

$$
V + E(\varepsilon | \varepsilon > -\eta)
$$
as an older worker and $V - \eta$ as a young worker. There is a $F(-\eta)$ probability that the worker moves to a different firm, bearing hiring costs and receiving wage $V - \eta$ as an older worker. Write

$$
V^* \equiv V + E(\varepsilon | \varepsilon > -\eta)
$$

Then the entry condition can be written as

$$
A < \frac{1}{2} (V - \eta + V^*) (1 - F(-\eta)) + (V - \eta) F(-\eta)
$$

so

$$
G[\frac{1}{2} (V - \eta + V^*) (1 - F(-\eta)) + (V - \eta) F(-\eta)]
$$

\(^{10}\) 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 $A$ depreciates 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 examines the age pattern of the entering and exiting cohorts across the business cycle.

\(^{11}\) For simplicity of notation, it is assumed that all rents go to the worker.
is the probability that a person enters the labor force.

To be consistent with the previous analysis,

\[ N = \text{(Cohort size)} \left( G\left( \frac{1}{2} (V - \eta + V^*) (1 - F(\eta)) + (V - \eta) F(\eta) \right) \right) \]

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

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

\[ V^* \equiv V^* + E(\varepsilon | \varepsilon > -\eta), \]

the new number of entrants to the labor market is

\[ N^* = \text{(Cohort size)} \left( G\left( \frac{1}{2} (V^* - \eta + V^{*\eta}) (1 - F(\eta)) + (V^* - \eta) F(\eta) \right) \right). \]

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

\[ N - N^* = \text{(Cohort size)} \left( G\left( \frac{1}{2} (V - \eta + V^*) (1 - F(\eta)) + (V - \eta) F(\eta) \right) - \right. \]

\[ \left. G\left( \frac{1}{2} (V^* - \eta + V^{*\eta}) (1 - F(\eta)) + (V^* - \eta) F(\eta) \right) \right). \]

\(^{12}\) The decrease in the value of each worker from \( V \) to \( V^* \) does not change the separation probability \( F(-\eta) \) for middle aged workers. A middle aged worker changes jobs if \( V^* + \varepsilon_i < V^* - \eta \), which is the efficient separation equation (2).
What happens to hires and separations during the recession? The economy requires several periods to transition from the initial level of employment of 2N to the new level of employment of 2N*. 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

\[(7) \quad \text{Hires during initial recession period} = N^* + F(-\eta)N.\]

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

\[(8) \quad \text{Hires during recession equilibrium} = N^* (1 + F(-\eta)).\]

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

\[(9) \quad \text{Separations during initial recession period} = N(1 + F(-\eta)).\]

After final adjustment, separations equal\(^{13}\)

\[(10) \quad \text{Separations during recession equilibrium} = N^* (1 + F(-\eta)).\]

The dynamics of hires and separations from the pre-recessionary levels to the levels that occur during the recession are shown in Figure 1. The time series pattern shows separations exceeding hires during the transition into recession, which is necessary for employment to decline from 2N to 2N*.\(^{14}\) The time series pattern in Figure 1 resembles that of the hires and separations published from the JOLTS data during the 2007-2009 recession (see Chart 3 of

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

\(^{14}\) The net employment change in each transition period is hires minus separations equal to N*-N.
Churn hiring occurs when a firm hires to replace a separating worker. Churn at the level of the firm is the minimum of hires and separations by that firm. In this model, for the economy as a whole, churn during the initial recession period is

\[(11) \text{ Churn during initial recession period} = N^* + F(-\eta)N.\]

During all subsequent recession periods, the level of churn is

\[(12) \text{ Churn during other recession periods} = N^*(1 + F(-\eta)).\]

Churn hiring declines when the economy goes from normal times to recession, from the level that prevails during normal times given by equation (4), to the interim level given by equation (11) to the new lower level in the low demand state, 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) and Figure 1, which is drawn to reflect them, provide a number of implications that are consistent with the facts. First, as mentioned above, churn is procyclical, falling from \(N(1+F(-\eta))\) during normal times (eq. 4) to \(N^*(1+F(-\eta))\) during recessions (eq. 12). 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 the recessionary
equilibrium, both hires and separations equal \( N^*(1 + \frac{F(-\eta)}{N}) \) 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 the recessionary equilibrium, 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 necessary for employment to decline during the recession. Again, this is consistent with the LEHD data as shown below, as well as consistent with the published JOLTS data.

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 shows large declines in the employment-to-population ratios for young workers relative to older workers during recessions. The empirical section below explicitly tests this using employment inflow and outflow rates calculated from the LEHD microdata.

Additional implications of the model can be checked using JOLTS and LEHD data. There is no unemployment in this framework so there are no implications for changes in unemployment over the business cycle. In this structure, unemployment takes the form of reduced labor force participation so it is more natural to look at the employment rate, which is defined as the proportion working relative to the working-age population, or
Employment Rate = \frac{N}{\text{(cohort size)}} \quad \text{during normal times}
\quad = \frac{N^*}{\text{(cohort size)}} \quad \text{during recessions}

Because N^* < N, the employment rate falls during recessions. This is consistent with the evidence for all recessions for which data are available.

It is also possible to examine the hires and separation rates. The lack of unemployment in the model means that the hires and separations defined relative to the working population remains constant, which is counterfactual. The data show that both hires and separation rates decline during recessions. There is a sense in which the hiring and separation rates fall during recessions. Because all unemployment works through changes in the number in the labor force, an alternative is to define the hires and separation rates relative to the working age population. Done this way, the model does fit the facts, predicting that both decline in recessions. Defining Population Hiring Rate as \frac{\text{Hires}}{\text{Number in the working age population}},

\begin{align*}
\text{(14)} \quad \text{Population Hires Rate} &= \frac{N(1 + F(-\eta))}{2 \text{(cohort size)}} \quad \text{during normal times} \\
&= \frac{N^*(1 + F(-\eta))}{2 \text{(cohort size)}} \quad \text{during recessions}
\end{align*}

which is lower during recessions because N^* < N. Similarly, the Population Separation Rate

\begin{align*}
\text{(15)} \quad \text{Population Separation Rate} &= \frac{N(1 + F(-\eta))}{2 \text{(cohort size)}} \quad \text{during normal times} \\
&= \frac{N^*(1 + F(-\eta))}{2 \text{(cohort size)}} \quad \text{during recessions}
\end{align*}

also falls during recessions, which is observed in both datasets.
II. Hires, Separations, and Churn

The empirical analysis begins with an examination of published hires and separations data. There are two sources of hires and separations data in the U.S.: 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 are available 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.

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 the worker (age, gender, 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. The analysis in this section uses quarterly measures of hires and separations downloaded from the Census Bureau website (http://ledextract.ces.census.gov/). 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 data from the 30 states that have data available from 1998:Q2 through 2011:Q4.15

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15 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. These 30 states account for about 65 percent of national employment.
Figure 2 presents the seasonally adjusted time series of quarterly hires and separations from the JOLTS and the LEHD. The levels of hires and separations are clearly different across the two data sources, and all series exhibit a secular decline over the last 15 years, but these are not serious concerns for the analysis here. The different levels and trends in the two data sources likely reflect the many short-duration jobs that are present in administrative data but not present in survey data. Hyatt and Spletzer (2013a) document that 40 percent of hires and separations in the LEHD in 1998:Q4 are person-firm matches that last less than one quarter. Analysis of the earnings data in the LEHD suggests that many of these short-duration jobs are quite short, with durations measured in days rather than weeks. The 40 percent statistic for 1998:Q4 falls to 33 percent in 2010:Q3, and this decline accounts for 53 percent of the twelve year decline of the LEHD hires and separations rates evident in Figure 2.

Important for an analysis of churn is the strong positive correlation that is evident in Figure 2 between hires and separations in both data sources. During the time period 2001:Q1 through 2011:Q4, the correlation between the LEHD hires and separations measures in Figure 2 is .974, and the correlation for the JOLTS measures is .857. The correlation is higher in the LEHD than in the JOLTS as a consequence of differences in the two series during the 2007-09 recession.

One of the implications of the theory is that hires and separations move together over the business cycle. During normal times, both hires and separations equal N(1+F(-η)) from equation

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16 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](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.

17 This raises the interesting question of why short-duration jobs in the U.S. economy have declined so dramatically during the past 10-15 years. Ongoing work documented in Hyatt and Spletzer (2013b) has not yet revealed any simple explanations.

18 During this recession, the LEHD hires and separations are both falling (with hires falling faster than separations), whereas the JOLTS hires are falling yet the JOLTS separations are initially constant before falling. When recession quarters are removed from the data, the JOLTS correlation jumps from .857 to .946.
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. The validity of each of these theoretical predictions is borne out by Figure 2. Both hires and separations are higher during normal times than during recessions. Furthermore, as the theory predicts, separations exceed hires as the recession begins, but fall to the lower level of hires as the recession ends.

What is true in the aggregate time series is also true across industries. Figure 3 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. 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 that each industry has its eleven-year average hires rate approximately equal to its eleven-year average separations rate.

Table 1 reports the industry-specific average quarterly hires and separations rates from Figure 3, and also reports the industry-specific time series correlation between hires and separations from both the JOLTS and the LEHD public use data. It is evident that hires and separations are positively correlated within each industry in each data source. Seven of the twelve industries in the JOLTS have a correlation greater than .8, and the other five industries have a positive correlation. In the LEHD, ten of the twelve industries have a correlation above .8, and the other two have a correlation greater than .5. These correlations provide evidence on

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19 The public use JOLTS and LEHD data are aggregated to 12 industries: Mining, Construction, Manufacturing, Wholesale Trade, 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 – 2011:Q4.
the importance of industry-level churn. The churn model implies a positive correlation between hiring and separation within industries. When an industry is experiencing high separation rates, it tends to hire more workers to replace them. 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, labor in industries that are shrinking should be taken up by industries that are growing. 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 within industries. The industry version of the expansion/contraction view is clearly not supported in the published industry-level data as table 1 shows. Indeed, the industry level conclusion was established years ago by Davis, Haltiwanger, and Schuh (1996), who showed that more than 90 percent of job reallocation is within 4-digit manufacturing industries rather than across industries.

The evidence in Table 1 and Figure 2 shows that the hires rates and the separations rates are highly positively correlated within industries. However, access to the underlying microdata is necessary to examine the whether this correlation measures reallocation of labor across businesses within industries or whether this correlation measures churn within businesses.

*Establishment-Level Hires, Separations, and Churn*
The empirical analysis continues 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, respectively. 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 $S$ 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 ($H^G_E$). 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 decrease 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 separations to decrease employment in the business ($S^D_C$) is the same as job destruction. For example, seven workers may be separated and five may be hired. Then replacement separations, $S^R_C$, would equal five and job destruction would equal two.
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 $H - S = H^G_E - S^D_C$. Note that churn plays no role in determining the magnitude of net employment growth.

Evidence from the LEHD Microdata

Figure 4 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. In the quarters following the 2007-2009 recession, 69 percent of quarterly hiring is churn.

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20 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, Davis, Faberman, and Haltiwanger (2012) estimate that 50 percent of hiring is churn, and Lazear and Spletzer (2012) find that 65 percent of hiring is churn. Although
During the mid 2000s, the churn-to-separations ratio from the LEHD data is 74 percent. This number is almost identical to the churn-to-hires ratio, which is not surprising given that total hires essentially equal total separations – see Figure 4. 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 as a result replacement hiring declines. The recessionary declines in hires and churn 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 11.2 percent. These statistics imply that the decline in churn during the 2007-09 recession accounts for 82 percent of the decline in hires.

Figure 4 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 used in Table 2 has over 276 million establishment-quarter observations (roughly five million establishments in each of the 55 quarters 1998:Q2 – 2011:Q4). The first specification in Table 2 estimates a simple one-variable regression of the establishment-level hires rate on the.

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the estimates of the churn-to-hires ratio differ across datasets and even within datasets, the literature agrees that churn is important.
establishment-level separations rate. The coefficient is .9372 (with an estimated standard error of .00002). This estimated coefficient declines only slightly when controls are added for time (column 2) and for industry (column 3). These results state that neither the secular decline in hires and separations evident in Figure 2 nor the inherent differences between high-turnover industries and low-turnover industries evident in Figure 3 change the conclusion that an establishment’s hires rate is positively related to its separations rate. The specification in column (4) of Table 2 speaks most directly to the importance of churn at the establishment level. Column (4) includes establishment fixed effects. The estimated coefficient in this specification is .9172, which implies 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. This is strong evidence for the presence and importance of establishment level churn.

III. 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 separation rates. Conversely, anything that increases 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 provide data on hiring or separation costs. It is not even clear how those numbers would be defined. The time cost associated with job search is likely to be a major component of turnover costs, which implies that high wage workers face larger turnover costs than low wage
ones for any given amount of time spent looking for a job. The empirical implication is that $\eta$ is higher and mobility lower in jobs that have higher average wages because the cost of moving from one job to another is increasing in the wage.

The issue is more complex because there may be a correlation between $\eta$, 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.

Consequently, it is useful to examine the effect of heterogeneity on the benefit from mobility. Heterogeneity 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):

\begin{equation}
V_i = V + \varepsilon_i \quad \text{and} \quad V_j = V + \varepsilon_j
\end{equation}

where $\varepsilon_i$ and $\varepsilon_j$ are i.i.d. Also, from (2), a move occurs only when $\varepsilon_i < - \eta$. If workers receive all the rents from the match, then the change in and productivity for movers is given by the expected gain from a move, which is $E(V + \varepsilon_j - V - \varepsilon_i | \varepsilon_i < - \eta) - \eta$, or

\begin{enumerate}
\item 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.
\item This assumption is not essential. The qualitative implications of what follows is invariant to having the rents shared in some given proportion between workers and firms.
\end{enumerate}
(16) Expected gain from move = \( \mathbb{E}(\varepsilon_i \mid \varepsilon_i < -\eta) - \eta \)

or equivalently,

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

because \( \varepsilon_j \) is independent of \( \varepsilon_i \) and has an expectation of zero. It is easy to show that under quite general conditions (i.e., well-behaved symmetric distributions), an increase in spread in the distribution also implies an increase in separation probabilities.

To see this, consider a distribution \( H(\varepsilon) \) where \( h(x^*) < f(x^*) \) and where there are two crossing points as shown in Figure 5. Thus, a distribution with higher spread is defined as one for which the height of the density function at zero is lower and for which the value of the cdfs are equal at \( x^* \). (For example, normal and uniform distributions with different variance, but the same mean satisfy the conditions.) Let \( A \) denote the value of the lower crossing point so that \( h(A) = f(A) \), \( F(A) < F(x^*) \) and \( H(A) < H(x^*) \). If \(-\eta < A\), then it is clear that \( H(-\eta) > F(-\eta) \), which means that separation probabilities are higher with \( h(x) \) than with \( f(x) \). It is also true that for \( A < -\eta < x^* \), \( H(-\eta) > F(-\eta) \). This follows from noting that \( H(x^*) = F(x^*) \) and that \( f(x) > h(x) \) for \( A < x < x^* \). 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. The creation of the wage distribution for use in the empirical work requires some discussion. The theory has assumed, for simplicity, that all individuals are homogeneous. But when taking the theory to the data, the relevant group for which homogeneity can be assumed must be defined more precisely.
For example, the wage distribution for teenagers is not the same as the wage distribution for college educated middle-aged persons. To account for these differences, 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. This stratification generates 36,480 different cells each quarter, and each cell is allowed to have its own wage distribution. The mean and standard deviation of the wage distribution for a given cell, $W_c$ and $SD_c$, respectively, are created in each quarter from the quarterly earnings of all individuals with the same gender, age group, education, industry, and state.\(^{23}\)

There are two interpretations of the model that influence the empirical work. The model can be viewed from the perspective of the individual – a worker separates when the alternative wage, net of moving costs, is higher than the wage that is received at the current firm. This occurs when $\epsilon_i < -\eta$. Workers are defined by their labor markets, which is the gender-age-education-industry-state specific cell. The alternative interpretation is at the firm level. Firms separate workers and hire a new worker to replace the separated one when the expected value of the new worker, net of hiring costs, exceeds the productivity of the incumbent. This occurs when $\epsilon_i < -\eta$, which is the same condition. Consequently, the empirical analysis is done at the worker level and also at the firm level.

The worker level regressions take a labor market, i.e., a cell, as the unit of analysis. The theory predicts that cells with a low mean wage and a high standard deviation of wages should

\(^{23}\) There are 2 genders, 8 age groups, 4 education categories, 19 industries, and 30 states. Thus 36,480 earnings distributions are created for every quarter in the dataset (1998:Q2 – 2011:Q4). Some technical details warrant mentioning. First, the quarterly earnings microdata have been winsorized 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 (2011:Q4=100) and in natural logs. And third, only “full quarter earnings” are used in the calculation, where full quarter earnings are the quarterly earnings for an individual who works for the current employer in both the previous and the following quarter. The LEHD does not have measures of hours or weeks worked, and this full quarter earnings restriction assumes that the individual works for the employer all 13 weeks of the quarter.
experience the highest turnover because the representative worker in that cell has low costs of search and higher change in value from moving.

The firm level regressions speak more directly to the issue of churn, which can be defined only at the firm level. If hiring and separation is primarily for replacement, then understanding churn is central. The firm-based regression determine how churn (in addition to hiring and separation) vary with the costs and benefits of efficient sorting of workers.

*Worker-based Job Separation Regressions*

The mean and the standard deviation of the individual’s relevant wage distribution, $W_c$ and $SD_c$, are the key explanatory variables in the job separation regressions. The prediction of the theory is that job separation should be negatively related to the wage level and positively related to the standard deviation. Ignoring time subscripts, the regression is

$$S_i = W_{c(i)}\beta 1 + SD_{c(i)}\beta 2 + X_i\alpha + \mu_i$$

where $S_i$ is a \{0,1\} indicator for whether the individual separates from a full-quarter job, $W_{c(i)}$ and $SD_{c(i)}$ are the mean and standard deviation of individual i’s relevant wage distribution, and $X_i$ is a vector of explanatory variables.

Table 3 reports the results from job separation regressions. Workers younger than 25 or older than 64 are excluded from the sample. There are about one-million observations in this quarter-worker cell data set. All specifications include year and quarter dummies to control for the secular decline in separations.

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24 Restricting to age 25-64 drops the sample of individual-quarter observations to 2.59 billion. There are potentially 966,720 labor markets, or cells, in this sample: 2 genders, 4 age groups, 4 education categories, 19 industries, 30 states, and 53 quarters of “full quarter” data (1998:Q3 – 2011:Q3). The average cell has 2685 individuals.
In Table 3, the main results linking back to the theory are clear. There is a strong 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 heterogeneity. The fatter is the distribution of wages in an individual’s relevant labor market, the more likely the individual is to separate from his or her current job. 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, \( W_{c(i)} \), rises, the cost of turnover rises and separation becomes less common. Additionally, and less easily explained by other theories, is that as the standard deviation of wages rise, the benefit from turnover rises and turnover is more common.

The estimated effects are large. The mean of the full quarter separation rate is .1046. Using the column (3) estimates, a one standard deviation increase in the average market wage reduces expected turnover by .0174 (\(.0359 \times .485\)), which is about 17% of the average turnover rate. A one standard deviation increase in the standard deviation of the wage of the cell in which the worker is situated increases turnover by .0061, which is about 6% of the average turnover rate.

*Firm Turnover Regressions*

Formally, the model is firm-based. In it, the firm hires one worker of a given ex ante type. Indeed, churn is a concept that makes sense only at the firm level, where workers are hired to replace separating workers. Because of the stylized model structure, there is no explicit need to consider ex ante worker heterogeneity, although nothing requires that the firm hire only one type of worker.
For empirical implementation, however, it is necessary to define the firm’s “representative” worker in order to obtain predictions for each firm’s churn. Workers differ within firms both for observable reasons (lawyers and janitors in the same firm) and unobservable reasons (match quality). Empirically, the observable component can be estimated. This requires two steps.

First, for each of the firm’s workers, there is a corresponding cell (of the 36,480) from which the worker was drawn. The cell to which the worker belongs defines the worker’s “type” which provides a mean wage and standard deviation of wages for that worker.\textsuperscript{25} Then, simply by aggregating over all workers in the firm, it is possible to define the firm’s “typical” worker’s wage mean and standard deviation.

Second, using subscript $j$ to index employers, the firm-level regression is specified as

$$Y_j = W_{c(j)} \beta_1 + SD_{c(j)} \beta_2 + X_j \alpha + \mu_j$$

where $Y_j$ is the separation rate in firm $j$, the hire rate in firm $j$, or the churn rate in firm $j$. $W_{c(j)}$ is the mean market wage averaged over all individuals in the firm, and $SD_{c(j)}$ is the standard deviation of the market wage averaged over all individuals in the firm.

The firm-level regressions are estimated from a sample of 184.9 million firm-quarter observations, which is approximately 3.5 million firms each quarter. Only individuals aged 25-64 were used when calculating the firm-level variables. Results are presented in Table 4, using hires, separations, and churn as the dependent variable.

The results are all consistent with the theoretical predictions and with those obtained in Table 3. Firms that have a typical worker with a higher mean wage have lower separation rates,

\textsuperscript{25} Our future plans are to also use the measure of match effects as in Card, Heining, and Kline (2013) and Lazear, Shaw, and Stanton (2012).
hiring rates, and churn rates. As expected, higher turnover costs result in less turnover. Additionally, firms that employ workers who come from labor markets with higher wage variation have greater separation, hiring, and churn rates. This finding is also consistent with the model. To the extent that wage variation in the market measures, or is at least related to, the variation in firm-worker match effects, churn should be more common in firms where match effects are more important.

These results from the firm-level regressions largely mimic the results from the individual-level regressions. Also of note in Table 4 is that the regression coefficients in the hiring rate regression are very similar to those in the separation rate regression. This is not surprising since hiring and separation rates are so highly correlated, even at the firm level. The effect of costs and benefits of turnover is significant and economically meaningful. A one standard deviation increase in the firm mean wage results in about a 1 ½ percentage point decrease in churn, which is about one-fourth of the overall churn rate. Additionally, a one-standard deviation increase in the standard deviation of firm wage results in a .27 percentage point increase in churn, which is about one-twentieth of the overall churn rate. The latter effect reflects the importance of heterogeneity in worker-firm productivity and addresses the value of efficient sorting. The former effect is directly related to the cost of transitioning from one job to another, which is higher for high wage workers. Consequently, firms that employ the higher wage workers engage in less churn.

Employment Entry and Exit Rates Over the Business Cycle

The model 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 do not 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 do not work for any private sector firm in the state for the next four consecutive quarters.\(^{26}\)

The seasonally adjusted time series of employment entry and exit rates are presented in Figure 6. The two rates average about 2.6 percent per quarter, and both entry and exit rates exhibit cyclical movement. The entry rates by age, shown in Figure 7, are more interesting for the purposes here. The employment entry rates for young persons aged 16-24 appear to be much more cyclically sensitive than those for middle-aged 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 greater than for any other age group. When expressed as a relative basis, young workers (aged 16-24) have a 31 percent decline in entry rates during recessions, whereas middle age workers (aged 25-34, 35-44, and 45-54) have declines of 24 to 26 percent.

**Conclusion**

Most hiring and separations are for the purpose of churn. Using the LEHD microdata, it is estimated that about 3/4 of quarterly 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

\(^{26}\) Restricting to four quarters of non-employment within the state, rather than across states, makes the computational burden much easier. Population data for the denominator of each rate are national data from [www.bls.gov/cps](http://www.bls.gov/cps), multiplied by .65 to reflect their use in a 30 state sample.
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 an efficient separation framework, the model predicts that hiring and separation move together. 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. The data clearly show that hiring and separations move together in the aggregate, within industries, and especially within establishments. The model also predicts that as a recession takes hold, hires fall before or by more than separations, which is borne out by both the JOLTS and LEHD data.

The wage level and standard deviation of wage within a labor market cell (defined by gender, age, education, industry, and location) are used as empirical proxies for the cost and benefits of turnover. The results show that as predicted, higher turnover costs are associated with lower hire, separation and churn rates, whereas higher benefits to turnover are associated with larger hire, separation and churn rates.

The strong positive correlation between hiring and separation rates is consistent with the view that separation and hiring reflect the same economic factors. The churn view of the labor market seems to be powerful in explaining cross-section and time series variations in both hiring and separation.
References


Means and Standard Deviations, LEHD Data

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<th>Table 2 (emp weighted)</th>
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Figure 1: Hires and Separations During a Recession
Equations (7) – (10) of the Model

\[ N(1 + F(-\eta)) \]

\[ N^*(1 + F(-\eta)) \]
JOLTS national data were downloaded from the BLS website and converted to a quarterly frequency. LEHD data for 30 states were downloaded from the Census Bureau website. All data are private sector and seasonally adjusted.
Figure 3: Quarterly Hires and Separations Rates, by Industry
JOLTS Data (left panel), Averages 2001:Q1 – 2011:Q4
LEHD Data (right panel), Averages 2001:Q1 – 2011: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 Census Bureau website.
Average hires rate on the horizontal axis; average separations rate on the vertical axis.
All data are private sector and seasonally adjusted.
Table 1: Quarterly Hires and Separations Rates, by Industry
JOLTS Data, Quarterly, 2001:Q1 – 2011:Q4
LEHD Data, Quarterly, 2001:Q1 – 2011:Q4

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<td>Retail Trade</td>
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<td>.137</td>
</tr>
<tr>
<td>Transport, Warehouse</td>
<td>.094</td>
<td>.094</td>
</tr>
<tr>
<td>Information</td>
<td>.074</td>
<td>.082</td>
</tr>
<tr>
<td>Financial Activities</td>
<td>.078</td>
<td>.078</td>
</tr>
<tr>
<td>Prof &amp; Bus Services</td>
<td>.158</td>
<td>.157</td>
</tr>
<tr>
<td>Educ &amp; Health Serv</td>
<td>.084</td>
<td>.078</td>
</tr>
<tr>
<td>Leis &amp; Hosp Services</td>
<td>.192</td>
<td>.189</td>
</tr>
<tr>
<td>Other Services</td>
<td>.114</td>
<td>.113</td>
</tr>
<tr>
<td>Total</td>
<td>.120</td>
<td>.120</td>
</tr>
</tbody>
</table>

JOLTS national data were downloaded from the BLS website and converted to a quarterly frequency.
LEHD data for 30 states were downloaded from the Census Bureau website.
All data are private sector and seasonally adjusted.
LEHD microdata for 30 states, private sector.
Each series is seasonally adjusted.
Table 2: OLS Regressions of Hires Rate on Separation Rate  
LEHD Data, Quarterly, 1998:Q2 – 2011:Q4

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.0155</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Std. Error)</td>
<td>0.0000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coefficient</td>
<td>0.9372</td>
<td>0.9372</td>
<td>0.9359</td>
<td>0.9172</td>
</tr>
<tr>
<td>(Std. Error)</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>Fixed Effects:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year-Quarter</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Industry</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Establishment</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>R-Squared</td>
<td>0.8746</td>
<td>0.8748</td>
<td>0.8747</td>
<td></td>
</tr>
</tbody>
</table>

LEHD microdata for 30 states, private sector.
All regressions are employment weighted.
Simple OLS standard errors reported.
Sample size is 276,352,702 establishment-quarter observations.
Figure 5: Two Hypothetical Wage Densities
### Table 3: Job Separation Regressions
**LEHD Full Quarter Data, 1998:Q3 – 2010:Q3**

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>.4191</td>
<td>.3848</td>
<td>.5521</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.0008)</td>
<td>(.0009)</td>
<td>(.0012)</td>
<td></td>
</tr>
<tr>
<td>$W_{c(i)}$</td>
<td>9.056</td>
<td>-.0378</td>
<td>-.0356</td>
<td>-.0359</td>
</tr>
<tr>
<td></td>
<td>(0.485)</td>
<td>(.0001)</td>
<td>(.0001)</td>
<td>(.001)</td>
</tr>
<tr>
<td>$SD_{c(i)}$</td>
<td>0.814</td>
<td>.0164</td>
<td>.0297</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.206)</td>
<td>(.0002)</td>
<td>(.0002)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>.4694</td>
<td></td>
<td>-0.0169</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(.0001)</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>42.36</td>
<td></td>
<td>-.0061</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(10.25)</td>
<td></td>
<td>(.0000)</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>13.50</td>
<td></td>
<td>-.0003</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2.01)</td>
<td></td>
<td>(.0000)</td>
<td></td>
</tr>
<tr>
<td>R-Squared</td>
<td>.2611</td>
<td>.2656</td>
<td>.4167</td>
<td></td>
</tr>
</tbody>
</table>

LEHD data from 30 states, private sector, individuals aged 25-64. The sample size is 964,938 State, Year-Quarter, Industry, Age Group, Gender, & Education cells.

Weighted OLS regressions. The dependent variable is the cell mean of the \{0,1\} indicator of whether an individual leaves the full quarter job next quarter; weighted mean=.1046.

Simple OLS standard errors in parentheses.

All specifications include year and quarter dummies. The specification with age also includes age squared (coefficient not reported).

The variables $W_{c(i)}$ and $SD_{c(i)}$ are defined in the text.
### Table 4: Hires, Separations, and Churn Regressions

<table>
<thead>
<tr>
<th></th>
<th>(1) Separation Rate</th>
<th>(2) Separation Rate</th>
<th>(3) Hiring Rate</th>
<th>(4) Churn Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>.5063 (.0003)</td>
<td>.4705 (.0004)</td>
<td>.4725 (.0004)</td>
<td>.3715 (.0002)</td>
</tr>
<tr>
<td>$W_{c(j)}$</td>
<td>9.056 (.402)</td>
<td>-.0474 (.0000)</td>
<td>-.0446 (.0000)</td>
<td>-.0444 (.0000)</td>
</tr>
<tr>
<td>$SD_{c(j)}$</td>
<td>0.814 (.187)</td>
<td>.0121 (.0001)</td>
<td>.0211 (.0001)</td>
<td>.0146 (.0000)</td>
</tr>
<tr>
<td>R-Squared</td>
<td>.0187</td>
<td>.0188</td>
<td>.0178</td>
<td>.0432</td>
</tr>
</tbody>
</table>

LEHD data from 30 states, private sector, individuals aged 25-64. The sample size is 184,891,430 firm-level observations (approximately 3.5 million firms each quarter).

Weighted OLS regressions. The dependent variable in columns 1-2 is the full quarter separation rate in the firm; weighted mean=.1046. The dependent variable in column 3 is the full quarter hire rate in the firm; weighted mean=.1036. The dependent variable in column 4 is the full quarter churn rate in the firm; weighted mean=.0555. Simple OLS standard errors in parentheses.

All specifications include year and quarter dummies.

The variables $W_{c(j)}$ and $SD_{c(j)}$ are defined in the text.
LEHD microdata, private sector.
Each series is seasonally adjusted.
Entry and exit rates are defined in the text.
Figure 7: Quarterly Employment Entry Rates, by Age
LEHD Data, 1998:Q2 – 2010:Q4

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