Cyclical Reallocation of Workers Across Employers by Firm Size and Firm Wage*

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Abstract

Several recent papers have proposed dynamic search-and-matching models where larger, higher-paying firms grow faster in expansions by poaching workers away from smaller, lower-paying firms. These models imply more cyclically sensitive employment growth at large employers, as well as a cyclical job ladder where on-the-job search increases reallocation of workers from lower-paying to higher-paying employers in economic expansions. Our contribution to this literature is the use of linked employer-employee data for the U.S., to provide direct evidence on worker reallocation over the business cycle and see if worker flows are consistent with the predictions of this model. We find strong evidence of pro-cyclical worker churn from job-to-job moves across all firm types, but the implications for net employment reallocation differ depending on whether we focus on firm size or firm wage. Net employment reallocation across firm size classes via job-to-job flows is small and relatively stable across the business cycle, with differences in cyclicality of small vs. large firms coming from nonemployment flows. However, job-to-job flows do reallocate workers from lower-paying to higher-paying firms, and this reallocation of workers from low-paying to high-paying employers is highly procyclical.

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1 Introduction

Models of on-the-job search generally make a natural assumption about "poaching" in the labor market: employers offering higher wages induce workers to leave lower paying jobs and accept their employment offers. This assumption is consistent with empirical evidence that changing employers is associated with strong earnings gains.[1] A related prediction of these models is that, since larger businesses offer higher wages, voluntary job moves should generally reallocate workers from smaller to larger employers. These predictions regarding the patterns of poaching have necessarily been informed by only limited empirical evidence, as there is little empirical data on job-to-job flows by firm size and firm wage.[2]

In this paper, we provide direct empirical evidence on the reallocation of workers across employers by firm size and by firm wage, using newly available data on job-to-job flows for the United States. The motivation for our analysis is the literature on on-the-job search, which consists largely of labor market wage posting models, beginning with Burdett and Mortensen (1998).[3] In their seminal model, more productive businesses post higher wages, attracting and retaining more workers than less productive, lower-paying firms.[4] When a higher-paying firm makes an offer to a worker at a lower-paying firm, the worker leaves their employer to join the new firm. Workers do not all move to the highest-paying firm due to search frictions; offers arrive stochastically, and there is an exogenous separation rate. This model establishes a theoretical basis for the empirical phenomenon documented by Brown and Medoff (1989) that larger businesses pay higher wages. The model also implies that smaller firms largely hire from the pool of unemployed, as they lose workers via poaching while not being able to offer sufficiently high wages to poach themselves.

Burdett and Mortensen (1998) limit their analysis to the consideration of the steady-state of their wage posting model. However, recent papers by Moscarini and Postel-Vinay (2009,

[1] See, among others, Topel and Ward (1992), Keith and McWilliams (1999), Bjelland et al. (2011), Hyatt and McEntarfer (2012b), and Fallick, Haltiwanger, and McEntarfer (2012).

[2] Movements between employers are also called "employer-to-employer flows" by some authors. In this paper, we will refer to such movements as "job-to-job flows."

[3] These include Coles (2001), Postel-Vinay and Robin (2002), van den Berg (2003), Christensen et al. (2006), Cahuc, Postel-Vinay, and Robin (2006), Moscarini and Postel-Vinay (2009, 2010, 2013, 2014), Coles and Mortensen (2012), Lise and Robin (2013), and Bagger et al. (2014).

[4] Note that the Burdett and Mortensen (1998) framework generates firm size and wage dispersion for ex ante identical firms and workers, and so larger firms offer higher wages even in the absence of any productivity differences for employers.

2010, 2013, 2014) propose dynamic versions of Burdett and Mortensen that include predictions about employment dynamics by firm size and wage. These models are motivated by an empirical finding in Moscarini and Postel-Vinay (2009, 2012) that large firms have more cyclically sensitive employment. In their model, firms have a technology that generates output that is linear in employment, and a firm's rank order in the productivity distribution is fixed, but fluctuates with changes in aggregate productivity. Their model predicts that larger, higher paying firms engage in more intensive poaching of workers from smaller, lower paying firms in times of low unemployment. Because smaller, lower paying firms rely more on the unemployed for recruiting purposes, they are more constrained in their ability to grow in times of low unemployment.[5] Through this poaching mechanism, they derive the prediction that employment at large, high wage businesses is more sensitive to the state of the cycle than the employment at small, low wage businesses.[6] They test this hypothesis by examining fluctuations in net employment growth at large vs. small firms in the Business Dynamics Statistics.

Our main contribution to this literature is the use of linked employer-employee data to test the implications of these models for the reallocation of workers across firms directly. We find that some core aspects of the Burdett and Mortensen (1998) model hold up fairly well when taken to the data. Larger and higher paying businesses poach a majority share of their hires from other firms, while smaller, lower paying businesses rely more on the pool of nonemployed for new workers. That poaching of workers from other firms increases in expansions and falls in recessions is also found to be true for all firm size and firm wage classes.

The core of our analysis builds on a decomposition of net employment growth (overall or by firm size or firm wage class) into net poaching from other firms and net hires from non-employment. Using this decomposition, we find the prediction that on-the-job search generally reallocates workers from small firms to large is not supported by the data. Instead, we find only a very small amount of employment on net is reallocated across smaller and larger employers via

[5] It is important to note that Moscarini and Postel-Vinay (2013) include vacancy posting as an extension of their core model, and this extension is what they estimate in Moscarini and Postel-Vinay (2014). This drives a wedge between recruiting flows from nonemployment for large and small businesses, allowing a larger business to, realistically, have more flows from nonemployment than a smaller one.

[6] Moscarini and Postel-Vinay's (2009, 2012) finding that large businesses are more cyclically sensitive than small businesses stands in contrast to such studies as Gertler and Gilchrist (1994) and Sharpe (1994), who articulated the now conventional wisdom that small firms are more cyclically sensitive because they are more likely to be credit constrained in economic contractions. Fort et al. (2013) present evidence on this for young businesses. The latter paper also emphasizes that this result is potentially sensitive to the choice of the cyclical indicator. We find this to be true in our analysis as well.

job-to-job moves and that it is in the wrong direction. In other words, rather than contributing to employment growth at large firms, large employers actually lose a small percentage of workers on net via worker moves to smaller firms. This apparent contradiction, that large firms both poach more workers than smaller firms yet on net lose workers through poaching, is partly explained by the strong tendency of firms to poach workers from firms within their own size class. So while large firms poach extensively, increasing poaching intensity in booms, they are mostly poaching workers from other large firms.

Because large employers ability to offer higher wages drives worker reallocation in the model, we also examine worker flows by average firm pay. In contrast to our results for size, here we find strong evidence that job-to-job moves reallocate workers from lower paying to higher paying firms. High wage firms experience net employment gains from job-to-job flows, and this net reallocation increases in expansions and declines in recessions. The opposite is true for low-wage employers, who experience much higher worker separations to better paying firms in booms. That worker reallocation has different patterns across wage classes than size classes suggests that the tight relationship between employer size and wages in the theoretical model may not hold in the data.

When we examine worker reallocation over the business cycle, we do find, consistent with Moscarini and Postel-Vinay (2012), that net employment growth responds to the difference of the unemployment rate from its Hodrick-Prescott (HP) trend more for large businesses than for small. But it is the differential pattern of net hires from non-employment across large and small employers that primarily accounts for this pattern. In contrast, we find that net employment growth for high wage firms is substantially greater in times of low unemployment compared to low wage firms. Moreover, it is net poaching away from low wage to high wage firms that is highly procyclical that accounts for most of this pattern.

Our results also highlight that in terms of differential cyclicality of net employment it is important to distinguish between different phases of the cycle. During times of economic contractions (which we capture by times of rising unemployment), small and low wage employers exhibit a greater decline in net hires from non-employment. High wage employers experience a greater decline in net poaching in economic contractions. In contrast, large employers experience a smaller decline in net poaching in economic contractions. In early stages of a recovery when unemployment remains high, large firms experience a slower recovery than small firms in terms of net poaching hires and net hires from non-employment with the latter being especially important. In such periods, net poaching hires from high wage firms remain low. Finally, later in a recovery when unemployment is low, high wage firms exhibit rapid net employment growth relative to low wage firms via net poaching.

These results together suggest that the tight parallel predictions of these models in terms of both firm size and firm wage are not supported by the data. The predictions of the theories in terms of firm wage are strongly supported by the evidence while the predictions in terms of firm size are not. To help reconcile these findings, we consider a number of extensions to our analysis. First, we show that while there is a strong employer size wage effect in the data, most of the variation in wages across firms is not accounted for by firm size effects. While this likely reflects the many sources of heterogeneity outside the scope of the models under consideration, it is still striking that the predictions of the theory holds up so well by firm wage but not firm size. Second, we consider alternative specifications to attempt to "rescue" the firm size predictions. We find that if we control for firm age as well as firm size that the predictions of the theory are more strongly supported but not to the same extent as the results by firm wage.[7] We also consider using relative measures of firm size within an industry and find this has little impact on the results.

As will become evident, the use of quarterly wage record administrative data implies some challenges in terms of the empirical decomposition of net employment growth into the net hires from poaching and net hires from non-employment. To address these challenges, we use a number of alternative definitions of job-to-job flows. We find our results our robust to these alternatives.

The paper proceeds as follows. We begin by discussing the implications of the Burdett and Mortensen (1998) model for how firms of different sizes and different wages obtain their workers, and how these hiring rates respond to labor market conditions. Next, we describe the data we use to identify flows of workers across employers. We then decompose net employment growth by poaching flows versus flows from and to nonemployment using the alternative approaches described above. We show how the patterns differ starkly by firm size vs. firm wage. We then conduct a series of sensitivity analyses. A brief conclusion follows.

[7] These results suggest an important avenue for extending the Burdett and Mortensen (1998) model is the inclusion of business entry, as in Coles and Mortensen (2012).

2 Conceptual Underpinnings

The Burdett and Mortensen (1998) model is a natural starting point for considering how job-to-job flows might reallocate workers across employers. This is a model of on-the-job search where profit-maximizing firms make offers to continuously lived agents, who accept any wage higher than their current one. Its equilibrium is quite useful for explaining wage dispersion, as it generates wage dispersion even for *ex ante* identical firms and workers.

In what follows, we sketch out a simplified version of the Burdett and Mortensen (1998) model, basically following Manning's (2003) simplified version. There is a unit measure of workers in the economy, who have a non-work option that provides utility b, and profit-maximizing firms offer some wage w. We make the standard assumption that no firm offers a wage such that it provides a worker with utility $u(w) < b$. There is a distribution of wages across firms $F(w)$, and $G(w)$ is the distribution of wages across workers. There is job separation: employed and nonemployed workers receive offers randomly at rate λ, which are equally likely to come from any firm (note that we have not introduced vacancy posting into this framework). Employed workers leave to nonemployment at rate δ, and the share of workers nonemployed is the unemployment rate u.

From this framework, we can write down exact formulations of hires from nonemployment and employment, as well as separations to nonemployment and other employers. The rate at which employees separate to nonemployment has already been defined as δ, and is proportional to employment, both for the economy as a whole, and for any particular employer. The rate q at which an firm's employees quit their jobs because they have received a better wage offer is simply the offer arrival rate λ multiplied by the fraction of businesses that pay a higher wage, or

$$q(w; F) = \lambda(1 - F(w)). \tag{1}$$

And so the rate at which employees separate from a given firm is simply $\delta + q(w; F)$. The number of workers any given firm hires from unemployment is simply the rate at which it makes offers multiplied by the number of unemployed:

$$E = \lambda u \tag{2}$$

Finally, the poaching inflows for a given firm are simply the offer arrival rate multiplied by the number of workers employed at other firms that pay a lower wage, or

$$P(w; F) = \lambda(1-u)G(w; F). \quad (3)$$

Because, in steady state equilibrium, inflows must equal outflows, we can derive equilibrium employment N (and hence the implied size distribution across firms) by comparing the number of its inflows to the rate of its separations, or

$$N(w; F) = \frac{E + P(w; F)}{\delta + q(w; F)}. \quad (4)$$

This model is quite tractable, and produces a steady-state equilibrium with many interesting implications, the formal demonstration of which we show in Appendix A. First, this model implies that higher-paying firms are larger. This is the most well-known implication of the Burdett and Mortensen model, and is consistent with the evidence presented by Brown and Medoff (1989), Haltiwanger et al. (2012), and others that workers at larger firms earn higher wages. Second, the model implies higher turnover at smaller, lower wage businesses. That is, as a share of employment, hire and separation rates are greater as a fraction of their steady-state employment are higher at smaller, lower wage businesses than larger, higher wage business.[8] The intuition for this result is that all businesses that post low wages have more of their workers poached, which increases this component of their separation rates. Hire and separation rates must balance in equilibrium, so lower wage (smaller) firms have higher overall turnover. We recently confirmed the higher turnover rate of smaller firms in an earlier paper (Haltiwanger et al., 2012).

Third, the model predicts the shares of hires that come from nonemployment are higher at smaller, low wage businesses than at larger firms. This is because, by assumption, the flow of hires from nonemployment are the same for every business, regardless of size or wage.[9] However, when businesses make wage offers (recall that this is a model of random, rather than directed,

[8]Moscarini and Postel-Vinay (2009, 2014) provide some evidence on the share of hires from other employers (vs. nonemployment) at large firms is higher than at small firms during economic expansions, using data from the Survey of Income and Program Participation. We find a level difference that changes only in degree over the business cycle.

[9]This aspect of the Burdett and Mortensen (1998) model is, of course, relaxed in extensions that allow for costly vacancy posting.

search), larger, high wage businesses have more of their offers accepted than small, low wage businesses. Fourth, there is a "firm size/wage job ladder." That is, over the course of a worker's employment spell, the worker moves from lower wage businesses that are smaller to higher wage firms that are larger. This implication of the Burdett and Mortensen (1998) model is given considerable attention by Moscarini and Postel-Vinay (2014).

Of particular interest for our analysis is the dynamic implications of this type of model with changes in economic conditions, as has been explored in a series of papers by Moscarini and Postel-Vinay (2009, 2010, 2012, 2013, 2014). We especially are indebted to their formal development of a version of Burdett and Mortensen (1998) with a stochastic economic environment, which is presented in its most complete form in Moscarini Postel-Vinay (2013). They show that the long-run steady state in the absence of aggregate shocks converges to the size distribution in a standard Burdett and Mortensen (1998) model (analogous to the implied size distribution in our equation (4)). The rather daunting challenge that this recent work accomplishes is to characterize the search equilibrium for this type of model where there are stochastic shocks in the economic environment (e.g., aggregate shocks to productivity). To do so, they develop what they term a Rank Preserving Equilibrium, and introduce the assumption that firms offer contracts that specify wages under any economic condition. The resulting Markov Perfect Nash Equilibrium is rank preserving in that a firm's position in the wage and size distribution never changes, and it is the firms that are higher in the productivity distribution who are larger and offer a higher wage. When economic conditions change, firm sizes move toward the new long-run steady-state, but each firm maintains its firm size rank order. As an extension, they also then add vacancy posting, which allows them to endogenize the job offer arrival rate, and this enhanced version of the model is what they calibrate in Moscarini and Postel-Vinay (2014).

The main empirical implication of this model is that the net employment growth of large firms will be more cyclically sensitive than that of small firms. A corollary prediction is this increased cyclical sensitivity is driven by the increase in job-to-job flows from small to large firms during times of economic expansions. We note that all of these predictions by firm size have analogous predictions for firm wages. We take both the firm size and firm wage predictions to the data. In Appendix A, we trace through the comparative statics of equation (4) to help provide some additional guidance about the underlying mechanisms.[10]

[10]We consider the relative responsiveness of small and large firms to changes in the arrival rate of offers λ

Before turning to our empirical work, we should note some limitations of the core Burdett and Mortensen (1998) framework and the subsequent literature that are relevant as the predictions are taken to the data. Perhaps the most apparent limitation is that the theoretical and empirical relationship between size, wages and productivity is complex. As we have noted, some of the predictions regarding poaching flows across firms of different sizes and wages from this class of models hold even if there are no differences in productivity across firms. But empirical evidence has found large differences in productivity across firms within the same industry, that such differences in productivity are closely related to the size and wages of firms, but that the several factors may drive wedges in the relationship between size, wages and productivity (see Syverson (2011) for a recent survey of the literature).

Other factors potentially also drive a wedge in the predictions about the reallocation of workers across employer size and employer wage. One such factor is that firms exhibit rich life cycle dynamics. Firms are born small and then exhibit an up or out dynamic that takes some time to unfold.[11] This pattern suggests there are young firms that may be highly productive but small. Such firms are on their way to becoming large but that process takes time for reasons relating to learning, adjustment costs, building a customer base or other frictions.[12] Productivity differences at the firm level are persistent but firms are subject to a continuous and substantial variance of new productivity shocks.[13] Those with positive shocks expand while those with negative shocks contract or exit but this process takes time. Another factor that may play a role is that size differences across firms in different industries may reflect differences in technology and market segmentation. In the analysis that follows, we take these factors into account.

A last issue we will discuss is which measure of cyclicality is most appropriate when taking the theory to the data. As we show later in the paper, many of the results on differential cyclicality are sensitive to the cyclical measure used. In their empirical analysis, Moscarini and

and the rate at which workers exit to nonemployment δ. Appropriate caution is required in interpreting the implications of such comparative static predictions but we think they help provide some helpful insights on the role of poaching as the mechanism relevant in this context. Readers should also note that the unemployment rate, which will be our cyclical indicator, is an endogenous variable in Burdett and Mortensen (1998), but the unemployment rate has a straightforward relationship with the offer arrival rate and the rate at which workers separate to nonemployment, which are exogenous.

[11] See, e.g., Haltiwanger, Jarmin and Miranda (2013).

[12] See, among others, Jovanovic (1982), Dunne, Roberts, and Samuelson (1989), Foster, Haltiwanger and Syverson (2013), and Dinlersoz, Greenwood, and Hyatt (2014)

[13] See Foster, Haltiwanger and Syverson (2008).

Postel-Vinay (2012) use the deviation of unemployment rates from HP trends as the indicator of cyclicality. Their argument is that this measure corresponds closely to the theory which focuses on measures of tightness of the labor market. For testing this class of hypotheses this may be a reasonable argument. But the literature on differential cyclicality of firms by firm characteristic use alternative cyclical indicators. Even for this class of hypotheses, we think that testing the poaching hypotheses that it is useful to explore patterns over different phases of the cycle. Moscarini and Postel-Vinay (2012) (hereafter we often refer to this paper as MPV (2012)) provide motivation for this when they provide the intuition for their hypotheses. They argue (see pages 2512-2513 in particular) that large firms should increase employment more in late stages of expansions through poaching but then also state that this implies that when an economy enters a downturn large firms have more employment to shed. Thus, in what follows we use alternative cyclical indictors to compare and contrast employment dynamics by firm size, firm wage and firm age to capture periods of economic contractions and expansions vs. periods where the economy is above or below trend.

3 Data

We use linked employer-employee data from the LEHD program at the U.S. Census Bureau to examine the flows of worker across firms. The LEHD data consist of quarterly worker-level earnings submitted by employers for the administration of state unemployment insurance (UI) benefit programs, linked to establishment-level data collected for the Quarterly Census of Employment and Wages (QCEW) program. As of this writing, all 50 states, DC, Puerto Rico, and the Virgin Islands share QCEW and UI wage data with the LEHD program as part of the Local Employment Dynamics (LED) federal-state partnership. LEHD data coverage is quite broad; state UI covers 95% of private sector employment, as well as state and local government.[14] The unit of observation in the UI wage data is the state-level employer identification number (SEIN). SEINs typically capture the activity of a firm within a state in a specific industry.

The LEHD data allow us to decompose employment growth by worker hires and separations. A chief contribution of this paper is we show that net employment growth can be further decomposed by hires and separations due to a job-to-job flow (what we call equivalently call a

[14]For a full description of the LEHD data, see Abowd et al. (2009).

poaching flow) and hires and separations from nonemployment. To accomplish this decomposition, we longitudinally link workers' job histories across firms using the approach described in Hyatt and McEntarfer (2012b). This approach links the main job in each quarter of an individual worker's employment history. When a worker separates from a job and begins work at a new job within a short time period, we classify it as a job-to-job flow. Transitions between jobs which involve longer spells of nonemployment are classified as flows to and from nonemployment.

A challenge for the identification of job-to-job flows in the LEHD data is that the administrative data do not provide enough information to identify why a worker left one job and began another. We only have quarterly earnings, from which we infer approximately when workers left and began jobs. Although information on precise start and end dates would be helpful, it would be insufficient to identify voluntary flows between jobs since workers switching employers may take a break between their last day on one job and their first day on a new job. To be certain that our main results are not sensitive to the rules we use to differentiate job-to-job flows from nonemployment flows in the LEHD data, we use several different approaches for defining a hire/separation pair as a job-to-job flow or a flow from a longer nonemployment spell.

The most conservative approach we take is to identify a job hire or separation as part of a job-to-job flow only when the separation from a former main job and accession to a new main job occur in the same quarter. As shown in Hyatt and McEntarfer (2012), these flows are highly procyclical and are associated with strong earnings gains, making them likely candidates for job-to-job flows. Our most liberal approach is to pool these within quarter job-to-job flows together with job transitions where the new main job begins in the quarter after the previous main job separation. This approach has the advantage that the measured hires and separations to/from nonemployment necessarily involve a full quarter spell of nonemployment. This permits us to quantify the contribution of hires and separations to/from at least one full quarter of nonemployment. The disadvantage of the second approach is that the measured job-to-job flows are more likely to involve spells of nonemployment that are above and beyond those associated with taking a break between jobs.

The third approach we consider is a hybid approach using information about the earnings dynamics around the time of the transition from one job to another to identify job-to-job flows. Since we observe total quarterly earnings from all jobs, we use this information to detect whether there is evidence of a significant earnings gap during the period of transition. If we detect an earnings gap consistent with less than one month of time between jobs, we identify this as a job-to-job flow. In practice, we implement this earnings threshold approach as follows. A within quarter transition is classified as a job-to-job flow if the total earnings in all jobs in the quarter of the transition is at least 2/3 of the average total earnings on all jobs in the quarter prior and the quarter after the transition. The 2/3 threshold is chosen to permit short spells of up to one month (1/3 of a quarter) to occur between jobs and still to identify the transition as a job-to-job flow. In a similar fashion for an adjacent quarter transition from t to $t+1$, we identify it as a job-to-job flow if the sum of earnings in t and $t+1$ is at least 5/6 of the sum of earnings in $t-1$ and $t+2$. The use of 5/6 as the threshold in this case is also consistent with permitting a 1 month spell of non-employment over the two quarters of transition (1 month out of the 6 months). The earnings threshold approach is not without its own limitations but it does incorporate additional useful information not captured in the first two approaches which simply use the presence of positive earnings to identify flows. In what follows, we call this the no significant earnings gap approach (or no earnings gap for short).

A fourth approach we consider is to use the methods that have been developed to adjust flow measures constructed from observations at discrete intervals to implied continuous time flows. Strong assumptions are required for the interpretation of such adjustments (specifically constant hazard rates within quarters) but we think this is still instructive.

In what follows, we show that our findings are robust to these four alternative approaches. As such, while we present and discuss results using all four approaches, the tables and figures in the text focus on results using the second and third approaches. Results using alternative approaches are discussed in the text with many of the details of the results reported in the appendices.

Firm size and firm age in the LEHD data is defined at the national level using the U.S. Census Bureau's Longitudinal Business Database (LBD).[15] Firm size is the national size of the firm in March of the previous year; we use three size categories: "large" firms employ 500 or more employees, "medium" firms employ 50-499 employees, and "small" firms employ 0-50 employees. In sensitivity analysis below, we also consider a definition of firm size using relative

[15] Haltiwanger et al. (2014) describes the methodology for linking the LBD firm size and firm age data with the LEHD data.

measures of firm size within industries. Firm age is the age of the national firm, defined as the age of the oldest establishment in the first year of a firm's existence, and aging naturally afterwards. We use two age categories: "young" firms are those up to 10 years of age, while firms who are 11 or more years of age are "mature." For firm wage, we use quintiles of the firm earnings per worker distribution in each quarter. We classify firms as high wage if they are in the top two quintiles, medium wage if in the next two quintiles, and low wage if they are in the bottom quintile.

For the measurement of firm wages, we use in each quarter the average earnings per worker of full quarter workers. The latter are workers who are employed in the prior, current and subsequent quarter by the firm. This approach has the advantage of excluding the workers who are hired and separating in the current quarter including the workers engaged in job-to-job transitions. As such, this mitigates concerns of reverse causality. For this purpose, we use the state-level SEIN unit of observation to measure firm wages. We recognize that ideally we might be interested in using a national firm wage but such a measure is not readily available. We have conducted some cross checks that mitigate these concerns. Specifically, we have used the LBD to investigate the relationship between the state-level firm wage and the national firm wage. We find they are highly correlated.

There are some additional limitations of the LEHD data that should be noted. First, employment coverage in the LEHD data is broad, but not complete, and in some cases regardless of approach we will erroneously classify a job-to-job transition as a flow to (or from) nonemployment. This includes flows to and from federal employment (approximately 2% of employment) and to parts of the non-profit and agriculture sectors. We will also misclassify some transitions that cross state boundaries. We start our time-series in 1998, when there is data available for 28 states, and states continue to enter the LEHD frame during our time series.[16] Our 28 states include many of the largest states so that our sample accounts for 65 percent of national private

[16]Our 28 states are CA, FL, GA ,HI, ID, IL, IN, KS, ME, MD, MN, MO, MT, NC, NJ, ND, NM, NV, PA, OR, RI, SC, SD, TN, VA, WA, and WV. Other states have data series that start in subsequent years. While we restrict our analysis to a pooled 28-state sample, we do allow flows into and out of that sample to be identified as poaching flows as data for states becomes available. For example, data for Ohio becomes available in 2000 so that if a worker changes employers from a firm in Ohio to one in New Jersey after 2000 this will be classified as a poaching hire in New Jersey, even though Ohio is not in the sample. By 2004 almost all states have data available so one might be concerned that the time series patterns may be noisier in the early years of our sample. Our analysis presented below suggests otherwise and more thorough analysis by Henderson and Hyatt (2012) shows that the omission of states has a discernable but small effect on job-to-job flow rates.

sector employment. Finally, for the cyclical indicators, we consider two alternatives: the change in the unemployment rate and deviations in the unemployment rate from an HP-filtered trend. The change in unemployment rate is much more closely linked to the NBER reference cycles and thus captures periods of expansions and contractions. The HP-filtered unemployment rate captures periods above and below trend. As we discussed above, the theory has predictions about both indicators.

Figure 1 illustrates the two alternatives we consider at the national level. As is evident from Figure 1, the change in unemployment rate is much more closely linked to the NBER reference cycles than is the HP-filtered unemployment rate. During NBER contractions, the change in unemployment tends to be positive while it is tends to be negative during NBER expansions. Consistent with this pattern, we note that the correlation between the net employment growth rate for our 28-state sample and the change in the unemployment rate is -0.90. The HP-filtered unemployment rate exhibits a related but different pattern. The HP-filtered unemployment rate rises during contractions but remains high long after recoveries are underway. This holds not only for the Great Recession but also for the 2001 downturn. The correlation between the HP-filtered unemployment rate and the change in the unemployment rate is only 0.15 and the correlation between the HP-filtered unemployment rate and the net employment growth rate (for our 28 state sample) is -0.24.

4 Empirical Analysis of the Reallocation of Workers Across Firm Size and Firm Wage Classes

4.1 Aggregate Patterns

It is useful to start with the following simple identity:

$$NetJobFlows(NJF) = H - S = H_p - S_p + H_n - S_n \tag{5}$$

where H is hires, S is separations, H_p is poaching (job-to-job) hires, S_p is poaching separations (workers that separate via a job-to-job flow), H_n is hires from nonemployment and S_n is separations into nonemployment. In implementing this decomposition empirically, we convert all flows to rates by dividing through by employment. All of the aggregate series we use in this section have been seasonally adjusted using the X-11 procedure.

We implement this decomposition with alternative definitions of job-to-job flows as described above. Figure 2 shows the job-to-job flow series using the within quarter definition, the within/adjacent quarter definitions, and the no earnings gap approach. Figure 2 also includes the CPS based job-to-job flow series from Fallick and Fleischman (2004). Conceptually, poaching hires and poaching separations balance out at the aggregate level but with our data and definitions they can differ slightly. For the within quarter definition, the difference can only arise because of hires and separations from out of the 28 state sample. It is apparent from Figure 2 that this problem is small. For the within/adjacent quarter definition and the no earnings gap approach, there can be differences within a given quarter given that adjacent quarter flows are associated with a separation one quarter and a hire the subsequent quarter. Figure 2 also shows that aggregate poaching hires and separations track each other closely with either of these approaches.

The within quarter definition yields levels that are below the CPS, the within/adjacent yields levels that are above the CPS, and the no earnings gap approach yields levels that are about the same as the CPS. Moreover, all LEHD based series are highly correlated. All pairwise correlations exceed 0.98 with the correlation between the within/adjacent and the no earnings gap at 0.997. Moreover, all three LEHD series have high correlations with the CPS based series. The CPS series has a correlation of 0.91 with the within quarter LEHD series, 0.96 with the within/adjacent quarter LEHD series, and 0.95 with the no earnings gap series. The similar patterns give us confidence to proceed in denoting the LEHD based series as poaching or job-to-job flows. Moreover, the very strong relationship between the three LEHD series enables us to focus on the within/adjacent and no earnings gap approaches in the main text. While the latter two approaches yield very highly correlated job-to-job flow series, both approaches have some advantages. The within/adjacent approach has the advantage that the hires and separations to/from non-employment are well defined in terms of having a minimum spell of non-employment. The no earnings gap approach has the advantage of yielding series that it yields levels more consistent with the CPS and avoids including transitions with significant earnings gaps during the time of the transition.

Figure 3a and 3b present the decomposition of private sector hires and separations into their poaching and nonemployment components for the within/adjacent quarter and no earnings gap approaches respectively.[17] The patterns are similar other than levels so we discuss them together. In both figures, the poaching hires and separations exhibit a pronounced downward trend (which has been discussed in the recent literature) and evident procyclicality.[18] Hires from nonemployment rise during expansions and separations to nonemployment increase substantially early in contractions (this is especially evident in the Great Recession). By construction, at the aggregate level net job flows are driven by these flows into and out of nonemployment. While this is by construction, Figure 3 helps highlight that the procyclical component of separations has no direct consequences for the fluctuations in net job flows (and in turn fluctuations in either nonemployment or unemployment). This is because the procyclical component of separations is driven by poaching flows.[19]

With this as a background, we now turn to flows by firm size. Panel 4a shows the patterns for large firms, Panel 4b for medium firms and Panel 4c for small firms. We show results using the within/adjacent and no earnings gap approaches. The gross poaching rates in all panels are large in magnitude and fluctuate systematically over time. The share of hires from poaching is greater for large firms compared to small firms. It is also evident that overall hires and separation rates (adding up the hires from poaching and nonemployment) rates are substantially higher for small firms relative to large firms. For all firm size classes and using both approaches, gross poaching flows exhibit a downward trend and are highly procyclical.[20] But for each size class, net poaching rates are relatively small in magnitude with relatively little variation over time. If anything, net poaching for small firms tends to be positive and net poaching for large firms is negative.

[17] All rates are as fractions of employment.

[18] The secular decline in job-to-job flows has been noted by Hyatt and McEntarfer (2012a, 2012b) in the LEHD data. Hyatt and Spletzer (2013) show that this decline is also apparent in the CPS job-to-job flows data, and that it reflects a trend in declining dynamics seen in many other measures of employment dynamics. Moscarini and Postel-Vinay (2014) consider this decline as well.

[19] Figure C.1 shows the poaching hires and separations and the hires and separations from nonemployment when poaching flows only include within quarter transitions. This reduces the rate of poaching hires and separations and also yields balancing out of poaching hires and separations in each quarter. Compared to Figure 3a and 3b there is more variation for both the trend and the cycle captured by hires and separations from nonemployment.

[20] The correlation between poaching hires and the change in the unemployment rate is about -0.3 and between poaching hires and the HP-filtered unemployment rate is about -0.6 using either approach. This holds for all size groups. In our empirical analysis that follows, we always consider specifications taking into account trends. Doing so here by using an HP-filtered poaching flows yields a correlation of -0.9 with the HP-filtered unemployment rate using the within/adjacent approach and about -0.8 using the no earnings gap approach.

Since net poaching rates are small for each size class, by the simple decomposition above fluctuations in net employment growth rates for each of the size classes is dominated by the net difference between hires and separations from nonemployment. The ratio of the standard deviation of net hires from nonemployment to net poaching flows is about 4 for each size class (using either approach). Hires from nonemployment is evidently procyclical while separations to nonemployment are counter-cyclical for each size class.[21]

Figure 5 shows the analogous patterns for firms classified by firm wages using both the within/adjacent and no earnings gap approaches. High wage firms have positive net poaching (Figure 5a) while low wage firms have negative net poaching (Figure 5c). Moreover, the net poaching has an evident procyclical pattern with the net poaching by high wage firms the largest late in expansions and the smallest during times of economic contractions. Hires and separations from non-employment exhibit considerable volatility as well. During contractions, separations to non-employment rise for both high and low wage firms and hires from nonemployment fall. But the decline in hires from non-employment is especially sharp for low wage firms in contractions.

Figure 6 summarizes the starkly different patterns of net poaching flows by firm size and firm wage classes (6a is for within/adjacent, 6b for no earnings gap). For both approaches, net poaching for high wage firms is positive and large while net poaching for low wage firms is large and negative. Late in booms (e.g., the 2004-06 period) it is evident that there is a high rate of net poaching away from low wage to high wage firms. Such net poaching differences virtually disappear in the sharp contraction during the Great Recession. An apparent adverse impact of contractions and especially the Great Recession is that there is a great slowdown in overall job-to-job flows and in turn in those job-to-job flows moving workers from low wage to high wage firms. In contrast, net poaching for large and small firms is small in magnitude and exhibits relatively little variation over the cycle.

Table 1 presents simple descriptive regressions to help quantify the cyclical patterns evident

[21]This statement is particularly evident using the change in unemployment indicator. The correlation between net hires from nonemployment and the change in the unemployment rate is -0.84 (-0.83) for large firms and -0.87 (-0.86) or small firms using the within/adjacent (no earnings gap) approach. This is not surprising since the correlation between overall net job flows and net hires from nonemployment is 0.97 for both large and small firms using either the within/adjacent or no earnings gap approach. Note that the correlation between overall net job flows and net poaching flows is -0.12 (-0.15) for large firms and -0.20 (-0.22) for small firms using the within/adjacent (no earnings gap) approach.

in Figures 4 and 5 for the within/adjacent approach. Table 2 reports the same specifications using the no earnings gap approach. The left hand side variable is differential net flows - either for overall net job flows or for the components in terms of net poaching and net non-employment flows. The key right hand side variable is the HP filtered unemployment rate in the first column and the change in the unemployment rate in the second column. The top panel uses net differentials between large and small firms. The bottom panel uses net differentials between high and low wage firms. All specifications include a linear trend.

Consistent with MPV (2012), we find that net job flows for large firms are more sensitive to fluctuations in the HP-filtered unemployment rate than small firms. This holds for both approaches. Referencing Table 1 (2), a 100 basis point positive deviation of unemployment from its HP trend is associated with an 11.6 (11.5) basis point decline in net job flows for large firms relative to small firms.[22] Both net poaching flows and net hires from non-employment contribute to this finding. Using the point estimates from Table 1 (2), 6.5 (10.2) basis points of the 11.6 (11.5) are from net hires from non-employment while 5.1 (1.3) basis points are from net hires from poaching. For the Table 1 results, only the net hires from poaching result is statistically significant. For the Table 2 results, only the net hires from non-employment result is statistically significant.[23]

The results from first differences show that when an economic contraction occurs (i.e., when the unemployment rate rises), a 100 basis point increase in the change in the unemployment rate is associated with a 15.6 (16.2) basis point increase in the net growth of large firms relative to small firms for the Table 1 (2) results. This is being driven by a 28.8 (24.5) point increase in the net hires from non-employment of large firms relative to small firms using the Table 1 (2) results. There is a 13.2 (8.3) basis point decline in net hires from poaching of large firms relative to small firms. But overall, small firms are getting hit harder in contractions than large firms (although the overall effect is not statistically different in either Tables 1 or 2).

More dramatic patterns of the cyclicality of differential net poaching are present between

[22]The results on net job flows are in principle not sensitive to the method for decomposing into poaching and non-employment flows but in practice there is some slight sensitivity due to seasonal adjustment. For the latter we seasonally adjust the components and then add to compute net job flows

[23]Table C.1 shows that if poaching flows are defined using within quarter flows only then all of differential net job flow response between large and small firms to an increase in the HP filtered unemployment rate is due to differential responses of net hires from non-employment. We find, in general, that the findings on large vs. small are more supportive of the MPV (2012) hypotheses when using the within/quarter definition as opposed to the within quarter definition of job-to-job flows.

high and low wage firms. The lower panel of Table 1 (2) shows that a 100 basis point deviation in the unemployment rate from its HP trend yields a 25.3 (23.8) basis point decline in net poaching of high wage firms relative to small firms. Even more dramatically, a 100 basis point increase in the change in the unemployment rate yields a 146.0 (106.2) point basis point decline in net poaching of high wage firms relative to small firms for the Table 1 (2) results. These large cyclical effects on differential net poaching between high wage and low wage firms are highly statistically significant. There are offsetting large and statistically significant effects of net hires from non-employment especially for changes in the unemployment rate. That is, a 100 basis point increase in the change in the unemployment rate yields a 93 (51.8) basis point increase in net hires from nonemployment for high wage relative to low wage firms. In other words, during a contraction, low wage firms have a substantially greater decrease in net hires from nonemployment.

These findings from the national decomposition provide considerable perspective about the predictions from the wage posting literature started by Burdett and Mortensen (1998). As a general pattern, the predictions of the theory receive strong support from net poaching patterns by firm wage class but not by firm size class. Clearly, the prediction that worker movements from poaching would generally be from small to large firms is not consistent with the evidence we have presented. In contrast, the evidence is supportive of poaching moving workers from low wage to high wage firms. Burdett and Mortensen (1998) also imply that small and low wage businesses should rely more on hires from nonemployment than large and high businesses, who in turn should rely more on poaching. This prediction is consistent with our evidence.

Turning to the dynamic predictions of Moscarini and Postel-Vinay (2012, 2013), the results show much more support using differences across firms classified by firm wage than firm size. Net poaching of high wage firms increases substantially late in booms (during periods of low unemployment) and falls dramatically in contractions relative to low wage firms consistent with the predictions of the theory. For firm size differentials, there is not much support for the theory. There are modest increases in net poaching for large firms relative to small firms during times of low unemployment using the within/adjacent approach but no effects using the no earnings gap approach. Modest decreases in net poaching for large firms relative to small firms during economic contractions hold for both approaches.

A related prediction by MPV (2012) is that high wage and large firms should have greater need to shed workers during periods of economic contractions compared to low wage and small firms because they were less constrained in their growth late in the boom preceding a contraction. In terms of net hires from non-employment, we find the opposite. That is, net hires from non-employment falls sharply at small and low wage firms relative to large and high wage firms during periods of economic contractions. Some factor is causing net hires from non-employment to decline much more at small and low wage firms during times of economic contractions. While we don't identify such factors, it is potentially consistent with models where credit constraints are more binding on low wage and small firms during periods of economic contractions.

The sharp decline in net hires from non-employment for small firms in economic contractions is enough to make the overall net employment growth of small firms to decline more sharply compared to large firms at such times. The sharp decline in net hires from non-employment for low wage firms in economic contractions is not sufficient to overwhelm the decline in net poaching from high wage firms so high wage firms still exhibit greater overall declines in net job growth. In this respect, the overall pattern of net job flows is more supportive of the hypothesis that high wage firms need to shed workers more than low wage workers. High wage firms shed workers in contractions through reducing their net poaching while low wage firms shed workers in contractions through reducing net hires from non-employment. The latter makes sense from the perspective of poaching models since low wage firms need to substitute towards reducing net hires from non-employment during contractions because their workers are not being poaching as often from high wage firms.

One limitiaton of the results presented thus far is that they reflect only a relatively small number of aggregate observations. To explore greater variation, in the next section we explore specifications that exploit national and state level variation in the cycle.

4.2 The Cyclicality of Poaching Flows by Firm Size and Firm Wage: Using State-Level Variation

We now employ state-level variation in the job flows to further quantify the nature of cyclical differences between the components of the net job flows by firm size and by firm wage. We employ variants of the following empirical specification:

$$Y_{st} = \gamma_s + \pi_{qt} + \beta * CYC_{st} + \epsilon_{st} \quad (6)$$

where s is state t is quarter, CYC_{st} is the cyclical indicator at the state by quarter level. We use the state-level unemployment rate to construct the two alternative cyclical indicators: the change in the unemployment rate and the HP-filtered unemployment rate. In the main text, we focus on specifications for π_{qt} that includes seasonal dummies and a time trend.[24] The appendix includes some sensitivity analysis with alternatives (such as including dummies for every quarter).

Tables 3 and 4 are the analogues to Tables 1 and 2 using the state by quarter variation.[25] The patterns in Table 3 largely mimic those in Table 1. Likewise the patterns in Table 4 largely mimic those in Table 2. For firm size, net job flows for large firms decline more when unemployment is high than small firms. For the within/adjacent approach in Table 3, this is driven in part by lower net poaching and lower net hires from nonemployment for large firms compared to small firms. For Table 4, this is driven entirely by lower net hires from nonemployment for large firms relative to small firms. For firm wage using either approach, high wage firms exhibit a decline in net job flows during periods of high unemployment relative to small firms but this is driven entirely by sharp decline in net poaching of high wage firms compared to low wage firms. The magnitude of the difference in effects between firm size and firm wage results are substantial. A 100 basis point increase in unemployment above trend yields a 7 (0) basis point decline in net poaching of large firms relative to small firms and a 25.1 (23.7) basis point decline in net poaching of high wage firms relative to low wage firms using the within/adjacent (no earnings gap) approach.[26]

The results by firm size and firm wage for periods of economic contractions are very similar using either the within/adjacent or no earnings gap approaches so we discuss them together. During periods of economic contractions, net job flows for large firms decline less than the

[24]We don't use X-11 in the main results using state-level analysis as we choose a more parsimonious specification where there are common seasonal effects.

[25]For state level specifications, we cluster the standard errors at the state level. In Tables C.2 and C.3, we show results where we cluster the standard errors at the quarter (time) level. The results are very similar to those in Tables 3 and 4.

[26]Table C.3.a of the appendix shows that if we use a specification with period (quarter) effects then there is no statistically significant relationship between the HP filtered unemployment rate and the differential net poaching between large and small firms. Table C.3.a also shows that the results using changes in the unemployment rate are robust to using period effects. SImilar findings are shown for the no earnings gap approach in Table C.4.a.

decline for small firms. This is driven both by a smaller decline in net poaching for large firms and especially by a smaller decline in net hires from nonemployment for large firms. Thus, both components (net poaching and net hires from non-employment) go the "wrong" way for the MPV (2012) predictions by firm size during periods of economic contractions. For firm wage, net job flows for high wage firms decline less than the decline for low wage firms during economic contractions. In this case, these patterns reflect substantial offsetting effects on net poaching and net hires from nonemployment. High wage firms experience a much larger decline in net poaching than low wage firms consistent with the predictions of the wage posting models. However, high wage firms experience a much smaller decline in net hires from nonemployment than low wage firms during contractions. The smaller decline in net hires for nonemployment dominates so that net job flows for high wage firms declines less than low wage firms during economic contractions. These findings contrast somewhat from the results at the national level since in this case low wage firms exhibit a greater overall decline in net job flows than high wage firms. [27] Both of the latter two findings are either inconsistent or at least outside the scope of the predictions of the wage posting models.[28]

[27]Table C.3.b reports results for the state-level analysis using firm wage classes and period (quarter effects). We find that the quarter effects wipe out the relationship between the differential net job flows between high and low wage firms with HP filtered unemployment rate. We still find a marginally signficant relationship between the differential net poaching for high and low wage firms and the HP filtered unemployment rate. In contrast, the results on unemployment changes are robust to using quarter effects. Similar results for the no earnings gap approach are shown in Table C.4.b.

[28]Additional sensitivity analyses are included in the appendix. The results in Appendix Table C.5 report the results when we use the decomposition of net job flows using the within quarter transitions to define job-to-job flows. We find no statistically significant relationship between the HP filtered unemployment rate and the differential net poaching between large and small firms. Using this approach, all of the differential response of large vs. small firms to deviations from HP filtered unemployment rates is due to differential responses from net hires from non-employment. Moreover, during contractions, the net job flows and their components go the wrong way for the MPV (2012) predictions by firm size. Table C.6 considers interactions of firm size and firm wage classes using the within/adjacent approach. The patterns in Table C.6 largely confirm those from Table 3. Much larger effects on net poaching are found on the firm wage dimension holding firm size constant than on firm size holding firm wage constant. It is also evident in Table C.6 that focusing on high wage, large firms vs. low wage, small firms does not yield much different effects than focusing on the firm wage difference alone.

5 Extensions and Sensitivity Analysis

5.1 Why Do the Results Differ So Much Between Firm Wage and Firm Size?

In this section, we consider a number of extensions and sensitivity analysis designed to investigate why the patterns differ so much between firm size and firm wage results. The first exercise we consider is to understand the relationship between firm size and firm wage in our data. Estimating a simple specification relating the log real earnings per worker to log firm size (with quarter fixed effects) yields a positive, highly statistically significant relationship but an R-squared of only about 0.04. Firm size by itself accounts for little of the overall variance in earnings per worker across firms which is not surprising since there are many factors that underlie differences in wages across firms such as the heterogeneity in skills across workers. While not surprising, this helps explain why the patterns for firm size and firm wage are so different. One might anticipate that the failure to control for factors such as skill heterogeneity would dampen the relationship between firm wage and the direction of poaching. But even though we control for no factors, we find strong and systematic patterns in the poaching flows by firm wage. This contrasts substantially with the results by firm size.

There are also factors for firm size that are likely important that we have not controlled for. One potentially important factor is firm age. Recent work has highlighted the importance of distinguishing between small, young firms and small, mature firms (Haltiwanger, Jarmin and Miranda (2013)). At least some small, young firms are high productivity firms that are in the process of growing to become large firms. Figure 7 shows that the decomposition of net job flows looks very different for small, young vs. small, mature firms.[29] Figure 7a shows the decomposition for large, mature firms, Figure 7b the decomposition for small, mature firms and Figure 7c the decomposition for small, young firms.[30] There is no figure for young, large firms since such firms are virtually non-existent. Interestingly, Figure 7c shows that young, small firms exhibit positive net poaching flows. Apparently, one of the reasons that large and mature firms exhibit negative net poaching flows is that workers are being poached away to

[29]For this sensitivity analysis and the remainder for this section we focus on the within/adjacent approach for the sake of brevity. In addition, the within/adjacent approach yielded the most supportive results for the predictions of MPV (2012) by firm size.

[30]Medium size young firms look similar to young, small firms in unreported results.

small, young firms.

Table 5 reports the results of the differential net job flows and components for alternative groupings of firms by firm size and firm age. Focusing on mature firms provides more supportive evidence for the wage posting models. A deviation in unemployment above its trend yields a larger decline in net job flows of large, mature firms relative to the net job flows of small, mature firms and this is driven about equally by net poaching and net hires from]non-employment effects. For large, mature vs. small, young the differential response of net job flows is smaller and more of this is driven by net hires from non-employment.

The results using first differences continue to point to factors outside the scope of the wage posting models. Small, mature and small, young businesses both exhibit a greater decline in net job flows in contractions than large, mature firms and this is driven especially by the responsiveness of net hires from non-employment.

Another potential limitation of the firm size results is that variation in firm size across industries may reflect differences in technology and minimum efficient scale - factors not part of the wage posting models. Table 6 considers a robustness check using terciles of the employment-weighted industry distribution to define relative firm size classes. Strikingly, results using relative size within industry are very similar to those using absolute size in Table 3.

Finally, all of the results presented thus far use the measured flows at a quarterly frequency (either using within/adjacent or within quarter based job-to-job flows). It has become common in the literature on gross flows to explore the sensitivity of the results to using continuous time adjustments to flows based on discrete time observations. For this purpose, we build on the approach of Mukoyama (2014) who in turn builds on the approach of Shimer (2012). For our purposes, we use a four state transition matrix - transitions from Small, Medium, Large Firms and Non-employment. For example, we measure the transition probability of a flow from large to small for workers whose main job is at a large firm in quarter t-1 and at a small firm in quarter t. The methods we use are identical to those of Mukoyama (2014) in his Appendix A translated to 4-state model. His application was to gross flows from the CPS data while our application is to transitions at a quarterly frequency. We note that a limitation of using this approach in our setting is that the transitions we measure from one quarter to the next are not based on exact point-in-time to point-in-time transitions as with the CPS. As such appropriate caution needs to be used for interpreting our findings.

We apply the Mukoyama (2014) methodogy to our state by quarter transitions. Aggregated versions of selected discrete time and continuous time adjusted flows are reported in Figures 8 and 9. The general pattern we find is that (similar to the findings of Mukoyma (2014) and others), the implied continuous time flows exceed the discrete time measures. However, this shift up in the continuous time flows is across the board so that this has limited implications for net poaching flows from large to small or vice versa as seen in Figure 9. We have also estimated our core state by quarter empirical specifications using the continuous time adjusted flows. As seen in Table 7, results are quite similar between the discrete time and continuous time flows.

Our findings in this subsection suggest that controlling for firm age helps mitigate the difference in results for firm size and firm wage but only to a limited extent. Using alternative approaches such as relative firm size within industries or continuous time adjustments for our discrete time flows does little to impact the firm size results.

5.2 Firm Wage and Size Job Ladders: Unconditional vs. Conditional Probabilities?

The results presented above show that net poaching is small in magnitude for both large and small firms while net poaching is positive and large for high wage firms and negative and large for low wage firms. These findings are about whether a given firm size or firm wage class is a net gainer or loser from net poaching. To help understand these patterns better, Tables 8 and 9 provide alternative ways at looking at the distribution of poaching hires and separations. The empirical analysis in Tables 8 and 9 takes a slightly different approach than the analysis so far. In Tables 8 and 9, origins and destinations by firm size class (Table 8) and firm wage class (Table 9) are identified. In contrast, our earlier analysis characterizes the poaching hires to a given firm size or firm wage group without identifying the origin (and likewise for separations we identify the origin but not the destination). Tables 8 and 9 are based on the within/adjacent approach but we show the analogues for the no earnings gap approach in the appendix where the results are qualitatively similar.

The top panel of Tables 8 and 9 reminds us that large and high wage firms obtain a larger share of their hires and separations from other firms compared to small and low wage firms. This pattern was already evident (and discussed) in Figures 3 and 4. The second panel of

Tables 8 and 9 shows unconditional probabilities of poaching hires and separations by origin and destination. For example, 15 percent of poaching flows have an origin and a destination of a small firm while 24.9 percent have an origin and a destination as a large firm. Likewise, 23.3 percent of poaching flows have an origin and destination as a low wage firms and 12.1 percent have an origin and destination as a high wage firm.

Comparing the diagonals to off-diagonals in the second panels of Tables 8 and 9 tells us that much of the poaching flows reflects flows within given size and wage classes. Such patterns likely reflect many factors - for example, there are likely skill differences across size and wage classes and the dominant diagonal patterns reflect such heterogeneity. For our purposes, we are especially interested in comparing the overall as well as the off-diagonal patterns. From the second panel of Table 8, a small firm is a slightly more likely to be a destination than an origin (comparing 32.7 percent to 31.7) while a large firm is a slightly more likely to be an origin than a destination (comparing 44.5 to 43.9 percent). In contrast, the second panel of Table 9 shows that a high wage firm is more much more likely to be a destination than an origin (comparing 25.3 percent to 21.8 percent) while a low wage firm is much more likely to be an origin than a destination (comparing 42.6 percent to 38.4 percent). These patterns are consistent with Figures 3 and 4. In the latter figures, the poaching flows are reported as percentages of employment while in the middle panels of these tables the poaching flows are reported as percentages of overall flows. But if a group is more likely to be an origin than a destination in terms of unconditional probabilities then it will be net loser and vice versa.

It is potentially interesting to also examine conditional probabilities. That is, to quantify the likelihood of starting out in one group and ending up in another group. The third panels of Tables 8 and 9 do this for both firm size and firm wage. In Table 8, conditional on starting in a small size class, the most likely destination is staying in a small size class. But there is a 30.6 percent chance of moving to a large firm. Table 8 also shows that conditional on starting in a large class, the most likely destination is also a large size class but there is also a substantial chance of moving to a small size class (23.0 percent). Table 9 shows that staying in the origin wage class is the most likely outcome but there are substantial probabilities of moving up or moving down.

At first glance, one might be tempted to draw the inference from these conditional probabilities that there is evidence of a firm size job ladder. That is, the likelihood of moving from small to large is greater than the likelihood from large to small. However, conditional probabilities are sensitive to the size of the respective groups. An extreme example makes the point. Suppose "small" firms were firms with less than five employees and "large" firms were firms with five or more employees. Then the conditional probability of moving from small to large would be much greater than the conditional probability of moving from large to small since most employment and hires are accounted for by large firms so defined.

This logic suggests that we need to adjust the conditional probabilities for the size of a group. Alternative notions of size that might be relevant are employment or hires shares of a group. We think in this context that the most relevant notion of size is the unconditional share of poaching hires. We normalize the conditional probabilities with destination shares in the bottom panels of Tables 8 and 9. The coefficients above one in all of the diagonals indicate that all groups are more likely to be destinations than one would expect based upon the combination of conditional probabilities and the share of each group as a destination. Given the coefficients are all above one on the diagonal, the coefficients on the off-diagonals are all below one. But we find that the normalized probability of going from low wage to high wage is substantially greater than the normalized probability of going from high wage to low wage. The same pattern does not hold for firm size.

An alternative way to see that the size of the group is relevant is to define groups so that they have equal shares of employment. We use this approach in Table 10 that uses the relative size classes based on terciles of the within industry employment distribution of employment. By construction, each size class accounts for one third of employment. The results in Table 10 yield no evidence of a firm size job ladder even from the conditional probabilities without any normalization. The latter and the normalized conditional probabilities yield the same message in this case since the equally sized groups implies there is no need for normalization.

In short, we interpret these results on the origins and destinations of job-to-job flows as providing further confirmation that there is evidence of a firm wage job ladder but not much evidence in support of a firm size job ladder. The simplest way of seeing this is that high wage firms are much more likely to be a destination than an origin. The same is not true for firm size.

6 Conclusion

We have presented new evidence on how firms hire and separate from workers by firm size, firm wage and firm age. Our data allows us to decompose net job flows into net hires from poaching and net hires from non-employment on all of these dimensions. This evidence has implications for the literature on wage posting that follows from Burdett and Mortensen (1998). Consistent with predictions from this class of models, we find that large and high wage employers tend to hire employees from other firms rather than from nonemployment, for small and low wage businesses the opposite is true. However, net poaching generally does not redistribute employment from smaller firms to large employers but it does redistribute employment from low wage to high wage employers.

We also consider the cyclicality of these flows. We replicate the Moscarini and Postel-Vinay (2012) finding that net job flows are more responsive to the deviation of the unemployment rate from its HP trend for large than small businesses, but there the similarities end. We find that the hypothesized mechanism for these differential flows, poaching, does not account for most of the differential response of large vs. small firms. And indeed, when we consider the responsiveness of employment flows to changes in the unemployment rate, we find that the employment of small businesses is much more responsive than large businesses including the component from net poaching.

We find much more support for the cyclical hypotheses of Moscarini and Postel-Vinay by firm wage. During expansions, high wage firms increase their employment through poaching from low wage firms. In contractions, net poaching from low wage to high wage firms falls substantially. Even for results by firm wage, there are some aspects of our findings outside the scope of the wage posting models. During contractions, we find that net hires from non-employment at low wage firms decline relative to the net hires from non-employment for high wage firms. From the wage posting models, high wage firms should have a greater need to shed workers than low wage firms at times of contractions since they are less constrained during booms. Instead it is the low wage firms that tend to do more shedding of workers at least through the net hires from non-employment margin.

Our weaker results on firm size relative to firm wage is partly attributable to distinguishing between firm size and firm age. We find the results on firm size are somewhat more supportive of the theory when we control for firm age. These findings suggest that the direction taken by Coles and Mortensen (2012) who emphasize the importance of firm entry and life cycle dynamics of firms is relevant in this context.

One might interpret our results as primarily a caution about using firm size as a proxy for productivity. An obvious future direction for research is to explore the reallocation of workers across firms of different productivities. We know from the work on job reallocation and productivity that firms with positive productivity shocks tend to increase employment while those with less favorable productivity shocks contract or exit. But we also know the evidence on firm-level productivity dynamics that while shocks are persistent that all firms are continually subject to new productivity innovations. Such dynamics of firm level productivity contributes to the imperfect relationship between size and productivity that is observed in the data. As noted, some aspects of these dynamics can potentially be captured by considering firm age as well as firm size. However, we believe that there is a lot more to learn about job-to-job flows across firms by firm size, firm age and in turn other firm characteristics such as productivity.

In closing, it is worth returning to the discussion of limitations of our definitions of job-to-job flows given the use of quarterly administrative wage records. The latter implies we measure and define job-to-job flows on a quarterly frequency. We consider three alternative definitions of job-to-job flows. We find our results are robust to these alternatives. We also find our results are robust to using continuous time adjustments to these discrete based series.

None of the alternative methods is foolproof but we think that the consistency of the results across these alternatives provides reassurance that our results are not being driven by the quarterly administrative data limitations. We note as well that some aspects of our results are immune from this concern. That, is our net job flow results well as our net hires from non-employment results are largely immune from this concern. Our findings on the differential cyclicality of net job flows by firm size and firm wage across different phases of the cycle do not depend on identifying job-to-job flows. Moreover, since our net hires from non-employment using one of our methods requires a minimum spell of non-employment, we know that this component is not clouded by job-to-job flows. We find that much of the cyclical differences in net job flows by firm size are driven by net hires from non-employment. Of particular interest here is the finding that small and low wage firms experience a much sharper contraction in net hires from non-employment in contractions than large and high wage firms. This finding is inconsistent with or at least must be driven by factors outside the scope of the wage posting models. And this finding is related to the core question of this paper - the nature of the cyclical reallocation of workers across firms by firm size and firm wage. Understanding the factors that drive the greater decline in net hires from non-employment for small and low wage firms during economic contractions should be a high priority for future research.

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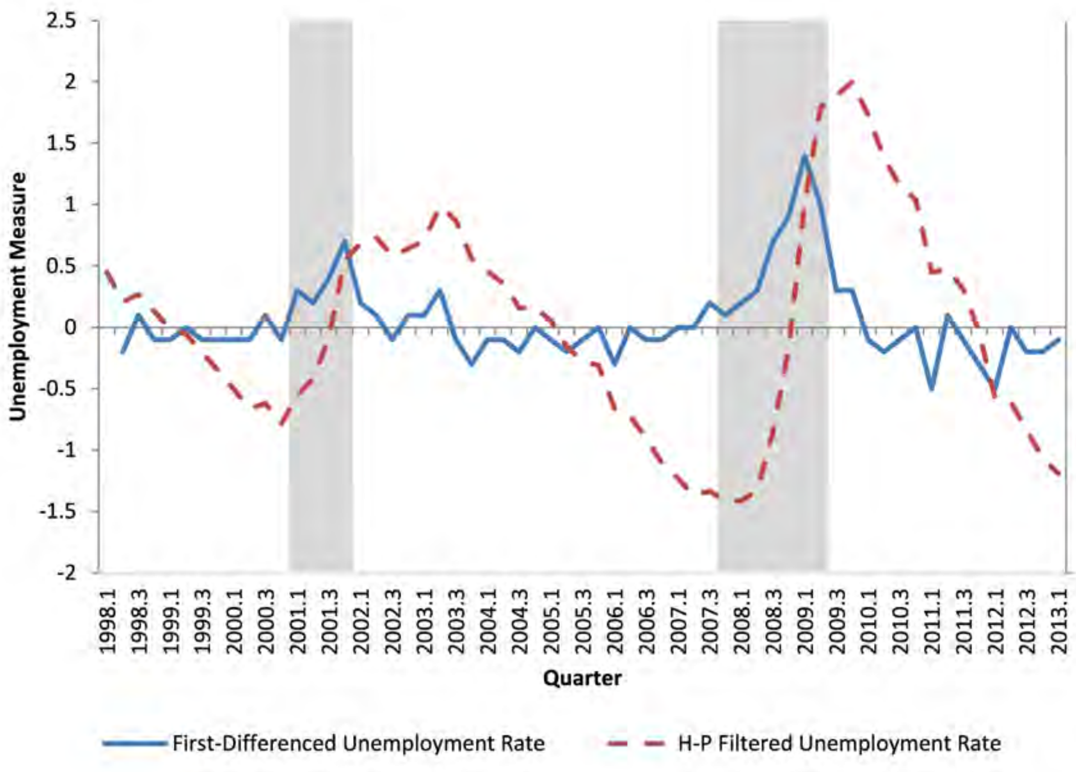
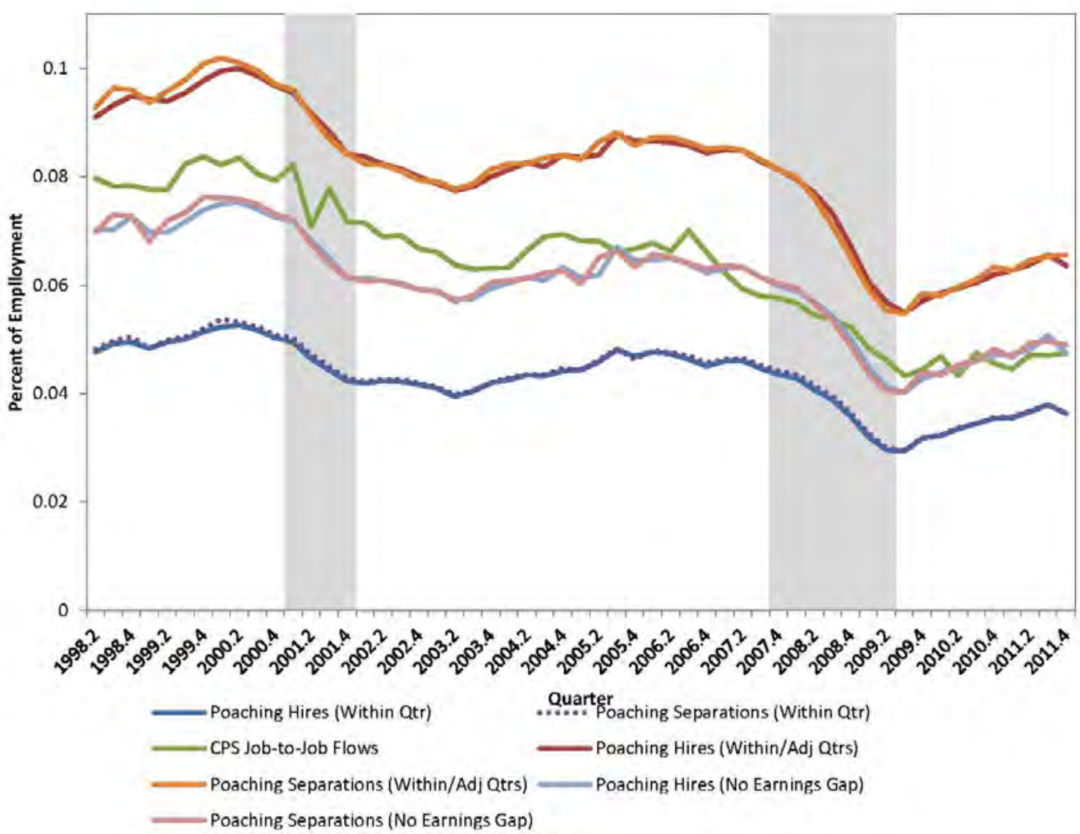
Figure 1: Cyclical Indicators: HP Filtered and First-Differenced Unemployment Rate



Note: Shaded regions indicate NBER recession quarters. All data are seasonally adjusted.

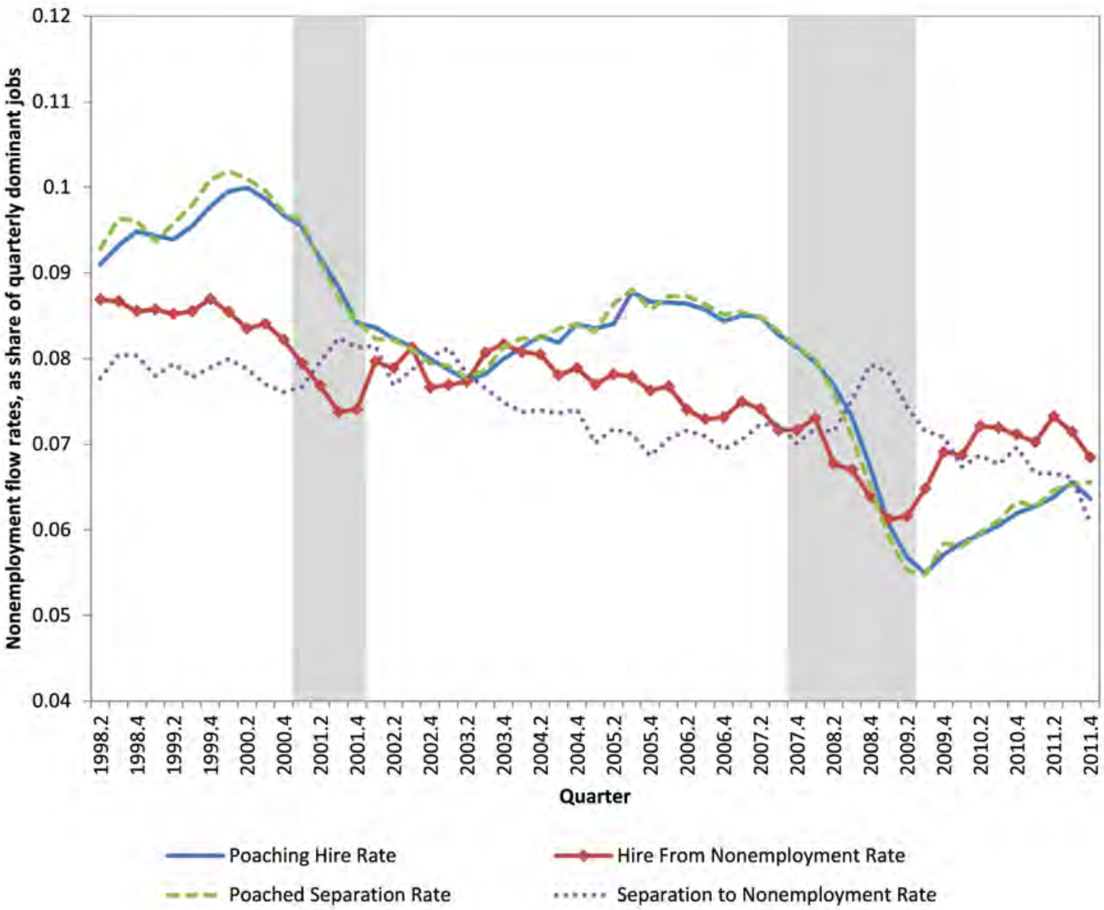
Figure 2: Comparisons of Alternative Job-to-Job Flow Series



Note: Shaded regions indicate NBER recession quarters. All data are seasonally adjusted.

Figure 3: Hires and separations: poaching vs. flows to and from nonemployment

Figure 3a: Within/Adjacent



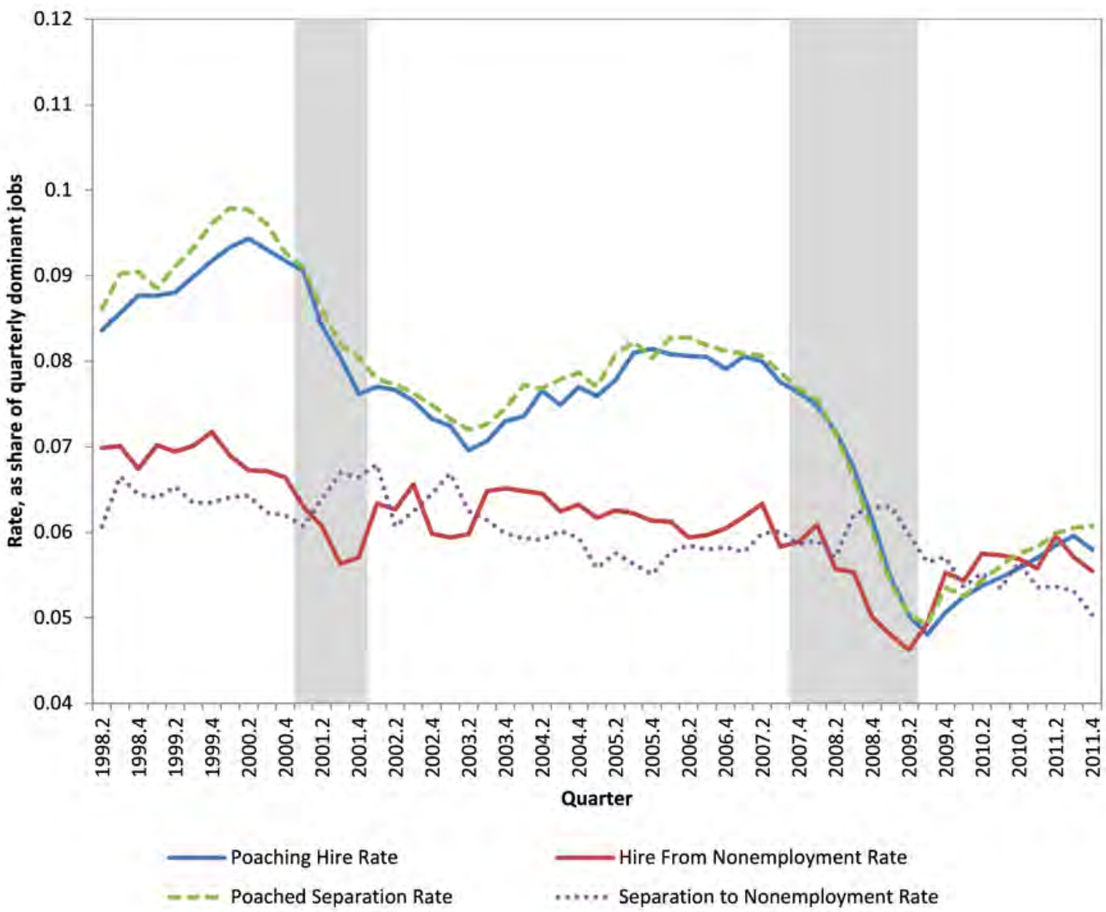
Note: Shaded regions indicate NBER recession quarters. All data are seasonally adjusted.

Figure 3b: No Earnings Gap

Note: Shaded regions indicate NBER recession quarters. All data are seasonally adjusted.

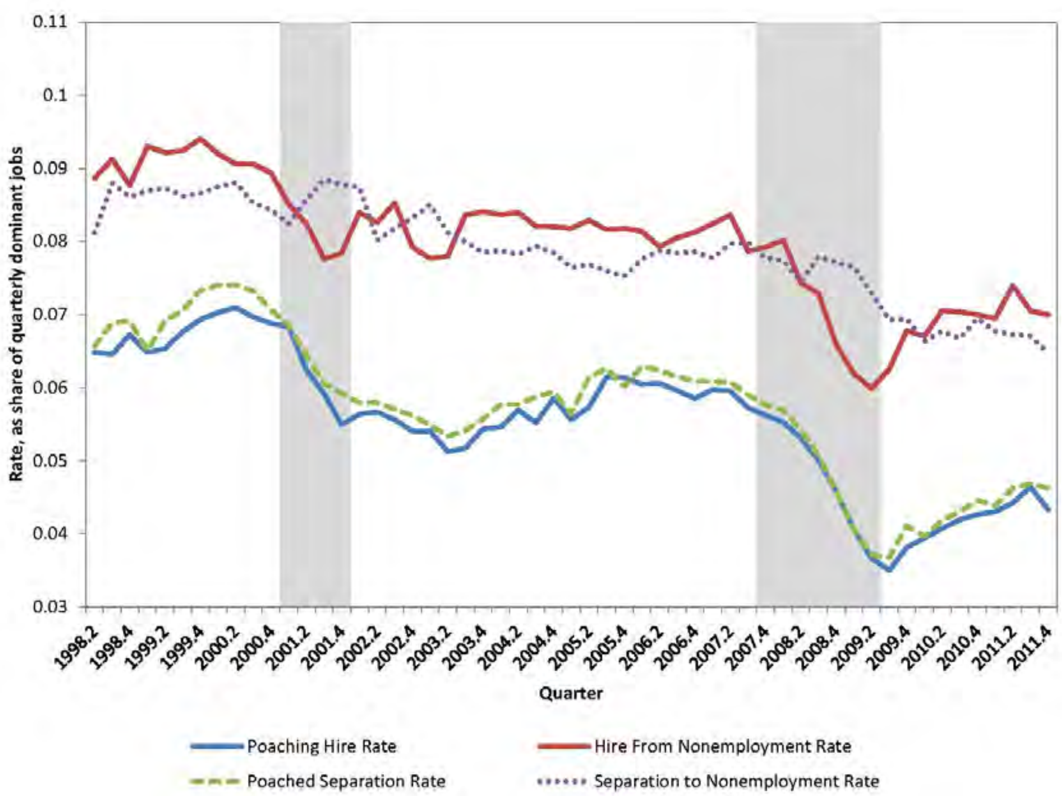
Figure 4: Hires and separations: poaching vs. flows to and from nonemployment, by size

Figure 4a(i): Large Firms, Within/Adjacent



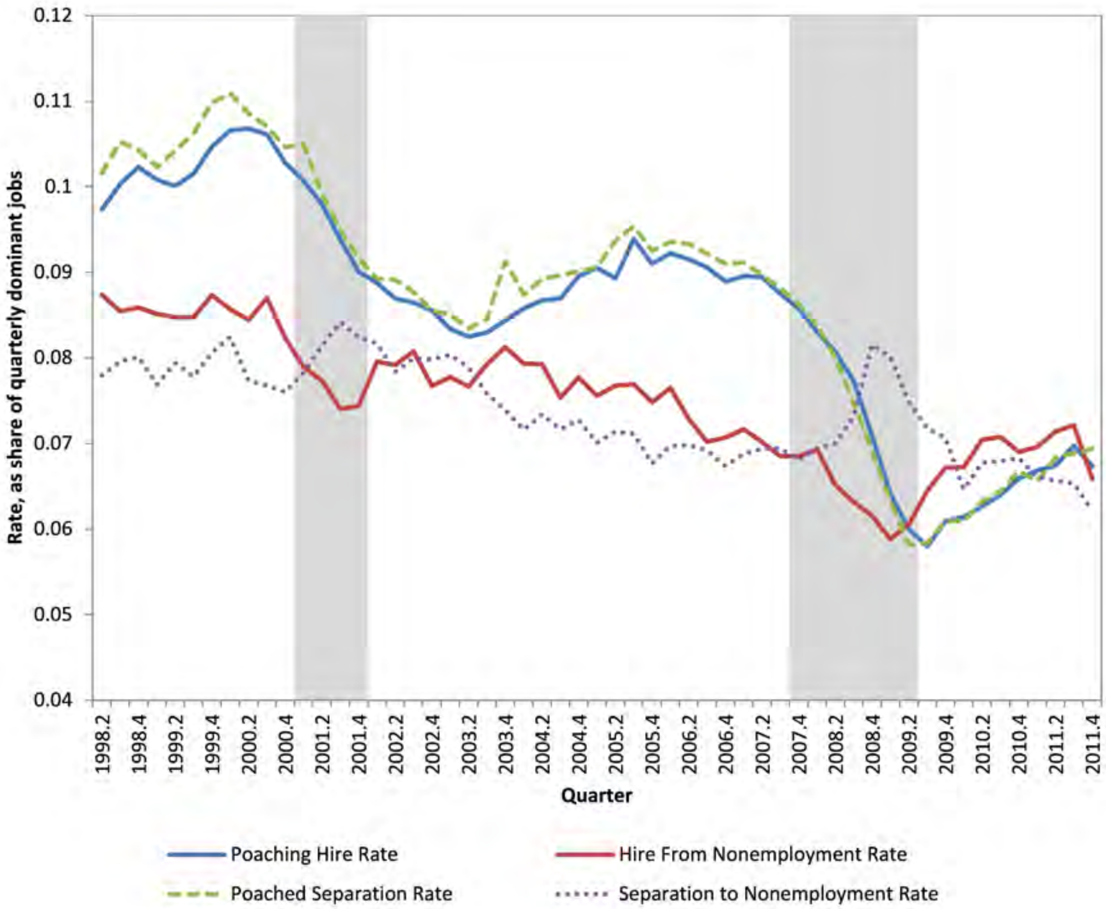
Note: Shaded regions indicate NBER recession quarters. All data are seasonally adjusted.

Figure 4a(ii): Large Firms, No Earnings Gap



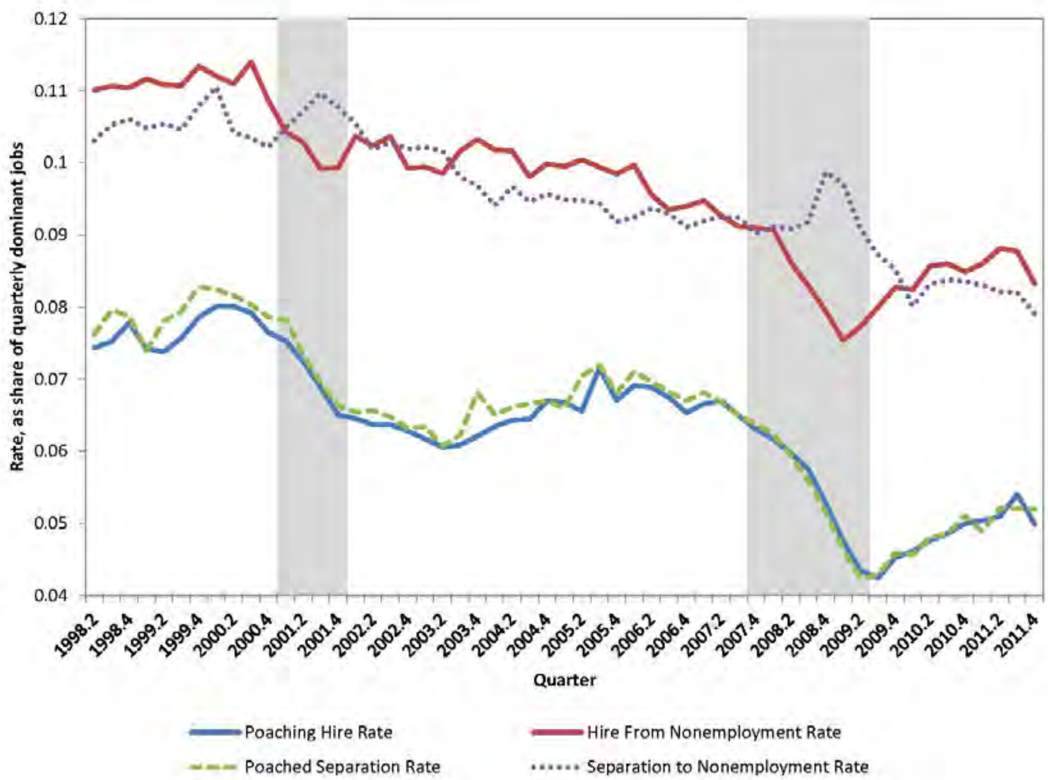
Note: Shaded regions indicate NBER recession quarters. All data are seasonally adjusted.

Figure 4b(i): Medium Size Firms, Within/Adjacent



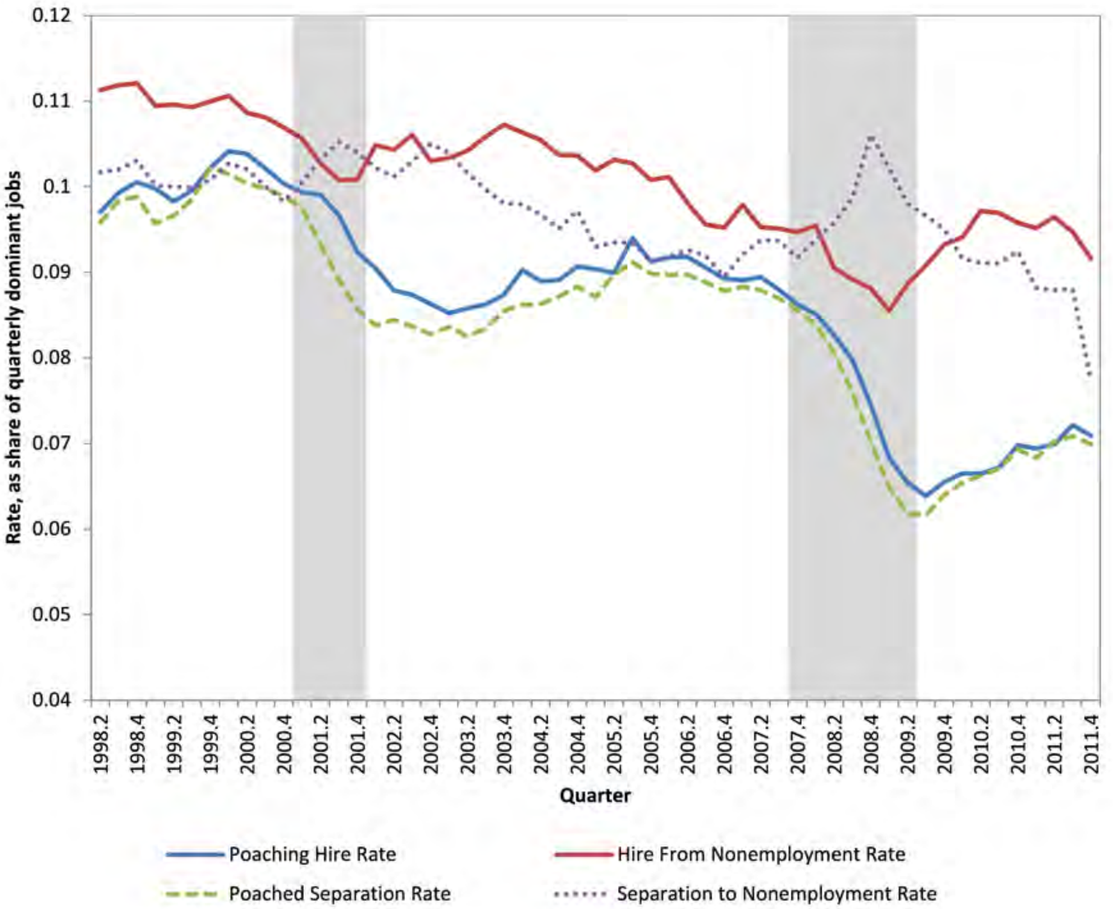
Note: Shaded regions indicate NBER recession quarters. All data are seasonally adjusted.

Figure 4b(ii): Medium Size Firms, No Earnings Gap



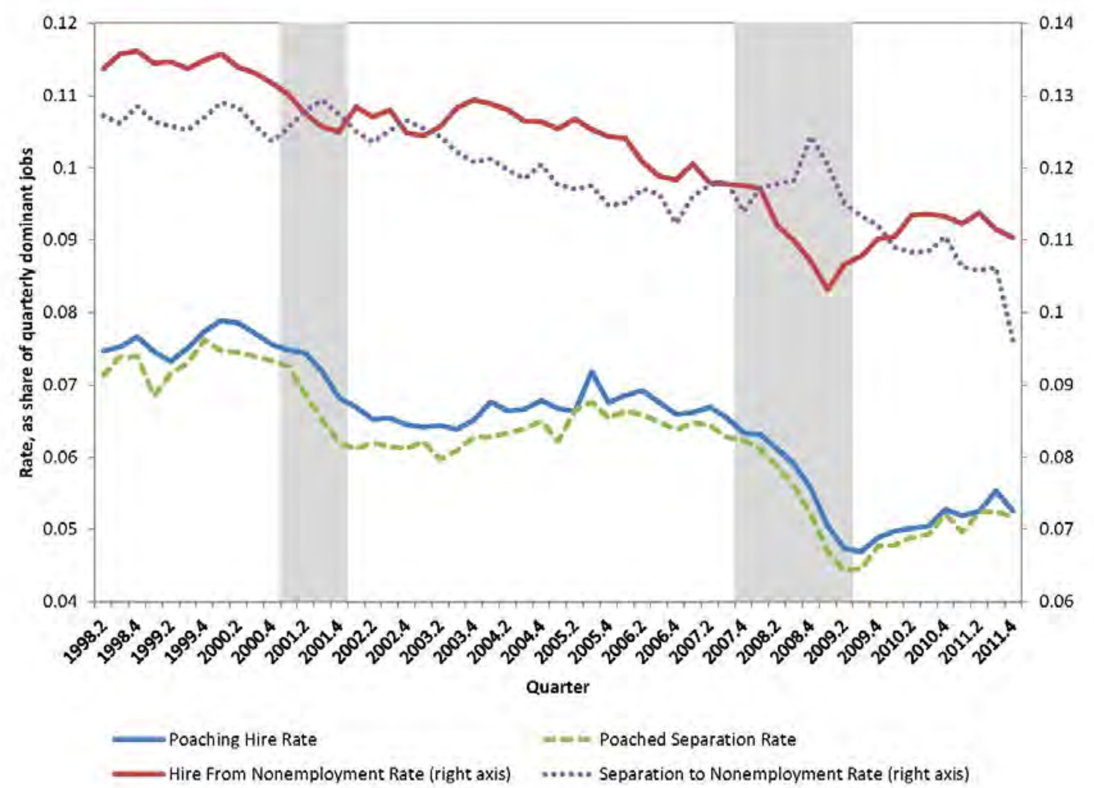
Note: Shaded regions indicate NBER recession quarters. All data are seasonally adjusted.

Figure 4c(i): Small Firms, Within/Adjacent



Note: Shaded regions indicate NBER recession quarters. All data are seasonally adjusted.

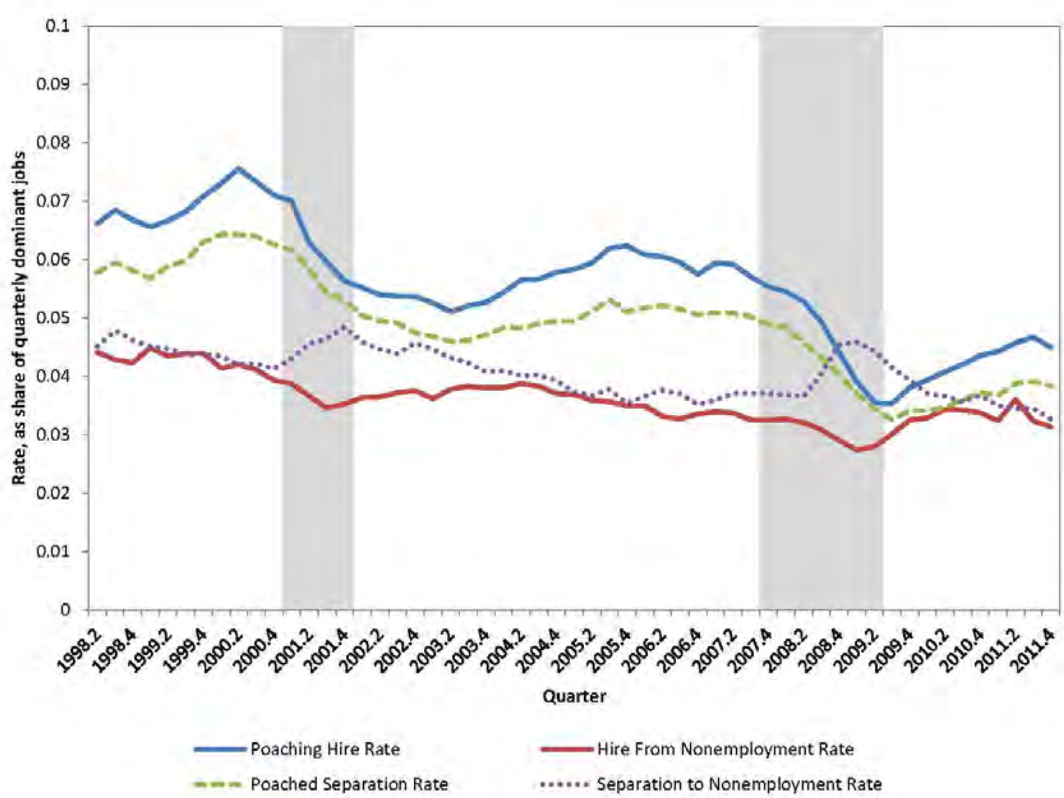
Figure 4c(ii): Small Firms, No Earnings Gap



Note: Shaded regions indicate NBER recession quarters. All data are seasonally adjusted.

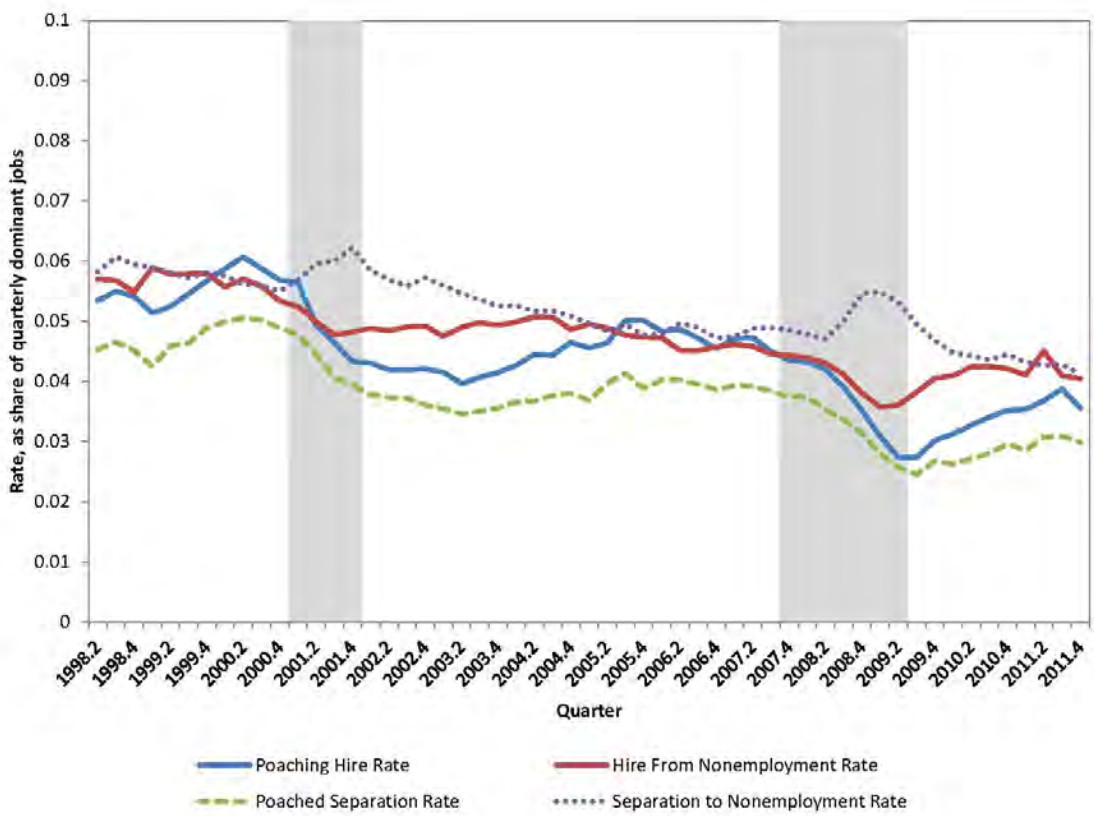
Figure 5: Hires and separations: poaching vs. flows to and from nonemployment, by wage

Figure 5a(i): High Wage Firms, Within/Adjacent



Note: Shaded regions indicate NBER recession quarters. All data are seasonally adjusted.

Figure 5a(ii): High Wage Firms, No Earnings Gap

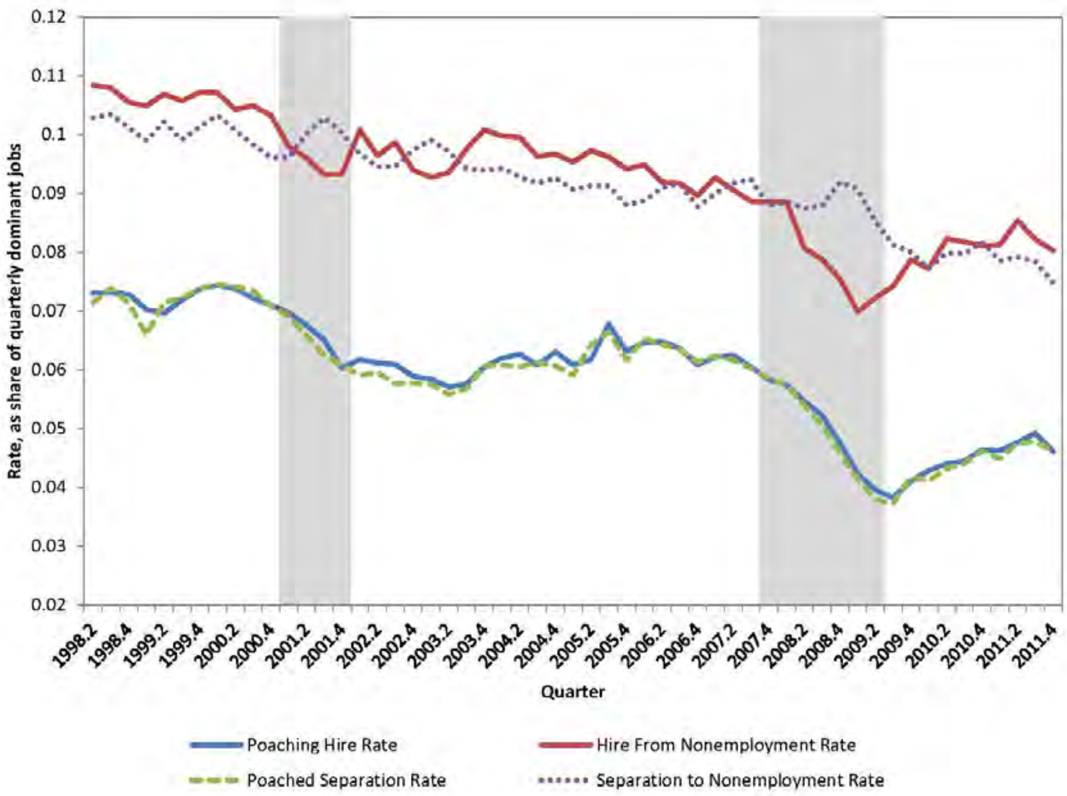


Note: Shaded regions indicate NBER recession quarters. All data are seasonally adjusted.

Figure 5b(i): Medium Wage Firms, Within/Adjacent

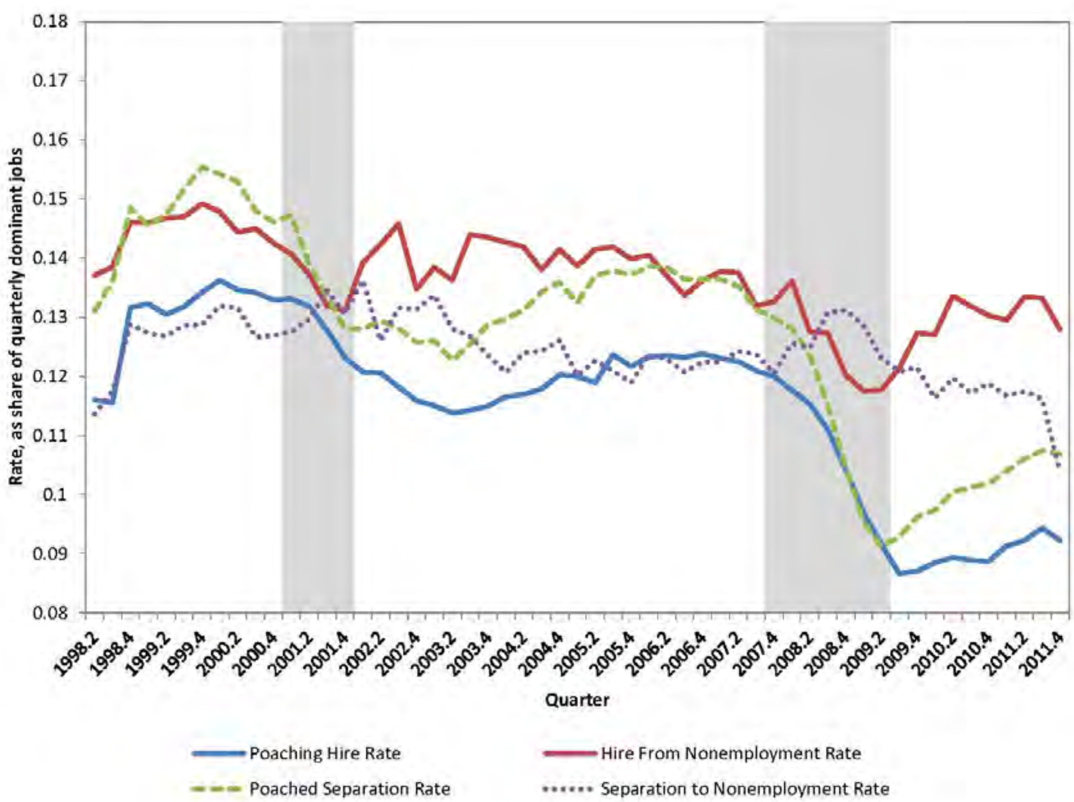
Note: Shaded regions indicate NBER recession quarters. All data are seasonally adjusted.

Figure 5b(ii): Medium Wage Firms, No Earnings Gap



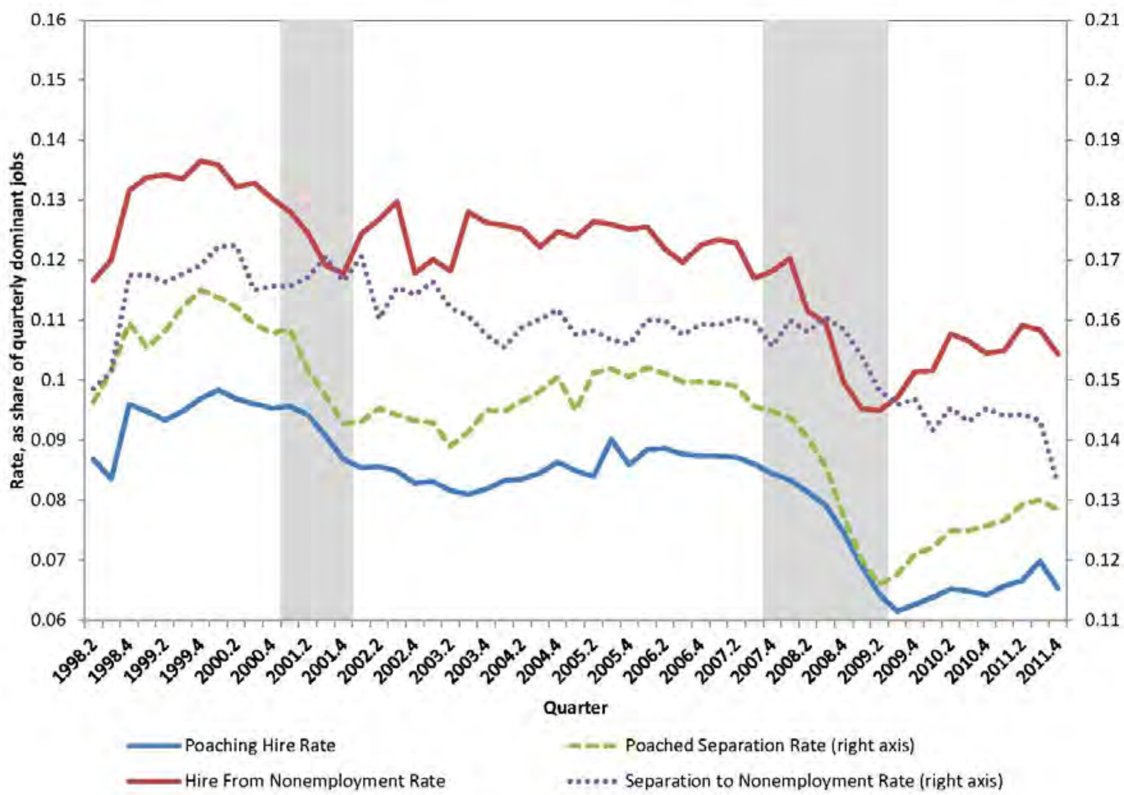
Note: Shaded regions indicate NBER recession quarters. All data are seasonally adjusted.

Figure 5c(i): Low Wage Firms, Within/Adjacent



Note: Shaded regions indicate NBER recession quarters. All data are seasonally adjusted.

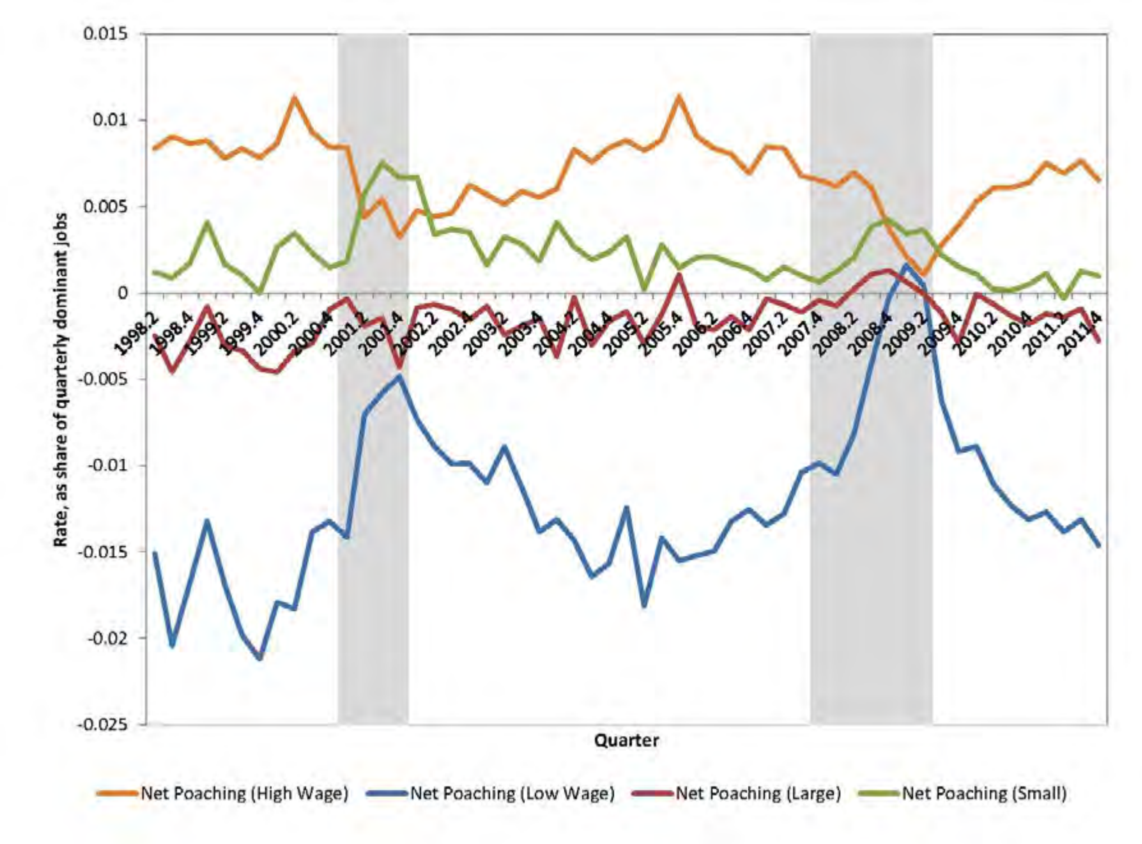
Figure 5c(ii): Low Wage Firms, No Earnings Gap



Note: Shaded regions indicate NBER recession quarters. All data are seasonally adjusted.

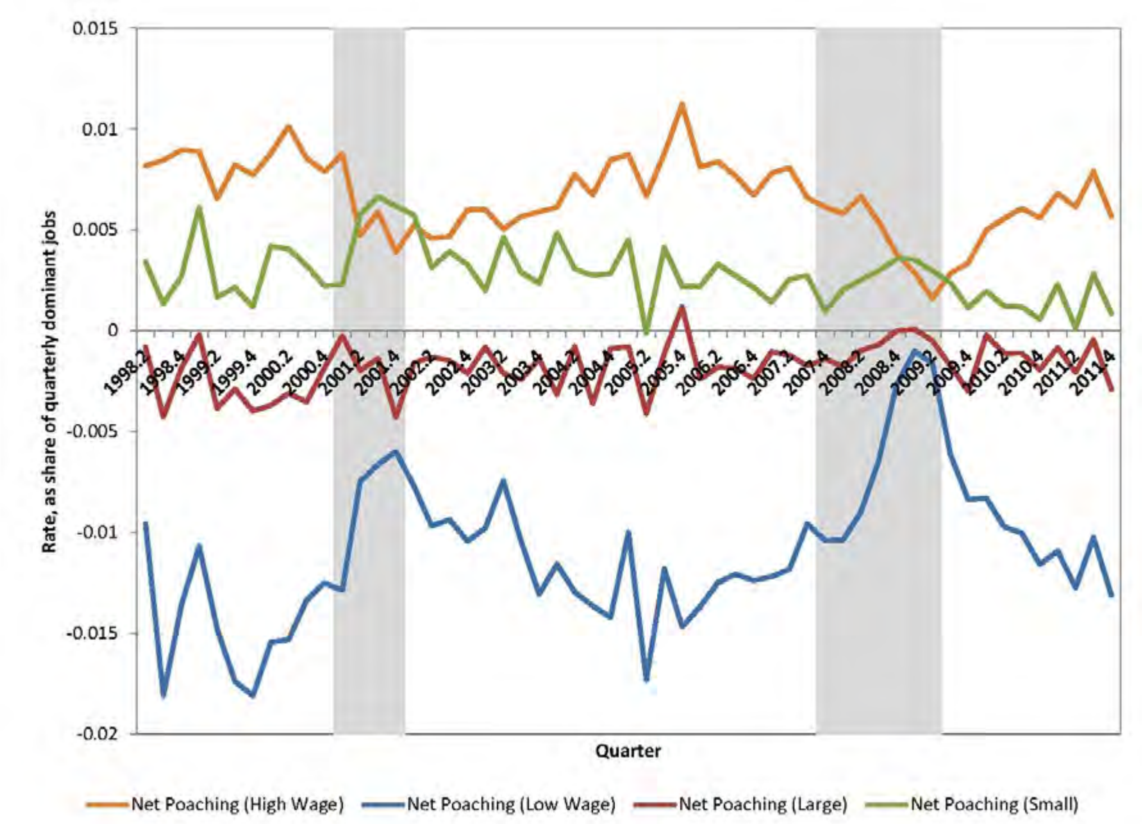
Figure 6: Net Poaching for Large vs. Small Firms and High vs. Low Wage Firms

Figure 6a: Within/Adjacent



Note: Shaded regions indicate NBER recession quarters. All data are seasonally adjusted.

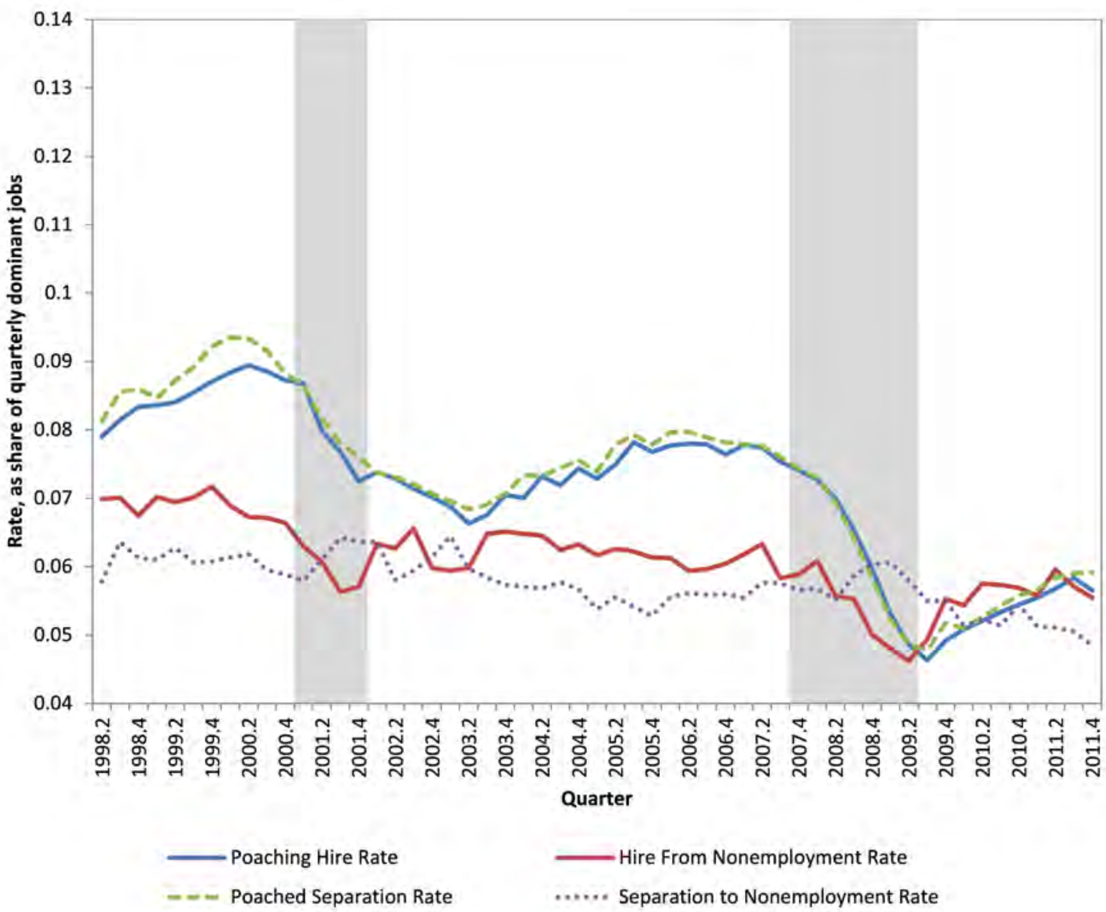
Figure 6b: No Earnings Gap



Note: Shaded regions indicate NBER recession quarters. All data are seasonally adjusted.

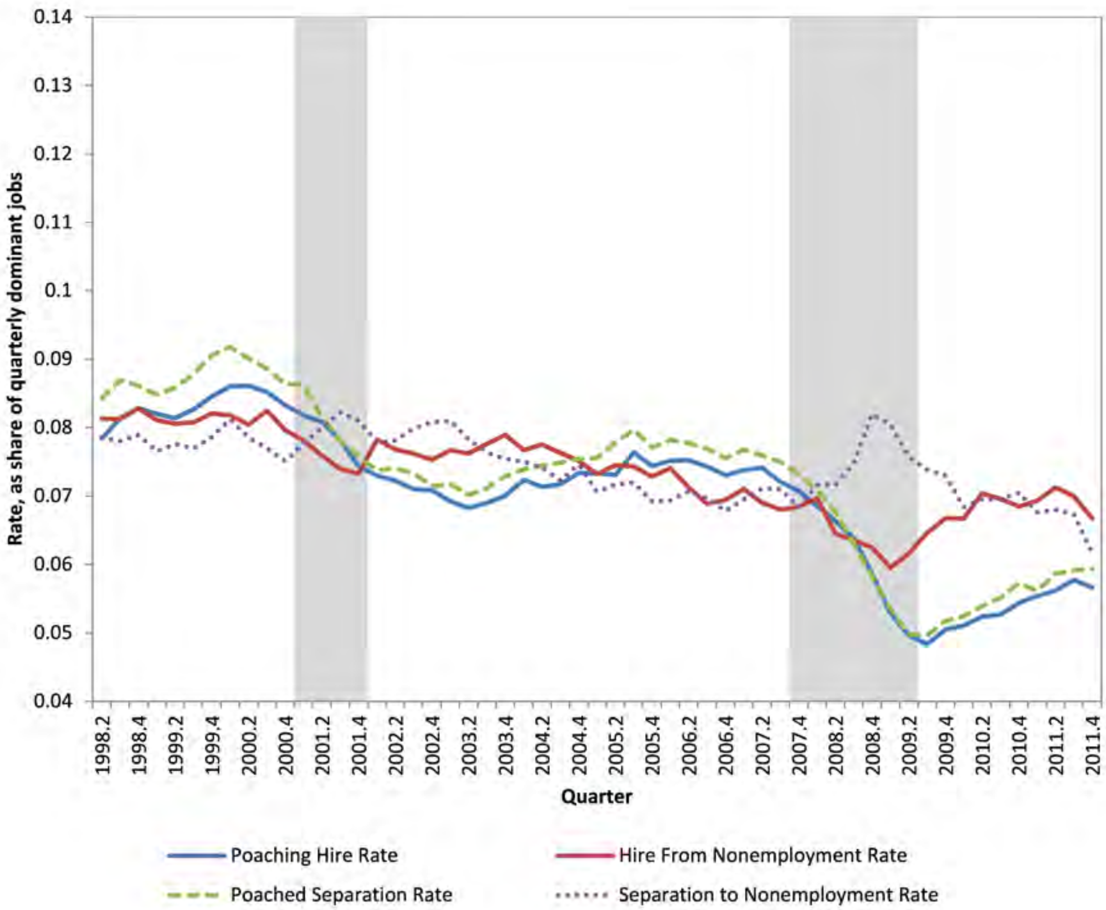
Figure 7: Hires and separations: poaching vs. flows to and from nonemployment, by size and age

Figure 7a: Large, Mature Firms



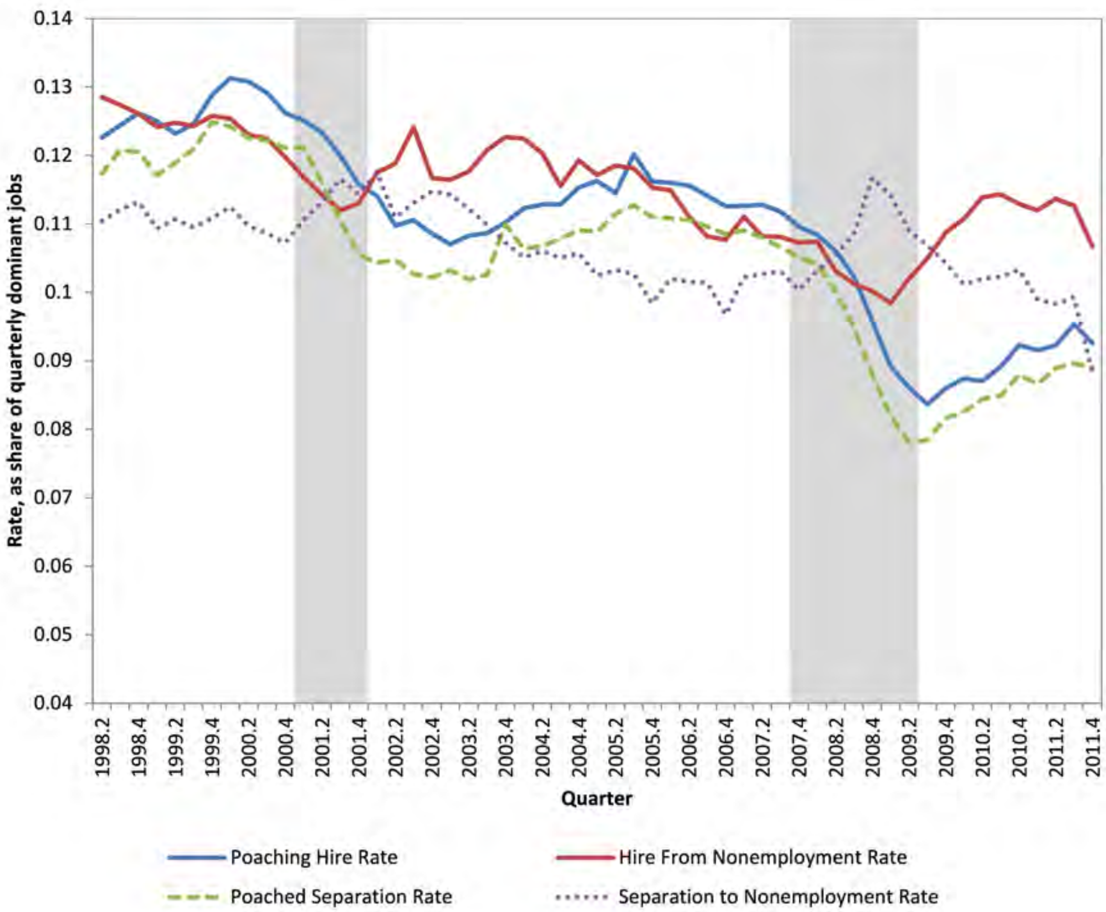
Note: Shaded regions indicate NBER recession quarters. All data are seasonally adjusted.

Figure 7b: SME, Mature Firms



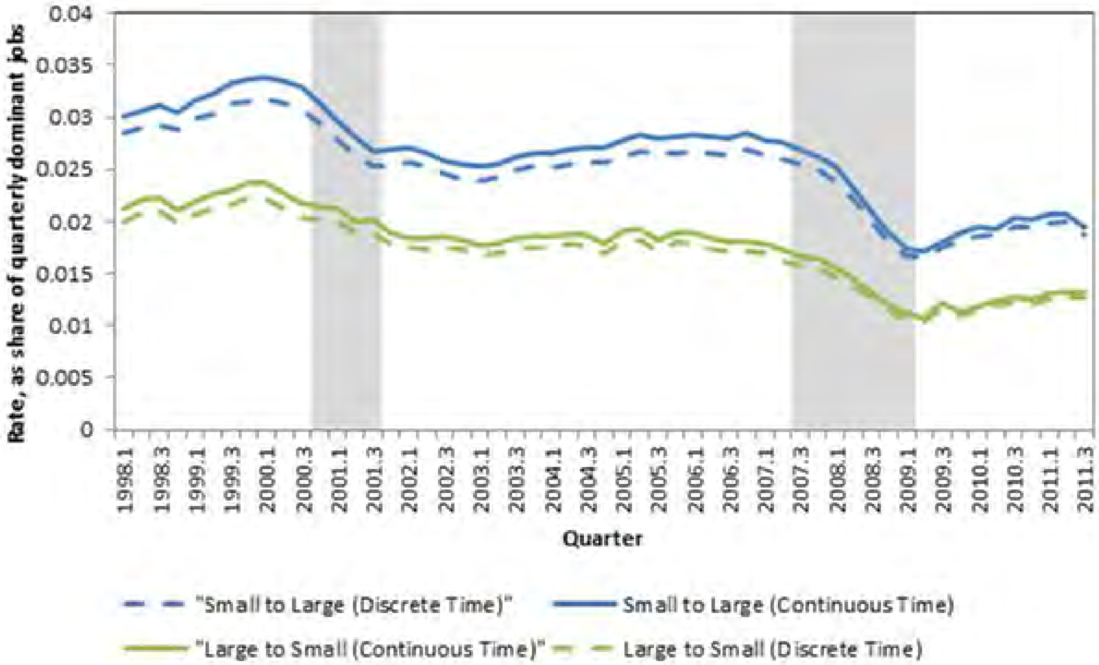
Note: Shaded regions indicate NBER recession quarters. All data are seasonally adjusted.

Figure 7c: SME, Young Firms



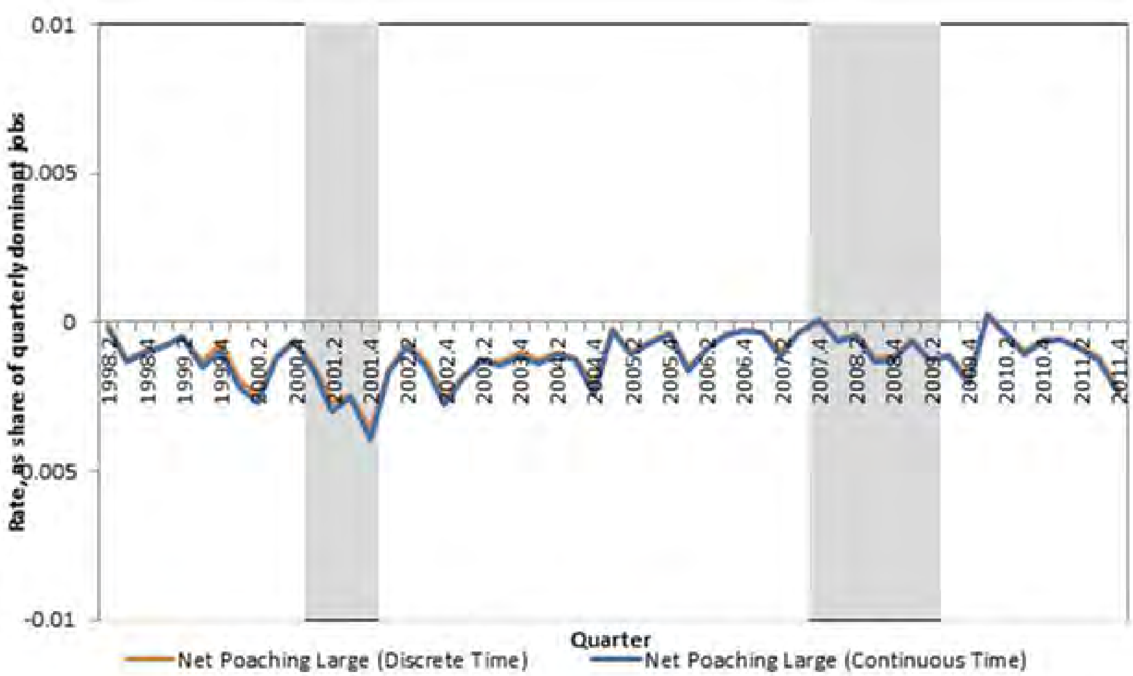
Note: Shaded regions indicate NBER recession quarters. All data are seasonally adjusted.

Figure 8: Continuous vs. Discrete Time Poaching Flows (Small to Large and Large to Small)



Note: Shaded regions indicate NBER recession quarters. All data are seasonally adjusted.

Figure 9: Continuous vs. Discrete Time Net Poaching Flows (Large Firms)



Note: Shaded regions indicate NBER recession quarters. All data are seasonally adjusted.

Table 1: Differential Net Flows, Coefficient on Cyclical Variable, National Time Series, Within/Adjacent

Dependent Variable	**Deviation from HP Trend**	**First Difference**
	By Size: Large minus Small	
Net Job Flows	−0.116*	0.156
	(0.054)	(0.144)
Net Poaching Flows:	−0.051+	−0.132+
	(0.027)	(0.086)
Net Nonemployment Flows	−0.065	0.288**
	(0.041)	(0.103)
	By Wage: High Wage minus Low Wage	
Net Job Flows	−0.269**	−0.557**
	(0.073)	(0.198)
Net Poaching Flows:	−0.253**	−1.460**
	(0.093)	(0.157)
Net Nonemployment Flows	−0.016	0.903**
	(0.072)	(0.139)

Notes: +, *, ** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. "Small" indicates that a firm has 0-50 employees, "Medium" indicates that a firm has 50-499 employees, and "Large" indicates that a business has 500+ employees. "High" indicates that the firm is in the top two quintiles of the wage distribution across firms. "Low" indicates that the firm is in the bottom quintile of the wage distribution across firms. Data are seasonally adjusted using X-11. Each specification includes a linear trend.

Table 2: Differential Net Flows, Coefficient on Cyclical Variable, National Time Series, No Earnings Gap

Dependent Variable	**Deviation from HP Trend**	**First Difference**
	By Size: Large minus Small	
Net Job Flows	−0.115*	0.162
	(0.055)	(0.146)
Net Poaching Flows:	−0.013	−0.083
	(0.024)	(0.060)
Net Nonemployment Flows	−0.102*	0.245*
	(0.044)	(0.116)
	By Wage: High Wage minus Low Wage	
Net Job Flows	−0.268**	−0.544**
	(0.073)	(0.273)
Net Poaching Flows:	−0.238**	−1.062**
	(0.070)	(0.135)
Net Nonemployment Flows	−0.030	0.518**
	(0.060)	(0.139)

Notes: +, *, ** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. "Small" indicates that a firm has 0-50 employees, "Medium" indicates that a firm has 50-499 employees, and "Large" indicates that a business has 500+ employees. "High" indicates that the firm is in the top two quintiles of the wage distribution across firms. "Low" indicates that the firm is in the bottom quintile of the wage distribution across firms. Data are seasonally adjusted using X-11. Each specification includes a linear trend.

Table 3: Differential Net Flows, Coefficient on Cyclical Variable, State-Level Panel, Within/Adjacent

Dependent Variable	**Deviation from HP Trend**	**First Difference**
	By Size: Large minus Small	
Net Job Flows	−0.169**	0.972**
	(0.038)	(0.232)
Net Poaching Flows	−0.070**	0.195*
	(0.017)	(0.080)
Net Nonemployment Flows	−0.099**	0.777**
	(0.027)	(0.158)
	By Wage: High Wage minus Low Wage	
Net Job Flows	−0.235**	0.198
	(0.035)	(0.162)
Net Poaching Flows	−0.251**	−0.706**
	(0.031)	(0.080)
Net Nonemployment Flows	0.016	0.904**
	(0.027)	(0.120)

Notes: +, *, ** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. "Small" indicates that a firm has 0-50 employees, "Medium" indicates that a firm has 50-499 employees, and "Large" indicates that a business has 500+ employees. "High" indicates that the firm is in the top two quintiles of the wage distribution across firms. "Low" indicates that the firm is in the bottom quintile of the wage distribution across firms. All specifications control for state effects, seasonal effects, and a linear time trend. Standard errors clustered at the state level.

Table 4: Differential Net Flows, Coefficient on Cyclical Variable, State-Level Panel, No Earnings Gap

Dependent Variable	**Deviation from HP Trend**	**First Difference**
	By Size: Large minus Small	
Net Job Flows	−0.169**	0.972**
	(0.038)	(0.232)
Net Poaching Flows	0.0001	0.112*
	(0.0009)	(0.043)
Net Nonemployment Flows	−0.169**	0.860**
	(0.032)	(0.191)
	By Wage: High Wage minus Low Wage	
Net Job Flows	−0.235**	0.198
	(0.035)	(0.162)
Net Poaching Flows	−0.237**	−0.610**
	(0.024)	(0.054)
Net Nonemployment Flows	0.002	0.809**
	(0.028)	(0.145)

Notes: +, *, ** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. "Small" indicates that a firm has 0-50 employees, "Medium" indicates that a firm has 50-499 employees, and "Large" indicates that a business has 500+ employees. "High" indicates that the firm is in the top two quintiles of the wage distribution across firms. "Low" indicates that the firm is in the bottom quintile of the wage distribution across firms. All specifications control for state effects, seasonal effects, and a linear time trend. Standard errors clustered at the state level.

Table 5: Differential Net Flows, Size-Age Interactions, State-Level Pane, Within/Adjacent

Dependent Variable	**Deviation from HP Trend**	**First Difference**
	Large & Mature minus Small & Mature	
Net Job Flows	−0.190**	0.816**
	(0.037)	(0.238)
Net Poaching Flows	−0.099**	0.202*
	(0.021)	(0.079)
Net Nonemployment Flows	−0.091**	0.614**
	(0.027)	(0.165)
	Large & Mature minus Small & Young	
Net Job Flows	−0.159**	1.178**
	(0.041)	(0.227)
Net Poaching Flows	−0.041*	0.186**
	(0.016)	(0.083)
Net Nonemployment Flows	−0.118**	0.992**
	(0.029)	(0.1503)

Notes: +, *, ** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. "Small" indicates that a firm has 0-50 employees, "Medium" indicates that a firm has 50-499 employees, and "Large" indicates that a business has 500+ employees. "Mature" indicates that the firm is 11 or more years old. "Young" indicates that the firm is 10 or less years old. All specifications control for state effects, seasonal effects, and a linear time trend. Standard errors clustered at the state level.

Table 6: Differential Net Flows, Within-Industry Relative Size,
State-Level Panel, Within/Adjacent

Dependent Variable	**Deviation from HP Trend**	**First Difference**
	By Within-Industry Size: Large minus Small	
Net Job Flows	−0.179**	0.736**
	(0.038)	(0.190)
Net Poaching Flows	−0.078**	0.175*
	(0.019)	(0.067)
Net Nonemployment Flows	−0.101**	0.561**
	(0.025)	(0.129)

Notes: +, *, ** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. "Small" indicates that a firm is in the lowest tercile of the industry's firm size distribution, and "Large" indicates that a firm is in the upper tercile of the industry's firm size distribution. All specifications control for state effects, seasonal effects, and a linear time trend. Standard errors clustered at the state level.

Table 7: Continuous Time Differential Net Flows
State-Level Panel

Dependent Variable	**Deviation from HP Trend**	**First Difference**
	By Size: Large minus Small	
Net Job Flows	−0.175**	1.039**
	(0.043)	(0.248)
Net Poaching Flows	−0.075**	0.131
	(0.021)	(0.080)
Net Nonemployment Flows	−0.100**	0.909**
	(0.30)	(0.178)

Notes: +, *, ** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. "Small" indicates that a firm has 0-50 employees, "Medium" indicates that a firm has 50-499 employees, and "Large" indicates that a business has 500+ employees. All specifications control for state effects, seasonal effects, and a linear time trend. Standard errors clustered at the state level.

Table 8: Poaching Flows, by Firm Size

	Small	Medium	Large
Share of hires, from other firms	41.8	48.8	50.6
Share of separations, from other firms	43.0	50.8	52.4

Share of private poaching hires private firm sources only		Destination Firm Size Small	Medium	Large	Row Total
Origin Firm Size	Small	15.0	7.0	9.7	31.7
	Medium	7.5	6.9	9.3	23.7
	Large	10.2	9.4	24.9	44.5
	Column Total	32.7	23.4	43.9	100.0

Conditional Probabilities (conditioning on origin):

		Destination Firm Size Small	Medium	Large
Origin Firm Size	Small	47.2	22.2	30.6
	Medium	31.6	29.0	39.4
	Large	23.0	21.2	55.8

Normalized Conditional Probabilities (Normalized by Destination Poaching Share):

		Destination Firm Size Small	Medium	Large
Origin Firm Size	Small	1.44	0.95	0.70
	Medium	0.97	1.24	0.90
	Large	0.70	0.91	1.27

Notes: “Small” indicates that a firm has 0-50 employees, “Medium” indicates that a firm has 50-499 employees, and “Large” indicates that a business has 500+ employees.

Table 9: Poaching Flows, by Firm Wage

		Low	Medium	High	
Share of hires, from other firms		41.89	49.01	58.03	
Share of separations, from other firms		46.0	51.2	48.28	

Share of private poaching hires private firm sources only		Destination Firm Wage Low	Medium	High	Row Total
	Low	23.27	14.35	4.93	42.6
Origin Firm Size	Medium	11.76	15.74	8.18	35.68
	High	3.35	6.28	12.14	21.77
	Column Total	38.38	36.37	25.25	100.0

Conditional Probabilities (conditioning on origin):

		Destination Firm Wage Low	Medium	High
	Low	54.68	33.72	11.58
Origin Firm Size	Medium	32.96	44.11	22.93
	High	15.39	28.85	55.76

Normalized Conditional Probabilities (Normalized by Destination Poaching Share):

		Destination Firm Wage Low	Medium	High
	Low	1.42	0.93	0.46
Origin Firm Size	Medium	0.86	1.21	0.91
	High	0.40	0.79	2.21

Notes: "Low" indicates that a firm is in bottom quintile of firm wage distribution, "Medium" indicates is in 2nd and third quintiles, and "High" indicates that firm is in top 4th and 5th quintiles of firm wage distribution.

Table 10: Poaching Flows, by Within-Industry Relative Firm Size

	Small	Medium	Large
Share of hires, from other firms	42.4	48.4	50.8
Share of hires, from other firms	43.5	50.5	52.6

Share of private poaching hires private firm sources only		Destination Firm Size Small	Medium	Large	Row Total
	Small	13.9	10.0	8.2	31.7
Origin Firm Size	Medium	10.7	12.5	10.8	23.7
	Large	8.7	10.8	14.5	23.7
	Column Total	33.2	33.3	33.6	100.0

Conditional Probabilities (conditioning on origin):

		Destination Firm Size Small	Medium	Large
	Small	43.3	31.1	25.6
Origin Firm Size	Medium	31.4	36.7	31.9
	Large	25.5	31.8	42.7

Normalized Conditional Probabilities (Normalized by Destination Poaching Share):

		Destination Firm Size Small	Medium	Large
	Small	1.30	0.94	0.76
Origin Firm Size	Medium	0.95	1.10	0.95
	Large	0.77	0.96	1.27

Notes: "Small" indicates that a firm is in bottom tercile of within industry employment-weighted distribution of firm size. "Large" indicates that the firm is in the upper tercile of within industry employment-weighted distribution of firm size.

Appendix

A Formal Implications of the Burdett and Mortensen (1998) Model

In this appendix, we explore some of the implications of the simplified Burdett and Mortensen (1998) model that we sketch out in Section II. The exact formulations for hires from nonemployment and other employers, as well as separations to nonemployment and other employers, are as in Section II, see especially equations (1) to (3). Equation (4) gives an equilibrium definition of firm size.

A.1 Properties of the stationary equilibrium

Proposition 1 *Higher-paying firms are larger.*

Proof. The unemployment rate is

$$u = \frac{\delta}{\delta + \lambda}. \tag{7}$$

Given an initial allocation of workers to firms, the rate of change in the mass of workers earning a wage at most w is

$$\frac{dG(w,t;F)(1-u(t))}{dt} = \delta F(w)u(t) - [\delta + \lambda(1 - F(w))]G(w,t;F)(1-u(t)). \tag{8}$$

In a stationary equilibrium, this time derivative must be equal to zero. Therefore,

$$G(w) = \frac{\delta F(w)}{\delta + \lambda(1 - F(w))} \tag{9}$$

Using (4) and the definition of $G(w)$, a firm's employment is given by

$$N(w;F) = \frac{\lambda\delta}{[\delta + \lambda(1 - F(w))]^2}, \tag{10}$$

which is strictly increasing in w.

■

Proposition 2 *Separation and hiring rates are higher at smaller, low paying firms.*

Proof. The separation rate can be written as the sum of separation rate to nonemployment, δ, and the rate of losses to other firms, $\lambda(1-F(w))$

$$\delta + q(w;F) = \delta + \lambda(1-F(w)), \tag{11}$$

which is strictly decreasing in w. The result then follows by Proposition 1. Since the hiring and separation rates must be equal in steady-state, hiring rates too must be higher at smaller firms. ■

Proposition 3 *The share of hires from poaching is higher at larger, high paying firms.*

Proof. Using the definitions of $P(w;F)$ and E, total hires by a firm can be written as

$$P(w;F) + E = \lambda\frac{\delta}{\delta+\lambda} + \lambda\frac{\lambda}{\delta+\lambda}\frac{\delta F(w)}{\delta+\lambda(1-F(w))}. \tag{12}$$

The share of poaching hires is then

$$\frac{P(w;F)}{P(w;F)+E} = \frac{\frac{\lambda}{\delta+\lambda}\frac{\delta F(w)}{\delta+\lambda(1-F(w))}}{\frac{\delta}{\delta+\lambda}+\frac{\lambda}{\delta+\lambda}\frac{\delta F(w)}{\delta+\lambda(1-F(w))}} \tag{13}$$

which is increasing in w, and hence, in a firm's employment, by Proposition 1. ■

Proposition 4 *Poaching flows move from smaller, low paying to larger, higher paying firms.*

Proof. A higher wage w implies a higher position in the wage distribution $F(w)$, and higher employment, by Proposition 1. Therefore, a worker only accepts an offer from any firm larger than his current employer, and rejects any other offer. ■

In addition, in the stationary equilibrium the following must hold.

Proposition 5 *Aggregate net poaching flows and net flows into nonemployment are zero.*

A.2 Comparative statics with respect to offer arrival and separation rates

Consider now some comparative statics at the stationary equilibrium with respect to labor market conditions as summarized by the exogenous offer arrival and separation rates. Formal treatment of the transitional dynamics of the model is beyond the scope of this paper and has been developed by Moscarini and Postel-Vinay (2009, 2010, 2013). Note that, in order to characterize the employment change at any particular firm, we must follow the Rank-Preserving Equilibrium assumption that these authors introduce.

A.2.1 Steady-state employment

Proposition 6 *Proposition 6. The sensitivity of firm size to the offer arrival and separation rates is higher for larger, high paying firms.*

Proof. Note that the derivative of a firm's size with respect to offer arrival rate is

$$\frac{dN(w;F)}{d\lambda} = \frac{d}{d\lambda}\frac{\delta\lambda}{[\delta + \lambda(1 - F(w))]^2}, \tag{14}$$

which is equal to

$$\frac{\delta(\delta - \lambda(1 - F(w)))}{[\delta + \lambda(1 - F(w))]^3}. \tag{15}$$

The semi-elasticity of employment with respect to the growth rate is then

$$\frac{\frac{dN(w;F)}{d\delta}}{N(w;F)} = \frac{\delta - \lambda(1 - F(w))}{\delta + \lambda(1 - F(w))} \tag{16}$$

Note that the semi-elasticity is positive if and only if

$$1 - \frac{\delta}{\lambda} < F(w). \tag{17}$$

The last inequality holds for firms that satisfy $F^{-1}(1 - \frac{\delta}{\lambda}) < w$ (provided that $\frac{\delta}{\lambda} < 1$). Therefore, larger firms experience an increase in employment in percentage terms in response to a rise in offer arrival rate, whereas smaller firms shrink. Note, also, that the semi-elasticity of firm size is decreasing in $(1-F(w))$, implying that the semi-elasticity increases in firm size. Overall, then, smaller firms tend to have small negative changes in employment when the offer arrival rate increases, while the largest firms tend to have the largest proportionate increases.

Similarly, the derivative of a firm's employment with respect to the exogenous job destruction rate δ is given by

$$\frac{dN(w;F)}{d\delta} = \frac{d}{d\delta}\frac{\lambda\delta}{[\delta+\lambda(1-F(w))]^2} = \frac{\lambda^2(1-F(w))-\lambda\delta}{[\delta+\lambda(1-F(w))]^3} \tag{18}$$

The semi-elasticity of an employer's size with respect to the job destruction rate is therefore

$$\frac{(1-F(w))-\delta}{\delta[\delta+\lambda(1-F(w))]}, \tag{19}$$

which is positive for smaller firms, i.e., for those that satisfy $F^{-1}(1-\delta) > w$. Again, taking the derivative of the semi-elasticity with respect to $(1-F(w))$, one obtains

$$\frac{2\lambda}{[\delta+\lambda(1-F(w))]^2} > 0, \tag{20}$$

which implies that the semi-elasticity is decreasing in firm size. ■

A.2.2 Importance of the poaching mechanism

Consider now the response of firm size to a change in the unemployment rate

$$\frac{dN}{du} = \frac{((\delta+q(w;F))(\frac{dE}{dx}+\frac{dP(w;F)}{dx}-(E+P(w;F))(\frac{d\delta}{dx}+\frac{dq(w;F)}{dx}))}{[\delta+q(w;F)]^2}. \tag{21}$$

In semi-elasticity form, one can write

$$\frac{\frac{dN}{dx}}{N} = \frac{1}{s(w;F)}(\frac{\frac{dE}{dx}}{N}+\frac{\frac{dP(w;F)}{dx}}{N}-\frac{d\delta}{dx}-\frac{dq(w;F)}{dx}) \tag{22}$$

Examining the four derivatives inside the brackets yield the following conclusions (see Tables A1 and A2 for the related calculations).

- When the separation rate increases (see Table A1):
  - Hires from nonemployment increase for all firms, and but more so for smaller firms as a share of their employment. However, outflow rates increase uniformly for all firms. On net, small firms may actually expand when non-employment increases.
  - Poaching hire rates increase for small firms but decrease for large firms. Poaching losses do not change since these losses are tied to a firm's position in the wage offer distribution, and the rank ordering of those positions do not change.
  - Overall, smaller firms expand and larger firms contract when the separation rate increases. The contraction is proportionately larger for larger firms.
- When the offer arrival rate increases (see Table A2):
  - Hires from nonemployment increase for all firms. These will be larger as a share of employment for smaller firms. Separations to nonemployment are not affected (by assumption, the job destruction rate is constant). Net hiring from nonemployment, as a share of employment, is therefore higher for smaller firms.
  - Poaching hire rates increase for all firms, but disproportionately for large firms. Poaching loss rates are disproportionately large for small firms. Overall, net employment changes from poaching are positive for large firms but negative for smaller ones.
  - The poaching channel dominates. Firms above a certain size expand, and the proportionate change is larger for larger firms. Smaller firms shrink when the offer arrival rate is higher.

Table A.1: Responseiveness by Firm Size or Wage when the Job Destruction Rate Increases

Component	**Definition**	**Derivative in (22)**	**Large/High**	**Small/Low**
Employment	$\frac{P(w;F)+E}{\delta+q(w;F)}$	$((1-F(w))-\delta)[\delta[\delta+\lambda(1-F(w))]]^{-1}$	Decreases	Increases
Poaching Hires	$\delta(1-u)G(w;F)$	$\lambda F(w)(\lambda^2(1-F(w))-\delta^2)[\delta(\lambda+\delta)^2]^{-1}$	Increases	Decreases
Poaching Separations	$\lambda(1-F(w))$	0	Does not vary	
Net Poaching	$\frac{1}{N(w;F)}\frac{dP}{d\delta}-\frac{q\delta}{d\delta}$	$\lambda F(w)(\lambda^2(1-F(w))-\delta^2)[\delta(\lambda+\delta)^2]^{-1}$	Decreases	Increases
Nonemp. Hires	$\lambda u=\frac{\lambda\delta}{\lambda+\delta}$	$\lambda(\delta+\lambda(1-F(w)))^2[\delta(\lambda+\delta)]^{-1}$	Greater Inc.	Lesser Inc.
Nonemp. Separations	δ	1	Does not vary	
Net Nonemp.	$\frac{1}{N(w;F)}\frac{dE}{d\delta}-\frac{d\delta}{d\delta}$	$\lambda(\delta+\lambda(1-F(w))^2*[\delta(\lambda+\delta)]^{-1}-1$	Decreases	Increases

Table A.2: Responseiveness by Firm Size or Wage when the Offer Arrival Rate Increases

Component	**Definition**	**Derivative in (22)**	**Large/High**	**Small/Low**
Employment	$\frac{P(w;F)+E}{\delta+q(w;F)}$	$(\delta-\lambda(1-F(w))[\delta+\lambda(1-F(w))]^{-1}$	Increases	Decreases
Poaching Hires	$\delta(1-u)G(w;F)$	$\frac{F(w)(\delta\lambda^2(1-F(w))+\lambda^2\delta+\lambda\delta^2)}{\lambda(\lambda+\delta)^2}$	Greater Inc.	Lesser Inc.
Poaching Separations	$\lambda(1-F(w))$	$1-F(w)$	Greater Inc.	Lesser Inc.
Net Poaching	$\frac{1}{N(w;F)}\frac{dP}{d\lambda}-\frac{q\delta}{d\lambda}$	$\frac{F(w)(\delta\lambda^2(1-F(w))+\lambda^2\delta+\lambda\delta^2)}{\lambda(\lambda+\delta)^2}-(1-F(w))$	Greater Inc.	Lesser Inc.
Nonemp. Hires	$\lambda u=\frac{\lambda\delta}{\lambda+\delta}$	$\delta(\delta+\lambda(1-F(w)))^2[\lambda(\lambda+\delta)]^{-1}$	Lesser Inc.	Greater Inc.
Nonemp. Separations	δ	0	Does not vary	
Net Nonemp.	$\frac{1}{N(w;F)}\frac{dE}{d\lambda}-\frac{d\delta}{d\lambda}$	$\delta(\delta+\lambda(1-F(w))^2*[\lambda(\lambda+\delta)]^{-1}$	Decreases	Increases

B Additional Data Details

B.1 LEHD Data

We use linked employer-employee data for the U.S. maintained by the Longitudinal Employer-Household Dynamics (LEHD) program at the U.S. Census Bureau. For background about the LEHD data, see Abowd et al. (2009). We use two recent enhancement to these data: the construction of a multi-state database of job-to-job flows, as well as national firm age and size data. This appendix provides additional background on these recent enhancements, and also provides more detail on the final construction of our analysis dataset.

B.1.1 Job-to-Job Flows

Our paper uses prototype data on worker flows across employers under development at the Longitudinal Employer-Household Dynamics (LEHD) program at the U.S. Census Bureau, as described by Hyatt and McEntarfer (2012a, 2012b). A public use job-to-job flows data product is currently scheduled for release by the LEHD program in late 2014, see Hyatt et al. (2014).

We longitudinally link the flows of workers across firms, industries, and geographies, using an enhanced version of the methodology described in Hyatt and McEntarfer (2012b). This earlier paper was analyzed a dataset constructed from a nine "reference state" database of job-to-job flows; coverage in the database we consider is more comprehensive. The methodology to construct the job-to-job flows database we analyze links the jobs across each quarter of an individual's work history. For workers who hold multiple jobs in a quarter, the highest-earnings employer is the reference employer. These job transitions include categories for the separation and accession events occurring in the same quarter, as well as events where the separation and accession events occur in adjacent quarters. These flows include workers with short duration jobs (less than a quarter) but only if this is the main job in the quarter.

Our quarterly nonemployment measure is a subset of those workers who experience nonemployment in a quarter. For most of our analysis, flows to and from nonemployment have at least a full-quarter of nonemployment (Appendix C reports results where individuals are allowed to have much shorter spells), so these are flows from fairly persistent nonemployment spells. In cases where a job separation is to a job in a state whose data is not available yet, we can misclassify this flow as a flow to nonemployment (and similarly for hires that are inflows from an unavailable states). We also miss flows to and from federal employment, which was not available at the time of this writing. Note that short spells of nonemployment are not inconsistent with a flow being a job-to-job flow. Workers may take at least a short break between their last day on one job and their first day on a new job even if the decision to leave the original job is based on having accepted a new job offer from the firm they are joining. Our definitions and measurement methods are consistent with such possibilities.

Recalls are treated as follows. Short recalls are omitted because one needs to receive no pay from a particular employer for a full quarter to meet our definition of nonemployment. Recalls across full quarter nonemployment are movements into and from nonemployment.

B.1.2 Firm size and age

Our firm age and size characteristics are also a relatively new enhancement to the LEHD data, documented in Haltiwanger et al. (2013). Over the last two years, the LEHD program has integrated Business Dynamics Statistics microdata on firm age and size derived from the U.S. Census Bureau's Longitudinal Business Database, as described in Haltiwanger et al. (2014).

Firm size is based on the total employment in all establishments belonging to the firm on March 12th of the previous year (or the current year for new firms). For any given consecutive two-year period, size is defined as the employment-weighted sum of firm size on March 12 in year t-1 of all establishments that are part of an EIN on March 12 in year t. This definition automatically covers mergers, divestitures, acquisitions, etc. For instance, if a firm in year t has three establishments belonging to three different firms in year t-1, initial firm size in year t is the weighted sum (where the weights are based on the year t size of each establishment) of the firm sizes in year t-1 of each of these three establishments. Firm age is based on the age of the oldest establishment in the year of the firm's birth, and ages naturally over its lifetime. This definition addresses issues of ownership changes. For example, a new legal entity (i.e., firm) that results from some MA activity is not necessarily considered a young firm; instead, it is assigned the age of its oldest establishment at the time of its birth. We also note that we are not the first to consider job-to-job flows by firm size. For our analysis, we group these into three size 'buckets': large (>=500 workers), medium (50-499), and small (<50 workers).

Firm age is the age of the national firm, defined as the age of the oldest establishment in the first year of a firm's existence, and aging naturally afterwards. An establishment is age zero in the first year that it reports any positive payroll. We use two age categories: those 0-10 years of age are called "Young" firms, and those of 11 or more years of age are called "Mature" firms. Note that in supplementary analyses excluded from this paper or any of its Appendices, we further sub-divided the "Young" category into 0-1 vs. 2-10 years of age. Finding that firms in these two age categories behaved similarly in their hiring activity, we combined them for expositional purposes.

B.1.3 Final LEHD dataset construction

Our sample and definitions are as follows. The LEHD data provides employment information for private UI-covered employment for all 50 states. As the first year of data availability varies by state, our sample consists of 28 states whose histories extend back to 1998, and we are then able to follow workers and firms through 2012. Our 28 states are CA, FL, GA ,HI, ID, IL, IN, KS, ME, MD, MN, MO, MT, NC, NJ, ND, NM, NV, PA, OR, RI, SC, SD, TN, VA, WA, and WV. By 2000, data is available for 44 states. A handful of states, mostly small southern states (AL, AR, MS, DC) enter the LEHD data in the 2000s, and Massachusetts is missing in entirety at the time of this writing. Henderson and Hyatt (2012) have studied the geographic bias in the job-to-job flow statistics calculated in Hyatt and McEntarfer (2012b) and found that it diminishes rapidly once the last large cohort of states enters the data in 2000. Based on this analysis, we believe the misclassification of cross-state jobs as flows to or from nonemployment is a minimal source of error over our time series.

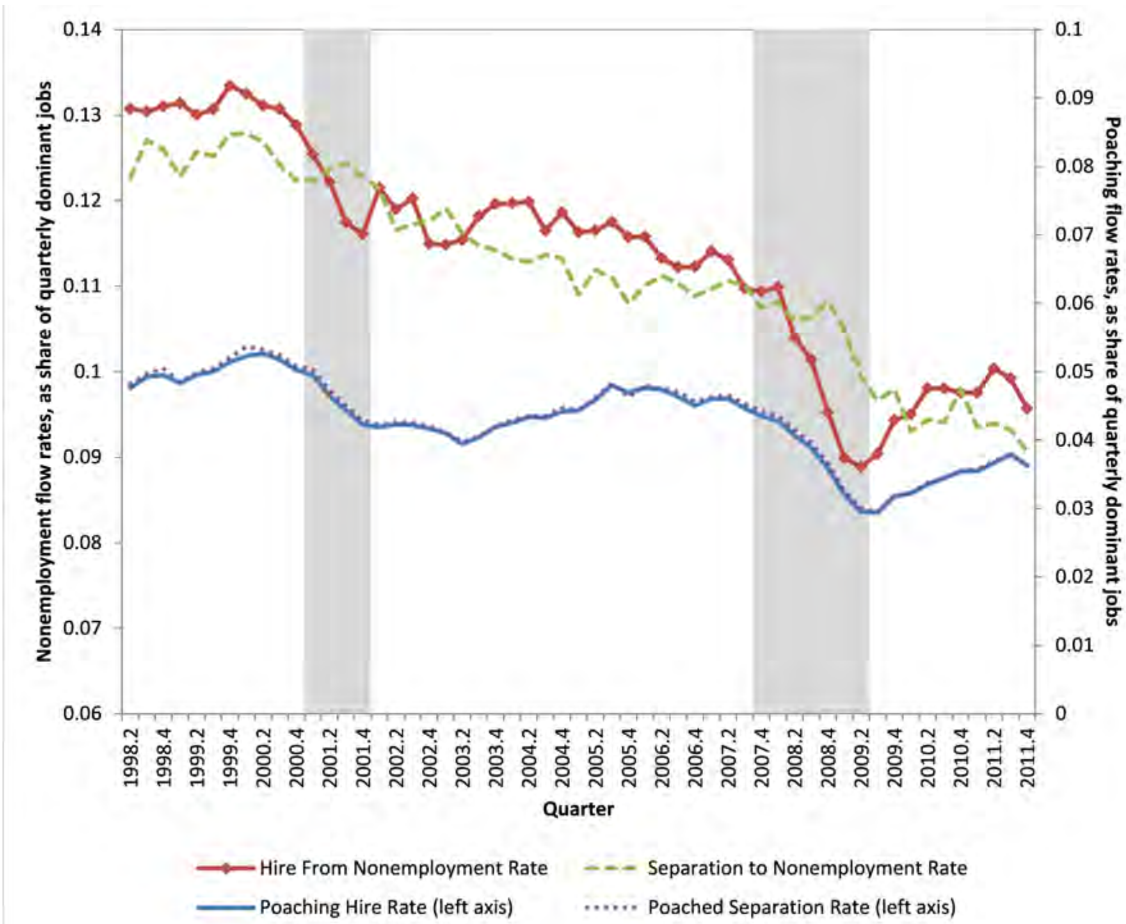
We start our time-series in 1998 to limit geographic availability bias, which is small and diminishes as more states enter the data in the early 2000s; see Henderson and Hyatt (2012). We focus our analysis for hires and separations for private sector firms. But we note that we include the contribution (which turns out to be modest) of poaching hiring flows at private sector firms that originate from state and local government entities and poaching separation flows from private sector firms that have as the destination state and local government entities.

B.2 Cyclical indicators

We exploit indicators of the cyclicality of the labor market using transformations of the unemployment rate. The unemployment rate aggregates responses to the Current Population Survey (CPS), and state- and national-level rates were downloaded from the BLS website, http://www.bls.gov. Our flow data from the LEHD are not seasonally adjusted so we start with not seasonally adjusted unemployment rate quarterly series from the CPS. But in all of our empirical specifications we include seasonal controls (mostly in the form of seasonal dummies).

C Robustness Tables and Figures

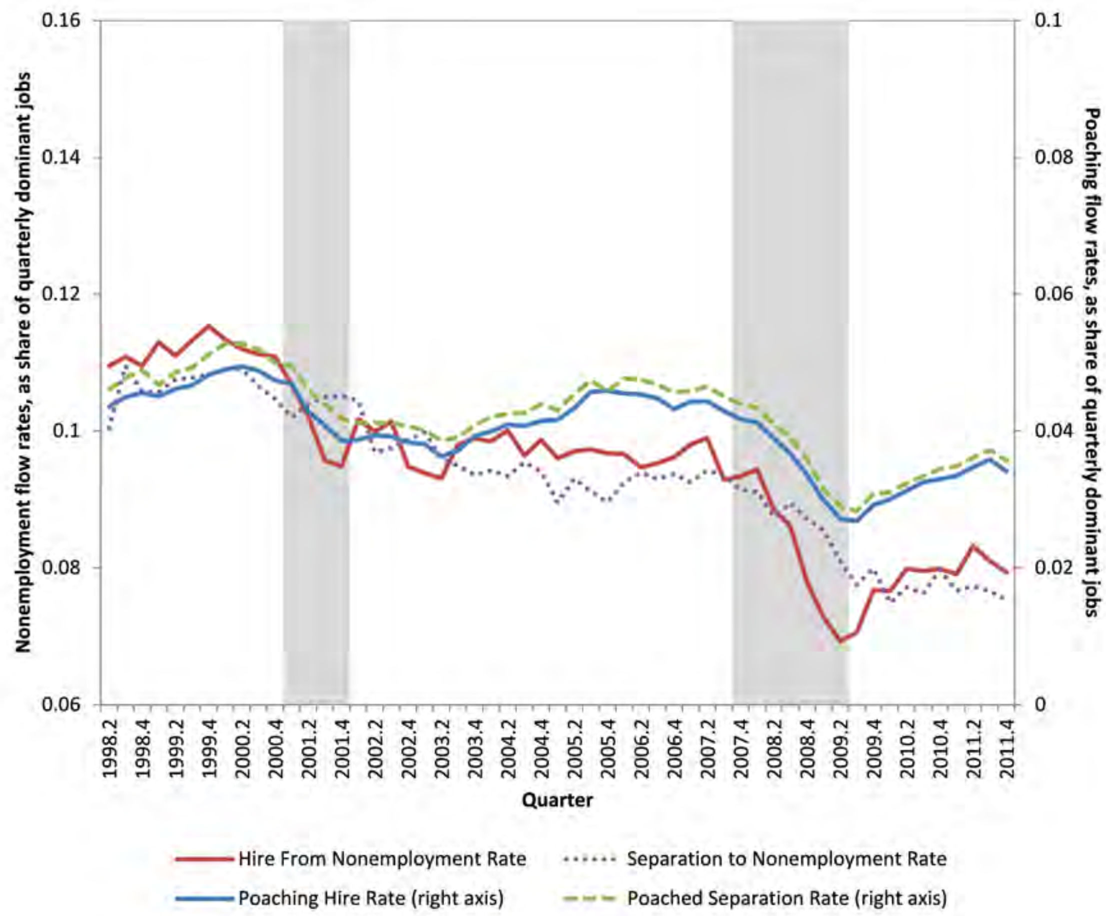
Figure C1: Hires and separations: poaching flows vs. flows to and from nonemployment (within quarter flows as poaching flows only)



Note: Shaded regions indicate NBER recession quarters. All data are seasonally adjusted. Poaching flows include within-quarter flows only.

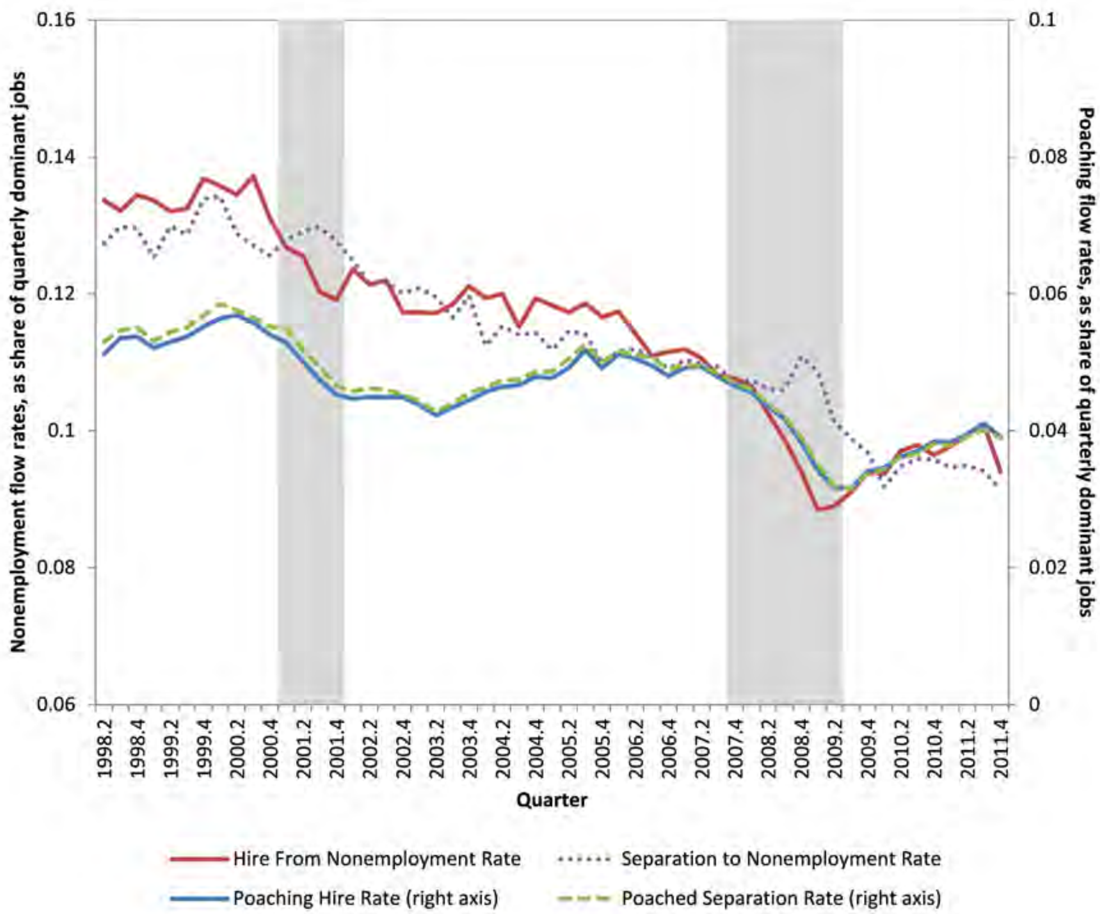
Figure C2: Hires and separations: poaching flows vs. flows to and from nonemployment by firm size (within quarter flows as poaching flowsonly)

Figure C2a: Large Firms



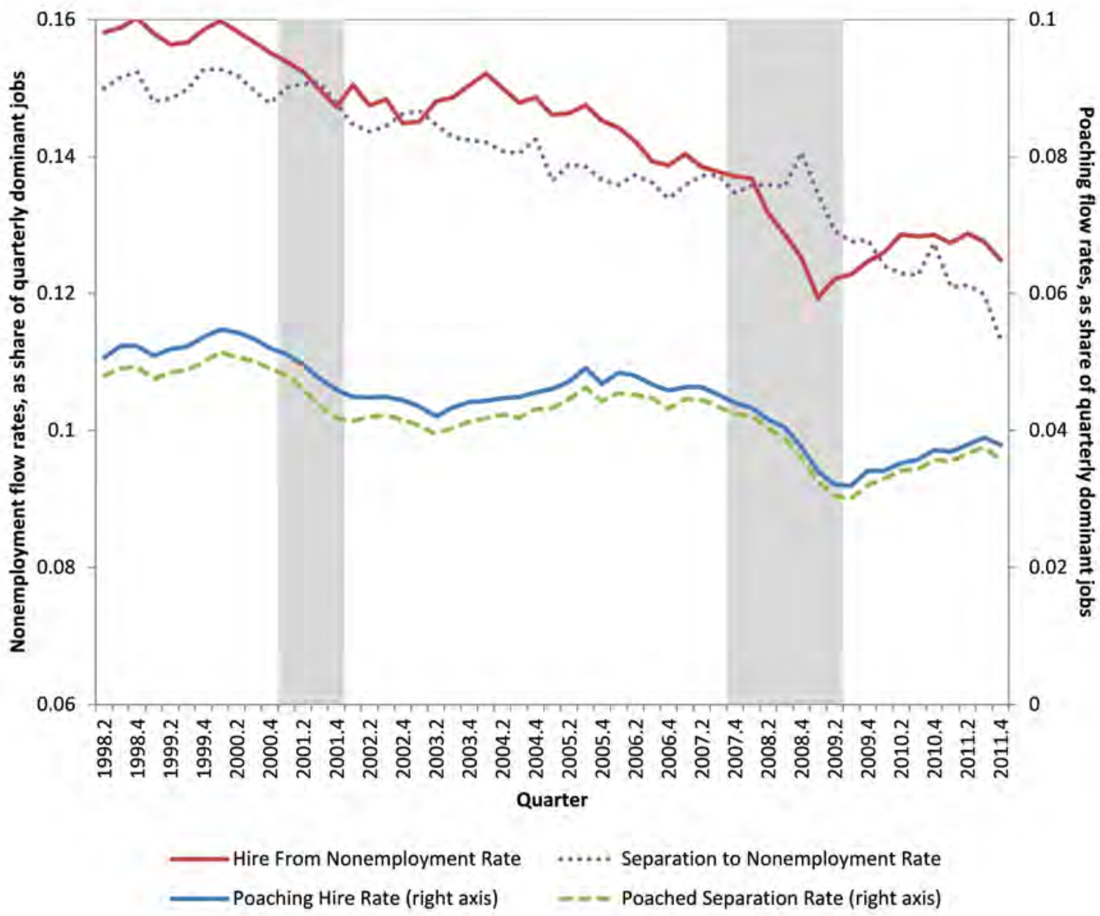
Note: Shaded regions indicate NBER recession quarters. All data are seasonally adjusted. Poaching flows include within-quarter flows only.

Figure C2b: Medium Size Firms



Note: Shaded regions indicate NBER recession quarters. All data are seasonally adjusted. Poaching flows include within-quarter flows only.

Figure C2c: Small Firms



Note: Shaded regions indicate NBER recession quarters. All data are seasonally adjusted. Poaching flows include within-quarter flows only.

Table C.1: Differential Net Flows, Within-Quarter Poaching Only
National Time Series

Dependent Variable	**Deviation from HP Trend**	**First Difference**
	By Size: Large minus Small	
Net Job Flows	−0.117**	0.153
	(0.053)	(0.142)
Net Poaching Flows	0.015	−0.040
	(0.011)	(0.029)
Net Nonemployment Flows	−0.132**	0.193
	(0.047)	(0.128)

Notes: +, *, ** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. "Small" indicates that a firm has 0-50 employees, "Medium" indicates that a firm has 50-499 employees, and "Large" indicates that a business has 500+ employees. Data are seasonally adjusted using X-11. Poaching flows include within-quarter flows only.

Table C.2: Differential Net Flows, Coefficient on Cyclical Variable, State-Level Panel, Within/Adjacent

Dependent Variable	**Deviation from HP Trend**	**First Difference**
	By Size: Large minus Small	
Net Job Flows	−0.169**	0.972**
	(0.057)	(0.247)
Net Poaching Flows	−0.070*	0.195*
	(0.030)	(0.085)
Net Nonemployment Flows	−0.099*	0.777**
	(0.045)	(0.172)
	By Wage: High Wage minus Low Wage	
Net Job Flows	−0.235**	0.198
	(0.075)	(0.174)
Net Poaching Flows	−0.251**	−0.706**
	(0.086)	(0.104)
Net Nonemployment Flows	0.016	0.904**
	(0.049)	(0.125)

Notes: +, *, ** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. "Small" indicates that a firm has 0-50 employees, "Medium" indicates that a firm has 50-499 employees, and "Large" indicates that a business has 500+ employees. "High" indicates that the firm is in the top two quintiles of the wage distribution across firms. "Low" indicates that the firm is in the bottom quintile of the wage distribution across firms. All specifications control for state effects and time effects. Standard errors clustered at the quarter level.

Table C.2: Differential Net Flows, Coefficient on Cyclical Variable, State-Level Panel, No Earnings Gap

Dependent Variable	**Deviation from HP Trend**	**First Difference**
	By Size: Large minus Small	
Net Job Flows	−0.169**	0.972**
	(0.057)	(0.247)
Net Poaching Flows	0.0001	0.112*
	(0.013)	(0.045)
Net Nonemployment Flows	−0.169**	0.860**
	(0.050)	(0.207)
	By Wage: High Wage minus Low Wage	
Net Job Flows	−0.235**	0.198
	(0.075)	(0.174)
Net Poaching Flows	−0.237**	−0.610**
	(0.065)	(0.079)
Net Nonemployment Flows	0.002	0.809**
	(0.043)	(0.145)

Notes: +, *, ** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. "Small" indicates that a firm has 0-50 employees, "Medium" indicates that a firm has 50-499 employees, and "Large" indicates that a business has 500+ employees. "High" indicates that the firm is in the top two quintiles of the wage distribution across firms. "Low" indicates that the firm is in the bottom quintile of the wage distribution across firms. All specifications control for state effects and time effects. Standard errors clustered at the quarter level.

Table C.3: Differential Net Flows, Within- and Adjacent-Poaching
State-Level Panel

Dependent Variable	**Deviation from HP Trend**		**First Difference**	
	Model		Model	
	1	2	1	2
	By Size: Large minus Small			
Net Job Flows	−0.169**	−0.228*	0.972**	1.535**
	(0.038)	(0.108)	(0.232)	(0.332)
Net Poaching Flows	−0.070**	−0.068	0.195*	0.448**
	(0.017)	(0.050)	(0.080)	(0.116)
Net Nonemployment	−0.099**	−0.160+	0.777**	1.075**
Flows	(0.027)	(0.080)	(0.158)	(0.226)
	By Wage: High Wage minus Low Wage			
Net Job Flows	−0.235**	−0.006	0.198	0.687**
	(0.035)	(0.140)	(0.162)	(0.240)
Net Poaching Flows	−0.251**	−0.080	−0.706**	−0.205*
	(0.031)	(0.077)	(0.080)	(0.094)
Net Nonemployment	0.016	0.074	0.904**	0.891**
Flows	(0.027)	(0.114)	(0.120)	(0.194)
Time Trend	X		X	
Fixed Effects				
State	X	X	X	X
Season	X		X	
Quarter		X		X

Notes: +, *, ** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. "Small" indicates that a firm has 0-50 employees, "Medium" indicates that a firm has 50-499 employees, and "Large" indicates that a business has 500+ employees. "High" indicates that the firm is in the top two quintiles of the wage distribution across firms. "Low" indicates that the firm is in the bottom quintile of the wage distribution across firms. Standard errors clustered at the state level.

Table C.4: Differential Net Flows, No Earnings Gap
State-Level Panel

Dependent Variable	**Deviation from HP Trend**		**First Difference**	
	Model		Model	
	1	2	1	2
	By Size: Large minus Small			
Net Job Flows	−0.169**	−0.228*	0.972**	1.535**
	(0.038)	(0.108)	(0.232)	(0.332)
Net Poaching Flows	0.0001	−0.013	0.112*	0.236**
	(0.010)	(0.026)	(0.043)	(0.064)
Net Nonemployment	−0.169**	−0.214*	0.860**	1.287**
Flows	(0.032)	(0.090)	(0.191)	(0.273)
	By Wage: High Wage minus Low Wage			
Net Job Flows	−0.235**	−0.006	0.198	0.687**
	(0.035)	(0.140)	(0.162)	(0.240)
Net Poaching Flows	−0.237**	−0.116+	−0.610**	−0.316**
	(0.024)	(0.060)	(0.054)	(0.070)
Net Nonemployment	0.002	0.110	0.809**	1.003**
Flows	(0.028)	(0.119)	(0.145)	(0.231)
Time Trend	X		X	
Fixed Effects				
State	X	X	X	X
Season	X		X	
Quarter		X		X

Notes: +, *, ** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. “Small” indicates that a firm has 0-50 employees, “Medium” indicates that a firm has 50-499 employees, and “Large” indicates that a business has 500+ employees. “High” indicates that the firm is in the top two quintiles of the wage distribution across firms. “Low” indicates that the firm is in the bottom quintile of the wage distribution across firms. Standard errors clustered at the state level.

Table C.5: Differential Net Flows, Within-Quarter Poaching Only
State-Level Panel

Dependent Variable	**Deviation from HP Trend**		**First Difference**	
	Model		Model	
	1	2	1	2
	By Size: Large minus Small			
Net Job Flows	−0.169**	−0.228*	0.972**	1.535**
	(0.038)	(0.108)	(0.232)	(0.332)
Net Poaching Flows	−0.012	−0.019	0.136*	0.289**
	(0.011)	(0.029)	(0.056)	(0.083)
Net Nonemployment	−0.157**	−0.209*	0.836**	1.235**
Flows	(0.031)	(0.087)	(0.180)	(0.257)
Time Trend	X		X	
Fixed Effects				
State	X	X	X	X
Season	X		X	
Quarter		X		X

Notes: +, *, ** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. "Small" indicates that a firm has 0-50 employees, "Medium" indicates that a firm has 50-499 employees, and "Large" indicates that a business has 500+ employees. Standard errors clustered at the state level.

Table C.6: Differential Net Flows, Size-Wage Interactions, State-Level Panel

Dependent Variable	**Deviation from HP Trend**	**First Difference**
	High Wage & Large minus Low Wage & Large	
Net Job Flows	−0.228**	−0.156
	(0.055)	(0.140)
Net Poaching Flows	−0.266**	−1.012**
	(0.045)	(0.086)
Net Nonemployment Flows	0.038	0.856**
	(0.035)	(0.107)
	High Wage & Large minus High Wage & Small	
Net Job Flows	−0.162**	0.146**
	(0.035)	(0.146)
Net Poaching Flows	−0.047*	0.045
	(0.020)	(0.057)
Net Nonemployment Flows	−0.115**	0.655**
	(0.021)	(0.097)
	High Wage & Large minus Low Wage & Small	
Net Job Flows	−0.281**	1.052**
	(0.050)	(0.312)
Net Poaching Flows	−0.253**	−0.344**
	(0.033)	(0.114)
Net Nonemployment Flows	−0.028	1.396**
	(0.041)	(0.215)

Notes: +, *, ** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. "Small" indicates that a firm has 0-50 employees, "Medium" indicates that a firm has 50-499 employees, and "Large" indicates that a business has 500+ employees. "High" indicates that the firm is in the top two quintiles of the wage distribution across firms. "Low" indicates that the firm is in the bottom quintile of the wage distribution across firms. All specifications control for state effects, seasonal effects, and a linear time trend. Standard errors clustered at the state level.

D Flows Including State and Local Government

Table D.2: Poaching Flows, by Firm Size, Including State & Local Govt.

Share of private poaching hires private firm sources only		Destination Firm Size Small	Medium	Large	Row Total
Origin Firm Size	Small	14.5	7.0	9.4	30.7
	Medium	7.2	6.7	9.0	22.9
	Large	9.9	9.1	24.0	43.0
Origin job in State or Local Govt.		1.1	0.8	1.5	23.7
	Column Total	32.7	23.4	43.9	100.0

Notes: "Small" indicates that a firm has 0-50 employees, "Medium" indicates that a firm has 50-499 employees, and "Large" indicates that a business has 500+ employees.

Table D.2: Poaching Flows, by Firm Size and Age, Including State & Local Govt.

Share of private poaching hires private firm sources only		Destination Firm Size Small	Medium	Large	Row Total
Origin Firm Size	SME, Young	10.4	7.6	8.0	27.1
	SME, Mature	8.2	9.2	8.4	26.8
	Large, Mature	8.3	8.4	19.8	38.4
Origin job in State or Local Govt.		0.8	0.9	1.2	3.1
	Column Total	27.8	26.0	37.5	*

Notes: "SME" indicates that a firm has 0-499 employees, and "Large" indicates that a business has 500+ employees. "Mature" indicates that a firm was born 11 or more years ago, while "Young" indicates that the firm is at most 10 years old.