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ABSTRACT

Do the job-to-job moves of workers contribute to the cyclicality of employment growth at different types of firms? In this paper, we use linked employer-employee data to provide direct evidence on the role of job-to-job flows in job reallocation in the U.S. economy. To guide our analysis, we look to the theoretical literature on on-the-job search, which predicts that job-to-job flows should reallocate workers from small to large firms. While this prediction is not supported by the data, we do find that job-to-job moves generally reallocate workers from lower paying to higher paying firms, and this reallocation of workers is highly procyclical. During the Great Recession, this firm wage job ladder collapsed, with net worker reallocation to higher wage firms falling to zero. We also find that differential responses of net hires from non-employment play an important role in the patterns of the cyclicality of employment dynamics across firms classified by size and wage. For example, we find that small and low wage firms experience greater reductions in net hires from non-employment during periods of economic contractions.

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1 Introduction

In this paper, we present empirical evidence of a cyclical job ladder reallocating workers from low-wage to high-wage employers, using new data on job-to-job flows for the United States. Aggregate expansions are well known to be associated with higher rates of worker mobility; here we show that increased worker churn during expansions results in a substantial net reallocation of workers from low-wage to high-wage employers in economic booms. When the economy contracts, worker mobility falls and the net reallocation of workers from low-wage to high-wage employers consequently declines (and during several quarters of the Great Recession, fell to approximately zero).

More generally, we characterize the cyclical reallocation of workers across firms using prototype job-to-job flows data constructed from longitudinal employer-employee linked data for the United States. Flows of workers across jobs are known to be quite large - much larger than those needed to reallocate labor across growing and shrinking employers.[1] Much evidence shows that the latter (job reallocation) is productivity enhancing as more productive businesses expand while less productive businesses contract (see, e.g., Syverson (2011) for a recent survey). Job-to-job flows contribute to both job reallocation and churn components of worker reallocation. In this paper, we decompose net job flows into net job-to-job flows and net hires from non-employment, identifying how job reallocation across firms manifests itself across the business cycle.

In addition to the role of job-to-job moves in job reallocation, worker mobility across jobs is of broader economic interest. Worker reallocation across firms is an important feature of seminal models of the labor market, which have strong implications for how on-the-job search reallocates workers across employers.[2] The procyclical nature of job-to-job flows and the corresponding

[1] Worker reallocation is defined as hires plus separations. Job reallocation is the sum of job creation and destruction. The difference between worker reallocation and job reallocation is often called excess worker reallocation or churn. The evidence shows worker reallocation is at least twice the pace of job reallocation. For early studies about the differences between worker and job reallocation see Davis and Haltiwanger (1992), Anderson and Meyer (1994) and Burgess, Lane and Stevens (2000). One highly relevant aspect of this distinction is that job reallocation is countercyclical while worker reallocation is procyclical (see Davis, Faberman and Haltiwanger (2012)).

[2] These include Burdett and Mortensen (1998), 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, 2013, 2014), Coles and Mortensen (2012), and Bagger et al. (2014).

wage increases associated with these flows has also suggested that job-to-job moves have an important role in allowing workers to find better job matches.[3] Thus the recent declining trend in worker separations has been of concern to economists and policy makers, because it may indicate diminished opportunities for employed workers to improve their employment situations.[4]

To guide our empirical analysis of job-to-job moves across firms we look to the theoretical literature on on-the-job search. A useful starting point for considering how job-to-job flows might reallocate workers across different firms are wage-posting models of on-the-job search. In the seminal model by Burdett and Mortensen (1998), larger businesses post higher wages, attracting and retaining more workers than smaller, lower-paying firms. A core prediction of the model is that job-to-job flows move workers up the firm size, firm wage job ladder.[5] The model also implies that larger firms will have lower turnover, pay higher wages and poach a larger share of their hires other firms. That larger firms pay higher wages and have lower turnover is well documented in the empirical literature.[6] In this paper, we take the implications for worker reallocation to the data and empirically test whether larger, higher-paying firms do indeed grow largely by poaching workers away from smaller, lower-paying firms.

Recent papers by Moscarini and Postel-Vinay (2009, 2013, 2014) develop dynamic versions of Burdett and Mortensen where poaching from small (low-wage) to large (high-wage) firms intensifies in tighter labor markets. The main prediction of their theoretical model is that employment at larger firms will be more cyclically sensitive, due to the greater ability of large firms to poach workers away from smaller firms by offering their workers higher wages. In Moscarini and Postel-Vinay (2009, 2012), they find evidence that large firms increase employment more during periods of low unemployment relative to small firms. Consistent with this result, Kahn and McEntarfer (2014) find evidence that high-wage employers increase their employment more

[3]For evidence that job-to-job flows are procyclical see Fallick and Fleischman (2004) and Bjelland et. al. (2011). For evidence that job-to-job flows tend to yield wage increases 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). For evidence that job-to-job flows have a declining trend since 2000, see Hyatt and McEntarfer (2012a) and Hyatt and Spletzer (2013).

[4]Davis and Haltiwanger (2014) present evidence that the decline in the pace of worker reallocation contributes to the declining employment rates especially for marginally attached workers.

[5]Burdett and Mortensen (1998) generate 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. But these predictions also hold with productivity differences.

[6]See Brown and Medoff (1989). For recent evidence using the QWI, see Haltiwanger et. al. (2012).

in times of low unemployment relative to low-wage employers. The conclusions drawn in these papers are that large, high wage employers have more cyclically sensitive employment.

In this paper, we decompose net employment growth (overall or by firm size or firm wage class) into net poaching from other firms and net hires from non-employment, to test the role of the poaching mechanism in employment flows on average and over the cycle more directly. We find that some aspects of the Burdett and Mortensen (1998) model hold up fairly well when taken to the data. Larger and higher paying businesses do poach a greater share of their hires from other firms, while smaller, lower paying businesses rely more on the pool of non-employed 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. Furthermore, 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.

However, the prediction that on-the-job search generally reallocates workers from small firms to large is not supported by the evidence. Instead, we find only a very small amount of employment on net is reallocated across smaller and larger employers via 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. Given that the net poaching from small to large remains negative and modest in magnitude at all points in the cycle, there is not much support for the poaching mechanism accounting for the net employment growth patterns by firm size over the cycle. That worker reallocation has different patterns across wage classes than size classes suggests that the one-to-one relationship between employer size and wages in this class of theoretical models does not hold in the data. We discuss this further below.

Taking into account the cyclical patterns of net hires from non-employment helps reconcile the different cyclical poaching and the overall net growth patterns by firm size and firm wage.

We find that it is the differential pattern of net hires from non-employment across large and small employers that primarily accounts for the Moscarini and Postel-Vinay (2012) finding that large employers increase employment more during times of low unemployment. In contrast, we find that it is the highly procyclical net poaching away from lower wage to high wage firms that accounts for the finding that high wage employers increase employment more during times of low unemployment. Thus our findings imply that the mechanisms underlying the empirical findings of Mocarini and Postel-Vinay (2012) and Kahn and McEntarfer (2014) are quite different even though a reading of the two papers suggests the same poaching mechanism is at work.[7]

The finding in this recent literature that large and high-wage firms have more cyclically sensitive employment is in contrast to the conventional wisdom in a long literature beginning with Gertler and Gilchrist (1994) that it is small businesses that are more cyclically sensitive, due to credit constraints. We investigate these conflicting views in our data and find that the results are sensitive to whether one uses cyclical indicators that capture expansions and contractions vs. periods of high and low unemployment. The deviation of the level of unemployment from its trend is only weakly correlated with measures of growth and change. When we use as our cyclical indicator the change in unemployment rate we find that it is small (and in using state-level cyclical variation, low-wage) employers that are more cyclically sensitive.[8] This latter finding is more consistent with the conventional wisdom and inconsistent with wage posting models predicting that high wage and large firms need to shed employment more during times of economic contractions. Perhaps not surprisingly, the difference is driven largely by the non-employment margin - layoffs are much more strongly correlated with changes in the unemployment rate than the HP-filtered unemployment rate.[9] During periods of economic contractions, the net hires from non-employment declines much more sharply for small and low wage firms than large and high wage firms. The non-employment margin is inherently interesting since the flows in and out of non-employment directly impact the pool of unemployed and non-employed.

[7]Consistent with our findings, Kahn and McEntarfer (2014) have some results showing that the poaching margin is at work for their findings.

[8]The change in unemployment rate is a co-incident indicator of economic contractions while the HP-filtered unemployment rate is a lagging indicator. The correlation between the change in unemployment rate and the aggregate net employment growth rate is negative and very large in magnitude. The correlation between the net employment growth rate and the HP-filtered unemployment rate is negative but relatively small in magnitude. This is a point highlighted by Fort et al. (2013). Fort et al. (2013) also find that young and small businesses have greater net employment declines during periods of economic contractions.

[9]We don't directly measure layoffs in our data but Davis et al. (2012) show that layoffs are highly correlated with job destruction and that such flows typically yield flows into non-employment.

Since a core aspect of our findings is that predictions of wage posting models in terms of firm wage are mostly supported by the evidence while the predictions in terms of firm size are mostly not supported, we consider a number of extensions to our analysis to help reconcile our findings with the theory. We recognize that there may be many sources of firm heterogeneity present in the data but outside the scope of the models and abstracting from such heterogeneity may be important to test the predictions of the theory. Evidence that there is substantial heterogeneity outside the scope of the models is readily apparent since, 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. Such unobserved heterogeneity likely plagues both our measures of firm size and firm wage. But since we find the results hold up so well for firm wages we focus our attention on factors that may be important to control for in our analysis of firm size. 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.[10] We also consider using relative measures of firm size within an industry and find this has little impact on the results.

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. We then discuss the more recent literature that develops the predictions about the patterns of job-to-job flows over the cycle, in particular, Moscarini and Postel-Vinay (2009, 2012, 2013, 2014). 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 non-employment 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.

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

[10]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). In this model, highly productive entrants post high wages and can poach workers from any relatively low productivity incumbent.

higher than their current one. Its equilibrium is quite useful for explaining wage dispersion across firms, 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 non-employed workers receive offers randomly at rate λ, which are equally likely to come from any firm. Employed workers leave to non-employment at rate δ, and the share of workers non-employed is the unemployment rate u.

From this framework, we can write down exact formulations of hires from non-employment and employment, as well as separations to non-employment and other employers. The rate at which employees separate to non-employment 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

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

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

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

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.[11] 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.[12]

Third, the model predicts the shares of hires that come from non-employment are higher at smaller, low wage businesses than at larger firms. This is because, by assumption, the flow of hires from non-employment are the same for every business, regardless of size or wage.[13] However, when businesses make wage offers (recall that this is a model of random, rather than directed, 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.

Of particular interest for our analysis is the dynamic implications of this type of model with

[11]Moscarini and Postel-Vinay (2009, 2014) provide some evidence on the share of hires from other employers (vs. non-employment) at large firms is higher than at small firms during economic expansions, using data from the Survey of Income and Program Participation. We find similar patterns but this does not yield that net poaching moves workers from small to large firms.

[12]We recently confirmed the higher turnover rate of smaller firms in an earlier paper (Haltiwanger et al., 2012).

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

changes in economic conditions, as has been explored in a series of papers by Moscarini and Postel-Vinay (2009, 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. 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.

There are 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. These models predict a very tight relationship between firm size and firm wage (and in turn with firm productivity). However, there are many factors that may drive a wedge in these relationships. 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.[14] This pattern suggests there

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

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.[15] 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.

Another issue 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 Postel-Vinay (2012) use the deviation of the unemployment rate from its HP trend 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 characteristics use alternative cyclical indicators. Even for testing hypotheses from the wage posting models we think it is useful to to explore patterns over different phases of the cycle. Moscarini and Postel-Vinay (2012) provide motivation for this when they provide the intuition for their hypotheses. They argue (see pages 2512-2513 in particular) that large, high wage 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, high wage firms have greater need to shed workers. In contrast, they argue that small, low wage firms should shrink less in downturns since they were more constrained in their growth during the previous expansion. 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

[15] See, among others, Jovanovic (1982), Dunne, Roberts, and Samuelson (1989), and Foster, Haltiwanger and Syverson (2013).

(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.[16] 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 the further decomposition of hires and separations due to a job-to-job flow (what we call equivalently call a poaching flow) and hires and separations from non-employment. This decomposition is necessary to directly test the contribution of poaching flows to net employment growth at firms. To identify worker flows from other employers, 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 non-employment are classified as flows to and from non-employment.[17]

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 non-employment 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 non-employment spell.

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

[17]Our data universe differs slightly from that used in the recently released public use Census Job-to-Job Flows data, which publishes quarterly worker flows for workers employed on the first day of the quarter, see Hyatt et al. (2014). By using all workers employed during the quarter in our sample, our worker flows have higher levels but almost identical trends as the public use data. As we show in Appendix E, similar results to what we find here for firm size can be obtained from the Job-to-Job Flows data.

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 (2012b), 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 non-employment necessarily involve a full quarter spell of non-employment. This permits us to quantify the contribution of hires and separations to/from at least one full quarter of non-employment. The disadvantage of the second approach is that the measured job-to-job flows are more likely to involve spells of non-employment that are above and beyond those associated with taking a break between jobs.

The third approach we consider is a hybrid 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 at the worker level, 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 at the worker level consistent with less than one month of time between jobs, we identify this as a job-to-job flow.[18] In what follows, we call this the no significant earnings gap approach (or no earnings gap for short). We find that about 90 percent of the within quarter flows and about 60 percent of the adjacent quarter flows are counted as job-to-job flows using the no earnings gap approach.

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.

[18] 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 for a worker 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).

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 are defined at the national level using the U.S. Census Bureau's Longitudinal Business Database (LBD).[19] 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 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. We use these categories for expositional convenience since in unreported results we have found that the patterns for the quintiles within our high and medium groups are similar.

For the measurement of firm wages, we use in each quarter the average earnings per worker of full quarter workers at the firm. 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. 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. 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. We have also in unreported results checked the sensitivity to using the average earnings per worker at the firm over the entire sample (or over the life of the

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

SEIN). We find very similar results but this approach has limitations at the beginning and end of our sample. In this cross check we found that firms tend to be in the same quintiles using the long run average as for our approach of using the current quarter measure.[20]

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) non-employment. 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.[21] Our 28 states include many of the largest states so that our sample accounts for 65 percent of national private 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

[20]One limitation is that our average earnings per worker is not controlling for hours per worker. This implies we have a potentially noisy proxy for the desired measure of the average wage at the firm. We think this is not likely to be an important source of measurement error given our use of quintiles of the earnings per worker distribution especially since we focus on the difference between high wage (top two quintiles) and bottom quintile. In our view, it is unlikely that this source of measurement error would reverse firms being in the high and low wage categories. Moreover, we think this is a form of classical measurement error implying that if anything this would imply we are understating differences between the high and low wage firm types. In addition, the use of full quarter workers mitigates these concerns.

[21]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.

expansions. Consistent with this pattern, 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 non-employment and S_n is separations into non-employment. 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 series are highly correlated.[22] 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 excludes transitions with significant earnings shortfalls in the quarter(s) of job change relative to surrounding quarters - these shortfalls may reflect an unemployment spell between jobs.

Figure 3, in Panels 3(a) and 3(b), presents the decomposition of private sector hires and separations into their poaching and non-employment components for the within/adjacent quarter and no earnings gap approaches respectively.[23] The different approaches of identifying job-to-job flows impact the levels of poaching vs. non-employment flows, but not the cyclicality or trend 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.[24] Hires from non-employment rise during expansions and separations to non-employment 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 non-employment. While this is by construction, Figure 3 helps highlight that the

[22] All pairwise correlations of LEHD series 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.

[23] All rates are as fractions of employment.

[24] 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.

procyclical component of separations has no direct consequences for the fluctuations in net job flows (and in turn fluctuations in either non-employment or unemployment). This is because the procyclical component of separations is driven by poaching flows.[25]

With this as a background, we now turn to our main decomposition of interest, the relative contribution of poaching flows to net employment growth at large and small firms. Recall that the main prediction of the Moscarini and Postel-Vinay (2013) model is that employment at larger firms will be more cyclically sensitive, due to the greater ability of large firms to poach workers away from smaller firms by offering their workers higher wages. If the data support this theory, we should observe net poaching flows at large firms (i.e. the net employment growth from poaching workers away from smaller firms) to be positive and procyclical. To see if this pattern holds in the data, Figures 4(a) and 4(b) show the decomposition for large firms and Figures 4(c) and 4(d) for small firms.[26] For each we show the decomposition using both the within/adjacent and no earnings gap approaches to identifying poaching flows.

A striking finding from Figure 4 is that net poaching is modestly negative for large firms and modestly positive for small firms in all quarters. This pattern holds for all of our approaches to measuring job-to-job flows.[27] In Appendix B, we show that the most common origin for the poaching hires by large firms is other large firms. Similarly, the most common origin for the poaching hires by small firms is other small firms. But overall small firms are more likely to be a destination than an origin for poaching while large firms are more likely to be an origin than a destination for poaching. Such origin vs. destination patterns are what underlies the patterns of net poaching shown in Figure 4.[28] Figure 4 also shows that job-to-job flows are procyclical for both large and small firms.[29] In this respect, the findings are consistent with

[25]Figure C.1 shows the poaching hires and separations and the hires and separations from non-employment 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 3(a) and 3(b) there is more variation for both the trend and the cycle captured by hires and separations from non-employment.

[26]Medium firms are shown in Figure C.2.

[27]See also Figure C.4 for the within quarter definition.

[28]Appendix B contains much more detailed analysis of the origins and destinations of poaching flows by firm size and firm wage. We also investigate the conditional probabilities of poaching flows. We show that it is critical to take into account the relative size of groups in computing conditional probabilities.

[29]For all firm size classes and using both approaches, gross poaching flows exhibit a downward trend and are highly procyclical. 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

large firms increasing their poaching hires during booms. Moreover, larger firms have a greater share of hires from poaching. But the same patterns hold for poaching separations from large firms. They increase in booms and they are a greater share of total separations for large firms.

Since net poaching for both large and small firms is modest in magnitude in all quarters, the cyclicality of employment growth at both large and small firms appears to be driven by worker flows in and out of non-employment. We quantify these patterns with statistical analysis below but both large and small firms have substantial cyclical fluctuations in hires from non-employment and separations to non-employment. Small firms have especially large increases in separations to non-employment in the Great Recession. This is a preview of the results to come where the non-employment margin plays an important role in the differential response of large and small firms during different phases of the cycle.

Figure 5 shows the analogous patterns for firms classified by firm wages using both the within/adjacent and no earnings gap approaches. In contrast to our results on firm size, high wage firms have positive net poaching (Panels 5(a) and 5(b)) while low wage firms have negative net poaching (Panel 5(c) and 5(d)).[30] 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. However, while the poaching flows from low wage to high wage firms are strongly procyclical, the implication for net employment growth over the business cycle is less clear.

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 non-employment fall. But the decline in hires from non-employment is especially sharp for low wage firms in contractions. In the regressions that follow, we decompose the contribution of poaching flows and non-employment flows to net employment growth to assess the relative contribution of each. Overall, Figure 5 shows that high wage firms only grow through net poaching which is highly procyclical – they actually tend to lose jobs through net hires from non-employment even in booms. In contrast, low wage firms gain jobs through net hires from non-employment in booms but they lose jobs from net poaching more intensively in booms as

HP-filtered unemployment rate using the within/adjacent approach and about -0.8 using the no earnings gap approach.

[30]Medium wage firms shown in in Appendix Figure C.3. Appendix B shows that high wage firms are much more likely to be a destination rather than an origin firm. The opposite is true for low wage firms.

well. During recessions low wage firms lose jobs on net via the sharp decline in net hires from non-employment at such times.

Figure 6 summarizes the starkly different patterns of net poaching flows by firm size and firm wage classes (Panel 6(a) is for within/adjacent, 6(b) 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) 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. 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 in Figures 4, 5 and 6 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 Moscarini and Postel-Vinay (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.[31] 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.[32]

[31] 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.

[32] 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.

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 decrease in the net growth of small firms relative to large firms for the Table 1 (2) results. This is being driven by a 28.8 (24.5) point decrease in the net hires from non-employment of small firms relative to largel 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, the point estimates yield that 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 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 decrease in net hires from non-employment for low wage relative to high wage firms. In other words, during a contraction, low wage firms have a substantially greater decrease in net hires from non-employment.

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 but not by firm size. 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.

small are more supportive of the Moscarini and Postel-Vinay (2012) hypotheses when using the within/quarter definition as opposed to the no earnings gap or within quarter definitions of job-to-job flows.

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 from low wage to high wage firms is highly procyclical while the same is not true for net poaching from small to large firms. A related prediction by Moscarini and Postel-Vinay (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. 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. This pattern is 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 limitation of the results presented thus far is that they reflect only a relatively small number of aggregate observations. To exploit 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:

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

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 two specifications. Model 1 specifies π_{qt} so that it includes seasonal dummies and a time trend. Model 2 specifies π_{qt} with a full set of time dummies for every quarter.[33]

Tables 3 and 4 are the analogues to Tables 1 and 2 using the state by quarter variation.[34] The patterns in Table 3 largely mimic those in Table 1. Likewise the patterns in Table 4 largely mimic those in Table 2. There are some differences between the model 1 and model 2 specifications. The former permits national variation to influence the estimated relationships while the latter uses only state-specific variation. The latter is pushing the data much harder but is also interesting since in principle the mechanisms of interest should be working with respect to state-specific variation.

We first focus on the results for model 1. 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 non-employment for large firms compared to small firms. For Table 4, this is driven entirely by lower net hires from non-employment 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

[33] 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 or common time effects that absorb seasonal effects.

[34] 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.

compared to low wage firms. The magnitude of the difference in effects between firm size and firm wage results are substantial. For model 1, 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. For model 2, the results by firm size are quite similar for the deviation from HP trend. For the firm wage results, we lose statistical significance for the within/adjacent approach but not for the no earnings gap approach.

The results by firm size and firm wage during economic contractions are very similar using either the within/adjacent or no earnings gap approaches so we discuss them together. This also holds for both models 1 and 2. During periods of economic contractions, net job flows for large firms decline less than the 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 non-employment for large firms. Thus, both components (net poaching and net hires from non-employment) go the "wrong" way for the Moscarini and Postel-Vinay (2012) predictions by firm size during periods of economic contractions. 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 non-employment. 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 non-employment than low wage firms during contractions. The smaller decline in net hires for non-employment dominates so that net job flows for high wage firms declines less than low wage firms during economic contractions. This pattern is more pronounced and statistically significant for model 2. These findings contrast 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.[35]

[35]Additional sensitivity analyses are included in the appendix. Appendix Table C.4 reports 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 Moscarini and Postel-Vinay (2012) predictions by firm size. Table C.5 considers interactions of firm size and firm wage classes using the within/adjacent approach. The patterns in Table C.5 largely confirm those from

The results on the non-employment margin of adjustment during economic contractions are of particular interest. We find that net hires from non-employment decline sharply at small and low wage firms relative to large and high wage firms during times of economic contractions. This margin dominates the overall net job flows for both firm size and firm wage results. These results are inconsistent with the prediction that large, high wage firms will need to shed workers more during times of economic contractions. Given the importance of this margin we investigate it further below.

5 Extensions and Sensitivity Analysis

5.1 The Non-Employment Margin of Adjustment

In this subsection, we dig deeper into the findings on the non-employment margin of adjustment. Table 5 shows the sensitivity of hires and separations from and to non-employment to the change in unemployment by firm size (top panel) and firm wage (bottom panel) using the national time and state-level series (for the latter we use the model 1 specification). We focus on the results using the within/adjacent quarter definition of job-to-job flows. We prefer this definition for this exercise since this implies non-employment spells of at least one quarter. Such workers are of particular interest given the challenges they face. Workers that experience a full quarter of non-employment are those that suffer the most substantial wage losses from a separation (see Fallick, Haltiwanger and McEntarfer (2012)). Workers with a substantial duration of unemployment are those that experience the greatest challenges finding jobs (see, e.g., Krueger, Cramer and Cho (2014) and Kroft, Lange, and Notowidigdo (2013)). We also focus on the response to the change in unemployment since our findings discussed above highlight the importance of the non-employment margin during periods of economic contractions. Recall that results discussed above show that low wage and small firms have greater declines in net hires from non-employment during periods of economic contractions.

The national and state panel regression results are largely consistent so we discuss them together. Table 5 shows that hires from non-employment decline and separations to non-employment increase during times of economic contractions for firms of all types. The increases

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.

in separations to non-employment are quantitatively large. For example, a 100 basis point increase in the unemployment rate is associated with a 90 basis point increase in separations to non-employment for small firms using the national time series variation. This increase is highly statistically significant. One core implication of Table 5 is that assuming separations to non-employment are constant over the cycle is rejected by the evidence. We find that the differential responses of separations to non-employment between small and large firms is important in accounting for the finding that overall net job flows for small firms decline more in economic contractions than for large firms. For the national time series, this is the dominant factor. Using state-level variation, it is an important contributing factor but the decline in hires from non-employment by small firms relative to large firms dominates using the state-level panel analysis. Turning to firm wage results, we find that separations to non-employment increase substantially for high and low wage firms during contractions but the estimated effects are similar in magnitude. In contrast, hires from non-employment fall sharply for low wage firms relative to high wage firms during contractions. It is this margin that drives the finding that net hires from non-employment fall more for low wage than high wage firms during times of economic contractions.[36]

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

In this subsection, 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 firm-level 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

[36] In Appendix Table C.6, we find that the non-employment margin tends to be less important for the responses to periods of high unemployment. This is because separations to non-employment rise sharply at the beginning of a contraction but then fall quickly while unemployment continues to rise well after a contraction is over.

are so different.

Our definition of high-wage and low-wage firms does not control for worker heterogeneity. Worker heterogeneity combined with firm heterogeneity leads to the potential role for positive assortative matching in the patterns of job-to-job flows over the cycle. For example, in a recent paper, Lise and Robin (2014) develop of model of job search whereby job-to-job moves reallocate higher-ability workers to firms whose technology yields higher returns to ability. Their model predicts increased matching of high-ability workers and firms in booms. At first glance this might be an alternative explanation for our finding of a procyclical firm wage ladder. But given that firms in their model have only one employee, it is not clear how to interpret their predictions in terms of our evidence. In our empirical analysis workers engaged in a job-to-job flow in a given quarter do not influence whether a firm is classified as high or low wage in that quarter, whereas in Lise and Robin, wages are a function of job match quality. Still we think greater consideration of the role of worker heterogeneity is an important area of future research.

We have investigated several other means by which the strong relationship between firm size and wage in the theoretical models we focus on here may not hold in the data. 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.[37] 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.[38] 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 small, young firms.

Table 6 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

[37]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 Moscarini and Postel-Vinay (2012) by firm size.

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

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 the change in unemployment 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 7 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. We build on the approach of Mukoyama (2014) who in turn builds on the approach of Shimer (2012) using 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. A potential limitation of 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 (Mukoyama (2014)). However, we show in Appendix F that our findings on continuous time are robust to using job-to-job flows that are closer to point-in-time to point-in-time based flows.

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 Appendix Figure F.1. 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. We have also estimated our core state by quarter empirical specifications using the continuous time adjusted flows. As seen in Appendix Table F.2, 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.

6 Conclusion

Which firms have more cyclically sensitive employment? Do job-to-job moves of workers contribute to the cyclicality of employment growth at these firms? Here we use new data on job-to-job moves calculated from U.S. administrative data to provide evidence on both of these questions. Using this data, we are able to decompose net employment growth into net growth from job-to-job moves and net hires from non-employment flows at large and small, high wage and low wage firms.

We find evidence of a strong procyclical firm wage ladder. Job-to-job flows move workers up the wage distribution across firms. Such moves are highly procyclical. During booms we find positive net poaching yields net employment growth gains of as much as 1 percent per quarter at high wage firms and net employment losses of an equivalent amount at lower wage firms. This high pace of reallocation of workers in booms falls dramatically in contractions. During the Great Recession, this firm wage ladder virtually disappeared. The firm wage ladder has the property that net employment gains of high wage firms in booms are dominated by net poaching. High wage firms have slight net employment losses from net hires from non-employment in booms. In contrast, low wage firms exhibit overall net employment gains in booms through high net hires from non-employment that overcome the high net poaching losses at such times. During contractions, net poaching from low wage to high wage essentially stops, both high wage and low wage firms suffer overall net employment losses through declines in net hires from non-employment. But interestingly it is especially the low wage firms with the greatest declines in net hires from non-employment in contractions.

In contrast, we find little evidence of a firm size ladder. Net poaching, if anything, moves workers away from large firms to small firms. This pattern holds at all stages of the cycle.

This surprising pattern is accounted for rapidly growing young firms that on poach from more mature firms of all sizes including small, mature firms. Given that net poaching from large to small is negative and modest in magnitude, we find little evidence that net poaching from small to large increases in booms. This also implies that differential cyclicality of net job flows by firm size classes is driven primarily by differences in the patterns of net hires from non-employment. For the latter, we find it is critical to distinguish between patterns over different phases of the cycle. During periods of economic contractions, small firms exhibit sharper contractions than large firms as net hires from non-employment fall more small firms. This pattern is consistent with conventional wisdom that during contractions small firms are hit harder. Alternatively, during periods of low unemployment, large firms tend to grow more rapidly than small firms. The latter is consistent with recent empirical findings by Moscarini and Postel-Vinay (2012) but as we show this is not primarily driven by large firms engaging in more net poaching from small firms during periods of low unemployment.

From the perspective of the wage posting models of on-the-job search, the predictions that firm wage and firm size ladders should exhibit very similar patterns is not supported. Our relatively weak results by firm size raise a number of questions since wage posting models imply a tight link between the predictions by firm size and firm wage. Since these models also suggest that there is an accompanying tight link with firm productivity differences, an obvious future direction for research is to explore the role of firm-level productivity in this context. Many models of firm heterogeneity including the wage posting models predict that firm productivity, firm size and firm wage should be positively related. While there is some empirical evidence in support of this prediction, little is known about whether job-to-job flows move workers up the productivity ladder or about the cyclical dynamics of job-to-job flows across firms with different productivity.

In closing, we think it is useful to think about the recent theoretical advances on dynamic wage posting models as making progress bringing the seminal insights of Burdett and Mortensen (1998) closer together with the seminal insights of Mortensen and Pissarides (1994). But we think our work suggests more work is needed since we find that both the non-employment and the job-to-job flow margins are important to understand the cyclical dynamics of net job flows by firm size and firm wage. Mortensen and Pissarides (1994) focused on the non-employment margin and our results remind us that this is an important margin in this context.

References

[1] Abowd, John, Bryce Stephens, Lars Vilhuber, Fredrik Andersson, Kevin McKinney, Marc Roemer, and Simon Woodcock. 2009. "The LEHD Infrastructure Files and the Creation of the Quarterly Workforce Indicators." In *Producer Dynamics: New Evidence from Micro Data*, 68, Studies in Income and Wealth, ed. Timothy Dunne, J.Bradford Jensen and Mark J. Roberts, 149-230. Chicago: University of Chicago Press.

[2] Anderson, Patricia, and Bruce Meyer. 1994. "The Extent and Consequences of Job Turnover."In *Brookings Papers in Economic Activity, Microeconomics*, ed. Winston, Baily, and Reiss. The Brookings Institution: 177-249.

[3] van den Berg, Gerard. 2003. "Multiple Equilibria and Minimum Wages in Labor Markets with Informational Frictions and Heterogeneous Production Technologies." *International Economic Review* 44(4): 1337-1357.

[4] Bagger, Jesper, Francois Fontaine, Fabien Postel-Vinay, and Jean-Marc Robin. 2014. "Tenure, Experience, Human Capital, and Wages: A Tractable Equilibrium Search Model of Wage Dynamics." *American Economic Review* 104(6): 1551-1596.

[5] Bjelland, Melissa, Bruce Fallick, John Haltiwanger and Erika McEntarfer. 2011. "Employer-to-Employer Flows in the United States: Estimates Using Linked Employer-Employee Data." *Journal of Business and Economic Statistics* 29(4): 493-505.

[6] Brown, Charles, and James Medoff. 1989. "The Employer Size-Wage Effect." *Journal of Political Economy* 97(5): 1027-1059.

[7] Burdett, Kenneth, and Dale Mortensen. 1998. "Wage Differentials, Employer Size, and Unemployment." *International Economic Review* 39(2): 257-273.

[8] Burgess, Simon, Julia Lane, and David Stevens. 2000. "Job Flows, Worker Flows, and Churning."*Journal of Labor Economics* 18(3): 473-502.

[9] Cahuc, Pierre, Fabien Postel-Vinay, and Jean-Marc Robin. 2006. "Wage Bargaining and On-the-Job Search: Theory and Evidence." *Econometrica* 74(2): 323-364.

[10] Christensen, Bent, Rasmus Lentz, Dale Mortensen, George Neumann, and Axel Werwatz. 2005. "On-the-Job Search and the Wage Distribution." *Journal of Labor Economics* 23(1): 31-58.

[11] Coles, Melvyn. 2001. "Equilibrium Wage Dispersion, Firm Size and Growth." *Review of Economic Dynamics* 4(1): 159-187.

[12] Coles, Melvyn, and Dale Mortensen. 2012. "Equilibrium Labor Turnover, Firm Growth and Unemployment." NBER Working Paper #18022.

[13] Davis, Steven, Jason Faberman, and John Haltiwanger. 2012. "Labor Market Flows in the Cross Section and Over Time." *Journal of Monetary Economics* 59(1): 1-18.

[14] Davis, Steven, and John Haltiwanger. 1992. "Gross Job Creation, Gross Job Destruction, and Employment Reallocation." *Quarterly Journal of Economics* 107(3): 819-863.

[15] Davis, Steven and John Haltiwanger. 2014. "Labor Market Fluidity and Economic Performance." NBER Working Paper No. 20479.

[16] Dunne, Timothy, Mark Roberts, and Larry Samuelson. 1989. "The Growth and Failure of U.S. Manufacturing Plants." *Quarterly Journal of Economics* 104(4): 671-698.

[17] Fallick, Bruce, Fleischman, Charles. 2004. "Employer-to-Employer Flows in the U.S. Labor Market: The Complete Picture of Gross Worker Flows." FEDS Working Papers 2004-34, Federal Reserve Board.

[18] Fallick, Bruce, John Haltiwanger, and Erika McEntarfer. 2012. "Job-to-Job Flows and the Consequences of Job Separations." U.S. Federal Reserve Board Finance and Economics Discussion Series Paper #2012-73.

[19] Fort, Teresa, John Haltiwanger, Ron Jarmin, and Javier Miranda. 2013. "How Firms Respond to Business Cycles: The Role of the Firm Age and Firm Size." *IMF Economic Review*.

[20] Foster, Lucia, John Haltiwanger, and Chad Syverson, 2013. "The Slow Growth of Young Plants: Learning About Demand" NBER Working Paper No. 17853, revised March 2013.

[21] Gertler, Mark, and Simon Gilchrist. 1994. "Monetary Policy, Business Cycles, and the Behavior of Small Manufacturing Firms." *Quarterly Journal of Economics* 109(2): 309-340.

[22] Haltiwanger, John, Henry Hyatt, Erika McEntarfer, and Liliana Sousa. 2012. "Business Dynamics Statistics Briefing: Job Creation, Worker Churning, and Wages at Young Businesses" Kauffman Foundation Statistical Brief.

[23] Haltiwanger, John, Henry Hyatt, Erika McEntarfer, Liliana Sousa, and Stephen Tibbets. 2014 "Firm Age and Size in the Longitudinal Employer-Household Dynamics Data." U.S. Census Bureau Center for Economic Studies Working Paper #CES-14-16.

[24] Haltiwanger, John, Javier Miranda, and Ron Jarmin. 2013. "Who Creates Jobs? Small versus Large versus Young." *Review of Economics and Statistics* 95(2): 347-361.

[25] Henderson, Cody, and Henry Hyatt. 2012. "Estimation of Job-to-Job Flow Rates Under Partially Missing Geography." U.S. Census Bureau Center for Economic Studies Discussion Paper #CES-12-29.

[26] Hyatt, Henry, and Erika McEntarfer. 2012a. "Job-to-Job Flows in the Great Recession." *American Economic Review Papers and Proceedings* 102(3): 580-583.

[27] Hyatt, Henry, and Erika McEntarfer. 2012b. "Job-to-Job Flows and the Business Cycle." U.S. Census Bureau Center for Economic Studies Working Paper #CES-12-04.

[28] Hyatt, Henry, Erika McEntarfer, Kevin McKinney, Stephen Tibbets, and Douglas Walton. 2014. "Job-to-Job (J2J) Flows: New Labor Market Statistics from Linked Employer-Employee Data." *JSM Proceedings 2014*, Business and Economics Statistics Section: 231-245.

[29] Hyatt, Henry, and James Spletzer. 2013. "The Recent Decline in Employment Dynamics." *IZA Journal of Labor Economics* 2(3): 1-21.

[30] Jovanovic, B. 1982. "Selection and the evolution of industry." *Econometrica* 50(3): 649-670.

[31] Kahn, Lisa, and Erika McEntarfer. 2014. "Employment Cyclicality and Firm Quality." NBER Working Paper 20698.

[32] Keith, Kristen and Abigail McWilliams. 1999. "The Returns to Mobility and Job Search by Gender." *Industrial and Labor Relations Review* 52(3): 460-477.

[33] Kroft, Kory, Fabaian Lange, and Matthew J. Notowidigdo. 2013. "Duration Dependence and Labor Market Conditions: Evidence from a Field Experiment" *Quarterly Journal of Economics* 128(3): 1123-1167.

[34] Krueger, Alan B., Judd Cramer, and David Cho. 2014. "Are the Long-Term Unemployed on the Margins of the Labor Market?" Forthcoming *Brookings Papers on Economic Activity.*

[35] Lise, Jeremy, and Jean-Marc Robin. 2014. "The Macro-dynamics of Sorting between Workers and Firms." Unpublished manuscript, University College London.

[36] Manning, Alan. 2003. *Monopsony in Motion: Imperfect Competition in Labor Markets.* Princeton, NJ: Princeton University Press.

[37] Moscarini, Giuseppe, and Fabien Postel-Vinay. 2009. "The Timing of Labor Market Expansions: New Facts and a New Hypothesis." In *NBER Macroeconomics Annual 2009*, Vol. 23, ed. Daron Acemoglu, Kenneth Rogoff, and Michael Woodford, 1-52. Chicago: University of Chicago Press.

[38] Moscarini, Giuseppe, and Fabien Postel-Vinay. 2012. "The Contribution of Large and Small Employers to Job Creation in Times of High and Low Unemployment." *American Economic Review* 102(6): 2509-39.

[39] Moscarini, Giuseppe, and Fabien Postel-Vinay. 2013. "Stochastic Search Equilibrium." *Review of Economic Studies* 80(4): 1545-1581.

[40] Moscarini, Giuseppe, and Fabien Postel-Vinay. 2014. "Did the Job Ladder Fail After the Great Recession?" Unpublished draft, Yale University.

[41] Postel-Vinay, Fabien, and Jean-Marc Robin. 2002. "Equilibrium Wage Dispersion with Heterogeneous Workers and Firms." *Econometrica* 70(6): 1295-1350.

[42] Mortensen, Dale, and Christopher Pissarides. 1994. "Job Creation and Destruction in the Theory of Unemployment." *Review of Economic Studies* 61: 397-415.

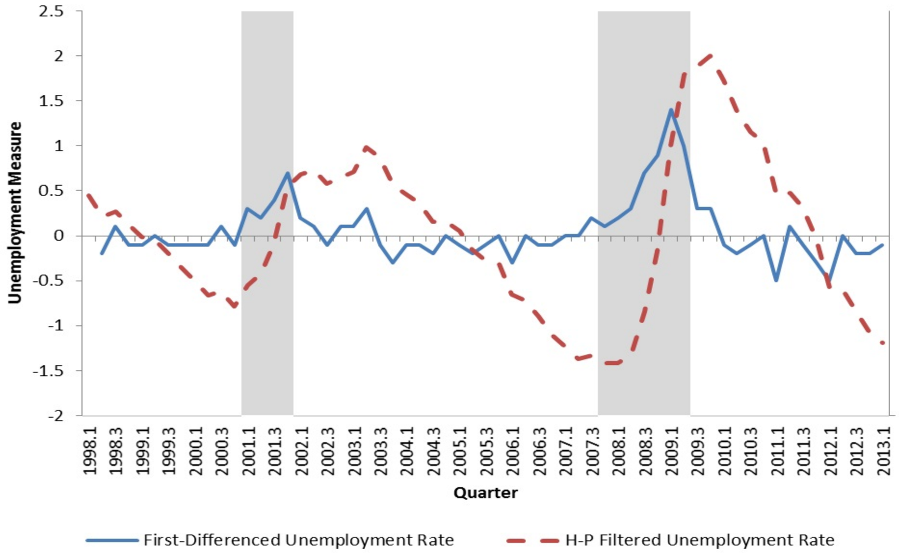
[43] Mukoyama, Toshihiko. 2014. "The Cyclicality of Job-to-Job Transitions and Its Implications for Aggregate Productivity." *Journal of Economic Dynamics and Control* 1-17.

[44] Shimer, Robert. 2012. "Reassessing the ins and outs of unemployment." *Review of Economic Dynamics*, 127-148.

[45] Syverson, Chad. 2011. "What Determines Productivity?" *Journal of Economic Literature* 49(2): 326-365.

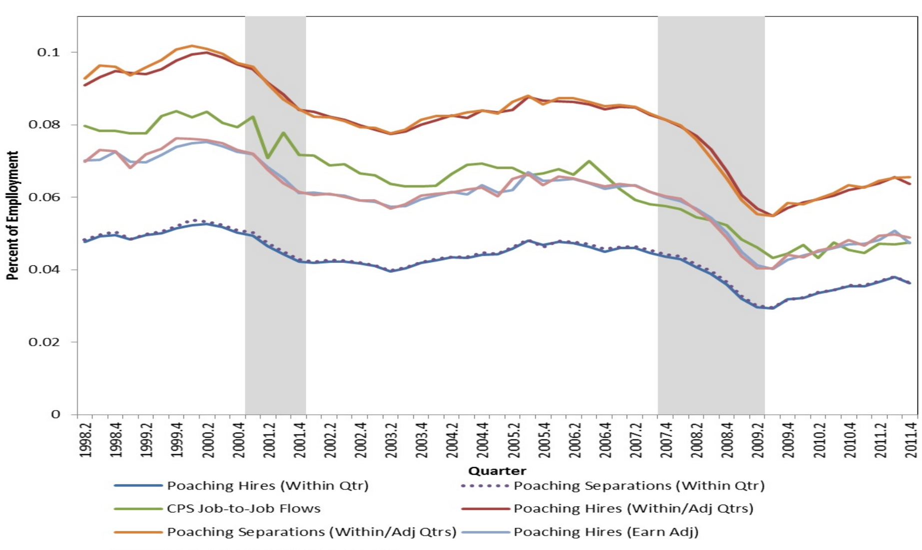
[46] Topel, Robert, and Michael Ward. "Job Mobility and the Careers of Young Men." *Quarterly Journal of Economics* 107(2): 439-479.

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



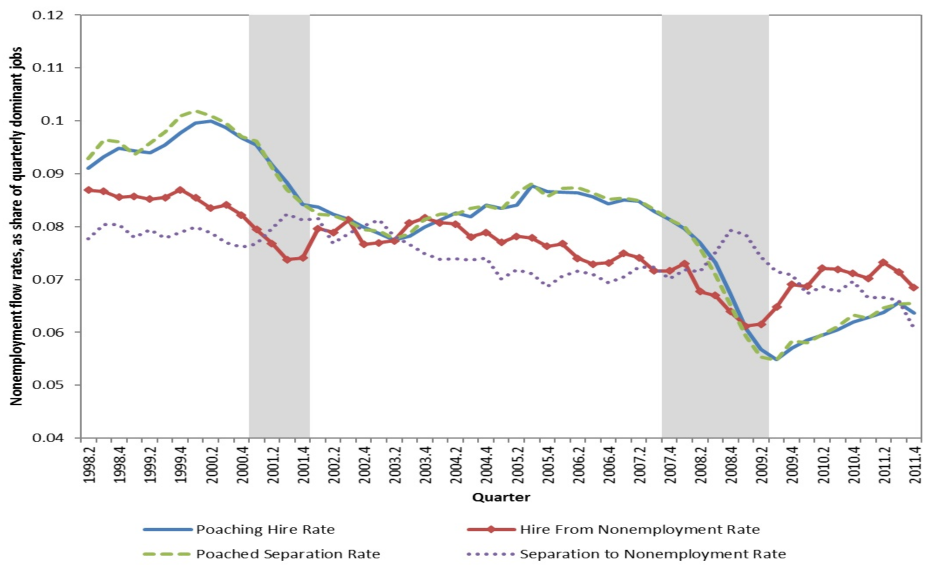
Notes: Shaded regions indicate NBER recession quarters. Data are seasonally adjusted using X-11.

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

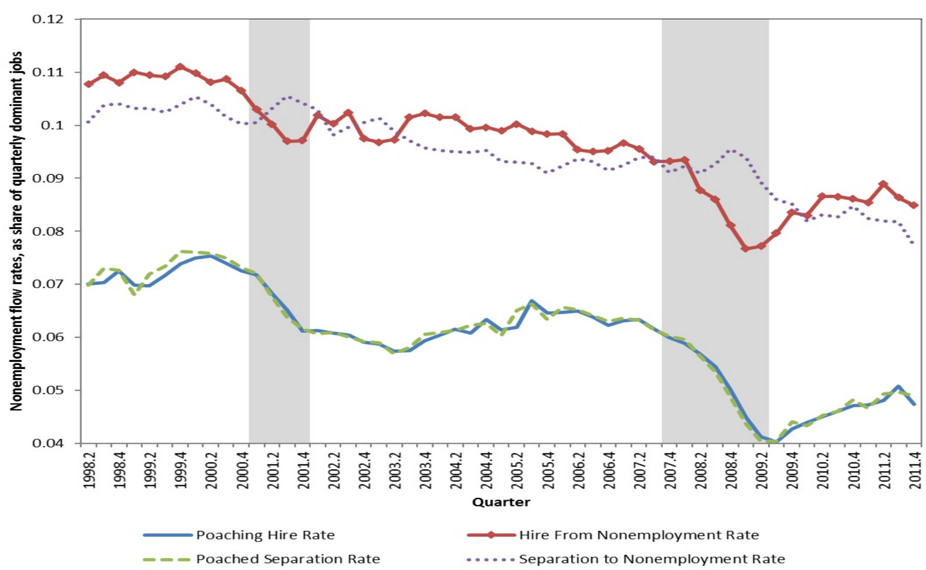


Notes: Shaded regions indicate NBER recession quarters. Data are seasonally adjusted using X-11.

Figure 3: Hires and Separations: Poaching vs. Flows to and from Non-Employment



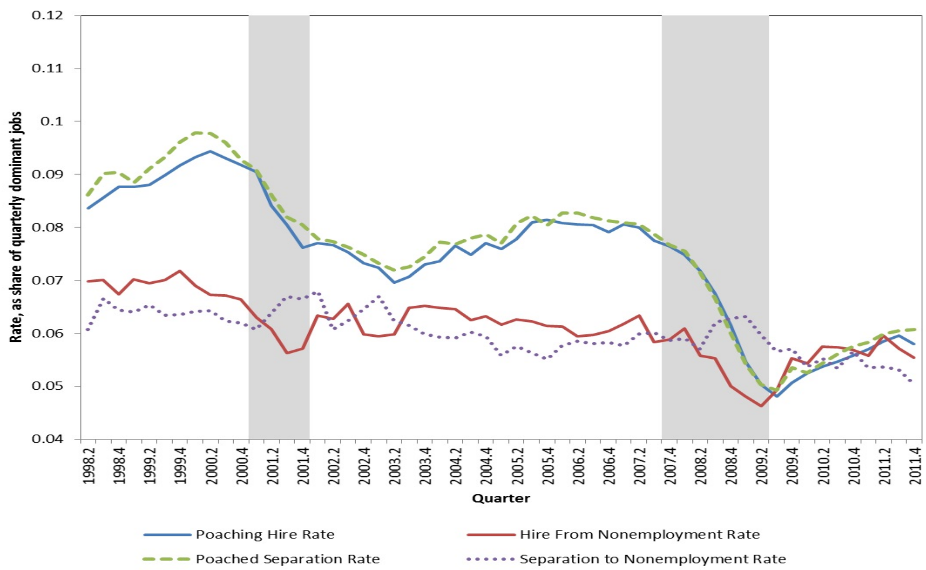
(a) Within/Adjacent



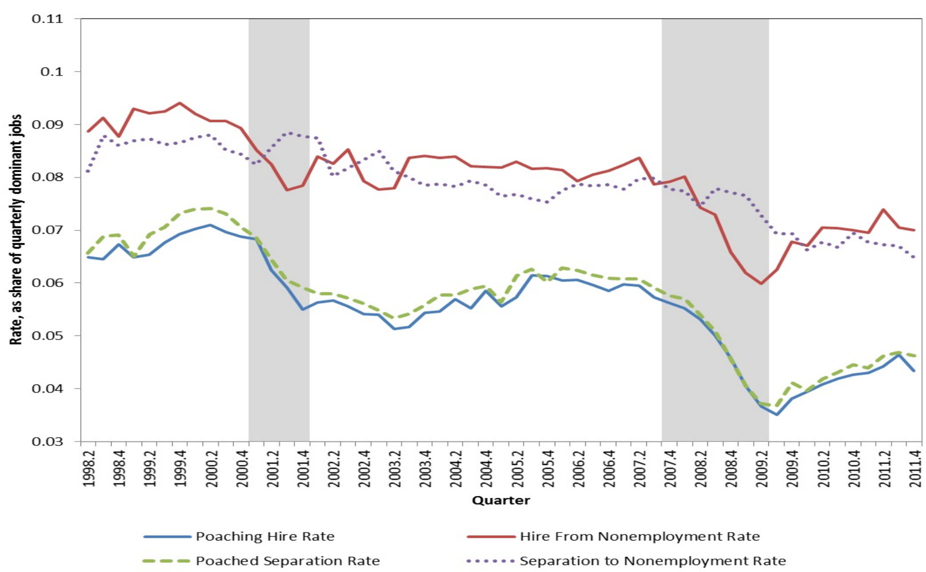
(b) No Earnings Gap

Notes: Shaded regions indicate NBER recession quarters. Data are seasonally adjusted using X-11.

Figure 4: Hires and Separations: Poaching vs. Flows to and from Non-Employment, by Size



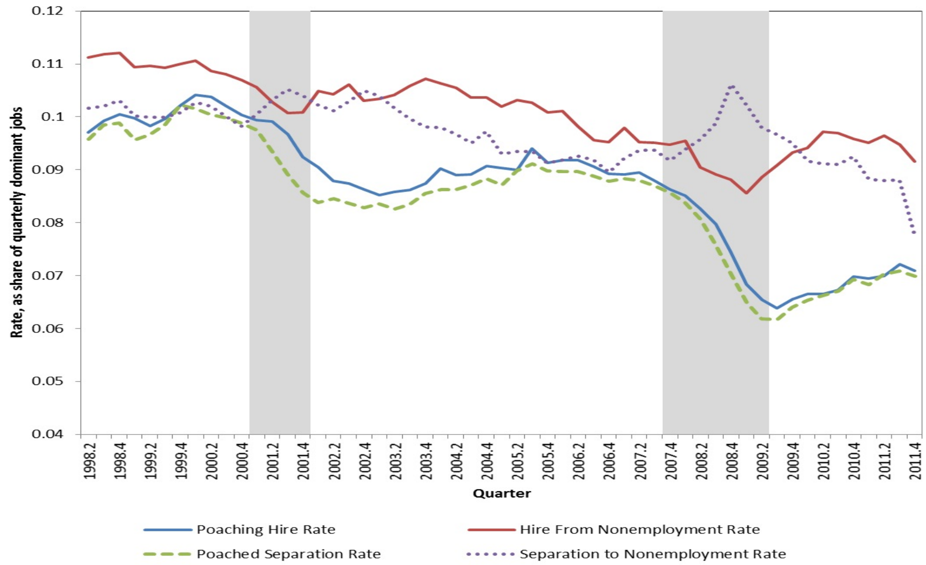
(a) Large Firms: Within/Adjacent



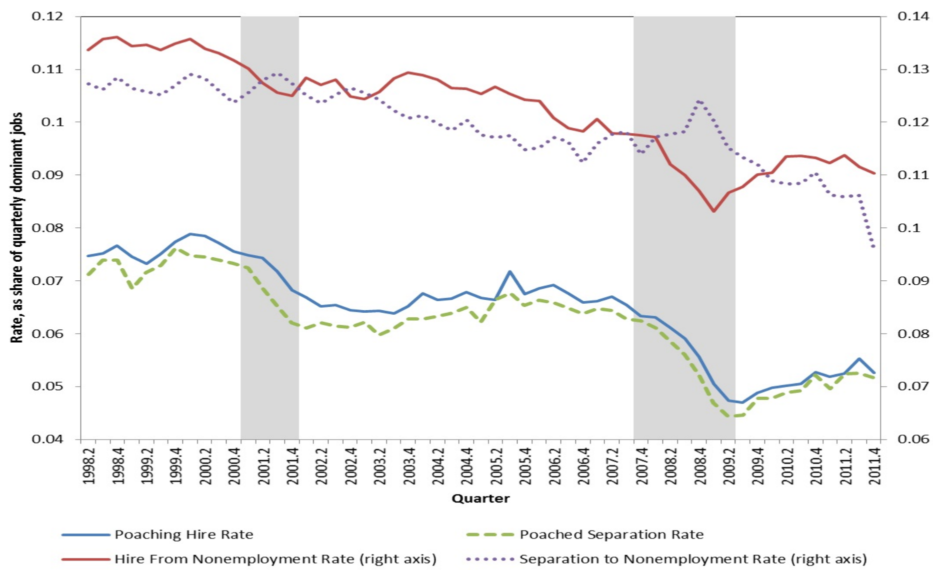
(b) Large Firms: No Earnings Gap

Notes: Shaded regions indicate NBER recession quarters. "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.

Figure 4: Hires and Separations: Poaching vs. Flows to and from Non-Employment, by Size



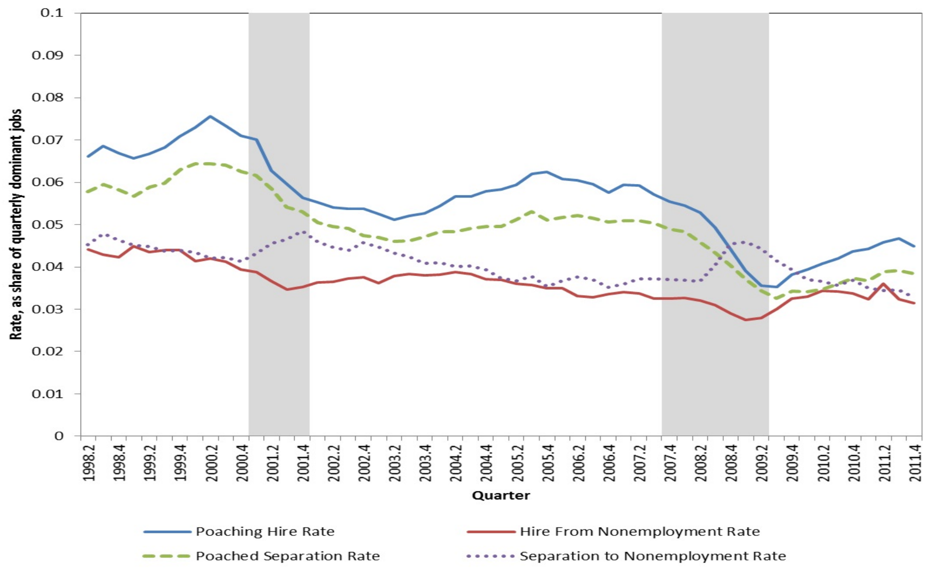
(c) Small Firms: Within/Adjacent



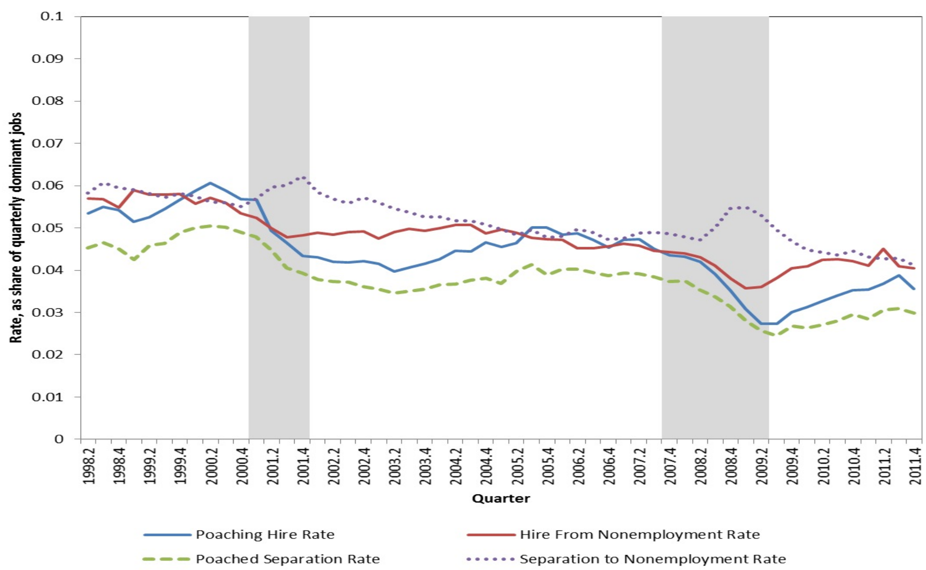
(d) Small Firms: No Earnings Gap

Notes: Shaded regions indicate NBER recession quarters. “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.

Figure 5: Hires and Separations: Poaching vs. Flows to and from Non-Employment, by Wage



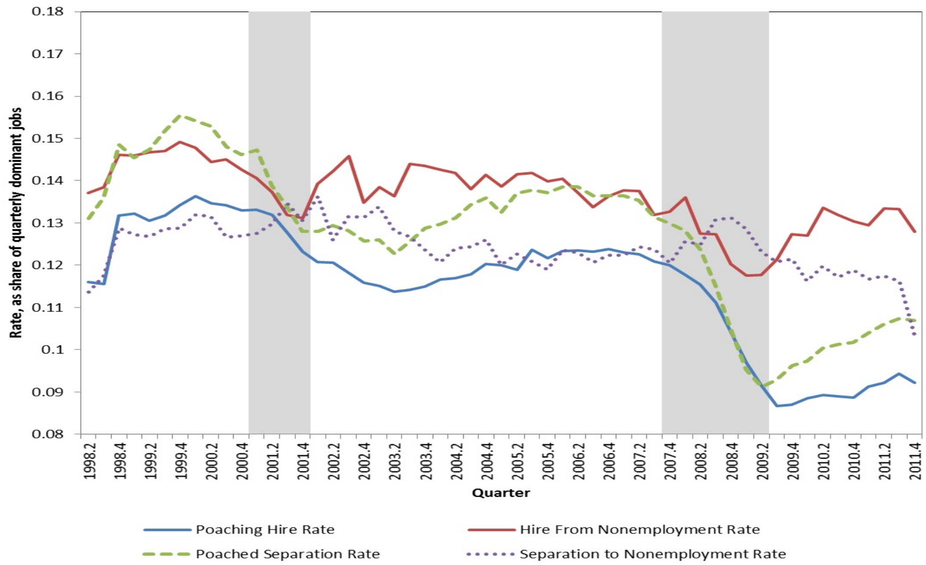
(a) High Wage Firms: Within/Adjacent



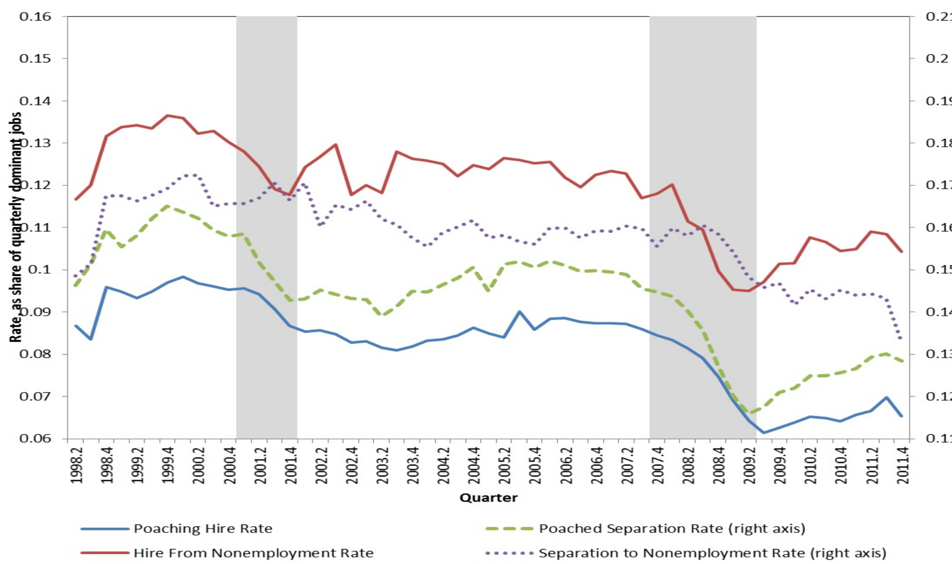
(b) High Wage Firms: No Earnings Gap

Notes: Shaded regions indicate NBER recession quarters. "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.

Figure 5: Hires and Separations: Poaching vs. Flows to and from Non-Employment, by Wage



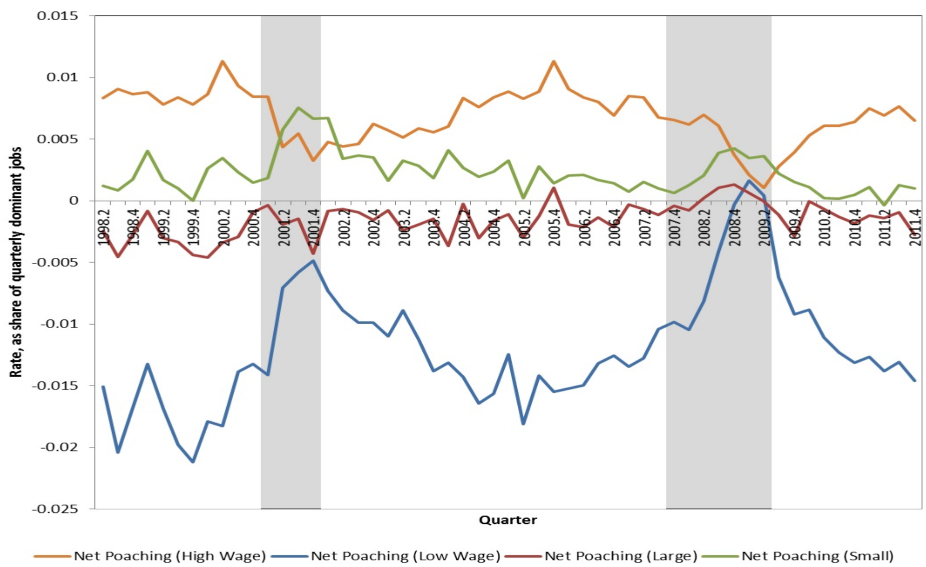
(c) Low Wage Firms: Within/Adjacent



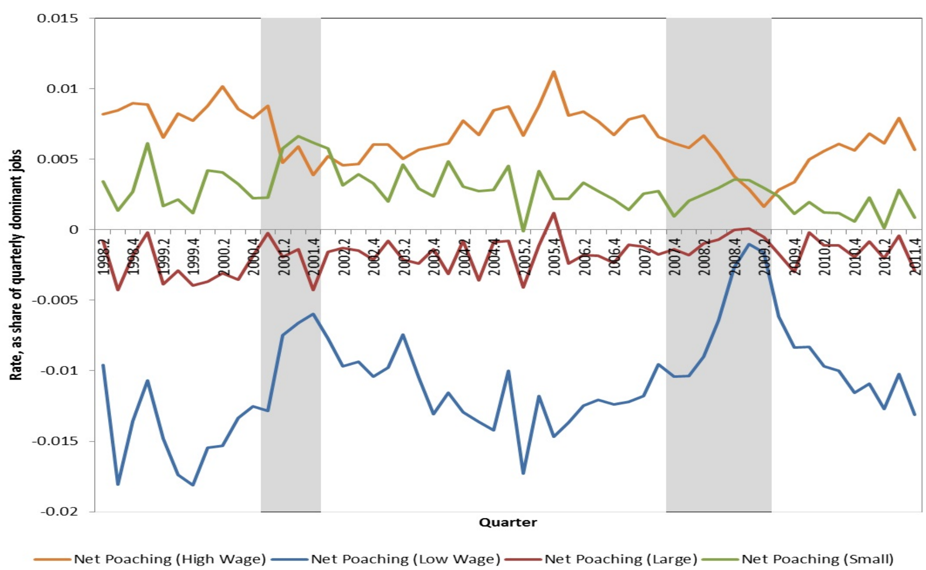
(d) Low Wage Firms: No Earnings Gap

Notes: Shaded regions indicate NBER recession quarters. “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.

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



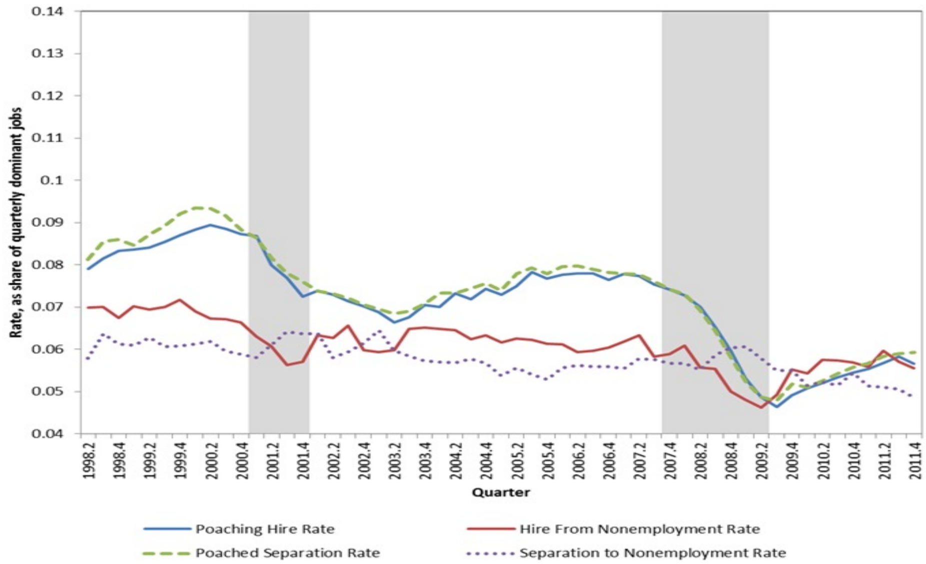
(a) Within/Adjacent



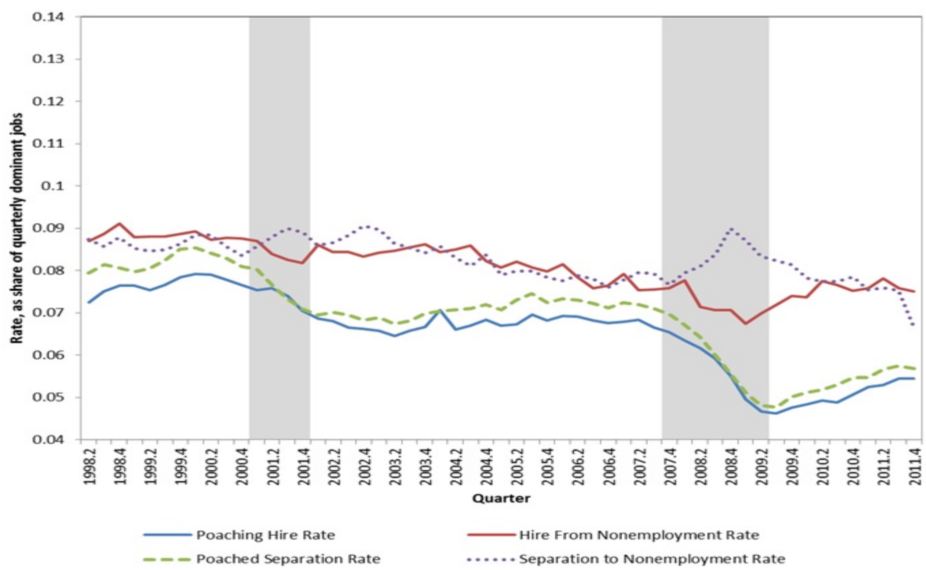
(b) No Earnings Gap

Notes: Shaded regions indicate NBER recession quarters. "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.

Figure 7: Hires and Separations: Poaching vs. Flows to and from Non-Employment, by Size and Age



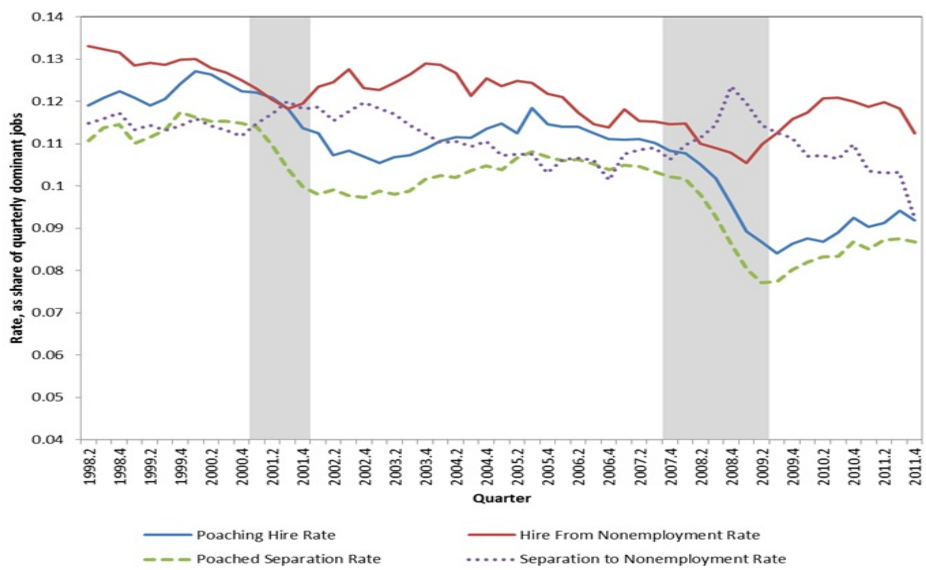
(a) Large, Mature Firms



(b) Small, Mature Firms

Notes: Shaded regions indicate NBER recession quarters. "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. Data are seasonally adjusted using X-11.

Figure 7: Hires and Separations: Poaching vs. Flows to and from Non-Employment, by Size and Age



(c) Small, Young Firms

Notes: Shaded regions indicate NBER recession quarters. "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. Data are seasonally adjusted using X-11.

Table 1: Differential Net Flows
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 Non-Employment 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 Non-Employment Flows	−0.016	0.903**
	(0.072)	(0.139)

Notes: Coefficient on the cyclical variable with standard errors in parentheses. +, *, ** 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. Net poaching and net non-employment flows are seasonally adjusted using X-11, net job flows reports the sum of these two components. Each specification includes a linear trend.

Table 2: Differential Net Flows
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 Non-Employment 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 Non-Employment Flows	−0.030	0.518**
	(0.060)	(0.139)

Notes: Coefficient on the cyclical variable with standard errors in parentheses. +, *, ** 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. Net poaching and net non-employment flows are seasonally adjusted using X-11, net job flows reports the sum of these two components. Each specification includes a linear trend.

Table 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 Non-Employment	−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 Non-Employment	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: Coefficient on the cyclical variable with standard errors in parentheses. +, *, ** 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 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 Non-Employment	−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)	(0.067)	(0.054)	(0.070)
Net Non-Employment	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: Coefficient on the cyclical variable with standard errors in parentheses. +, *, ** 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 5: The Non-Employment Margin: Response to First Difference in Unemployment

Dependent Variable	**National**	**State-Level**
	By Firm Size: Large(L) vs Small(S)	
Hires from Non-Employment (Large)	-0.824**	-0.534**
	(0.093)	(0.048)
Hires from Non-Employment (Small)	-0.776**	-1.157**
	(0.079)	(0.137)
Separations to Non-Employment (Large)	0.559**	0.242**
	(0.074)	(0.059)
Separations to Non-Employment (Small)	0.895**	0.395**
	(0.109)	(0.066)
Difference in Hires from Non-Employment (L-S)	-0.049	0.624**
	(0.099)	(0.141)
Difference in Separations to Non-Employment (L-S)	-0.337**	-0.153**
	(0.095)	(0.048)
	By Firm Wage: High(H) vs. Low(L)	
Hires from Non-Employment (High)	-0.458**	-0.382**
	(0.066)	(0.047)
Hires from Non-Employment (Low)	-1.202**	-1.325**
	(0.139)	(0.129)
Separations to Non-Employment (High)	0.672**	0.365**
	(0.073)	(0.044)
Separations to Non-Employment (Low)	0.831**	0.324**
	(0.174)	(0.087)
Difference in Hires from Non-Employment (H-L)	0.744**	0.938**
	(0.141)	(0.121)
Difference in Separations to Non-Employment (H-L)	-0.159	0.034
	(0.182)	(0.072)

Notes: Coefficient on the cyclical variable (first difference in unemployment) with standard errors in parentheses. +, *, ** 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. Results reported are for the within/adjacent definition of job-to-job flows.

Table 6: Differential Net Flows, Size-Age Interactions, State-Level Panel, 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 Non-Employment 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 Non-Employment Flows	−0.118**	0.992**
	(0.029)	(0.1503)

Notes: Coefficient on the cyclical variable with standard errors in parentheses. +, *, ** 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 7: 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 Non-Employment Flows	−0.101**	0.561**
	(0.025)	(0.129)

Notes: Coefficient on the cyclical variable with standard errors in parentheses. +, *, ** 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. Industry terciles are defined at the NAICS sub-sector (3-digit) level. All specifications control for state effects, seasonal effects, and a linear time trend. Standard errors clustered at the state level.

Web Appendix (Not intended for publication)

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 non-employment and other employers, as well as separations to non-employment 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 non-employment, 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 non-employment 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, 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 non-employment 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 non-employment increase for all firms. These will be larger as a share of employment for smaller firms. Separations to non-employment are not affected (by assumption, the job destruction rate is constant). Net hiring from non-employment, 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: Responsiveness 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	$\delta(1-u)G(w;F)$	$\lambda F(w)(\lambda^2(1-F(w))-\delta^2)[\delta(\lambda+\delta)^2]^{-1}$	Decreases	Increases
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
Non-Emp. Hires	$\lambda u=\frac{\lambda\delta}{\lambda+\delta}$	$\lambda(\delta+\lambda(1-F(w)))^2[\delta(\lambda+\delta)]^{-1}$	Greater Inc.	Lesser Inc.
Non-Emp. Separations	δ	1	Similar Increase	
Net Non-Emp.	$\frac{1}{N(w;F)}\frac{dE}{d\delta}-\frac{d\delta}{d\delta}$	$\lambda(\delta+\lambda(1-F(w))^2*[\delta(\lambda+\delta)]^{-1}-1$	Decreases	Increases

Table A.2: Responsiveness 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	$\lambda(1-F(w))$	$1-F(w)$	Lesser Inc.	Greater 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.
Non-Emp. Hires	$\lambda u = \frac{\lambda\delta}{\lambda+\delta}$	$\delta(\delta+\lambda(1-F(w)))^2[\lambda(\lambda+\delta)]^{-1}$	Decreases	Increases
Non-Emp. Separations	δ	0	Does not vary	
Net Non-Emp.	$\frac{1}{N(w;F)}\frac{dE}{d\lambda} - \frac{d\delta}{d\lambda}$	$\delta(\delta+\lambda(1-F(w))^2 * [\lambda(\lambda+\delta)]^{-1}$	Decreases	Increases

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

The results presented in the main text 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 B.1-B.4 provide alternative ways at looking at the distribution of poaching hires and separations. Origins and destinations by firm size class (Table B.1) and firm wage class (Table B.2) are identified. The main text focuses on 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). These tables use the within/adjacent approach. In unreported results we have also examined the no earnings approach and the results are similar.

The top panel of Tables B.1 and B.2 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 B.1 and B.2 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 B.1 and B.2 tells us that the majority of poaching flows are within a given size and wage class. This explains why gross poaching is much higher than net worker reallocation from poaching across wage and size classes. Regarding the net reallocation of workers, the row and column totals of the second panel are quite instructive. From the second panel of Table B.1, 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 B.2 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.

While the second panel helps explain the origin-destination destination flows behind our net poaching decomposition, it does not answer the question of whether or not a worker at a small firm is more likely to move to a large firm than not. To get a sense of this we also examine the conditional probabilities of moving between size/wage classes. The third panels of Tables B.1 and B.2 do this for both firm size and firm wage. In Table B.1, 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 B.1 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 B.2 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. 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 the "large" firms.

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. Given that these are flows, an appropriate metric for the size of the group is the unconditional share of poaching hires. We normalize the conditional probabilities with destination shares in the bottom panels of Tables B.1 and B.2. 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 B.3 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 B.3 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.

Table B.1: Poaching Flows, by Firm Size

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

Share of private poaching hires private firm sources only		Destination Firm Size			Row
		Small	Medium	Large	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 B.2: Poaching Flows, by Firm Wage

	Low	Medium	High
Share of hires, from other firms	41.9	49.0	58.0
Share of separations, to other firms	46.0	51.2	48.3

Share of private poaching hires private firm sources only		Destination Firm Wage Low	 Medium	 High	Row Total
	Low	23.3	14.4	4.9	42.6
Origin Firm Wage	Medium	11.8	15.7	8.2	35.7
	High	3.4	6.3	12.1	21.8
	Column Total	38.4	36.4	25.3	100.0

Conditional Probabilities (conditioning on origin):

		Destination Firm Wage Low	 Medium	 High
	Low	54.7	33.7	11.6
Origin Firm Wage	Medium	33.0	44.1	22.9
	High	15.4	28.9	55.8

Normalized Conditional Probabilities (Normalized by Destination Poaching Share):

		Destination Firm Wage Low	 Medium	 High
	Low	1.42	0.93	0.46
Origin Firm Wage	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 B.3: 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 separations, to 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

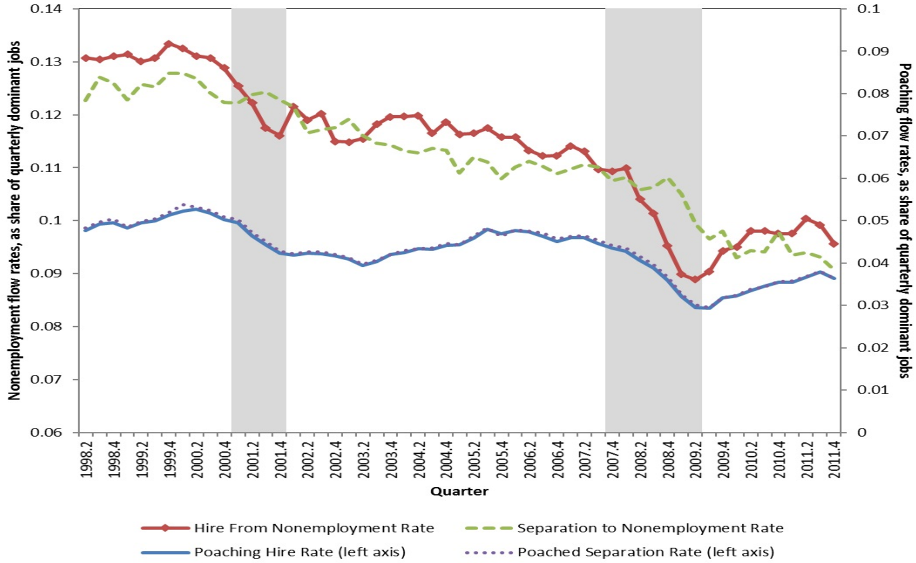
Normalized Conditional Probabilities (Normalized by Destination Poaching Share):

		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.

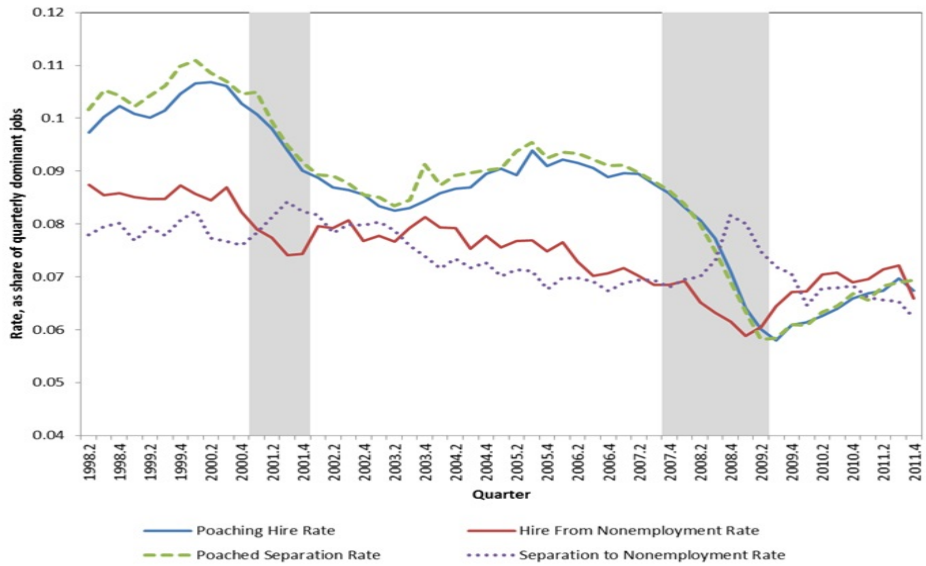
C Robustness Tables and Figures

Figure C.1: Hires and Separations: Poaching Flows vs. Flows to and from Non-Employment (Within Quarter Flows as Poaching Flows Only)

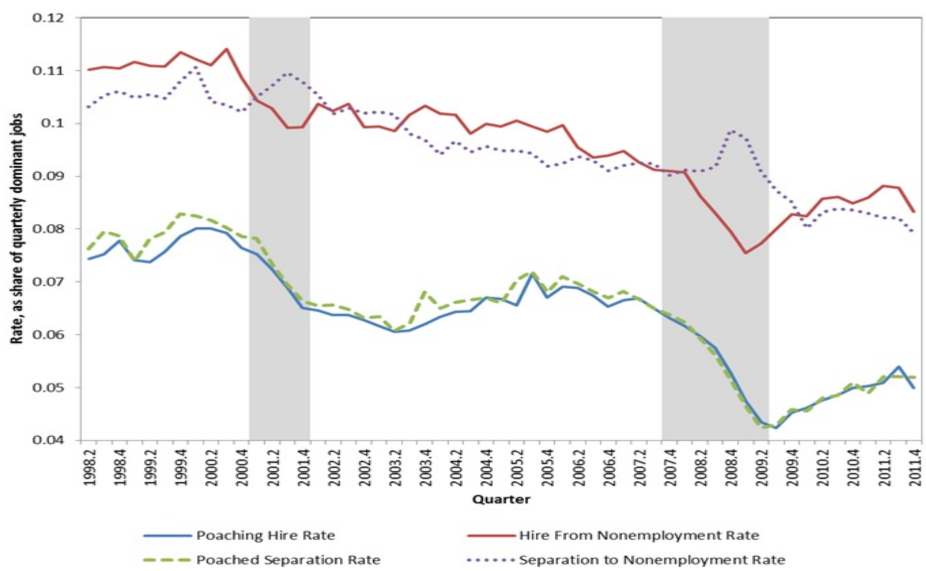


Notes: Shaded regions indicate NBER recession quarters. Data are seasonally adjusted using X-11. Poaching flows include within-quarter flows only.

Figure C.2: Hires and Separations: Poaching Flows vs. Flows to and from Non-Employment, by Size



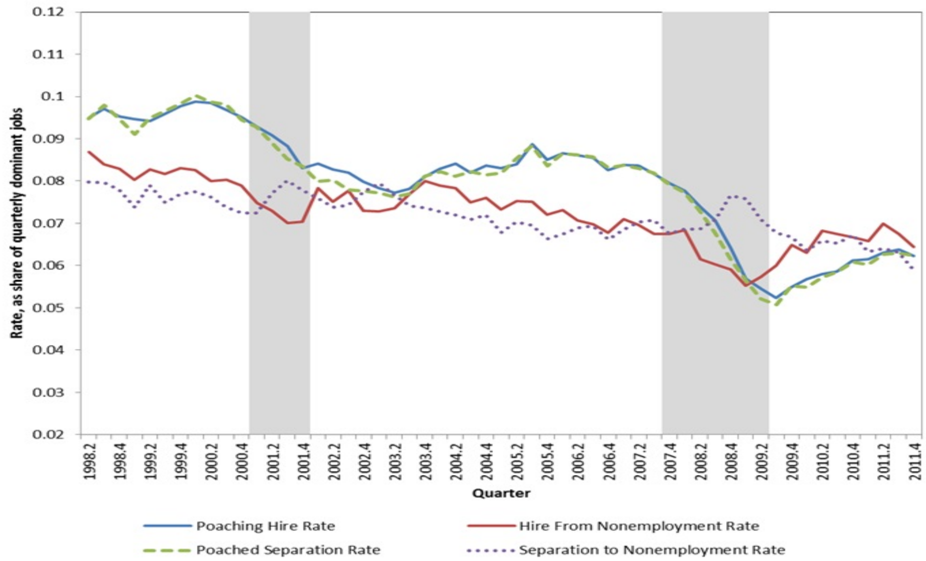
(a) Medium Size Firms: Within/Adjacent



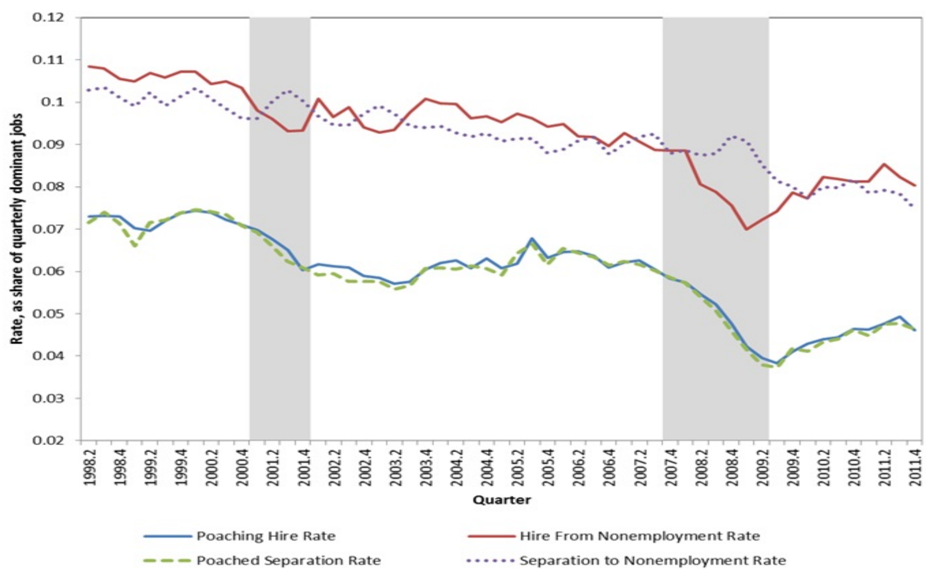
(b) Medium Size Firms: No Earnings Gap

Notes: Shaded regions indicate NBER recession quarters. "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.

Figure C.3: Hires and Separations: Poaching Flows vs. Flows to and from Non-Employment, by Wage



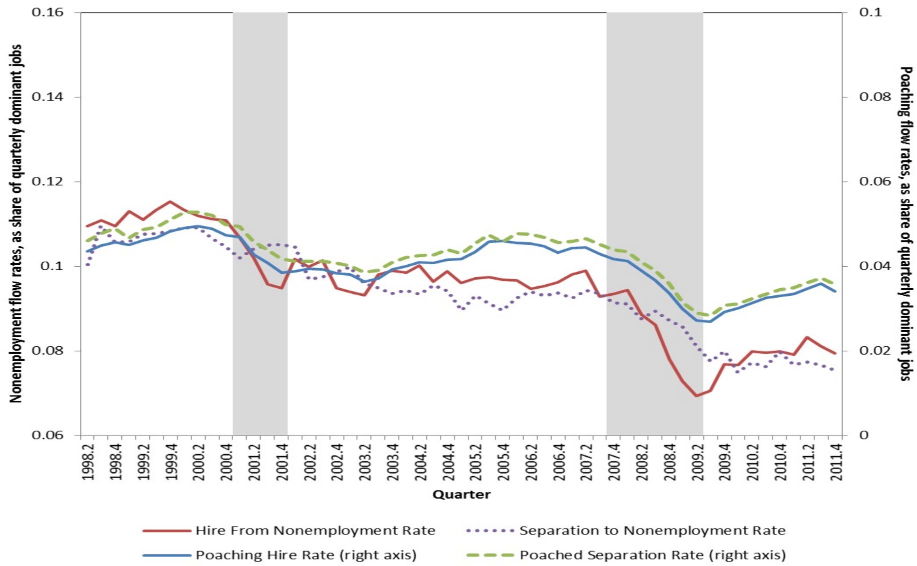
(a) Medium Wage Firms: Within/Adjacent



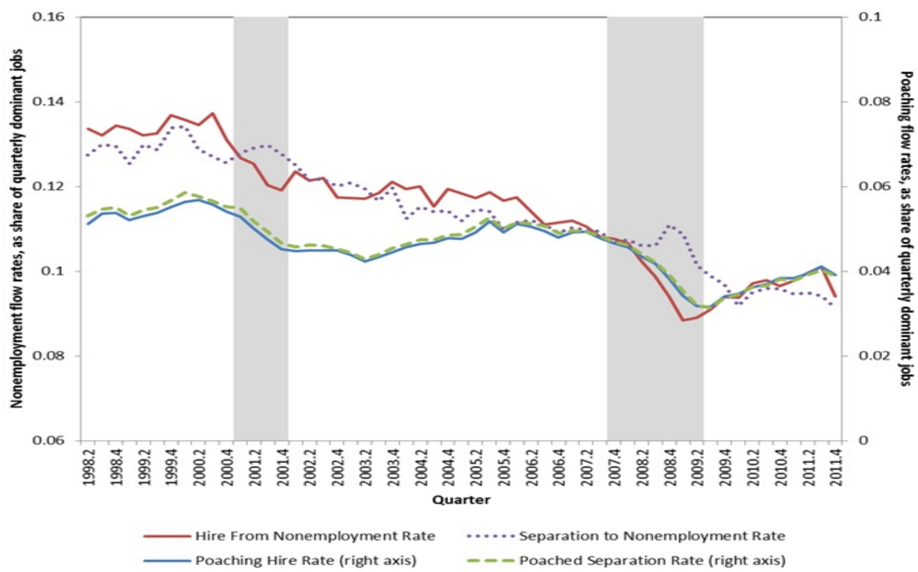
(b) Medium Wage Firms: No Earnings Gap

Notes: Shaded regions indicate NBER recession quarters. “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.

Figure C.4: Hires and Separations: Poaching vs. Flows to and from Non-Employment, by Size (Within Quarter Flows as Poaching Flows Only)



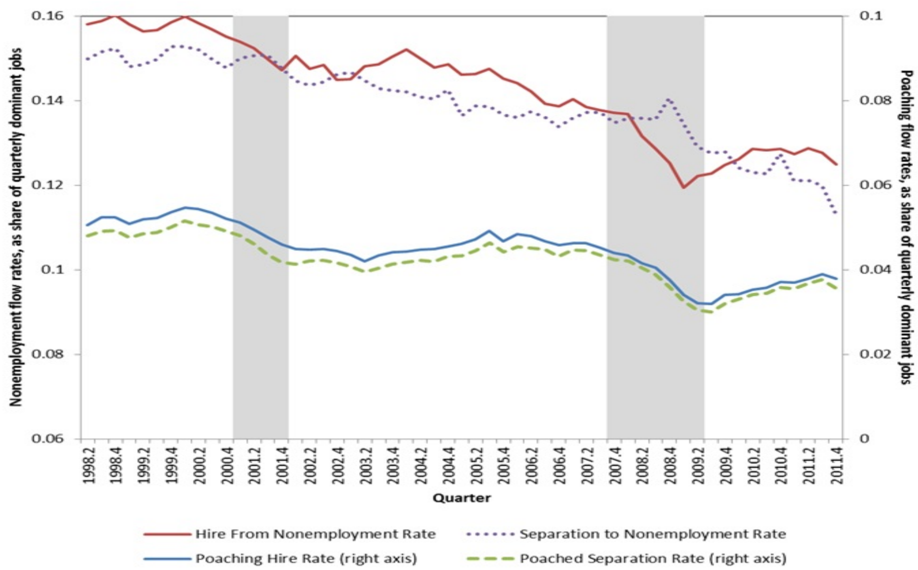
(a) Large Firms: Within-Only



(b) Medium Size Firms: Within-Only

Notes: Shaded regions indicate NBER recession quarters. “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. “Within-Quarter Poaching Flows Only” indicates that poaching flows include only those where the job-to-job flow has reported earnings from both the origin and destination employer in the quarter of transition, adjacent-quarter transitions are treated as a flow into and from non-employment. Data are seasonally adjusted using X-11.

Figure C.4: Hires and Separations: Poaching vs. Flows to and from Non-Employment, by Size (Within Quarter Flows as Poaching Flows Only)



(c) Small Firms: Within-Only

Notes: Shaded regions indicate NBER recession quarters. “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. “Within-Quarter Poaching Flows Only” indicates that poaching flows include only those where the job-to-job flow has reported earnings from both the origin and destination employer in the quarter of transition, adjacent-quarter transitions are treated as a flow into and from non-employment. Data are seasonally adjusted using X-11.

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 Non-Employment Flows	−0.132**	0.193
	(0.047)	(0.128)

Notes: Coefficient on the cyclical variable with standard errors in parentheses. +, *, ** 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, State-Level Panel, Within/Adjacent, Cluster Standard Errors at the Quarter (Time) Level

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 Non-Employment 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 Non-Employment Flows	0.016	0.904**
	(0.049)	(0.125)

Notes: Coefficient on the cyclical variable with standard errors in parentheses. +, *, ** 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, State-Level Panel, No Earnings Gap, Cluster Standard Errors at the Quarter (Time) Level

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 Non-Employment 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 Non-Employment Flows	0.002	0.809**
	(0.043)	(0.145)

Notes: Coefficient on the cyclical variable with standard errors in parentheses. +, *, ** 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.4: 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 Non-Employment Flows	−0.157**	−0.209*	0.836**	1.235**
	(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: Coefficient on the cyclical variable with standard errors in parentheses. +, *, ** 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.5: 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 Non-Employment 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 Non-Employment 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 Non-Employment Flows	−0.028	1.396**
	(0.041)	(0.215)

Notes: Coefficient on the cyclical variable with standard errors in parentheses. +, *, ** 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 C.6: The Non-Employment Margin: Response to Deviation from HP Trend Unemployment

Dependent Variable	**National**	**State-Level**
By Firm Size: Large(L) vs Small(S)		
Hires from Non-Employment (Large)	-0.128*	-0.144**
	(0.054)	(0.023)
Hires from Non-Employment (Small)	0.075	-0.007
	(0.050)	(0.033)
Separations to Non-Employment (Large)	0.026	0.022
	(0.041)	(0.035)
Separations to Non-Employment (Small)	0.163**	0.060
	(0.060)	(0.042)
Difference in Hires from Non-Employment (L-S)	-0.203**	-0.137**
	(0.026)	(0.029)
Difference in Separations to Non-Employment (L-S)	-0.138**	-0.038
	(0.036)	(0.033)
By Firm Wage: High(H) vs. Low(L)		
Hires from Non-Employment (High)	0.026	0.007
	(0.035)	(0.020)
Hires from Non-Employment (Low)	-0.157+	-0.233**
	(0.081)	(0.030)
Separations to Non-Employment (High)	0.182**	0.142**
	(-0.038)	(0.028)
Separations to Non-Employment (Low)	-0.017	-0.083+
	(0.081)	(0.048)
Difference in Hires from Non-Employment (H-L)	0.183**	0.234**
	(0.062)	(0.018)
Difference in Separations to Non-Employment (H-L)	0.199**	0.218**
	(0.065)	(0.033)

Notes: Coefficient on the cyclical variable (difference from HP trend) with standard errors in parentheses. +, *, ** 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. Results reported are for the within/adjacent definition of job-to-job flows.

D Flows Including State and Local Government

Table D.1: 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
	Small	14.5	7.0	9.4	30.7
Origin Firm Size	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
	SME, Young	10.4	7.6	8.0	27.1
Origin Firm Size	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.

E Census Public Use Job-to-Job Flows Data

The empirical results in this paper use linked LEHD confidential microdata, which is available to researchers with approved projects through the Census Research Data Center (RDC) network. While this research was ongoing, two of the authors of this paper were simultaneously working with a larger team at Census to develop public use data on job-to-job flows tabulated from LEHD microdata. The research described in this paper uses an early prototype from this project, identifying job-to-job flows as described in Hyatt and McEntarfer (2012b). In early 2015, a beta version of Census public use Job-to-Job Flows (J2J) was released to the public. In this appendix, we describe the key differences between the early prototype used here and the new public use data, and reproduce our main results on worker reallocation by firm size using the new public Census Job-to-Job Flows data.

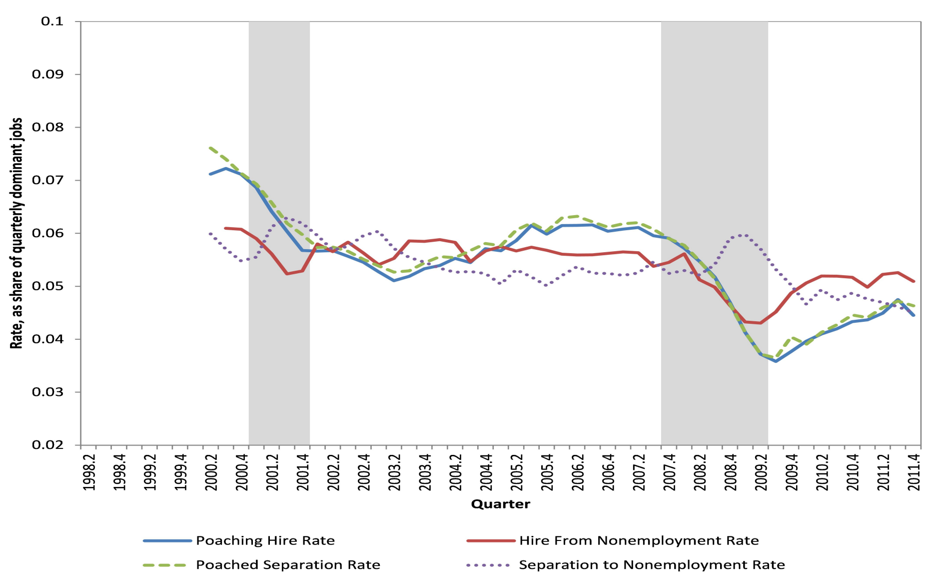
The identification of worker flows in the Census Job-to-Job Flows data is similar to the earlier prototype we use in this paper, but differs in one key respect. The public use J2J data links main jobs held on the first day of each quarter, whereas the earlier prototype links main jobs held at any time during the quarter. Non-employment status in the public use data is similarly defined in the public use data as the absence of an observed job on the first day of the quarter. The use of point-in-time employment and non-employment creates cleaner identities in the public use data, and tighter correspondence between Job-to-Job Flows and the Quarterly Workforce Indicators and OnTheMap. But these advantages do come at a cost - some transitions from short-term jobs, especially for more marginally attached workers, are included in the early prototype but not in the public use J2J data. Thus the public data generally has lower levels of poaching flows and non-employment flows than the earlier prototype we use in this paper. Despite the level difference in worker flows, the overall patterns of worker flows between employment and non-employment are very similar between the early prototype and the public use data.

A couple of other items should be noted in comparing the public-use flow rates with those in the body of the paper. The time period of the public-use data is shorter than the time series employed in the rest of this paper. Public use J2J data is not available until the second quarter of 2000, with flows from non-employment not available until 2000.3. Net job flows here is the quarterly change in main job employment in each group that is due to either workers changing employers or moving to and from non-employment (the sum of poaching and non-employment flows) and excludes the small component due to continuous dual job holders switching which job is the main source of earnings.

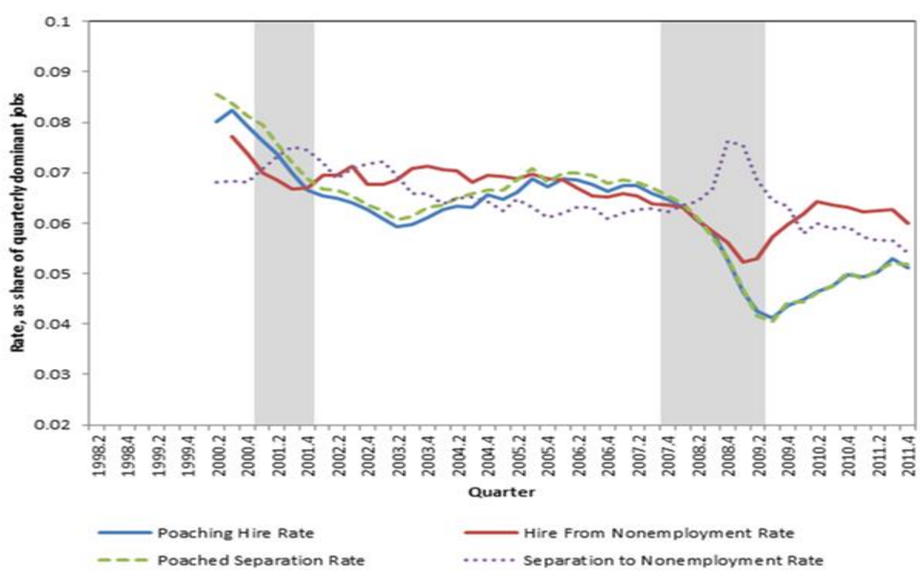
To show that our main findings on worker reallocation across size class can be reproduced in the public use J2J data, we first show our main decomposition using the new J2J data. In Figure E.1, we replicate Figure 3 in this paper, decomposing hires and separations by poaching versus non-employment flows, using the public use national J2J data. Specifically, Panel E.1(a) shows poaching and non-employment flows from 2000.2-2011.4 in the public J2J data (the national public use J2J data time series begins in 2000.2). As can be seen in Panel E.1(a), poaching and non-employment flow rates for large firms are lower in the public use J2J data, compared to Panel 3(a), but the general features of the decomposition are much the same. Gross poaching flows for large firms are strongly procyclical, but net poaching is again small and negative for most of the time series, with a very small amount of worker reallocation from larger firms to smaller firms. Panels E.1(b) and E.1(c) show the same decompositions for medium and small firms, respectively. Again, the decomposition shows very little worker reallocation across firm size by job-to-job moves, and in the opposite direction as predicted by the job ladder model, with small firms net gainers from job-to-job moves.

Table E.1 replicates Table 1 using the national J2J data, showing the coefficient on the cyclical indicators in the national regressions. Here again we obtain qualitatively similar results, although there are some differences. We do again replicate the Moscarini and Postel-Vinay (2012) finding that large firms have more cyclicality sensitive employment when using the HP-filtered unemployment rate, but the coefficient is no longer statistically significant. This is likely because the public use time series begins in 2000.2 instead of 1998.2, shortening our time series and losing the expansion preceding the 2001 recession. Similarly, we obtain the opposite result when using the first difference of the unemployment rate, but again higher standard errors mean the result loses statistical significance, even though the magnitude is similar to our national results by firm size. The coefficients on net poaching and net employment flows are also similar in magnitude to our results using the microdata, although only the results for the first difference of the unemployment rate are still statistically significant. Table E.2 presents results from the state-level regressions. The point estimates are greater in magnitude than those obtained from the public-use data for the national series, but both the overall responsiveness of these flows to the unemployment rate is lower than those in the body of the paper. In summary, results on the how large and small firms react to high and low unemployment is qualitatively similar to other results presented in this paper.

Figure E.1: Hires and Separations: Poaching vs. Flows to and from Non-Employment, by Size



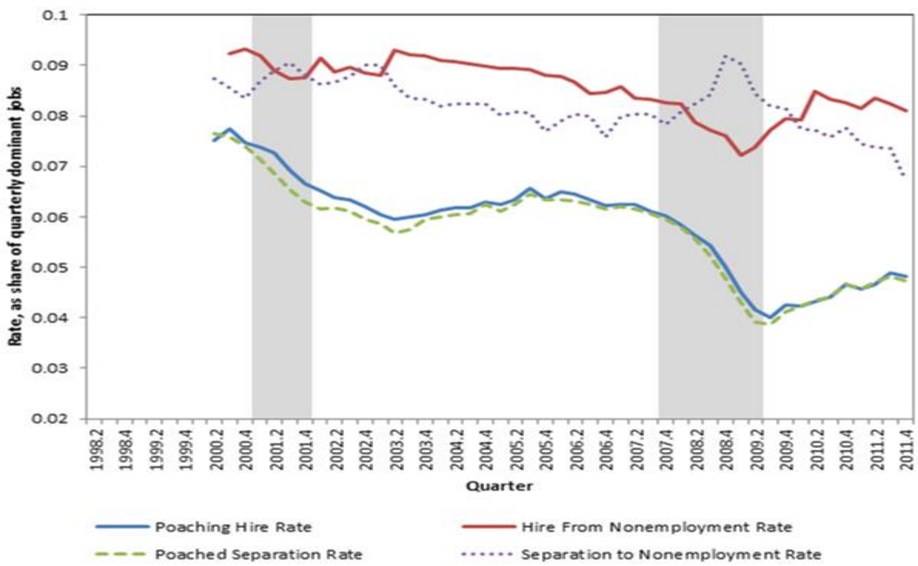
(a) Large Firms



(b) Medium Firms

Source: Census National Job-to-Job Flows, beta 2015 Q1. *Note*: This set of figures uses the new public use Census Job-to-Job Flows national data on worker flows between jobs, by firm size, private firms only. Hires from poaching are main jobs held on the last day the quarter where the worker started the job during the quarter and separated from their main job in either the same quarter or the previous quarter. Separations poached away are main jobs held on the first day of the quarter where the worker separates during the quarter previous and begins a new main job in this quarter or the subsequent quarter. Hires from non-employment are hires to new and begins a new main job in this quarter or the subsequent quarter. Hires from non-employment are hires to new main jobs for workers who were not employed on the first day of this quarter or last quarter. Separations to non-employment are main job separations in this quarter where the worker is not employed by the end of the quarter or the end of the subsequent quarter.

Figure E.1: Hires and Separations: Poaching vs. Flows to and from Non-Employment, by Size



(c) Small Firms

Notes: Census National Job-to-Job Flows, beta 2015 Q1.This set of figures uses the new public use Census Job-to-Job Flows national data on worker flows between jobs, by firm size, private firms only. Hires from poaching are main jobs held on the last day the quarter where the worker started the job during the quarter and separated from their main job in either the same quarter or the previous quarter. Separations poached away are main jobs held on the first day of the quarter where the worker separates during the quarter previous and begins a new main job in this quarter or the subsequent quarter. Hires from non-employment are hires to new and begins a new main job in this quarter or the subsequent quarter. Hires from non-employment are hires to new main jobs for workers who were not employed on the first day of this quarter or last quarter. Separations to non-employment are main job separations in this quarter where the worker is not employed by the end of the quarter or the end of the subsequent quarter.

Table E.1: Differential Net Flows, National J2J Public-Use Series

Dependent Variable	**Deviation from HP Trend**	**First Difference**
	By Size: Large minus Small	
Net Job Flows	−0.065	0.195
	(0.051)	(0.143)
Net Poaching Flows	−0.021	−0.090*
	(0.017)	(0.045)
Net Non-Employment Flows	−0.043	0.285**
	(0.042)	(0.111)

Notes: Coefficient on the cyclical variable with standard errors in parentheses. +, *, ** 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. Each specification includes a linear trend. Standard errors clustered at the state level.

Table E.2: Differential Net Flows, State-Level Public-Use J2J Panel

Dependent Variable	**Deviation from HP Trend**	**First Difference**
	By Size: Large minus Small	
Net Job Flows	−0.113**	1.107**
	(0.030)	(0.246)
Net Poaching Flows	−0.037**	0.178*
	(0.010)	(0.067)
Net Non-Employment Flows	−0.075**	0.929**
	(0.023)	(0.182)

Notes: Coefficient on the cyclical variable with standard errors in parentheses. +, *, ** 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.

F Time Aggregation Adjustment

This appendix describes how the job-to-job flow rates are affected by quarterly aggregation. Because the job-to-job flows data employs the concept of a "dominant job" (i.e., maximal earnings job) each quarter, and considers transitions only between these dominant employers, some short job spells may be omitted. We employ a standard technique for dealing with these job-to-job flow rates, which views the observed transition rates as a proxy for the true underlying transition rates, and with can be recovered using some basic parametric assumptions. In our continuous time adjustment, we follow the Mukoyama (2014) approach to continuous time time adjustment, which in turn extends the adjustment method of Shimer (2012) to include job-to-job transitions. The question we address is whether our size results are an artefact of the quarterly aggregation inherent in the data that we are using. This additional set of specifications indicate that it does not.

Our adjustment method is as follows. We consider the observed transition rates considering the size of the origin and destination employers, as well as non-employment. We consider the within/adjacent set of job-to-job flows for both the data that is used in the body of the paper that follows the definitions in Hyatt and McEntarfer (2012b), as well as the public-use data which follows the definitions in Hyatt et al. (2014), and the results from which are presented in Appendix E. Note that non-employment in both datasets is full-quarter non-employment.

There are four origin and four destination states initially, which are the three size categories (large, medium size, and small), as well as non-employment. The observed quarterly transition rates between states large L, medium size M, small S, and non-employment N can be represented in matrix D_t for any quarter t as

$$\begin{pmatrix} p_t^{LL} & p_t^{ML} & p_t^{SL} & p_t^{NL} \\ p_t^{LM} & p_t^{MM} & p_t^{SM} & p_t^{NM} \\ p_t^{LS} & p_t^{MS} & p_t^{SS} & p_t^{NS} \\ p_t^{LN} & p_t^{MN} & p_t^{SN} & p_t^{NN} \end{pmatrix}$$

where p_t^{JK} is transition from category J to category K. To recover a continuous-time analogue, we calculate the eigenvalues of this matrix, represented by eigenvector V_t. The adjusted matrix is calulcated as

$$\Lambda_t = V_t \tilde{D}_t V_t^{-1}$$

where $\tilde{D}_t$ is a diagonal matrix whose elements are the respective log eigenvalues of D_t. The elements of this matrix can be written as

$$\begin{pmatrix} \lambda_t^{LL} & \lambda_t^{ML} & \lambda_t^{SL} & \lambda_t^{NL} \\ \lambda_t^{LM} & \lambda_t^{MM} & \lambda_t^{SM} & \lambda_t^{NM} \\ \lambda_t^{LS} & \lambda_t^{MS} & \lambda_t^{SS} & \lambda_t^{NS} \\ \lambda_t^{LN} & \lambda_t^{MN} & \lambda_t^{SN} & \lambda_t^{NN} \end{pmatrix}$$

where λ_t^{JK} is the adjusted flow rate from category J to category K.

Note that the net flows concepts under these transitions concepts are slightly different from the empirical specifications everywhere outside this Appendix, which consider separation poaching flows as distinct from hiring poaching flows. In this framework, we must account for the poaching destination of every hire and vice versa. To recover net transitions to non-employment for any firm size category J, we use:

$$NetNonEmployment_J = p_t^{NJ} * \frac{\Sigma N}{\Sigma J} - p_t^{JN}$$

for the unadjusted data, where ΣN_t is the number of individuals not employed in a quarter and ΣJ_t is the number of individuals employed by a firm of size category J. Likewise, for the adjusted data, we define:

$$AdjNetNonEmployment_J = \lambda_t^{NJ} * \frac{\Sigma N_t}{\Sigma J_t} - \lambda_t^{JN}.$$

Net poaching for any firm size category J, relative to K and Q is a bit more complicated. The hires and separations must take into account the fact that, for the adjacent quarter job-to-job flows, the separation occurs in the quarter preceding the quarter of hire. Let the share of job-to-job transitions that are adjacent quarter, among all jobs where the separation is in quarter t, be represented A_t^{JK}. Then, the net poaching flows for any size category J can be written:

$$\begin{aligned}
NetPoaching_J =& p_t^{KJ} * \frac{\Sigma K_t}{\Sigma J_t} * (1 - A_t^{JK}) + p_{t-1}^{KJ} * \frac{\Sigma K_{t-1}}{\Sigma J_t} * A_{t-1}^{JK} + \\
& p_t^{KJ} * \frac{\Sigma Q_t}{\Sigma J_t} * (1 - A_t^{JK}) + p_{t-1}^{KJ} * \frac{\Sigma Q_{t-1}}{\Sigma J_t} * A_{t-1}^{JQ} \\
& - (p_t^{JK} + p_t^{JQ})
\end{aligned}$$

and likewise the adjusted net poaching for any category is

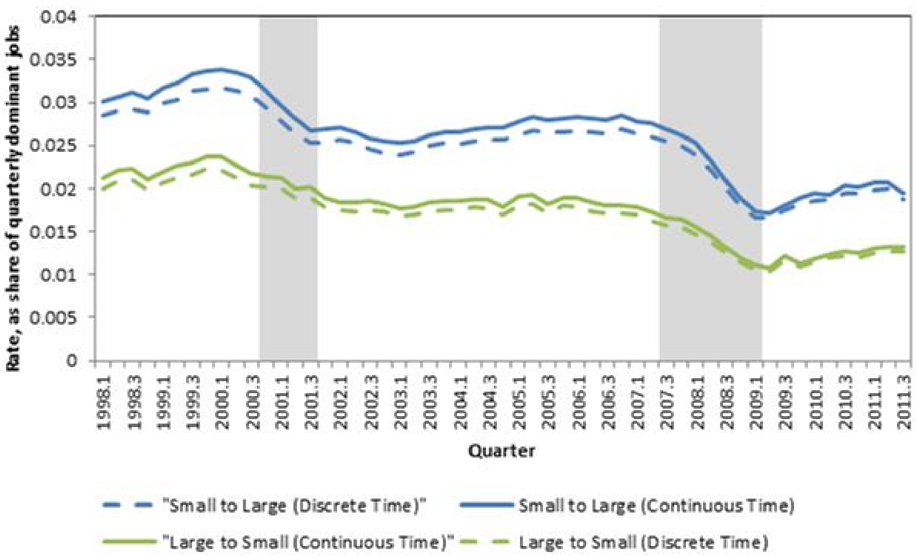
$$\begin{aligned}
NetPoaching_J =& \lambda_t^{KJ} * \frac{\Sigma K_t}{\Sigma J_t} * (1 - A_t^{JK}) + \lambda_{t-1}^{KJ} * \frac{\Sigma K_{t-1}}{\Sigma J_t} * A_{t-1}^{JK} + \\
& \lambda_t^{KJ} * \frac{\Sigma Q_t}{\Sigma J_t} * (1 - A_t^{JK}) + \lambda_{t-1}^{KJ} * \frac{\Sigma Q_{t-1}}{\Sigma J_t} * A_{t-1}^{JQ} \\
& - (\lambda_t^{JK} + \lambda_t^{JQ})
\end{aligned}$$

Figure F.1 shows how this adjustment method affects the quarterly transition rates. As in any time aggregation adjustment, the overall flow rates are higher after implementing our correction procedure. Panel F.1(a) shows that the job-to-job flows from small to large and vice versa are higher after this adjustment. However, Panel F.1(b) shows these adjustments basically cancel each other, and the net poaching of large firms is basically identical after our adjustment procedure.

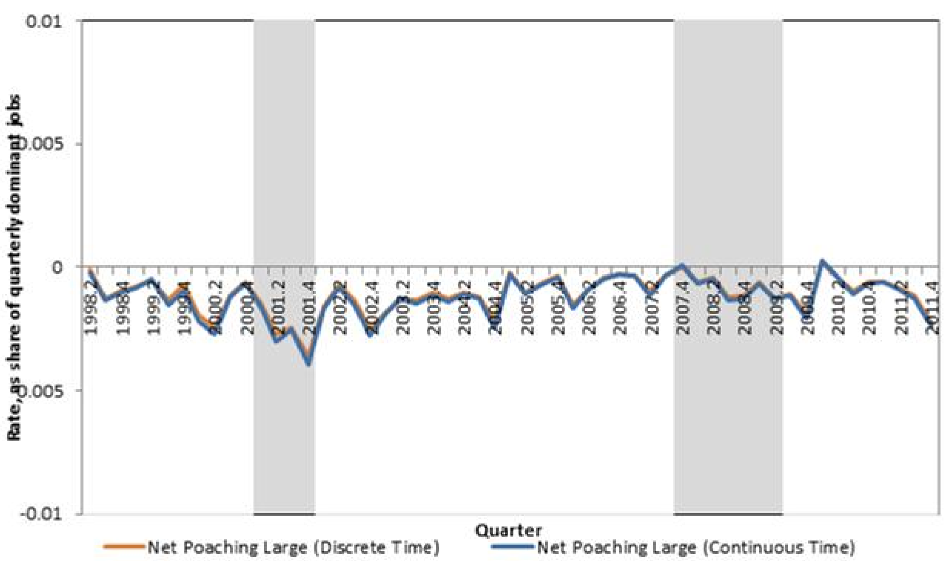
Not only are the time trends in differential net flows nearly identical, our state-level regressions are as well. We use the formulas for net non-employment hiring and net poaching as given above. For maximum comparability, we show the results before and after continuous time adjustment. This origin-destination combination is called the "separation-based" approach, and the state of the job-to-job flow origin is the state of interest in these state-level regression. Table F.1 replicates Table 3 using the separations-based approach using the discrete-time formulas above. These are very similar to those in Table 3, especially for the responsiveness to the difference from the HP trend, the poaching response to the first difference in the unemployment rate is somewhat higher. Table F.2 shows results after continuous time adjustment are nearly identical to those in Table F.2, with the more change evident for the response to the first difference in the unemployment rate than the difference from its HP trend.

Table F.3 replicates Appendix Table E.2 using state-level public-use J2J data in the "separations based" framework in discrete time. Again, results are qualitatively similar before and after this adjustment Table F.4 shows that, again, the time aggregation adjustment does basically nothing to the results. In summary, adjustment for the quarterly time aggregation inherent in our data has only a tiny effect on the size results presented in this paper: the excess sensitivity of large firms to the HP-filtered unemployment rate is driven much more by differential net hiring from non-employment than by poaching.

Figure F.1: Continuous vs. Discrete Time Poaching Flows



(a) Small to Large and Large to Small Flows



(b) Poaching Flows (Large Firms)

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

Table F.1: Continuous Time Differential Net Flows, Separations-Based Framework, State-Level Panel

Dependent Variable	**Deviation from HP Trend**	**First Difference**
	By Size: Large minus Small	
Net Job Flows	−0.170**	0.899**
	(0.039)	(0.224)
Net Poaching Flows	−0.071**	0.122
	(0.018)	(0.074)
Net Non-Employment Flows	−0.099**	0.777**
	(0.027)	(0.17)

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 F.2: 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 Non-Employment Flows	−0.100**	0.909**
	(0.030)	(0.178)

Notes: Coefficient on the cyclical variable with standard errors in parentheses. +, *, ** 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 F.3: Differential Net Flows, State-Level Public-Use J2J Panel, Separation-Based Framework

Dependent Variable	**Deviation from HP Trend**	**First Difference**
	By Size: Large minus Small	
Net Job Flows	−0.111**	1.069**
	(0.028)	(0.242)
Net Poaching Flows	−0.036**	0.141*
	(0.009)	(0.067)
Net Non-Employment Flows	−0.075**	0.929**
	(0.023)	(0.182)

Notes: Coefficient on the cyclical variable with standard errors in parentheses. +, *, ** 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 F.4: Continuous Time Differential Net Flows, State-Level Public-Use J2J Panel

Dependent Variable	**Deviation from HP Trend**	**First Difference**
	By Size: Large minus Small	
Net Job Flows	−0.110**	1.189**
	(0.030)	(0.264)
Net Poaching Flows	−0.036**	0.149*
	(0.010)	(0.072)
Net Non-Employment Flows	−0.075**	1.040**
	(0.025)	(0.199)

Notes: Coefficient on the cyclical variable with standard errors in parentheses. +, *, ** 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.