

Job-to-Job Flows and Earnings Growth: Web Appendix*

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Appendices

A Job-to-Job Flow Definitions (Web Only)

This appendix provides the formal definitions of the job-to-job flow concepts used in the forthcoming earnings tabulation. Definitions follow the notational conventions established by Abowd et al. (2009), augmented to include job-to-job flows by Hyatt et al. (2014). The starting point is earnings for individual i from employer j in quarter t , denoted w_{ijt} . If an individual has no earnings from an employer in a given quarter, then the worker did not receive unemployment insurance taxable income from that employer during that quarter, otherwise, if the worker did receive positive earnings from that employer ($w_{ijt} > 0$), then the worker worked for the employer.

The job-to-job flow definitions used for published tabulations, as listed in Hyatt et al. (2014), consider the subset of jobs that span two consecutive quarters (often called “consecutive quarter” or “beginning of quarter” jobs). Such consecutive quarter jobs have the desirable property that, for most such employment relationships, the employee was employed by the employer at the time of transition between the quarters, which allows this employment measure to reasonably be interpreted as indicative of point-in-time employment (recall that these administrative records lack start and end dates). Formally, these are

$$b_{ijt} = \begin{cases} 1, & \text{if } w_{ijt-1} > 0 \text{ and } w_{ijt} > 0 \\ 0, & \text{otherwise.} \end{cases}$$

Before we define the earnings measures formally, it is useful to introduce one more term, that for full quarter jobs. Such jobs span three consecutive quarters, in other words,

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$$f_{ijt} = \begin{cases} 1, & \text{if } w_{ijt-1} > 0 \text{ and } w_{ijt} > 0 \text{ and } w_{ijt+1} > 0 \\ 0, & \text{otherwise.} \end{cases}$$

For any two-quarter pair, job-to-job flows are calculated only using jobs that are maximal earning among all such consecutive quarter jobs, referenced from the “beginning” of quarter t . Formally, this is defined as:

$$domb_{ijt} = \begin{cases} 1, & \text{if } b_{ijt} = 1 \text{ and} \\ & w_{ijt} + w_{ijt-1} > w_{ikt} + w_{ikt-1} \forall k \\ & \text{s.t. } b_{ikt} = 1 \text{ and } j \neq k \\ 0, & \text{otherwise.} \end{cases}$$

The Job-to-Job Flows data product records transitions between dominant job status across quarters. These are worker movements between employers, as well as into and from nonemployment. In accounting for earnings, we also consider workers who did not change jobs, who are called “job stayers.” This leads to five earnings concepts, each with one or two earnings observations attached: workers transitioning into and out of nonemployment can get only one earnings observation because there are no earnings associated with nonemployment (by definition). In contrast, job stayers and each of two types of job-to-job flows each get two earnings observations, in order to assign earnings changes to these employment statuses.

Job stayers that contribute to earnings tabulations have at least four quarters of consecutive earnings: this is the minimum number of quarters necessary to compare a given job stayer’s full quarter earnings in a given quarter to full-quarter earnings in the previous quarter. Additionally, such workers must be dominant among consecutive quarter jobs at the beginning of the reference quarter t , as well as at the beginning of the next quarter $t + 1$. Formally,

$$fdombe_{ijt} = \begin{cases} 1, & \text{if } domb_{ijt} = 1 \text{ and } domb_{ijt+1} = 1 \\ & \text{and } f_{ijt-1} = 1 \\ 0, & \text{otherwise.} \end{cases}$$

For these so-defined job-stayers, we can compare earnings from quarter $t - 1$ to earnings in quarter t . The earnings for the quarter preceding the reference quarter are

$$fdombe_jfqearn_{ijt} = \begin{cases} w_{ijt-1}, & \text{if } fdombe_{ijt} = 1 \\ 0, & \text{otherwise,} \end{cases}$$

and the earnings contemporaneous with the reference quarter are

$$fdombe_kfqearn_{ijt} = \begin{cases} w_{ijt}, & \text{if } fdombe_{ijt} = 1 \\ 0, & \text{otherwise.} \end{cases}$$

Two types of job-to-job transitions are also tabulated: those in which there is earnings from the previous employer j and subsequent employer k in the same calendar quarter (called “within-quarter” job-to-job flows) and in which the earnings from the subsequent employer begins in the following quarter (called “adjacent-quarter” job-to-job flows).

The first type of job-to-job flow involves the case in which a worker had a different employer at the beginning of a quarter than its end (i.e., the beginning of the next quarter), from employer j to employer k . The worker must separate from the previous employer j and be hired at employer k in quarter t .

$$fee_{ijkt} = \begin{cases} 1, & \text{if } domb_{ijt} = 1 \text{ and } domb_{ikt+1} = 1 \\ & \text{and } f_{ijt-1} = 1 \text{ and } f_{ikt+1} = 1 \\ & \text{and } w_{ijt+1} = 0 \text{ and } w_{ikt-1} = 0 \\ & \text{and } j \neq k \\ 0, & \text{otherwise.} \end{cases}$$

Earnings are taken from the last available full-quarter earnings observation from the previous employer j and the first available full-quarter earnings observation from the subsequent employer k .

$$fee_jfqearn_{ijt} = \begin{cases} w_{ijt-1}, & \text{if } fee_{ijkt} = 1 \\ 0, & \text{otherwise,} \end{cases}$$

and the earnings at the next employer are taken from the quarter immediately after the reference quarter, i.e. quarter $t+1$.

$$fee_kfqearn_{ijt} = \begin{cases} w_{ijt+1}, & \text{if } fee_{ijkt} = 1 \\ 0, & \text{otherwise.} \end{cases}$$

There is a second type of job-to-job flow definition that captures employment at a job that ends in the quarter before the subsequent employment begins at the worker’s next employer. Note that workers in a quarter t who have no employer j such that $b_{ijt} = 1$ could be said to be nonemployed at the beginning of quarter t . However, it is well known that in some cases jobs start on the first day (or first weekday) of a given month. These adjacent-quarter job-to-job flows that have earnings attached

$$faq_{ijkt} = \begin{cases} 1, & \text{if } domb_{ijt-1} = 1 \text{ and } domb_{ikt+1} = 1 \\ & \text{and } f_{ijt-1} = 1 \text{ and } f_{ikt+1} = 1 \\ & \text{and } domb_{ilt} \neq 1 \forall l \text{ and } j \neq k \\ 0, & \text{otherwise.} \end{cases}$$

Earnings are taken from the last available full-quarter earnings observation from the previous employer j and the first available full-quarter earnings observation from the subsequent employer k .

$$faq_jfqearn_{ijt} = \begin{cases} w_{ijt-2}, & \text{if } faq_{ijkt} = 1 \\ 0, & \text{otherwise,} \end{cases}$$

and the earnings contemporaneous with the reference quarter are

$$faq_kfqearn_{ijt} = \begin{cases} w_{ijt+1}, & \text{if } faq_{ijkt} = 1 \\ 0, & \text{otherwise.} \end{cases}$$

We also assign earnings to transitions involving movements into and out of “persistent” nonemployment, that is, a worker has no consecutive quarter job at the beginning of quarter t or quarter $t+1$. If the worker was employed at the beginning of the previous quarters and t quarter but is not employed at the beginning of quarters $t+1$ and $t+2$, then the worker transitioned from employment to nonemployment, otherwise if the worker was not employed at the beginning of quarters $t-1$ and t , but is employed at the beginning of quarter $t+1$, then the worker is said to have transitioned from nonemployment into employment during quarter t .

Flows into persistent nonemployment in quarter t have full-quarter earnings when

$$fen2_doms2_{ijt} = \begin{cases} 1, & \text{if } domb_{ijt} = 1 \text{ and } f_{ijt-1} = 1 \\ & \text{and } domb_{ilt+1} \neq 1 \forall l \\ & \text{and } domb_{imt+2} \neq 1 \forall m \\ 0, & \text{otherwise,} \end{cases}$$

and those earnings, taken from quarter $t-1$, are

$$fen2_fqearn_{ijt} = \begin{cases} w_{ijt-1}, & \text{if } fen2_doms2_{ijt} = 1 \\ 0, & \text{otherwise} \end{cases}.$$

Flows from persistent nonemployment into employment in quarter t have full quarter earnings when

$$fen2_doma2_{ikt} = \begin{cases} 1, & \text{if } domb_{ikt+1} = 1 \text{ and } f_{ikt+1} = 1 \\ & \text{and } domb_{ilt} \neq 1 \forall l \\ & \text{and } domb_{imt-1} \neq 1 \forall m \\ 0, & \text{otherwise,} \end{cases}$$

and those earnings, taken from quarter $t + 1$ are defined as:

$$fne2_fqearn_{ijt} = \begin{cases} w_{ijt+1}, & \text{if } fne2_doma2_{ikt} = 1 \\ 0, & \text{otherwise.} \end{cases}$$

B Decomposition Transformations (Web Only)

The decomposition exercise accounts for the different mechanisms by which earnings from one quarter to the next, in other words, quarter $t - 1$ to quarter t . We transform twelve of the measures defined in Appendix A into five aggregates: one for overall earnings growth, as well as the contribution of job stayers, job-to-job flows, transitions into and out of nonemployment, and a residual. Earnings in each quarter can be viewed from previous P to an event, or subsequent S to an event. Each quarter t for which data is available has job stayers and job-to-job flows which contribute once to previous earnings, and once to subsequent earnings. For example, for the job stayer $fdombe_{ijt}$, the earnings $fdombe_kfqearn_{ijt}$ come from quarter t and are hence viewed from the S perspective, while the earnings $fdombe_jfqearn_{ijt}$ come from quarter $t - 1$ and hence are viewed from the P perspective. We can, for any quarter t , express average earnings as the weighted sum of earnings for each job-to-job flow measure. By contrast, transitions into and out of nonemployment only contribute once: employment-to-nonemployment flows only contribute to S earnings, and nonemployment-to-employment flows only contribute to P earnings. We specify how to account for growth in S earnings in a manner similar to Hahn, Hyatt, and Janicki (2016).

The decomposition will express earnings change associated with changes in the shares of the workforce that are stayers and each type of transitioner, as well as changes in those shares, and changes in earnings. We will turn twelve of the measures defined in Appendix A into six average earnings measures and six share of employment measures (the fact that both sum to twelve is purely coincidental).

Call the total number of earnings observations $totemp_t^P$ when viewed the P perspective and $totemp_t^S$, when viewed from the S perspective. This can be calculated as

$$totemp_t^P = \begin{aligned} & \sum_i fdombe_{ijt+1} + \\ & \sum_i fee_{ijt+1} + \\ & \sum_i faq_{ijt+2} + \\ & \sum_i fen2_{ijt+1}. \end{aligned}$$

Note that all observations that contribute to quarter t 's earnings come from transitions referencing quarter $t + 1$ with the exception of adjacent-quarter flows, because the earnings from which earnings are taken lag the reference quarter by one relative to the other transition types.

Earnings for a given quarter, viewed from the subsequent perspective draw from the transition reference quarter $t - 1$ with the exception of job stayers, which reference quarter t :

$$totemp_t^S = \begin{aligned} & \sum_i fdombe_{ijt} + \\ & \sum_i fee_{ijt-1} + \\ & \sum_i faq_{ijt-1} + \\ & \sum_i fne2_{ijt-1}. \end{aligned}$$

Now, we can define the shares associated with job-stayers JS , job-to-job flows JJ , and flows into nonemployment EN and flows out of nonemployment NE viewed from both the previous and subsequent perspectives, as follows.

The share of earnings observations viewed from the previous perspective that are associated with job stayers is

$$D_t^{P,JS} = \frac{\sum_i fdombe_{ijt+1}}{totemp_t^P}.$$

The share of earnings observations viewed from the previous perspective that are associated with job-to-job flows is

$$D_t^{P,JJ} = \frac{\sum_i fee_{ijt+1} + \sum_i faq_{ijt+2}}{totemp_t^P}.$$

The share of earnings observations viewed from the previous perspective that are associated with flows into nonemployment is

$$D_t^{P,EN} = \frac{\sum_i fen2_{ijt+1}}{totemp_t^P}.$$

The share of earnings observations viewed from the subsequent perspective that are associated with job stayers is

$$D_t^{S,JS} = \frac{\sum_i fdombe_{ikt}}{totemp_t^S}.$$

The share of earnings observations viewed from the subsequent perspective that are associated with job-to-job flows is

$$D_t^{S,JJ} = \frac{\sum_i fee_{ikt-1} + \sum_i faq_{ikt-1}}{totemp_t^S}.$$

The share of earnings observations viewed from the subsequent perspective that are associated with flows into nonemployment is

$$D_t^{S,EN} = \frac{\sum_i fne2_{ijk-1}}{totemp_t^S}.$$

We now define six average earnings measures. The average earnings viewed from the previous perspective that is associated with job stayers is

$$\bar{w}_t^{P,JS} = \frac{\sum_i fdombe_jfqearn_{ijt+1}}{\sum_i fdombe_{ijt+1}}.$$

The average earnings viewed from the previous perspective that is associated with job-to-job flows is

$$\bar{w}_t^{P,JJ} = \frac{\sum_i fee_jfqearn_{ijt+1} + \sum_i faq_jfqearn_{ijt+2}}{\sum_i fee_{ijt+1} + \sum_i faq_{ijt+2}}.$$

The average earnings viewed from the previous perspective that is associated with flows into nonemployment is

$$\bar{w}_t^{P,EN} = \frac{\sum_i fen2_fqearn_{ijt+1}}{\sum_i fen_{ijt+1}}.$$

The average earnings viewed from the subsequent perspective that is associated with job stayers is

$$\bar{w}_t^{S,JS} = \frac{\sum_i fdombe_kfqearn_{ikt}}{\sum_i fdombe_{ikt}}.$$

The average earnings viewed from the subsequent perspective that is associated with job-to-job flows is

$$\bar{w}_t^{S,JJ} = \frac{\sum_i fee_kfqearn_{ikt-1} + \sum_i faq_kfqearn_{ikt-1}}{\sum_i fee_{ikt-1} + \sum_i faq_{ikt-1}}.$$

The average earnings viewed from the subsequent perspective that is associated with flows into nonemployment is

$$\bar{w}_t^{S,EN} = \frac{\sum_i fne2_fqearn_{ijk-1}}{\sum_i fne2_{ijk-1}}.$$

Armed with these 6 shares and 6 earnings definitions, we can decompose average earnings into different components: job stayers, job-to-job flows, and nonemployment, as well as a residual. To do so, we use a convenient substitution.

$$\Delta \bar{w}_t = \bar{w}_t^S - \bar{w}_{t-1}^S = \underbrace{(\bar{w}_t^S - \bar{w}_{t-1}^P)}_{=JS+JJ+N} - \underbrace{(\bar{w}_{t-1}^S - \bar{w}_{t-1}^P)}_{residual}.$$

The residual $\bar{w}_{t-1}^S - \bar{w}_{t-1}^P$ indicates the difference that quarter $t-1$ earnings are when viewed from the previous vs. subsequent perspective. We do additional transformations of $\bar{w}_t^S - \bar{w}_{t-1}^P$. First, note that

$$\bar{w}_t^S - \bar{w}_{t-1}^P = \sum_C \bar{w}_t^{S,C} D_t^{S,C} - \bar{w}_{t-1}^{P,C} D_{t-1}^{P,C}.$$

For the components for job-stayers and job-to-job flows, that is, $C \in \{JS, JJ\}$ we further distinguish:

$$\begin{aligned} \bar{w}_t^{S,C} D_t^{S,C} - \bar{w}_{t-1}^{P,C} D_{t-1}^{P,C} &= \\ & \underbrace{(D_t^{S,C} - D_{t-1}^{P,C}) \left(\frac{\bar{w}_t^{S,C} + \bar{w}_{t-1}^{P,C}}{2} \right)}_{\text{extensive margin}} + \\ & \underbrace{(\bar{w}_t^{S,C} - \bar{w}_{t-1}^{P,C}) \left(\frac{D_t^{S,C} + D_{t-1}^{P,C}}{2} \right)}_{\text{intensive margin}}. \end{aligned}$$

We group the terms associated with the ‘‘dilution’’ of employment by the net entry of workers from nonemployment. In other words, we group the $(D_t^{S,C} - D_{t-1}^{P,C})$ ‘‘extensive margin’’ terms with nonemployment’s other component, $\bar{w}_t^{S,NE} D_t^{S,NE} - \bar{w}_{t-1}^{P,EN} D_{t-1}^{P,EN}$.

Now, for any quarter t , we can define the components of our decomposition.

Job stayers contribute

$$JS_t = (\bar{w}_t^{S,JS} - \bar{w}_{t-1}^{P,JS}) \left(\frac{D_t^{S,JS} + D_{t-1}^{P,JS}}{2} \right),$$

job-to-job flows contribute

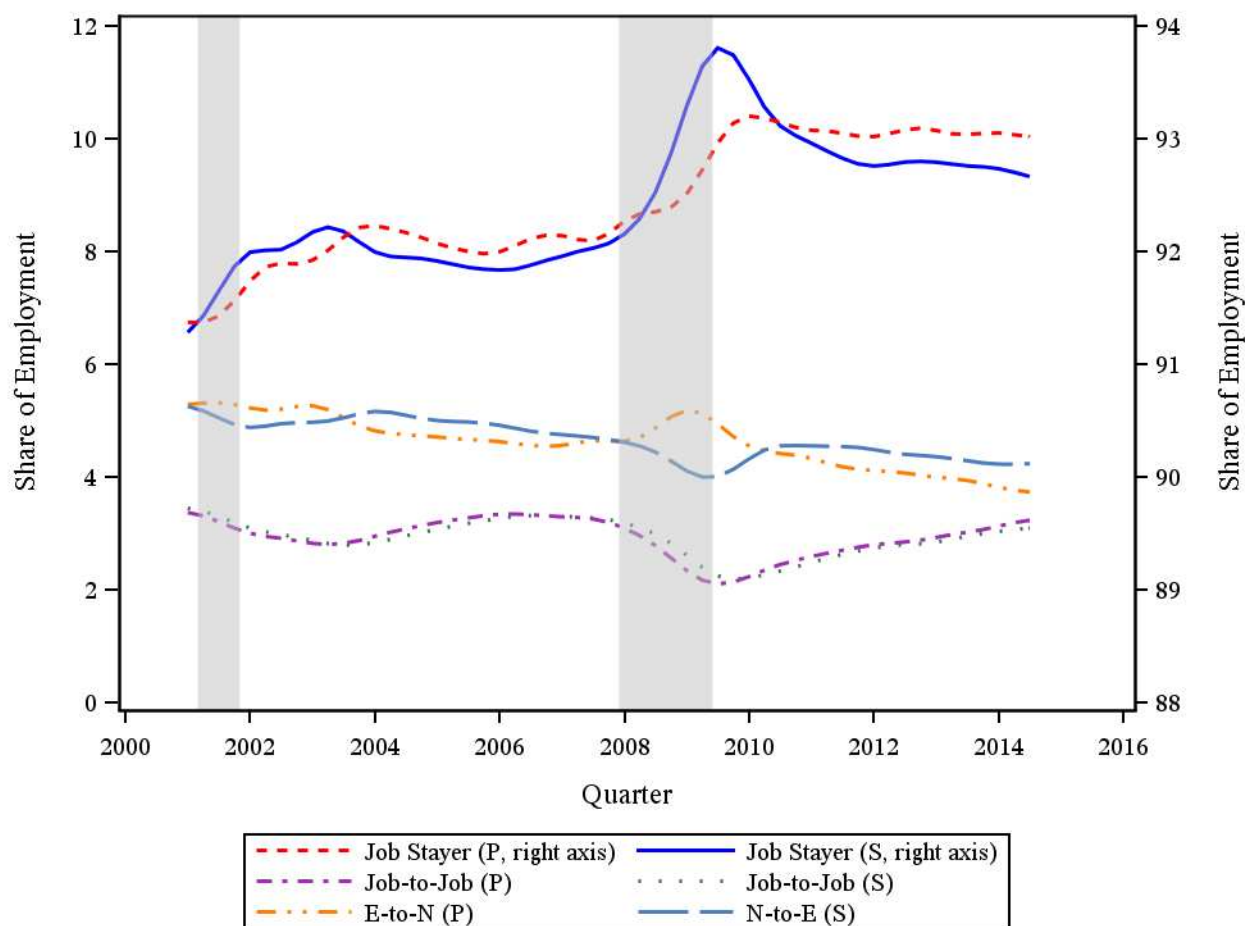
$$JJ_t = (\bar{w}_t^{S,JJ} - \bar{w}_{t-1}^{P,JJ}) \left(\frac{D_t^{S,JJ} + D_{t-1}^{P,JJ}}{2} \right),$$

and nonemployment contributes

$$\begin{aligned} N_t &= (D_t^{S,JS} - D_{t-1}^{P,JS}) \left(\frac{\bar{w}_t^{S,JS} + \bar{w}_{t-1}^{P,JS}}{2} \right) + \\ & (D_t^{S,JJ} - D_{t-1}^{P,JJ}) \left(\frac{\bar{w}_t^{S,C} + \bar{w}_{t-1}^{P,JJ}}{2} \right) + \\ & \bar{w}_t^{S,NE} D_t^{S,NE} - \bar{w}_{t-1}^{P,EN} D_{t-1}^{P,EN}. \end{aligned}$$

Released data are converted to 2014 constant dollars. Overall earnings growth in time t is, by construction, equal to the sum of $JS_t + JJ_t + N_t$ and the residual from time t . Overall earnings growth, JS_t , JJ_t , N_t , and the residual are the dependent variables for each column in Table 1, respectively, and are presented, after adjustment for trading day effects, changes in the composition of U.S. states, seasonally adjustment, and Henderson filtering, in Figure 1.

Figure C1: Share of Employment



Notes: All data are seasonally-adjusted using x12. Shaded areas indicate recessions. “Job Stayers (P)” indicates the frequency in previous quarter for job stayers who remain at their jobs at least four quarters. “Job Stayers (S)” indicates the frequency in the current quarter for job stayers who remain at their jobs at least four quarters. “Job-to-Job Flows (P)” indicates the frequency of a job-to-job flow from one employer to another, separating from the former, being hired at the latter, in the previous quarter. Both jobs last at least three quarters. “Job-to-Job Flows (S)” indicates the frequency of a job-to-job flow from one employer to another, separating from the former, being hired at the latter, in the current quarter. Both jobs last at least three quarters. “Flows from Nonemployment (P)” indicates the frequency of nonemployment entrants from jobs that last at least three quarters in the previous quarter. “Flows from Nonemployment (S)” indicates the frequency of nonemployment exiters into jobs that last at least three quarters in the current quarter.

C Descriptive Figures (Web Only)

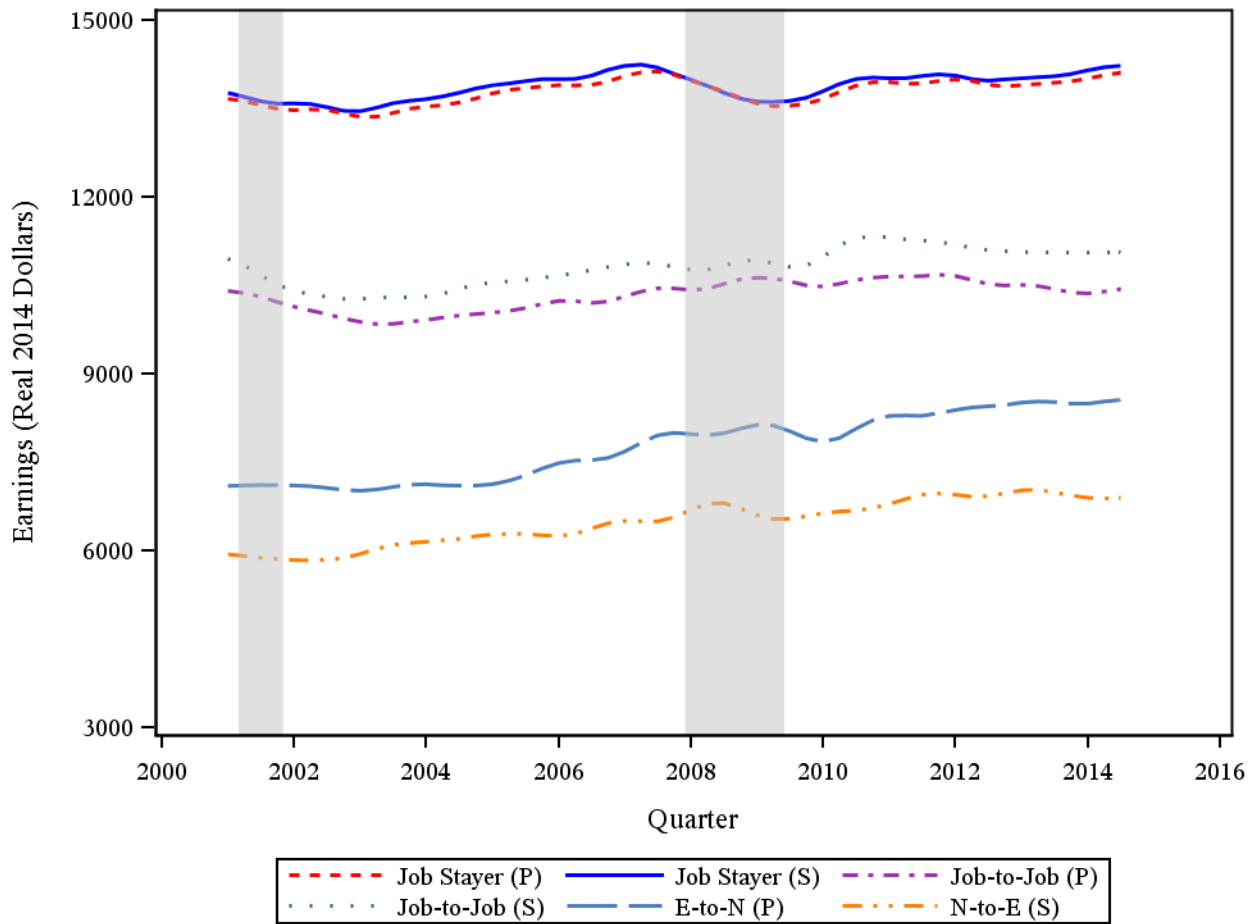
In this section, we describe the relative frequency of job stayers, job-to-job flows, and nonemployment entrants and exiters, as well as the average earnings associated with each group. All results are seasonally adjusted using x12. All results reference time t and present the contemporaneous value (subsequent S , containing earnings from time t) as well as the value corresponding to the quarter before (previous P , containing earnings from time $t - 1$). In terms of the definitions from Appendix B, for each component C , we plot $D_t^{S,C}$ and $D_{t-1}^{S,C}$.

Figure C.1 plots the relative frequency of job stayers, job-to-job flows, and nonemployment entrants and exiters. In every quarter, most workers are job stayers (plotted on

the right axis), who constitute at least 91% of employment in each quarter. The share of employment that job stayers constitute increases procyclically, and is at its highest in the late stages of recoveries. Job-to-job flows are procyclical and reach a series low at the end of the 2007-2009 recession. Job-to-job flows constitute 2% to 4% of employment. Nonemployment flows are more frequent than job-to-job flows throughout the time series and account for 4% to 6% of employment. Flows out of nonemployment are procyclical and generally exceed flows out of employment and into nonemployment, which are countercyclical.

These figures also distinguish whether the earlier (previous P) or later (subsequent S) are used. Recall that the number of job stayers in each quarter t is the same whether

Figure C2: Average Earnings



Notes: All data are presented in 2014 constant dollars and are seasonally-adjusted using x12. Shaded areas indicate recessions. “Job Stayers (P)” indicates average earnings in the previous quarter for job stayers who remain at their jobs at least four quarters. “Job Stayers (S)” indicates average earnings in the current quarter for job stayers who remain at their jobs at least four quarters. “Job-to-Job Flows (P)” indicates average earnings in the previous quarter for workers involved in a job-to-job flow from one employer to another, separating from the former, being hired at the latter. Both jobs last at least three quarters. “Job-to-Job Flows (S)” indicates average earnings in the current quarter for workers involved in a job-to-job flow from one employer to another, separating from the former, being hired at the latter. Both jobs last at least three quarters. “E-to-N (P)” indicates average earnings in the previous quarter for nonemployment entrants from jobs that last at least three quarters. “N-to-E (S)” indicates average earnings in the previous quarter for nonemployment exiters into jobs that last at least three quarters.

measured as part of P or S , all that is different is the denominator. Differences in the share of employment that job stayers constitute is driven by the difference in the share of employment of workers exiting and entering nonemployment. During and shortly after economic contractions, more workers enter nonemployment than leave it, which leads the share of employment constituted by job stayers to be greater measured as part of S relative to P . Similarly, during economic expansions, job stayers contribute less to S than to P . A similar intuition holds for the fluctuations in job-to-job flows measured from P or S .

Figure C.2 plots the average earnings of job stayers, job-to-job flows, and nonemployment entrants and exiters in 2014 constant dollars. Job stayers have the highest earn-

ings, and its average is in the range of \$13,400 and \$14,200. The average earnings of job stayers is procyclical, growing gradually during the middle to late stages of economic expansions, and falling during and after economic contractions. Workers going through job-to-job flows earn less than job stayers. Workers who recently moved to another employer tend to earn more (\$10,200 to \$11,400) than workers who recently left an employer for another (such workers have average earnings in the range of \$9,800 to \$10,700), and this difference is greatest in the late stages of economic expansions, during which it can exceed \$600. Workers entering and exiting nonemployment have lower earnings (\$7,000 to \$8,600), and new entrants to employment have the lowest earnings \$5,800 to \$7,100). This differ-

ence in the earnings of workers entering vs. exiting nonemployment is almost certainly in part due to the fact that all workers who are initially entering the labor market without previous work experience are part of nonemployment-to-employment flows, and that some share of employment-to-nonemployment flows are workers who are voluntarily retiring.

These two figures provide additional intuition for one of the main results in the body of the paper. Because workers entering employment from nonemployment tend to earn much less than workers who are continuously employed, and the number of such workers increases during expansions and declines during contractions, nonemployment flows induce earnings to be lower during expansions, but this effect lessens during and after economic downturns.

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