Worker Turnover and Job Reallocation: Evidence from Matched Employer-Employee Data*

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Abstract

This paper uses employer-employee data to jointly examine worker turnover and job flows in Ethiopia. We find substantial worker turnover (38%) at the aggregate level. Nearly half of this turnover is driven by establishment-level job flows while the other half is accounted for by excess turnover or churning. A substantial part of hiring (separation) occurs among downsizing (growing) establishments underscoring that worker flows are much higher than job reallocation across establishments. Churning of workers appears to be negatively associated with subsequent employment growth at the establishment level and this relationship is stronger among employers that rely more on long-term relationships with workers. Excess turnover in turn rises subsequent to rapid employment expansion but declines among establishments that pay above average wages and benefits. From a comparative perspective, worker turnover rates in Ethiopia and other developing countries appear to be higher than that of European countries but lower than that of the United States.

Key Words: Job Creation, Job Destruction, Worker Turnover, Churning, Hiring and Separation Rates, Ethiopia.

1. Introduction

Improved access to matched employer-employee data from developed countries has allowed researchers to jointly examine job reallocation and worker mobility across large samples of employers in contrast to previous efforts where both processes were studied separately using firm- or worker-level data. This approach has contributed to a more complete understanding of labor market dynamics by addressing a range of questions including the extent and nature of worker turnover at the establishment and aggregate levels, the cross-firm variation in job match quality, the relationship between job and worker flows, and the relative importance of firm and worker fixed effects in wage determination (Anderson and Meyer, 1994; Abowd, Corbel, and Kramarz, 1999; Burgess, Lane, and Stevens, 2000, 2001; Haltiwanger et al., 2012)[1].

Because of the scarcity of employer-employee data, however, studies that examine worker turnover in developing countries and its interactions with job reallocation remain rare. Much of what we know about labor market flows in the developing world comes from studies that use household or labor force surveys that often do not capture firm-level flows and characteristics. Some of these studies find that, compared to developed countries, tenure tends to be shorter in developing countries (Schaffner, 2001), while others find that separation rates tend to be higher (Gong, van Soest, and Villagomez, 2004; Blattman and Dercon, 2018). Donovan, Lu and Schoellman (2020) use harmonized labor force surveys from a relatively large sample of developed and

[1] Other studies attempt to overcome the lack of matched employer-employee data by combining different datasets (Davis, Faberman, Haltiwanger, 2006, 2012; Davis and Haltiwanger, 2014).

developing countries to show a reduction in the transition rate from employment to non-employment, hence lower turnover, as per capita income increases. These findings indirectly suggest that worker turnover rates are higher in developing countries than in developed countries. Only recently have researchers begun to observe labor market flows based on employer-employee data from middle-income countries, including Flórenz et al. (2020), Kerr (2018), and Kaplan et al. (2007) for Colombia, South Africa and Mexico, respectively.[2] There remains a major gap in our understanding of labor market dynamics in low-income countries and this paper contributes to the literature by exploiting unique administrative data from Ethiopia that links formal private sector employers and employees, covering the period September 2011 to September 2018.

Our empirical analysis consists of three parts. In the first part, we examine the distribution of job and worker flows across distinct groups of establishments and over time. We find a worker turnover rate of about 38% in the formal private sector of Ethiopia suggesting that nearly two out of five employees would either be hired or separated over a period of six months. A little over half (52%) of this turnover is driven by job reallocation across establishments while churning or worker turnover in excess of job flows accounts for the remaining 48%. We then compare our findings with similar studies from the US (Anderson and Meyer,1994; Burgess et al., 2000; and Lazear and Spletzer, 2012), Europe (Hamermesh et al.,1996; Albeak and Sørensen, 1998; Abowd et al.,1999; Contini, 2002; and Bauer and Bender, 2004), Latin America (Flórenz et

[2] Recent studies from Brazil have also used matched employer-employee data where the primary focus has been estimating the labor market effects of trade shocks (Dix-Carneiro, 2014; Krishna, Poole and Senses, 2014; Dix-Carneiro and Kovak, 2017) and the relative importance of firm age in creating stable jobs (Brummund and Connolly, 2019).

al.,2020; Kaplan et al.,2007), and South Africa (Kerr, 2018). In doing so, we provide a rare insight on labor market flows around the world by juxtaposing evidence from high-, middle- and low-income countries. Our comparative analysis indicates that worker turnover rates for developing countries including Ethiopia are, on average, higher than that of European countries but lower than that of the United States. This observation seems to qualify the rather widely accepted view that worker turnover rates in developing countries are systematically and substantially higher than that of developed countries.

Having documented the distributions of job and worker flows, the second part of our empirical analysis examines the dynamic relationship between worker turnover and job growth at the establishment level. We focus in particular on the implications of excess turnover or churning for job growth and assess firm heterogeneity in the job flows-churning relationship based on expected differences in the relative importance of job match stability across establishments. We find that churning is negatively associated with subsequent net employment growth at the establishment level, and that this relationship tends to be stronger in sectors that are more reliant on trained and experienced workers. This analysis relates to recent studies that have examined the role of churning both at the macro and micro levels. Davis and Haltiwanger (2014) and Mercan and Schoefer (2020) find that quit-driven replacement hiring increases aggregate employment in the United States and Germany, respectively, while Moscarini and Postel-Vinay (2016) arrive at a similar conclusion using a dynamic job ladder

model.[3] At the establishment level, however, Burgess et al. (2000) find that excess turnover is negatively correlated with subsequent employment growth, while Lane et al. (1996) show that churning increases the hazard of firm exit.[4]

Lastly, we provide econometric analysis of the drivers of worker turnover and churning at the establishment level. We find that churning declines with establishment size and average worker compensation but rises significantly after periods of rapid employment growth. These results are consistent with Burgess et al. (2000, 2001) and Lane et al. (1996) who show that churning is not randomly distributed across US establishments. Kerr (2018) and Kaplan et al. (2007) also show that worker turnover declines with firm size in South Africa and Mexico, respectively, although these studies do not control for other establishment characteristics and fixed effects. Unlike previous studies of churning, we contribute further by providing worker-level analysis of the probability of separation to better understand and check the consistency of our findings from the establishment-level analysis of excess turnover.

This paper also relates to a broader research agenda concerned with improving our understanding of labor markets in developing countries. Some recent papers establish a few "stylized facts" for labor markets in poor countries, including Sub-Saharan Africa (SSA), that diverge from that of developed countries. Rud and Trapeznikova (2021)

[3] At the individual level, turnover may allow young worker to move up to high-wage firms (Topel and Ward, 1992) while subjecting them to income loss if the transition to a new job involves unemployment (Anderson and Meyer, 1994).
[4] These establishment-level relationships in the US are consistent with the implications of efficiency wage models and that of Alvarez and Veracierto (2001) where reducing turnover through severance payments may reduce the unemployment rate.

note that while labor markets in SSA are characterized by high labor force participation rates, the share of workers in wage employment is very low relative to middle-income countries. These authors attribute the region's poor labor market outcomes to poorly functioning labor markets and job match inefficiencies. Lagakos et al. (2019) show that workers in low-income countries face substantially lower returns to experience relative to their counterparts in developed countries, while Feng et al. (2021) show that the relationship between education and unemployment is very different across rich and poor countries. Our paper contributes to this broader literature on labor market performance by investigating whether patterns of job and worker dynamics in Ethiopia are different from those already identified for richer countries.

The rest of the paper is organized as follows. The next section provides an overview of the country context and the administrative data. Section three discusses the definition and measurement of job and worker flows, followed by evidence on aggregate flows for our Ethiopian sample as well as a cross-country comparison based on studies that use employer-employee data. Section four provides econometric analysis of the relationship between job flows and excess turnover at the establishment level, and how this relationship varies across groups of firms. Section five examines the drivers of establishment-level churning, and the underlying probability of worker separations. Section six concludes the paper.

2. Country Context and Data

Ethiopia provides an interesting case to study labor market dynamics in low-income countries that are struggling to expand formal employment. Ethiopia is the second most populous country in Africa with about 3% population growth rate. Its real GDP growth of about 10% per annum since the early 2000s is among the highest in the region. And yet, approximately 67% of total employment is still in agriculture[5] while urban unemployment rate remains relatively high. According to the Urban Employment and Unemployment Survey (UEUS) conducted by the Central Statistical Agency (CSA) of Ethiopia, the urban unemployment rate was 25% in the early 2000s and declined to 17% in 2016 before rising to 19% in 2017 and 2018. Youth unemployment in urban areas has consistently been above 25% over the last two decades. Approximately 75% of urban employment is in the private sector, of which 60% is accounted for by self-employment according to the UEUS. There are no minimum wages or unemployment benefits for private sector workers, and labor unions are typically weak. Despite some improvements over the last decade, courts remain inefficient and provide limited legal recourse to disputes between employers and employees. The urban labor market that we study is thus marked by rapid labor force growth, high unemployment and self-employment rates, low wages and limited restraints on worker separation either from labor unions or the court system.

The data for this paper come from the administrative records of the Private Organizations' Employees Social Security Agency (POESSA) of Ethiopia, and cover the

[5] According to data from the World Bank's World Development Indicators for 2017-2019.

period from September 2011 to September 2018 on a biannual basis. POESSA is responsible for managing the mandatory social security scheme for private sector employees that was introduced by the Ethiopian government in June 2011. This is a defined benefits pension scheme that applies to all private sector firms with at least one employee. The POESSA data do not include civil servants and employees of state-owned enterprises who are covered under an older social security scheme established in the 1960s. Also not covered under POESSA are the self-employed, and employees of private firms who already had Provident Funds (PFs) as a form of social security as of June 2011.[6] The new pension scheme under POESSA is expected to cover at least 80% of formal private-sector firms that were established before 2011 and all firms established thereafter. However, due to weak enforcement of the new pension law, it is not entirely clear what percentage of private employers are actually registered with POESSA. According to Shiferaw et al. (2017), close to 50% of privately-owned manufacturing firms have complied with the new pension law in 2012 and 2013[7]. If small firms are less likely to comply with the 2011 pension law than large firms, and if worker turnover and job reallocation rates are higher among small than large firms, our findings may underestimate the extent of worker and job flows in the labor market. The

[6] Provident funds are voluntary schemes that draw contributions from employers and employees, and provide lump sum payments at separation. The 2011 pension law allows PFs to co-exist with the new scheme if both employers and employees agreed to keep them while prohibiting the formation of new ones. It is not clear exactly how many privately-owned firms and their employees have PFs. However, Shiferaw et al. (2017) indicate that approximately 20% of manufacturing firms have PFs and that such firms tend to be larger than their counterparts without PFs. We expect even lower coverage of PFs in the services sector given that firm size is substantially lower in services relative to manufacturing.

[7] The 2015/16 Large and Medium Scale Manufacturing and Electricity Industries Survey conducted by the Central Statistical Agency of Ethiopia captures approximately 3200 manufacturing firms that employ at least 10 workers and use power driven machinery. Approximately 5% of these manufacturing firms are state-owned enterprises and about 20% of them have PFs and hence do not report to POESSA. With a 100% compliance, one would expect approximately 2400 manufacturing firms in the POESSA data. The actual number of manufacturing firms in the POESSA data is about 1100 firms at any point during our sample period, which amounts to a compliance rate of about 45%.

dataset does not enable us to distinguish firm entry from compliance with the new pension law, or firm exit from failure to comply with the pension law. Our analysis can therefore not isolate the contribution of firm entry and firm exit to job and worker dynamics. The POESSA dataset also does not enable us to distinguish different reasons as to why a worker has left a firm. For example, we cannot distinguish between voluntary quits and layoffs.

Despite these limitations, the POESSA data provide the largest sample of formal private establishments in Ethiopia that are matched with employees. Unlike most firm-level studies on job flows that cover only manufacturing firms, we have a more complete picture of the formal labor market encompassing all economic sectors across all administrative regions in the country. Our sample of the POESSA data has 1,645,645 workers matched with 51,600 establishments. The total number of worker observations is 4,969,487 and the total number of establishment observations is 234,521. The dataset contains worker-level information on wages, benefits, sex and age, and establishment-level information on sector and location. Measures of experience and job tenure can be constructed for each individual, and it is possible to obtain a measure of total establishment employment, which we use as a proxy for establishment size. Unfortunately, the dataset does not contain information about workers education or occupation. Individuals and establishments have unique identification numbers, which enables us to construct a linked employer-employee panel dataset where we can track workers who move across firms over time. While concerns about data quality remain, the consistency of some of the descriptive statistics with widely recognized patterns of

firm behavior in the existing literature, as discussed shortly, gives us confidence regarding data quality and representativeness.

3. Measuring Job and Worker Flows

3.1. Establishment-level measurements

We measure job and worker flows following standard practice in the literature on labor market flows (Davis and Haltiwanger,1992; Burgess et al., 2000). The establishment-level *Hiring Rate* (HR_{it}) is calculated by dividing the total number of workers hired by establishment i at time t (H_{it}) by average employment level (E_i) during t and $t-1$: $HR_{it} = \frac{H_{it}}{0.5(E_{it}+E_{it-1})}$. Since we have biannual data at the end of March and September of sample years, H_{it} represents the number of workers hired over the past six months while the denominator is average establishment-level employment during that period. The *Separation Rate* (SR_{it}) is the number of workers separated from establishment i at time t (S_{it}) relative to average employment: $SR_{it} = \frac{S_{it}}{0.5(E_{it}+E_{it-1})}$. We calculate the number of separations (S_{it}) by counting employees who are no longer working for establishment i at time t after being observed at $t-1$. We calculate *Net Employment Growth Rate* ($NEGR_{it}$) as the difference between hiring and separation rates: $NEGR_{it} = \frac{H_{it}-S_{it}}{0.5(E_{it}+E_{it-1})}$. The *Worker Flow Rate* (WFR_{it}) is the number of hired and separated workers relative to average establishment-level employment: $WFR_{it} = \frac{H_{it}+S_{it}}{0.5(E_{it}+E_{it-1})}$. We also refer to WFR_{it} as the worker turnover rate, or simply worker flows.

The *Job Creation Rate* (JCR_{it}) is positive NEGR while the *Job Destruction Rate* (JDR_{it}) is negative NEGR. Because we are measuring these variables at the establishment level, an establishment can either create, destroy or have no change in jobs at a given point in time. The *Job Flow Rate* (JFR_{it}) is thus the absolute value of *NEGR*, i.e., $JFR = \left|\frac{E_{it}-E_{it-1}}{0.5(E_{it}+E_{it-1})}\right| = \left|\frac{H_{it}-S_{it}}{0.5(E_{it}+E_{it-1})}\right|$. The establishment-level *Excess Worker Flow Rate* ($EWFR_{it}$) or churning rate is the worker flow rate that is above and beyond the job flow rate: $EWFR_{it} = WFR_{it} - JFR_{it}$. This can be interpreted the mobility of workers over and above the rate required to match firms' employment adjustments from one period to another.

Calculating the above-mentioned indicators at the microlevel allows us to examine firm heterogeneity in job and worker flows as well as their dynamic interactions. We also calculate aggregate measures of job and worker flows to capture their overall magnitude and relative importance. The aggregate worker turnover rate, for instance, is the sum of all hires and separations divided by aggregate employment in our sample lagged by one period.

3.2. Aggregate Patterns of Job and Worker Flows

The main patterns of biannual job and worker flows are reported in Table 1. Column 1 shows the median while Column 2 shows the aggregate flows. The aggregate net employment growth rate is relatively modest at 2.4%, but there is considerable simultaneous job creation and job destruction. The overall worker flow (turnover) rate, defined simply as the sum of the hiring and separation rates, is 38.3% of employment

which implies that nearly two out of five private sector employees, at any given point in time, have either been hired or separated over the preceding six months. The overall job flow rate, defined as the summation of job creation and job destruction rates is 20%. The fact that the worker flow rate is considerably higher than the job flow rate implies substantial worker churning: worker mobility is much greater than what would be necessary to accommodate job creation and destruction by employers. This discrepancy between worker and job flows is measured by the excess worker flow (churning) rate. At 18.2%, churning accounts for 48% of the overall worker turnover rate while the rest (52%) is attributable to the reallocation of jobs across establishments, i.e., job flows. The prevalence of excess worker turnover in our sample is also reflected both in the average hiring rate that is 1.8 times the job creation rate, and in the average separation rate that is more than twice the job destruction rate[8].

There is also remarkable heterogeneity in job and worker flows across establishments as shown by the difference between the median and aggregate measures in Table 1. The median establishment experiences zero employment growth,12.4% job creation rate and 12.1% job destruction rate that are far below the respective aggregate numbers in column 2. To further highlight the significance of this heterogeneity, we conducted a decomposition analysis of job and worker flows based on the net employment growth (NEGR) status of establishments as indicated in columns 3 to 5 of

[8] For firms that were registered with POESSA in 2011 and 2012 and remained in the sample until 2018, only 3.9% of workers remained employed with the same firms throughout the sample period, which underscores the high turnover rate of workers. Similarly, for the entire sample of firms regardless of the time when they joined POESSA and how long they remained in the sample, about 40% of workers were observed only once suggesting an employment spell of less than six months. Further details on number of observations per worker are reported in Table A8 and Figure A6 in the online appendix.

Table 1. We find that 79% of hiring in the private sector occurs among establishments experiencing positive jobs growth while 69% of separations take place among downsizing establishments. While this shows strong ties between job flows and worker flows, the decomposition analysis shows that 27% of separations take place among growing establishments while close to 18% of hiring takes place among downsizing establishments. While instances of employment expansion and contraction are essentially equal as indicated in the last row of Table 1, growing establishments account for 55% of total worker turnover and 53% of churning, while downsizing establishment account for 42% of worker turnover and 39% of churning.[9]

3.3. Cross-country comparison

How do the aggregate labor market flows in Ethiopia compare with patterns observed for other countries? Table 2 compares our results with worker turnover rates based on employer-employee data from other developed and developing countries. Naturally, due to differences in the source, scope and frequency of data across these studies, the comparison should be interpreted with some caution. Nevertheless, there appear to be some consistent differences in the patterns of worker turnover across countries. Converting all measurements into annual flows, Table 2 shows that worker turnover rates in European countries are relatively low and vary from about 25% in the

[9] Among firms with zero growth, hiring and separation rates are tied at nearly 5% although three quarters of such firms have zero hires and separations. The remaining 25% of firms in this group have equal but non-zero hiring and separation rates, with a churning rate of 41.8% (20.9% HR plus 20.9% SR), which is the highest for any group of firms.

Netherlands to 61% in Italy. For the United States, quarterly turnover rates in Burgess et al. (2000) based on employer-employee data from Maryland translate to annual worker turnover rates of 129% in non-manufacturing and 78% in manufacturing. This is slightly less than the 156% and 120% worker turnover rates reported in Anderson and Meyer (1994) across all sectors and manufacturing firms, respectively, based on data from six states in the US. Table 2 confirms the well-established observation that worker turnover rates in the US are higher than in European countries.[10] The corresponding annual turnover rates from our Ethiopian sample are 77% across all sectors and 68% in manufacturing. Labor mobility in Ethiopia is thus substantially higher than that of European countries but lower than that of the United States. It is also interesting to note that despite their middle-income status, the 53% and 71% worker turnover rates for South Africa (Kerr, 2018) and Mexico (Kaplan et al., 2018), respectively, are closer to our findings for Ethiopia. Only Columbia seems to have overall and manufacturing worker turnover rates that are closer to that of the US. Table 2 thus suggests that worker turnover rates in developing countries lie between the relatively lower rates in European countries and the much higher rates in the United States. The cross-country patterns of worker turnover based on employer-employee data seem to differ somehow from the patterns in Donovan et al. (2020) where worker flows — as proxied by aggregate transition rates from employment to non-employment and non-employment to employment — decline steadily with per capita income.

[10] Lower worker turnover rates in Europe have largely been attributed to restrictive labor market regulations as compared to the US (Bertola and Rogerson, 1997; Pries and Rogerson, 2005; Kiyotaki and Lagos, 2007).

The simultaneous hiring and separation of workers observed in developed countries (Haltiwanger et al., 2012; Hamermesh et al., 1996; Lazear and Spletzer, 2012) is also evident in our Ethiopian sample. However, while churning plays a predominant role in worker turnover in the US (accounting for 70% and 62% of total turnover in the non-manufacturing and manufacturing sectors, respectively; see Burgess et al., 2000), we find that churning accounts for 48% worker turnover in Ethiopia. Both Anderson and Meyer (1994) and Burgess et al. (2000) reported 23% quarterly separation rate among US firms, which is also substantially higher than the 18% biannual separation rate in Ethiopia (roughly 9% per quarter).

3.4. Variation across establishments, sectors and localities

We now turn to distributional aspects of job and worker flows that have received attention in this literature. Table 3 shows variation across the size distribution of establishments. We distinguish five size groups: Very Small (1-10 workers); Small (11-20 workers); Medium I (21-50 workers); Medium II (51-100 workers); and Large (more than 100 workers). Unsurprisingly, net employment growth (NEGR) declines with establishment size: from 7.8% among very small establishments to -0.75% among large ones. Worker turnover also declines with establishment size but not as dramatically as NEGR. While worker turnover lies in the 42-47% range among establishments with less than 100 employees, it drops sharply to 28.5% among larger establishments with at least 100 employees. The main reason for the inverse relationship between worker flows and establishment size appears to be the decline in hiring rate as establishment

size increases while the separation rate remains relatively stable particularly among small and midsize employers. Similarly, excess turnover remains stable within the 19-24% range among small and midsize establishments before dropping sharply to about 13% among large establishments. This suggests that large establishments have better match quality although they tend to grow at a slower rate. The decline in total and excess worker turnover with establishment size in the Ethiopian sample is also consistent with findings from other developed and developing countries mentioned in Table 2.

In the online appendix we provide detailed information on how job and worker flows vary across sectors, across locations and over time. In order to conserve space, we briefly summarize our findings here. We highlight three results. First, there is considerable variation in worker mobility across sectors. Appendix Table A2 shows that mobility is relatively low in the manufacturing sector, and relatively high in the construction sector. The relative stability of manufacturing jobs in Ethiopia is consistent with evidence from developed countries (Burgess et al., 2000; Anderson and Meyer, 1994; Abowd et al., 1999). Second, we find substantial variation in employment growth across administrative regions but not in worker flows (see Appendix Table A4). Third, the time series of worker and job flows appear only weakly related to macroeconomic fluctuations responding rather to political stability (Appendix Figure A3). Moreover, churning appears to be more procyclical in the US (Lazear and Spletzer, 2012) than in Ethiopia. The variation of worker flow rates in Ethiopia across sectors or across firms of

differing size, appears to be similar to that of more advanced economies, despite differences in average turnover rates.

4. Worker Turnover and Job Growth

We now examine the dynamic relationship between job and worker flows at the establishment level. Given that job flows would inherently lead to labor mobility, the real question is how excess turnover interacts with job flows. We exploit the panel nature of our employer-employee data to investigate this relationship while controlling for establishment fixed effects and sectors-specific and location-specific trends. To that effect we specify an econometric model of establishment-level net employment growth (NEGR) that features lagged churning and other widely used determinants of growth as follows:

$$NEGR_{jsryt} = \propto_j + \beta_1 Churning_{jt-1} + \beta_2 Firm-Size_{jt-1} + \beta_3 [Firm-Size]^2_{jt-1} + \beta_4 Wage_{jt-1} + \beta_5 Benefit_{jt-1} + \tau_y + \delta_t + \rho_{s*y} + \mu_{r*y} + \varepsilon_{jyt} \quad (1)$$

where, subscripts j, s and r index establishments, sectors and regions, respectively. Year and month of observation are represented by the subscripts y and t, respectively. *Firm-size* is establishment-level average employment consistent with the way job and worker flows are calculated (see Table A9 in the online appendix for the distribution of firm size). *Wage* measures the deviation of establishment-level mean wage from the sector average at time t, where the establishment-level mean wage is calculated as

nominal monthly wage bill divided by the number of workers. *Benefit* represents total employer contribution to the pension scheme relative to the establishment's wage bill. Firm size, wage and benefits are measured in logarithms. Eq.1 also includes establishment, year and month fixed effects that are represented by $\propto_j$, τ_y, and δ_t, respectively. The time fixed effects allow us to control for countrywide effects such as macroeconomic shocks and political unrest that change over time and affect all firms equally. All variables are lagged by one period (six months) to capture dynamics and mitigate the simultaneity problem. Recognizing that the equation error term ε_{jyt} is likely serially correlated within an establishment, we use standard errors that are clustered at the establishment level. The model also includes interaction terms of sector and year dummy variables that are represented by ρ_{s*y} as well as interactions of regional states and year dummy variables represented by ρ_{r*y}. In doing so, we allow for sector- and region-specific trends in NEGR and hence accounting for different growth prospects in labor markets that may be segmented by sector and region. Following standard practice in empirical labor market studies, we exclude very small establishments that employ less than four workers from the analysis.

By using the panel fixed effects estimator on Eq.1, we account for time-invariant and establishment specific unobserved factors such as its personnel policy that could be correlated with churning, wages and benefits. The consistency of the fixed effects estimator requires the explanatory variables to be strictly exogenous. To check if strict exogeneity may have been violated in our sample, we will also show results from a pooled OLS estimator, which only requires the standard exogeneity assumption.

Results from Eq.1 are reported in Table 4. Columns 1 and 2 show results for the entire sample using pooled OLS and panel fixed effects estimators, respectively. For both estimators, the coefficient on lagged churning is negative and statistically significant. The point estimate obtained by means of the fixed effects model suggests that reducing churning by 10 percentage points would increase NEGR by a third of a percentage point. This is consistent with the findings of Burgess et al. (2001) for US firms and supports the view that excess turnover is costly for firms. This interpretation assumes that establishments decide on the number of jobs and then apply time invariant personnel policies to determine which workers to hire and retain. Interpreting β_1 as the direct effect of churning becomes problematic in the unlikely scenario where firms frequently switch both personnel policies (say from hiring indiscriminately and firing poor matches to strict screening of applicants) and employment targets simultaneously. Although our dataset does not distinguish quits from layoffs, the negative coefficient on churning is consistent with quit-driven replacement hiring rather than firms laying off less productive workers and replacing them with more productive ones.[11] In the latter case, the coefficient on churning would be statistically insignificant, if not positive and significant.

The coefficients on establishment size and its squared term are also significant and suggest that employment growth declines with establishment size, albeit at a

[11] This is consistent with the implications of efficiency wage models (Alvarez and Veracierto, 2001;Salop, 1979; Stiglitz 1974)

decreasing rate. The fixed effects estimates imply elasticities of NEGR with respect to establishment size equal to -0.492, -0.417 and -0.313 at the 10^{th} percentile, the mean and the 90^{th} percentile of the firm size distribution, respectively. The deviation of establishment-level wage from the sector average is positively associated with NEGR. This seems to capture, as will be shown in section 5, the reduction in worker separation rate among firms that pay above-average wages. Non-wage benefits in the form of employer pension contributions, however, tend to reduce NEGR significantly. This suggests that the cost of pension benefits is not fully shifted to workers in terms of lower wages hence reducing firms' demand for labor.

Columns 4-6 in Table 4 show results from Eq. 1 for small, medium and large establishments. The coefficient on churning is statistically insignificant among small establishments with fewer than 21 workers while it is negative and significant for medium and large establishments. The coefficient on churning among large establishments is more than twice that of midsize employers although a chi-square test shows this difference to be imprecise with a p-value of 0.20. Job growth is thus least impacted by churning in small establishments with relatively high churning rates. Also worth noticing is the negative association between pension benefits and employment growth that turns out to be stronger and highly significant for small establishments but insignificant for large ones. This is presumably because larger firms can absorb the cost of such benefits better than small firms.

Panel A of Table 5 shows that the coefficient on lagged churning is negative and statistically significant only in manufacturing and services. Manufacturing seems more sensitive to churning than services but a chi-square test shows a noisy difference with a p-value of 0.20. While churning is also negatively associated with job growth in the remaining three sectors, it turns out to be statistically insignificant. It is worth noticing that while construction firms exhibiting the highest churning rate, they do not seem to be adversely impacted by it; the converse is true for manufacturing firms.

Lastly, panel B of Table 5 examines Eq. 1 across establishment age. For younger establishments under 10 years-of-age, churning is insignificantly correlated with employment growth. For establishments that have been in business for more than 10 years, however, we find the coefficient on churning to be negative and significant.

Wages, Experience and Tenure

The substantial amount of worker turnover in the Ethiopian private sector and the inverse relationship of churning with job growth in some sectors requires further analysis to better understand the role of worker mobility. Potentially, worker turnover may contribute to the reallocation of high productivity workers toward high productivity firms. Such a process is often referred to as assortative matching of workers and firms, and can be explored using wage equations that include both worker and firm characteristics. Pioneered by Abowd et al. (1999), this approach uses linked employer-employee data to identify the role of firm fixed effects and worker fixed effects in wage determination. Labor economists interpret a positive correlation between the two fixed

effects as evidence of high-wage workers being matched with high-wage firms. Wage equations can also shed some light as to why some employers tend to be more susceptible to excess turnover than others. Specifically, we can examine whether firms that rely more on experienced and skilled workers are more likely to suffer adverse effects of excess turnover. This question can be addressed by comparing the returns to human capital across groups of firms.

To this effect, we estimate a wage equation following the approach in Abowd, Kramarz and Margolis (1999), here after AKM, that includes both worker and firm characteristics:

$$W_{ijt} = \mu + X_{it}\beta + Z_{j(i,t)t}\gamma + \theta_i + \psi_{j(it)} + \varepsilon_{it} \quad (2)$$

where W_{it} is monthly wage of worker i at time t, X_{it} represent time varying worker characteristics, and $Z_{j(it)t}$ represent time varying characteristics of establishment j in which worker i is employed at time t. The parameters θ_i and ψ_j represent, respectively, worker and firm effects that are time invariant. Some of these fixed effects are observed in the data, while others remain unobserved. White noise equation errors are represented by ε_{it}. Identification of the firm and worker fixed effects in the AKM specification depends critically on the presence of a subsample of workers who move between firms in our sample.

Results from the AKM estimation for the entire sample show that worker fixed effects play a dominant role (73%) relative to firm fixed effects (7.8%) in explaining variation in

wages[12]. This is consistent with the dominance of the worker fixed effect documented in almost all existing studies that use this approach. We also find a negative correlation (-0.17) between worker and firm fixed effects. This also happens to be consistent with the findings of several studies from developed countries. Abowd et al. (2002) and Goux and Maurin (1999) report correlation coefficients of -0.28 and -0.32 for France, respectively, while Gruetter and Lalive (2009) and Andrews et al. (2008) find a correlation of -0.27 and -0.15 for Austria and Germany, respectively. For the US, however, Abowd et al. (2004) and Woodcock (2015) find rather mild correlations of 0.02 and -0.01, respectively. The lack of evidence in support of assortative matching in our sample suggests significant search frictions in the Ethiopian labor market. However, it is important to note that there is an ongoing debate about the reliability and interpretation of a negative correlation between worker and firm fixed effects especially in a situation where there is limited mobility of workers across firms in the sample (Andrews et al., 2008; Lopes de Melo, 2018). This seems to be particularly relevant in our sample as the fraction of firms connected by workers who moved between them is quite low[13]. Our AKM results should thus be interpreted with this caveat in mind, although our findings are qualitatively similar to what has been documented in this literature.

[12] We use the memory-saving approach to estimating an AKM model proposed by Cornelissen (2008).

[13] Workers that move across firms within the POESSA sample account for 2.4% of observations. This suggests that the overwhelming majority of separated workers move outside the POESSA sample. The latter include transitions to unemployment, nonemployment, employment at private firms not yet enrolled with POESA, government employment, self-employment and informal employment.

To address our question on firm heterogeneity in the sensitivity of job growth to churning, we estimate the returns to time-varying human capital variables across sectors. Given the limited number of firms connected by movers in our sample, it is difficult to run the AKM model for each sector separately. Fortunately, unlike the firm and worker fixed effects discussed earlier, identification of the returns to experience and tenure does not require movement of workers across firms. We thus estimate the coefficients on human capital across sectors using a standard panel fixed effects model as the AKM procedure itself estimates the coefficients of all time-varying variables using the within estimator. We checked this by comparing the coefficients on time-varying covariates for the entire sample using the AKM regressions and the within estimator, and the results are practically identical.

As such, we run the following wage equation to estimate the returns to human capital for the entire sample and by sector:

$$W_{ijsryt} = \theta_{ij} + \gamma_1 EXP_{it} + \gamma_2 EXP_{it}^2 + \gamma_3 Worker - Spell_{ijt} + \beta_1 Firm - Size_{jt} + \beta_2 [Firm - Size]_{jt-1}^2 + \beta_3 Benefit_{jt} + \tau_y + \delta_t + \rho_{s*y} + \mu_{r*y} + \varphi_{ijt} \quad (3)$$

where the dependent variable is nominal monthly wage for worker i in establishment j, sector s and region r. The time subscripts y and t capture year and month of observations, respectively, while the match specific worker-establishment fixed effect is represented by θ_{ij}. In the absence of a direct measure of experience and tenure in the

POESSA dataset, we proxy general labor market experience using workers' age[14]. Because of errors in recording workers' date-of-birth in the POESSA database, we have reliable information on age only for 45% of worker observations.[15] We also use w$orker - Spell$, which measures the number of times a worker has been observed as an employee of a given establishment since its registration with POESSA, as a proxy for tenure. Eq.2 also allows for sector- and region-specific trends in wage by include the interaction terms ρ_{s*y} and ρ_{r*y}, respectively. The fact that we proxy experience with age implies that, within the same age cohort, the proxy likely overestimates the labor market experiences of more educated workers with higher wages. We thus expect the coefficient on experience to provide a lower bound of the returns to experience. Since POESSA does not capture workers' education, we rely on the panel fixed effects estimator to account for the returns to schooling assuming that educational attainment remains unchanged for employed workers.

Statistically insignificant returns to experience and tenure would suggest that replacement hiring is not costly for firms either because the production activities do not require substantial experience and training or new hires can match the productivity of experienced workers rather quickly. Such a finding would thus be inconsistent with the results in Tables 4 and 5.

[14] Specifically, we use age minus 14 as our indicator of potential labor market experience.
[15] We checked if this problem introduces a selection bias in our sample. OLS regression of log wage on a dummy variable indicating whether date of birth is entered correctly turnout to be negative but statistically insignificant after controlling for sector, firm size and gender.

Table 6 reports results from Eq.3 for the entire sample and by sector. Column 1 shows that the coefficients on our proxies for experience and tenure are positive and statistically significant for the entire sample. Across sectors, we observe that the returns to tenure as proxied by $Worker - Spell$ are positive and highly significant in manufacturing and services but insignificant in agriculture and non-profit sectors. General labor market experience is statistically insignificant for construction workers. Payment structures emerging from the earnings equation are thus broadly consistent with the relationship between NEGR and churning across sectors, in the sense that establishments that we expect to rely more on firm-specific skills and experiences tend to have wage structures that incentivize long-term relationships with employees (Lazear, 1979). We also find that wages initially decline with establishment size and then rise substantially among large establishments with the inflection point occurring at the median establishment size for the entire sample.

Table 7 reports regression results from Eq.3 by establishment size as our last robustness check. We find that the coefficient on *worker-spell* is three times larger for midsize and large establishments as compared to that of small establishments with fewer than 21 employees. A chi-square test confirms that small establishments differ significantly from midsize and large establishments in rewarding tenure, while the difference between midsize and large employers is insignificant. This is once again consistent with the coefficient on churning in Eq.1 being statistically insignificant for small establishments while it is negative and significant for midsize and large establishments that are likely to rely on specific human capital.

5. Determinants of Churning and Worker Separation

We now turn to an econometric analysis of churning that would allow us to determine more formally whether churning is randomly distributed across employers, and how it responds to job flows. Our churning model includes lagged net employment growth as an explanatory variable similar to Burgess et al. (2000). It also takes into account wage and non-wage benefits, which we presume are important considerations of workers in making mobility decisions. Our churning model is thus:

$$Churning_{jsryt} = \beta_0 + \beta_1 NEGR_{jt-1} + \beta_2 Firm - Size_{jt-1} + \beta_3 [Firm - Size]^2_{jt-1} + \beta_5 Wage_{jt-1} + \beta_6 Benefit_{jt-1} + v_j + \tau_y + \delta_t + \rho_{s*y} + \mu_{r*y} + \varepsilon_{jyt} \quad (4)$$

where variable names and subscripts are as described in eq. (1). The lag structure allows us to mitigate the simultaneity problem. Using the panel fixed effects estimator on Eq.4 allows us to control for time-invariant unobserved characteristics, such as the establishment's personnel policy that are correlate with churning, as well as job growth and compensation structure. For reasons already discussed, which relate to the potentially strong assumption of strict exogeneity that underlies the fixed effects estimator, we also show pooled OLS estimates. By including time dummy variables and their interactions with sector and location dummy variables, we control for sector- and region-specific trends in churning. We implement a similar model where the dependent variable is worker turnover to show the difference between total and excess turnover.

The results from the fixed effects estimator and the pooled OLS estimator are presented in Table 8 where Panel A refers to churning and Panel B refers to total worker turnover. We find that churning is positively and significantly associated with lagged net employment growth for the entire sample and across all sectors. The fixed effects estimate implies that, on average, raising employment growth by 10 percentage points would increase subsequent churning by less than a third of a percentage point. The positive relationship between job growth and churning is consistent with the findings of Burgess et al. (2000) for the United States. This suggests that an increase in the number of new hires would lead to more separations subsequently, which is broadly consistent with search and matching models of turnover. We also find that the idiosyncratic component of an establishment's wage rate is inversely related with churning. Another finding is a substantial decline in churning with pension benefits where a percentage point increase in employer pension contribution rate reduces churning by more than three quarters of a percentage point. Churning seems to rise with establishment size in a non-linear fashion, where the inflection point occurring at about 100 workers for the entire sample, which is above the 95th percentile of the establishment size distribution.

While churning rates and its implications for job flows vary significantly across sectors as shown in Tables 4 and 5, respectively, Table 8 shows very little difference across sectors on how churning responds to job growth. There is also very little difference across sectors in establishments' ability to reduce churning through benefits. Only the relationship between wages and churning seems to vary across sectors with the

coefficient on idiosyncratic wage being insignificant in construction and agriculture but negative and significant in others. Moreover, the R-squared from the churning model is typically below 10% across sectors as compared to the R-squared for the employment growth model in Tables 4 and 5 where it varies between 25-42% across sectors. These observations suggest that the variation in churning across establishments remains largely unexplained while the sensitivity of job flows to churning varies significantly across establishments.

Panel B of Table 8 shows important differences between total and excess worker turnover. Unlike churning, total turnover decreases significantly with establishment size before starting to rise among large establishments. This suggests that while small establishments may experience very high total worker turnover rate, they do not necessarily have the highest churning rate. The reason why churning is not substantially lower among large employers is because job flows that contribute to more than 50% of worker flows also decrease with establishment size. See also Table A7 in the appendix which, among other things, shows that the share of churning in total worker turnover increases with establishment size. This is consistent with Burgess et al. (2000) where the share of churning in worker flows is 64% among firms that employ less than 50 workers and 76.7% among firms that employ more than 1000 workers. Establishments experiencing rapid employment growth tend to have lower worker turnover rates subsequently. Since churning is already shown to increase following rapid employment growth, the negative association between lagged NEGR and total turnover indicates a reduction in job flows following a period of rapid employment growth. This is shown in

Table A3 where the coefficient on NEGR is negative and significant in a model where the dependent variable is the job flow rate (JFR).

The probability of separation

The evidence so far seems to support that churning is largely driven by workers quitting their jobs rather than firms churning workers to improve productivity. We now turn to the probability of separation which forms the micro foundation of search and matching models (Jovanovic, 1979). Since churning captures replacements for separated workers, a worker-level analysis of the probability of separation would allow us to determine if churning is concentrated among a specific group of workers. Our separation model controls for worker and establishment characteristics as follows:

$$S_{ijyt} = \gamma + \alpha_1 Sex_i + \alpha_2 EXP_{iyt} + \alpha_3 EXP_{iyt}^2 + \alpha_4 Worker - Spell_{ijyt} + \alpha_5 Wage_{ijyt} + \beta_1 Firm - Size_{jyt} + \beta_2 [Firm - Size]_{jyt}^2 + \beta_3 Firm - Wage_{jyt} + \beta_4 Benefit_{jyt} + \tau_y + \delta_t + \rho_s + \mu_r + \omega_{ijt} \quad (5)$$

where, S_{ijyt} is a binary variable that takes the value of one if worker i gets separated from establishment j in the coming six months $(t+1)$ and zero otherwise. We use the logit model to estimate Eq.5 using worker- and establishment-level covariates observed at time t. The worker-level covariates include sex, proxies for potential experience and tenure, and individual wage. In labor markets with high search costs, it may take young workers quite some time to find suitable jobs. Moreover, the cost of switching employers may increase as workers acquire more firm-specific capital that is less valuable

elsewhere. We thus expect the probability of separation to decline with experience and tenure as implied by search and matching modes (Jovanovic, 1979; Moscarini, 2005). The establishment-level explanatory variables include establishment size, pension benefits and average wage. The latter is measured in terms of the deviation of an establishment's mean wage from the sector average. As indicated earlier, establishment size could reduce the probability of separation if workers at large establishment have better chances of rising through the job ladder than their counterparts in small firms. The model also controls for year, month, sector and region fixed effects.

Table 9 reports the marginal effects from Eq.5 for the entire sample and by sector. At the individual level, our proxies for experience and tenure are inversely related with the probability of separation, suggesting that younger workers and those who recently joined a firm are more likely to be separated. This is consistent with evidence provided in Farber (1999) from the US. The coefficient on experience is negative and significant in all sectors except for the sector with the highest turnover rate, i.e., construction. Low-wage workers are more likely to be separated in the coming six months as compared to high-wage workers. After controlling for individual wages, the probability of separation is significantly lower among establishments that pay above average wages in their respective sectors. In fact, the marginal effect of the establishment's idiosyncratic wage is larger than the marginal effect of a worker's own wage. Taken together, our findings are consistent with workers considering both current wage and the prospect of wage growth in making mobility decisions. We also find that the probability of separation initially rises with establishment size but starts to decline sharply among midsize and

large establishments that employ more than 20 workers. Since an employee's current wage, establishment-level wage and benefits are controlled for, the size effect presumably reflects the prospect of climbing the job ladder within large establishments as compared to small producers, or the ability of large establishments to screen job applicants more strictly as implied in Pries and Rogerson (2005).

6. Conclusion

In this paper we use matched employer-employee data to jointly examine job and worker flows in a low-income African country: Ethiopia. We show that the labor market for the formal private sector is characterized by relatively slow employment growth and high worker turnover rates. Our comparative analysis indicates that worker turnover rates for Ethiopia and a few middle-income developing countries are, on average, higher than for European countries but lower than for the United States. We find that worker turnover in Ethiopia is driven both by churning and by job reallocation across establishments in practically equal proportions. There is also substantial variation in turnover across production sectors and across establishments of differing size and age.

We find that churning is negatively associated with subsequent net employment growth at the establishment level. This suggests that excessive churning hampers the firms' ability to grow. Consistent with underlying differences in the relative importance of long-term relationship with workers, there is substantial firm heterogeneity in the job growth-churning relationship. Differences in the returns to experience and tenure across groups

of establishments also suggest that establishments that stand to suffer more from excess turnover have payment structures that incentivize long-term relationships with workers. Indeed, wages are related to job and worker dynamics: establishments that pay above average wages experience lower rates of separation, lower rates of turnover and less churning – and higher rates of employment growth.

Our analysis also sheds some light on the driving factors of churning. We find that rapidly growing establishments risk higher subsequent churning. This is consistent with the notion that extensive hiring in a short period reduces average job match quality. Moreover, the high churning rates do not seem to be driven by a strong worker-to-firm assortative matching process. In fact, our analysis of the determinants of wages indicates that firm and worker fixed effects are, if anything, weakly negatively correlated. The pattern that emerges is thus one where workers move frequently across establishments, in a labor market where worker and firm productivity are only weakly related.

In the final part of the paper, we study patterns of worker separation. We find that, conditional on wages and benefits, workers with shorter experiences and tenure are more likely to be separated from their jobs than more experienced workers. Youth unemployment rates in urban areas of Ethiopia are high, suggesting that young workers face difficulties finding a job. Our results from the analysis of separation indicate that young workers also face considerable job insecurity. Part of the problem could be search frictions that undermine the quality of job matches. The study by Abebe et al.

(2016) highlights the importance of reducing search frictions for young job seekers in order to raise the probability of employment in the formal private sector and the quality of job matches.

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Table 1: Job and Worker Flows in the Formal Private Sector

	All Establishments		**Decomposition by Establishment Growth Status**		
	Median	Overall	Growing	Contracting	No Change
	1	2	3	4	5
HR	0.1240	0.2031	0.1606	0.0358	0.0067
SR	0.1212	0.1795	0.0484	0.1244	0.0067
NEGR	0.0000	0.0236	0.1122	-0.0886	0.0000
JCR	0.0000	0.1122	0.1122	0.0000	0.0000
JDR	0.0000	0.0886	0.0000	0.0886	0.0000
JFR	0.1106	0.2008	0.1122	0.0886	0.0000
WFR	0.3125	0.3826	0.2090	0.1601	0.0135
EWFR	0.1060	0.1818	0.0968	0.0715	0.0135
Observations	182676	182676	60536 (33.1%)	62487 (34.2%)	59653 (32.7%)

Note: Author's computation based on POESSA data. HR is hiring rate, SR is separation rate, NEGR is net employment growth rate, JCR is job creation rate, JDR is job destruction rate, WFR is worker flow rate and EWTR is excess worker flow rate. For each variable, number in columns 3 to 5 add up to numbers in column 2. The last row shows the number of establishment observations.

Table 2: Comparison of Annual Worker Flows Across Countries

Country	Sector	Period	HR	SR	WFR
France	All	1987-90	0.1365	0.1381	0.2746
France	Manufacturing	1987-90	0.1105	0.1131	0.2236
Netherlands	All	1988,1990	0.1240	0.1180	0.2420
Germany	All	1995-96	0.1354	0.1859	0.3213
Denmark	Manufacturing	1980-91	0.2850	0.2800	0.5650
Italy	All	1986-96	0.3100	0.3000	0.6100
USA1	All	1978-84	0.6452	0.9216	1.5668
USA1	Manufacturing	1978-84	0.3916	0.8108	1.2024
USA2	Non-Manufacturing	1985-94			1.2920
USA2	Manufacturing	1985-94			0.7760
USA3	All	2000-2005	0.5240	0.4280	0.9520
Ethiopia	All	2011-18	0.4062	0.3590	0.7652
Ethiopia	Manufacturing	2011-18	0.3600	0.3198	0.6798
South Africa	All	2011-14			0.5300
Mexico	All	1986-2001	0.3780	0.3350	0.7130
Colombia	All	2009-2017	0.6520	0.5920	1.2440
Colombia	Manufacturing	2009-2017			0.9020

See Abowd, et al. (1999) for France; Hamermesh et al. (1996) for the Netherlands; Albeak and Sørensen (1998) for Denmark; Bauer and Bender (2004) for Germany; Contini (2002) for Italy; Anderson and Meyer (1994) for USA1 ; Burgess et al. (2000) for USA2 ; Davis et al. (2006) for USA3; Kerr (2018) for South Africa; Kaplan et al. (2007) for Mexico; and Flórez et al. (2020) for Colombia. Abowd et al. (1999) and Anderson and Meyer (1994) include firms with at least 50 workers while Hamermesh et al. (1996) include firms with at least workers. Numbers for USA are obtained by multiplying quarterly rates by four while that of Ethiopia are multiplied by two to arrive at annual rates. For France, we calculate simple means across growing, shrining and stable firms in the absence of total turnover rates.

Table 3: Job and Worker Flow by Establishment Size

	Base Establishment Size					
	Very Small (1-10)	Small (11-20)	Medium I (21-50)	Medium II (51-100)	Large (>100)	All Firms
HR	0.2672	0.2593	0.2403	0.2261	0.1386	0.2031
SR	0.1887	0.2138	0.2102	0.1963	0.1462	0.1795
NEGR	0.0785	0.0454	0.0301	0.0298	-0.0075	0.0236
JCR	0.1702	0.1465	0.1220	0.1220	0.0743	0.1122
JDR	0.0918	0.1011	0.0919	0.0922	0.0819	0.0886
JFR	0.2620	0.2476	0.2139	0.2142	0.1562	0.2008
WFR	0.4560	0.4731	0.4505	0.4224	0.2847	0.3826
EWFR	0.1940	0.2255	0.2366	0.2082	0.1285	0.1818
Observations	121962 (66.7%)	25920 (14.2%)	20437 (11.2%)	7561 (4.1%)	6796 (3.7%)	182676 (100%)
Mean Base Employment	3.3	14.5	30.9	69.5	250.6	11.7
Employment Share	19.6%	11.6%	17.3%	13.8%	37.7%	100%

Note: see notes under Table 1. The size classification is based on the number of workers in an establishment when it is first observed in the POESSA database.

Table 4: Net Employment Growth and Churning

	Pooled OLS All Firms	Panel Fixed Effects				Sample Means
		All Firms	Small	Medium	Large	
	1	2	3	4	5	6
Firm Size	-0.3044[a]	-0.5988[a]	-0.6455[a]	-0.7257[a]	-0.3539[a]	2.7198
	(0.0067)	(0.0121)	(0.0197)	(0.0611)	(0.0907)	(1.0963)
[Firm Size]^2	0.0358[a]	0.0340[a]	0.0339[a]	0.0418[a]	0.0006	8.5991
	(0.0001)	(0.0021)	(0.0048)	(0.0085)	(0.0092)	(7.3874)
Wage	0.0396[a]	0.0426[a]	0.0193[b]	0.0909[a]	0.0810[a]	-0.2026
	(0.0017)	(0.0064)	(0.0077)	(0.0133)	(0.0209)	(0.8013)
Benefits	-0.8138[a]	-0.5878[a]	-0.5938[a]	-0.2743[b]	-0.0344	-2.3234
	(0.0685)	(0.0662)	(0.0756)	(0.1321)	(0.3677)	(0.1542)
Churning	-0.0159[a]	-0.0328[a]	-0.0044	-0.0537[a]	-0.1310[a]	0.2370
	(0.0049	(0.0062)	(0.0066)	(0.0126)	(0.0288)	(0.3013)
R^2	0.2680	0.2685	0.3068	0.3817	0.4149	
N	82,059	82,059	53,041	22,271	6,747	

Note: The dependent variable is NEGR. Firm size, wage and benefits are measured in logarithms and lagged by six months. Wage measures the deviation of establishment-level wage from the sector mean. All specifications include sector- and region-specific trends and an intercept. Standard errors are clustered at the establishment level and hence robust to heteroscedasticity and autocorrelation of the equation error terms. Letters a, b and c represent, respectively, statistical significance at the 1%, 5% and 10% level of significance. The last column provides sample means and standard deviations of explanatory variables. Notice that the sample mean for churning is not weighted by establishment size.

Table 5: Net Employment Growth and Churning by Sector and Age

A. Sector					
	MN	SR	CN	AG	NP
Firm Size	-0.4299[a]	-0.6647[a]	-0.6080[a]	-0.5476[a]	-0.5764[a]
	(0.0438)	(0.0173)	(0.0442)	(0.0688)	(0.0212)
[Firm Size]^2	0.0117[b]	0.0461[a]	0.0318[a]	0.0233[b]	0.0302[a]
	(0.0055)	(0.0035)	(0.0065)	(0.0109)	(0.0037)
Wage	0.0427[b]	0.0446[a]	0.0514[b]	0.1534[a]	0.0286[b]
	(0.0200)	(0.0090)	(0.0217)	(0.0378)	(0.0117)
Benefits	-.9985[a]	-0.5636[a]	-0.4398	-0.1251	-0.4965[a]
	(0.2562)	(0.0957)	(0.3120)	(0.5647)	(0.1041)
Churning	-0.0817[a]	-0.0375[a]	-0.0324	-0.0511	-0.0149
	(0.0269)	(0.0080)	(0.0266)	(0.0520)	(0.0112)
R^2	0.2923	0.2710	0.2770	0.3422	0.2664
N	8,349	38,778	6216	1935	26,781
B. Establishment Age					
	1-5	6-10	11-20	21-30	31-40
Firm Size	-0.6749[a]	-0.6259[a]	-0.5795[a]	-0.4464[a]	-0.6164[a]
	(0.0206)	(0.0342)	(0.0328)	(0.0718)	(0.0856)
[Firm Size]^2	0.0274[a]	0.0147[b]	0.0212[a]	0.0001	0.0343[b]
	(0.0043)	(0.0067)	(0.0065)	(0.0123)	(0.0161)
Wage	0.0137	0.0223	0.0327[b]	-0.0216	0.0558
	(0.0103)	(0.0159)	(0.0174)	(0.0353)	(0.0560)
Benefits	-0.7284[a]	-0.5974[a]	-0.5523[a]	-0.0658	-0.0653
	(0.0954)	(0.1451)	(0.1705)	(0.3433)	(0.3815)
Churning	0.0150	-0.0145	-0.0402[b]	-0.0791[b]	-0.2131[a]
	(0.0094)	(0.0139)	(0.0164)	(0.0470)	(0.0742)
R^2	0.3139	0.3019	0.2758	0.3004	0.4167
N	28,701	17,142	11,818	2,611	881

Note: See notes to Table 5. Letters a, b and c represent, respectively, statistical significance at the 1%, 5% and 10% level of significance

Table 6: Wage Determination by Sector

	All	MN	SR	CN	AG	NP	Means
	1	2	3	4	5	6	7
EXP	0.0664[a]	0.0625[a]	0.0548[a]	-0.0164	0.0660[a]	0.1122[a]	19.2390
	(0.0089)	(0.0184)	(0.0140)	(0.0183)	(0.0217)	(0.0145)	(10.0189)
EXP^2	0.0003[a]	0.0003	0.0005[a]	0.0007[a]	-0.0001	0.0001	
	(0.0001)	(0.0002)	(0.0001)	(0.0001)	(0.0002)	(0.0001)	
Worker-Spell	0.0234[a]	0.0318[a]	0.0307[a]	0.0253[b]	0.0097	0.0059	3.8580
	(0.0050)	(0.0084)	(0.0062)	(0.0100)	(0.0114)	(0.0103)	(2.8580)
Firm Size	-0.0674[b]	-0.0718[c]	-0.1759[a]	0.0115	0.0749	-0.0458[c]	2.7198
	(0.0266)	(0.0484)	(0.0460)	(0.0411)	(0.0695)	(0.0252)	(1.0963)
$[\text{Firm Size}]^2$	0.0212[a]	0.0180[a]	0.0415[a]	0.0037	0.0049	0.0177[a]	8.5991
	(0.0036)	(0.0057)	(0.0065)	(0.0044)	(0.0072)	(0.0036)	(7.3874)
Benefits	-0.1513[a]	-0.1390[b]	-0.2662[a]	0.0936	0.2541	-0.0830	-2.3234
	(0.0496)	(0.0696)	(0.0929)	(0.1106)	(0.1748)	(0.0874)	(0.1542)
R^2	0.33	0.37	0.33	0.17	0.44	0.39	
N	2,077,923	446,768	736,235	220,724	105,151	569,045	

Note: The dependent variable is logarithm of nominal monthly wage. EXP measures potential experience after age 14. Worker-Spell measures the number of times a worker is observed as an employee of an establishment. Benefits stands for average employer contribution rate to pension benefits. Firm Size and Benefits are in logarithms. The column heads represent establishments in Manufacturing (MN), Services (SR), Agriculture (AG), Construction (CN) and Non-profit (NP) sectors. Letters a, b and c represent, respectively, statistical significance at the 1%, 5% and 10% level of significance. The last column provides sample means and standard deviations of explanatory variables.

Table 7: Wage Determination by Establishment Size

	All Establishments	Small (3-20)	Medium (21-100)	Large (>100)
EXP	0.0664[a]	0.1599[a]	0.0406[a]	0.0352[a]
	(0.0089)	(0.0047)	(0.0097)	(0.0106)
EXP^2	0.0003[a]	-0.0006[a]	0.0004[a]	0.0004[a]
	(0.0001)	(0.0000)	(0.0001)	(0.0001)
Worker-Spell	0.0234[a]	0.0099[a]	0.0340[a]	0.0351[a]
	(0.0050)	(0.0019)	(0.0052)	(0.0054)
Firm Size	-0.0674[b]	0.0758[a]	-0.1073	-0.1961
	(0.0266)	(0.0152)	(0.0873)	(0.1434)
$[\text{Firm Size}]^2$	0.0212[a]	-0.0016	0.0237[a]	0.0298[b]
	(0.0036)	(0.0029)	(0.0081)	(0.0121)
Benefits	-0.1513[a]	0.1022[a]	-0.2395[a]	-0.2736[a]
	(0.0496)	(0.0163)	(0.0662)	(0.0779)
R^2	0.33	0.51	0.28	0.26
N	2,077,923	668,191	1,409,732	1,133,630

Note: See Note to Table 7.

Table 8: Churning Flows and Worker Turnover Rates

	Pooled OLS	Panel Fixed Effects					
	All Firms	All	MN	SR	CN	AG	NP
	1	2	3	4	5	6	7
Panel A: Dependent Variable - Churning							
Firm Size	0.1051[a]	0.1013[a]	0.0742[a]	0.1170[a]	0.1546[a]	0.0731[c]	0.0825[a]
	(0.0048)	(0.0077)	(0.0195)	(0.0125)	(0.0260)	(0.0378)	(0.0138)
[Firm Size]^2	-0.0150[a]	-0.0109[a]	-0.0072[a]	-0.0141[a]	-0.0138[a]	-0.0033	-0.0097[a]
	(0.0007)	(0.0012)	(0.0025)	(0.0020)	(0.0038)	(0.0055)	(0.0024)
Wage	-0.0564[a]	-0.0355[a]	-0.0602[a]	-0.0353[a]	-0.0004	-0.0071	-0.0416[a]
	(0.0021)	(0.0045)	(0.0129)	(0.0069)	(0.0133)	(0.0254)	(0.0077)
Benefits	-0.8010[a]	-0.7900[a]	-0.5590[a]	-0.8010[a]	-0.9265[a]	-1.0572[a]	-0.7726[a]
	(0.0615)	(0.0576)	(0.1573)	(0.0878)	(0.2037)	(0.3735)	(0.0961)
NEGR	0.0479[a]	0.0306[a]	0.0399[a]	0.0203[a]	0.0730[a]	0.0576[a]	0.0234[a]
	(0.0037)	(0.0037)	(0.0103)	(0.0057)	(0.0117)	(0.0205)	(0.0061)
R^2	0.065	0.0382	0.0678	0.0350	0.0764	0.0993	0.0390
N	82,059	82,059	8,349	38,778	6,216	1,935	26,781
Panel B: Dependent Variable – Worker Turnover							
Firm Size	-0.0118	-0.2750[a]	-0.1944[a]	-0.2819[a]	-0.1633[a]	-0.2576[a]	-0.3280[a]
	(0.0078)	(0.0128)	(0.0441)	(0.0207)	(0.0399)	(0.0627)	(0.0229)
[Firm Size]^2	-0.0016	0.0237[a]	0.0104[c]	0.0256[a]	0.0143[a]	0.0214[b]	0.0299[a]
	(0.0012)	(0.0021)	(0.0059)	(0.0038)	(0.0053)	(0.0088)	(0.0041)
Wage	-0.0623[a]	-0.0466[a]	-0.0573[a]	-0.0455[a]	-0.0195	-0.0240	-0.0542[a]
	(0.0030)	(0.0062)	(0.0186)	(0.0092)	(0.0205)	(0.0357)	(0.0099)
Benefits	-1.5119[a]	-1.1316[a]	-0.9538[a]	-1.1119[a]	-1.4631[a]	-0.7255	-1.1386[a]
	(0.0834)	(0.0670)	(0.2177)	(0.1012)	(0.2395)	(0.5230)	(0.1080)
NEGR	-0.0101[b]	-0.0761[a]	-0.0582[a]	-0.0857[a]	-0.0337[a]	-0.0627[b]	-0.0868[a]
	(0.0049)	(0.0046)	(0.0153)	(0.0067)	(0.0142)	(0.0293)	(0.0080)
R^2	0.0619	0.0867	0.1143	0.0815	0.0810	0.1368	0.1030
N	82,059	82,059	8,349	38,778	6,216	1,935	26,781

Note: Firm Size and Benefits are in logarithms. Wage measures the deviation of establishment-level wage from the sector mean. NEGR is net employment growth. The column heads represent establishments in Manufacturing (MN), Services (SR), Agriculture (AG), Construction (CN) and Non-profit (NP) sectors. Letters a, b and c represent, respectively, statistical significance at the 1%, 5% and 10% level of significance

Table 9: The probability of separation: average marginal effects from a logit model

	All	MN	SR	CN	AG	NP
Sex	-0.0023	-0.0041	-0.0010[i]	-0.0131	0.0278	-0.0161
	(0.0005)	(0.0010)	(0.0008)	(0.0019)	(0.0024)	(0.0009)
Wage	-0.0060	-0.0100	-0.0063	-0.0086	0.0035[i]	-0.0054
	(0.0004)	(0.0009)	(0.0007)	(0.0011)	(0.0021)	(0.0008)
EXP	-0.0036	-0.0040	-0.0036	0.0007	-0.0090	-0.0031
	(0.0001)	(0.0002)	(0.0002)	(0.0003)	(0.0004)	(0.0002)
EXP^2	0.0001	0.0001	0.0001	-0.0000[i]	0.0002	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Worker-Spell	-0.0152	-0.0127	-0.0159	-0.0243	-0.0081	-0.0133
	(0.0001)	(0.0002)	(0.0002)	(0.0004)	(0.0005)	(0.0002)
Firm Size	0.0244	0.0198	0.0323	0.0744	-0.0746	0.0236
	(0.0008)	(0.0023)	(0.0013)	(0.0028)	(0.0044)	(0.0013)
$[\text{Firm Size}]^2$	-0.0039	-0.0035	-0.0050	-0.0085	0.0074	-0.0036
	(0.0001)	(0.0002)	(0.0001)	(0.0003)	(0.0005)	(0.0001)
Firm-Wage	-0.0211	-0.0364	-0.0338	0.0031	-0.0478	-0.0150
	(0.0005)	(0.0011)	(0.0008)	(0.0012)	(0.0029)	(0.0009)
Benefits	-0.0937	-0.0949	-0.0417	-0.2117	-0.3193	-0.0726
	(0.0057)	(0.0114)	(0.0094)	(0.0186)	(0.0265)	(0.0110)
N	2,110,877	451,264	746,320	227,786	105,452	580,055

Note: Sex takes the value of one for female workers and zero for males. Experience measures potential worker experience after age 14. Worker-Spell measures the number of times a worker is observed as an employee of a firm. Wage measures individual wage while Firm-Wage is the deviation of an establishment's average wage from the sector average wage. Benefits stands for average employer contribution rate to pension benefits. All coefficients are statistically significant at 5% or better except for those marked with the letter *i*.