Borradores de ECONOMÍA

Labour flows across firm´s size, economic sectors and wages in Colombia: evidence from employer-employee linked panel

By: Luz Adriana Flórez
Leonardo Morales Z
Daniel Medina G
José Lobo C

No. 1013
2017

BANCO DE LA REPÚBLICA
COLOMBIA

tá - Colombia - Bogotá - Colombia - Bogotá - Colombia - Bogotá - Colombia - Bogotá - Colombia - Bogotá - Colombia - Bogotá - Colombia - Bogotá - Col

Labour flows across firm´s size, economic sectors and wages in Colombia: evidence from employer-employee linked panel

Luz Adriana Flórez[♣] Leonardo Morales Z[♣]. Daniel Medina G[♠].

lflorefl@banrep.gov.co lmoralzu@banrep.gov.co dsmedinag@gmail.com

José Lobo C[♠].

jjloboc@unal.edu.co

Banco de la República

Abstract

This paper explores the behavior of Colombia labour market flows. We focus on job creation and job destruction from the plant´s perspective, and on hiring and separations from the worker´s point of view. We show how these labour flows change across different dimensions such as, firm's size, economic sectors, as well as wages and present the dynamic of tenure across these dimensions. Our results are in line with those of Birch (1981) and more recently Neumark, Wall, and Zhang (2008), who found that small firms are the ones who created jobs in the economy. We found that small firms have higher job and worker reallocation rates; and firms especially those with less than 50 employees are the ones with a higher employment growth rates compared to the larger ones. Moreover, we found that construction presents the highest labour flows, while manufacture the lowest. Finally, we found a negative relation between firm´s average wages and labour flows.

JEL classification: E24, J63, M50

Keywords: Job creation, Job destruction, Hiring, Separations, Firm´s size, Churning, Wages, Tenure.

[♣] Researchers of Labour Market Analysis Group (GAMLA by his initials in Spanish), and [♠] research assistants at central bank of Colombia from *Universidad Nacional de Colombia*, Medellin branch. The opinions expressed here are those of the authors and not of the *Banco de la República de Colombia* nor of its Board. All errors are authors´ responsibility. Corresponding author: lflorefl@banrep.gov.co. We thank Leidy Gomez for her research assistance in this updated version (October 2018).

Introduction

During the last decades in developed and developing countries, policy makers have focused on small firms as a strategy to create employment. The idea behind this, it is the belief that small firms are the ones who create more jobs in the economy. Literature showing evidence in favor of the previous sentence begins with Birch (1981), who using information for the US, explores the question of who creates jobs, and who is most likely to respond to changes in economic policy. The author affirms that this knowledge is essential since it makes the public policies more efficient focusing on those who will take advantage of the incentives to create jobs. Moreover, he found that firms with 100 or fewer employees produce around 80% of total job openings. Small business more than offsets their higher failure rates with their capacity to start up and expand dramatically.

Following Birch´s (1981) findings, a number of studies support the idea that small firms are the ones who created most jobs in a number of developed countries (Anyadike, Bonner, & Hart, 2011; Baldwin & Picot, 1995; Barnes & Haskel, 2002; Broersma & Gautier, 1997). Other authors, however, criticize the firm size measure used by Birch (1981) because it is subject to the "regression fallacy[1]" that leads to overestimating the contribution of small firms to job growth (Davis, Haltiwanger, & Schuh, 1996a, 1996b). These authors proposes different ways to measure the firm's size and find that large plants are the ones that account for most newly-created and newly-destroyed job (manufacturing sector), and small firms do not exhibit higher net job creation rates. In addition, they found that the net job creation rate in the manufacturing sector of the US does not present a strong or systematic relationship between the dynamics of the firm´s size. (Davis & Haltiwanger, 1992; Davis et al., 1996a, 1996b; Fuchs & Weyh, 2010; Van Stel & Storey, 2004; Wagner, 1995).

However, more recently for the US, Neumark, Wall, and Zhang, (2008) have found evidence in favor of Birch´s (1981) results, using a more accurate database such as the National Establishment Time Series (NETS). This dataset allows studying the dynamic of the whole economy (including the manufacturing sector where most previous research has focused on).

[1] Davis et al. (1996a) explain that the "regression fallacy" arise because when employers experience transitory fluctuations in size, and there is a strong relationship between the reclassification of the firm and the transitory change in employment, p. 305.

For the period 1992-2004, the authors showed that small firms and small establishments create more jobs for the overall economy. Even after controlling for the "regression fallacy" suggested by Davis et al. (1996), they found a negative relationship between establishment size and job creation in the manufacturing sector. Even though this is still an important debate in developed countries, the evidence for developing countries is very limited[2].

In Colombia, the majority of empirical evidence about the dynamics of job creation and job destruction has focused on the manufacturing sector. Using the Annual Survey of The Manufacture Sector (EAM by its initials in Spanish) administrated by the National Department of Statistics (DANE by its initials in Spanish), some authors such as Wengel (2006), Rivas (2000), among others, studied the dynamic of job creation and job destruction in the manufacture sector in Colombia. Wengel (2006) found high heterogeneity between establishments of the same sector, which implied a difficulty in the implementation of policies focused on a particular sector. Rivas (2000), on the other hand, explored dynamics of job creation and job destruction for the sector in 1977 to 1999. The results showed that there was a negative relationship between the size of the establishments and the job creation and job destruction rate. Using the same data for the period 1994-2009, Melo and Ballesteros (2013) described job creation, destruction and net growth of employment across other dimensions such as industrial sub-sectors, occupational categories (temporal, or permanent job), and type of jobs (jobs related to the administrative or productive activities). The results show a higher heterogeneity in the behavior of job flows within than across subsectors and between permanent vs. temporal employment[3].

However, in Colombia, there is no evidence of the dynamics of job flows and worker flows for the whole economy. Our paper explores the measures of worker flows such as the hiring

[2] Haltiwanger and Vodopivec (2002, 2003), present evidence of worker and job flows for some economies in transition such as Estonia and Slovenia.

[3] Other papers for the Colombia case, have explored the relationship between the flow measures and some macroeconomic facts. For example, González (2006) examines the effect of job reallocation on the productivity dynamics of the sector. The author found that the job reallocation has a remarkable increase in productivity. Melo and Ballesteros (2014) extended the study of job flows, analyzing the effect of the real exchange rate, foreign direct investment and the degree of openness of firms on the job creation and job destruction. The authors found that an increment in the real exchange rate increases job creation and decreases job destruction, suggesting a positive impact on net employment growth in the sector. Similarly, Haltiwanger, Kugler, Kugler, Micco and Pagés (2004), explore the effect of tariffs and exchange rate on job reallocation for different Latin American economies as Argentina, Brazil, Chile, Colombia, Mexico, and Uruguay. They focus the impact of trade reforms on the pace of job reallocation and net employment growth within sectors of each country. They found that trade reforms have significant effects on the pace of job reallocation within sectors. However, improvement in reallocation is costly, given that a reduction in tariffs is also associated with a decline in net employment growth.

and separations, and flow measures from firms as job creation and job destruction. The main contribution of our work is to explore all this flow measures not only in the manufacturing sector but also for all the rest of the economy and across different dimensions such as firm´s size, economic sector, and wages. We also characterize the tenure across these various dimensions. According to Davis et al. (1996b) higher rates of job creation make it easier for unemployed workers to find employment, while higher job destruction rates may imply less job security for employed persons. Understanding the behavior of labour flows is very important, since they have a significant impact on unemployment, job security and productivity, among others things (Davis & Haltiwanger, 2014; Morales & Medina, 2016, among others).

To achieve these goals we have access to administrative data that allow us to follow firms and workers in time, and this information is available for all sectors of the economy. The data we will use in this paper is the "Integrated Record of Contributions to Social Security" (PILA by its initials in Spanish) for the period 2009-2017. Few papers have worked with this information. One of them is Núñez (2012), who used these data for the period 2008-2011 to study the relation between worker flows and labour stability in the formal sector. To the best of our knowledge, our paper is the first to analyze labour market flows dynamics for the Colombian economy as a whole.

We show that job and worker flows in Colombia have cross-sectional and time series properties in line with those predicted by theory and the empirical literature. We found a remarkable heterogeneous dynamic of labour flows at the firm´s size, average wage, and economic sectors. More specifically, our results show that small firms tend to present higher worker and job flow rates. They enjoy higher net employment growth rates compared to larger firms. Moreover, small firms have lower churning rates (excess of worker flows in relation to job flows) compared to the big ones. Among sectors, we found that construction has the highest labour flows and manufacturing the lowest, a finding which is in keeping with that of other authors in the literature, such as Burgess, Lane, and Stevens (2000) and Davis, Faberman, and Haltiwanger (2006). Additionally, we found a negative relationship between firm´s average wages and labour flows; this applies to all but firms in the first quartile of the wages distribution. Finally, we found that there are substantial differences in the one-year

tenure across different dimensions such as firm´s size, economic sectors, and wage levels. However, comparing the long tenure duration (8 years), we find that around 30%-40% of workers remain in the same firm for any dimension with the exceptions of firms between 2 to 10 employees (43.38%), public services (43.93%) and firms in the first quartile (43.21%).

The remainder of the paper is as follows. Section 1 presents the measures of labour flows used in this paper. Section 2 presents aggregate labour flows and compares these flows with those found in the U.S. Section 3 presents the dynamics of different labour market flows by categories such as firm´s size, economic sector, and wages. Section 4 presents the statistical significance of the results found in the previous section, and finally, section 5 summarizes the main results.

1. Definitions of labour market flows

As we mentioned in the previous section the data employed in this paper comes from PILA, which is a panel that links information about employers and employees. This panel allows us to build the different definitions of labour flows used in the literature, in a monthly and quarterly frequency since 2009[4]. Using PILA, we follow and define as formal those firms that contribute at least to one of two social system payments such as health and pension system. This implies that we are not covering informal firms that provide half of total employment in Colombia.

Following Davis et al. (1996b), a plant is a physical location where production takes place, and a firm is an economic and legal entity that encompasses one or more plants. In this paper, we will use the firm as a unit of analysis[5]. As it is usual in labour flows literature Davis et al. (1996a), we define a job as a position filled by a worker. We are not able to observe positions or vacancies, all of our measures are based on observations of the size of firm and the flow of workers entering and exiting that firm. Before describing our fluidity measures, let us introduce some notation and definitions[6].

[4] PILA is available since 2008, however, to avoid measurement errors we prefer to use the information since 2009.
[5] Unfortunately, with PILA we are not able to identify the number of plants or establishments that constitute a firm.
[6] Definitions and notation used in this section, carefully follow Morales and Medina (2016).

There are two main components of labour-flows: the job flows that from the firm´s point of view refer to job destruction and job creation; and the worker flows represented by hirings and separations. Assume firm j_t is a set of business-firms with at least two employees. An individual i_{jt} is an employee observed in the payroll of firm j at period t. Given that we have employer-employee information, we can compute hires (h_{jt}) as the set of particular employees observed in a given time that were not observed before. Similarly, separations (s_{jt}) are generated as the specific employees found in the previous periods that were not observed in the current one. Then the set of hires, separations, and stayers (k_{jt}) in a firm j in the period t is defined as:

$$h_{jt} = \{i:\ i_t \in j_t \ \text{ and } \ i_t \notin j_{t-1}\}$$

$$s_{jt} = \{i:\ i_t \notin j_t \ \text{ and } \ i_t \in j_{t-1}\}$$

$$k_{jt} = \{i:\ i_t \in j_t \ \text{ and } \ i_t \in j_{t-1}\}$$

The payroll of the firm in a given period is denoted as $e_{jt} = k_{jt} + h_{jt}$, which represent the employees who continue working in firm j plus new hired workers. We approximate the number of jobs created and destroyed by each firm as changes in the payroll from one period to the next; we assume that an increase (reduction) in the payroll implies the creation (destruction) of jobs. Therefore, job creation c_{jt} and job destruction d_{jt} of firm j in the period t are denoted as:

$$c_{jt} = \ 1_{\{\Delta e_{jt}>0\}}\Delta e_{jt}$$

$$d_{jt} = -1_{\{\Delta e_{jt}<0\}}\Delta e_{jt}$$

We can calculate aggregated measures for different categories. For example, category A consists takeoff summations of all these previous sets. Therefore, the aggregate flows of hires ($H_{A,t}$), separations ($S_{A,t}$), job creation ($JC_{A,t}$), and job destruction ($JD_{A,t}$) for category A are represented as:

$$H_{A,t} = \sum_{j\epsilon A} h_{jt};\ S_{A,t} = \sum_{j\epsilon A} s_{jt};\ JC_{A,t} = \sum_{j\epsilon A} c_{jt};\ JD_{A,t} = \sum_{j\epsilon A} d_{jt}$$

To simplify the exposition, we omit the category A. However, all the measures we will discuss next are aggregated at some level. An interesting point of the labour flows is that worker flows and job flows are connected. According to Laing (2011, p.806), given that each job is defined to be filled only by one worker, it must be true that:

$$\Delta E_t \equiv JC_t - JD_t \equiv H_t - S_t$$

The most used measures of labour market fluidity (ie. mobility) are worker and job reallocation. The worker reallocation (*WR*) refers to the number of workers who change of labour statues (Employed/Unemployed) during a period (Davis & Haltiwanger, 1999), which is given by $WR_t \equiv H_t + S_t$. The job reallocation (*JR*) refers to the number of jobs that are created and destroyed, which is given by: $JR_t \equiv JC_t + JD_t$. Using the measure of reallocations, we can build the churning flows. Churning flows refer to the excess of worker´s reallocation over job reallocation:

$$CH_t \equiv WR_t - JR_t$$

All the measures previously discussed can be express as rates, in which case following Davis et al. (1996a), we divide by a measure of employment level of firm j at time t defined as: $\mathrm{x_{jt}} = \left(\mathrm{e_{jt}} + \mathrm{e_{jt-1}}\right)/2$. Therefore, for using this notation, the employment level of any category A can be defined as $\mathrm{X_{A,t}} = \sum_{\mathrm{j}\in\mathrm{A}} \mathrm{x_{jt}}$.

2. Aggregate labour market flows

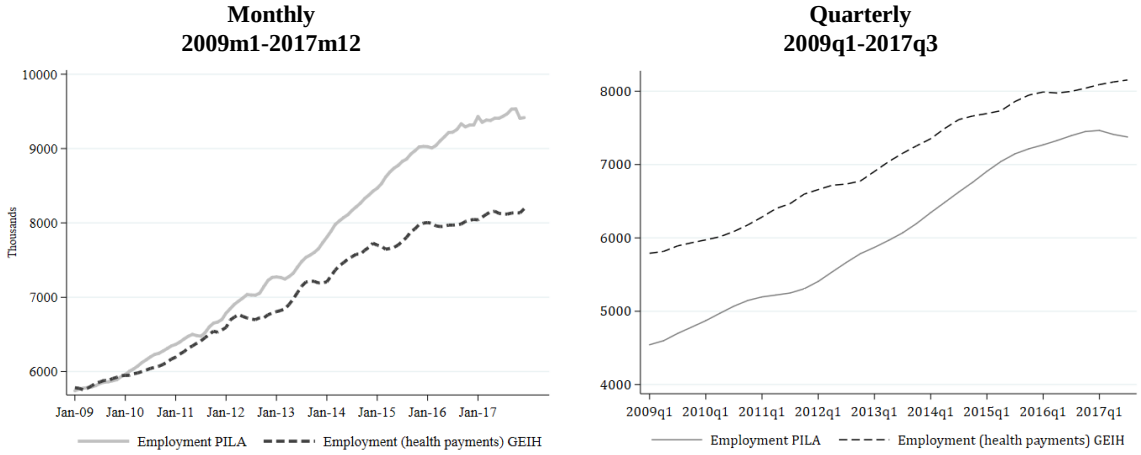
2.1 Aggregate statistics for Colombia

Formal employment levels computed from PILA can be contrasted with information from official Household surveys (GEIH by its initials in Spanish), reported by the National Department of Statistics (DANE by its initials in Spanish). **Figure 1** presents information from PILA and GEIH at monthly and quarterly frequency. Insofar as monthly measures are concerned, we observe that formal employment levels from PILA are relatively similar to the ones computed from GEIH.

For quarterly frequency we follow Burgess et al. (2000) and Davis et al. (2006), who takes as employees only those workers who last at least a quarter in the firm, avoiding the noise

that arrives from very short employment spells. Then, by construction, using the quarterly data we are losing some information. The difference between quarterly and monthly formal employees is around 2.3 millions of workers, which represents around 24.5% of the total employment from PILA in 2017[7]. However, comparing the quarterly measures of PILA and formal employment with GEIH, we found that these two measures follow a similar dynamic, even though their levels are not the same.

Figure 1: Total employment
National level

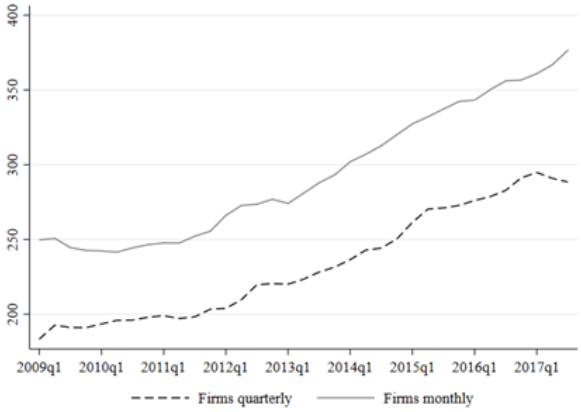


Note: Information is aggregated at the national level. Formal employment from GEIH is defined as employees who have reported to contribute the health system and they are not self-employed.
Source: **PILA and GEIH. PILA time series include employees in firms with at least two employees. Seasonally adjusted and moving average order three, authors' calculations.**

Davis et al. (2006) find that, for the US, the quarterly flows rates (H, S, JC and JD) are in average 2.6 times the monthly ones[8]. Our results show that this ratio is 1.7 for Colombia; this number reflects the importance of very short job spells in Colombian labor markets, among other factors. However, as we will present in these paper, the dynamic of the labour flows at monthly and quarterly measures are very similar. **Figure 2** presents the number of firms when using the monthly and quarterly data. The dynamics of the number of firms across time is similar using the monthly and quarterly data[9]; however, there is an average gap of around 60 thousand firms for the whole period, between the two measures.

[7] The total average employment in 2017 correspond to the average total employment from january 2017 to september 2017.
[8] The paper uses the Job Openings and Labor Turnover Survey – JOLTS.
[9] Using the quarterly data we observe a substantial fall in the number of firms at the first quarter of 2017. This was explained by a loss of 8.7% of firms, which is not usual in the behavior of this series across time. The small ones (2 to 19 employees)

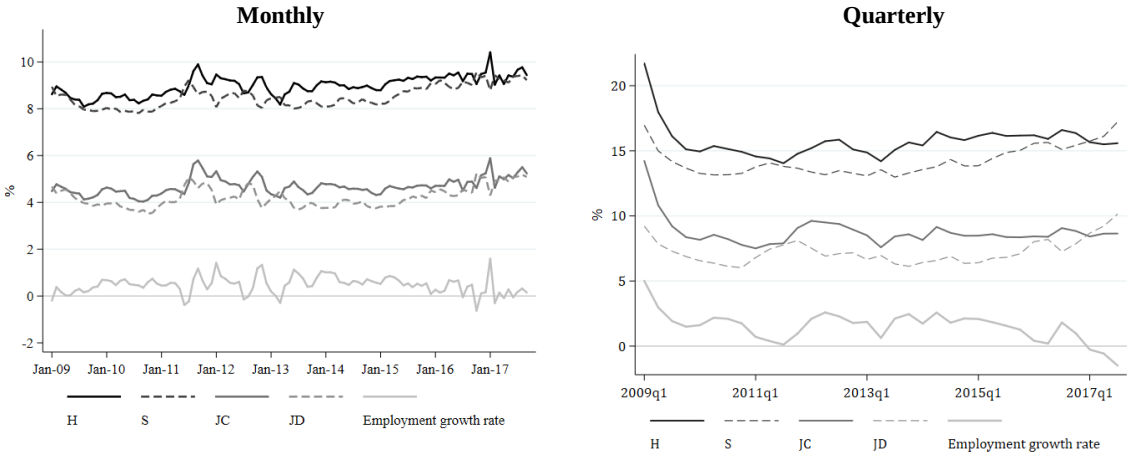
Figure 2. Firms 2009Q1-2017Q3.
(Thousands)



***Source: PILA*; Include firms with at least two employees; authors' calculations, seasonal adjusted and moving average order three.**

Following Davis et al. (1996a, 1996b), we calculate job creation, job destruction, hiring and separation rates. We also compute net employment change at time (t) at the national aggregate level. **Figure 3** presents those flows rates; during most of the study period, we observed a positive net employment growth rate, which implies that job creation rate (JC) [hiring rate (H)] is higher than the job destruction rate (JD) [separation rate (S)]. Moreover, we observed that worker flows are almost twice the size of job flows, and they are slightly increasing across time.

Figure 3. Worker and Job Flow Rates 2009Q1-2017Q3.



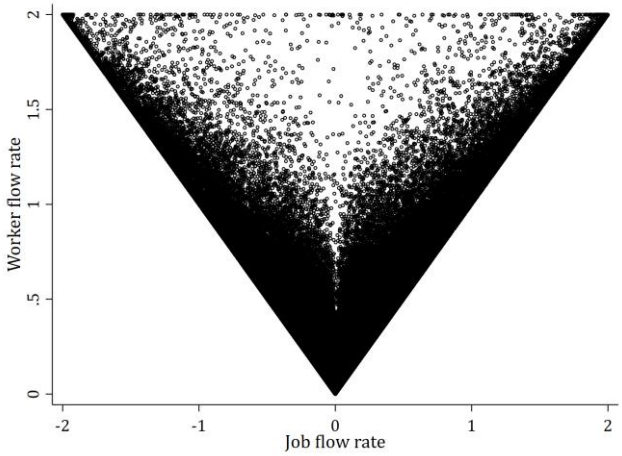
***Source: PILA*; Include firms with at least two employees; authors' calculations, seasonally adjusted and moving average order three.**

account for the 95% of the fall in firms, 36% of firms belong to the sector of private services, 22% belong to the sector of transportation & trade and 16% to public services

The relationship between worker and job flows is not trivial, as it is suggested by Burgess et al. (2000); Burgess, Lane, and Stevens (2001); Hamermesh, Hassink, and van Ours (1996); Lane, Stevens, and Burgess (1996), among others. Both expanding firms and shrinking employers engage in hiring, while expanding firms also fire workers. Therefore, churning rates are positive in all the spectrum of possible employment growth rates.

Figure 4 illustrates the relationship between worker flows [hiring ((*H*) and separation (*S*)] and job flows [job creation (*JC*) and destruction jobs (*JD*)]. In the horizontal line we have the net employment change rates, and in the vertical line we have the worker reallocation as the sum of hirings and separations rates at the firms level. The 45 degree line represents the case where the worker reallocation is equal to the change in employment, in which case worker churning is equal to zero. The difference between any point and the 45 degree line express the worker churning. This figure show that shrinking firms (those that destroy jobs), have high separation rates but at the same time present a positive hiring rate. Also, expanding firms (those that create jobs) present high hiring rates but at the same time positive separation rates, in which cases worker churning is always positive. Similar to Burgess et al. (2000), we found that higher churning flow rates tend to be associated with lower absolute job flow rates. Moreover, even when job destruction or job creation rates are equal to zero, there still is a positive and not negligible churning.

Figure 4. Job flow and worker flow rate.
2009-2017. Monthly data



Source: PILA, Include firms with at least two employees; authors' calculations. This figure is based on Figure 4 in Burgess et al. (2000). The worker flow rate is the mean of different firm´s worker flow rates associated with the same job flow rate, redounded to the millionths, for the whole panel dataset.

According to Burgess et al. (2000), p. 474, there are two reasons that explain the presence of churning. The first reason is the worker´s decision of quitting, so they need to be replaced by the firm. The second reason is the firm´s needs to hire and fire workers to improve the quality of their workforce or to reconfigure their skill mix, replacing jobs of one type with jobs of another kind. In the next section, we will explore how the dynamic of worker and job flows change across different dimensions such as firm´s size, wages, and economic sector. Moreover, we explore how tenure dynamics change across these various dimensions.

2.2. Comparing the labour market flows for Colombia vs United States

In this section, we compare our measures with those found in the United States, a country in which there are several sources of data used to study the job and worker flows[10]. There is ample literature using this information for the estimation of job-and-worker flows for the US (Abowd & Vilhuber, 2011; Davis, Faberman, Haltiwanger, & Rucker, 2010; Lazear & McCue, 2017).

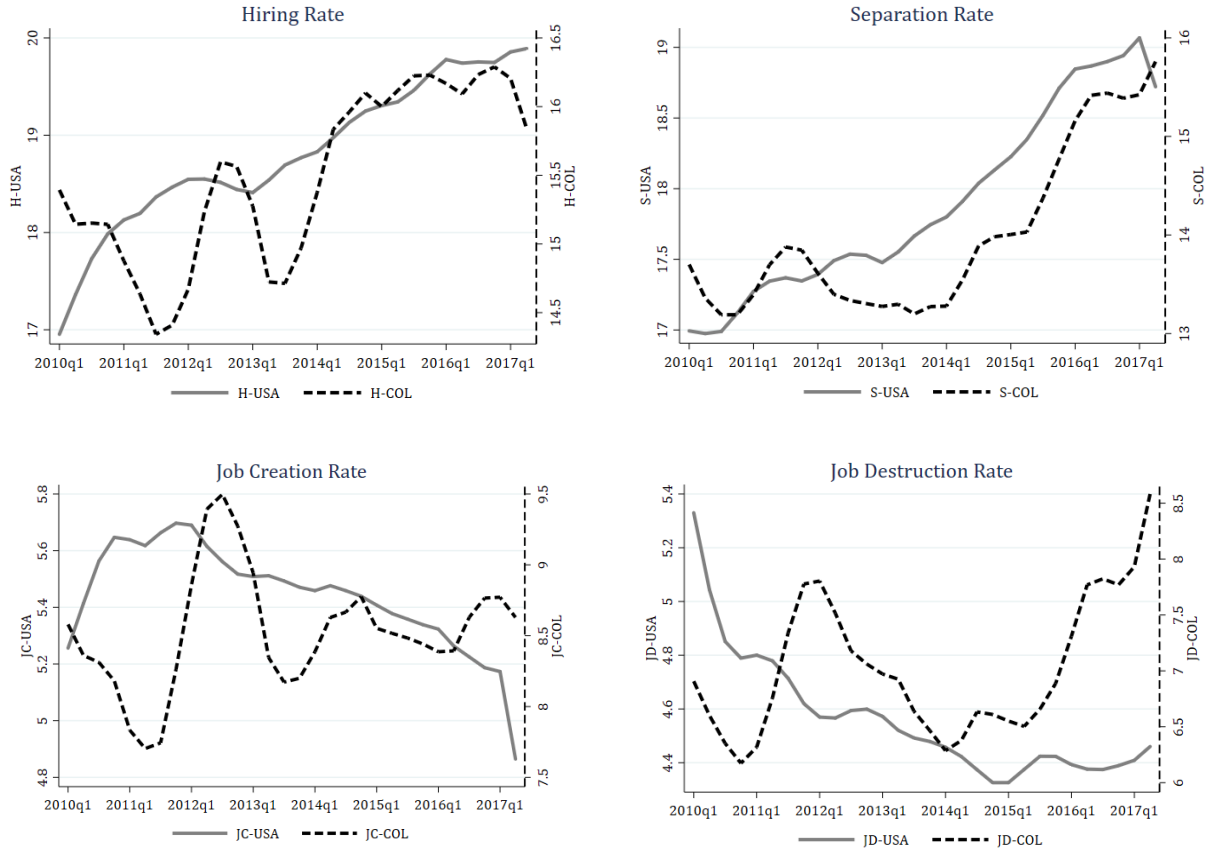
Figure 5 presents the job flows and workers flows at quarterly measures from the Colombian and United States. For the case of the US, we use the measures presented by the U. S Census Bureau, using the LEHD; these flows are built on a quarterly basis. The levels of the worker flows rates are very closely related showing an increasing trend since 2009. While on average during 2017 United States presented a quarterly hiring rate (separation rate) of around 19.8% (18.9%), this measure was around 16% (15.6%) for the case of Colombia. However, we found a sharp volatility in the Colombian measures. Furthermore, when we compared the job flows, the difference is remarkable. These flows are different not just in their levels but also in their dynamics across time. For United States, the job destruction presents a decreasing trend across time (with a level average of 4.43% during 2017), while in the case of Colombia we found an increasing trend across time (with level average of 8.25% in the same period). As is suggested by Davis and Haltiwanger (2014, p. 7) we do not expect these flows to be similar between the two countries. These measures are "strongly influenced by labor market

[10] Some examples include the Job Openings and Labor Turnover Survey (JOLTS), the Business employment dynamics (BED) from the Bureau of Labor Statistics (BLS) and the Longitudinal Employer-Household Dynamics (LEHD) from the United States Census Bureau.

institutions, the structure of production and employment, data quality, and measurement methods – all of which can differ substantially across countries".

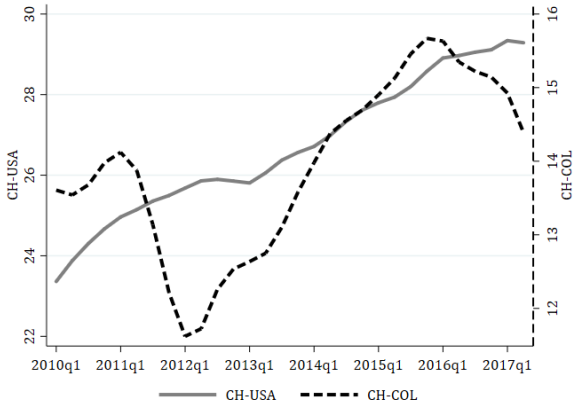
Finally, we compared the churning rates for the two countries according to previous job and worker flows (see **Figure 6**). As we can expect the churning rates of United States are higher compared to the Colombian ones, this is explained because job flows in Colombia are greater than in the United States; therefore, the excess of worker flows that are not explained by creation or destruction is higher in the United States than in Colombia. Hence, the churning rate of United States is almost twice the Colombia one, and both exhibit an increasing trend across the same period.

Figure 5. Worker and job flows rates for Colombia (PILA) and U.S.A (LEHD).
National level (2010q1-2017q2)



Note: Quarterly seasonally adjusted series. Series are smoothed as three-period moving averages.
Source: U.S. Census Bureau and PILA, authors' calculations.

Figure 6. Churning rates for Colombia (PILA) and U.S.A (LEHD).
National level (2010q1-2017q2)



Note: Quarterly seasonally adjusted series. Series are smoothed as three-period moving averages.
Source: U.S. Census Bureau and PILA, authors' calculations.

3. Labor market flows by categories

In this section, we study the flow measures of the labour market for different categories. First, we focus on the size of the firm. Second, we study flows according to different economic sectors such as Agriculture & Mining, Manufacturing, Construction, Transportation & Trade, Public Services, and Private Services. Finally, we study flows across the average wage paid by the firms. Our analysis is based on monthly and quarterly data, and show how the results can change across these different dimensions.

3.1 Plant´s size

In this section, we focus on the flow measures by plant´s size. Following Davis et al. (1996b) we use different definitions or categories of firm size, therefore, we avoid the problem of size distribution fallacy and the regression to the mean bias or regression fallacy[11]. The following categories are applied to both monthly and quarterly data.

i) Current plant size: defined as the average of the employment level observed for the firm j in the month/quarter t and $t-1$.

[11] The size distribution fallacy arises when firms migrate between size categories from one year to the next, and regression fallacy occurs when employers experience transitory fluctuations in size, and there is a strong relationship between the reclassification of the firm and the transitory change in employment. See Davis et al. (1996b), p. 305.

ii) Annual average plant size: defined as the annual moving average of the employment level observed for the firm j during the last twelve months/four quarters.

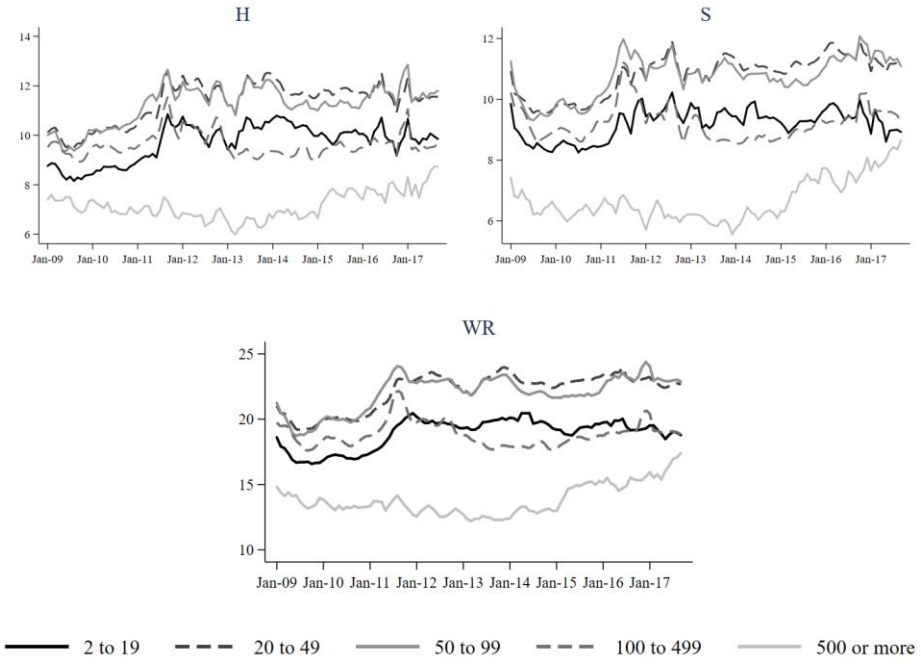
iii) Average plant size: defined as the average number of employees for all the firm j (monthly/quarterly) observations.

Appendix A presents a small description of the distribution of firms and employment across different size categories for the monthly and quarterly data. With monthly data, we follow 262 thousand firms on average. We found that the distribution of employment across firms is very skewed. For example, 73% of firms between 2-10 employees represent 10.9% of the total employment; 2.8% of the firms between 100-499 employees represent around 22.1% of the total employment and less than 1% of the firms with more than 500 employees represent 42.5% of total employment. This picture is very similar using quarterly data (see Table A from Appendix A).

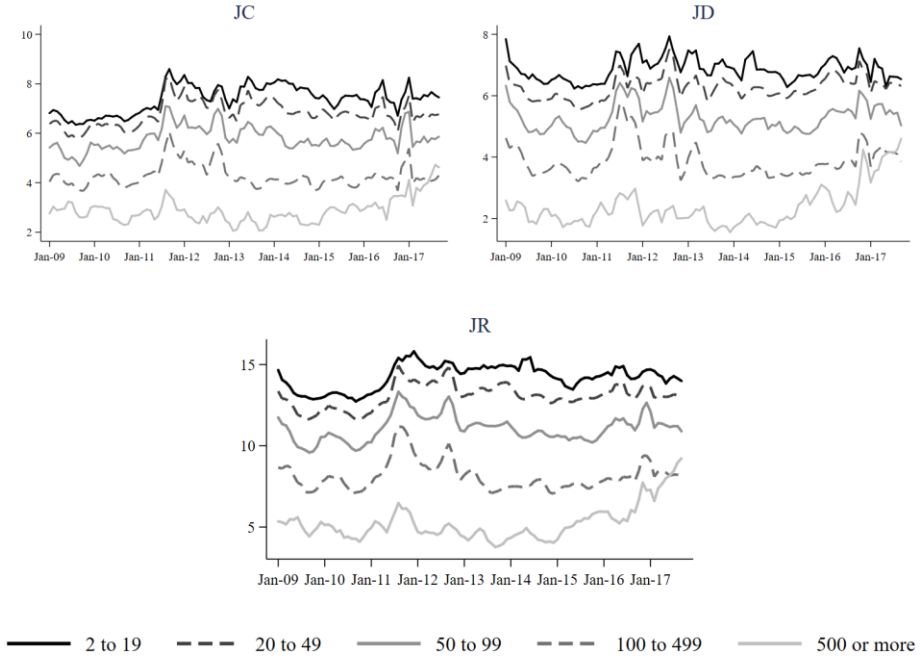
Figure 7 presents the monthly dynamics of the worker-and-job flows by average plant size (definition *iii*), for the period January-2009 to September-2017. From Panel A, in Figure **7** we observe that, worker flows are decreasing with the firm´s and more remarkably for firms with more than 50 employees. For example, the hiring rates (H) and separations rates (S) are subtantially higher for plants size between 20-49 employees in comparison with firms with 100-499 and more than 500 employees. Moreover, the majority of the plant sizes exhibit increasing hiring and separation rates across time, except plants with more than 500 employees, which present growing trend in worker flows just since 2014.

Comparing the dynamic of the job flows (Panel B, Figure 8), we observe that job creation (JC) and job destruction (JD) rates decrease with plant size. However, job flows present an increasing trend that is less clear across time compared to worker flows. Figure A from Appendix A, shows the dynamics of job and worker flows using quarterly data. As we observed the dynamics of these flows are similar to those observed in the monthly data, however, the level of all flow rates is higher than the ones found with the monthly data.

Figure 7: Worker and Job flows (monthly data)
Panel A: ***Worker flows:***



Panel B: ***Job flows***



Source: PILA, monthly measures, seasonal adjusted and moving average order three, own calculations

Table 1 (Panel A) summarizes labour flows using monthly data for all period January-2009 to September-2017. As commented before, hiring (H) and separation (S) rates, and therefore worker reallocation (WR), decrease more remarkably for firms with more than 50 employees. Similar to the dynamic observed with the worker flows, job flows are also dropping with the firm size. Panel B from **Table 1** shows the results of labour flows using quarterly data. One of the most interesting results is that the measures of labour flows with quarterly data tend to be almost twice the monthly ones (as is found by Davis et al. 2006). For example, using the current plant size, we observe that the quarterly hiring rate of a firm between 2 to 10 employees is 18.32% while the monthly hiring rate is around 9.36%. The same happens for firms with more than 500 employees, where the quarterly hiring rate is 13.17% while the monthly hiring rate is around 7.41%. Even though the level of the monthly labour flows is different compared to quarterly labour flows, the behavior across firm´s size is very similar. We found that hiring, separations, worker reallocation, job creation, job destruction and job reallocation rates tend to decrease with the firm´s size, both for the quarterly and monthly data. In the case of worker flows, this is true for firms with more than 50 employees (average size).

Table 1: Panel A Monthly

	Worker Flows			***Job Flows***		
Number of Employees	***H***	***S***	***WR***	***JC***	***JD***	***JR***
			I. Current plant size			
2 to 10	9.36	8.26	17.63	7.88	6.78	14.66
11 to 19	10.25	9.49	19.75	7.31	6.55	13.87
20 to 49	11.04	10.22	21.27	6.89	6.07	12.95
50 to 99	11.07	10.40	21.47	5.91	5.24	11.16
100 to 499	9.80	9.36	19.16	4.37	3.92	8.29
500 and more	7.41	6.92	14.33	2.90	2.42	5.32
			II. Annual average plant size			
2 to 10	9.93	7.82	17.75	8.36	6.25	14.62
11 to 19	10.63	9.57	20.19	7.47	6.41	13.88
20 to 49	11.27	10.50	21.77	6.91	6.13	13.04
50 to 99	10.96	10.43	21.39	5.75	5.21	10.96
100 to 499	9.54	9.33	18.87	4.21	4.00	8.22
500 and more	7.25	7.02	14.27	2.80	2.56	5.36
			III. Average plant size			
2 to 10	9.16	8.60	17.76	7.45	6.89	14.34
11 to 19	10.59	10.10	20.69	7.28	6.79	14.06
20 to 49	11.34	10.80	22.14	6.80	6.25	13.05
50 to 99	11.25	10.74	21.99	5.79	5.27	11.07
100 to 499	9.63	9.22	18.85	4.27	3.86	8.13
500 and more	7.16	6.65	13.82	2.87	2.37	5.24
All	**8.98**	**8.47**	**17.40**	**4.67**	**4.12**	**8.79**

Panel B : Quarterly						
I. Current plant size						
2 to 10	18.32	16.17	34.49	15.61	13.46	29.07
11 to 19	18.43	16.64	35.07	13.47	11.66	25.13
20 to 49	18.66	16.80	35.46	12.14	10.28	22.42
50 to 99	18.30	16.60	34.90	10.55	8.82	19.37
100 to 499	15.85	14.54	30.38	7.66	6.33	13.99
500 and more	13.17	11.88	25.05	5.40	4.09	9.49
II. Annual average plant size						
2 to 10	18.79	15.55	34.34	15.93	12.69	28.62
11 to 19	18.80	16.46	35.26	13.59	11.22	24.81
20 to 49	19.01	16.72	35.74	12.24	9.93	22.17
50 to 99	18.35	16.46	34.81	10.39	8.47	18.86
100 to 499	15.63	14.51	30.15	7.52	6.37	13.88
500 and more	12.81	12.01	24.82	5.11	4.31	9.42
III. Average plant size						
2 to 10	17.81	16.12	33.94	15.05	13.36	28.40
11 to 19	18.53	16.93	35.46	13.35	11.72	25.07
20 to 49	18.85	17.09	35.93	12.04	10.28	22.31
50 to 99	18.62	17.07	35.69	10.54	8.96	19.49
100 to 499	15.91	14.59	30.50	7.68	6.34	14.01
500 and more	12.95	11.61	24.56	5.37	4.03	9.39
All	**15.64**	**14.15**	**29.79**	**8.68**	**7.17**	**15.85**

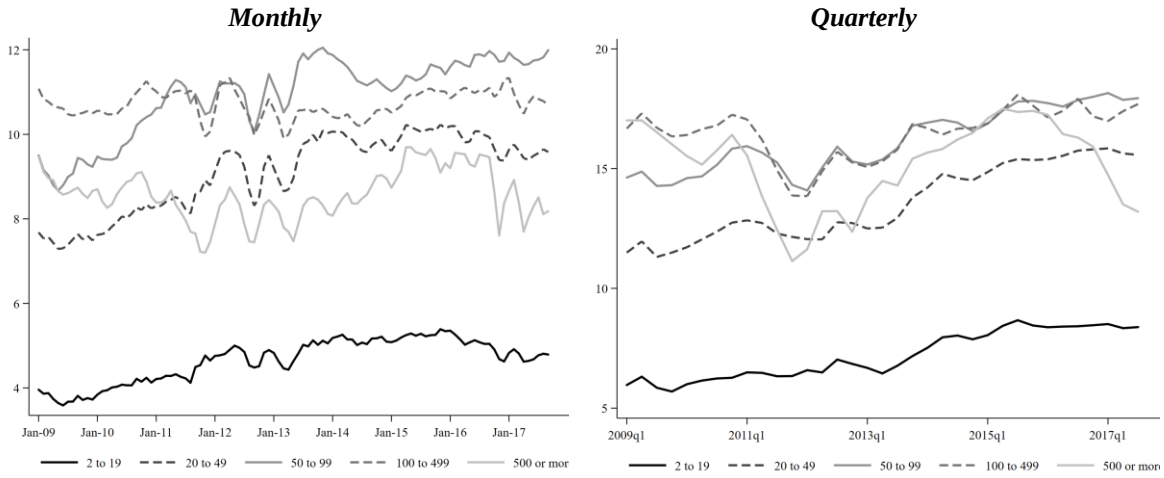
Notes: Tables entries are means of monthly/quarterly values in time interval, seasonal adjusted. Source: author´s calculations

As it was discussed in the first section, total churning is defined as the difference between worker reallocation and job reallocation [$CH_t \equiv WR_t - JR_t$]. **Figure 8** presents churning rates dynamics using monthly and quarterly measures. As we have already mentioned, there is a difference in the size of the monthly rates (almost double); however, the behavior across time of all the measures is very similar. Hence, from both measures we can conclude that since 2011 to 2016 the churning rates have increased for all firm sizes, with a reduction during 2017. Moreover, using quarterly measures, we found clear evidence that bigger firms present higher churning rates. Thus, firms with more than 50 employees present higher churning rates than those with less workers.

Churning rates are also summarized in **Table 2**. Panel A from Table 2 presents the monthly measures. Then as observed from **Figure 8,** churning rates (CH) seem to be increasing with the firm´s size. Another way to analyze these churning rates is suggested by Burgess et al. (2000), expressing the proportion of churning that is explained by the worker's reallocation. The column four of **Table 2**, presents the ratio between churning and worker reallocation **(**CH/WR**)**. In general, we found that higher firm´s size shows a higher rate. In other words,

for the largest firms (100+), more than 50% of the worker's reallocation corresponds to churning, while for the smallest firms (less than 20 employees) this proportion is less than 30%. These results are similar to Burgess et al. (2000), who found that bigger firms are constantly reevaluating the value of their match, improving the quality of their workforce or reconfiguring their skill mix.

Figure 8*: Churning rates (CX): 2009-2017*



Source: PILA, seasonal adjusted and moving average order three, own calculations

The last column of **Table 2**, presents the net change in employment ($\Delta E = H - S = JC - JD$). Using all size categories, we observed that the employment change is higher for small and medium sized firms (less than 49 employees) in comparison with larger firms. Defining the size categories with the average plant size, **Table 2** shows that for firms with less than 49 employees the average growth rate of employment is high and decrease with the firm´s size. Moreover, comparing the results of net change in employment with the quarterly measure, we found evidence that supports Birch`s (1981) findings that smallest firms present higher employment growth rates. In summary, the evidence shows that small and medium sized firms present higher job and worker flow rates and have higher employment growth rates compared to larger firms. Moreover, small firms have lower churning rates compared to big ones, where more than 50% of worker's reallocation corresponds to churning.

Table 2: Churning rates

2009-2017 Monthly

Number of Employees	*WR*	*JR*	*CH*	*CH/WR*	*∆E/E*
		I. Current plant size			
2 to 10	17.63	14.66	2.97	0.17	1.10
11 to 19	19.75	13.87	5.88	0.30	0.76
20 to 49	21.27	12.95	8.32	0.39	0.82
50 to 99	21.47	11.16	10.31	0.48	0.67
100 to 499	19.16	8.29	10.87	0.57	0.45
500 or more	14.33	5.32	9.01	0.63	0.48
		II. Annual movil average plant size			
2 to 10	17.75	14.62	3.14	0.18	2.11
11 to 19	20.19	13.88	6.31	0.31	1.06
20 to 49	21.77	13.04	8.73	0.40	0.77
50 to 99	21.39	10.96	10.44	0.49	0.54
100 to 499	18.87	8.22	10.65	0.57	0.21
500 or more	14.27	5.36	8.91	0.63	0.23
		III. Average plant size			
2 to 10	17.76	14.34	3.42	0.19	0.57
11 to 19	20.69	14.06	6.63	0.32	0.49
20 to 49	22.14	13.05	9.09	0.41	0.54
50 to 99	21.99	11.07	10.92	0.50	0.52
100 to 499	18.85	8.13	10.72	0.57	0.42
500 or more	13.82	5.24	8.58	0.62	0.50
All	**17.40**	**8.79**	**8.61**	**0.51**	**0.56**
		Quarterly			
		I. Current plant size			
2 to 10	34.49	29.07	5.42	0.16	2.15
11 to 19	35.07	25.13	9.94	0.28	1.81
20 to 49	35.46	22.42	13.04	0.37	1.86
50 to 99	34.90	19.37	15.54	0.45	1.73
100 to 499	30.38	13.99	16.39	0.54	1.33
500 or more	25.05	9.49	15.55	0.62	1.31
		II. Annual average plant size			
2 to 10	34.34	28.62	5.73	0.17	3.25
11 to 19	35.26	24.81	10.45	0.30	2.37
20 to 49	35.74	22.17	13.57	0.38	2.31
50 to 99	34.81	18.86	15.95	0.46	1.93
100 to 499	30.15	13.88	16.26	0.54	1.15
500 or more	24.82	9.42	15.40	0.62	0.80
		III. Average plant size			
2 to 10	33.94	28.40	5.54	0.16	1.69
11 to 19	35.46	25.07	10.39	0.29	1.63
20 to 49	35.93	22.31	13.62	0.38	1.76
50 to 99	35.69	19.49	16.20	0.45	1.58
100 to 499	30.50	14.01	16.48	0.54	1.34
500 or more	24.56	9.39	15.17	0.62	1.34
All	**29.79**	**15.85**	**13.93**	**0.49**	**1.21**

Notes: Tables entries are means of monthly/quarterly values in time interval, seasonal adjusted. Source: author´s calculations

3.2 Economic sector

In this section, we present the dynamic of labour flows in different economic sectors for the period January 2009- September 2017. To simplify our analysis, we divide the economic sectors into six main categories[12]: Agriculture & Mining, Manufacturing, Construction, Transportation & Trade, Public Services, and finally, Private Services. **Table B1** from appendix B presents employment shares of each sector using monthly and quarterly data. For example, the public services sector represents 22.33% of total employment, while private services sector represents around 36.33%, followed by the transportation and trade with 16.91%, manufacturing with 9.66%, and construction and agriculture & mining with 6.37% and 8.41 respectively[13].

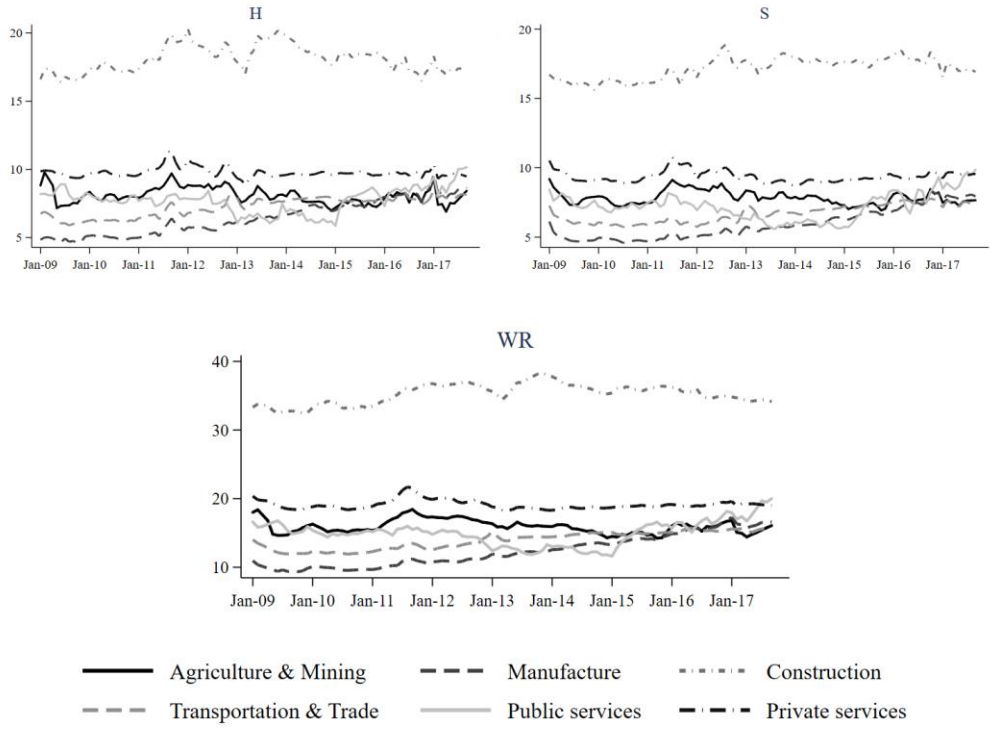
Figure 9 presents the dynamic across time of worker and job flows according to economic sectors using monthly data. Panel A presents the worker flow rate for all the six economic sectors. All sectors, except construction, tend to converge to similar levels. Comparing these dynamics across time with the quarterly data, we get the same conclusions (See Figure B, from Appendix). Panel B from **Figure 9** presents the dynamics of job flow rates across sectors, we do not find a significant difference in the job creation or job destruction rates across economic sectors, except for construction and public services at the end of the sample.

Panel B from **Table 3**, presents job and worker flows according to quarterly measures. We find that the level of job and worker flows are high compared to the levels observed with the monthly measures. For example, we found that with the quarterly measures the construction sector presents a job creation rate of 16.41% and a job destruction rate around 13.36% while the monthly job creation and job destruction rates are 10.53% and 9.58%, respectively. Likewise, the quarterly hiring and separation rates for the same sector are around 25.61% and 22.78% respectively, compared to monthly rates of around 18.10 and 17.16%, respectively.

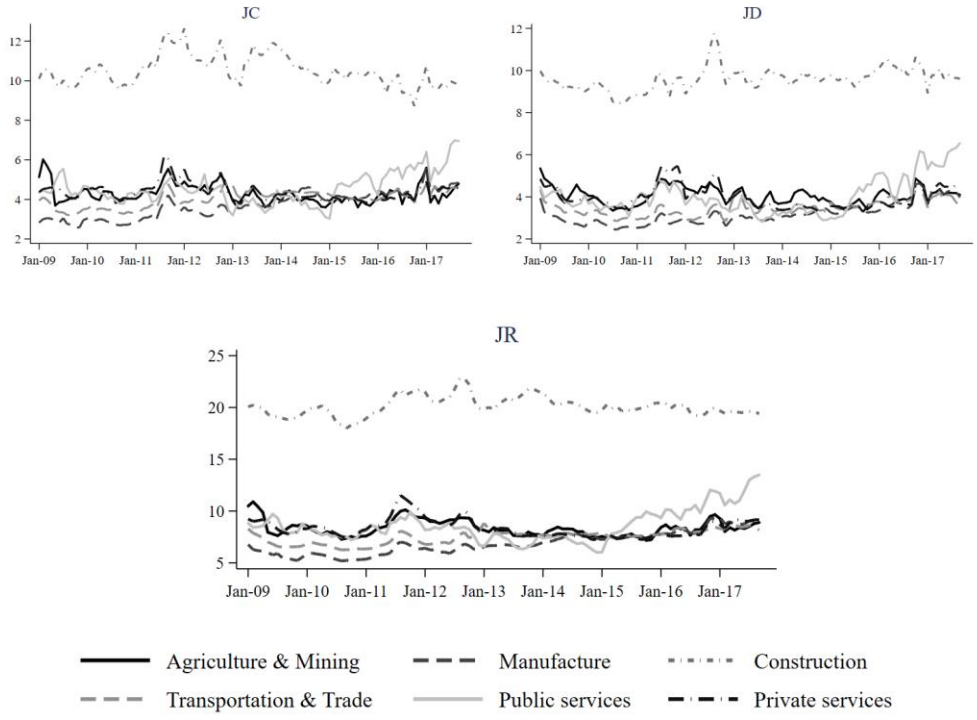
[12]To build these groups we aggregate some sectors in the following way: *Agriculture & Mining*: include Agriculture, forestry, fishing and mining; *Transportation & Trade*: include transportation, warehousing, information, trade, hotels and food; *Public Services*: include community, social and personal services, electricity, gas and water and finally, *Private Services*: include real state, rental, leasing and finance. The classification uses CIIU ("*Clasificación Industrial Internacional Uniforme"* by its initials in Spanish) known also as International Standard Industrial Classification (ISIC).

[13] Table B2 from appendix presents distribution of firms between private and public, in general 89% of firms are from private sector and represent the 86% of the employment.

Figure 9: Worker and Job flows by economic sectors (monthly data)
Panel A: ***Worker flows***



Panel B: ***Job flows***



Source: PILA, monthly measures, seasonal adjusted and moving average order three, own calculations

As previous results, the sector with the lowest job and worker flow rates is manufacturing. Similar results were found by Davis et al. (2006), when comparing worker and job flows between construction and manufacturing sector in the United States. Although the classification of sectors could be different between Colombia and U.S.A[14], Davis et al. (2006) show that "job flow rates are three times larger in construction than in manufacturing" p. 7. Moreover, Lazear and McCue (2017) remark that "manufacturing has the lowest hires and separations rates in each data source" p. 21.

Table 3: Job and worker flows by economic sectors

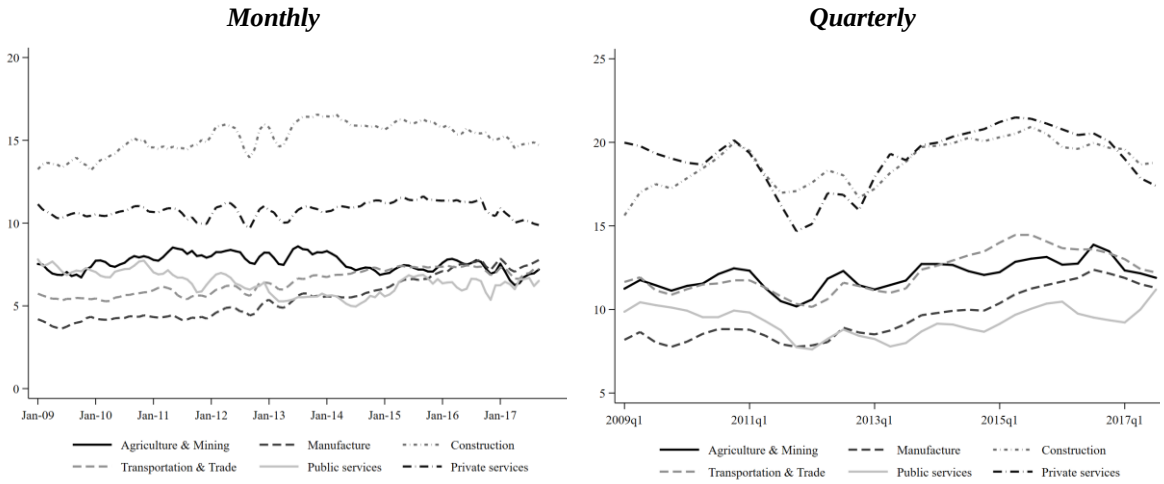
Panel A: Monthly						
	Worker flows			***Job flows***		
Sector	***H***	***S***	***WR***	***JC***	***JD***	***JR***
Agriculture & Mining	8.09	7.84	15.93	4.29	4.04	8.34
Manufacture	6.45	5.91	12.36	3.71	3.17	6.88
Construction	18.10	17.16	35.27	10.53	9.58	20.11
Transportation & Trade	7.25	6.67	13.92	4.04	3.46	7.50
Public services	7.72	7.21	14.93	4.55	4.02	8.57
Private services	9.76	9.36	19.12	4.37	3.97	8.34
All	**8.97**	**8.48**	**17.46**	**4.68**	**4.19**	**8.87**
Panel B: Quarterly						
	Worker flows			***Job flows***		
Sector	***H***	***S***	***WR***	***JC***	***JD***	***JR***
Agriculture & Mining	14.41	13.48	27.89	8.41	7.45	15.86
Manufacture	12.08	10.56	22.64	7.30	5.73	13.03
Construction	25.61	22.78	48.39	16.41	13.36	29.77
Transportation & Trade	13.82	12.13	25.95	7.74	6.02	13.76
Public services	13.69	12.09	25.78	9.03	7.41	16.44
Private services	17.74	16.63	34.38	8.24	7.11	15.35
All	**15.63**	**14.18**	**29.82**	**8.69**	**7.20**	**15.89**

Notes: Tables entries are means of monthly/quarterly values in time interval, seasonal adjusted. Source: author´s calculations

Figure 10 summarizes the behavior of worker and job flows using churning rates by sectors. As it is expected (using the monthly measures) the construction sector is the one with the highest churning rate (around 15.15% see **Table 4**), followed by private services (around 10.78%). The rest of sectors present a convergence on their churning rates at the end of 2017 (around 7%).

[14] JOLTS and LEHD sectors are based on the North American Industry Classification System (NAICS), whereas PILA sectors are based on various versions of "*Clasificación Industrial Internacional Uniforme"* (CIIU according to its initial in Spanish).

Figure 10: Churning rates (*CH*) by economic sectors



Source: PILA, seasonal adjusted and moving average order three, own calculations

Analyzing the quarterly measure, we did not find differences in churning rates between construction and private services, which implies that once we eliminate the monthly volatility, the behavior of these two sectors is very similar. Moreover, as with the monthly measures, the rest of sectors present very similar churning rates, with public services and manufacture with the lowest churning rates (Burgess et al., 2000).

Table 4 presents the measure CH/WR, even though we do not find a clear difference among sectors using monthly measures, there is still a difference using quarterly measure. The public services sector presents the lowest ratio (36%), and private services presents the highest ratio (55%). Finally, there is an important difference in the employment growth rate across sectors. The sector with the highest employment growth is construction (0.94% monthly and 3.05% quarterly), followed by transportation & trade, public and private services and manufacturing. The sector with the lowest employment growth rate is agriculture and mining (0.25% monthly and 0.97% quarterly).

3.3 Wages

In this section, we analyze labour flows across different levels of wages. Taking the wage of each employee reported by the firm, we calculate the firm´s average wage. To avoid volatility, we calculate the firm`s three year average wage as well as the average wage for

the whole period.[15]. We expect that job and worker flows change with the level of wages. Taking wages as a measure of productivity, we expect that low productivity firms might find it easier to replace workers given that the level of skills required is low. However, high productivity firms might find it difficult to replace their labour force, because the worker´s skills required is highly intensive in human capital. As a result, we expect that highly productive firms may have lower job and worker flows.

Table 4: Churning by economic sectors

Monthly

Sector	*WR*	*JR*	*CH*	*CH/WR*	*∆E/E*
Agriculture & Mining	15.93	8.34	7.60	0.48	0.25
Manufacture	12.36	6.88	5.48	0.44	0.54
Construction	35.27	20.11	15.15	0.43	0.94
Transportation & Trade	13.92	7.50	6.42	0.46	0.58
Public services	14.93	8.57	6.36	0.43	0.53
Private services	19.12	8.34	10.78	0.56	0.40
All	**17.46**	**8.87**	**8.59**	**0.49**	**0.49**

Quarterly

Sector	*WR*	*JR*	*CH*	*CH/WR*	*∆E/E*
Agriculture & Mining	27.89	15.86	12.03	0.43	0.97
Manufacture	22.64	13.03	9.61	0.42	1.57
Construction	48.39	29.77	18.62	0.38	3.05
Transportation & Trade	25.95	13.76	12.19	0.47	1.73
Public services	25.78	16.44	9.34	0.36	1.62
Private services	34.38	15.35	19.03	0.55	1.13
All	**29.82**	**15.89**	**13.93**	**0.46**	**1.48**

Notes: Tables entries are means of monthly/quarterly values in time interval, seasonal adjusted. Source: author´s calculations

To classify firms between different levels of wages, we distribute them by quartiles, based on the whole distribution of the average wage paid by firms during each month/quarter. **Table C** from appendix presents the employment shares of firms between each category. As in the previous sections, we analyze monthly and quarterly measures. Using the three-year average wage and monthly measures, we find that firms in the 1st, 2nd, 3rd and last quartile of the average wage, represent 5.52%, 13.04%, 22.24%, 59.2% of total employment. The employment distribution is similar when analyzing the quarterly measures.

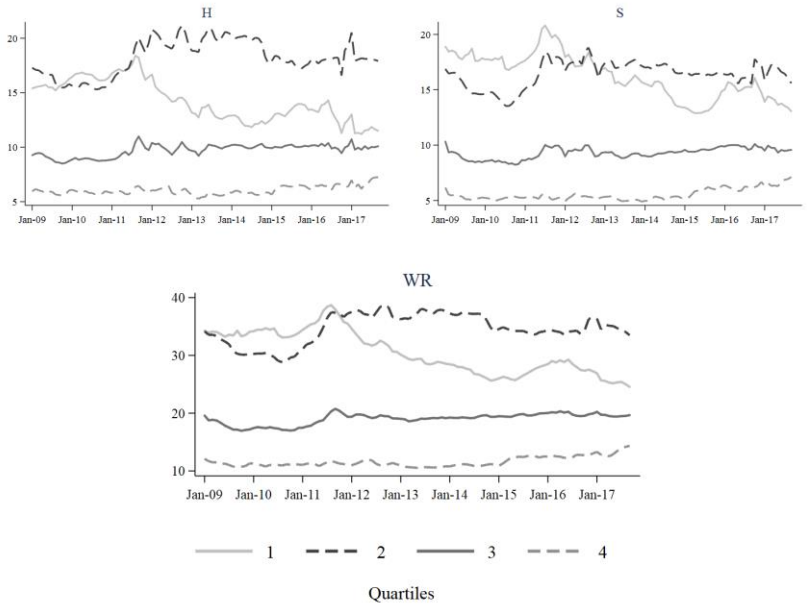
[15] The idea of using the average wage for the entire period or the average wage for at least year years, assumes that the firm´s productivity does not change in a short period.

Figure 11 presents the behavior of the monthly measures of job and worker flows across time for different quartiles. Panel A presents the dynamic of worker flows. As we observed in the previous section, there is a similar trend across time in worker flows for all firms except firms in the first quartile. Firms in the first and second quartile differ in the dynamic of workers reallocation; while these flows for the first quartile firms present a decreasing trend across time, the worker flow rates of firms in the second quartile show an increasing trend. Similar patterns are observed when comparing job flows; firms in the second, third and fourth quartile present a similar upward trend across time (see Panel B, **Figure 11**). Comparing the dynamics of labour flows using quarterly measures we get similar conclusions (see Figure C from Appendix).

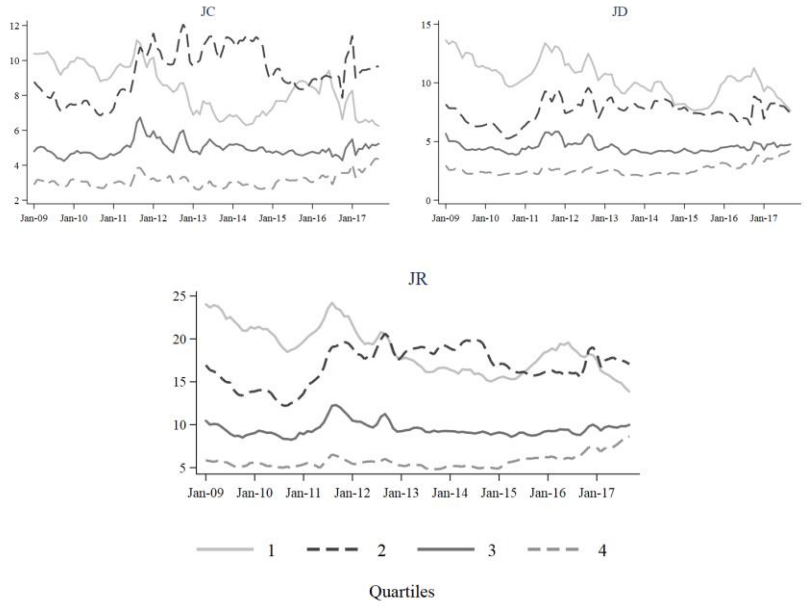
Table 5 summarizes labour flow rates by quartiles using monthly and quarterly measures. According to the monthly measures and a three-year average wage, we found that firms in the second quartile present the highest worker flows while firms in the fourth quartile present the lowest workers flows. As a result, worker reallocation (WR) is decreasing with firm´s wages. Nevertheless, these negative relations between firm´s wages and worker flows, do not apply to the first quartile firms. Similar to the monthly worker flows, job flows rates are decreasing with wages. In summary, using quarterly and monthly rates, we find that firms with low wages are the ones with highest job and worker flows, except for firms in the first quartile, while firms with high wages present the lowest worker flows.

To summarize the behavior of job and workers flows we show the dynamics of the monthly and quarterly churning rates across time (see **Figure 12).** As we expected, the lowest churning rate is present in firms with high wages (firms in the fourth quartile). Excluding firms in the first quartile, we found that churning rate is decreasing with wages. The dynamics, across time, of the churning rate of firms in the first quartile is opposite to the rest of the firms. While firms with medium and high wages present a churning rate which is increasing across time, firms in the first quartile exhibit a decreasing churning rate across time. Similar behavior is also observed when analyzing the quarterly churning rates (see **Figure 12**).

Figure 11: Worker and job flows by wages (monthly data)
Panel A: ***Worker flows***



Panel B: ***Job flows***



Source: PILA, monthly measures using average wage category, seasonally adjusted, own calculations

Table 5: Labour flows by wages 2009-2017

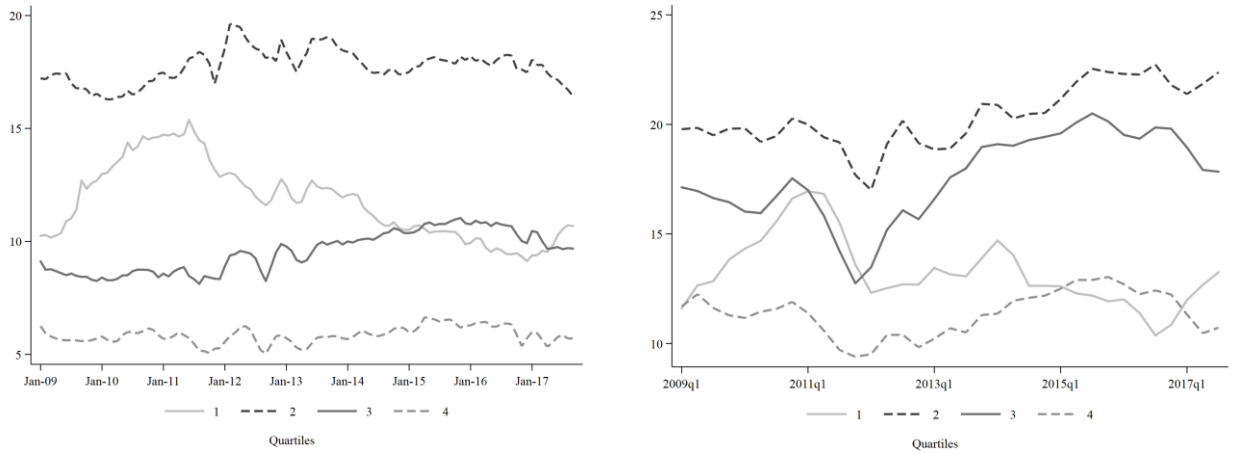
	Worker flows			*Job flows*		
Quartiles	***H***	***S***	***WR***	***JC***	***JD***	***JR***
			Monthly			
			I. Three years average wage			
1	11.14	13.27	24.41	7.46	9.59	17.06
2	19.62	17.89	37.51	10.02	8.28	18.31
3	9.97	9.60	19.56	5.04	4.66	9.70
4	6.04	5.53	11.57	3.11	2.60	5.71
All	**8.98**	**8.49**	**17.47**	**4.69**	**4.20**	**8.88**
			II. Average wage all period			
1	14.24	16.24	30.47	8.36	10.35	18.71
2	18.18	16.41	34.59	9.31	7.53	16.84
3	9.72	9.28	19.01	4.96	4.51	9.47
4	6.05	5.52	11.58	3.13	2.60	5.73
All	**8.98**	**8.49**	**17.48**	**4.69**	**4.20**	**8.89**
			Quarterly			
			I. Three years average wage			
1	17.38	21.61	38.98	12.74	16.89	29.63
2	27.64	22.84	50.48	16.84	12.05	28.89
3	17.92	16.82	34.74	9.14	8.02	17.16
4	12.17	10.76	22.93	6.45	5.04	11.49
All	**15.63**	**14.20**	**29.83**	**8.67**	**7.23**	**15.89**
			II. Average wage all period			
1	20.22	24.22	44.44	13.61	17.56	31.17
2	26.19	21.59	47.78	16.03	11.38	27.42
3	17.75	16.58	34.33	8.99	7.78	16.76
4	12.20	10.70	22.90	6.52	5.01	11.53
All	**15.63**	**14.20**	**29.83**	**8.67**	**7.22**	**15.90**

Notes: Tables entries are means of monthly/quarterly values in the time interval, seasonal adjusted. Source: author´s calculations

Table 6 summarizes the level of monthly and quarterly churning rates of firms according to wages for the whole period. Analyzing the monthly measures and the three years average wage, we found that, except for the firms in the first quartile, the highest churning rate is observed in firms in the second quartile, while, the lowest churning rate is observed for firms in the fourth quartile. However, when comparing the proportion of excess of workers flows explained by workers reallocation (*CH/WR*), we do not find a major difference in this ratio across wages, again with the exception of firms in the first quartile.

Figure 12: Churning rates by wages

Monthly ***Quarterly***



Source: PILA, monthly/quarterly measures, seasonally adjusted and moving average order three, own calculations

Finally, the relation of firms´ wage and employment growth rate is less clear (See **Table 6**). For example, there is a substantial difference between employment growth rate of firms belonging to the first quartile vs. the rest of firms. While firms in the third and fourth quartile present on average an employment growth rate of around 0.5% with monthly measures; firms in the first quartile show a negative employment growth rate. In contrast, firms in the second quartile present a positive and high employment growth rate (around 1.6% with monthly measures).

In summary, using monthly and quarterly measures, we found a negative relationship between firm´s wages and labour flows, except for firms in the first quartile. As a result, the job and worker reallocation and churning rates are also decreasing with firm´s wages. However, the relation between firm´s wage and employment growth rate is less clear. Moreover, we find surprising the difference between labour flows dynamics of firms in the first quartile and the rest of the firms. These results may be explained because firms in the first quartile are the once with a binding minimum wage, which perhaps does not reflect their optimal wage according with their productivity level.

Table 6: Churning rates by wages 2009-2017

Quartiles	*WR*	*JR*	*CH*	*CH/WR*	*∆E/E*
		I. Three years average wage			
1	24.41	17.06	7.35	0.29	-2.13
2	37.51	18.31	19.20	0.51	1.74
3	19.56	9.70	9.86	0.50	0.38
4	11.57	5.71	5.86	0.51	0.51
All	**17.47**	**8.88**	**8.59**	**0.50**	**0.49**
		II. Average wage all period			
1	30.47	18.71	11.76	0.39	-1.99
2	34.59	16.84	17.75	0.52	1.77
3	19.01	9.47	9.54	0.50	0.44
4	11.58	5.73	5.84	0.51	0.53
All	**17.48**	**8.89**	**8.59**	**0.50**	**0.49**
		Quarterly			
		I. Three years average wage			
1	38.98	29.63	9.36	0.24	-4.15
2	50.48	28.89	21.59	0.43	4.79
3	34.74	17.16	17.58	0.51	1.11
4	22.93	11.49	11.44	0.50	1.41
All	**29.83**	**15.89**	**13.94**	**0.48**	**1.44**
		II. Average wage all period			
1	44.44	31.17	13.27	0.30	-3.95
2	47.78	27.42	20.36	0.43	4.65
3	34.33	16.76	17.57	0.51	1.21
4	22.90	11.53	11.37	0.50	1.51
All	**29.83**	**15.90**	**13.94**	**0.48**	**1.45**

Notes: Tables entries are means of monthly/quarterly values in time interval, seasonal adjusted. Source: author´s calculations

3.4 Tenure

In this section, we explore the relationship between worker´s tenure across all dimensions, such as firm´s size, economic sector, and wages. The increasing labour market flows dynamics across time, such as worker reallocation are expected to affect the workers' tenure. **Table 7, Panel A,** presents the proportion of workers that belong to a firm in 2009 and remain in the same firm in 2010. This proportion decreases with the firm´s size; 77.2% of employees that belong in 2009 to a firm between 2 to 10 employees remain in the same firm in 2010, this proportion is 69.73% for firms with 11 to 19 employees, 67.25% for firms between 20

to 49 and 64.79% for firms between 100 to 500 employees. These figures are similar when comparing different years. Moreover, we observe that there is a fall in the one-year tenure for all firm´s size. This result point to a major flexibility in the Colombian labour market and might explain the increasing trend of worker flows across time.

Panel B, Table 7 presents the dynamics, across firms sizes, of the proportion of workers who belong to the firm in 2009 and continue at the same firm after *t* years. For example, on average 67.17% of the employees that in 2009 belonged to firms between 2 to 10 employees remained in the same firm after two years, 60.26% remained after three years, and finally, after eight years, we found that on average 43.38% of employees stayed in the same firm. This decreasing trend on tenure duration is similar across all firm sizes. Moreover, after eight years of tenure, we did not find a high difference across firm´s size, with exception of firms between 2 to 10 employees. These results imply that the long tenure duration does not depend on the size of the firm, supporting the evidence of a major flexibility in the Colombian labour market across all firm sizes.

Table 7: Tenure by average plant size

Panel A: one year tenure						
Tenure one year	**2 to 10**	**11 to 19**	**20 to 49**	**50 to 99**	**100 to 499**	**>500**
2010	77.20	69.73	67.25	65.26	64.79	67.02
2011	77.47	68.99	66.17	63.45	62.59	64.89
2012	76.32	66.75	63.15	60.71	60.30	62.37
2013	75.98	65.94	62.73	60.77	60.94	63.53
2014	75.71	65.93	63.01	60.64	61.11	64.51
2015	75.32	64.83	61.38	59.45	59.80	63.30
2016	74.89	62.91	58.51	56.84	57.44	60.39
2017	75.53	63.07	58.77	56.33	56.81	58.65
Panel B: long tenure (base year 2009)						
Years (t)	**2 to 10**	**11 to 19**	**20 to 49**	**50 to 99**	**100 to 499**	**>500**
1	77.20	69.73	67.25	65.26	64.79	67.02
2	67.17	58.82	56.30	53.60	52.23	54.51
3	60.26	51.33	48.28	46.06	44.90	46.42
4	55.41	46.12	43.39	41.35	40.70	42.50
5	51.31	42.32	40.00	38.08	37.49	39.59
6	48.11	39.53	37.24	35.34	34.61	36.73
7	45.53	36.47	34.20	32.65	31.88	33.61
8	43.38	34.58	32.36	30.61	29.78	30.63

Note. –This calculation is performed overall reporting units surviving to the date shown. For the last year we are using the average between January to September. Based on Burgess et al. (2000).

We also analyze how tenure duration changes across different economic sectors. **Table 8, Panel A** presents the difference of one-year tenure duration across economic sectors. We find that there is a big difference among sectors; for example in 2010 the construction sector presented the lowest proportion of workers that remained in the same firm after a year (56.32%), followed by sectors such as manufacture, transportation and trade, private services and agriculture with a proportion around 74.04%, and finally public services with the highest proportion (80.41%). These results are in line with the difference in labour flows among sectors, with construction being the sector with the highest churning rates and public services and manufacturing with the lowest ones. Again, we observe a decreasing trend in one-year tenure across time for all economic sectors, supporting the evidence of major labour flexibility across time.

Table 8, Panel B presents the dynamics of long tenure duration across economic sectors. We found an important difference among sectors that seem to remain after eight years. For example, the proportion of workers that belong to the same firm after eight years is around 38.45% for agriculture, 37.96% for manufacture, 29.75% for construction, 35.79% for transportation and trade, 43.93% for public services and finally 40.4% for private services. While there is a sharp difference between one, two and even three years tenure durations among sectors, after eight years these differences remain with Construction with the lowest and public services with the highest long tenure.

Finally, we analyzed how tenure duration change across different firm wages. **Table 9, Panel A** presents the tenure after one year across different quantiles. We found that there was a difference on the one year tenure across wages, with firms in the second quartile being the ones with the lowest proportion of workers that belong to the same firm after one year (69.67% in 2010), followed by firms in the third quartile (73.39% in 2010) and firms in the first and fourth quartile (with high proportions 80.29% and 76.56%, respectively). Even though there was a decreasing trend in one-year tenure for each quartile, the gap between different productivity levels remained.

Table 8: Tenure by economic sectors

Panel A: one year difference						
Tenure one year	**Agriculture & Mining**	**Manufacture**	**Construction**	**Transportation & Trade**	**Public services**	**Private services**
2010	74.70	74.04	56.32	73.83	80.41	76.61
2011	73.85	73.86	55.79	73.81	79.81	76.52
2012	72.55	72.29	53.21	72.45	77.61	74.94
2013	72.40	71.42	51.48	71.37	78.53	75.25
2014	72.18	71.29	52.01	70.72	78.46	74.76
2015	72.25	70.57	51.34	69.98	78.22	74.42
2016	70.82	70.03	50.78	69.20	75.95	74.04
2017	71.07	69.67	51.32	69.32	76.80	74.16
Panel B: Long tenure (base year 2009)						
Years	**Agriculture & Mining**	**Manufacture**	**Construction**	**Transportation & Trade**	**Public services**	**Private services**
1	74.70	74.04	56.32	73.83	80.41	76.61
2	63.52	63.12	46.81	62.37	70.60	66.19
3	56.25	55.73	41.15	54.56	62.78	58.89
4	51.33	50.70	37.70	48.85	57.58	54.11
5	47.03	46.74	35.26	44.60	53.19	49.29
6	43.82	43.29	33.26	41.20	49.70	45.76
7	40.89	40.38	31.23	38.20	46.29	42.88
8	38.45	37.96	29.75	35.79	43.93	40.40

Note. –This calculation is performed overall reporting units surviving to the date shown. For the last year, we are using the average between January to September. Based on Burgess et al. (2000).

Panel B, from **Table 9** presents the dynamics of long tenure duration across different firm wages. Again, we found a substantial gap among wages, however, after eight years these gaps disappear. For firms in the first quartile, the proportion of workers that belong to the same firm after eight years is 43.21%, for firms in the second quartile this percentage is 34.54% for firms in the third quartile is 38.58% and finally for firms in the fourth quartile is 39.06%.

In summary, we found that there was an important difference in the one-year tenure across different dimensions such as firm´s size, economic sectors, and wages that persist over time. However, comparing the long tenure duration, we did not find a substantial difference across any dimension. Thus, after eight years, around 30%-40% of workers remain in the same firm,

with some exceptions such as firms between 2 to 10 employees (43.38%), public services (43.93%) and firms in the first quartile (43.21%)[16].

Table 9: Tenure by three years average wage

Panel A: one year difference				
Tenure one year	**1**	**2**	**3**	**4**
2010	80.29	69.67	73.39	76.56
2011	80.09	70.52	73.03	76.33
2012	78.04	66.53	71.60	74.23
2013	77.41	64.82	71.22	74.62
2014	76.78	62.97	71.13	74.62
2015	76.83	65.84	70.54	74.32
2016	73.18	65.53	69.91	73.40
2017	72.41	64.39	69.99	74.21
Panel B: Long tenure (base year 2009)				
Years	**1**	**2**	**3**	**4**
1	80.29	69.67	73.39	76.56
2	71.11	59.34	62.62	65.60
3	63.39	50.59	55.60	57.26
4	58.35	45.05	50.73	51.88
5	53.28	40.83	46.75	47.74
6	49.33	41.55	43.66	44.31
7	45.66	38.45	40.92	41.37
8	43.21	34.54	38.58	39.06

Note. –This calculation is performed overall reporting units surviving to the date shown. For the last year we are using the average between January to September. Based on Burgess et al. (2000).

4. Linear regression estimation results

To explore partial correlations between labour market fluidity and some firm characteristics, such as plant size and wages, we conduct regression analysis. Regressions complement the previous sections analysis because they allow us to obtain a measure of the correlation between firm characteristics and fluidity measures controlling for other covariates, time effects, seasonal fixed effects, and firm fixed effects. Taking advantage of our data, we estimated panel fixed effects regression using firm´s data. Therefore, we have confidence

[16] We also calculate these tenure measures using the quarterly data, and found similar results. This information is available upon request.

that our coefficients are not biased by the correlation of time invariant unobserved characteristics of the firm with the regressions covariates. The estimated equations are of the form:

$$f_{jt} = \alpha + \boldsymbol{x'_{jt}}\beta + \gamma_j + Y_{jt} + q_{jt} + \epsilon_{jt} \qquad (1)$$

The dependent variable f_{jt} represents the fluidity measure considered in this paper: worker reallocation, job reallocation, and churning rates. In addition, we estimated regressions with the net employment growth rate as the dependent variable. All variables in the regression are generated on a monthly basis at the firm level. The vector $\boldsymbol{x_{jt}}$ contains firm characteristics such as firm size and average wages, γ_j is a firm-specific fixed effect, Y_{jt} stands for a year fixed effect, and q_{jt} represents the fixed quarter effect. In addition, ϵ_{jt} is an error term with a mean zero and constant variance. The standard errors are clustered by firms.

To be able to eliminate the firm-specific permanent unobserved heterogeneity, we estimate the model using traditional panel data methods utilizing a within transformation. The estimation is conducted over the monthly panel; monthly data, as presented in Figure 1, represents well the Colombian formal labor market [17]. We divide the sample to analyze the heterogeneity of the effects of firm size and wage by economic sectors; nevertheless, we report the estimation results with the whole sample as well. For easiness in the interpretation of the coefficients, the dependent variable f_{jt} and all variables in vector $\boldsymbol{x_{jt}}$ are standardized; therefore, marginal effects are interpreted as changes of f_{jt}, expressed in terms of standard deviations, as a result of an increment in one standard deviation of the independent variable.

Tables **10** and **11** show the results of the estimation of equation (1); the results for job and worker reallocation rates are presented in Table 10, and the ones for churning and net employment growth rates are presented in Table 11. The regressions results for job/worker reallocation and churning rates support the patterns outlined in the previous sections; after we control for different covariates and the unobserved firm-specific fixed effects, we still found a negative and significant correlation between firm's size and worker/job reallocation rates. This was true for estimations with the whole sample and all particular sector

[17] Results from the quarterly panel are very similar to the ones using the monthly panel we show in this section.

subsamples. Furthermore, the churning rate presents a positive and significant relationship with the plant's size, which is consistent with the evidence from the un-conditional means analysis, presented in Table 2. This evidence is similar to that found by Burgess et al. (2000) for US, who found that big plants have higher churning rates because larger firms are constantly reevaluating the value of their match, improving the quality of their workforce or reconfiguring their skill mix. The negative (positive) effect of firm size on worker and job reallocation (churning) is not linear since the quadratic term is positive (negative) and significant, then the magnitude of the effect diminishes with size.

The magnitude of the effect of the firm´s size on labour market fluidity is not negligible; for the average size (standardized variable equal to zero) worker and job reallocation rates decrease 0.10 and 0.15 standard deviations, respectively, per standard deviation of increment in firm size. The effect of size on fluidity rates is not linear; it decreases in absolute value with the firm size, and switches sign for firms greater than the mean by around 1.8 for WR and 1.9 for JR standard deviations[18]. In the case of the churning rate, it increases 0.11 standard deviations, per standard deviation of increment in firm size. This effect also shows a nonlinear form with respect to firm size and it switches sign for very big firms (mean plus 2.1 standard deviations).

The effect of size on net employment growth rate is positive but nonlinear as in previous cases; therefore, the magnitude of this effect diminishes with firm size. For the average size, net growth rate increase 0.19 standard deviations per standard deviation of increment in firm size. As before, for big firms, the effect of size on net growth rate ends up being negative for big firms (mean plus 1.9 standard deviations). This evidence is somewhat consistent with what we observe (monthly data) in Table 2, in which the growth rate increases within the first three categories of average plant size and then decreases rapidly for the remaining categories.

The average wage has a significant negative and nonlinear effect on all fluidity rates; nevertheless, the magnitude of this effect is smaller in comparison with the effect of firm´s

[18] The number when there is a switches sign is calculated following (Wooldridge, 2009), pag. 193. The formula is $x^* = \left|\widehat{\beta_1}/(2\widehat{\beta_2})\right|$ where the coefficient associated to the variable in its linear form is β_1 and β_2 is associated to the variable in its quadratic form.

size. For the average wage firm, an increment in one standard deviation in average wages is associated with a reduction on fluidity rates of between 0.05 for WR and 0.06 for JR. The effect of mean wage is also negative on the net growth rate, but its magnitudes for the average wage firm is even smaller (0.019 standard deviations), and it switches sign very quickly as firm´s wage increases. These estimation results are consistent with the evidence presented in Table 6, where worker and job reallocation rates decrease for higher categories of average wages, and in the case of churning, they decrease for higher categories of average wages, with the exception of the lowest category.

Estimations include the unemployment rate of each city to control for the economic cycle. We found a negative and significant coefficient of the unemployment rate in the regressions for churning and net employment growth rate; this suggests a pro-cyclical behavior of these flows, which is consistent with results found by Morales and Medina (2016) for the case of Colombia. In addition, we find a positive and significant relationship between the percentage of the payroll under 25 years old and churning and net employment growth rate. This supports the hypothesis presented by Shimer (2001), who finds a positive effect on employment of the share of youths in the working age population as firms will find that creating jobs in younger labor markets is more profitable (Morales & Medina, 2016).

Tables **10** and **11** present regression results according to economic sector subsamples. In general, results in each subsample are similar to the ones in the overall sample for all outcomes. Nevertheless, the elasticities of employment to all outcomes are usually higher for manufacturing, construction and transportation and trade. For instance, the effect of firm size on churning, job reallocation, and employment growth is nearly twice as much the overall effect. In the case of the average wage, the effects are much more homogenous across different sectors.

The low within R squared suggests that the within transformation of the dummy variables such as firm´s size and quartile wages, and the local unemployment rate, explains little of the variation in labour market flows. As noticed by Burgess et al. (2000), the idiosyncratic unobserved firm-specific fixed effect is very important to explain labour flows. These results are explained by the authors as a consequence of particular recruiting policy that is persistent

and sustainable across time. These results raise interesting questions about optimal recruiting decisions that are beyond the scope of this paper.

5. Final remarks

This paper explored the behavior of different labour market flows in Colombia. From the firm´s point of view we focused on job creation and job destruction; and from the worker´s point of view, we focused on hiring and separations. Using administrative data (PILA), we found that labour market flows in Colombia are similar to those in USA, (Burgess et al., 2000; Davis et al., 2012; Lazear & McCue, 2017). In Colombia as in has been reported for many developed economies, churning rates are positive in all the spectrum of possible employment growth rates. In other words, shrinking firms also present a positive hiring rate and expanding firms present positive separation rates.

We make a comparison of reallocation and churning rates, on a quarterly basis, between a developing country like Colombia, and the US. Regarding worker flows rates, we find that during the period between 2009 and 2017, worker reallocation rates are very similar in both economies (trend and levels); however, the volatility in the Colombian measures is stronger than in the USA. Regarding the job flows, we find that creation and destruction rates are, in average, around twice as much their counterparts in the US. Since both economies present similar worker flows, but job flows are higher in the Colombian case, the churning rates registered for the US labor market are near twice the Colombian ones, for the period of study. In both cases, churning rates present an upward trend, especially after 2012. These differences in job and churning flows between the two economies reflect the fact that many of the hires and separations in the Colombian economy are explained by creation or destruction of jobs. Colombian labor market seems to be more unstable for firms, in the sense that firms born, shrink and die more intensively. Nevertheless, US labor market present higher, worker flow rates than Colombian labor market; this means that the excess of worker's movements in reference to job movements is higher in the US. This is consistent with a more stable environment for firms, with flexible labor market where workers move from existing position in a more frequent fashion.

Table 10: Regresions Results of Estimation with Firms Data

Variable	Worker Reallocation							Job Reallocation						
	Overall	A&M	Manufacture	Construction	T&T	Public S	Private S	Overall	A&M	Manufacture	Construction	T&T	Public S	Private S
Employment	-0.094***	-0.104***	-0.298***	-0.133***	-0.218***	-0.132***	-0.087***	-0.146***	-0.156***	-0.379***	-0.262***	-0.301***	-0.183***	-0.130***
	(0.005)	(0.009)	(0.035)	(0.012)	(0.031)	(0.023)	(0.005)	(0.008)	(0.011)	(0.042)	(0.022)	(0.042)	(0.028)	(0.007)
$Employment^2$	0.026***	0.031***	0.125***	0.059***	0.092***	0.056**	0.023***	0.038***	0.046***	0.156***	0.113***	0.125***	0.072***	0.033***
	(0.007)	(0.009)	(0.032)	(0.016)	(0.030)	(0.022)	(0.007)	(0.010)	(0.012)	(0.039)	(0.029)	(0.041)	(0.027)	(0.010)
Wages	-0.049***	-0.043***	-0.059***	-0.057***	-0.056***	-0.053***	-0.052***	-0.043***	-0.038***	-0.052***	-0.045***	-0.048***	-0.050***	-0.046***
	(0.002)	(0.007)	(0.005)	(0.006)	(0.004)	(0.004)	(0.003)	(0.002)	(0.007)	(0.005)	(0.006)	(0.004)	(0.004)	(0.003)
$Wages^2$	0.031***	0.027***	0.033***	0.035***	0.031***	0.036***	0.031***	0.028***	0.026***	0.030***	0.029***	0.028***	0.034***	0.029***
	(0.002)	(0.007)	(0.005)	(0.007)	(0.005)	(0.004)	(0.003)	(0.002)	(0.007)	(0.005)	(0.006)	(0.004)	(0.003)	(0.003)
Unemployment Rate	0.020***	0.039***	0.004	0.003	0.012***	0.042***	0.027***	0.023***	0.042***	0.005	-0.002	0.015***	0.044***	0.032***
	(0.002)	(0.007)	(0.006)	(0.007)	(0.004)	(0.005)	(0.003)	(0.002)	(0.007)	(0.006)	(0.007)	(0.004)	(0.004)	(0.003)
$Unemployment\ Rate^2$	-0.019***	-0.033***	-0.006	-0.006	-0.012***	-0.040***	-0.025***	-0.020***	-0.034***	-0.007	0.001	-0.013***	-0.040***	-0.029***
	(0.002)	(0.007)	(0.006)	(0.007)	(0.004)	(0.004)	(0.003)	(0.002)	(0.006)	(0.006)	(0.007)	(0.004)	(0.004)	(0.003)
Percentage of Men in the Payroll	-0.138***	-0.154***	-0.172***	-0.054***	-0.147***	-0.128***	-0.130***	-0.160***	-0.191***	-0.194***	-0.100***	-0.167***	-0.141***	-0.152***
	(0.002)	(0.009)	(0.007)	(0.006)	(0.004)	(0.005)	(0.003)	(0.002)	(0.009)	(0.007)	(0.006)	(0.005)	(0.005)	(0.003)
$Percentage\ of\ Men\ in\ the\ Payroll^2$	0.156***	0.143***	0.167***	0.119***	0.158***	0.151***	0.150***	0.168***	0.171***	0.187***	0.147***	0.175***	0.161***	0.162***
	(0.002)	(0.008)	(0.007)	(0.006)	(0.004)	(0.005)	(0.003)	(0.002)	(0.008)	(0.007)	(0.006)	(0.004)	(0.005)	(0.003)
Percentage of Employees under 25 years	0.001	-0.008***	-0.001	0.021***	0.002	0.004*	0.002	-0.041***	-0.046***	-0.034***	-0.057***	-0.030***	-0.025***	-0.036***
	(0.001)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.001)	(0.001)	(0.003)	(0.004)	(0.004)	(0.003)	(0.003)	(0.001)
Percentage of Employees under 25 $years^2$	0.030***	0.041***	0.037***	0.005*	0.033***	0.029***	0.027***	0.062***	0.069***	0.059***	0.069***	0.054***	0.050***	0.056***
	(0.001)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.001)	(0.003)	(0.004)	(0.004)	(0.003)	(0.003)	(0.002)
Constant	-0.153***	-0.198***	-0.193***	-0.142***	-0.192***	-0.105***	-0.153***	-0.147***	-0.192***	-0.167***	-0.131***	-0.184***	-0.101***	-0.151***
	(0.001)	(0.004)	(0.004)	(0.005)	(0.003)	(0.003)	(0.002)	(0.001)	(0.004)	(0.004)	(0.005)	(0.003)	(0.003)	(0.002)
Observations	30684541	2356509	2863931	2210185	6936638	5607667	10577181	30684541	2356509	2863931	2210185	6936638	5607667	10577181
R-squared within	0.007	0.008	0.015	0.009	0.010	0.010	0.006	0.009	0.010	0.017	0.020	0.013	0.011	0.008

Notes:

Standard error in parentheses. * p<10 **p<0.05 ***p<0.01. All Robust standard error are clustered by firms. A&M stands for Agricultue and Mining, T&T stand for technology and Trade, Public and Private S, stands for public and private services. Employment corresponds to the number of employees of a firm in a given month. Wages correspond to the mean wage paid by the firm in given month. All regressions include month and year fixed effects, but coefficients are not reported for the sake of shortness.

Table 11: Regresions Results of Estimation with Firms Data

Variable	Churning Rate							Net employment Growth Rate						
	Overall	A&M	Manufacture	Construction	T&T	Public S	Private S	Overall	A&M	Manufacture	Construction	T&T	Public S	Private S
Employment	0.115***	0.112***	0.153***	0.222***	0.171***	0.119***	0.103***	0.187***	0.193***	0.421***	0.356***	0.373***	0.242***	0.159***
	(0.005)	(0.007)	(0.014)	(0.018)	(0.022)	(0.011)	(0.005)	(0.010)	(0.013)	(0.047)	(0.033)	(0.056)	(0.035)	(0.008)
$Employment^2$	-0.027***	-0.029***	-0.058***	-0.092***	-0.066***	-0.035***	-0.024***	-0.048***	-0.054***	-0.174***	-0.159***	-0.155***	-0.091***	-0.039***
	(0.007)	(0.006)	(0.012)	(0.023)	(0.022)	(0.010)	(0.006)	(0.013)	(0.014)	(0.044)	(0.043)	(0.054)	(0.035)	(0.012)
Wages	-0.027***	-0.020***	-0.030***	-0.034***	-0.032***	-0.019***	-0.026***	0.019***	0.010**	0.019***	0.029***	0.013***	0.030***	0.024***
	(0.001)	(0.004)	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)	(0.001)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.002)
$Wages^2$	0.013***	0.008***	0.014***	0.018***	0.013***	0.011***	0.012***	-0.009***	-0.008**	-0.008***	-0.013***	-0.004***	-0.014***	-0.012***
	(0.001)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)	(0.001)	(0.001)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.001)
Unemployment Rate	-0.003	-0.001	-0.002	0.010	-0.007*	0.003	-0.007*	-0.018***	0.002	0.008	0.023***	-0.003	-0.034***	-0.039***
	(0.002)	(0.007)	(0.006)	(0.008)	(0.004)	(0.005)	(0.004)	(0.002)	(0.006)	(0.006)	(0.007)	(0.004)	(0.004)	(0.003)
$Unemployment\ Rate^2$	-0.001	-0.005	-0.000	-0.015*	-0.000	-0.007	0.006	0.007***	-0.017***	-0.005	-0.026***	-0.005	0.020***	0.024***
	(0.002)	(0.007)	(0.006)	(0.008)	(0.004)	(0.004)	(0.004)	(0.002)	(0.006)	(0.005)	(0.007)	(0.003)	(0.003)	(0.003)
Percentage of Men in the Payroll	0.030***	0.062***	0.024***	0.078***	0.023***	0.013**	0.035***	0.112***	0.153***	0.134***	0.084***	0.130***	0.114***	0.107***
	(0.002)	(0.009)	(0.007)	(0.006)	(0.004)	(0.005)	(0.003)	(0.002)	(0.008)	(0.007)	(0.006)	(0.005)	(0.005)	(0.003)
$Percentage\ of\ Men\ in\ the\ Payroll^2$	0.001	-0.043***	-0.019***	-0.030***	-0.013***	0.001	-0.006*	-0.091***	-0.128***	-0.121***	-0.064***	-0.125***	-0.119***	-0.089***
	(0.002)	(0.008)	(0.006)	(0.006)	(0.004)	(0.005)	(0.003)	(0.002)	(0.007)	(0.006)	(0.006)	(0.004)	(0.004)	(0.003)
Percentage of Employees under 25 years	0.108***	0.095***	0.087***	0.154***	0.082***	0.085***	0.105***	0.122***	0.123***	0.108***	0.162***	0.093***	0.101***	0.114***
	(0.001)	(0.003)	(0.003)	(0.004)	(0.002)	(0.002)	(0.002)	(0.001)	(0.003)	(0.004)	(0.005)	(0.004)	(0.003)	(0.001)
$Percentage\ of\ Employees\ under\ 25\ years^2$	-0.076***	-0.063***	-0.051***	-0.124***	-0.047***	-0.052***	-0.075***	-0.092***	-0.098***	-0.078***	-0.134***	-0.064***	-0.078***	-0.085***
	(0.001)	(0.004)	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)	(0.001)	(0.003)	(0.004)	(0.005)	(0.003)	(0.003)	(0.002)
Constant	-0.048***	-0.054***	-0.105***	-0.050***	-0.057***	-0.031***	-0.034***	0.190***	0.227***	0.166***	0.191***	0.228***	0.140***	0.244***
	(0.001)	(0.004)	(0.004)	(0.005)	(0.002)	(0.003)	(0.002)	(0.001)	(0.004)	(0.004)	(0.005)	(0.003)	(0.003)	(0.002)
Observations	30684541	2356509	2863931	2210185	6936638	5607667	10577181	30488741	2338994	2848312	2201931	6891960	5569963	10508559
R-squared within	0.006	0.006	0.006	0.020	0.005	0.005	0.005	0.015	0.016	0.022	0.039	0.020	0.016	0.014

Notes:

Standard error in parentheses. * p<10 **p<0.05 ***p<0.01. All Robust standard error are clustered by firms. A&M stands for Agriculture and Mining, T&T stand for technology and Trade, Public and Private S, stands for public and private services. Employment corresponds to the number of employees of a firm in a given month. Wages correspond to the mean wage paid by the firm in given month. All regressions include month and year fixed effects, but coefficients are not reported for the sake of shortness.

We compared the labour market dynamics using quarterly measures and monthly measures. The differences between monthly and quarterly measures are in line with what is found in the case of US, but they are less pronounced. We find that the quarterly measures are 1.7 times the monthly measure. Davis et al. (2006) for the United States, find that the quarterly flows rates are in average 2.6 times the monthly ones. These differences are smaller in Colombia because of short spells jobs (less than 3 months), which are ignored in the quarter measures, are much more important in the Colombian labor market. Nevertheless, the main conclusions over the dynamics of the Colombian labour market flows are virtually the same regardless of the time aggregation frame (monthly or quarterly).

Using the unconditional means analysis, we found evidence in favor of Birch (1981) findings that shows that small firms present a high job and worker flows; furthermore, they are the ones with a higher employment growth rates compared to the larger firms. Using the average plant´s size with monthly data, we find that growth rates fall with the size of the firm, for firms with more than 50 employees. Moreover, we found that for larger firms more than 50% of workers reallocation corresponds to churning, while for small firms this proportion is less than 30%. These results are similar to Burgess et al. (2000), which found that bigger firms are constantly reevaluating the value of their match, improving the quality of their workforce or reconfiguring their skill mix.

By economic sectors, we found that construction is the sector with the highest labour flows and manufacture with the lowest (similar results were found by Burgess et al. (2000) and Davis et al. (2006)); and by wages, we found a negative relationship between firm´s wages and labour flows, with the exception of firms in the first quartile (lowest wage). As a result, the job and worker reallocation and churning rates are also decreasing with firm´s wage. However, the relation of firm´s wage and employment growth rate is less clear.

The perspective on labour market flows is complemented with a short brief of the tenure across all dimensions such as firm´s size, economic sectors and wages. We found that it is an important difference in the one-year tenure across those dimensions. However, comparing the long tenure duration (8 years), we did not find a substantial difference across any dimension. Then after seven years, around 30%-40% of workers remain in the same firms, independently of the firm size, economic sector or the firm`s wage with the exception of

firms between 2 to 10 employees (43.38%), public services (43.93%) and firms in the first quartile (43.21%) .

We used a panel fixed effect estimation, to confirm or contrast some of the previous results found using unconditional means. We confirm the negatives effect of firm´s size and average wages on reallocation rates (worker and job). Regarding the effect of firm´s size on the employment growth rate, the regression analysis we found that for small and medium firms there is a positive effect of size on the growth rate, but this effect became negative for firms 1.9 standard deviations greater than the mean. As reported by Burgess et al. (2000), the idiosyncratic unobserved firm-specific fixed effects are very important to explain the labour flows. These results are explained by the authors as a consequence of particular recruiting policy that is persistent and sustainable across time. Then, further research is required to analyze the optimal recruiting decisions of firms that explain the idiosyncratic effect of the labour flows.

References

Abowd, J. M., & Vilhuber, L. (2011). National estimates of gross employment and job flows from the Quarterly Workforce Indicators with demographic and industry detail. *Journal of Econometrics*, *161*(1), 82–99.

Anyadike, D. M., Bonner, K., & Hart, M. (2011). *Job Creation and Destruction in the UK. Economics & Strategy Group, Aston University*.

Baldwin, J., & Picot, G. (1995). Employment generation by small producers in the Canadian manufacturing sector. *Small Business Economics*, *7*(4), 317–331.

Barnes, M., & Haskel, J. (2002). *Job Creation, Job Destruction and the Contribution of Small Businesses: Evidence for UK Manufacturing* (U of London Queen Mary Economics No. 461).

Birch, D. L. (1981). Who creates jobs? *The Public Interest*, *65*(3), 3–14.

Broersma, L., & Gautier, P. (1997). Job Creation and Job Destruction by Small Firms: An Empirical Investigation for the Dutch Manufacturing Sector. *Small Business Economics*, *9*(3), 211–224.

Burgess, S., Lane, J., & Stevens, D. (2000). Job Flows, Worker Flows, and Churning. *Journal of Labor Economics*, *18*(3), 473–502.

Burgess, S., Lane, J., & Stevens, D. (2001). Churning dynamics: an analysis of hires and separations at the employer level. *Labour Economics*, *8*(1), 1–14.

Davis, S., Faberman, R. J., & Haltiwanger, J. (2006). The Flow Approach to Labor Markets: New Data Sources and Micro–Macro Links. *Journal of Economic Perspectives*, *20*(3), 3–26.

Davis, S., Faberman, R. J., & Haltiwanger, J. (2012). Labor market flows in the cross section and over time. *Journal of Monetary Economics*, *59*(1), 1–18.

Davis, S., Faberman, R. J., Haltiwanger, J., & Rucker, I. (2010). *Adjusted Estimates of Worker Flows and Job Openings in JOLTS* (NBER No. 14137). Cambridge, MA.

Davis, S., & Haltiwanger, J. (1992). Gross Job Creation, Gross Job Destruction, and Employment Reallocation. *The Quarterly Journal of Economics*, *107*(3), 819–863.

Davis, S., & Haltiwanger, J. (2014). *Labor Market Fluidity and Economic Performance* (NBER No.

20479). Cambridge, MA.

Davis, S. J., & Haltiwanger, J. (1999). Handbook of Labor Economics. In *Handbook of Labor Economics* (Vol. 3, pp. 2711–2805). Elsevier.

Davis, S. J., Haltiwanger, J. C., & Schuh, S. (1996a). *Job creation and destruction*. MIT Press.

Davis, S. J., Haltiwanger, J., & Schuh, S. (1996b). Small business and job creation: Dissecting the myth and reassessing the facts. *Small Business Economics*, *8*(4), 297–315.

Fuchs, M., & Weyh, A. (2010). The determinants of job creation and destruction: plant-level evidence for Eastern and Western Germany. *Empirica*, *37*(4), 425–444.

González, J. (2006). On the Benefits and Costs of Job Reallocation in Colombia. *Desarrollo y Sociedad*, *57*, 123–162.

Haltiwanger, J., Kugler, A., Kugler, M., Micco, A., & Pagés, C. (2004). Effects of tariffs and real exchange rates on job reallocation: evidence from Latin America. *The Journal of Policy Reform*, *7*(4), 191–208.

Haltiwanger, J., & Vodopivec, M. (2002). Worker Flows, Job Flows and Firm Wage Policies: An Analysis of Estonia. *Labour Economics*, (9), 601–630.

Haltiwanger, J., & Vodopivec, M. (2003). Worker flows, job flows and firm wage policies. *The Economics of Transition*, *11*(2), 253–290.

Hamermesh, D., Hassink, W., & van Ours, J. (1996). Job Turnover and Labor Turnover: A Taxonomy of Employment Dynamics. *Annales d'Économie et de Statistique*, *42*(41/42), 21–40.

Laing, D. (2011). *Labor economics : introduction to classic and the new labor economics*. W.W. Norton & Co.

Lane, J., Stevens, D., & Burgess, S. (1996). Worker and job flows. *Economics Letters*, *51*(1), 109–113.

Lazear, E., & McCue, K. (2017). *Hires and Separations in Equilibrium* (NBER No. 23059). Cambridge, MA.

Melo, L., & Ballesteros, C. (2014). Impacto de los factores externos sobre la creación y destrucción

de empleo en el sector manufacturero colombiano. *Lecturas de Economía*, (81), 155–186.

Melo, L. y Ballesteros, C. (2013). Creación, destrucción y reasignación del empleo en el sector manufacturero colombiano. *Revista de Economía Institucional.*, *15*(28), 281–311.

Morales, L., & Medina, D. (2016). Labor Fluidity and Performance of Labor Outcomes in Colombia: Evidence from Employer-Employee Linked Panel. *Borradores de Economía*, (926).

Neumark, D., Wall, B., & Zhang, J. (2008). *Do Small Businesses Create More Jobs? New Evidence from the National Establishment Time Series* (NBER No. 13818). Cambridge, MA.

Núñez, J. (2012). *Pobreza, empleo y movilidad social: Evidencia e interpretación de los problemas sociales en Colombia*. Pontificia Universidad Javeriana, Bogotá, Colombia.

Rivas, G. (2000). Dinámica del empleo industrial en Colombia 1977-1999. *Cuadernos PNUD-Ministerio de La Protección Social*, (4).

Shimer, R. (2001). The Impact of Young Workers on the Aggregate Labor Market. *The Quarterly Journal of Economics*, *116*(3), 969–1007.

Van Stel, A., & Storey, D. (2004). The Link between Firm Births and Job Creation: Is there a Upas Tree Effect? *Regional Studies*, *38*(8), 893–909.

Wagner, J. (1995). Firm size and job creation in Germany. *Small Business Economics*, *7*(6), 469–474.

Wengel, J. Ter. (2006). Creación y Destrucción del Empleo en la Industria Colombiana. *Revista de La Información Básica*, *1*(2), 1–18.

Wooldridge, J. (2009). *Introducción a la econometría. Un enfoque moderno.* (Cengage Learning, Ed.) (4th ed.).

Appendix A: Firms size

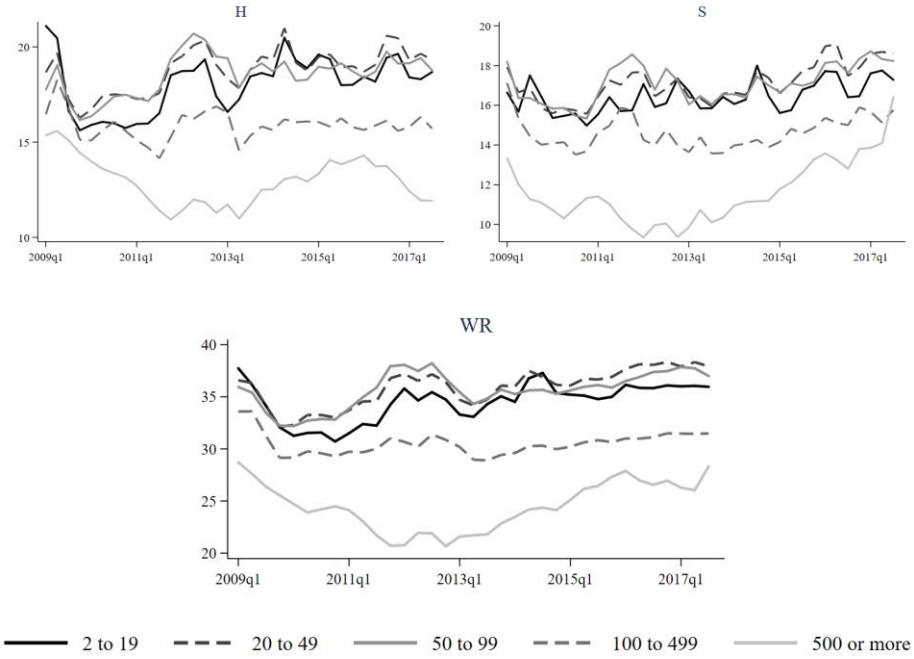
Table A: *Shares*

Monthly

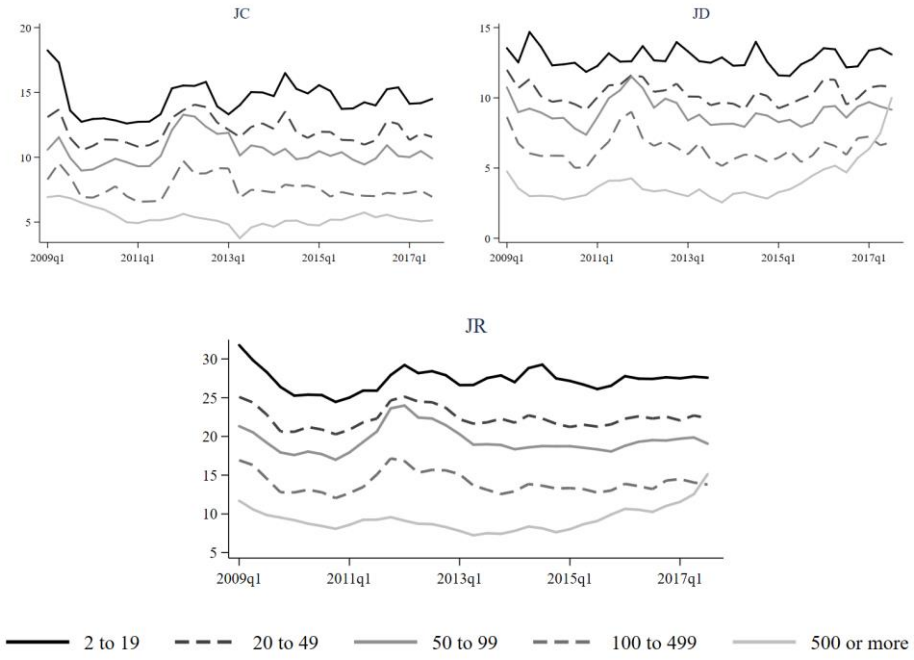
Number of Employees	*H*	*S*	*JC*	*JD*	*Employment*	*Firms*
			I. Current plant size			
2 to 10	11.61	10.99	18.81	18.64	10.92	73.35
11 to 19	6.76	6.72	9.29	9.6	5.92	11.09
20 to 49	12.49	12.41	14.97	15.2	10.17	8.88
50 to 99	10.17	10.26	10.43	10.65	8.28	3.14
100 to 499	24.08	24.67	20.54	21.18	22.15	2.84
500 or more	34.89	34.95	25.96	24.73	42.56	0.69
			II. Annual average plant size			
2 to 10	12.34	10.38	20.00	17.07	11.00	72.62
11 to 19	7.36	7.09	9.96	9.77	6.23	11.70
20 to 49	13.09	13.04	15.41	15.65	10.44	9.08
50 to 99	10.15	10.31	10.21	10.55	8.34	3.13
100 to 499	23.38	24.4	19.76	21.34	22.07	2.81
500 or more	33.68	34.78	24.65	25.62	41.92	0.67
			III. Average plant size			
2 to 10	10.68	10.61	16.89	17.52	10.24	67.81
11 to 19	7.79	7.87	10.40	10.91	6.55	13.90
20 to 49	13.69	13.81	15.91	16.46	10.79	10.62
50 to 99	10.89	11.01	10.86	11.10	8.68	3.67
100 to 499	24.25	24.57	20.78	20.99	22.59	3.26
500 or more	32.71	32.12	25.16	23.02	41.14	0.75
			Quarterly			
			I. Current plant size			
2 to 10	13.98	13.71	21.51	22.73	11.20	74.03
11 to 19	7.10	7.10	9.36	9.92	5.87	10.89
20 to 49	11.89	11.86	13.94	14.42	9.84	8.51
50 to 99	9.48	9.52	9.83	10.02	8.09	3.03
100 to 499	22.40	22.80	19.45	19.66	22.40	2.84
500 or more	35.14	35.01	25.92	23.25	42.60	0.70
			II. Annual average plant size			
2 to 10	14.76	13.56	22.62	22.05	11.62	74.10
11 to 19	7.64	7.41	9.96	10.08	6.20	11.12
20 to 49	12.50	12.16	14.50	14.37	10.17	8.42
50 to 99	9.71	9.63	9.90	9.82	8.28	2.95
100 to 499	22.21	22.84	19.20	19.83	22.48	2.75
500 or more	33.18	34.39	23.81	23.84	41.25	0.66
			III. Average plant size			
2 to 10	13.56	13.58	20.69	22.34	11.14	72.08
11 to 19	7.62	7.70	9.91	10.60	6.24	11.97
20 to 49	12.46	12.46	14.35	14.85	10.19	9.08
50 to 99	10.13	10.25	10.33	10.64	8.49	3.24
100 to 499	22.68	22.99	19.68	19.67	22.60	2.94
500 or more	33.55	33.03	25.04	21.89	41.34	0.70

Notes: Tables entries are means of monthly/quarterly values in time interval, seasonal adjusted. Source: author´s calculations

Figure A: Worker and Job flows (quarterly data)
Panel A: ***Worker flows:***



Panel B: ***Job flows***



Source: PILA, seasonal adjusted and moving average order three, own calculations

Appendix B: Economic sectors

Table B1: Shares by economic sectors

Sector	*H*	*S*	*JC*	*JD*	*Employment*	*Firms*
			Monthly			
Agriculture & Mining	7.60	7.81	7.73	8.18	8.41	7.78
Manufacture	6.93	6.72	7.66	7.33	9.66	9.15
Construction	12.95	13.03	14.44	14.85	6.37	6.93
Transportation & Trade	13.67	13.31	14.64	14.02	16.91	22.49
Public services	19.25	18.97	21.57	21.21	22.33	18.71
Private services	39.60	40.15	33.97	34.42	36.33	34.93
			Quarterly			
Agriculture & Mining	7.34	7.59	7.69	8.31	7.91	7.52
Manufacture	7.87	7.56	8.57	8.11	10.19	9.20
Construction	8.48	8.35	9.80	9.75	5.06	5.91
Transportation & Trade	15.76	15.23	15.90	14.93	17.81	23.72
Public services	21.24	20.66	25.17	24.90	24.44	19.70
Private services	39.31	40.61	32.87	34.00	34.59	33.95

Source: PILA, seasonal adjusted, own calculations

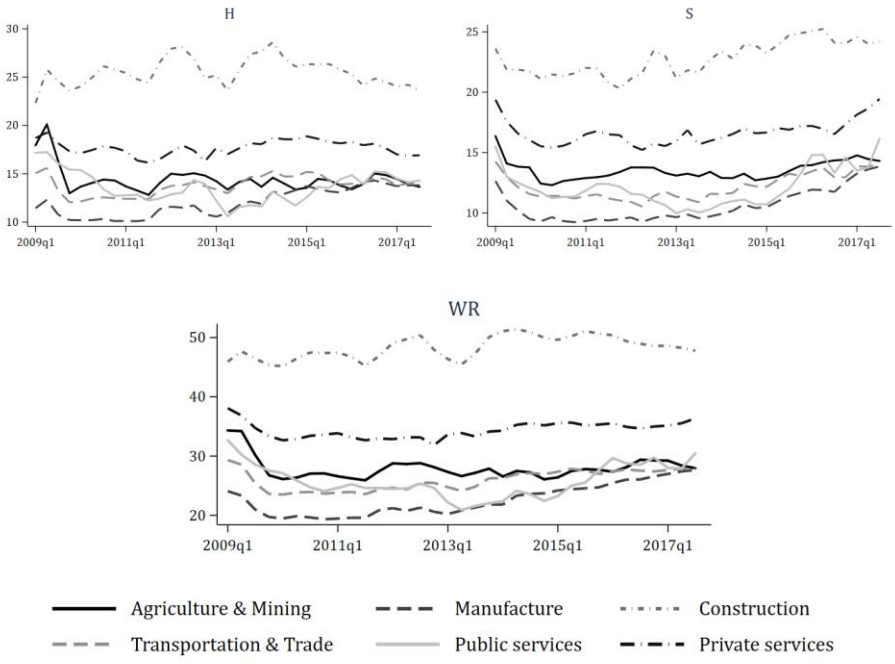
Table B2: Shares by employer type

Employer type	**Employment**	**Establishments**	**Hirings**	**Separations**	**JC**	**JD**
			Monthly			
Private	86.12	88.97	92.56	85.80	89.10	75.06
Public	13.44	10.38	7.25	13.93	10.53	24.38
Others*	0.45	0.65	0.19	0.28	0.37	0.56

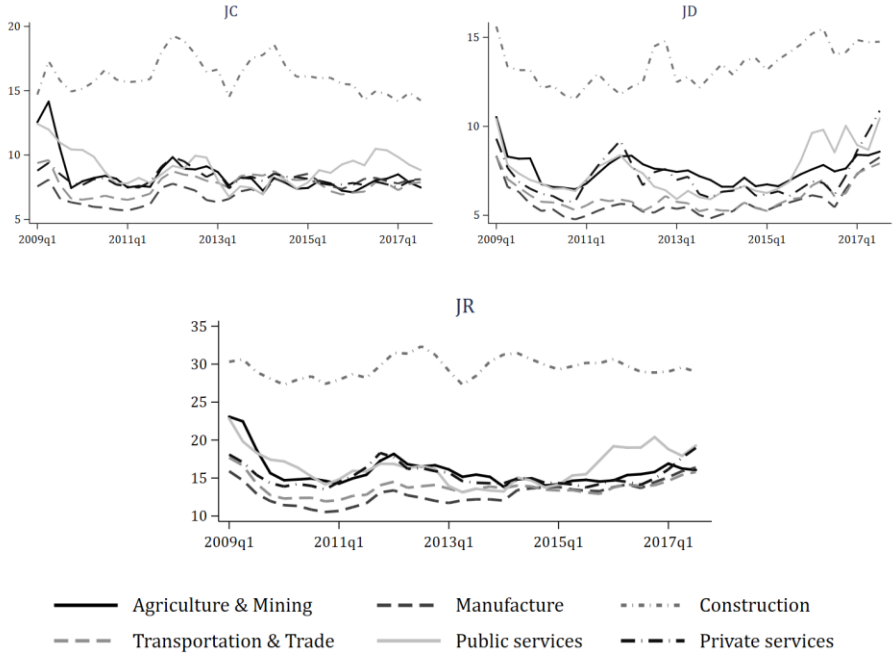
*** Others include mixed, multilateral or missing information establishments. This shares are mean of shares per month.**

Figure B: Worker and job flows by economic sectors (quarterly data)

Panel A: ***Worker flows***



Panel B: ***Job flows***



Source: PILA, monthly measures, seasonal adjusted and moving average order three, own calculations

Appendix C: Wages

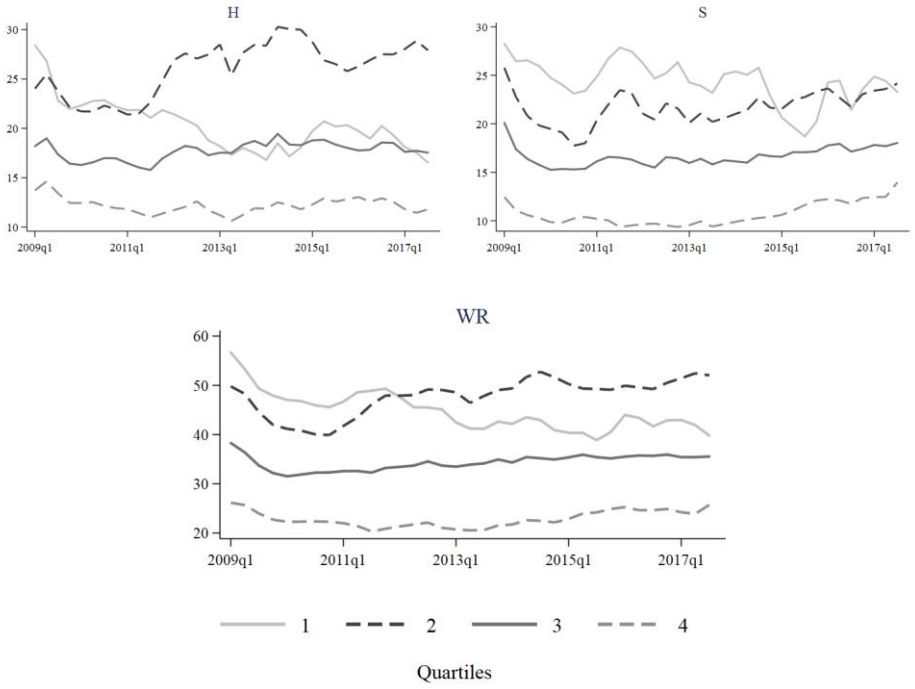
Table C: Shares by wages

Quartiles	*H*	*S*	*JC*	*JD*	*Employment*	*Firms*[19]
			Monthly			
			I. Three years average wage			
1	7.11	8.91	11.70	14.10	5.52	23.33
2	28.60	27.61	25.80	24.64	13.04	23.83
3	24.70	25.15	23.03	23.26	22.24	26.03
4	39.58	38.32	39.46	38.00	59.20	26.80
			II. Average wage			
1	11.70	14.09	13.16	18.14	7.14	23.55
2	25.81	24.62	25.33	22.90	12.74	23.83
3	23.03	23.24	22.49	22.88	21.27	25.72
4	39.46	38.05	39.01	36.08	58.85	26.89
			Quarterly			
			I. Three years average wage			
1	6.43	8.81	8.57	13.52	5.27	23.19
2	21.54	19.65	23.55	20.46	12.03	24.39
3	25.44	26.30	23.34	24.66	22.12	25.86
4	46.59	45.24	44.54	41.36	60.59	26.56
			II. Average wage			
1	8.88	11.77	10.69	16.82	6.26	22.87
2	19.78	17.92	21.85	18.59	11.67	24.70
3	25.02	25.74	22.81	23.78	21.97	25.78
4	46.32	44.57	44.64	40.81	60.10	26.64

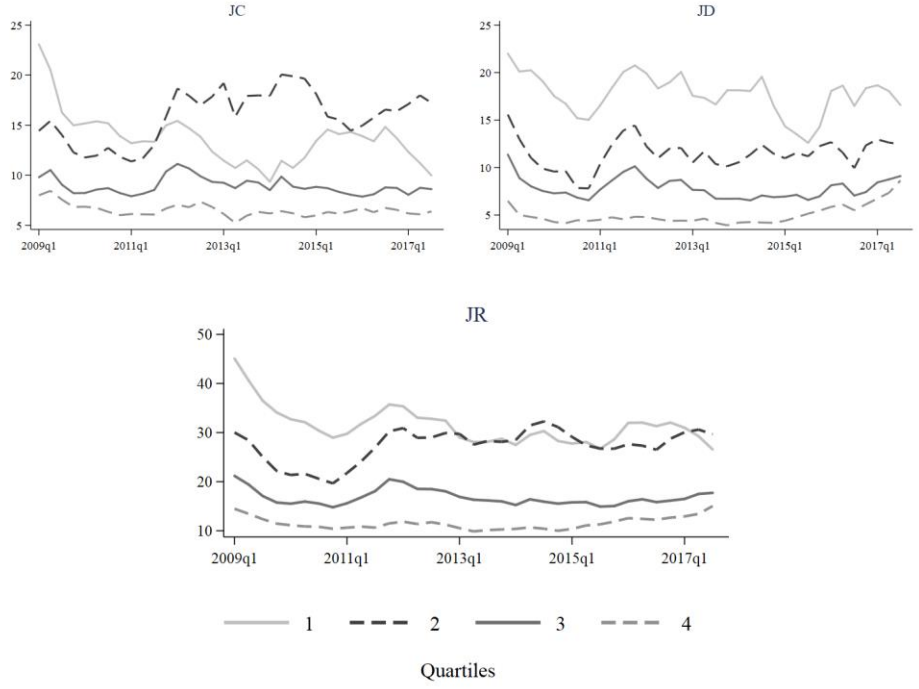
Notes: Tables entries are means of monthly/quarterly values in time interval, seasonal adjusted. Source: author´s calculations

[19] The distribution of the number of firms is not exactly 25%, because the wage associated with a particular percentile is repeated in the sample.

Figure C: Worker and job flows (quarterly data)
Panel A: ***Worker flows:***



Panel B: ***Job flows***



Source: PILA, seasonal adjusted and moving average order three, own calculations


BANCO DE LA REPÚBLICA
COLOMBIA