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Labor Fluidity and Performance of Labor Outcomes in Colombia: Evidence from Employer-Employee Linked Panel.[*]

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Abstract

In this paper, we compute standard measures of fluidity for the Colombian urban labor market: worker and job reallocation rates and the excess of worker reallocation over job reallocation. We analyze the period between the second semester of 2008 and the second semester of 2014, finding evidence of an increase of fluidity in the labor market, especially after 2010. We test the hypothesis of a positive effect of fluidity on different employment and occupation indexes using instrumental variables regression models that exploit the variation of labor results and fluidity measures between metropolitan areas and over time. We find robust and positive effects of fluidity on some labor market result indexes related to employment and occupation. To the best of our knowledge, a positive causal effect of fluidity on the performance of the labor market has not been documented for a developing economy.

JEL Classification Codes: J60, J63, J11.
Keywords: Labor market fluidity; unemployment; occupation.

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1. Introduction

In this paper, we compute fluidity measures of the formal labor market in Colombia for the period between the second semester of 2008 and the second semester of 2014. Our fluidity measures are based on flows of hires, separations, jobs created and jobs destroyed at the level of formal firms. We aggregate these measures for the 23 main metropolitan areas in Colombia. Our definition of a firm is broad: in this paper, a firm is a multi-establishment set of firms in a city, with at least two employees in total. In addition, these establishments belong to the formal sector of the economy in the sense that they account for payroll taxes and social security payments for their employees.

Following the mainstream literature on this topic, we compute Worker Reallocation Rates (WR), Job Reallocation Rates (JR), and Churning Rates (CH). Analyzing these fluidity measures for the period between 2008 and 2014, we provide some evidence that the formal labor market in Colombia became more fluid after the last quarter of 2010, and this fact coincides with a substantial decrease in the unemployment rate during the same period. Even though there may be an ambiguous relation between fluidity and performance of the labor market, the literature on this topic has documented a direct relationship between employment and fluidity for the US economy (Davis & Haltiwanger, 2014).

We estimate econometric models in order to capture the causal relationship between the measures of fluidity and some labor market results. The outcomes we analyze in this paper are labor market results related with the salaried and formal labor market, mainly because the fluidity measures we can generate from our data are exclusively for salaried formal workers and jobs. Specifically, the dependent variables of the models in this paper are, on the one hand, the share of salaried, formal, and salaried-formal workers over the total labor force; on the other hand, the share of salaried, formal, and salaried-formal workers over the total working-age population. The first three variables are components of the employment rate (1- unemployment rate). The other three are occupation rates for salaried, formal, and salaried-formal populations. We find a consistent and strong effect of WR, JR, and CH on several of our labor market outcomes. In general, we present evidence that increments in the fluidity of the labor market increase formal employment of the labor force, and formal occupation of the working age population. We deal with problems of endogeneity of the fluidity measures by using an instrumental variables methodology (IV).

In the second section of this paper, we describe the literature related with the connection between labor market fluidity and labor market outcomes. In the third section, we comment on our sources of information, while in the fourth we describe our fluidity measures and our methodology. In the sixth

section, we present our empirical results, and in the last one, we conclude and offer general policy implications.

2. Data

The data we use in this paper came from two different sources: we generate our fluidity measures from administrative records from the Colombian "Integrated Record of Contributions to Social Security" (PILA, by its acronym in Spanish). The Ministry of Social Security in Colombia designed and implemented an integrated system for collecting all social security-related payments that an employer is required to make. When doing these payments, employers must fill out a form with information for each employee on their payroll. The PILA is a unique source of longitudinal information by employee, containing wages, contributions to retirement funds and health insurance, some basic demographic characteristics, and some basic characteristics of the firm, among other things. Using this source of information, we constructed an employer-employee linked panel with firms observed at least once during the period from August 2008 to December 2014.

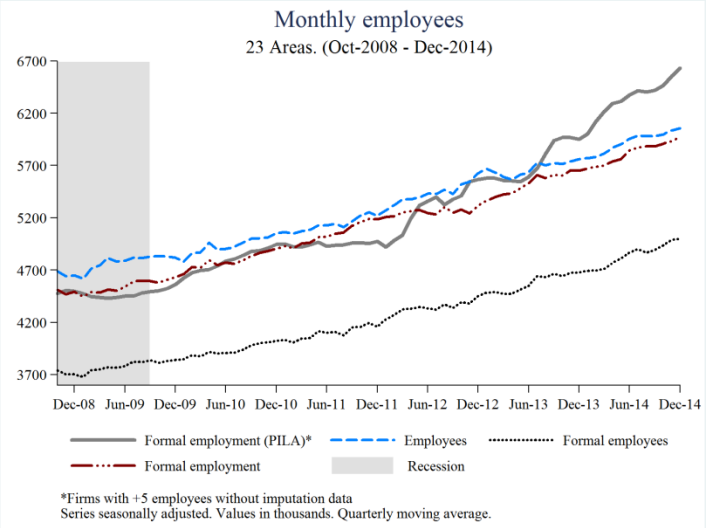
Additionally, we generated labor market outcomes and additional control variables by using the official Colombian household survey (GEIH[4] by its initials in Spanish). This survey is the source of information for the official labor market indexes in Colombia. We generated labor market outcomes and controls for the main 23 metropolitan areas in Colombia for the same period we are able to generate our fluidity measures. In table 1, section 7, we present summary statistics of our data.

The focus of this paper is on salaried employees working on "formal firms," which are formal in the sense that they account for payroll taxes and contributions to the social security system. In Graph 1, we represent the employment for salaried and formal workers from different sources. The dotted line is the employment from formal firms with more than five employees reported in the PILA. The red and blue lines are the formal employment and the total salaried employees, respectively, from the official household survey (GEIH). The definition of a formal worker used by the Colombian bureau of statistics is "a salaried employee in a firm with more than 5 employees or a professional self-employed worker." Employment in the PILA increased substantially after 2013; after this year, PILA employment is higher than salaried and formal workers from the GEIH. All three measures of employment show that, especially after the second semester of 2014, employment has increased

[4] The GEIH, "Gran Encuesta Integrada Hogares" is applied by DANE, the Official Statistics Bureau of Colombia.

substantially. This increment in the number of employees matches a period of remarkable economic growth in Colombia.

Graph 1: Total formal employment, GEIH and PILA



We have had to deal with some problems of using administrative data: for instance, firms may be misreporting information. In order to deal with this problem, we use a set of refinements of the data based on imputations..

3. Fluidity Measures

As explained before, the type of information we use to generate fluidity measures is an employer-employee linked panel. Our definitions of fluidity are strongly shaped by the nature of the data; nevertheless, these definitions are standard because big part of the literature uses this type of employer-employ linked panels. Following (Davis, Haltiwanger, & Schuh, Job Creation and Destruction, 1996), we define a job as "a position filled by a worker." We were not able to observe positions or vacancies. All our measures are based on observations of the size of a firm and the flow of workers entering and exiting that firm. We measure these flows on a monthly basis for technically all "formal" firms in Colombia from the second semester of 2008 to the second semester of 2014. Formality is a broad concept in this study, and it refers only to the fact that these firms account for payroll taxes.

Before describing how we constructed, our fluidity measures, let us introduce some notation and definitions. A firm j_t is a set of business-establishments in the same city with at least two employees.

Additionally, this firm belongs in a broad sense to the formal labor market because it accounts for payroll taxes. An individual i_{jt} is an employee observed in the payroll of firm *j* at period *t.*

Based on the PILA, we generate an employer-employee linked panel by observing, on a monthly basis, the payroll of a given firm. Based on this data structure we are able to compute hires (h_{jt}) as the set of employees observed in a given period that were not observed before. Similarly, separations (s_{jt}) are generated from the employees observed in the previous period not observed in the current one. The set of hires, separations, and stayers (k_{jt}) in a firm *j* in the period t is defined as:

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

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

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

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

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

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

In order to generate aggregate measures of fluidity in a local labor market A (a metropolitan area), we take summations of all this previous sets. Therefore, the aggregate flows of hires ($H_{A,t}$), separations ($S_{A,t}$), job creation($C_{A,t}$), and job destruction ($D_{A,t}$) in A´s local labor market can be represented as:

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

We follow the mainstream literature in this matter (Steven, Haltiwanger, & Schuh, 1996; Davis & Haltiwanger, 1992) defining the size of the firm as the moving average of order two of the firm's employment, as represented in the following equation: $x_{jt} = \left(e_{jt} + e_{jt-1}\right)/2$. Therefore, total firm size in a metropolitan area is defined as:

$$X_{A,t} = \sum_{j \in A} x_{jt}$$

The reader can notice from our definitions that $H_{A,t}$ $(S_{A,t})$ represents all the hires (separations) that occurred in metropolitan area *A* at time *t*. In addition, $C_{A,t}$ $(D_{A,t})$ represents all employments gains (losses) from new (exiting) and expanding (shrinking) establishments. Finally, $X_{A,t}$ is a measure of the size of the employment in local market *A*. We express the worker flows (hires and separations) and the job flows (job construction and destruction) as rates of the total labor market employment $X_{A,t}$. Therefore, the fluidity measures used in this paper are defined as follows:

Worker Reallocation Rate (WR) $\left[WR_{A,t} = \left(H_{A,t} + S_{A,t}\right)/X_{A,t}\right]$: This is the sum of monthly rates of hires and separation. Worker reallocation is the amount of people that either change of firm or employment status (employed/unemployed) from one period to the next (Davis et al. (1997)). It measures the number of workers entering or exiting firms.

Job Reallocation Rate (JR) $\left[JR_{A,t} = \left(C_{A,t} + D_{A,t}\right)/X_{A,t}\right]$: This is the sum of monthly job creation and destruction rates. Job reallocation is the amount of employment gains and losses from one period to the next (Davis et al. (1997)). It measures the amount of opportunities by moving between shrinking to expanding firms.

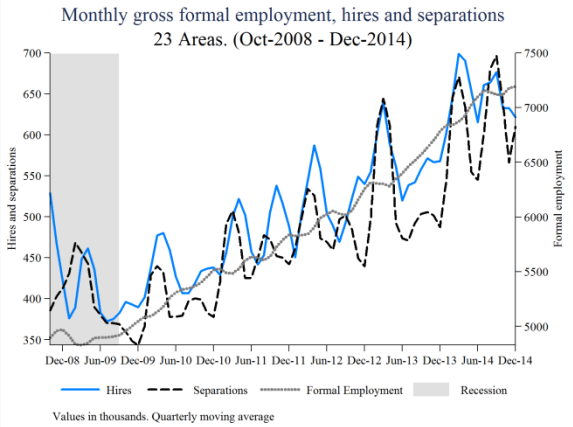
Churning Rate (CR) $\left[CR_{A,t} = \left(H_{A,t} - C_{A,t} + S_{A,t} - D_{A,t}\right)/X_{A,t}\right]$**:** This is the difference between WR and JR, usually referred to as an excess of worker flows over and above the amount required to accommodate job flows (Davis & Haltiwanger, 2014). On the one hand, the Churning Rate captures the amount of hires that are not new jobs created, and the amount of separations that are not jobs destructed. Churning jobs are those jobs that came from replacing workers that were separated from their jobs either because they quit or because they were fired in a process of refinement of the matching employer-employee process by the firm.

4. Recent Dynamic of Fluidity Measures in Colombia

Graph number 2 presents the flows that are the building block of traditional fluidity measures in the literature: hires, separations, job creation and job destruction during the period between the second semester of 2008 and the second semester of 2014. In the left-hand side of the panel in Graph 1 (2.1 and 2.3), we present the flows in moving averages of order three; in the right hand side of the panel (2.2 and 2.4) we present seasonally adjusted versions of the same series. The first thing to notice is that during this paper´s period of study all flows show remarkable increments, especially after the last period of economic recession (second semester of 2008 to first semester of 2009). The row for flows of hires (separations) went from a level of 410.4k (389.1k) workers (Jan/2009-June/2010) to nearly 632.8k (594.2k) workers (Jan/2013- December /2014). Similarly, the jobs created (destructed) increased from 193.1k (201.2K) jobs (Jan/2009-June/2010) to 307k (333.7k) jobs (Jan/2013-December /2014). The expansion period of these flows coincides with a period of good economic performance of the Colombian economy: the annual growth rate of the economy was at least 4% for every year after 2009. Before this period, Colombia experienced a deceleration in its economic growth. Proof of this is that the annual growth of real GDP in 2009 was 1.65%, low in comparison with the rates observed later on.

Graph 2: Hires, separations, job creation and destruction in 23 MA.

2.1



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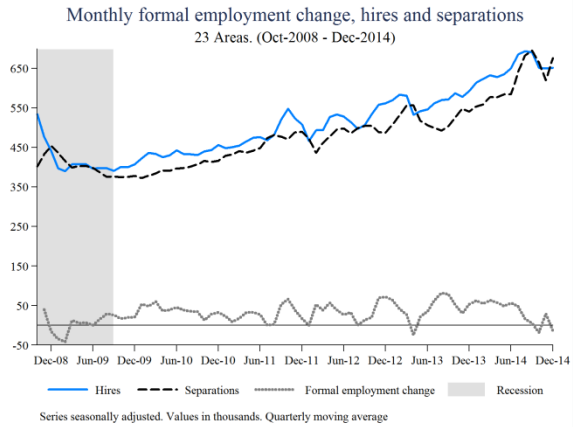

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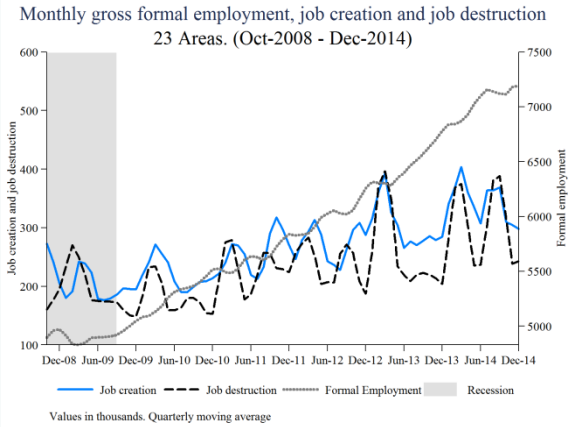
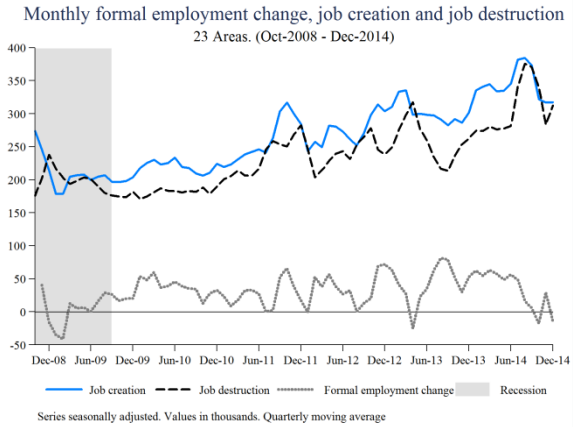


2.4



The relationship between worker and job flows can be characterized from the previous set of graphs. From the second semester of 2008 to the second semester of 2014, the average flow[5] of workers hired from all formal firms in Colombia was 522k; for the same period, the average creation of new job opportunities was 260k jobs. Roughly speaking, 50% of all hires observed corresponded to replacements of workers and not to the creation of new jobs. Similarly, the average flow[6] of workers separated from formal firms in Colombia was 491k, while the destruction of jobs was 270k jobs. Roughly speaking, 45% of all separations correspond to replacements of workers and not to the destruction of existing jobs.

[5] Using seasonally adjusted data.
[6] Using seasonally adjusted data.

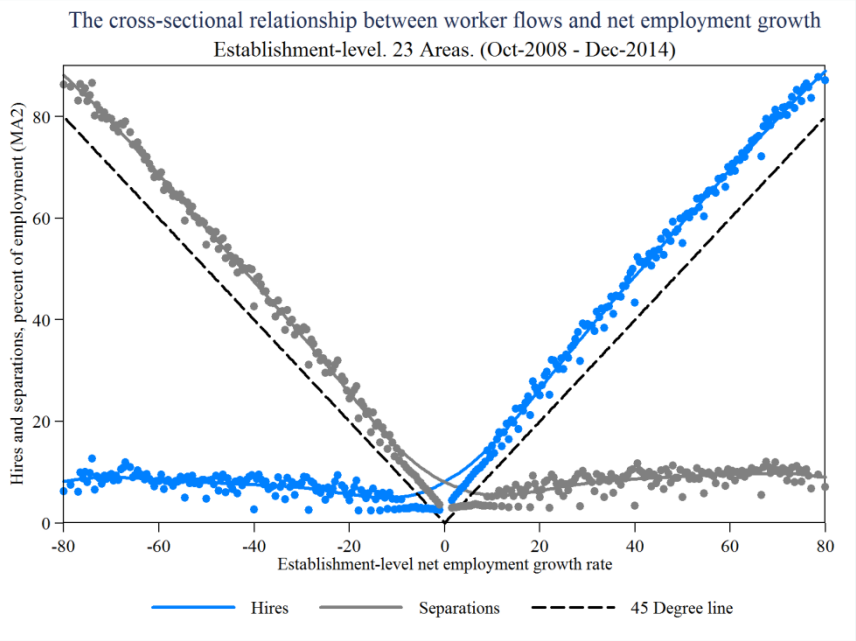
The left-hand side panel of Graph 2 illustrates the relationship between the flows and the change in net employment. As the reader can notice, the change in employment is positive (negative) when creation is above (below) destruction. For existing firms it is also true that net change in employment must be equal to hires minus separations; therefore, it is observed as well that change in employment is positive (negative) when hires is above (below) separations.

Graph 3 illustrates the relationship between employment net changes and hiring and separation flows. The graph describes how the rates of creation and destruction of jobs are related with separation and hiring rates. This graph presents a scatterplot of net employment growth rates[7] and hiring and separation rates (median) observed from establishment level data. The graph describes the close relationship between worker flows and employment growth: it shows that positive growth is observed when the hiring rate is above the separation rate. On the one hand, the separation rates for shrinking firms are extremely high, and the hiring rates are low and flat; on the other, hiring rates for expanding firms are extremely high and separation rates are low and flat as well. From graph 3 we can characterize the behavior of firms in relationship with hiring and separations.

The behavior of firms is symmetric in expansions and contractions. The relationship between net growth and hiring or separation rates has what the literature usually refers to as "hockey-stick" shapes. In both cases, the pairs of hiring (separation) rates and net growth rates are above a 45-degree line. This should be the case because in contractions a small but non-zero level of hiring is observed, and in expansions a small but non-zero level of separations is observed as well. For example, in the case of expansions, the growth rate has to be greater than the hiring rate to compensate for separations. Interestingly, for big expansions and contractions the blue and grey lines in graph 3 are even farther away from the 45-degree line. In the case of expansions, for instance, this is because rapid expansions are observed with a noticeable greater rate of separations. This makes sense because rapid expansion requires a more important degree of separations in order to maintain the quality of the employer-employee match.

[7] Net employment growth rates are defined as the ratio between changes in employment and firm size defined as $x_{jt} = \left(e_{jt} + e_{jt-1}\right)/2$.

Graph 3:

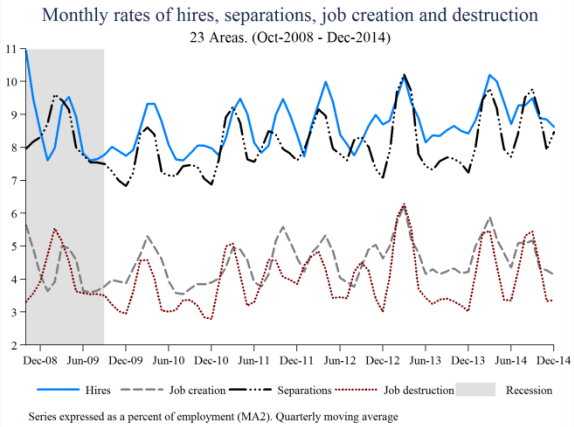


Notes: This figure is based on Figure 6 in Davis, Faberman & Haltiwanger (2012). Estimates are the employment-weighted average of the establishment-level growth rates within intervals (0.5 percentage points).

Graph number 4.1 presents flows of workers and jobs presented as percentages of employment levels in the MA. In Graph number 4.2, we present Worker (WR) and Job (JR) Reallocation Rates, and the combination of both, the Churning Rate (CR). Graph 4.1 shows that the rates of hires and separations are between 6.6% and 12% during the period studied. The average hiring rate was 8.9%, while the average separation rate was 8.4%. In times when the hiring rate is above the separation rate, an important reduction in the unemployment rate is observed (Graph 4.3). As mentioned before, job creation and destruction rates are just a share of hiring and separation rates, respectively. On average, the job creation rate is 50% of the hiring rate, and the destruction rate is 54.7% of the separation rate. This shows that the percentage of destruction from total separations is greater that the percentage of creation from total hires, which is coherent with the reduction in unemployment observed during the period. Graph 4.2 shows that both WR and JR present a noticeable increment in magnitude and volatility after the last trimester of 2010. The combination of these two yields the Churning Rate (CR), which has also increased after 2011. The increment of the CR is subtler, but the seasonally adjusted series allows us to see a noticeable increment: between 2010 and 2011 CR is quite stable, but between 2008 and 2010, churning decreased remarkably.

Graph 4: Fluidity measures

4.1



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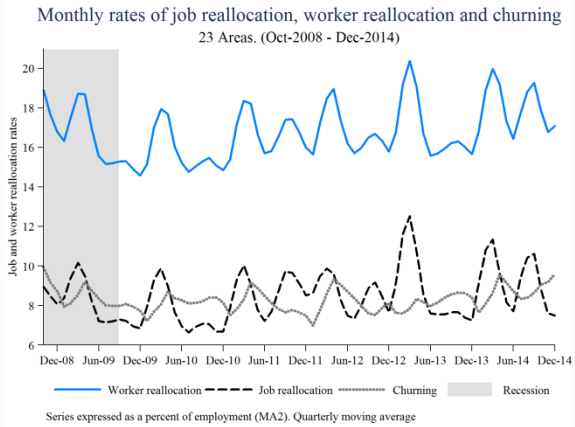

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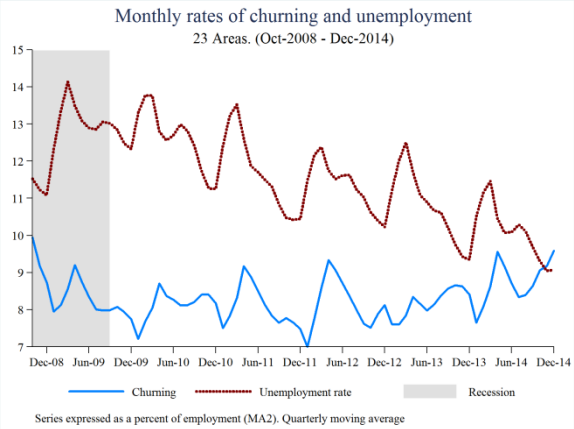

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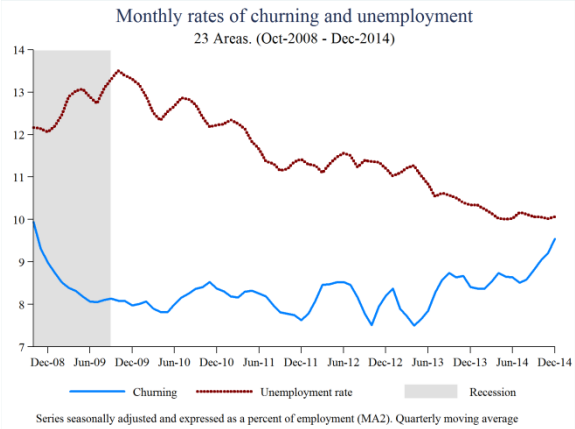

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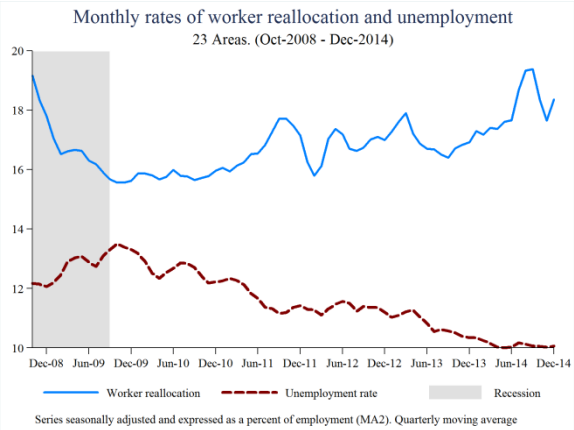
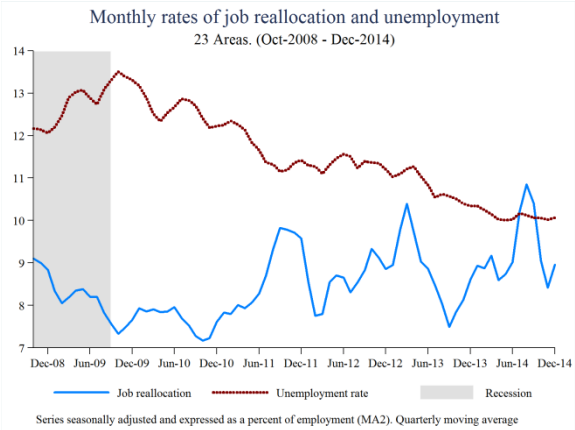


4.6



Graphs 4.4, 4.5 and 4.6 graphically compare the evolution of unemployment and our three measures of labor market fluidity Churning Rate (CH), Worker Reallocation (WR) rate and Job Reallocation Rate (JR). In all three cases, it seems that after 2009 there exists a negative relationship between unemployment and all three measures. When unemployment shows a decreasing trend, the fluidity measure seems to increase.

5. The relationship between fluidity in the labor market and labor market results

The influence of fluidity in labor markets can go in opposite directions. The literature remarks positive and negative consequences of more fluid labor markets. The ambiguity of the influence of fluidity measures on the labor market arises by construction from the definition of fluidity measures. Either **JR** or **WR** rates are the combination of opposite flows: on the one hand, hiring and job creation; on the other, separations and job destruction.

From labor market search models (see Mortensen & Pissarides, 2011) increments in **JR** rates will increase unemployment if they imply higher job destruction because a higher flow of workers will move into unemployment. Therefore, a reduction in **JR** rates can imply a reduction in unemployment. A reduction in **JR** can be associated to a greater job security and lower incidence of unemployment, and these two are desirable characteristics of a labor market for many reasons. For example, job loss can lead to lower earnings for many years after the unemployment episode (Davis & Haltiwanger, 2014). Several papers evaluate the impact of an unemployment episode in a variety of outcomes, from health outcomes to psychological wellbeing measures, finding important negative effects. For a review of this literature, the reader can refer to Steven & Von Wachter (2011). There is an empirical regularity in the literature on worker/jobs flows for several economies: the inverse relationship between firm size and the pace of job reallocation (Davis & Haltiwanger, 1999). Following this evidence, an advantage of a low **JR** mentioned in the literature is that a reduction in the JR can be associated with higher productivity levels. The argument for this association is that the reduction in the JR can be driven by a growth in firm size, as bigger firms show lower reallocation measures while also being the ones with higher productivity.

For several reasons the relationship between fluidity and employment or occupation may be positive. An increment of the **JR** can be explained by the creation of new jobs; therefore, a positive effect of fluidity on employment is expected. In addition, a more fluid labor market will decrease the average duration of unemployment because it implies an increase in the rate of arrival of job offers. There is

an expected direct relationship between fluidity and job mobility; therefore, more fluid markets show an enhanced employee´s ability to change career or move into better positions, which is a desirable characteristic in labor markets. Regarding the employer-employee matching process, there can be a better quality of this match in more fluid markets. Akerlof, Rose, Yellen, Ball, & Hall (1988) argue that an employee's job to job mobility is highly pro-cyclical, and it improves matching between workers and jobs creating an additional welfare benefit from unemployment reductions. This may be one of the main reasons why higher levels of fluidity can be beneficial: an enhanced matching between workers and jobs increases a firm´s productivity, which is a key factor for economic development.

An additional argument in favor of the benefits of a better fluidity is that it may be the result of a less rigid labor market. There is evidence in the literature of the influence of some particular institutional contexts and fluidity. More specifically, several papers find that employment protection laws reduce labor market fluidity (Blanchard & Portugal, 2001; Gómez-Salvador, Messina, & Vallanti, 2004; Boeri & Jimeno, 2005; Decker, Haltiwanger, Jarmin, & Miranda, 2014). Even though the topic is controversial, economists tend to support the hypothesis that a less-rigid labor market produces better aggregate results, such as lower unemployment rates or higher productivity in the economy, for example. For the specific case of the North American economy, Autor, Donohue III, & Schawb (2006) and Autor, Kerr, & Kugler (2007) present evidence of the negative effects of labor protection laws on employment and total factor productivity.

In this paper we test what Davis & Haltiwanger (2014) call the "Fluid Market Hypothesis". In short, this hypothesis establishes that fluid labor markets promote higher levels of employment. We test the influence of standard fluidity measures on mainly two labor market results: (1) employment rates (one minus unemployment rate), and (2) occupation rates. The first study that asses a causal relation between fluidity and employment is Shimer (2001). This paper finds that there is a positive effect of the share of youths (16-24 years old) on employment in the working age population. As explained in the paper, this happens, among other reasons, because the more remarkable the participation of youth in the working age population, the cheaper is the recruitment of new employees by the firms. Recruitment is cheaper and easier with an important share of youth in the market because the quality of the employer/employee match is poorer with youth than with prime-age workers. Therefore, an important share of the labor supply is constantly willing to take another job. Under circumstances like these, firms will find that creating jobs in younger labor markets is more profitable, thus boosting job creation and reducing unemployment (Shimer, 2001).

Research on fluidity of labor markets is highly focused on developed economies; nevertheless, recently there has been an increasing interest for this topic in the Latin American Region, especially referring to "job flows." The most comprehensive description of job creation in the Latin American region can be found in Pagés, Pierre, & Scarpetta (2009). This book describes the job creation process in the region, analyzing a hypothesis that explains what the authors called "weak creation of productive jobs."

Previous work on labor market flows in Colombia has focused on worker flows constructed with retrospective questions of household surveys, on one hand, and on the other, on measures of job creation and job destruction for specific economic sectors. The papers that study job flows in Colombia (job creation and destruction) are restricted to the manufacturing sector (Melo & Ballesteros, 2013; Melo & Ballesteros, 2014). These papers describe job flows for the manufacturing sector, finding correlations of creation and destruction with macroeconomic variables. Lasso V. (2011), and López Castaño & Lasso Valderrama (2015) are good examples of research on worker flows in Colombia. The idea in most of the cases is to quantify the magnitude of the flows and disentangle changes in unemployment rates (or other labor market results) using flows of workers entering and exiting unemployment, employment and inactivity. These works are not interested in the concept of fluidity itself, but they analyze worker flows and the role they play on unemployment and occupation.

6. Empirical model

The purpose of this paper is to identify the role that labor market fluidity plays on employment and occupation rates. The definition of "labor market" is a metropolitan area (MA). There are 23 main metropolitan areas in Colombia. We compute standard fluidity measures and control variables for each MA in each period (month) from October 2008 to December 2014. The equation that we estimate can be represented as:

$$y_{it} = x_{it}'\beta + \delta_i + \sum_m \tau_{i,m} + \alpha f_{it} + \varepsilon_{it} \qquad (1)$$

Where y_{it} is the labor market outcome (employment and occupation rates defined for salaried and formal workers) in MA *i* at period *t*, δ_i is fixed effect by MA, the vector x_{it} contains a series of control variables that varies by MA, and period, $\tau_{i,m}$ denotes a series of dummy variables by month of the year. The coefficient of interest is α, which captures how the labor market outcome changes y_{it} when the fluidity measure f_{it} increases one percentage point. The control variables we include in vector x_{it}

are the following: hourly wage deflated by the Implicit GDP deflator (IGD); share of working-age population (WAP) with college studies; share of private firms; the employees' average age; share of males in the payroll; State-level labor demand[8]; GDP per person employed; employers costs; Hodrick–Prescott filter of quarterly GDP; and department annual GDP growth.

There is a series of reasons why α can be affected by endogeneity bias. There can be time-varying unobserved factors in the MA that determine the labor market result y_{it}, while at the same time they are correlated with the fluidity measure f_{it}. In addition, given that we construct fluidity measures based on administrative records, these measures can be subject of measurement errors; for example, firms can misreport their payroll information for some periods. These imperfections in the employer-employee linked panel lead to misestimating the fluidity measures. There is not a strong reason to think that the measurement error is not random, but that could be possible. For all these reasons, we estimate instrumental variable models.

6.1.1 Instrumental variables

We are interested in assessing the effect of our three fluidity measures WR, JR and CH on each one of our labor market outcomes. For reasons mentioned before, these variables are presumably endogenous. Based on previous literature we construct valid instruments for each one of our endogenous variables. We use two types of instruments: on the one hand, we use local labor market characteristics, that, conditional on the control variables included in the regressions are assumed to be exogenous. On the other hand, following Davis & Haltiwanger (2014), we construct instruments based on national-level measures of fluidity intensity by economic sectors; these instruments map changes in national labor fluidity on Metropolitan Area fluidity intensity.

Instruments based on characteristics of local markets: We use two type of instruments based on the idea that low-skilled, young workers present the highest mobility in the labor market (Shimer, 2001; Davis & Haltiwanger, 2014). On the first hand, we use as instruments the population between 18 and 24 with less than high school and at most high school, both of them as a share of the working age population. On the other hand, we use the minimum wage based on the idea that it is binding for low-skilled young workers. We use these instruments provided that we control for the median wage per hour in each local labor market. The minimum wage is an exogenous factor frequently imposed on the market by the government. Furthermore, both workers and firms, acting individually, have

[8] In the section 6.1.1, we explain in detail how this control was constructed.

virtually no opportunity to influence it. Therefore, we assume that, conditional on the average wage per MA, the effect of the minimum wage on the labor market outcomes considered here is only throughout the effect it has on the fluidity of the labor market.

Instruments based on the reallocation intensity of economic sectors: In this case, we follow the literature on local labor demand measures. Bartik (1991) designs a measure for changes in local labor demand unrelated to local labor supply. The idea is mapping "national" employment changes into local employment changes (by "national" we mean total minus local employment). This is done by averaging national employment changes across industries using local industry employment shares as weights. In this paper, we use the original Bartik´s index of local labor demand changes as a control variable, constructed as follows:

$$B_{at} = \sum_{k=1}^{K} \gamma_{kat} \cdot \Delta_{kt}^{-} \qquad (2)$$

$$where, \;\; \Delta_{kt}^{-} = \frac{\Delta E_{kt}^{-}}{\frac{1}{2}(E_{kt}^{-} + E_{kt-1}^{-})}$$

where γ_{kat-1} is the share of local market a employment in economic sector k, and Δ_{kt}^{-} is the change in employment in economic sector k at time t, E_{kt}^{-} (excluding local labor market a) as a percentage of the second order moving average of E_{kt}^{-}. This special growth rate is often used in the literature on worker/job flows and is called DHS net employment growth (Davis, Haltiwanger, & Schuh, 1996). The variable B_{at}, predicts what would had been the net DHS net employment in local labor market a net employment growth, given the net employment growth of other labor markets and its own industrial composition.

Several papers construct instruments following Bartik´s original idea. Good examples of these are Blanchard, Katz, Hall, & Eichengreen (1992), Bound & Holzer (2000), and Autor & Duggan (2003). In the specific context of the study on fluidity of the labor market, Haltinwanger & Davis (2014) propose a series of instruments that result from the interaction between Bartik-like local labor demand indexes and job reallocation rates. In this paper, we use of all this previous literature in order to design our reallocation intensity instrument in the following way:

$$BI_{at} = \sum_{k=1}^{K} \gamma_{kat-1} \cdot f_{kt}^{-} \qquad (3)$$

where f_{kt}^{-} is a fluidity measure (WR, JR, CR) of sector k computed nationally, but excluding local market a. In addition, γ_{kat-1} is the share of local market a employment in economic sector k in the previous period. This instrument captures the interaction of the fluidity measures in different

industries of other labor markets given the previous industrial composition in the local labor market. The instrument BI_{at} uses national fluidity measures (excluding local´s) of different economic sectors to predict local fluidity measures. In the construction of the instruments, these "national" fluidity measures are weighted by the lagged share of a sector's employment into the local industrial composition.

7. Results

In this section, we present the results of the estimation of equation (1). Given that we can only generate our fluidity measures for the salaried and formal employees, the outcomes that we study are related with the salaried and formal labor markets. Particularly, we focus on six labor market outcomes: on the one hand, the share of salaried workers, formal workers, and salaried-formal workers over the total labor force; on the other, the share of salaried workers, formal workers, and salaried-formal workers over the total working age population. The first three variables are components of the employment rate, and we will refer to them as "employment rates"; the other three are "occupation rates" for salaried, formal, and salaried-formal populations.

Table 1a presents summary statistics for controls and dependent variables, while Table 1b presents summary statistics for fluidity measures. The period studied is characterized by a reduction of unemployment and important economic growth, therefore, it is not surprising that the average hiring rate (9.22%) was greater than the average separation rate (8.47), and that the average job creation rate (5.57%) was greater than the average job destruction rate (4.81%). We can characterize the average relationship between worker and job flows from these numbers. As the reader can notice, around 60% of all hiring corresponds to new jobs, and around 57% of all separations corresponds to jobs destructed.

As the reader can notice from table A1, during the period studied, the average salaried worker employment rate was 36.5%, which is the average of the labor force share with a salaried job per MA and period. In the case of salaried formal workers, this MA average reduces to 28%. The average salaried worker occupation rate per MA was 23.25, which is the average of the working age population share with a salaried job per MA and period. As for salaried formal workers, this MA average reduces to 18%. It is worth mentioning some other characteristics of the estimation sample of our regression. For example, the average growth rate per department during this period was 4.31%,

the average employees' age was 33.3 years, and the average of the hourly wage rate per MA during the period studied was $4,221 Colombian pesos of 2008.

Table 1a: Summary statistics of fluidity measures, job and worker flows.

Table 1a: Summary statistics

Variable	Obs.	Mean	Std. Dev.	Minimum	Maximum
Hires	1725	9.22	2.57	3.02	24.47
Separations	1725	8.47	2.44	2.18	23.13
Job creation	1725	5.57	2.08	2.11	23.16
Job destruction	1725	4.81	1.9	1.4	21.74
Worker reallocation	1725	17.68	4.48	6.48	33.96
Job reallocation	1725	10.37	3.32	3.82	27.66
Churning	1725	7.31	2.59	0.67	15.98

Notes:
All series expressed as a percent of employment (MA2).

Table 1b: Summary statistics of labor market outcomes and covariates.

Table 1b: Summary statistics

Variable	Obs.	Mean	Std. Dev.	Minimum	Maximum
Salaried workers / Labor Force	1725	36.57	8.12	21.99	56.11
Formal worker / Labor Force	1725	35.43	6.87	22.54	52.67
Salaried formal workers / Labor Force	1725	28.46	6.7	17.28	45.51
Salaried workers / WAP	1725	23.25	5.7	13.58	38.04
Formal worker / WAP	1725	22.5	4.87	13.64	38.04
Salaried formal workers / WAP	1725	18.08	4.6	10.52	31.41
Hourly wage rate (deflacted IPI)	1725	4221.13	638.19	2770.91	8161.54
% WAP with College	1725	0.25	0.06	0.13	0.42
% Private firms	1725	0.97	0.02	0.88	0.99
Employees' average age	1725	33.3	14.04	-18.06	39.61
Employees' average age^2	1725	1306.06	330.35	97.01	1568.75
Share of males in the payroll	1725	0.63	0.03	0.55	0.69
State-level labor demand†	1725	0.01	0.02	-0.05	0.06
GDP per person employed	1725	5674.5	188.29	5313.41	6152.27
Employers costs (firms)	1725	0.53	0.05	0.42	0.56
HP filter quarterly GDP	1725	-357.04	1111.73	-2814.8	1599.06
Deparmental GDP growth	1725	4.31	4.58	-6.37	25.18

Notes:
WAP stands for Working Age Population
† Control for state-level labor demand as described in appendix B.

We estimate each one of these equations by the OLS and Instrumental Variables (IV) methodology. In the case of IV, we use 2 instruments selected from the ones described in the previous section. Not

all instruments work for each outcome, so we select the ones that have the strongest correlation with the endogenous variables. Coefficients estimated using IV are local effects, they have to be interpreted as the average effect that changes on the fluidity measure have on labor outcomes, but these changes in fluidity are generated as average responses of changes in a particular instrument. Therefore, in order to gain interpretability of the coefficients, in this paper we use just a single instrument per regression. It is important to notice that our estimated effects of fluidity measures on labor outcome should always be interpreted as local effects. They only take place by the channel and in the margin defined by the instrument.

We analyze three fluidity measures: WR, JR, and CH, and six different outcomes. There are two tables per fluidity measure: the first one shows the regression explaining the three "employment rates," and the second one shows the regressions explaining the three "occupation rates." For each set of outcomes (employment rates or occupation rates), a particular table presents an OLS regression and two IV regressions, each one with a different instrument. We divide this section into three subsections, one per each fluidity measure. In section 7.1 we discuss the results of the regression where the variable of interest is WR (tables 2a and 2b); in section 7.2 we discuss the results of the regression where the variable of interest is JR (tables 3a and 3b); finally, in section 7.1 we discuss the results of the regression where the variable of interest is CH (tables 4a and 4b).

The unit of observation in all models we present here are labor markets, which we define as Colombian metropolitan areas. We were able to collect all information necessary to estimate equation (1) for the main 23 Colombian metropolitan areas for the period between October 2008 and December 2014. In general, the fit of the regressions is high in all regressions with r squares above 90%. In all regressions, we control fixed effects, month fixed effects and year fixed effects per city. All these fixed effects explain an important portion of the variation of our dependent variables. There are some control variables that have a consistent sign and significance throughout most of the specifications we estimate. For all of our dependent variables, participation rates and employment rates, the share of the working age population with college degree and the ratio GDP/population correlates positively and significantly with each of these labor indexes. As for employment rates, the percentage of private firms is correlated negatively and significantly with this labor index. In other words, labor markets where the public sector represents an important share of global employment has greater employment rates. For this same labor index, we observe a significant and positive correlation with the real GDP growth rate by department.

7.1 Worker Reallocation Rate (WR):

The first fluidity measure we analyze is the Worker Reallocation Rate. As the reader may remember, it refers to the amount of people that either change of firm or employment status from one period to the next, as a percentage of a firm´s size, which is defined as an employment MA process of order 2.

Employment Rates (Table 2a):

The OLS estimations show that the WR has a positive effect on the salaried employment rate and the formal salaried employment rate, but the magnitudes are quite small: an increment in one percentage point in the WR increases the salaried employment rate and the formal salaried employment rate 0.047 and 0.025 percentage points, respectively.

Regarding the IV results, we find a positive and significant causal relationship between the WR and two outcomes: the salaried-formal employment rate (using Bartik-like IV) and the formal Workers Occupation Rate (using minimum wage IV). The magnitudes of these relationships are substantially bigger than in the OLS: an increase in one percentage point in the WR increases the salaried-formal employment rate and the formal workers occupation rate in 0.28 and 0.34 percentage points, respectively. In other words, the estimations of IV show evidence of a causal relationship of WR on some of the employment rates we consider. This response is inelastic, but it is not negligible, being around 1/3 of the increment in the WR.

Occupation Rates (Table 2b): The OLS estimations show that the WR has a positive effect on all three measures of occupation rates considered in this paper. Once again, the magnitudes are small: an increment in one percentage point in the WR increases the salaried employment rate and the formal salaried employment rate 0.044 and 0.026 percentage points respectively.

As in the previous case, the results using IV are quite different. We find a positive and significant causal relationship between the WR and two outcomes, the salaried-formal occupation rate (with Bartik-like and minimum wage IVs) and the formal Workers Occupation Rate (using minimum wage as the IV). The magnitudes of these relationships are bigger than in the OLS: an increase in one percentage point in the WR increases the salaried-formal employment rate and the formal Workers Occupation Rate almost 0.23 and 0.35 percentage points, respectively. This is evidence of a causal relationship of the WR on some of the occupation rates we consider. This response is inelastic, but not negligible: it is around 1/3 of the increment in the WR in the case of the formal worker occupation rate, and more than 1/5 in the case of the formal salaried occupation rate.

Table 2a: The Relationship Between Labor Outcomes and Fluidity Labor Market (Using the Worker Reallocation Rate)

	OLS Results			IV Results					
				Bartik-Like IV			Real Minimum Wage (18-25)		
Variable	Salaried workers / Labor Force	Formal worker / Labor Force	Salaried formal workers / Labor Force	Salaried workers / Labor Force	Formal worker / Labor Force	Salaried formal workers / Labor Force	Salaried workers / Labor Force	Formal worker / Labor Force	Salaried formal workers / Labor Force
Worker reallocation	0.047***	0.025*	0.030**	0.192	-0.001	0.283**	-0.133	0.387**	0.245
	(0.02)	(0.01)	(0.01)	(0.17)	(0.13)	(0.13)	(0.22)	(0.19)	(0.16)
Hourly wage rate (deflacted IGD)	-0.001***	-0.000	-0.000	-0.000***	-0.000	-0.000	-0.001***	0.000	-0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
% WAP with College	23.797***	34.293***	22.890***	22.807***	34.475***	21.167***	25.024***	31.828***	21.423***
	(3.23)	(2.38)	(2.15)	(3.48)	(2.51)	(2.44)	(3.56)	(2.83)	(2.48)
% Private firms	-60.620***	-37.371***	-64.027***	-49.150***	-39.475***	-44.063***	-74.833***	-8.816	-47.028***
	(13.80)	(10.74)	(9.95)	(18.55)	(14.57)	(14.14)	(22.52)	(19.01)	(15.58)
Employees' average age	0.018	-0.074	0.082	0.023	-0.074	0.091	0.012	-0.061	0.090
	(0.10)	(0.09)	(0.07)	(0.10)	(0.08)	(0.08)	(0.10)	(0.11)	(0.08)
Employees' average age^2	-0.000	-0.002	0.000	-0.001	-0.002	-0.001	0.000	-0.003*	-0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Share of males in the payroll	3.676	7.201**	9.332***	-1.239	8.103	0.777	9.767	-5.036	2.048
	(4.26)	(3.48)	(3.07)	(7.11)	(5.77)	(5.63)	(8.70)	(7.71)	(6.55)
State-level labor demand†	-1.225	1.490	0.813	-0.304	1.321	2.418	-2.368	3.785	2.179
	(4.68)	(3.92)	(3.52)	(4.83)	(3.94)	(3.80)	(5.02)	(4.47)	(3.81)
GDP per person employed	0.004***	0.004***	0.004***	0.003***	0.004***	0.003***	0.004***	0.003***	0.003***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Employers costs (firms)	0.852	-2.512	-8.836*	-6.777	-1.112	-22.116**	10.307	-21.506*	-20.144*
	(7.51)	(5.54)	(5.22)	(11.74)	(8.98)	(9.24)	(14.01)	(12.04)	(10.59)
HP filter quarterly GDP	-0.000	0.000	-0.000	-0.000	0.000	-0.000	-0.000	0.000	-0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
State annual GDP growth	0.001	0.056***	0.022**	0.010	0.054***	0.038***	-0.010	0.079***	0.036***
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)
Constant	81.261***	55.805***	72.235***	76.523***	56.674***	63.989***	87.132***	44.010**	65.214***
	(16.50)	(13.55)	(11.81)	(17.15)	(13.79)	(13.54)	(18.47)	(17.20)	(13.35)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1725	1725	1725	1725	1725	1725	1725	1725	1725
Adjusted R-squared	0.944	0.951	0.959	0.942	0.951	0.950	0.941	0.934	0.953
F-statistic					19.46			14.03	

Notes:

Standard errors in parenthesis. * p<0.10 ** p<0.05 *** p<0.01

Bartik-Like instrument is calculated for worker reallocation as described in section 6.1.1. Real minimun wage is deflacted by CPI.

†Control for state-level labor demand as described in section 6.1.1.

Table 2b: The Relationship Between Labor Outcomes and Fluidity Labor Market (Using the Worker Reallocation Rate)

Variable	OLS Results			IV Results					
				Bartik-Like IV			Real Minimum Wage (18-25)		
	Salaried worker / WAP	Formal worker / WAP	Salaried formal workers / WAP	Salaried worker / WAP	Formal worker / WAP	Salaried formal workers / WAP	Salaried worker / WAP	Formal worker / WAP	Salaried formal workers / WAP
Worker reallocation	0.037***	0.028***	0.029***	0.178	0.075	0.240***	0.017	0.388***	0.251**
	(0.01)	(0.01)	(0.01)	(0.11)	(0.09)	(0.09)	(0.14)	(0.14)	(0.11)
Hourly wage rate (deflacted IGD)	-0.000***	0.000*	0.000	-0.000**	0.000*	0.000*	-0.000***	0.000**	0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
% WAP with College	17.532***	24.476***	16.545***	16.569***	24.154***	15.104***	17.667***	22.020***	15.028***
	(2.05)	(1.68)	(1.35)	(2.25)	(1.78)	(1.65)	(2.28)	(2.24)	(1.73)
% Private firms	-21.834***	-9.298	-28.883***	-10.671	-5.573	-12.185	-23.392*	19.154	-11.299
	(8.42)	(7.06)	(6.19)	(12.46)	(9.73)	(10.29)	(13.36)	(15.75)	(11.46)
Employees' average age	0.024	-0.034	0.061	0.029	-0.033	0.069	0.023	-0.022	0.069
	(0.06)	(0.06)	(0.04)	(0.07)	(0.06)	(0.06)	(0.06)	(0.08)	(0.06)
Employees' average age^2	-0.001	-0.002**	-0.000	-0.001	-0.002**	-0.001	-0.001	-0.003**	-0.001
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Share of males in the payroll	-2.347	0.592	2.164	-7.131	-1.004	-4.992	-1.679	-11.601*	-5.372
	(2.68)	(2.36)	(1.95)	(4.72)	(3.96)	(3.86)	(5.56)	(5.92)	(4.63)
State-level labor demand†	-0.906	0.689	0.501	-0.009	0.988	1.843	-1.031	2.975	1.915
	(3.04)	(2.64)	(2.25)	(3.19)	(2.64)	(2.58)	(3.12)	(3.52)	(2.70)
GDP per person employed	0.000	0.000	0.000	-0.000	0.000	0.000	0.000	-0.001	0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Employers costs (firms)	3.392	1.029	-3.566	-4.033	-1.448	-14.674**	4.429	-17.897*	-15.263**
	(4.45)	(3.60)	(3.15)	(7.71)	(6.14)	(6.40)	(8.32)	(9.43)	(7.29)
HP filter quarterly GDP	-0.000	0.000	-0.000	-0.000	0.000	-0.000	-0.000	-0.000	-0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
State annual GDP growth	0.011	0.043***	0.022***	0.020*	0.046***	0.036***	0.010	0.066***	0.036***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Constant	49.776***	35.220***	46.077***	45.165***	33.681***	39.179***	50.419***	23.467*	38.813***
	(9.86)	(8.80)	(7.23)	(10.99)	(9.02)	(9.50)	(10.65)	(14.08)	(9.94)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1725	1725	1725	1725	1725	1725	1725	1725	1725
Adjusted R-squared	0.957	0.960	0.968	0.953	0.959	0.955	0.957	0.928	0.954
F-statistic					19.46			14.03	

Notes:

Standard errors in parenthesis. * p<0.10 ** p<0.05 *** p<0.01

Bartik-Like instrument is calculated for worker reallocation as described in section 6.1.1. Real minimun wage is deflacted by CPI. WAP stands for Working Age Population.

†Control for state-level labor demand as described in section 6.1.1.

Job Reallocation Rate (JR)

The second fluidity measure we analyze is the Job Reallocation Rate. As the reader may remember, it refers to the amount of employment gains and losses from one period to the next as a percentage of firm´s size.

Employment Rates (Table 3a):

The OLS estimations show no significant relationship of the JR on employment rates. Regarding the IV results, using a Bartik-like type of instrument there is no significant relationship between the JR and the employment rate. Nevertheless, using the minimum wage as IV, we find a positive, significant, and important causal relationship of the JR on employment rates. The magnitudes of these effects are quite large. For instance, in the case of the salaried workers employment rate, an increment of one percentage point in the JR increases this employment rate in almost 0.75 percentage points. These responses on other employment rates given the changes in the JR are important as well, even though not as large as in the case of salaried workers.

Occupation Rates (Table 3b):

As in the previous case, the OLS estimations show no significant relationship of the JR on occupation rates. The IV regressions with Bartik-like IV do not show any evidence of an effect of the JR on occupation rates. Nevertheless, using the minimum wage as IV, we find a positive, significant, and important causal relationship of the JR on occupation rates. An increment of one percentage point in the JR increases the occupation rates for salaried workers, formal workers, and formal-salaried workers by 0.45, 0.35, and 0.37, respectively. The magnitudes of these effects of the JR on occupation are important as well: they are not as high as the effect of the JR on employment rates, but, for example in the case of salaried workers, this response is almost ½ of a change in the JR.

Table 3a: The Relationship Between Labor Outcomes and Fluidity Labor Market (Using the Job Reallocation Rate)

	OLS Results			IV Results					
				Bartik-Like IV			Real Minimum Wage employees		
Variable	Salaried workers / Labor Force	Formal worker / Labor Force	Salaried formal workers / Labor Force	Salaried workers / Labor Force	Formal worker / Labor Force	Salaried formal workers / Labor Force	Salaried workers / Labor Force	Formal worker / Labor Force	Salaried formal workers / Labor Force
Job reallocation	0.031	0.007	0.012	0.142	0.019	0.092	0.706***	0.455**	0.533***
	(0.02)	(0.02)	(0.02)	(0.17)	(0.14)	(0.12)	(0.27)	(0.20)	(0.20)
Hourly wage rate (deflacted IGD)	-0.001***	-0.000	-0.000	-0.000***	-0.000	-0.000	-0.000	0.000	0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
% WAP with College	24.042***	34.449***	23.065***	23.773***	34.422***	22.872***	22.415***	33.371***	21.808***
	(3.24)	(2.39)	(2.16)	(3.23)	(2.37)	(2.16)	(3.85)	(2.70)	(2.71)
% Private firms	-62.235***	-38.881***	-65.579***	-54.706***	-38.130***	-60.179***	-16.701	-8.716	-30.408*
	(13.82)	(10.74)	(9.99)	(17.72)	(14.07)	(12.33)	(23.68)	(17.85)	(17.83)
Employees' average age	0.020	-0.074	0.082	0.031	-0.073	0.090	0.087	-0.029	0.134
	(0.10)	(0.08)	(0.07)	(0.10)	(0.09)	(0.07)	(0.15)	(0.11)	(0.11)
Employees' average age²	-0.000	-0.002	0.000	-0.000	-0.002	0.000	-0.002	-0.003*	-0.001
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Share of males in the payroll	4.674	7.922**	10.116***	2.555	7.711*	8.596**	-8.144	-0.569	0.215
	(4.21)	(3.46)	(3.04)	(5.33)	(4.39)	(3.84)	(7.94)	(5.85)	(5.99)
State-level labor demand†	-1.342	1.372	0.694	-0.690	1.437	1.161	2.600	3.984	3.739
	(4.69)	(3.92)	(3.54)	(4.77)	(3.93)	(3.54)	(6.20)	(4.69)	(4.68)
GDP per person employed	0.004***	0.004***	0.004***	0.003***	0.004***	0.003***	0.003**	0.003***	0.003***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Employers costs (firms)	1.223	-1.678	-8.076	-6.335	-2.431	-13.497	-44.483**	-31.956**	-43.380***
	(7.72)	(5.64)	(5.34)	(14.24)	(11.07)	(10.02)	(21.64)	(15.80)	(16.26)
HP filter quarterly GDP	-0.000	0.000	-0.000	-0.000	0.000	-0.000	-0.000	0.000	-0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
State annual GDP growth	-0.001	0.054***	0.020**	0.002	0.055***	0.023**	0.018	0.067***	0.035**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)
Constant	82.121***	56.475***	72.951***	79.706***	56.235***	71.219***	67.520***	46.803***	61.673***
	(16.52)	(13.55)	(11.82)	(16.56)	(13.52)	(11.74)	(22.72)	(17.19)	(17.12)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1725	1725	1725	1725	1725	1725	1725	1725	1725
Adjusted R-squared	0.943	0.951	0.959	0.942	0.951	0.958	0.908	0.929	0.927
F-statistic					20.75			15.8	

Notes:

Standard errors in parenthesis. * p<0.10 ** p<0.05 *** p<0.01

Bartik-Like instrument is calculated for job reallocation as described in section 6.1.1. Real minimun wage is deflacted by CPI.

†Control for state-level labor demand as described in section 6.1.1.

Table 3b: The Relationship Between Labor Outcomes and Fluidity Labor Market (Using the Job Reallocation Rate)

Variable	OLS Results			IV Results					
				Bartik-Like IV			Real Minimum Wage employees		
	Salaried worker / WAP	Formal worker / WAP	Salaried formal workers / WAP	Salaried worker / WAP	Formal worker / WAP	Salaried formal workers / WAP	Salaried worker / WAP	Formal worker / WAP	Salaried formal workers / WAP
Job reallocation	0.025**	0.014	0.016*	0.147	0.075	0.107	0.439***	0.343**	0.352***
	(0.01)	(0.01)	(0.01)	(0.12)	(0.10)	(0.09)	(0.17)	(0.14)	(0.13)
Hourly wage rate (deflacted IGD)	-0.000***	0.000*	0.000	-0.000**	0.000*	0.000	-0.000	0.000***	0.000**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
% WAP with College	17.720***	24.631***	16.702***	17.428***	24.484***	16.483***	16.725***	23.839***	15.892***
	(2.05)	(1.68)	(1.36)	(2.06)	(1.67)	(1.38)	(2.45)	(1.94)	(1.74)
% Private firms	-23.012***	-10.543	-30.073***	-14.818	-6.414	-23.933***	4.860	11.642	-7.382
	(8.41)	(7.01)	(6.19)	(11.79)	(9.51)	(8.32)	(15.54)	(13.29)	(12.02)
Employees' average age	0.025	-0.034	0.062	0.037	-0.028	0.071	0.066	-0.001	0.095
	(0.06)	(0.06)	(0.04)	(0.07)	(0.06)	(0.05)	(0.09)	(0.08)	(0.07)
Employees' average age^2	-0.001	-0.002**	-0.000	-0.001	-0.002**	-0.001	-0.002	-0.003**	-0.001
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Share of males in the payroll	-1.591	1.265	2.831	-3.897	0.102	1.103	-9.437*	-4.980	-3.557
	(2.64)	(2.34)	(1.92)	(3.43)	(2.94)	(2.48)	(4.94)	(4.11)	(3.84)
State-level labor demand†	-0.990	0.595	0.412	-0.280	0.952	0.944	1.424	2.516	2.377
	(3.05)	(2.65)	(2.26)	(3.18)	(2.67)	(2.32)	(3.98)	(3.32)	(3.06)
GDP per person employed	0.000	0.000	0.001	-0.000	0.000	0.000	-0.000	-0.000	0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Employers costs (firms)	3.597	1.537	-3.137	-4.628	-2.608	-9.299	-24.380*	-20.732*	-25.913**
	(4.53)	(3.64)	(3.21)	(9.54)	(7.73)	(6.76)	(13.71)	(11.30)	(10.61)
HP filter quarterly GDP	-0.000	0.000	-0.000	-0.000	0.000	-0.000	-0.000	-0.000	-0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
State annual GDP growth	0.009	0.042***	0.021***	0.013	0.043***	0.023***	0.021*	0.051***	0.030***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Constant	50.421***	35.821***	46.667***	47.793***	34.497***	44.698***	41.483***	28.708**	39.391***
	(9.86)	(8.78)	(7.22)	(10.42)	(8.94)	(7.59)	(14.33)	(12.33)	(11.21)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1725	1725	1725	1725	1725	1725	1725	1725	1725
Adjusted R-squared	0.956	0.960	0.968	0.954	0.959	0.966	0.929	0.936	0.940
F-statistic					20.75			15.8	

Notes:

Standard errors in parenthesis. * p<0.10 ** p<0.05 *** p<0.01

Bartik-Like instrument is calculated for job reallocation as described in section 6.1.1. Real minimun wage is deflacted by CPI. WAP stands for Working Age Population.

†Control for state-level labor demand as described in section 6.1.1.

Churning Rate (CH)

The last fluidity measure we analyze is the Worker Reallocation Rate. As the reader may remember, it captures the amount of hires that are not new jobs created, on the one hand, and the amount of separations that are not jobs destroyed, both of them as a percentage of the firm´s size. In other words, churning is the portion of worker flows that is not a direct consequence of job creation or destruction. It could be the result of employer-employee mismatches in the search process, or it could be an important part of the search equilibrium as well.

Employment Rates (Table 4a): The OLS estimations show that the the CH has a positive and significant relationship with all three types of employment rates; nevertheless, the magnitude of these correlations is not particularly large. In all three cases, an increase in 1 percentage point in the fluidity measure increases these labor indexes 0.1 percentage points. Regarding the IV results, by using the Bartik-like IV, which is by far the best instrument we have for CH, we find that there is only one causal relation of CH on salaried-formal employment rate. An increase in one percentage point in the CH increases salaried-formal employment rate 0.32 percentage points. This is an inelastic response, but it is still important: the salaried-formal employment increase is almost 1/3 of an increase in churning. We obtain a positive causal relation between churning and employment rates when using a set of demographic instruments: the ratio between WAP (18-24) with High School education and WAP (18-60), and the ratio between WAP (18-24) with at most High School education and WAP (18-24). Our identification assumption is that these instrumental variables do not affect labor outcomes within Metropolitan Areas except through their effects on the pace of fluidity measures. As previous literature has shown (Davis & Haltiwanger (2014), for instance), younger workers, especially with low education, have much higher rates of churn regarding other demographic groups. The partial effect of churning throughout this "demographic" channel is substantially higher than using the Bartik-like instruments. The response of employment rates to an increase of one percentage point in churning is around one for all cases. In the case of the salaried employment rate, this response is even greater: 1.14.

Occupation Rates (Table 4b): As in the previous case, the OLS estimations show that CH has a positive and significant relationship with all three types of occupation rates. Similarly, the magnitudes of these correlations are quite small: one percentage point of increase in churning increases participation rates by 0.08 percentage points. Using a Bartik-like instrument, regression IV only shows evidence of a causal relationship between the CH and the salaried-formal occupation rate, in which case, an increase in one percentage point in the CH increases the salaried-formal occupation rate 0.23 percentage points.

Table 4a: The Relationship Between Labor Outcomes and Fluidity Labor Market (Using the Churning Rate)

	OLS Results			IV Results					
				Bartik-Like IV			Demographic IV		
Variable	Salaried workers / Labor Force	Formal worker / Labor Force	Salaried formal workers / Labor Force	Salaried workers / Labor Force	Formal worker / Labor Force	Salaried formal workers / Labor Force	Salaried workers / Labor Force	Formal worker / Labor Force	Salaried formal workers / Labor Force
Churning	0.110***	0.104***	0.107***	0.099	-0.030	0.322***	1.146***	1.041***	0.937***
	(0.04)	(0.03)	(0.03)	(0.16)	(0.13)	(0.12)	(0.38)	(0.32)	(0.27)
Hourly wage rate (deflacted IGD)	-0.001***	-0.000	-0.000	-0.001***	-0.000	-0.000*	-0.001***	-0.000	-0.000**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
% WAP with College	23.631***	34.007***	22.622***	23.680***	34.598***	21.672***	19.066***	29.880***	18.967***
	(3.23)	(2.39)	(2.14)	(3.35)	(2.43)	(2.21)	(3.91)	(3.10)	(2.71)
% Private firms	-63.045***	-38.180***	-65.152***	-63.173***	-39.726***	-62.667***	-51.105***	-27.383**	-55.589***
	(13.89)	(10.59)	(9.78)	(13.68)	(10.56)	(9.60)	(16.66)	(13.30)	(12.04)
Employees' average age	0.010	-0.081	0.074	0.010	-0.072	0.060	-0.058	-0.142	0.020
	(0.10)	(0.09)	(0.07)	(0.10)	(0.08)	(0.07)	(0.11)	(0.10)	(0.08)
Employees' average age²	-0.000	-0.002	0.000	-0.000	-0.002	-0.000	-0.001	-0.003	-0.001
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Share of males in the payroll	3.623	6.513*	8.753***	3.788	8.506**	5.552	-11.765	-7.402	-3.571
	(4.32)	(3.54)	(3.13)	(4.77)	(3.92)	(3.58)	(7.88)	(6.89)	(5.86)
State-level labor demand†	-1.467	1.382	0.678	-1.472	1.314	0.787	-0.942	1.856	1.098
	(4.67)	(3.91)	(3.52)	(4.61)	(3.87)	(3.51)	(5.33)	(4.59)	(4.10)
GDP per person employed	0.004***	0.004***	0.004***	0.004***	0.004***	0.003***	0.003**	0.003***	0.003***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Employers costs (firms)	4.981	0.409	-5.645	4.812	-1.625	-2.376	20.691**	14.614*	6.937
	(7.53)	(5.60)	(5.23)	(7.70)	(5.77)	(5.33)	(10.53)	(8.50)	(7.48)
HP filter quarterly GDP	-0.000	0.000	-0.000	-0.000	0.000	-0.000	-0.000	0.000	-0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
State annual GDP growth	0.002	0.058***	0.024**	0.002	0.053***	0.032***	0.039**	0.091***	0.054***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)
Constant	81.577***	55.489***	72.033***	81.699***	56.964***	69.664***	70.189***	45.192***	62.913***
	(16.65)	(13.53)	(11.78)	(16.44)	(13.41)	(11.77)	(19.93)	(16.68)	(14.61)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1725	1725	1725	1725	1725	1725	1725	1725	1725
Adjusted R-squared	0.944	0.951	0.959	0.944	0.951	0.958	0.926	0.931	0.942
F-statistic					96.58			16.05	

Notes:

Standard errors in parenthesis. * p<0.10 ** p<0.05 *** p<0.01

Bartik-Like instrument is calculated for churning as described in section 6.1.1.

Demographic IVs are defined as: 1) the ratio between WAP (18-24) and WAP (18-60) with High School education; 2) the ratio between WAP (18-24) at most High School education and WAP (18-24).

†Control for state-level labor demand as described in section 6.1.1.

Table 4b: The Relationship Between Labor Outcomes and Fluidity Labor Market (Using the Churning Rate)

Variable	OLS Results			IV Results					
				Bartik-Like IV			Demographic IV		
	Salaried worker / WAP	Formal worker / WAP	Salaried formal workers / WAP	Salaried worker / WAP	Formal worker / WAP	Salaried formal workers / WAP	Salaried worker / WAP	Formal worker / WAP	Salaried formal workers / WAP
Churning	0.080***	0.085***	0.082***	0.069	0.009	0.231***	0.208	0.148	0.211
	(0.03)	(0.02)	(0.02)	(0.10)	(0.08)	(0.08)	(0.21)	(0.18)	(0.14)
Hourly wage rate (deflacted IGD)	-0.000***	0.000	0.000	-0.000***	0.000*	0.000	-0.000***	0.000	0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
% WAP with College	17.428***	24.288***	16.381***	17.475***	24.625***	15.724***	16.865***	24.015***	15.812***
	(2.05)	(1.68)	(1.35)	(2.13)	(1.73)	(1.40)	(2.10)	(1.74)	(1.41)
% Private firms	-23.799***	-10.505	-30.202***	-23.922***	-11.385*	-28.482***	-22.325**	-9.789	-28.714***
	(8.34)	(6.91)	(6.02)	(8.23)	(6.82)	(5.97)	(8.89)	(7.37)	(6.45)
Employees' average age	0.018	-0.041	0.055	0.018	-0.036	0.045	0.009	-0.045	0.047
	(0.06)	(0.06)	(0.04)	(0.06)	(0.05)	(0.04)	(0.07)	(0.06)	(0.04)
Employees' average age²	-0.001	-0.002**	-0.000	-0.001	-0.002**	-0.000	-0.001	-0.002**	-0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Share of males in the payroll	-2.299	0.261	1.920	-2.141	1.396	-0.296	-4.199	-0.661	0.002
	(2.72)	(2.40)	(1.99)	(3.12)	(2.71)	(2.35)	(4.05)	(3.53)	(2.91)
State-level labor demand†	-1.097	0.556	0.361	-1.103	0.517	0.437	-1.033	0.588	0.427
	(3.04)	(2.64)	(2.25)	(2.99)	(2.60)	(2.26)	(3.03)	(2.62)	(2.26)
GDP per person employed	0.000	0.000	0.000	0.000	0.000	0.000	-0.000	0.000	0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Employers costs (firms)	6.530	3.784	-0.827	6.368	2.626	1.436	8.469	4.725	1.131
	(4.48)	(3.66)	(3.19)	(4.60)	(3.75)	(3.28)	(5.74)	(4.62)	(3.96)
HP filter quarterly GDP	-0.000	0.000	-0.000	-0.000	0.000	-0.000	-0.000	0.000	-0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
State annual GDP growth	0.012	0.044***	0.023***	0.011	0.042***	0.028***	0.016	0.047***	0.028***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Constant	50.088***	35.185***	46.113***	50.205***	36.025***	44.473***	48.683***	34.503***	44.694***
	(9.87)	(8.73)	(7.16)	(9.75)	(8.62)	(7.18)	(10.32)	(9.11)	(7.56)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1725	1725	1725	1725	1725	1725	1725	1725	1725
Adjusted R-squared	0.957	0.960	0.968	0.957	0.960	0.967	0.956	0.960	0.967
F-statistic					96.58			16.05	

Notes:

Standard errors in parenthesis. * p<0.10 ** p<0.05 *** p<0.01

Bartik-Like instrument is calculated for churning as described in section 6.1.1. WAP stands for Working Age Population.

Demographic IVs are defined as: 1) the ratio between WAP (18-24) and WAP (18-60) with High School education; 2) the ratio between WAP (18-24) at most High School education and WAP (18-24).

†Control for state-level labor demand as described in section 6.1.1.

8. Conclusions

This paper analyzes the fluidity of the formal labor market from Colombia, and the relationship between measures of fluidity and some labor market results, particularly employment rates and occupation rates for salaried and formal workers. Theoretically, the relationship between fluidity and labor market outcomes may by ambiguous; nevertheless, recent empirical work (Davis & Haltiwanger, 2014) has found that fluidity has a positive influence on employment. Furthermore, a persistent reduction in the United States' labor market´s fluidity is partly responsible for an increase in the long run unemployment equilibrium rate.

We analyze the standard fluidity measures from the second semester of 2008 to the second semester of 2014. We find that for all three fluidity measures we study in the paper (worker and Job Reallocation Rates and Churning Rate) there has been a noticeable, increasing trend after 2009. This is a period where unemployment has shown a remarkable reduction. By using econometric models, we show evidence of a consistent and strong causal effect of fluidity measures on several of our labor market outcomes.

Using simple OLS models, we find that fluidity measures have a positive and significant correlation with our employment and occupation rates, but the magnitudes of these correlations is quite small. With the instrumental variables regression approach, several fluidity measures are no longer significant, but in the cases where there is still a significant relationship, the magnitudes of the coefficients are substantially higher.

From the 2sls regressions, we find that that the Worker Reallocation Rate causes increments in salaried-formal and formal employment rates and occupation rates. The magnitudes depend upon the instruments used, but the effect is between 0.25 and 0.38 percentage points of increment for one percentage point of increment in the Worker Reallocation Rate. Regarding the Job Reallocation Rate we find that using the minimum wage as an instrument has a positive impact on all employment and occupation rates used as dependent variables in this study, with magnitudes ranging from 0.45 to 0.70, depending upon the outcome. Finally, in regards to churning rate, we find a positive and highly inelastic impact on salaried-formal employment and occupation rates when we use instruments that exploit the exogenous variation in the national intensity of reallocation of workers and jobs. Using demographic instruments, we find a larger effect of churning on all the employment rates considered: this effect in all outcomes is close to an increase of one percentage point given an increase in one percentage point in the Churning Rate.

This study is one of the few that assess the influence of fluidity on labor market outcomes. To the best of our knowledge, there is no other reference on the impact of fluidity on salaried and formal employment indexes for a developing country. We find evidence of a causal, positive relationship of fluidity on these outcomes in the formal labor market in Colombia. According to the evidence presented here, more fluid and flexible labor markets have been beneficial for the Colombian labor market, and in this way beneficial for the whole economy.

The evidence we present in this paper favors flexible labor markets, flexibility increases fluidity of labor markets, and the more fluid they are the more occupation and the less unemployment there would be. The magnitudes of the elasticities we get are subtle, but important. At least partially, the good performance that the Colombian labor market had in during 2009 and 2014 is a result of an increase in the fluidity of the market. This conclusion shed light on the beneficial effects that policies seeking more flexible labor markets would have in developing countries with economics similar to the Colombian one. Additional research is needed to understand the reasons behind the increase in the fluidity of the labor market as well as the causal impacts of fluidity on additional outcomes such as productivity of the firms, for instance.

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APPENDIX A1

Table A1. First-Stage IV regression

Variable	Worker reallocation		Job reallocation		Churning	
	IV1	IV2	IV1	IV2	IV1	IV2
Bartik-Like WR	32.486***					
	(7.36)					
Real Minimum Wage (18-25)		-0.003***				
		(0.00)				
Bartik-Like JR			30.582***			
			(6.71)			
Real Minimum Wage employees				-0.004***		
				(0.00)		
Bartik-Like CHUR					59.260***	
					(6.03)	
WAP-HS(18-24)/WAP-HS(18-60)†						-0.116***
						(0.02)
WAP at most HS(18-24)/WAP(18-24)†						0.051***
						(0.01)
Hourly wage rate (deflacted IGD)	-0.000**	-0.000**	-0.000***	-0.000***	0.000	0.000**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
% WAP with College	6.280*	8.303**	2.185	4.452	3.863**	10.198***
	(3.57)	(3.63)	(3.34)	(3.48)	(1.64)	(2.73)
% Private firms	-78.472***	-79.333***	-69.183***	-64.548***	-7.246	-16.588**
	(24.72)	(25.01)	(23.22)	(23.34)	(8.17)	(8.39)
Employees' average age	-0.038	-0.036	-0.075	-0.112	0.012	0.057
	(0.16)	(0.16)	(0.15)	(0.15)	(0.05)	(0.05)
Employees' average age^2	0.003	0.003	0.002	0.002	0.001	0.001
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Share of males in the payroll	33.579***	33.734***	19.249**	19.391***	13.865***	14.631***
	(7.51)	(7.48)	(7.53)	(7.49)	(3.07)	(3.12)
State-level labor demand§	-8.508	-6.804	-10.757*	-5.944	5.078*	-0.681
	(6.06)	(6.08)	(5.89)	(5.77)	(2.65)	(2.69)
GDP per person employed	0.001	0.002**	0.001	0.001	0.000	0.001
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Employers costs (firms)	36.090***	49.623***	47.840***	65.269***	-6.678*	-16.759***
	(12.95)	(12.03)	(13.23)	(12.31)	(3.98)	(4.04)
HP filter quarterly GDP	0.000	0.000	0.000	0.000	0.000	0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
State annual GDP growth	-0.065***	-0.062***	-0.029	-0.028	-0.034***	-0.036***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)
Constant	38.369	39.827	31.655	29.832	2.047	15.884*
	(27.82)	(27.96)	(26.40)	(26.47)	(9.28)	(9.63)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1725	1725	1725	1725	1725	1725
Adjusted R-squared	0.708	0.707	0.539	0.537	0.851	0.842
F-statistic	19.46	14.03	20.75	15.8	96.58	16.05

Notes:

Standard errors in parenthesis. * p<0.10 ** p<0.05 *** p<0.01

Bartik-Like instruments are calculated as described in section 6.1.1. Real mimimum wage is deflacted by CPI. WAP stands for Working Age Population.

† Demographic instruments of churning rate are defined as: 1) the ratio between WAP (18-24) and WAP (18-60) with High School education; 2) the ratio between WAP (18-24) at most High School education and WAP (18-24).

§ Control for state-level labor demand as described in section 6.1.1.


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