The cyclical behavior of separation and job finding rates in Colombia

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Abstract

This work uses readily accessible data about the stocks of unemployed workers, labor force and duration of unemployment to measure the job finding and separation rates for Colombia from 1984 to 2014. It also evaluates the relative contribution of these rates to the fluctuations of unemployment rate. It is found that contemporaneous movements in both rates explain significantly and in roughly the same proportion the changes in the unemployment rate during the analyzed period; however, for the last seven years job finding rate has driven the unemployment fluctuations. The results of this work differ from previous findings by Lasso (2011) where the separation rate is the most important in Colombia. Results are contrasted with the obtained for France and United States to show that Colombian unemployment is of European nature but has United States' features.

JEL Codes: J63, J64, E32

Keywords: Job finding rate, separation rate, business cycle, unemployment

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1 Introduction

1.1 Search and matching models in the labor market

Several types of frictions characterize most of the real world labor market transactions: When a firm wants to hire a new worker, may not know clearly the productivity of the candidate; similarly, the worker must effort to signal his productivity. On the other hand, there could be mismatches between the skill requirements of jobs and the skill mix of workers; differences in locations of jobs and workers, slow mobility of labor force or poor transmission of information about job opportunities. All these frictions are reflected in the fact that it takes time for a worker to find a good job and for firms to fill vacancies; agents then must invest in a costly and time consuming process of searching to learn what the alternative opportunities are. As a result, the procedure might end with idle resources in equilibrium, that is: unemployment and vacancies.

Despite their importance, research about search frictions in the labor market started formally only in early 1970's with the influential contributions of McCall (1970), Mortensen (1970) and Phelps (1970). The aim of last two articles was to obtain the microfoundations of the Phillips curve assuming a wage distribution and a reservation wage strategy of workers; however, in all the three works, if a worker was unemployed, it was because he had not found yet a wage offer that satisfied its reservation level

A different approach was taken by Pissarides (1979) where the *matching function* was first introduced, from this view, jobs and workers have different features that make them suitable or not to engage together in production through a labor contract, hence it is not only the worker who is concerned to find a wage that is high enough, but also the firm is interested in locating a good match before filling a vacancy; thus the process of assigning workers to jobs takes time, whatever the wage offered by each job. From this view, unemployment is neither voluntary nor involuntary, it is just the result of a decentralised equilibrium that moves towards a level where flows in and out of it are balanced.

A second alternative to the first one-sided search models, where the only role of workers was to accept or not the wage offers set by firms, was put forward by Diamond (1982), who incorporated in the search models the fact that wage setting was actually two sided: neither the firms nor the workers have the whole power to decide the remuneration of labor. He argues that a more suitable way of modeling wage setting is to assume that wages are

negotiated in a bargaining process between the worker and the employer. Therefore, when these two sides meet or decide to engage in production, they have a stream of future benefits to share; and the wage decision establishes how the difference between what they can earn together relative to the alternative is going to be split.

The combination of previous three contributions started to be know as the Diamond-Mortensen-Pissarides (DMP henceforth) model, and soon it became a reference in the study of labor markets theory. Its main foundations can be summarized in three points:

1. Workers and firms engage in a costly and time consuming search process to find the adequate trade partner.

2. The rate at which a new hire appears is given by the matching function.

3. Wages are set in a Nash bargaining process.

One of appeals of DMP model was that it seemed more realistic than the traditional competitive market view; for example, the definition of unemployment proposed in search and matching theory is precisely the one proposed by International Labor Organization, that is, the number of workers which are not in a job, are looking for one, and available to take one.

Moreover, the DMP models were able to make predictions about the movement of workers between employment, unemployment, out of the labor force, and between jobs; therefore they are useful to understand the stylized facts about job and worker flows that literature has documented. To mention just an example, Rogerson and Shimer (2010) show that in the United States recessions are typically characterized by a sharp increase in the inflow rate of workers from employment into unemployment and a large decline in the outflow rate of workers from unemployment into employment. Thus, employment could be low because employed workers are losing their jobs at a high rate; or, alternatively, it may be low because unemployed workers are not searching very intensively, or because firms are reluctant to hire. Neither of these possibilities is easily understood in a model without search frictions.

Search and matching models are also analytically tractable and they permit to consider the reactions to frictions and how the reactions to them by others change the economic environment, how we interpret labor market data and how we suggest policies. They can be useful for example, to analyze the wage dispersion across identical workers, the effects of unemployment benefits on search behavior of unemployed workers, the effects in hiring and firing rates of Employment Protection Legislation, the behavior at different stages of the business cycle of workers flows and the probabilities to find a job, to loose one or to move from out the labor force to employment or unemployment during the cycle.

Furthermore, search theory has opened several branches of literature that although related, have different primary concerns. First group of researchers aim to explain worker and job flow and unemployment levels; the second one focuses in how wage dispersion can be a result of labor markets with frictions; and a third one with the interests to

incorporate the search frictions in the labor markets into the Dynamic Stochastic General Equilibrium Models to study business cycles.

Additionally, the analysis of the labor markets trough the approach of search frictions models has been prolific specially for the United States, for other OECD countries there have been also several studies; and new discussions have raised to complement and enrich original DMP models. However almost no progress has been done for developing countries, mostly because of the lack of appropriated data about the flows of workers, the level of vacancies and the durations of the spells of employment, unemployment and inactivity. The goal of this work is to use the search frictions framework to analyse the contributions of job finding and separation rates to fluctuations in unemployment for the Colombian case from 1984 to 2014 exploiting questions from household surveys to construct the required data. Moreover, results are compared with the corresponding from France and the United States to analyse to which of this two polar labor markets is closer the Colombian one.

The remainder of this work is composed of five sections. The second part of this introduction makes a brief presentation of Colombian labor market to put in context analysis done in this document. The methodologies used to compute the job finding and separation rates and to analyze their behavior in the business cycle are presented in section 2. Section 3 presents the sources and describes the procedure to construct the data. Results obtained for Colombia and their comparison with France and the United States are presented in section 4. Finally, section 5 concludes.

1.2 The Colombian labor market

On 2013, Colombian Central Bank published a book to gather the most important facts, trends and institutions of the Colombian labor market. As part of the research, Arango and Hamann (2013) asked to a group of analysts of the domestic labor market which were, according to them, the main sources of unemployment. Interestingly, search frictions were signalled as the most important; analysts chose the mismatch between the skill requirements of firms and the skill mix of labor force as the major cause for unemployment, in the fourth place, slightly below the high level of the minimum wage, it appeared the low mobility and poor information systems about both sides of the market. When analysts were asked about the best policies that could improve the performance of Colombian labor market, the strengthening of information system was chosen in second place.

Accordingly, search frictions in the Colombian labor market have a prominent role; still, few analyses of them have been done so far. However, before starting to study the job findings and separation rates in Colombia, it worth to make first a brief description about how is the labor market in the country.

Recently, Colombian economy has strengthen; since 2001 it has not had negative growth rates of real GDP, foreign investment has increased and the unemployment rate has shown a decreasing trend during the last 10 years. The gradual change of Colombian economy has also translated to the labor market; however it presents very contrasted features. In some aspects, its behavior is similar to more dynamic labor markets in

developed countries. First, flows of workers moving from employment, unemployment and inactivity are considerable; according to Lasso (2011) after 1998 the probability to move from wage employment to unemployment has duplicated, moving from about 9% in 1995 to 18% in 1999, the probability to find a job as self employed has also showed an increasing trend during the last 15 years and the likelihood of remaining in the self employment after a year has decreased over time, specially since 2002[1]. These numbers suggest that workers are less attached to their jobs, but they also find more easily a new one; then, on average they are rotating more in the labor market from one state to the other specially since 1998. Second, female labor participation has increased markedly during the last 25 years, starting at 40% in 1984 until be around 70% in 2011, this is presented in panel (a) of figure 1.1.

In addition, Colombian labor force is more educated now. The share of workers that have at most primary school has dropped, in panel (b) of figure 1.1 it is possible to see that in 1984 they represented 38% of total labor force; but by 2014 they were 18%. Similarly, the median schooling of labor force has increased from 7 years to 11 between 1984 and 2011.

On the other hand, some features of the labor market would instead lead us to think that it is a rigid one. In 1995 Colombia had the lowest unemployment rate from its recent history, but in 1998 and 1999 the country experienced the most severe economic crisis which leaded to levels of unemployment up to 20%, even today it has not been possible to come back to the 1995's level, this is presented in the panel (c) of figure 1.1; the strong hysteresis of the unemployment rate suggests that the adjustments in the labor market are very slow, and that maybe, they occur mostly in the quantities (persons) instead of prices (wages).
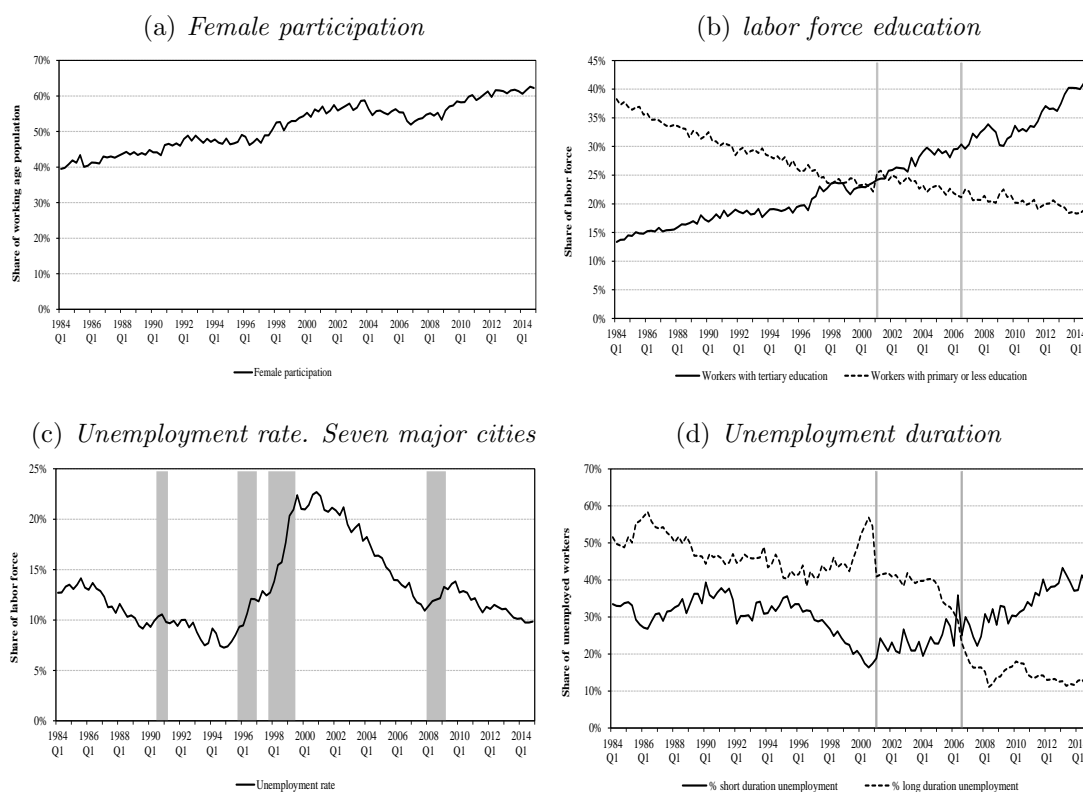
The Colombian labor market presents also an interesting duality feature, most of the unemployed workers are in one of two extreme situations: they have being unemployed during 3 months or less or they have being unemployed for one year or more, this is displayed in the panel (d) of figure 1.1 and implies that there is an important share of workers that easily go in and out of employment while other non negligible group has low employability[2].

Besides, the country has had a huge growth of its informal sector up to levels of 25%; according to López Castaño (2008), the employment in modern sectors in Colombia has been biased in favor of the labor force with some degree of education and against the less educated. This poses a marked contrast with the fact that there is relative abundance of workers with at most secondary education, and consequently moves these latter to the informal sector that seems to have no limits to growth. From the firms point of view, Mejía and Posada (2013) argue that the high level of informality could emerge as an optimal choice of firms to the incentives that presents a rigid labor market where the

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[1] In 2002, 63% of employed workers with high education keep their jobs during a year; in 2010, this share had reduced to 56%. For low educated workers, the figures went from 60% to to 50% during the same time interval.

[2] Official statistics of unemployment according to its duration are not published by the National bureau of statistics of Colombia, to classify unemployed workers by duration intervals, it is used the micro data of households surveys. More details appear in section 3.

Figure 1.1: Some Features of Colombian labor market

(a) *Female participation*

(b) *labor force education*

(c) *Unemployment rate. Seven major cities*

(d) *Unemployment duration*

Source: Author's construction based on household surveys.

Note: Vertical lines in panel (c) signal the changes in household surveys. See section 3. Shaded areas in panel (d) represent the recession dates according to Alfonso et al. (2011)

minimum wage is set above its equilibrium level. The level of under employment in the country[3] is also very high ; yet, according to Puyana et al. (2011) the employed workers who wish to work more hours per week perceive a higher wage per hour, suggesting that compensating differentials play an important role in this case.

Finally, the persistent differences in the results of labor markets from one city to the other suggest that there is low internal mobility of the labor force, calculations done by Arango (2011) show that the difference between the cities with the lowest and the highest participation rates is about 16 percentage points, the discrepancy can go up to 18 percentage points for the occupation rate whereas for the unemployment rate the range is close to 10 percentage points. Thus, even if flows of workers are high at the aggregated level as suggested by Lasso (2011), the movements seems to occur within the same regions; high transportation costs and lack of information could be important determinants of this fact. Further research should either confirm or reject this hypothesis or set new ones.

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[3]According to the current Colombian household survey, *under employment* denotes all employed workers who wish to improve its revenues from work, to increase the number of hours worked, or, to have a job more suitable for their education/formation. If the person not only expresses her desire, but also has made some search in order to ameliorate its actual labor conditions, it is considered an *objective* under employed.

2   Measuring job finding and separation rates

As mentioned in the introduction, DMP models are useful to analyze and to understand in more detail several empirical regularities of labor markets; in this section the focus is in one of them: the behavior along the business cycle of the separations and job finding rates and how they contribute to the cyclical fluctuations in unemployment rate.

In a pioneer work Darby et al. (1986) assessed that for the United States economy changes in separation rates were the main determinant of unemployment rate; similarly Davis and Haltiwanger (1990) highlighted that large job creation and job destruction flows can co-exist at all phases of the business cycle.

More recent analysis by Shimer (2005, 2012) drew new conclusions that are totally opposed to the previous ones; in particular, using publicly available data from the Current Population Survey (CPS henceforth) he argues that the prominent role attributed to separation rates in earlier studies is a consequence of a time aggregation bias, which basically results from the fact that transitions in the labor market occur continuously, but we only have information on whether the workers were in a state or not in discrete intervals (monthly in the best cases). He claims that once the bias is removed, it is clear that separation rates are nearly acyclical whereas job finding rates are strongly procyclical and the main driving force of unemployment fluctuations.

As expected, these findings were controversial and subsequent studies developed alternative methodologies to either debate or confirm them. Elsby et al. (2009) proposed a slightly different method to evaluate the job finding and separation rates and found that even with Shimer's own data, inflows to unemployment have an important role in the increase of unemployment during recessions. Correspondingly, Fujita and Ramey (2009) used CPS gross flow data to quantify the contribution of each flow to overall unemployment variability and concluded that both are roughly equally important to explain movements in unemployment. Similarly, Yashiv (2006) compared several data sources and found that there is considerable cyclicality and volatility of both outflows and inflows to unemployment and hence, both are important for understanding the business cycle.

For other countries, Petrongolo and Pissarides (2008) used administrative and labor force survey (LFS) data to study the contribution of finding and separation rates to unemployment for Spain, France and the United Kingdom; their main finding is that even if both rates have an important role in fluctuations of unemployment rate, job finding is

more relevant in high firing costs scenarios. On the other hand, Hairault et al. (2012) utilized also administrative and LFS data and showed a dominant role of the job finding rate in the French unemployment fluctuations during the last decade but still cyclical fluctuations of separation rates.

Finally, Elsby et al. (2008) made a comparative analysis of fourteen OECD countries using annual measures of the unemployment stock classified by its duration to conclude that fluctuations in both inflow and outflow rates make important contributions to unemployment variation within countries, that there is a geographical partitioning of the relevance of each rate[1] and that the timing of contributions is similar across countries.

As can be noticed, despite its relevance; the debate has been focused in advanced economies. The reason for this is mainly that there are not good or long enough datasets in developing countries, in particular regarding the labor market flows and the vacancies rates. However, Shimer (2005) and Elsby et al. (2009) methodologies permit to estimate the job finding and job separation rates based on the stock of unemployment and the duration of the spells, and these data are more likely to be available for several countries. Colombia for example counts on it quarterly from 1984 on.

As a first approach to the debate for the Colombian case, the works by Shimer (2005), Elsby et al. (2009), Fujita and Ramey (2009) and the modifications done to them to fit the data available for Colombia are presented next. In order to give a better analysis of the results, the outcomes obtained for Colombia are compared with the updated existent findings for the United States and French economies, therefore it is also presented the approach proposed by Elsby et al. (2008) to deal with French data given the low frequency at which it is available[2].

For the forthcoming analysis, there will be considered only two states in which workers can be: employment and unemployment. Thus *separation rate* will refer to the transitions from employment to unemployment, and *job finding rate* to the transitions from unemployment to employment. With this approach movements in and out of the labor force are certainly ignored, and it is not possible to distinguish job loss from job leaving when separations occur; however for the United States case, Shimer (2012) established that the two transitions considered here explain more than two thirds of the variability of unemployment; similarly Hairault et al. (2012) assessed that the two-states approach can capture the main dynamics of French unemployment. For the Colombian case Lasso (2011) argues that the changes between employment and unemployment within the labor force are the main drivers of unemployment fluctuations; and as will be shown after, the two-states is a fairly good approximation since the unemployment rate predicted from such case closely tracks the actual one.

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[1]They found that Anglo-Saxon countries' unemployment rates are mostly determined by job finding rates whereas in Continental European countries' rates play an equal role

[2]The French labor Survey is annual since 1950, in 2003 the survey moved to be a rotative quarterly panel where each household is surveyed during six quarters.

# 2.1   Methodology for continuous time/discrete data

Shimer (2005, 2012) proposes a methodology to compute the job finding and separation rates using publicly available data. He makes four main assumptions:

1. Workers neither enter nor exit the labor force, but just move between employment and unemployment; the latter defined as the period of active job search[3].

2. Since the methodology is based in macroeconomic aggregated data, workers are consider ex ante identical, meaning that in any period t unemployed have the same job finding rate and employed workers have the same job separation rate; therefore it is ignored any heterogeneity or duration dependence that could make some unemployed workers more likely to find a job.

3. Given that the variations in the job finding or separation rates within the period are not observable, they are assumed to be constant.

4. Initially, Shimer (2005) considers that there is not on-the-job search, this last assumption is relaxed after in order to evaluate the possibility that workers change from job without experiencing unemployment spells and to match the stylized fact that these transitions are strongly procyclical. But given the features of the data used here, this work will stay in the basic model where there is not on-the-job search.

The environment proposed by Shimer (2005) is a continuous time in which data is available only at discrete dates. This is the source of time aggregation bias: even if people loose and find jobs at very short intervals of time, say every day; the labor force surveys are conducted only on a monthly or quarterly basis, then they could not capture the inflows and outflows from unemployment over the period.

Under this setting, Shimer (2005) refers to the interval of time $[t, t + 1)$ as the period t. Additionally $\tau \in [0, 1]$ is set to be the time elapse since the previous Labor Force Survey date. For illustrative purposes figure 2.1 is presented. In t and $t + 1$ individuals are surveyed, but between these dates, in a moment τ, the unemployment count could have changed with respect to the reported by the survey in period t since some workers could have loose their jobs and some unemployed workers might have found one.

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[3]As was pointed in the introduction, this criteria for defining unemployment is actually consistent with the official definition of the International labor Organization (ILO), which considers as unemployed a person in working age (more than 15 years old for developed countries) who: *i)* has worked less than one hour during the reference week, *ii)* is *available* for working during the next two weeks and *iii)* has *actively looked for a job* during the last month.

Figure 2.1: Source of time aggregation bias
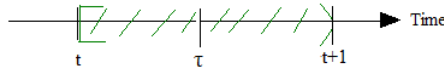
In the moment of time τ the number of employed and unemployed workers could differ from the reported in survey done in t. This problem is exacerbated when the surveys are conducted in a lower frequency.

Let $U_{t+\tau}$ denote the number of unemployed workers at time $t+\tau$ and $E_{t+\tau}$ the number of employed workers at the same moment of time; together they determine the labor force $L_{t+\tau} = E_{t+\tau} + U_{t+\tau}$.

Finally $U_t^s(\tau)$ represents the short term unemployment, that is, the number of workers that are unemployed in time $t + \tau$ but that were employed at some point between t and $t + \tau$. This group of workers will not be captured as unemployed by the survey done in period t even if they are unemployed most of the time interval elapsed between the two measurement dates; and then could bias any analysis about unemployment done only on the basis of stocks. To close notation, $U_t^s(0) = 0 \ \forall t$ and $U_t^s(1) = U_{t+1}^s$ is the total amount of short term unemployment at the end of period t^4.

Assuming that job offers arrive to unemployed workers following a Poisson process with rate f_t and that all offers are accepted[5], $F_t = 1 - e^{-f_t} \in [0, 1]$ represents the probability that a worker who begins the period t unemployed finds at least one job during the period of time (before the next survey date).

Likewise, if separations arrive to employed workers following a Possion process with rate s_t, the probability that a workers who begins period t employed losses his job within the period is given by $S_t = 1 - e^{-s_t}$.

With this two Possion processes, it is possible to obtain the law of motion for unemployment:

$$\dot{U}_{t+\tau} = s_t E_{t+\tau} - f_t U_{t+\tau} \tag{2.1}$$

Similarly, for the short term unemployment we can set:

$$\dot{U}_t^s(\tau) = s_t E_{t+\tau} - f_t U_t^s(\tau)$$

Combining both equations to eliminate $E_{t+\tau}$:

$$\dot{U}_{t+\tau} = \dot{U}_t^s(\tau) - f_t[U_{t+\tau} - U_t^s(\tau)]$$

By construction $U_t^s(0) = 0$, so given the an initial condition for U_t, this can be solved for U_{t+1} and $U_{t+1}^s = U_t^s(1)$:

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[4]This means that U_{t+1}^s is the number of workers that are unemployed at the moment of the next survey but that were not registered as such in the previous interrogation.

[5]Here, it is assumed that workers do not use a reservation wage strategy to search for a job, this differs from initial search models as in Mortensen (1970) or Burdett and Mortensen (1998).

$$U_{t+1} = (1 - F_t)U_t + U_{t+1}^s$$

Solving for F_t this yields:

$$F_t = 1 - \frac{U_{t+1} - U_{t+1}^s}{U_t} \tag{2.2}$$

From the previous equation, it is possible to obtain the probability that a typical unemployed worker finds a job during the time elapsed between two consecutive surveys: F_t. This result can be then used to get the job finding rate, i.e the rate at which job offers arrive:

$$\boxed{f_t = -\ln(1 - F_t)} \tag{2.3}$$

So, it is straightforward to notice that, having measures of unemployment and short term unemployment[6] it is possible to obtain the job finding probability and with it, the job finding rate.

Combining the information about the labor force and the job finding rate, it is possible to use the law of motion of unemployment to obtain the job separation rate:

$$U_{t+1} - U_t = s_t(L_t - U_t) - f_t U_t$$

After solving forward equation 2.1, we can finally have a non linear equation for s_t that can be used to obtain the separation rate[7]:

$$\boxed{U_{t+1} = \frac{s_t L_t \left[1 - e^{-(f_t + s_t)}\right]}{f_t + s_t} + e^{-(f_t + s_t)}U_t} \tag{2.4}$$

In steady state, this equation reduces to:

$$\boxed{u_t^{ss} = \frac{s_t}{s_t + f_t}} \tag{2.5}$$

Where u_t is the unemployment rate and the index ss indicates that we are considering the steady sate. This rate is the one that balances the inflows and outflows from unemployment. Shimer (2005), Elsby et al. (2009) and Fujita and Ramey (2009) argue that

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[6]Thus short term unemployment is defined as the number of unemployed workers whose duration of the unemployment spell is lower or equal than the time interval between two consecutive surveys: If surveys are done monthly, short term unemployment corresponds to unemployed workers who have been in such state during 4 weeks or less; in the case of quarterly surveys, the ones that have been during 12 or less weeks.

[7]Equation 2.4 is solved using Fsolve procedure in Matlab. An initial value for s_t is proposed and the program will change it iteratively until the equation is satisfied.

the evolution of actual unemployment rate is closely approximated by this steady state relationship, that is: $u_t \approx u_t^{ss}$. For the United States, Shimer (2005) found a correlation between this two values of 0.99; for the French case Hairault et al. (2012) obtained a value of 0.91 when administrative data is used and of 0.83 when LFS is the source of information; for Colombia Lasso (2011) found a correlation between the cycles of these two series of 0.99.

Hence, to measure the job finding and separation rates in practice we need data about:

1. The number of employed workers: E_t

2. The number of unemployed workers: U_t

3. The unemployment duration, in particular the number of unemployed of short term[8]: U_t^s

Previous data can be obtained for several countries beyond the developed economies, for the Colombian case we can construct such series from 1984 on using microdata from households surveys for the seven major cities for the country.

Finally, Shimer (2005) computes the hypothetical steady state unemployment rate that would prevail if the job finding rate would remain at its historical average in order to obtain the relative contribution of this rate to overall unemployment fluctuations; an equivalent procedure is done for the separation rate. In this way, in Shimer (2005) and Shimer (2012) each transition rate's contribution to changes in unemployment rate is presented in table 2.1 :

Table 2.1: Contribution of job finding and separation rate to overall unemployment fluctations. Shimer (2005) approach

Contribution of job finding rate	*Contribution of job separation rate*
$\mathrm{c}_t^f = \dfrac{s^m}{s^m + f_t}$	$\mathrm{c}_t^s = \dfrac{s_t}{s_t + f^m}$

Where s^m and f^m represent the average sample values of separation and finding rates respectively.

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[8]For the United States case, Shimer (2005) must adjust this series from 1994 on due to a redesign of the survey that changed how the unemployment duration question was asked; prior to 1994, the official measure of short-term unemployment captured the total number of unemployed workers who were employed at any point during the preceding month but not at the moment of the survey; whereas after the redesign, short term unemployment counted only workers who moved from employment at one survey date to unemployment at the next survey date, ignoring movements within the period. To fit the true value, his proposal is to multiply the official series by a correction factor of 1.1

2.2   Methodology for continuous time/discrete data with weekly measurement

The counter-intuitive results of Shimer (2005,2012) regarding the acyclical behavior of separation rates have motivated a new wave of works that proposed alternative approaches to evaluate these findings. One of them, based also in Labor Force Survey data that is available for the public is the study by Elsby et al. (2009) [9].

Their methodology is based on the same assumptions from Shimer (2005), but it incorporates into the analysis the fact that most of the LFS that follow the International Labor Organization (ILO hereafter) guidelines consider the week previous to the survey as the relevant reference period to compute aggregated employment and unemployment figures; their aim is therefore to be consistent with the official labor force definitions that underlie the construction of the series that are used to obtain job finding and separation rates.

Hence, Elsby et al. (2009) propose a discrete weekly equivalent to Shimer's time aggregation correction method. They use the same definition as equation (2.2) in order to compute the job finding probability, but make a difference computation to obtain the separation rate. Bearing in mind that the reference period is a week, for monthly data the time elapsed since the last survey (τ) can only take four values:

$$\tau \in \left\{ 0, \frac{1}{4}, \frac{1}{2}, \frac{3}{4} \right\}$$

The stock of unemployment under this conditions evolves following a difference equation:

$$U_{t+\tau+\frac{1}{4}} = U_{t+\tau} + s_t E_{t+\tau} - f_t U_{t+\tau}$$

Given that they assume initially a constant labor force, if the previous expression is solved forward four weeks it is obtained:

$$U_{t+1} = s_t L_t \sum_{n=0}^{3} (1 - s_t - f_t)^n + (1 - s_t - f_t)^4 U_t \tag{2.6}$$

From this new non-linear expression we can get the separation rate once the job finding rate has been obtained in equation (2.3). An extended equation (2.6) to fit quarterly data is used in the Colombian case, details are presented in the appendix A, the resulting formula is basically the same, except from the exponents and limits of the sum:

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[9]In their paper, Elsby et al. (2009) express their preference for this kind of data over the gross flow despite its usefulness as they claim that this latter are subject to numerous deficiencies, for example they exclude the individuals who change residence (and actually changes in domicile could be endogenous to a labor market transitions) and generate spurious transitions because of missclassification that could have occurred in either of the months used in the longitudinal match.

$$U_{t+1} = s_t L_t \sum_{n=0}^{11} (1 - s_t - f_t)^n + (1 - s_t - f_t)^{12} U_t \qquad (2.7)$$

According to the authors, this new methodology solves the over correction of time aggregation bias that results from Shimer (2005) procedure and avoids the problem of raising the level of estimated inflow rates to unemployment and reducing the variations of the rate over the economic cycle that Shimer (2005) has.

The assumption of a constant labor force leads to a steady state relationship just as in equation (2.5); since this expression is approximately equal to the actual unemployment rate, Elsby et al. (2009) propose a distinct manner to evaluate the impact that changes in either the job finding or separation rates have on the variation of unemployment.

Arguably, using a log differentiation of the steady state unemployment rate is less arbitrary than setting separation (job finding) rate at its sample mean to evaluate the contribution of job finding (separation) rate to unemployment variability. Log differentiation of the steady state unemployment rate expression in equation (2.5) yields:

$$du_t \approx u_t(1 - u_t)[d\ln(s_t) - d\ln(f_t)] \qquad (2.8)$$

Where u_t is the actual unemployment rate. If it is small, that is, if $(1 - u_t) \approx 1$, the logarithmic changes in s_t and f_t will translate into fairly proportional changes in the unemployment rate. With this decomposition of the unemployment rate variations, Elsby et al. (2009) introduce a technique to quantify the contributions of each transition rate to the fluctuations in u_t; all that is needed, is to compare the log variations in the two flows with the corresponding in the unemployment rate to check which is more important.

2.3 Methodology for low frequency data

Elsby et al. (2008) argue that short duration unemployment can be very noisy for countries in which it accounts for a small proportion of overall unemployment, posing a natural limitation to Shimer (2005) procedure when it is going to be applied for countries other than the United States. For the French economy for example, the share of workers with more than a year of unemployment has fluctuated for more than 30 years around 40% whereas in the United States the workers just experience nine weeks of unemployment on average. To illustrate the magnitude of the difference, figure 2.2 compares the share of unemployed workers with more than 27 weeks of unemployment in France and the United States[10], it appears that indeed most of French unemployment corresponds to people that has been in such state during a long period of time, therefore, using Shimer (2005) method could bring misleading results.

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[10]The BLS does not publish the number of unemployed workers with more than 12 months of unemployment, the highest interval covers the people with more than 27 weeks of unemployment, that is why it is used here as the reference to compare with French unemployment.

Figure 2.2: Unemployed workers with more than 27 weeks of unemployment
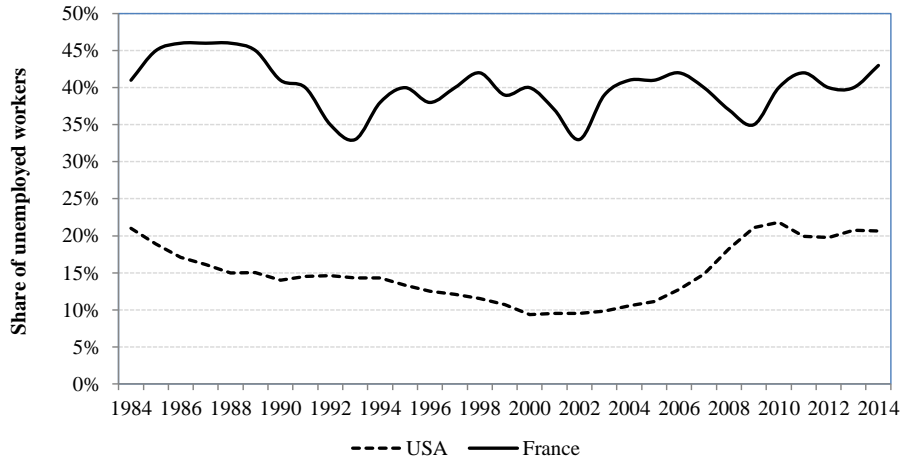
To address this difficulty Elsby et al. (2008) develop a method that exploits data on unemployment at lower frequencies to construct comparable time series of the job finding and separation rates for the cases where the actual unemployment rate can not be closely approximated by its flow steady state value (equation (2.5)) and derive a decomposition of unemployment variation that allows it to deviate from the equilibrium relationship. Their method has into account that Shimer (2005) procedure can not be applied directly to other OECD countries because the data needed are not available or the frequency of the surveys for most of the cases is low, for France for example it is annual until 2002.

Considering again only two states in which workers can be (employed and unemployed) the evolution of the unemployment rate can be written as:

$$\frac{du_t}{dt} = s_t(1 - u_t) - f_t u_t$$

Assuming that the flow hazard rates s_t and f_t are constant within years, and solving the equation one year forward it is found:

$$\boxed{u_t = \lambda_t u_t^* + (1 - \lambda_t)u_{t-12}} \tag{2.9}$$

Where u_t^* is the steady state unemployment rate presented in equation (2.5) and $\lambda_t = 1 - e^{-12(s_t + f_t)}$ denotes the annual rate of convergence to the steady state.

As an extension of the Shimer (2005) method, it is possible to write the probability that an unemployed workers exits unemployment within d months as:

$$F^{<d} = 1 - \frac{U_{t+d} - U_{t+d}^{<d}}{U_t} \tag{2.10}$$

Where U_{t+d} denotes the stock of unemployed workers in period $t + d$ and $U_{t+d}^{<d}$ the stock of unemployed workers with duration less than d months.

As in Shimer (2005) this can be mapped into a job finding rate given by:

$$\boxed{f_t^{<d} = \frac{-\ln(1 - F_t^{<d})}{d}} \tag{2.11}$$

With this estimation of job finding rate, it is possible to compute the separation rate using equation (2.9).

Finally, in order to evaluate the contribution of each rate to overall fluctuations in unemployment it is not possible to use Elsby et al. (2009) formulation since the unemployment rate in countries where the share of short duration unemployment is low can substantially differ from its flow steady state value. Instead, if we do a log-linear approximation of equation (2.9), it is possible to express the logarithmic change in unemployment rate as:

$$\Delta \ln u_t \approx \lambda_{t-1} \left\{ (1 - u_t^*)[\Delta \ln s_t - \Delta \ln f_t] + \frac{1 - \lambda_{t-2}}{\lambda_{t-2}} \Delta \ln u_{t-1} \right\} \tag{2.12}$$

Where $\lambda_t = 1 - e^{-12(s_t + f_t)}$ is the rate of convergence of unemployment rate to its steady state value. Thus, if unemployment dynamics are very fast, λ_t is close to one for all t and the equation reduces to the decomposition proposed by Elsby et al. (2009), as in equation (2.8); however, out of steady state contemporaneous changes in unemployment rate are driven not only by contemporaneous but also by lagged variation in the job finding and separation rates. In order to summarize the contributions of each rate Elsby et al. (2009) compute:

$$\beta_f = \frac{cov(\Delta \ln u_t, C_{ft})}{var(\Delta \ln u_t)} \quad \beta_s = \frac{cov(\Delta \ln u_t, C_{st})}{var(\Delta \ln u_t)} \quad \beta_0 = \frac{cov(\Delta \ln u_t, C_0)}{var(\Delta \ln u_t)}$$

(2.13)

Where β_f, β_s and β_0 represent respectively the total contribution of job finding rate, job separation rate and the initial deviation from steady state on the fluctuations of unemployment rate. Similarly, C_{ft}, C_{st} and C_0 are the *cumulative* contributions of contemporaneous and past variations in the job finding rate, job separation rate and the initial deviation from steady state at time $t = 0$ and are defined as:

$$C_{ft} = \lambda_{t-1} \left[-(1 - u_{t-1}^*)\Delta \ln f_t + \frac{1 - \lambda_{t-2}}{\lambda_{t-2}} C_{ft-1} \right], \quad \text{with } C_{f0} = 0$$

$$C_{st} = \lambda_{t-1} \left[(1 - u_{t-1}^*)\Delta \ln s_t + \frac{1 - \lambda_{t-2}}{\lambda_{t-2}} C_{st-1} \right], \quad \text{with } C_{s0} = 0$$

And,

$$C_{0t} = \frac{\lambda_{t-1}(1 - \lambda_{t-2})}{\lambda_{t-2}} C_{0t-1}, \quad \text{with } C_{00} = \Delta \ln u_0$$

This approach will be the one used for France as it only have long time series at annual frequency.

2.4 Measures of cyclicality and contributions of separation and job finding rate.

Fujita and Ramey (2009) also made a contribution to the debate about the movements of job finding and separation rates along the cycle; instead of using the stock of unemployed and employed workers, they use the CPS gross flow data to analyse business cycle dynamics of separation and job finding rates and to quantify the contributions of these rates to overall unemployment variability. Moreover, using traditional Hodrick Prescott filtering to remove the trend of the data, they evaluate the comovements of the cyclical components of job finding and separation rate with the corresponding of the productivity and unemployment rate at various leads and lags to evaluate their degree of cyclicality.

To quantify the contributions of separation and job finding rates to overall unemployment variability, Fujita and Ramey (2009) made use of the steady state approximation of the actual unemployment presented in equation (2.5); this expression could also be applied to the trends obtained with the HP filter[11]

$$\bar{u}_t \approx \frac{\bar{s}_t}{\bar{s}_t + \bar{f}_t} \approx \bar{u}_t^{ss}$$

Doing a log linear approximation of u_t^{ss} around its trend $\bar{u}_t^{ss}$ leads to the following decomposition:

$$\ln\left(\frac{u_t^{ss}}{\bar{u}_t^{ss}}\right) = (1 - \bar{u}_t^{ss})\ln\left(\frac{s_t}{\bar{s}_t}\right) - (1 - \bar{u}_t^{ss})\ln\left(\frac{f_t}{\bar{f}_t}\right) + \epsilon_t$$

This can be expressed in a more general form as:

$$du_t^{ss} = du_t^{sr} + du_t^{jfr} + \epsilon_t \tag{2.14}$$

Where du_t^{sr} and du_t^{jfr} represent respectively the deviations of separation rate and job finding rate from their trends. The expression in equation (2.14) makes it possible to decompose unemployment variability in terms of changes in job finding and job separation rates, that is, $Var(du_t^{ss})$ can be written as:

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[11]Originally, the trends could also be set to be the value of unemployment steady state lagged one period, that is, $\bar{u}_t^{ss} = u_{t-1}^{ss}$

$$Var(du_t^{ss}) = Cov(du_t^{ss}, du_t^{sr}) + Cov(du_t^{ss}, du_t^{jfr}) + Cov(du_t^{ss}, \epsilon_t)$$

Expressed as a fraction of total variation of steady state unemployment, the expression reduces to:

$$1 = \frac{Cov(du_t^{ss}, du_t^{sr})}{Var(du_t^{ss})} + \frac{Cov(du_t^{ss}, du_t^{jfr})}{Var(du_t^{ss})} + \frac{Cov(du_t^{ss}, du_t^{\epsilon})}{Var(du_t^{ss})}$$

Which is equivalent to:

$$1 \approx \beta^{sr} + \beta^{jfr} + \beta^{\epsilon}$$

Therefore, the variation in du_t^{ss} that derives from variations in du_t^{sr}, du_t^{jfr} or du_t^{ϵ} is given by:

$$\beta^i = \frac{Cov(du_t^{ss}, du_t^i)}{Var(du_t^{ss})} \tag{2.15}$$

Where i can refer to sr, jfr or ϵ. Thus, the betas measure how much of unemployment variation is explained by fluctuations in the separation, job finding rates and a residual component.

Results of the detrending procedure show that for the United States the separation rate and productivity have a peak correlation of -0.58 when the HP filter is used. For the job finding rate, the obtained correlation has its peak at a lead of two or three quarters in the HP filtering data. Using as cycle indicator the unemployment rate, they are also found different degrees of comovement between the labor market hazard rates and the business cycle. These results once more contradict Shimer (2005) finding about aciclycality of separation rate.

Since for the Colombian case the gross flows of workers between one state and the other are not available, the Fujita and Ramey (2009) method for computing the job finding and separation rates will not be used; This work uses of the measures of contributions to unemployment variability (β^{sr} and β^{sr}) proposed by them.

3 Data and data treatment

3.1 Colombian Household surveys

This work relies on Households Survey data provided by the National Statistical Department of Colombia (DANE); using this source of information it is possible to obtain relatively long time series for the Colombian case.

In Colombia, household surveys started to be implemented during the decade of 1970, the first of them was *Encuesta Nacional de Hogares*[1] (ENH henceforth) and had as main goal to produce basic statistics related to the demographic, social and economic features of Colombian population, changes in the level of employment were also captured by this initial survey. From 1970 to 1983, only nine surveys were conducted, with different frequency and sample designs; in 1978 for example was done the first measurement of rural areas; some cities were surveyed only twice a year whereas other every quarter.

More homogeneous series are available since 1984, when ENH started to be applied quarterly to the seven main cities in the country[2] and the municipalities close to them using a standard methodology, the same sample design and basically the same questions each time it was done. However, according to Lasso (2002), this survey was subject to some limitations; for example, the high rotation of the staff in charge of collecting the data made it hard the development of the survey and monitoring of the households.

In order to correct these failures, to modernise the surveys system and to obtain results that were consistent with the ILO guidelines, in 1996 the DANE began a project to improve the quality of the households survey, updating the methodologies, the samples and changing the frequency at which data was collected.

In 2001, a new survey took place, the *Encuesta Continua de Hogares* (ECH in what follows) replaced the ENH and introduced the designed changes: the survey became continuous, meaning that data collection was conducted each of the 52 weeks of the year; more cities were included (13 instead of 7) and aggregated data was published every month instead of every quarter.

Nevertheless the most considerable modification from one survey to the other was the classification of individuals between employed, unemployed or inactive: First, the contributing family workers (previously referred to as unpaid family workers) working in

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[1]National Households Survey
[2]Bogotá, Cali, Medellín, Barranquilla, Pasto, Bucaramanga and Manizales

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a family business during one hour or more per week are considered as employed workers according to the ILO definitions adopted by the ECH; conversely in ENH, this category covered the family workers who worked 15 weeks or more per week. Thus, people who devoted up to 14 hours per week to work in a family business without any compensation or wage, move from being considered unemployed or inactive in the ENH to be employed in the ECH. The second main change was done to the definition of unemployed worked; the ECH concept includes the *availability* to work of people that express the desire to do it; therefore, in comparison with the ENH, in the ECH people who is not available to work or does not have a valid reason for unemployment[3] is not considered as unemployed.

As a result of these two changes, the unemployment rate was reduced in about 3 percentage points while the employment rate increased about one percentage point; this break in the series posed a challenge to the researchers and politicians willing to do long term analysis about Colombian labor market. Lasso (2002) and Arango et al. (2006) suggested different methods to splice the two labor market time series resulting from each survey. For this work, the aggregated series obtained from the latter work will be used to analyse the job finding and separation rates during a longer period of time.

In the third quarter of 2006, further adjustments were included to the households survey. The sample was updated according to the population census done in 2005 and two more surveys related to the households conditions in the country were included: The National Survey of Revenues and Expenditures and the Life Conditions Survey. Besides, a mobile device to collect the data was introduced and the answers of each person started to be answered directly by the individual instead of being responded by the chief of the household. According to the DANE, changes done in 2006 did not have important effects on the main figures from the labor markets in the urban areas with respect to the ECH, therefore any procedure to splice the time series from ECH and the new survey will be used. Gran Encuesta Integrada de Hogares, *GEIH*, was the name given to the survey that resulted from the 2006 modifications to the ECH, it is the main source of information about the Colombian labor market until now .

3.2 Construction of the series: The Colombian case.

This work relies on the microeconomic data from the Household Surveys from the first quarter of 1984 to the last quarter of 2014. In order to obtain time series for this period, several steps are followed:

First, to obtain the data from 1984 to 2000:IV this work uses the aggregated spliced series of unemployment rate (UR_t^s), occupation rate (ER_t^s) and participation rate (PR_t^s) from Arango et al. (2006). Since the data needed to apply the methodologies presented

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[3]Valid reasons for unemployment include: *i)* Already found a job, *ii)* being waiting for callback, *iii)* do not find job in the city, *iv)* do not know how to look for a job, *v)* do not find job in her the profession or occupation, *vi)* do not have the experience needed for the job, *vii)* being discouraged of searching, *viii)* being waiting for the high season, *ix)* do not have enough resources to start her own business, or, *x)* being considered too young or too old by the employers. Reasons from *iii)* to *vi)* could be considered as search frictions.

in section 2 refers to the *number* of employed and unemployed people instead of the rates, the required series are computed using the fact that the definition of the working age population did not changed from one survey to the other[4]:

$$LF_t^s = WAP_t * PR_t^s$$

$$U_t^s = UR_t^s * LF_t^s$$

$$E_t^s = WAP_t * ER_t^s$$

Where LF_t corresponds to the labor force, WAP_t to the working age population, U_t to the number of unemployed workers and E_t to the number of employed workers. The index s indicates that the series are spliced; note that the working age population does not have the index since it did not changed from the ENH to the ECH.

Second, to get the data from the first quarter of 2001 on, it is computed the quarterly average of the number of people belonging to the labor force and its classification between unemployed and employed. This is done only for the seven cities that were originally surveyed in the ENH.

Finally, the series are seasonally adjusted using the procedure census X-12. Results from the splicing procedure and seasonal adjustment for the number of unemployed workers are presented in figure 3.1. It is evident the break in the series derived from the change of the survey; however, the splicing procedure seems to correct it fairly well.

Figure 3.1: Spliced series for unemployment
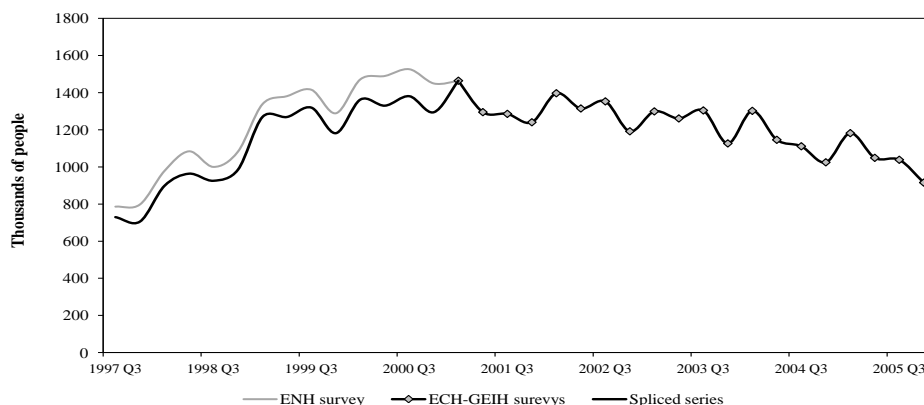
Source: Author's construction based on household surveys and Arango et al. (2006).

Note: Constructed for the seven cities that were surveyed in ENH.

The classification of unemployed workers according to their unemployment duration is not published officially by the DANE; nevertheless, since 1984 all the surveys have asked

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[4]In Colombia, the working age population includes all persons with 12 years or more in urban areas or 10 years or more in rural areas.

to the individuals two different questions related to their unemployment spells: *i)* How many weeks have you looked for a job? *ii)* How many weeks have you been unemployed? Given that the methodologies presented in previous chapter refer to search and matching models, and because to be consider as unemployed worker it is necessary, according to the official ILO definition, to be actively looking for a job; the first question is used to construct the short term unemployment series[5].

The change in the frequency of the household survey from quarterly to monthly since 2001 poses a challenge for the construction of the short term unemployment series; if the whole sample period were quarterly, it can be easily defined as the number of unemployed workers that have been in such state during 12 weeks or less; similarly, if the whole data came from monthly surveys, short term unemployed workers would be those with less than 5 weeks of search. But with two different frequencies it is not so straightforward which should be the period considered to construct the series.

However, given that the Shimer (2005) method defines the relevant time interval to compute the short term unemployment as the time elapsed between two measurement dates and that this work is based mostly on quarterly data, short term unemployment will refer to the unemployed workers that have been looking for a job during 12 weeks or less. Figure 3.2 presents the resulting series. The first vertical line signals the date when the survey moved from been quarterly to monthly, and the second one when the mobile capture device was introduced to collect the data[6]. It can be noticed that the change of the survey the second time brought a significant increase of the series[7]; thus the series is corrected to eliminate the effect of the new survey, it is assumed that short term unemployment can be expressed as:

$$SU_t = c + t + d + \epsilon_t$$

Where SU_t is the short term unemployment resulting from the microdata, c is a constant, t the time trend, ϵ_t an error term and d a dummy variable with:

$$d = \begin{cases} 1, & \text{if survey is GEIH} \\ 0, & \text{otherwise} \end{cases}$$

The resulting estimated coefficient for d is discounted from short term unemployment; results are also presented in figure 3.2 (solid line).

Finally, Colombia does not have and official Business Cycle Dating Committee as it is the case in the United States or in Europe; however, a chronology of the business cycle is needed in order to have a reference to evaluate the performance of the unemployment, job

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[5]Besides, according to the information presented by the Bureau of labor Statistics of the United States, the duration of unemployment is computed on the base of how much time persons had been looking for work. Thus for comparative purposes the first question is more suitable to construct the series

[6]This means, the first vertical line signals the movement from ENH to ECH and the second one from ECH to GEIH.

[7]Such break did not occur in the other relevant series. See appendix B.

Figure 3.2: Colombian short term unemployment for quarterly data
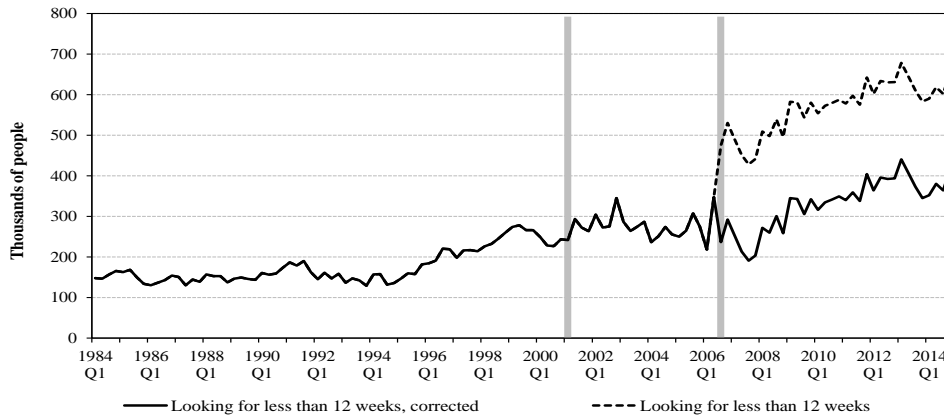
Source: Author's construction based on household surveys. Seasonally adjusted series. Vertical lines represent
changes of Labor Force Surveys

finding and separation rates along the cycle. To overcome this lack of official data, the
dates of recession and expansion for the Colombian economy are based on the monthly
chronology proposed by Alfonso et al. (2011)[8]; since the frequency of this study is quar-
terly, in order to make the chronology equivalent, the quarters of recession are set to
be the ones for which the monthly chronology marked at least one month of economic
downturn.

3.3 Series for France and the United States.

In this paper Shimer (2005), Elsby et al. (2009) and Elsby et al. (2008) works are updated
until the last quarter of 2014 in order to compare Colombian labor market with two
countries, the United States and France. These two economies are interesting because
they illustrate two polar cases, the former is usually consider as a very flexible labor
market whereas the latter is consider a very rigid one with strong employment protection
and low labor reallocation. According to Allard (2005) index[9], the United States have an
average score of 0.6 in its employment protection, the lowest from the OECD countries,
whereas France reached a value of 3, only below Greece and Italy.

For the United States, this work uses the public CPS monthly data published by the
Bureau of labor Statistics; series about the employment, unemployment and short term

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[8]This dating of business cycle is based on 41 monthly series that cover the whole Colombian economy,
the proposed chronology results from analysing the levels of the series without using any detrending
procedure as the Hodrick and Prescott (1980) (HP) filter, and its performance seems satisfactory when
it is contrasted with other variables not used in its construction as the urban GDP.

[9]The index is the weighted sum of the score that each country obtains according to several indicators
of how easy or difficult is for a firm to dismiss a worker, it includes how many salaries does a firm
has to pay when fires a worker, the notice period required to inform the worker about the decision, the
definition of unfair dismissal and the maximum number of successive temporary contracts. The score goes
from 0 (very easy) to 6 (very hard) and it is computed for three types of situations: Regular contracts,
Temporary contracts and Collective dismissal.

Figure 3.3: Unemployed workers with less than 5 weeks of unemployment in France
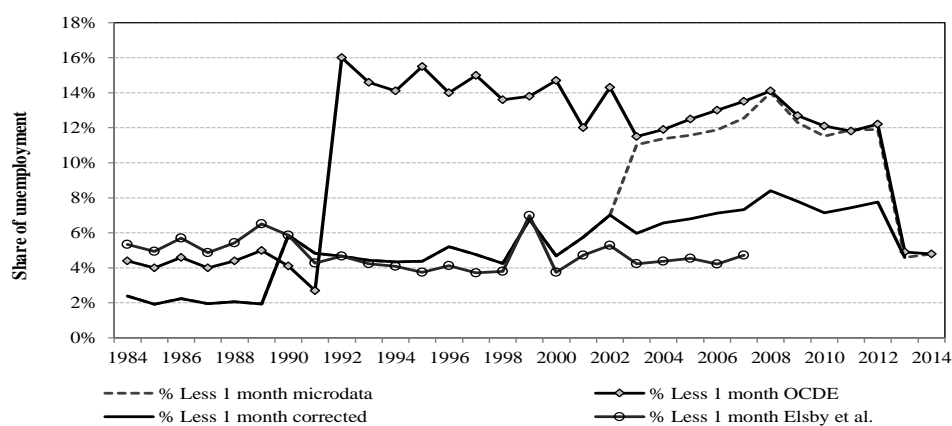
Source: Author's construction based on household surveys, OECD data and Elsby et al. (2008)

unemployment are available since 1948; however, it is just considered the period from 1984 to 2011 in order to make it homogeneous to the Colombian period of analysis. To work in the same frequency I take the quarterly average of the data. Finally, to describe the business cycle in the United States, it is used the official quarterly chronology published by the Business Cycle Dating Committee of the National Bureau of Economic Research.

The French case requires more attention; household surveys started in 1950 but at annual frequency, only since 2003 it is possible to obtain data every quarter. In 2013 a further change was introduced to the survey and for this year and 2014 data is annual once more. The French Statistical Department (INSEE) has published some spliced series at the quarterly frequency for the unemployment level, but the series for the employment level and the unemployment classified by its duration are only available at the annual frequency. This is the reason for using the procedure suggested by Elsby et al. (2008) for low frequency data presented previously.

The classification of unemployed workers according to the duration of their spells is published annually by the OECD, this is the source of information used by Elsby et al. (2008); however, the official data presents two strong breaks: one very large in 1992 and the other less dramatic in 2003, in 2013 the series drops again close to its 1991 level; these breaks are not presented in Elsby et al. (2008) data. Given this strange jump of the series, the share of workers with less than 5 weeks of unemployment is computed using the microdata of French LFS (Enquête emploi). Results are presented in figure 3.3; it appears that Elsby et al. (2008) series basically coincides with the official published by the OECD until 1992. Conversely, the series obtained from microdata present a higher level during the period of time of quarterly survey (2003-2012) and comes to its previous trend in 2013-2014; thus the series is corrected using an analogous procedure to the one performed for the Colombian case.

Regarding the dating of the business cycle, this work follows the definition proposed by the Centre for Economic Policy Research (CEPR) for the European case, that is, France will be in recession whenever the growth rate of the real GDP is negative during two

consecutive quarters. For the annual data, years of crisis will be the ones when at least one quarter was marked as recession.

4 Separation and job finding rates in Colombia

4.1 Separation and job finding rates.

Figure 4.1 shows the smoothed job finding and separation rates obtained for Colombia using both Shimer (2005) and Elsby et al. (2009) methodologies[1]. From the figure two main facts are evident: First, the separation rates obtained from both methods closely track each other and follow parallel trends, but just as Elsby et al. (2009) mentioned for the United States case, Shimer (2005) method (solid line in panel (b)) produces greater estimated rates of inflow to unemployment. Second, both job finding and separation rates move along the cycle following the expected direction, that is, during recessions separation rate increases and job finding rate falls, with the exception of the 2008 downturn when the decrease in finding rate occurred only towards the end of the business cycle phase. Moreover, it can be noticed that separation rate seems to have a turning point before than the cycle does, that is, separation seems to lead the cycle whereas job finding rate appears to move contemporaneously with the business cycle. From a visual approach, separation rate is not acyclical and is a leader indicator of the business cycle.

Separation rate reaches an average value of 5,0% when measured according to Elsby et al. (2009) method or 5,2% following Shimer (2005), besides during the last 5 years it has increased; in particular, separation rate has not come back to the levels it had before 2008 crisis, this finding is consistent with Lasso (2011) results who argues that separation rate duplicated after 1999 and has not showed any signal of significant reduction since then. Given that separation rates are usually small, separation rates and separation probability are very close, that means that on average a Colombian worker will loose her job in a given quarter with a probability of 4,9%, value that is more than 2 percentage point higher than in the United States, an more than 4 percentage points greater than French labor market.

Job finding rate has an average value of 35,1% and it has also increased markedly during recent years, but conversely to Lasso (2011), results in this work indicate that it has reached higher levels than it had before the 1998 crisis, attaining a maximum value of 54% in 2010 after being in a minimum value of 15% in 2000. The same behavior is true for the job finding probability, $F_t = 1 - e^{-f_t}$, (dashed line in panel (a)) although the level of the latter is smaller. On average, in the Colombian labor market an unemployed

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[1] See equations (2.3), (2.4) and (2.7)

Figure 4.1: Job finding and separation rates for the Colombian labor market

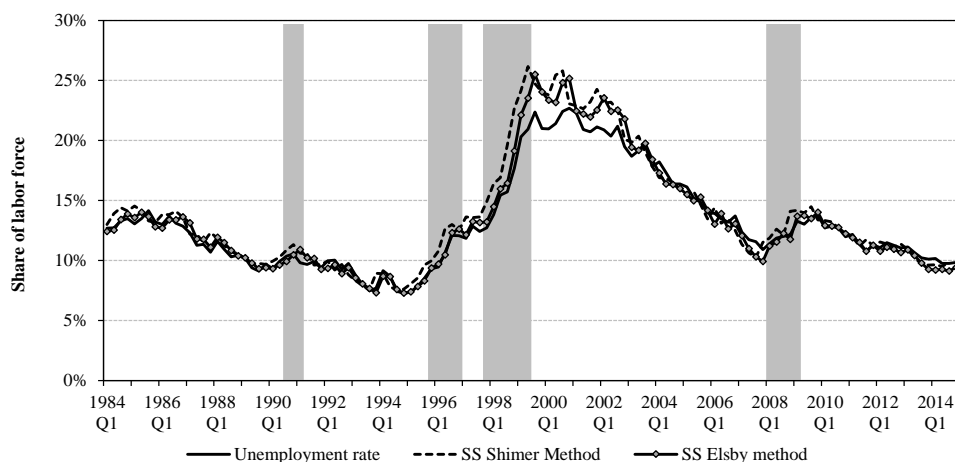(a) *Job finding rate*

(b) *Separation rate*
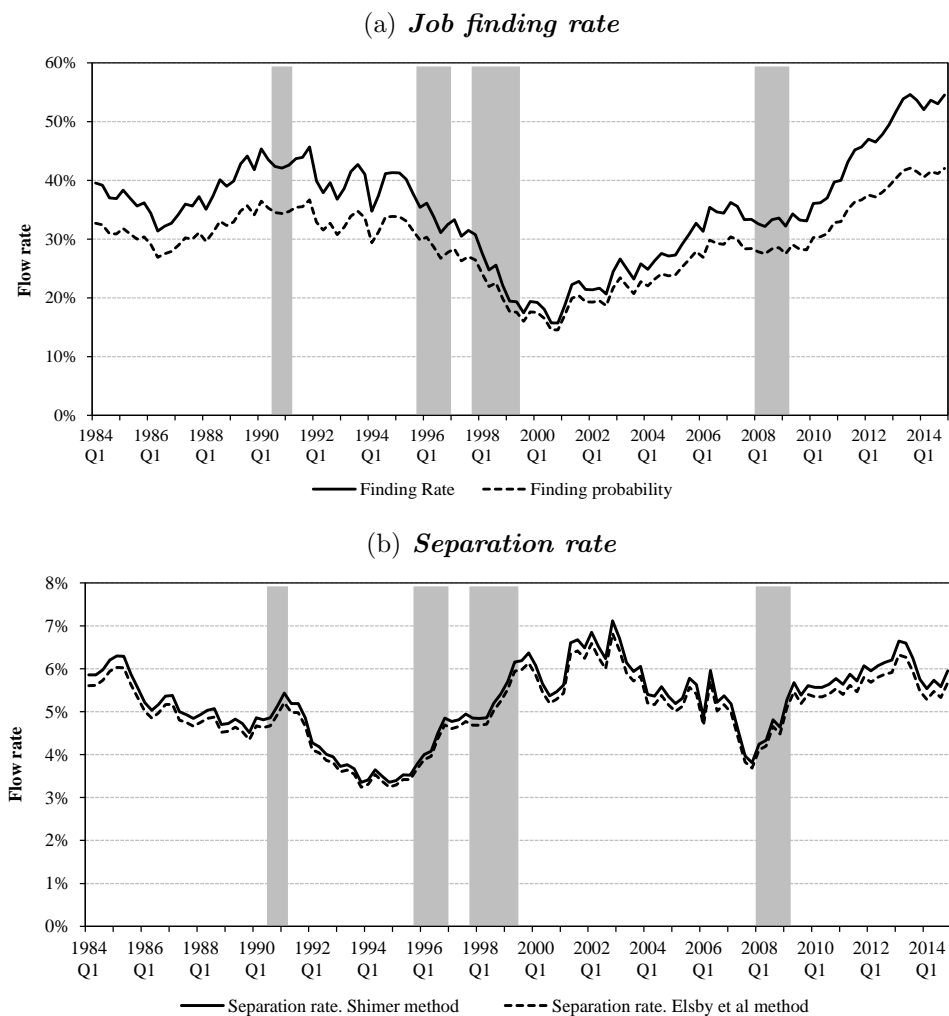
Source: Author's construction based on household surveys.
Note: Smoothed series. Shaded areas represent recession dates according to Alfonso et al. (2011).

worker will find a job in a particular quarter with 29% of probability, such value is lower than the estimated for the United States that reaches a mean value of 46% during the post war period, but still significantly higher than the French figures that reach 7,5% in Hairault et al. (2012); 7,8% in Elsby et al. (2009) or 8% in calculations done in this work. Further comparisons will be given in next section.

On the other hand, the steady state obtained from the resulting job finding and separation rates is a good approximation of actual unemployment rate. The correlation between the two series is 99% irrespectively of computing the series with Shimer (2005) or Elsby et al. (2009) methodologies. This value is equivalent to the obtained for the United States and confirms that the assumption of two states (employment and unemployment) done in section 2 is a fairly good approximation for the Colombian labor market at the aggregated level; this is displayed in figure 4.2.

However, in the aftermath of the 1998 crisis the predicted steady state unemployment

Figure 4.2: Colombian steady state unemployment

rate was notably higher than the actual one, and only until the first quarter of 2003 the two values become closer again. The omission of inactivity state could be a plausible explanation of the deviation during this period; in fact, during this period the annual growth of the participation rate was almost 4 percentage points, such value is higher than the observed in previous recessions, meaning that secondary members of the household such as housewives and older children become active job seekers at a stronger rate than before, imposing additional pressure to the labor market that was in part eased by the big flow of international emigration of working age population that experienced the country during the years following the crisis.

Overall, the estimations of separation and job finding rates are coherent with the features of Colombian labor market and indicate that flows on it are relatively high, specially during recent years. They also seem to have an prominent role in the evolution of unemployment rate since they fluctuate along the business cycle, this allows to make interesting contributions to the analysis of the labor market of the country. In what follows their cyclical properties are presented and it is studied how important they are to explain changes in unemployment; finally, the results obtained from this analysis are compared with the corresponding for the French and the United States economy.

4.2 Cyclical behavior of job finding and separation rates.

The results displayed in figure 4.1 suggest that separation and job finding rates do move along the business cycle. In this section it is presented a more standard analysis of the cyclicality of both rates.

The correlation coefficient between the cyclical components of the transition rates and an indicator of the business cycle is computed for various leads and lags using two

filtering procedures: Hodrick Prescott with parameter 1600 and the Band Pass proposed by Baxter and King (1995). For business cycle indicators, the unemployment rate and the real GDP are used. Results obtained for each detrending method and each business cycle indicator are displayed in figure 4.3.

From the band pass filtering it is possible to conclude that separation rate does fluctuates in the business cycle, it reaches a peak correlation of 0.51 with the unemployment rate at zero leads/lags. Conversely, when the cycle indicator is the real GDP, the correlation has a contemporaneous maximum at value -0.54. The HP filtering yields similar results, showing a positive correlation between separation and unemployment rate and a negative one when the transition rate is compared with the real GDP reaching a correlation of -0.4 at zero lags. In sum, this means that separation rate is countercyclical and adjusts contemporaneously with the cycle; this timing of the comovement was also found by Fujita and Ramey (2009) for the United States case.

Figure 4.3: Correlations between transition rates and business cycle indicators

(a) *Job finding and unemployment*   (b) *Separation and unemployment*

(c) *Job finding and real GDP*   (d) *Separation and real GDP*
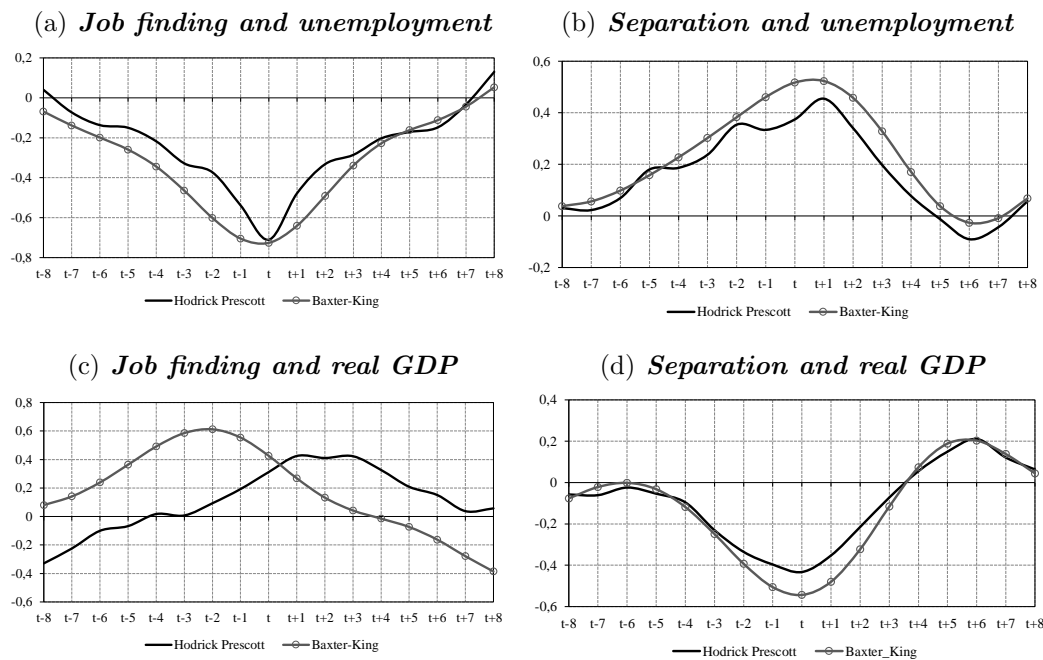
Source: Author's construction.

The correlation between unemployment and job finding rates peaks with zero lags at -0.7 regardless of which filter is used. When the cyclical indicator is the real GDP, correlation reaches 0.6 at two leads if band pass is used or 0.4 at one lag when the HP filter is employed. Thus, the job finding rate is highly procyclical and moves contemporaneously with the unemployment rate and leads the real GDP.

This findings are more in favour of Elsby et al. (2009), Petrongolo and Pissarides (2008) and Fujita and Ramey (2009) than of Shimer (2005) and indicate that both job finding and separation rates do fluctuate along the business cycle in the Colombian case.

4.3 Contribution to unemployment fluctuations.

Resulting job finding and separation rates have been proved to move along the cycle, and then to contribute to unemployment rate fluctuations. However, it is still necessary to disentangle which of the two rates has a higher impact on movements of unemployment rate. This has very important policy implications, since governments could promote more accurate mechanisms to reduce high unemployment rates. For instance, if job finding rate's movements are the main drivers of unemployment fluctuations, policies aimed to improve the information systems and the mobility of the labor force will be more effective, by contrast, if the separation rate has the most prominent role, better employment protection legislation could do a better job.

In order to revise which rate dominates unemployment fluctuations, it is presented first the Shimer (2005) approach to evaluate the contribution of each rate by fixing the value of one of them at its sample mean, that is, the contribution of separation rate must be computed as follows:

$$c_t^s = \frac{s_t}{s_t + f^m} \tag{4.1}$$

Where f^m is the sample mean of the job finding rate. The obtained series will be the hypothetical unemployment rate that would prevail if only the separation rate would had moved during the cycle. An identical computation is done for the job finding rate fixing the separation at its mean. The hypothetical series that tracks more closely the actual value of unemployment rate would indicate which rate contributes the most to unemployment fluctuations. This procedure is done for the hazard rates obtained from both Shimer (2005) and Elsby et al. (2009) methodologies [2] and results are presented in figure 4.4

From the visual analysis of the results obtained, it could be said that both rates explain equally unemployment fluctuations until 1998, but after that year, job finding rate seems to have the most prominent role. Such break would suggest, according to Petrongolo and Pissarides (2008), that in 1998 Colombian labor market adopted more restrictive employment protection legislation (EPL) since job finding rate basically drives unemployment dynamics in regimes of strict EPL. However basic labor institutions did not change as soon as the crisis appeared, only until 2002 a labor reform was introduced in the country and it was actually in the opposite direction, in order to make more flexible the Colombian labor market. Therefore, such break seems to respond to economic reasons and not to changes in institutions and is opposite to this wisdom.

Shimer (2005) proposal to evaluate the contributions of job finding and separation rates to the overall unemployment fluctuations is illustrative but it is not exempted of problems. Fujita and Ramey (2007) argue that this measures do not actually decompose total unemployment variability and Elsby et al. (2009) claim that it is very sensitive to the value at which separation and job finding rate are held constant. Indeed, choosing

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[2] See equations (2.3), (2.4) and (2.7).

Figure 4.4: Contribution of job finding and separation rates for the Colombian labor market

(a) *Contribution of job finding rate*

(b) *Contribution of separation rate*
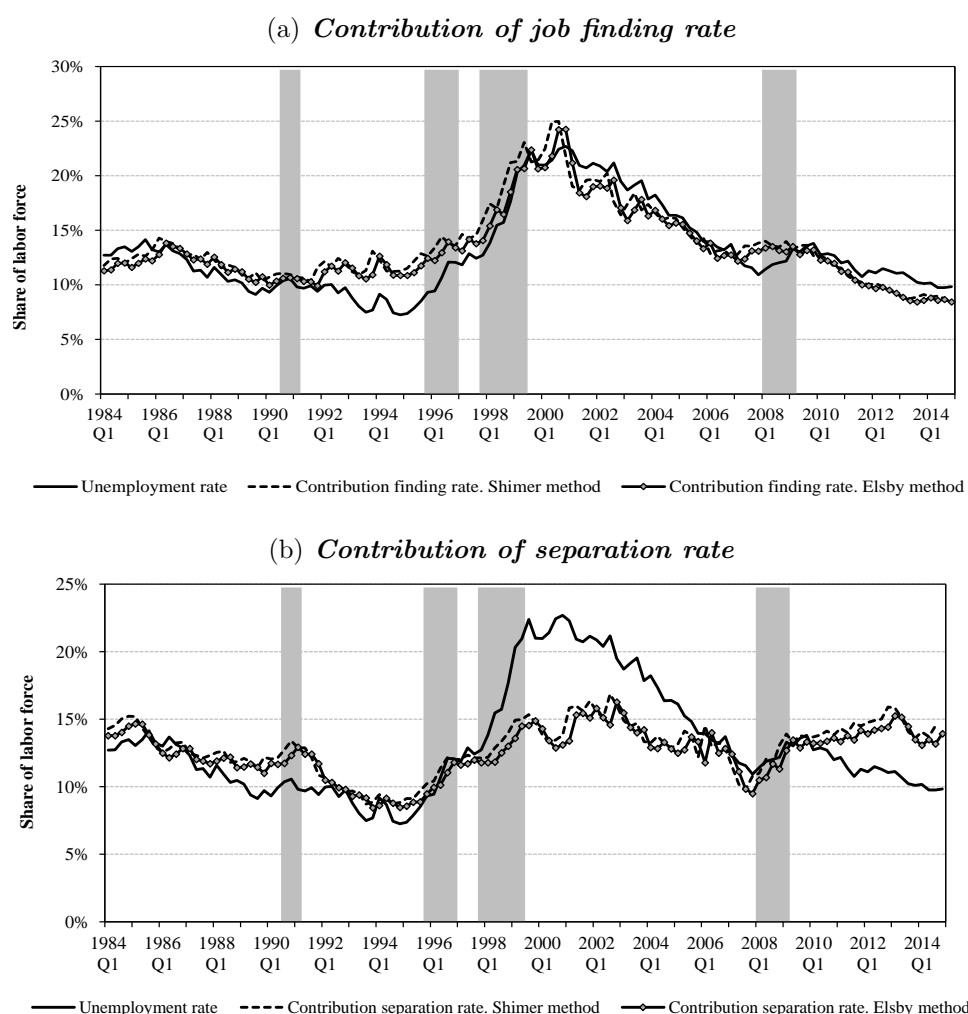
Source: Author's construction based on household surveys.

Note: Shaded areas represent recession dates according to Alfonso et al. (2011).

the sample mean as the reference value is not explained in Shimer (2005) and could be consider as arbitrary, if the same hypothetical series would be constructed using the value of the trends in each quarter instead of the means, separation rate would not reduce its importance in explaining the unemployment movements, and in fact, would move closer to actual unemployment rate during the whole sample period.

Given the drawbacks of Shimer (2005) method, it is computed the contribution of job finding and separation rate to unemployment fluctuations using a single measure as was proposed by Fujita and Ramey (2009) for the United States. Such calculations have been also done for France, Spain and Great Britain thanks to studies by Petrongolo and Pissarides (2008) for France by Hairault et al. (2012) and for Colombia by Lasso (2011); this last work however differs from the assumptions done in this paper and calculations worth to be re-done under the framework proposed here.

Table 4.1 presents the values for β^{jfr} and β^{sr} (Resulting from expression (2.15)) using a Hodrick Prescott filter with parameter 1600. From here it can be noticed that for the whole period of analysis, job finding rate contributes slightly less to unemployment fluctuations; thus it could be said that both rates contribute equivalently to unemployment movements. These findings differ from Lasso (2011) who found a higher role for inflow to unemployment.

Differences in the results of this paper with respect to the ones in Lasso (2011) may come from two main sources: First, he considers a four states setting, that is, labor force is not constant and workers can move to unemployment, wage earning employment, non wage earning employment and inactivity; however this does not seem to be a major source of discrepancy as in Lasso (2011) analysis movements between employment and unemployment are the main drivers of unemployment fluctuations. Second, even if the data we use comes from the same survey, he constructs the gross flows of workers moving from one state to the other at a annual frequency, whereas here it is used quarterly data; the data of this paper has the advantage of considering shorter periods of time and thus capture more detailed transitions that workers may have experienced within a year.

As was mentioned before, figure 4.4 suggests that job finding rate became the main driver of unemployment fluctuations from 1998 on, this is evaluated in more detail next, where the sample is divided into two periods: before and after 1998. However, this partition is not consistent with any labor reform, therefore it is presented also a more interesting analysis splitting the sample according to the political and institutional changes introduced to the Colombian labor market: Before 1990, from 1990 to 1993, from 1993 to 2002 and from 2002 on; this sectioning will lead to a better analysis of Petrongolo and Pissarides (2008) affirmation about the relevance of each rate according to the level of employment protection legislation prevailing in the country.

Let us consider the results in table 4.1 in more detail. The first split of the sample period confirms the graphical conclusion from figure 4.4. According to H-P filtering, after 1998 the job finding rate contributed the most to changes in unemployment whereas before that year separation rate was slightly more important. According to Avella (2012), analysts from that time attributed to demographic factors, the decreased economic activity and the growth of the participation rate the behavior of the labor market after 1998, at the same time labor market institutions started to be questioned but changes on them occurred only until December 2002.

Nevertheless, the additional intervals in which the sample is divided do correspond to changes in labor market institutions. Firstly, the reform implemented in 1990 (through the Law 50 of 1990), was a result of long debates that had been held in the country since previous decades. In 1970 a special mission from the ILO was invited to the country to propose an integral employment policy and to discuss which factors might had been generating the high levels of unemployment by that times compared with past years. The visit concluded with several suggestions and warnings about the degree of rigidity that the labor market had; to cite some examples it paid special attention over the following facts: *i)* fixed term contracts could not be established for less than one year, must last 3 years at most and could be renewable indefinitely, *ii)* massive dismissals should be authorized by the labor Ministry, *iii)* working day could not exceed 8 hours per day without implying

Table 4.1: Contribution of job finding and separation rates to unemployment fluctuations in Colombia

	HP filter $\lambda = 1600$	
	Elsby et al. (2009)	*Shimer (2005)*
Full sample		
β^{jfr}	0.447	0.457
β^{sr}	0.477	0.467
β^{ϵ}	0.073	0.073
Pre 1998		
β^{jfr}	0.360	0.368
β^{sr}	0.474	0.466
β^{ϵ}	0.159	0.160
Post 1998		
β^{jfr}	0.509	0.522
β^{sr}	0.490	0.478
β^{ϵ}	-0.007	-0.007
Pre 1990		
β^{jfr}	0.729	0.735
β^{sr}	0.255	0.250
β^{ϵ}	-0.016	-0.017
1990-1993		
β^{jfr}	0.334	0.356
β^{sr}	0.575	0.551
β^{ϵ}	0.060	0.061
1993-2002		
β^{jfr}	0.619	0.621
β^{sr}	0.311	0.308
β^{ϵ}	0.052	0.053
Post 2002		
β^{jfr}	0.295	0.309
β^{sr}	0.685	0.670
β^{ϵ}	0.015	0.015

Source: Author's construction.

extra and nocturnal payments, *iv)* unfair firings implied compensations according to the tenure of the employee and if it was more than 10 years, it would imply rehiring the worker.

In 1985 a new expertise group was convened under the name of *Employment Mission* (also know as Chenery Mission) to make further inquiries about the situation of Colombian labor market; the suggestions done by previous ILO mission were confirmed by this new group, which also found that social contributions that employers had to do were near to 78% of wages paid in 1982, although they were given to a small share of all employees (about 29%). The Mission also made special warnings about the way in which severance payments have been paid off [3].

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[3]Before 1990 severance payments were settled in the following way: For each year of work the dismissed employee would receive one month of payment valued according to the last wage earned, the employee

Under this context, it could be said that before 1990 Colombia had a stricter Employment Protection Legislation and as a consequence unemployment fluctuations should have been driven mainly by changes in job finding rate, table 4.1 does not give sharp evidence on this when the HP filter is used given that the divergence between the contribution of each rate is not large.

In December of 1990 was promulgated the Law 50 of 1990, which was thought to increase flexibility and make structural adjustments to the Colombian labor market. Five principal changes were introduced: First, it established that fixed term contracts could be inferior to one year, but not than 6 months. Second, it eliminated the obligation to rehire the worker when it was proved that the dismissal was unfair and she had a 10 years or more tenure. Third, it made it possible to have working days longer than 8 hours. Fourth, it excluded the possibility of trade unions to participate in politics. Fifth, it modified the formula for paying off severance payments, now the dismissed worker would receive the equivalent to three months of wage if he had been in the job for more than one year, less than five months if had been from five to ten years in the position and nine in case of have been working during more than 10 years, besides it eliminated the double retroactive effect that was seen as a heavy impediment to create new jobs.

Following Petrongolo and Pissarides (2008), this reforms aimed to increase the flexibility of the labor market should be reflected in the contribution of job finding and separation rates to overall unemployment fluctuations; indeed the period of time just after the 1990 reform and previous to the publication of Law 100 of 1993 was characterised by a weaker role of job finding rate to explain movements in unemployment.

In 1993 a new law was published to address social security aspects that were not discussed in the reform of 1990, its main goal was to integrate the assurance against professional risks, pensions and social security in a single Integral Social Security System. But to that end it also changed the social contributions that employers should to per each worker from 13,5% to 25,5% stepping back some of the flexibility that has been obtained from previous labor reform. Consequently, job finding rate reached once more an important role to explain unemployment fluctuations after 1993.

Finally in December of 2002 a new labor reform was approved, this time the working day was increasing again and nocturnal recharges to the wage were paid only if the worker stayed at his job beyond 10:00 pm, the payment for extra hours of work was also reduced as well as the compensation that a worker should receive after an unfair dismissal. This new wave of reformation to labor institutions reduced once more the predominant role of job finding rate and reduced labor stability, specially for low skilled workers.

Altogether, it is found that there are some periods where each rate has been the most important to explain unemployment fluctuations, then, on average both rates play roughly equal roles. However the division in sub-periods that is proposed here is not exhaustive and several alternatives can be addressed; for example, it could be excluded from the analysis the period 1998-2001 when there was a big discrepancy between the the actual

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could use part of these payments when she was still employed, and the withdrawals done during the working time were deducted from the final amount (received when the contract ended) only for its nominal value. This formula of paying off was known in Colombia as the *double retroactive effect*.

Figure 4.5: Job finding and separation rates during recessions
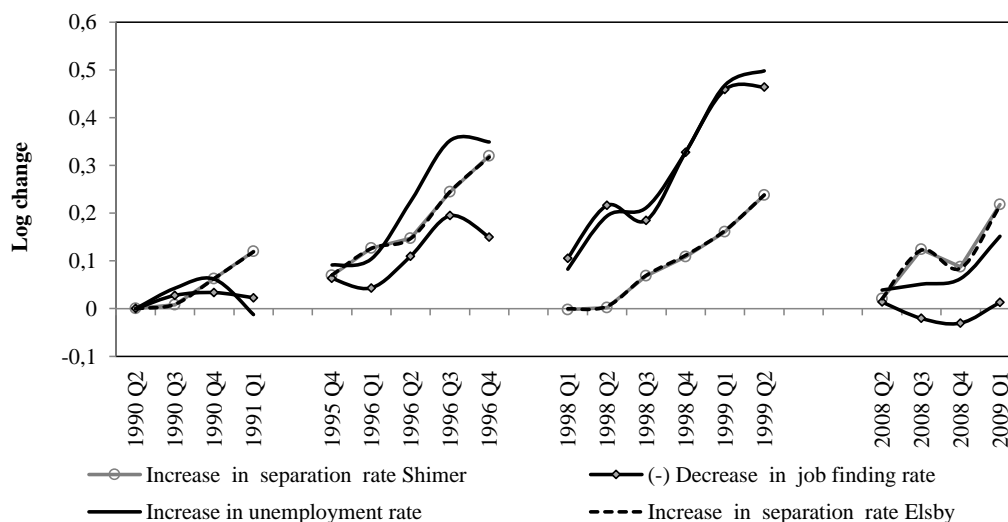
unemployment rate and the unemployment implied by the steady state flow equilibrium, as is done by Petrongolo and Pissarides (2008) for the United Kingdom case; this work does not consider that possibility here since the deviation period contains the most severe economic crisis that the country has experienced and omit it could lead to misleading results.

Similarly, the division of the sample could be done considering the global context, for example to check the impact that the Latin American crisis of the 1980 decade or the Asian crisis of 1997 had in Colombian labor market. Other interesting division could be done by splitting the sample according to the political situation of the country, after 2002 for example violence indicators dropped in the country, this definitely might have impact the labor market. However, for the scope of the work there are just considered direct modifications in labor market institutions.

On the other hand, the information about the contributions of job finding and separation rate to unemployment fluctuations is of particular interest during a recession, since it becomes a tool to understand its dynamics and therefore to design more suitable policies to face its increase. Figure 4.5 displays the logarithmic growth of these three variables during the recessions[4]. It can be seen that for the 1990 recession the unemployment and job finding rates basically followed the same behavior while separation rate did not. Conversely, in 1995 and 1998 crisis all the series followed almost parallel directions, although for the latter downturn the decrease (with opposite sign) of job finding rate was closer to the growth of unemployment rate. Finally, during the last recession it was the separation rate which was nearer to unemployment movements.

In order to offer a more formal criteria to determine the contribution of hazard rates to unemployment fluctuations during recessions, table 4.2 presents the values of β^{jfr}, β^{sr}

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[4]For the job finding rate it is displayed the logarithmic growth with the opposite sign, this because as was presented in section 4.2 job finding rate is procyclical whereas unemployment rate is countercyclical.

and β^ϵ considering only the contraction episodes of Colombian economy; here it is found that separation rate contributes the most to unemployment fluctuations.

Table 4.2: Contribution of job finding and separation rate to unemployment fluctuations during recessions

|	HP filter $\lambda = 1600$	
	Elsby et al. (2009)	*Shimer (2005)*
Recessions		
β^{jfr}	0.331	0.325
β^{sr}	0.483	0.493
β^ϵ	0.136	0.132

Source: Author's construction.

4.4   Comparison with the United States and France

This section updates the computations done by Shimer (2005) and Elsby et al. (2009) for the United States and by Elsby et al. (2008) for France in order to have the same period of time to compare them with the results presented previously for Colombia. The choice of this two countries for making the comparison is not casual; traditionally they have been considered as two totally opposite labor markets, a very rigid one with strict employment protection legislation (EPL) and low turnover as is the French, and a very flexible one with high rates of rotation as is the one of the United States. According to the Allard (2005) index, the United States has the lower EPL value of the OECD countries with a value of 0.6 whereas such value reaches 3 for France (almost the maximum of this group of countries). The comparison will allow to examine if Colombian labor market is closer to the French or the United States' one in terms of the transition probabilities that a typical worker faces.

Even if the data for France and the United States are available since the decade of 1950, this work considers the period 1984-2014 to make it compatible with the Colombian one; likewise, the monthly USA data will be averaged to obtain it quarterly; for France it is possible to work only at the annual frequency, so quarterly data from 2003 on will be averaged to obtain its annual average.

The first fact that emerges from comparison is the traditionally high level of the Colombian unemployment rate with respect to the other countries, presented in panel (a) of figure 4.6. Higher unemployment in Colombia is an empirical observation that persists irrespectively of doing the comparison with developed economies or Latin American countries; therefore several explanations to this reality have been proposed without having one totally satisfactory; some suggest that differences arise from discrepancies in institutions, others that they come from cultural aspects, and others that they appear as a result of having distinct definitions of the working age population, the employed and the unemployed workers and the varying methodologies that each LFS applies.

However, during the 1992-1995 boom in Colombia, the unemployment rate was lower

Figure 4.6: Unemployment rates in Colombia, France and USA

<div align="center">(a) Unemployment rates   (b) Median duration of unemployment</div>
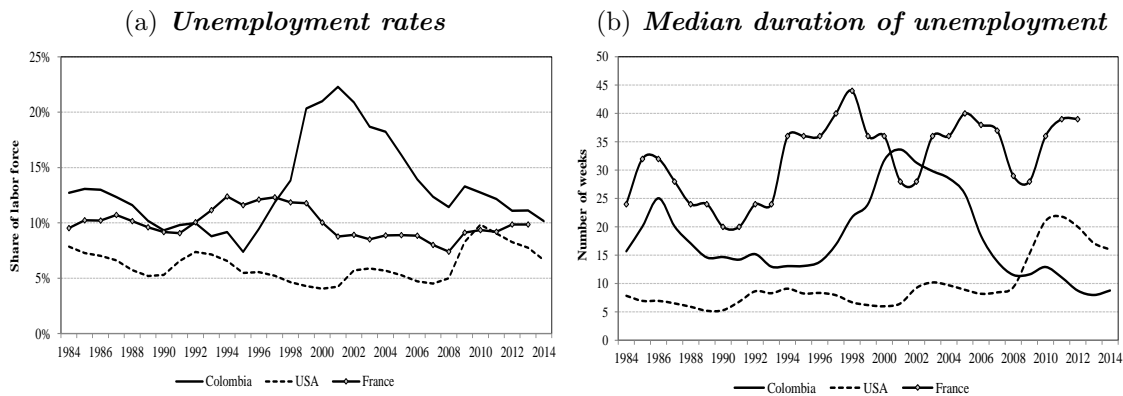
Source: Author's construction based on official BLS publication and LFS from Colombia and France

than the French one and closer to the one of the United States. Besides, during the last years the number of unemployed workers as a share of labor force has converged between Colombia, France and the United States as a consequence of financial crisis of the last years that hit sharply the two last countries but did not affect severely to the Colombian economy. Therefore, considering only the unemployment rate as the indicator of labor market conditions, we could talk about convergence in the three labor markets during the last years.

On the other hand, differences in the unemployment between these countries go beyond their levels; the median duration of the spells is notably high in France and normally overcomes the three quarters (36 weeks); conversely in the United States it is low and has been around (with the exception of 2008 crisis) 9 weeks for the period of analysis. Colombia is an intermediate case between the two, with the exception of the last 3 years, the median duration of unemployment has been always higher than in the United States, but for the whole period, all the time smaller than in France. Moreover Colombian case presents a richer dynamic, median unemployment duration started at 15 weeks, it fluctuated around that value until 1997 to begin a fast increase until 2001 when it reached its maximum (34 weeks) and since then it has slowly decreased up to lower levels than the pre 1998 crisis.

The stylized fact presented earlier will be key to understand the job finding and separation rates obtained from each country and means that even if Colombian unemployment rate is higher than in France, workers move faster out of this state, following the assumptions done in this work, this would mean that they found a job more easily than in France. This hypothesis is corroborated next, when results of the updating of Shimer (2005) and Elsby et al. (2008) are exposed.

First, the findings of Shimer (2005) and Elsby et al. (2009) for the United States are brought up to 2014 having into account the correction done by each authors to the short term unemployment series from 1994 on[5]. Results are presented in figure 4.7 and show

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[5]Recall that from 1994 on the way that unemployment duration was asked changed and induced an under report of it. To correct it is enough to multiply by 1.1 the official BLS series in the case of Shimer (2005) and by 1,1549 in the case of Elsby et al. (2009).

that job finding probability falls significantly during recessions and has decreased to be half of what it used to be. Conversely, separation rate grows during economic downturns and the increase has been particularly fast during the last crisis episode.

Figure 4.7: Job finding and separation rates in the United States
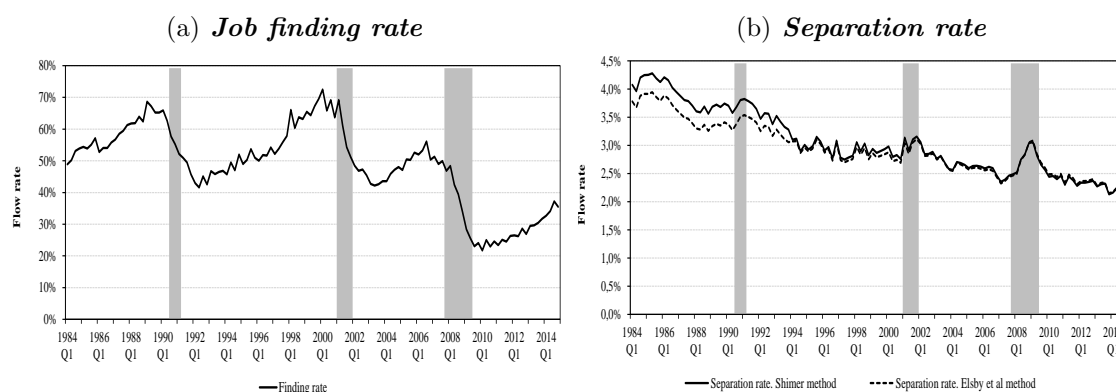
(a) *Job finding rate*   (b) *Separation rate*

Source: Author's construction.

Note: Shaded areas correspond to recession dates according to the Business Cycle Dating Committee of NBER
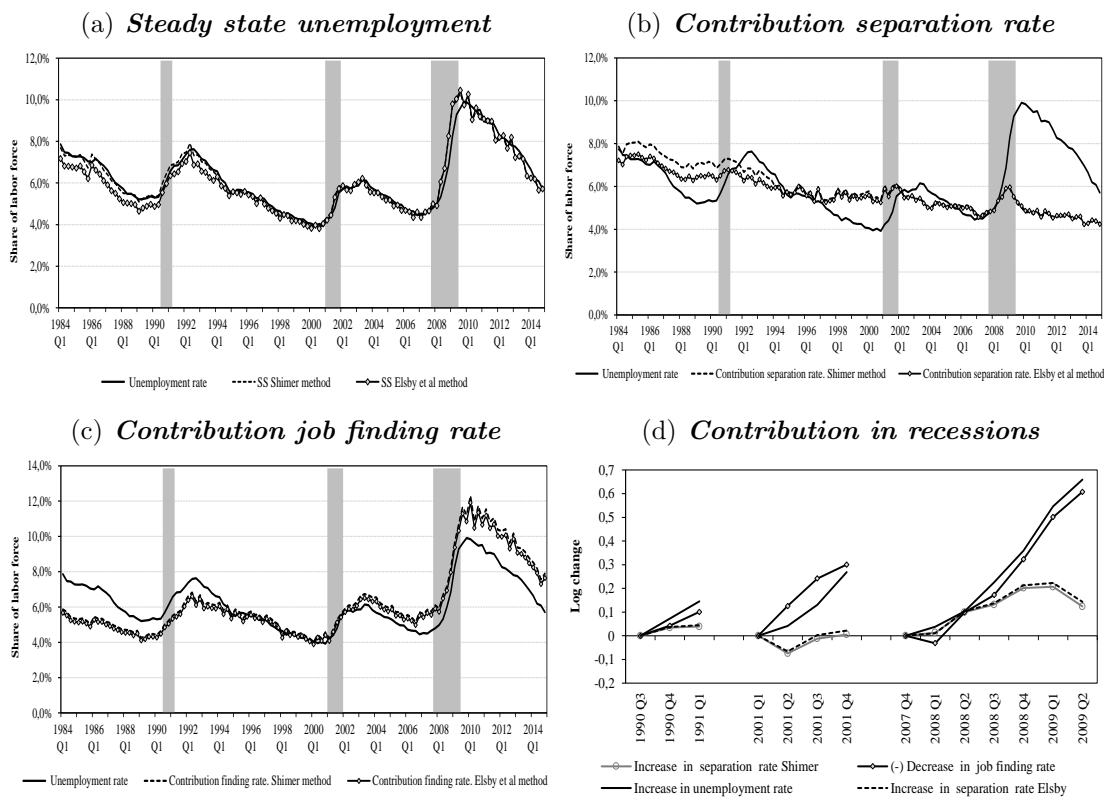
On average, an unemployed worker in the United States will find a job with 37% of probability, which is 8 percentage points higher than the obtained in Colombia; on the other hand, separation probability has a mean value of 2.1% which is smaller than in Colombia. This means that in Colombia people looses his job easier and finds a new one with more difficulty when compared with the United States; as a result duration of unemployment in the first country should be at higher levels than in the latter; which is actually observed in the empirical data presented previously.

The steady state unemployment rate derived from the transition rates in the US closely tracks the actual one, these two series have a correlation coefficient of 97% when Elsby et al. (2009) methodology is adopted or 98% when Shimer (2005) method is used, this is displayed in panel (a) of figure 4.8 and suggests that the two states (employment and unemployment) case is a fairly good approximation to the aggregated labor market of the United States.

Finally, to examine the contribution of each rate to unemployment fluctuations, the procedure followed for the Colombian case is applied here once more; first, panels (b) and (c) of figure 4.8 present the hypothetical unemployment rates that would prevail if each of the rates would be constant at its mean value, that is, to obtain the contribution of job finding rate, separation rate is set at its average value and to get the participation of inflows to unemployment, job finding rate is set to its mean.

Resulting series suggest that job finding rate governs the movements of unemployment, whereas separation rate predicts a roughly constant unemployment rate; this observation was exactly the one reached by Shimer (2005) who argues that in the past three decades the separation rate has varied little over the business cycle. Nevertheless, this visual conclusion is examined more formally through the Fujita and Ramey (2009) analysis. A special remark must be done, here it is just considered the period 1984-2014 which has

Figure 4.8: Transition rates in the United States: Steady state and contributions

(a) *Steady state unemployment*

(b) *Contribution separation rate*

(c) *Contribution job finding rate*

(d) *Contribution in recessions*

Source: Author's construction.

Note: Shaded areas correspond to recession dates according to the Business Cycle Dating Committee of NBER

been characterised by a low separation rate with small volatility; therefore, when the results of this section are compared with previous findings by Shimer (2005), Elsby et al. (2009) or Fujita and Ramey (2009), this observation should not be forgotten.

Table 4.3 displays the values of β^{jfr}, β^{sr} and $\beta\epsilon$ obtained for the whole sample and for recession episodes in the United States, numbers in the first case are quite similar to the obtained by Fujita and Ramey (2009) for the Shimer data during the post 1985 period (Table 1 in their work) and reflect that for the last three decades fluctuations in unemployment rate have been driven mainly by movements in job finding rate; however, separations still explain up to 18% of changes in unemployment. Recessions exhibit an identical behavior, and according to the panel (d) of figure 4.8, increase in unemployment was closer to the growth of separation rate only in 2001 recession, for the other two cases, it was job finding rate which mainly determined movements in unemployment.

The previous finding is interesting since it differs from the conclusion for the Colombian case where both transition rates are equally important, and seems to be against the wisdom that the role of separation rate in unemployment fluctuations is limited in countries with strict employment protection and low labor turnover. It was pointed out in the introduction and subsection 4.3 that Colombian labor market is considered rigid due to the elevated contributions that employers must do over the wages paid; conversely,

Table 4.3: Contribution of job finding and separation rate to unemployment fluctuations in USA

	HP filter $\lambda = 1600$	
	Elsby et al. (2009)	*Shimer (2005)*
Full sample		
β^{jfr}	0.783	0.800
β^{sr}	0.179	0.163
β^{ϵ}	0.002	0.0317
Recessions		
β^{jfr}	0.620	0.634
β^{sr}	0.267	0.253
β^{ϵ}	0.041	0.041

Source: Author's construction.

the United States has been considered as the main reference of a flexible labor market[6] and previously to the 2008 crisis its model was commonly regarded as only way to have low unemployment by allowing to the workers to move continuously. Therefore, as it was the case in Hairault et al. (2012), results in this work suggest that models of search and matching do not necessary imply that firing costs reduce the contribution of inflows to changes in unemployment.

Elsby et al. (2008) analysis for low frequency data is updated next for the French case, results are displayed in figure B.1 and show that separation rate has increased every year where there has been at least one quarter in recession whereas job finding rate has decreased in the same years. On average, a French worker looses his job with 1% of probability, the lower value for the studied countries. Similarly, the likelihood for an unemployed to find a job is 9,7%, once more, the lowest value for the analysed countries.
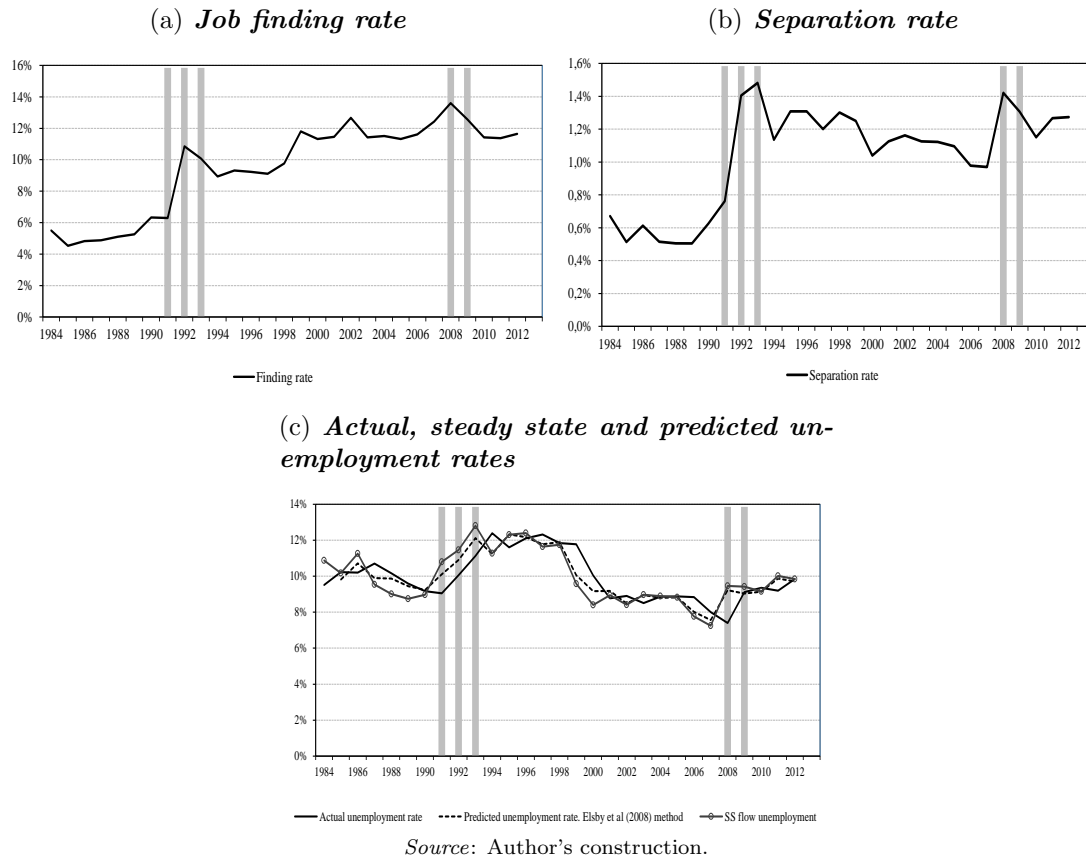
Job finding rate obtained here is higher than the obtained by Elsby et al. (2008) (who found 7,8%) and by Hairault et al. (2012) (how found 7,5%); differences from the second group of authors could be due to the use of different data: here it is used the stock of unemployment classified according to the duration of the spell and they use the gross flow of workers moving from one state to the other. Even if the methodology followed in this section is the one proposed by Elsby et al. (2008), findings differ as a consequence of the issue with the short term unemployment presented in section 3.

On the other hand, figures obtained for France indicate a very low labor turnover, and demonstrate that even if unemployment rate is lower in France than in Colombia, in the former country people willing to work but unable to find a job will find one very hardly; therefore they would be in unemployment for extremely long periods, as was presented in figure 4.6. This poses a harder challenge for the country as would require in first place to know the main reason of the low employability of this workers to then design the more suitable policy to increase it; normally, long periods in unemployment generate a

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[6]For example, union density and coverage have been traditionally low and these figures have notably decreased since 1980, Allard (2005) describes the US as a country with no legal restrictions on firing and OECD data indicates that tax wedge in the United States is 29% whereas in countries like Belgium it goes beyond 50%.

depreciation of human capital of workers, which increases the mismatch between the skill requirements of the firms and the skill mix of labor force. However, this work is based on the assumption of homogeneous workers, thus the features of long duration unemployed are left for further research.

Figure 4.9: Job finding and separation rates in France

(a) *Job finding rate*   (b) *Separation rate*

(c) *Actual, steady state and predicted unemployment rates*

Source: Author's construction.

Note: Shaded areas correspond to the years with at least one quarter of recession according to the CEPR criteria.

Elsby et al. (2008) argue that for countries where the share of short term unemployment is low, as is the case in France, the steady state approximation is inaccurate, and that a better estimation is reached through equation (2.9). Both series are presented in panel (c) of figure B.1, where it can be noticed that the predicted unemployment rate from equation 2.9 does a better job in tracking actual unemployment, the correlation coefficient between the two reaches 85%, while with the traditional flow steady state only gets 72%.

Finally, to analyse which transition rate contributes the most to unemployment fluctuations, computations of equation 2.13 are presented next in table 4.4, where it is shown that job finding rate is the main driver of unemployment fluctuations as is the case in the US; hence concerning the contributions of job finding and separation rates, French and United States' labor markets are not so different, such remark had been already done by Hairault et al. (2012). On the contrary, Colombian case does not seems to be close to any country for this particular feature.

Table 4.4: Contribution of job finding and separation rate to unemployment fluctuations in France

	Elsby et al. (2008)
Full sample	
β_f	0.732
β	0.225
β_ϵ	0.031

Source: Author's construction.

4.5 Separations and job finding rates at monthly frequency for Colombia

It was mentioned in section 3 that Labor Force Surveys in Colombia changed to monthly frequency in 2001 with the introduction of the ECH, and that further adjustments were included in the third quarter of 2006 with the GEIH. This survey is the main source of information about labor market in Colombia and then should be the base for performing any analysis of labor market transition rates, not only in an historical perspective but also for tracking the behavior of separation and job finding rates with opportunity.

This section replicates the previous analysis about separation and job finding rates in Colombia but at monthly frequency[7] and using information for the 13 main cities of the country, i.e. including six more into the computations. It only uses information from GEIH, then it goes from 2007 to 2014.

The first panel of figure 4.10 presents the results for the finding rate, it shows that they are equivalent to the obtained for the seven cities at quarterly frequency, meaning that in the last recession it remain constant, but has increased during the last five years. From 2010, the average probability at which a worker will find a job in a given month is 35%, such value is 28% from 2007 to 2009.

For separation rate, results are not very close to the corresponding in quarterly frequency. Here, with monthly data, separation rate did not have a marked increase during the last recession as was the case in results of section 4.1; this finding could suggest that the additional six cities included in the analysis mitigated the growth of separations that occurred in the seven main cities. This is indeed corroborated in panels (c) and (d) of figure 4.10.

Using monthly data of the main 13 cities of the country, the obtained steady sate unemployment rate has correlation of 91% with the observed rate (panel (e) of figure 4.10). Although this value is lower than the resulting from quarterly data (99%), it is still strong, larger than the corresponding result for France and indicates that the two states assumption is a good approximation of Colombian transitions in labor market.

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[7]In this case, short term unemployment will refer to unemployed workers with four weeks or less of search.

Figure 4.10: Job finding and separation rates for the Colombia. Monthly data

(a) *Job finding rate: 13 cities*

(b) *Separation rate: 13 cities*

(c) *Job finding rate: Additional cities*

(d) *Separation rate: Additional cities*

(e) *Steady sate unemployment rate*

Source: Author's construction based on GEIH.
Note: Shaded areas represent recession dates according to Alfonso et al. (2011).

Table 4.5: Contribution of job finding and separation rate to unemployment fluctuations. Monthly data

	Full sample	Recession
β_f	0.665	0.077
β_s	0.318	0.842
β_ϵ	0.011	0.030

Source: Author's construction.

Finally, table 4.5 presents the contribution of separation and job finding rate to changes in unemployment rate in Colombia from 2007 on and the last economic downturn. Using monthly data, it is found that job finding rate has driven the unemployment fluctuations; however, as was the case in quarterly data, during recessions it is the separation rate which contributes the most to the growth in unemployment rate.

5 Conclusions

This work has extended the debate about the behavior of job finding and separation rates along the business cycle and their contributions to unemployment fluctuations to the Colombian case. Until now, these discussions have mainly focused in the developed economies and few works have been done to examine developing labor markets.

Assuming that labor force is constant and therefore that workers can only move from unemployment to employment and vice versa, the job finding and separation rates for Colombia have been computed at quarterly and monthly frequency using the stocks of workers in unemployment or employment states and the duration of unemployment spells as main sources. The period of analysis for quarterly data is 1984-2014 and it covers the seven main metropolitan areas of Colombia; for monthly series it is 2007-2014 and includes the 13 main cities that are currently surveyed.

The resulting series for the quarterly analysis show that the transition rates in Colombia are high. On average the probability that a worker finds a job in a given quarter is 35,1% whereas the probability of being separated from a job is 4,9%. Moreover, these rates do move during the business cycle; in all recessions the separation rate has increased while the job finding rate has fallen; besides, the correlation coefficients between the cyclical components of real GDP and these rates can go up to 70%. This finding is in line to Elsby et al. (2009) and Fujita and Ramey (2009) conclusion for the United States where it is shown that separation rate does varies along the business cycle.

Similarly, the works by Shimer (2005) and Elsby et al. (2009) for the United States and by Elsby et al. (2008) for France have been updated until the last quarter of 2014 in order to compare the results obtained for the Colombian case with the corresponding of two opposite labor markets. Traditionally, it has been argued that French labor markets are extremely rigid with low flow of workers within it; conversely, the United States' is considered as one of the most flexible labor markets in the world.

The updating procedure and the comparison done show that during the last 30 years the contribution that the movements of separation rates have on unemployment fluctuations has decreased markedly for France and the United States; whereas for Colombia they have remained equally important as the changes in job finding rate. Besides, the transition rates in the Colombian labor market indicate that there is high turnover and such rates are large when compared with their French counterparts; a typical Colombian employee is almost five times more likely to loose its job than a French one; but in Colombia a worker finds a job with four times more probability than it would happen in

France. Contrariwise, when comparison is done between Colombia and the United States, it happens to be that in the latter country job finding rate is higher whereas separation is lower. Hence, given that people loose his jobs more easily in Colombia and find a new one with more difficulty than in the United Sates, unemployment duration in Colombia must be higher than in the United States, this line of argumentation is consistent with the empirical data exposed in section 4.

More surprising is the finding regarding the fact that although Colombia has a high unemployment rate which could be considered of European nature, that is, larger with respect to the one of the United States or other Anglo Saxon countries; the share of workers moving in and out of unemployment is closer to the figures obtained for the United States.

Furthermore, the two states assumption from which derive all previous results performs pretty well; however it is not irrelevant, Elsby et al. (2009) showed that for the United States the share of unemployment coming from non participation is big enough to represent almost half of it; López Castaño (1996) found that even if movements from inactivity to employment are mostly acyclical, workers with low education move to inactivity in booms and come back to the labor market in crisis; therefore this study is just a first step to develop further analysis where several states, on the job search and demographic groups should be considered.

For monthly data, results indicate that it is the job finding rate which overall has contributed the most to unemployment rate fluctuations in the last seven years; nevertheless, during recessions it is the separation rate which has the prominent role. Using the information of the main 13 cities included in the GEIH certainly gives a broader scope to understand the movements of workers between employment and unemployment; besides using monthly data will bring for sure higher opportunity to analyze the Colombian labor market from the search and matching approach presented in this document; it will help policy makers to track the transitions from one state to the other and assess if prevailing institutions are the most suitable according to the current market conditions.

Further analysis that introduce heterogeneity by sex, educational level, location or that allows for on the job search or informal sector could be addressed and would be useful to have a better understanding of labor market transitions in Colombian Economy.

A   Extension of Elsby et al. (2009) method for quarterly data:

I extend Elsby et al. (2009) procedure to obtain the separation rate in the case of quarterly data. Maintaining the *week* as the reference period for the survey, τ can take 12 values:[1]

$$\tau \in \left\{ 0, \frac{1}{12}, \frac{1}{6}, \frac{1}{4}, \frac{1}{3}, \frac{5}{12}, \frac{1}{2}, ..., \frac{11}{12} \right\}$$

Using $U_{t+\tau+1/12} = U_{t+\tau} + s_t E_{t+\tau} - f_t U_{t+\tau}$, the definition of the labor force and solving it forward for one quarter:

$$U_{t+1} = s_t L_t + (1 - s_t - f_t) U_{t+\frac{11}{12}}$$

Solving $U_{t+\frac{11}{12}}$ and replacing it, it would be obtained:

$$U_{t+1} = s_t L_t + (1 - s_t - f_t) s_t L_t + (1 - s_t) - f_t)^2 U_{t+\frac{10}{12}}$$

Continuing with the iteration, at the end it yields:

$$U_{t+1} = s_t L_t \sum_{n=0}^{11} (1 - s_t - f_t)^n + (1 - s_t - f_t)^{12} U_t$$
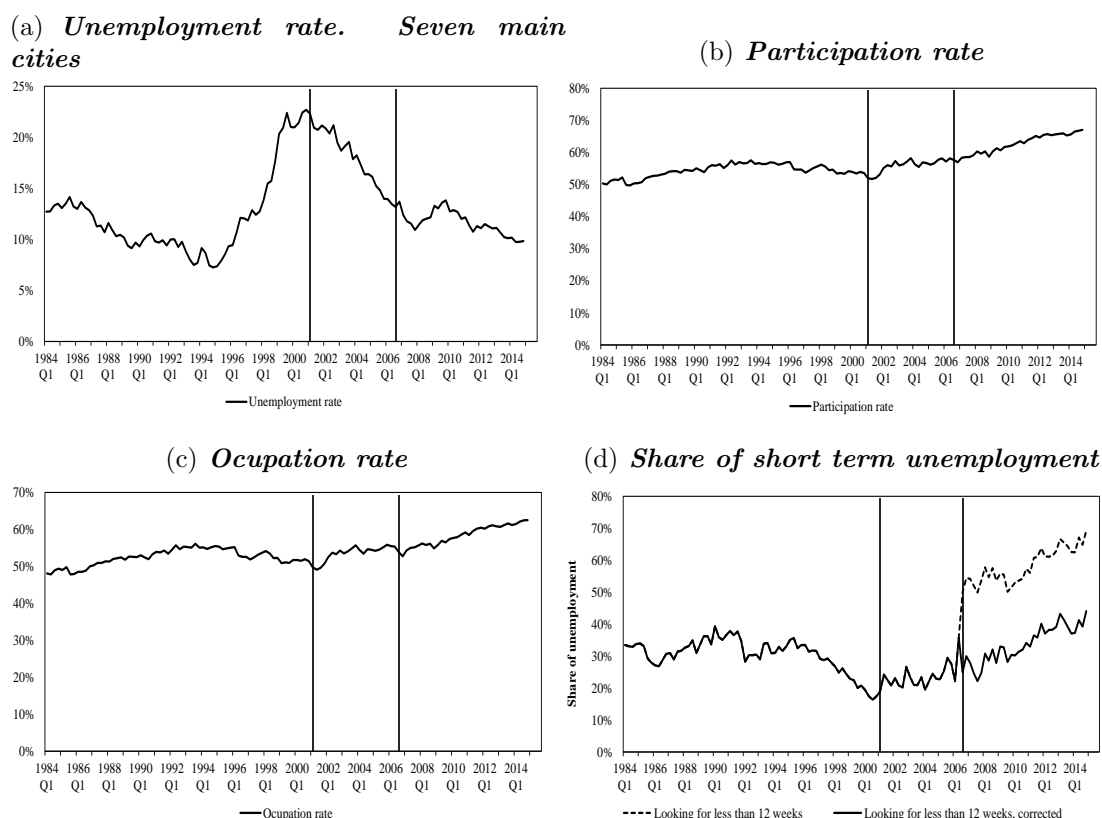
Which is exactly the expression in (2.7).

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[1]Colombian labor force surveys had important methodological changes in 2000, but despite of them the reference period to classify employed and unemployed workers is the *week*. Details are presented in chapter 3

B   Effect of changes in Labor Force Surveys in Colombia

It was mentioned in section 3 that the series of short term unemployment had a strong jump with the introduction of GEIH; however such break did not occurred in the other series. This appendix presents the most important labor market indicators to illustrate this point. In all panels, vertical lines indicate changes in the survey.

Figure B.1: Labor market variables in Colombia

(a) *Unemployment rate. Seven main cities*

(b) *Participation rate*

(c) *Ocupation rate*

(d) *Share of short term unemployment*

Source: Author's construction based on ENH,ECH and GEIH data.

Note: Shaded areas correspond to recessions according to Alfonso et al. (2011).

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