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REFORMING EMPLOYMENT PROTECTION IN EGYPT:
AN EVALUATION BASED ON TRANSITION MODELS
WITH MEASUREMENT ERRORS

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Send correspondence to:
Shaimaa Yassin
University of Paris 1 Pantheon-Sorbonne (CES)
cyassine.eco@gmail.com

Abstract

Do reforms introducing more flexibility in developing countries' labor markets reduce unemployment? This paper proposes to evaluate the new Egyptian labor market law, which was introduced in 2003, aiming to enhance the flexibility of the hiring and the firing processes. The Egypt labor market panel surveys (ELMPS 2006 and ELMPS 2012) are used to measure the impact of this reform on the dynamics of separation and job finding rates, and to quantify their contributions to overall unemployment variability. Using synthetic panel data created from the retrospective accounts of the 2006 and 2012 cross-sections, and by overlapping the two surveys, we estimate annual and semi-annual transition probabilities of workers among employment, unemployment and inactivity labor market states. A unique and novel model is built to correct for the recall and design bias observed in the retrospective data. Using our "corrected" data, we show that the reform significantly increases the separation rates in Egypt, but leads to non-significant effects on the job finding rates. The combined net effect is therefore an increase in the levels of the Egyptian unemployment rate. By performing counterfactuals analysis, we show evidence of the increasingly dominant role of the job separation rate in accounting for Egyptian unemployment fluctuations.

1. Introduction

The history of institutions in most developing countries led their labor markets to be very rigid, where private sector contractual opportunities approached the rules of public sector appointments. Major international organizations have therefore encouraged reforms, to introduce more flexibility in these labor markets. The importance of ensuring a healthy dynamic labor market lies in creating more productive jobs and destroying less productive ones (see Veganzones-Varoudakis and Pissarides 2007). Increased dynamics also scale down the difference between formal employment and informal work, which is very flexible by definition. By attracting more workers to formal jobs, the shift of employment into the formal sector allows an increase in the fiscal revenues of governments and hence reduces their budgetary deficits.

The importance of a more flexible labor market was recognized by the Egyptian Government in 2003, as they introduced the new labor law (No.12). The new Egypt labor law came to action in 2004 aiming at increasing the flexibility of the hiring and firing processes in Egypt. The law provides comprehensive guidelines for recruitment, hiring, compensation and termination of employees. It directly addresses the right of the employer to terminate an employee's contract and the conditions in which it performs under.

Although flexible employment protection strategies have been recommended, economic theory predicts ambiguous effects of increased flexibility on the performance of labor markets. Indeed, the conventional model of Mortensen and Pissarides (1994) shows that facilitating termination of employees leads to increased job finding rates, but also has a direct positive effect on transitions from employment to unemployment. Since the employment rate is an increasing function of job finding rates but a decreasing function of separations, evaluating a policy that increases labor market flexibility necessitates the analysis of the different elasticities of these two rates of transitions to the reform in question.

It hence becomes extremely crucial to assess the adjustment of the Egyptian overall separation and job finding rates (the two main components of Egypt's unemployment rate) to such a more flexible employment protection strategy, introduced by the new 2003 labor law. In general, only one earlier study by Wahba (2009) investigated the short term impact (i.e., after two years) of the law but on the formalization process in Egypt. Our paper is able to reply to the following research questions:

1. Investigate the evolution of worker flow trends over the period 1998-2012, and link changes in the job finding and separation rates to the New Egyptian Labor Law implemented in 2004.
2. Build up a model in a way that enables us to simulate labor market policies and examine their implications on dynamics of the Egyptian labor market.

From a methodological point of view, the construction of the observed labor market transitions from microeconomic data, as developed by Shimer (2005, 2012), seems to be a perfect fit to assess this type of labor market reforms. It's a methodology that allows for the exploitation of rich labor market surveys, to disentangle the changes in all transitions and to deduce, using a simple balance of flows, the impact on aggregates, such as the rate of unemployment. In this paper, we try to use this construction methodology, to create aggregate flows from microeconomic surveys in the spirit of the work of Shimer. From an econometric point of view, the reform will be analyzed as a break in the series of job finding and separation rates. The aggregated effect on unemployment will be deduced from the composition of the differentiated effects of transition rates.

The originality of our work lies in the construction of the flow dynamics time series of the Egyptian labor market. As in most countries in the project development process, micro surveys, which trace the history of each individual every month, are unavailable. Only a labor

market panel survey where individuals report their retrospective and current accounts of their labor market states is repeated almost every six years. Even with high quality collection methods and accurate cross-validated questions, such surveys and retrospective information are subject to a memory bias (recall error).[1] De Nicola and Giné (2014) have shown that the magnitude of the recall error increases over time, in part because respondents resort to inference rather than memory. Their findings are based on a comparison between administrative records and retrospective survey data from a developing country, more precisely a sample of self-employed households engaged in fishing in costal India. Using data of a developed country (USA), Poterba and Summers (1986) find through audits of employment surveys that correcting employment self-reports can change the estimated duration of unemployment by a factor of two. Thus, the methodological contribution of our paper is to propose an original method correcting this recall error, using the markovian structure of the labor market transitions. We estimate a function representing the "forgetting rate" conditional on the individual's state in the labor market, for example employed or unemployed in the simple two-state model. Our methodology is close to the one developed by Magnac and Visser (1999). Given the importance of taking into consideration the entry and exit of the labor force, in an attempt to portray the Egyptian labor market as fully as possible, and to test the robustness of our method, we extend our analysis to a three-state model of the labor market (employment, unemployment and inactivity) and check if the results on unemployment rates, reconstructed from a series of corrected labor market flows, are consistent. We show that estimates of corrections then yield similar results, suggesting that our statistical correction method produces robust series. Consequently, we can conclude that our method can be applied to multiple surveys only available between two relatively spaced dates (points in time), which is often the case in developing countries.

The paper uses the Egypt labor market panel surveys (ELMPS 2006 and ELMPS 2012) to extract annual and semi-annual synthetic retrospective panel data sets over the period 1999-2012. As mentioned above, given the nature of our data (with a wave repeated almost every six years), we were concerned with recall error. We were also concerned by a potential design bias in our data due to the very rich information obtained about the most recent employment/non-employment vector versus relatively limited information about past trajectories. We hence develop our novel methodology to correct for the "recall and design" error in the labor market transitions time series.

In his 2012, Shimer shows that reconstructing workers flows from microeconomic surveys gives the advantage to job finding rates in explaining fluctuations of US unemployment. His results therefore contrast with those obtained by [Blanchard, Diamond, Hall, and Murphy (1990) and Davis and Haltiwanger (1990, 1992): these authors showed that, based on statistics of job creations and destructions (job flows), the majority of fluctuations in the US unemployment rate arise from the job destruction rate. In our article, despite the use of a methodology similar to that proposed by Shimer (2012), we show that the new 2003 labor law had significant positive effects on the separation rates, but barely any effects on the job finding rates. The increase in separation rates therefore outweighs the no significant change in job finding rates leading to an increase in the unemployment rates after the reform. These results are valid whether we include or exclude the inactivity state from our analysis. By performing counterfactuals analysis, we show evidence of the increasing dominant role of the separation rates in accounting for Egyptian unemployment fluctuations. It's important to note, however, that the separation and job finding rates remain at extremely low levels, reflecting the very rigid nature of the Egyptian labor market.

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[1] Given the long time interval between the waves of the survey, we cannot use simple methods of memory bias correction used in annual surveys to reconstruct monthly data from retrospective calendars. See e.g., Hairault, Le Barbanchon, and Sopraseuth (2013) applied on French data.

In the Mortensen and Pissarides (1994) model, these results can be explained as follows: if increasing labor market flexibility is modeled as a downward shift of the firing costs, the direct impact of this policy would definitely be a substantial increase in the separation rate, but also a small positive impact on the job finding rate. Nevertheless, this latter effect can be very small, given that it results from the composition of two contradicting forces: the job creation increases because firms know that their firing taxes are lower (i.e., the net job value increases), but this increase is dampened by a job duration which is expected to decrease (i.e. the sum of actualized profit declines). If the separation rate is highly elastic to the policy, then the decrease in job duration effect will be substantial. Consequently, only separations will increase in response to the more flexible labor market. Our results hence suggest that the policy should be tailored to the particular way in which labor markets adjust. A major bottle neck for employment in Egypt has been its labor market's rigidity and its job creation process. Moreover, most of the adjustments to shocks seem to have resided on the earnings' and work hours' side. Yassine (2013) provided estimates of a rudimentary partial Burdett and Mortensen (1998) model, showing that a worker in Egypt can spend up to 25 years in one job. Stylized descriptive facts in Yassine (2014) showed showed that even after the financial crisis and January 2011 uprising, the Egyptian labor marker flows responded relatively in a slow manner and remained at extremely low levels when compared to the overall employment and unemployment stocks in the market.

The rest of the paper is divided as follows. The second section surveys the literature and outlines the value added by our paper. Section 3 briefly presents the data used in our analysis, the creation of the synthetic retrospective panel data sets and the potential error treatments. Section 4 discusses the presence of recall and design bias in our transition matrices, and hence a model is built and estimated to correct for the bias. Section 5 explores the econometric methodology adopted. The sixth section presents our estimation methodology and results. Section 7 provides counterfactual experiments and policy implication conclusions. Finally, we then conclude.

2. Value Added and Literature Survey

Egypt has long been ranked as a country with very rigid labor laws (see World Bank (2014)). This has stemmed from the time when virtually all industrial employment was public sector and heavily unionized. In 1990, the private sector accounted, at most, for 23 percent of Egypt's manufacturing sector output, and 25 percent of its employees. Very bureaucratic rules were established. Fear of the social costs of privatization may have kept these rules rigid, especially the costs of paying off fired workers.[2] Using the Employment Protection LAMRIG indices constructed by Campos and Nugent (2012), we've unsurprisingly noted that Egypt was ranked the most rigid among the MENA region countries, which are themselves the most restrictive developing countries, after the Latin American region.[3] This index decreases substantially to reach a level lower than 1.5 during the period 2000-2004, after a long period of stagnation around a level of 1.8 for about three decades since 1970. Indeed, the Law 12 of the New 2003 Labor Code seems to have relatively reduced the state's role, giving greater leeway to employers to hire and fire.[4] With such a reform, should an employer need to go out of business, he gets the right to lay off all workers. In case of

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[2] The crisis at the beginning of the 90's compelled the government to look to the International Monetary Fund (IMF), World Bank and the Paris Club for support, where Egypt was required to undergo a structural adjustment package as a counterpart to receiving a stand-by credit. The result was an increase in economic activity, and strong growth in private-sector manufacturing. By 2003, the share of the Egyptian total industrial value added reached 70 percent and employment increased substantially to 60 percent.

[3] Veganzones-Varoudakis and Pissarides (2007) underline the ranking of the different developing country regions from the least to the most rigid as follows: South Asia (1.25), Sub-Saharan Africa (1.45), East Asia (1.6), MENA (1.65), Latin America (2.05), with the index of labor market regulation between parenthesis.

[4] The new 2003 law also gives greater leeway to employers to set wages and benefits.

economic necessity, an employer has the right to lay off workers or modify contracts given that he provides a notice period of 2 months for an employee of less than 10 years seniority, and 3 months if seniority is over 10 years. Severance payments of an amount of 1 month per year for workers with less than 5 years experience and of an amount of 1.5 months per year after that are implemented (see Campos and Nugent (2012) for more details).

Unfortunately , the impact of the new 2003 labor market reform has been rarely assessed. It's extremely important to measure whether the policy has achieved its direct objective on the labor market's flexibility in general, the separation and finding rates in particular, as well as it's consequent effect on national unemployment. Policy evaluation techniques necessitate the availability of time series labor market flows to detect structural changes in a given labor market. In a country like Egypt, where available data and analyses hinged on static, cross-sectional and aggregate approaches, our mission becomes difficult. The limitations and potential errors that synthetic panel data, constructed from retrospective accounts, are subject to, prevents research from confirming trends and results obtained by simple descriptive statistics. Previous research, as a result, hardly satisfied the urge to explore the true story of the dynamics of the Egyptian Labor market and the effect of reforms on the labor market outcomes. This paper therefore aims at enriching the existing literature and exploring the effect of the new labor law implemented in 2004 on separation and job finding rates, about which we know very little from the official aggregate data and statistics.

The paper also overcomes the budget constraints limiting annual data collection to follow workers through their careers by benefiting from the existing two waves of the Egypt Labor Market Panel Survey (2006 and 2012), as well as by benefitng from the improved techniques to construct trajectory panels for individuals within these surveys from the retrospective accounts to provide us with annual panel data sets. Our techniques are not limited to only capturing these trajectories and labor market dynamics, but also include correcting the recall and design bias from which our retrospective data tend to suffer.[5] Like previous research, as for example De Nicola and Giné (2014), we were concerned by the recall bias observed in our retrospective calendars. Uncorrected preliminary descriptives might give false impressions about the dynamics of worker flows and unemployment in Egypt. In the literature on measurement error in transition models, two approaches are used. The first approach, in the tradition of the seminal papers of Poterba and Summers (1986, 1995), uses either validation or reinterview data (assuming that the data is error free) to estimate the measurement error. While Poterba and Summers (1986) use the reinterview data from the Current Population Survey to study the impact of measurement error on the estimated number of labor market transitions, Magnac and Visser (1999) use prospective and retrospective data for the same time period to study labor mobility of French workers with the Labor Force Survey, where the prospective data was being treated as error-free. The second approach, used for example by Rendtel, Langeheine, and Berntsen (1998), is applied when no auxiliary (error-free) information is available. Based on the assumption of the Independent Classification Errors[6], these methods use a latent Markov model with measurement error. In Magnac and Visser (1999) and Bassi, Hagenaars, Croon, and Vermunt (2000), this method is extended to the case where correlation between errors are possible, also by using retrospective data.

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[5] In an investigation of the effect of measurement error on poverty transitions in the German Socio-Economic Panel (GSOEP), Rendtel, Langeheine, and Berntsen (1998) conclude that approximately half of the observed transitions are due to measurement error. Lollivier and Daniel (2002) corroborate this result for the European Community Household Panel (ECHP).

[6] This assumption means that the errors made at two subsequent time periods are conditionally independent given the true states.

Nevertheless, these methods are designed for short term analysis of the labor market (the impact of the business cycle on labor market transitions). They use surveys where annual waves are available, and which include intra-annual information. From this perspective, the measurement error can be approximated as a small noise, with an update each year at the time of the interview. In our case, the delay between the two interviews is much longer, requiring a new method to correct for long-term memory recall bias. In addition to the recall bias, we also suspect a potential design bias in our constructed synthetic panel data sets, due to differences in the nature of questions asked about the current or most recent labor market status and those asked about the individuals' histories. We therefore add to the existing literature by applying a new theoretical model to correct for the bias observed in our data, for both a two-state and a multiple state labor market. Empirically, the technique we use to extract a retrospective panel and correct for "recall and design" bias using the Egyptian Labor market data sets would definitely allow researchers and policy-makers (who use the same or similar data sets) to use these data sets for further research and needed investigations about labor market dynamics. We also use the cross-sectional information obtained from a third wave of the Egypt Labor Market Panel Survey in 1998 to verify the results we obtain using our corrected transition rates time series. We explain in the data section the limitations of this data set and why we chose not to use it in our econometric estimations.

3. Data and Sample Selection

Our paper relies on the Egypt Labor Market Panel Surveys 2006 and 2012, the second and third rounds of a periodic longitudinal survey that tracks the labor market and demographic characteristics of households and individuals interviewed in 1998. The households selected in the longitudinal data are nationally-representative and randomly selected. The final sample interviewed in 2012 consists of 12,060 households, which include 6,752 original households (out of 8,371 interviewed in 2006), 3,308 split households and a refresher sample of 2,000 households. The attrition weights attributed in this data set by Assaad and Krafft (2013) allow us to expand sample figures to a macro population level.

We make use in this paper of the rich retrospective information available in both questionnaires as well as current state information and the newly added chapter (in ELMPS12) of life events calendar. Unfortunately, the ELMPS 1998 round did not contain "full" (compared to ELMPS06 and ELMPS12) retrospective accounts about the interviewed individuals. The type and different characteristics of an individual's first state in the labor market have not been collected. We therefore choose to exclude this round from our analysis, for comparability reasons, given that it does not contain the minimal information required to extract our synthetic panel data. We only refer to the cross-section vector (1998) in this round of the survey, after we're done with our corrections and estimations, to verify the estimates of our corrected transition rates for that year.

Following the methodology adopted by Yassine (2014), we extract two panel datasets for the periods 1999-2006 (from ELMPS06) and 1999-2012 (from ELMPS12). ELMPS06 records only the year of start of an individual's state, allowing us to just extract an annual panel data set between 1999-2006. The availability of the month and year of the date of start of a state in ELMPS12, on the other hand, enables the construction of both semi-annual and annual panels. Since missing values about the month and year of start of a state are problematic when creating such synthetic panels, we adopted the same assumptions made in Yassine (2014) to create the ELMPS12 panel datasets. Consequently, the cross-state transitions do not get evenly distributed over the 2 semesters of the year. Semi-annual transitions are not representative for a 6 months period. However, as they are lumped into an annual trajectory, this allows us to capture the maximum range of transitions an individual went through during the year t. Cross-state labor market transitions such as job finding and job separations are therefore derived from the semi-annual constructed panel, but then lumped into annual

transitions in order to be representative, as well as comparable with the 1999-2006 panel extracted from the ELMPS06.

The general sample of our panel datasets includes individuals who answered the retrospective question (i.e., those who ever worked in the Egyptian labor market, the young unexperienced new entrants and the individuals who are permanently out of the labor force).

In this paper, we focus on employed, unemployed and inactive male individuals between 15 and 49 years of age. Our analysis excludes female workers since their movement in and out of the labor market follows personal motives most of the time, such as marriage and child birth. Moreover, going back in time, our sample should have included people who were alive back then but passed away by the year of the survey (i.e., 2006 and 2012) and hence did not respond to the ELMPS questionnaire. Due to this backward attrition, we were obliged to limit the age of our analysis group to what we refer to as the prime age group (i.e. between 15 and 49 years old). Another reason why one would want to avoid including old people in the analysis group is to limit recall error, which is intutively likely to increase with advanced age.

A potential type of error that our data is susceptible to is the response error, including the "present" mis-report bias and recall bias (Yassine, 2014). We cannot deal with the bias resulting from people deliberately mis-reporting their present employment status and information to avoid taxes and government registers. We therefore assume the non-existence of this bias. The extent of recall bias is examined and corrected by our constructed model in the next section.

In addition to the recall error, we also suspect the presence of what we call the "design" bias that leads to a systematic inaccuracy (in the same direction of the recall bias) in our constructed synthetic panels. The ELMPS survey contains very detailed (almost complete) questions about an individual's current employment/unemployment/inactivity state. Questions about retrospective accounts are, however, minimal and very broad, where people mostly end up recording their jobs history, ignoring histories about their unemployment spells. It's also worth noting that individuals responding to the retrospective chapter in the survey are required to to have at least one work experience. Consequently, using the available collected data, we obtain correct estimates for the current labor market state and increasingly biased estimates as we move backwards, especially among the unemployed and inactive who have never worked before. We examine in the next section the nature of the bias observed in the data and suggest a methodology to correct for it.

Finally, it's important to note that in this paper we have two stages of analysis. One is where an individual can occupy one of two states, namely employment (E) or unemployment (U). The transition from employment to unemployment is referred to as job separation and the transition from unemployment to employment is referred to as job finding. A three-state (Employment [E] - Unemployment [U] - Inactivity [I]) model is also developed where all inter- and intra- state transitions are illustrated and are used to calculate the job finding and separation rates of the three-state economy following Shimer (2012).

4. Recall and Design Bias

4.1 Descriptive statistics

Following the Diamond-Mortensen-Pissarides (DMP) matching model of unemployment, in steady-state equilibrium, flows into unemployment ("separations") equal flows from unemployment ("finds"). Using the flow balance equation, we therefore have

$$\underset{fU}{\underline{f U}}\, Probability\ to\ find\ a\ job \times no.of\ unemployed = \underline{sE}\, Probability\ to\ quit/lose\ a\ job \times no.of\ employed \qquad (1)$$

We can therefore show that in equilibrium, unemployment rate is

$$\frac{U}{L} \, UnemploymentRate = \frac{s}{s+f}$$

(2)

This represents the rate of unemployment to which the economy naturally gravitates in the long run. The natural rate of unemployment is determined by looking at the rate people are finding jobs, compared with the rate of job separation (i.e., people quitting), and not the size of the population or the economy. In any given period, people are either employed or unemployed. As a result, the sum of structural and frictional unemployment[7] is referred to as the natural rate of unemployment, also called "full employment" unemployment rate. This is the average level of unemployment that is expected to prevail in an economy and in the absence of cyclical unemployment. A healthy dynamic economy is therefore one with high separation and finding rates, keeping natural unemployment rate at its minimum.

Using the job finding and job separation rates obtained from our constructed synthetic panel data sets, we plot in figure 1 the theoretical steady state versus the empirical unemployment (the rate of unemployed in the labor force). It is very obvious that the theoretical unemployment rate is correctly estimated and hence a good proxy for the prevailing unemployment rate in the economy only for the year 2011(i.e., the most recent year). The gap between the empirical and theoretical unemployment rate increases as we go back in time. As we examine the data thoroughly, we note that this gap can be mainly attributed to two factors acting in the same direction, namely to the recall error and the design nature of the ELMPS survey.

On the one hand, it's intuitive and very likely that when reporting their labor market histories, individuals would not recall their unemployment spells, especially the short ones. On the other hand, as previously mentioned the design of our survey tends to under-record the unemployment and inactivity spells through the retrospective accounts. Consequently, our estimations for the job separation rates over previous years are likely to be underestimated. On the other hand, people are more likely subject to over-recall and over-record their job finding transitions. This becomes clearly obvious as we overlap in figure 2 the job finding and separation rates from both panels, ELMPS06 and ELMPS12. Estimations for the job separation rates are increasingly being underestimated as we move backwards from the year of the survey, whilst job finding rates tend to be over-estimated. Even by adding the separation and job finding rates in 1998 obtained from the ELMPS98 synthetic panel, which contains incomplete information, we still note the same trend in the bias.

A potential argument behind the reason of the backward increasing gap between the theoretical and empirical unemployment rates is the declining growth rate of the working age population in Egypt. The Steady State theoretical unemployment rate assumes a population that increases at a constant growth rate. We therefore replot in figure 3 the steady state theoretical unemployment rate with a declining population growth rate n. Even after correcting for the population dynamics, the theoretical unemployment rate curve keeps the same form confirming the backward increasing trend of the "recall and design" bias suggested above. For brevity and simplicity, we use throughout the rest of the paper the term recall error to refer to this combined bias.

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[7] Frictional unemployment occurs naturally in any economy. People have to search to find an employer who needs their specific skills. Finding the right employee-employer match takes time and energy. Individuals have to look for the right job, and firms have to screen individuals for the right qualifications. This takes some time. Therefore, there will always be some level of unemployment in the healthiest of economies.

4.2 A Model correcting recall error

4.2.1 A two-state model

We suppose that the true labor market histories are generated by a discrete-time Markov chain. The vector of the true labor market state occupied at year t is

$$X(t) = \begin{bmatrix} E(t) \\ U(t) \end{bmatrix}$$

where $E(t)$ and $U(t)$ represent the true proportion of employed and unemployed respectively in the labor force in year t. The vector

$$x(t) = \begin{bmatrix} e(t) \\ u(t) \end{bmatrix}$$

denotes the observed labor market state histories at time t, with $e(t)$ and $u(t)$ being the observed proportion of employed and unemployed in the labor force in year t. With $s(t-1,t)$ being the separation rates and $f(t-1,t)$ the job finding rate, the matrix

$$M(t-1,t) = \begin{bmatrix} 1 - s(t-1,t) & s(t-1,t) \\ f(t-1,t) & 1 - f(t-1,t) \end{bmatrix}$$

gives the observed transition probabilities between the year $t-1$ and the year t. Thus, we have

$$x(t) = M(t-1,t)x(t-1)$$

As explained in the above section, the observation of the transition probabilities can be biased: the recall bias.

To correct this bias, we propose to estimate two functions, one for the separation rate and another for the job finding rate. We define $\phi(t-1,t)$ and $\psi(t-1,t)$ as the associated error terms to the separation and job finding rates rates respectively. These errors vary in time and increase as we go back in history, as observed in the descriptive statistics. They simply reflect that people tend to lose accuracy and memory as they report older events. This allows us to write the true matrix of transition probabilities between years $t-1$ and t as follows;

$$\Pi(t-1,t) = \begin{bmatrix} 1 - s(t-1,t) - \phi(t-1,t) & s(t-1,t) + \phi(t-1,t) \\ f(t-1,t) + \psi(t-1,t) & 1 - f(t-1,t) - \psi(t-1,t) \end{bmatrix}$$

With the correction, we obtain

$$X(t) = \Pi(t-1,t)X(t-1)$$

Given the shape of the recall bias observed and discussed in the previous section, we assume that the error terms $\phi(t-1,t)$ and $\psi(t-1,t)$ have the following functional forms;

$$\phi(t-1,t) = \mu(1 - exp(-\alpha(T-t)))$$

$$\psi(t-1,t) = \gamma(1 - exp(-\beta(T-t)))$$

implying $\phi(T-1,T) = \psi(T-1,T) = 0$. Since as we show in the previous section, our worker flows are correctly estimated for the most recent year T, we therefore assume that $\Pi(T-1,T) = M(T-1,T)$ for a given panel data set. This implies that for the ELMPS12 constructed panel $\Pi(2010,2011) = M(2010,2011)$ and for the ELMPS06 $\Pi(2004,2005) = M(2004,2005)$. It's also important to note here that we exclude, from our

analysis, transitions between the years 2011-2012 and 2005-2006, since these transitions are only observed for part of the year and not the entire years 2006 and 2012. The data collection process for both surveys was conducted early 2006 and 2012. Given the above setting and the availability of two waves from the ELMPS, we are able to estimate the parameters $\hat{\alpha}$, $\hat{\beta}$, $\hat{\mu}$ and $\hat{\gamma}$, by solving the following system

$$X(2011)_{ELMPS12} = \left(\prod_{t=2005}^{2011} \Pi'(t-1,t) \right) X(2004)_{ELMPS06}$$

such that

$$\Pi(2004,2005 \mid \phi_{2010,2011}, \psi_{2010,2011})_{ELMPS06} = \Pi(2004,2005 \mid \phi_{2004,2005}, \psi_{2004,2005})_{ELMPS12}$$

We use our estimated $\hat{\alpha}$, $\hat{\beta}$, $\hat{\mu}$ and $\hat{\gamma}$ to reproduce the true transition probabilities $\Pi(t-1,t)$ between the years 1999 and 2005 using the constructed ELMPS06 panel.

4.2.2 Accounting for a large set of labor market transitions (N states)
The vector of the true labor market state occupied at year t becomes now

$$Y(t) = \begin{bmatrix} E(t) \\ U(t) \\ I(t) \end{bmatrix}$$

where $E(t)$, $U(t)$ and $I(t)$ represent the true proportion of employed, unemployed and inactive individuals respectively in year t. The vector

$$y(t) = \begin{bmatrix} e(t) \\ u(t) \\ i(t) \end{bmatrix}$$

denotes the observed labor market state histories at time t, with $e(t)$, $u(t)$ and $i(t)$ being the observed proportion of employed, unemployed and inactive in year t. With $\lambda_{ji}(t-1,t)$ being the transition rates from state j occupied in $t-1$ to the state i occupied in t, the matrix

$$N(t-1,t) = \begin{bmatrix} \lambda_{EE}(t-1,t) & \lambda_{EU}(t-1,t) & \lambda_{EI}(t-1,t) \\ \lambda_{UE}(t-1,t) & \lambda_{UU}(t-1,t) & \lambda_{UI}(t-1,t) \\ \lambda_{IE}(t-1,t) & \lambda_{IU}(t-1,t) & \lambda_{II}(t-1,t) \end{bmatrix}$$

gives the observed transition probabilities between the year $t-1$ and the year t. There exists a restriction on these transition rates: the sum of the elements of each column must be equal to one. Thus, we have:

$$\lambda_{EE}(t-1,t) = 1 - \lambda_{EU}(t-1,t) - \lambda_{EI}(t-1,t)$$

$$\lambda_{UU}(t-1,t) = 1 - \lambda_{UE}(t-1,t) - \lambda_{UI}(t-1,t)$$

$$\lambda_{II}(t-1,t) = 1 - \lambda_{IE}(t-1,t) - \lambda_{IU}(t-1,t)$$

This transition matrix leads to

$$y(t) = N(t-1,t)y(t-1)$$

As previously, the observation of the transition probabilities can be biased due to the recall error. To correct this bias, we propose to estimate, in this case, three functions, one for each subgroup. We define $\varphi_z(t-1,t)$, for $z = E,U,I$, as the associated error terms to the z-type agents (the subgroup). These errors also vary in time and increase as we go back in history. Again, these simply reflect that people tend to lose accuracy and memory as they report older events. This allows us to write the true matrix of transition probabilities between years $t-1$ and t as follows;

$$\Omega(t-1,t) = \begin{bmatrix} \lambda_{EE} - \varphi_E & \lambda_{EU} + a_1\varphi_E & \lambda_{EI} + (1-a_1)\varphi_E \\ \lambda_{UE} + b_1\varphi_U & \lambda_{UU} - \varphi_U & \lambda_{UI} + (1-b_1)\varphi_g \\ \lambda_{IE} + c_1\varphi_I & \lambda_{IU} + (1-c_1)\varphi_I & \lambda_{II} - \varphi_I \end{bmatrix}$$

With the correction, we obtain

$$Y(t) = \Omega(t-1,t)Y(t)$$

The error terms $\varphi_z(t-1,t)$ are assumed to have the following functional forms:

$$\varphi_z(t-1,t) = v_z(1 - exp(-\theta_z(T-t)))$$

implying $\varphi_z(T-1,T) = 0$. Since as we show in the previous section, our worker flows are correctly estimated for the most recent year T, we therefore assume that $\Omega(T-1,T) = N(T-1,T)$ for a given synthetic panel data set. This implies that for the ELMPS12 constructed panel $\Omega(2010,2011) = N(2010,2011)$ and for the ELMPS06 $\Omega(2004,2005) = N(2004,2005)$. Given this new three-state setting, we are now able to estimate the parameters $\hat{\theta}_z$, $\hat{v}_z$ (for $z = E,U,I$), a_1, b_1 and c_1, by solving the following system

$$Y(2011)_{ELMPS12} = \left(\prod_{t=2005}^{2011} \Omega'(t-1,t) \right) Y(2004)_{ELMPS06}$$

such that

$$\Omega(2004,2005 \mid \varphi_z(2010,2011))_{ELMPS06} = \Omega(2004,2005 \mid \phi_z(2004,2005))_{ELMPS12}$$

We use our estimated $\hat{\theta}_z$, $\hat{v}_z$, $\hat{a}_1$, $\hat{b}_1$ and $\hat{c}_1$ to reproduce the true transition probabilities $\Omega(t-1,t)$ between the years 1999 and 2005 using the constructed ELMPS06 panel.

5. Econometric Methodology

Our objective is to detect a structural break, linked to a permanent change in the labor market policy. In our constructed time series, there are two components. The first one accounts for the business cycle, whereas the second accounts for long run component. Only this part matters for our analysis. It is therefore necessary in this section to purge the time series from their cyclical components.

5.1 A two-state labor market

In the spirit of Okun's law (1970), we consider that a first approximation of the labor market flows can be modeled as follows:

$$x_t - x_t^{\mathring{a}} = \alpha(y_t - y_t^{\mathring{a}}) + \beta + \varepsilon_t \quad for\ x = f,s$$

where f_t and s_t are respectively the observed job finding and job separation rates, $f_t^{\mathring{a}}$ and $s_t^{\mathring{a}}$ represent the natural rates of the job finding and the job separation, y_t is the log of the

observed output and $y_t^{\mathring{a}}$ is the log of the potential output. The left-hand side term represents the flow gap, whereas $y_t - y_t^{\mathring{a}}$ captures the output gap. In other words, the difference between the observed and potential real GDP captures the cyclical level of output. Likewise, the difference between the observed and natural rate of job finding and the job separation represent the cyclical rate of worker flows.

A major problem with this model is that there are no observable data on $f_t^{\mathring{a}}$, $s_t^{\mathring{a}}$ and $y_t^{\mathring{a}}$. They therefore have to be estimated, which means it is necessary to generate f_t, s_t and y_t trend series. A problem then arises concerning the choice of the detrending method. To relatively overcome it, we approximate $y_t - y_t^{\mathring{a}}$ by the first difference of the observed output Δy_t, leading to a stationary process measuring the cyclicality of the economy, whereas we assume that the natural rates of the job finding and the job separation are constant over time, in accordance to the usual model of the labor market. Thus, our statistical model is

$$x_t - x^{\mathring{a}} = \alpha \Delta y_t + \beta + \varepsilon_t \quad for \ x = f, s$$

$$\Leftrightarrow x_t = \alpha \Delta y_t + \beta + x^{\mathring{a}} + \varepsilon_t \quad for \ x = f, s$$

In this model, the estimated constant term encompasses the "true" constant and the structural rate of worker flows (hiring or separation). This suggests that any policy, that changes the natural rate of the worker flows ($x^{\mathring{a}}$), introduces an instability on this relation, even if the strong assumption of the stability α is satisfied. We exploit this basic point to test the impact of the 2003 reform in the Egyptian labor market. More formally, we estimate the following model:

$$x_t = \alpha \Delta y_t + \beta + I_b x^{\mathring{a}} + I_a x^{\mathring{a}} + \varepsilon_t \quad for \ x = f, s$$

$$\Leftrightarrow x_t = \alpha \Delta y_t + b + I_a \gamma + \varepsilon_t \quad for \ x = f, s$$

where $I_b = 1$ before the reform and 0 after, whereas $I_a = 1$ after the reform and 0 before. From

this equation, we deduce that if $\hat{\gamma} \neq 0$, then the reform has a significant impact on the long run worker flows, and thus on their current values.

To test for the robustness of our approximation of $y_t - y_t^{\mathring{a}}$ by the first difference of the observed output Δy_t, we also build our statistical model using the standard [8] filter, to remove the business cycle component from the observed output y_t time series. We hence obtain the detrended output y_t^{HP}.

$$x_t = \alpha y_t^{HP} + \beta + I_b x^{\mathring{a}} + I_a x^{\mathring{a}} + \varepsilon_t \quad for \ x = f, s$$

$$\Leftrightarrow x_t = \alpha y_t^{HP} + b + I_a \gamma + \varepsilon_t \quad for \ x = f, s$$

Using the estimates of these regressions, one can also construct counterfactuals. First, we extract the cyclical component of the worker flows driven by the output gap, in order to only focus on structural changes in the labor market. This leads us to analyze the time series

$$\hat{x}_t = \hat{b} + I_a \hat{\gamma} + \hat{\varepsilon}_t \quad for \ x = f, s.$$

Without any observed policy change ($\hat{\gamma} = 0$), the variations in $\hat{x}_t$ are driven by unobservable changes in the matching and the separation processes. Thus, the time series $\hat{x}_t^s$, built under the assumption of a stable relationship over time, can be interpreted as the counterfactual of a economy without any policy changes (this time series is build with $\hat{\gamma} = 0$). If the policy changes the natural rate of the worker flows, then the "true" series of the natural worker flows are give by $\hat{x}_t^s$. The gap between $\hat{x}_t$ and $\hat{x}_t^s$ measures the impact of the reform.

Given that the unemployment rate is well approximated by its stationary value at the flow equilibrium, we can use our estimations of the natural flows to construct the implied natural unemployment. More formally, we have $u = \dfrac{s}{s + f}$. Thus, if we only focus on the component of the worker flows purged from the cyclical component linked to the GDP, we have

$$\hat{u}_t = \frac{\hat{s}_t}{\hat{s}_t + \hat{f}_t} \quad \text{and} \quad \hat{u}_t^s = \frac{\hat{s}_t^s}{\hat{s}_t^s + \hat{f}_t^s}.$$

Finally, in order to measure the relative contribution of the worker flows in the unemployment dynamics, one can compute $\hat{u}_t^f = \dfrac{\hat{s}_t}{\hat{s}_t + \tilde{f}_t^s}$: this time series gives the unemployment dynamics if only the job finding rate is affected by the reform, or in other words, the contribution of the change in the job finding rate to the natural unemployment variation. The same methodology is adopted for the two-state employment/non-employment labor market model. The model in this case, however, allows us to measure the relative contribution of the worker flows (NE-to-E finding rate and E-to-NE separation rate) to the dynamics of the non-participation rate.

5.2 Entry and exit from the labor force

In a developing rigid labor market such as Egypt, flows to and from inactivity play an important role as a determinant of final labor market outcomes. Examining the gross flows of workers, between the three labor market states, employment (E), unemployment (U) and inactivity, becomes essential to portray as fully as possible the real story and the particular nature of the market.

In such a case, we adopt the same econometric methodology described above to measure the impact of the 2003 new labor law on the three-state labor market transitions. However, as mentioned previously, we now have a 3×3 matrix of the corrected transition probabilities, $\Omega(t-1,t)$. With $\Lambda_{ji}(t-1,t)$ being the corrected transition rates from state j occupied in $t-1$ to the state i occupied in t, we re-write $\Omega(t-1,t)$ as follows;

$$\Omega(t-1,t) = \begin{bmatrix} \Lambda_{EE} & \Lambda_{EU} & \Lambda_{EI} \\ \Lambda_{UE} & \Lambda_{UU} & \Lambda_{UI} \\ \Lambda_{IE} & \Lambda_{IU} & \Lambda_{II} \end{bmatrix}$$

This therefore allows us to model the first approximation of the labor market flows as follows:

$$x_t - x_t^* = \alpha(y_t - y_t^*) + \beta + \varepsilon_t \quad for \ x = \Lambda_{EE}, \Lambda_{EU}, \Lambda_{EI}, \Lambda_{UE}, \Lambda_{UU}, \Lambda_{UI}, \Lambda_{IE}, \Lambda_{IU}, \Lambda_{II}$$

With no observable data on x_t^* and y_t^*, we approximate $y_t - y_t^*$ by the first difference of the observed output Δy_t and we assume that the natural rates of the different labor market transitions are constant over time. Replicating the above procedure and deriving similarly the equations adopted in the previous section for the two-state model, we are able to analyze the time series

$$\hat{x}_t = \hat{b} + I_a \hat{\gamma} + \hat{\varepsilon}_t \quad for \ x = \Lambda_{EE}, \Lambda_{EU}, \Lambda_{EI}, \Lambda_{UE}, \Lambda_{UU}, \Lambda_{UI}, \Lambda_{IE}, \Lambda_{IU}, \Lambda_{II}.$$

This allows us to test if the policy changes the natural rate of the worker flows or not.

We then use our estimations of the natural flows to construct the implied natural unemployment. Following Shimer (2012), in a three-state E-U-I model, the number of employed, unemployed and inactive individuals are determined by the following equations;

$$E = k(\Lambda_{UI}\Lambda_{IE} + \Lambda_{IU}\Lambda_{UE} + \Lambda_{IE}\Lambda_{UE})$$

$$U = k(\Lambda_{EI}\Lambda_{IU} + \Lambda_{IE}\Lambda_{EU} + \Lambda_{IU}\Lambda_{EU})$$

$$I = k(\Lambda_{EU}\Lambda_{UI} + \Lambda_{UE}\Lambda_{EI} + \Lambda_{UI}\Lambda_{EI})$$

where k is a constant set so that E, U and I sum to the relevant population. The steady-state unemployment rate ($u = \dfrac{s}{s+f}$) in a three-state labor market can therefore be written as

$$u = \frac{\Lambda_{EI}\Lambda_{IU} + \Lambda_{IE}\Lambda_{EU} + \Lambda_{IU}\Lambda_{EU}}{(\Lambda_{EI}\Lambda_{IU} + \Lambda_{IE}\Lambda_{EU} + \Lambda_{IU}\Lambda_{EU}) + (\Lambda_{UI}\Lambda_{IE} + \Lambda_{IU}\Lambda_{UE} + \Lambda_{IE}\Lambda_{UE})}$$

The relative contribution of the worker flows in the unemployment dynamics is then calculated. One can compute $\hat{u}_t = \dfrac{\overset{f}{\hat{s}_t}}{\underset{s}{\hat{s}_t} + \hat{f}_t}$, a time series that gives the unemployment dynamics if only job finding rate is affected by the reform, given no change in the separation rates. In the three-state model (where individuals can also be inactive), the separation and job finding rates take into account all intermediate states/transitions an individual could have gone through before exiting into unemployment or entering into employment. The hypothetical separation and job finding rates are therefore calculated as follows;

$$\hat{s}_t = \overline{\Lambda}_{EI}\overline{\Lambda}_{IU} + \overline{\Lambda}_{IE}\overline{\Lambda}_{EU} + \overline{\Lambda}_{IU}\overline{\Lambda}_{EU}$$

$$\underset{s}{}$$

$$\hat{f}_t = \Lambda_{UI}\overline{\Lambda}_{IE} + \overline{\Lambda}_{IU}\Lambda_{UE} + \overline{\Lambda}_{IE}\Lambda_{UE}.$$

In other words, we show the unemployment dynamics if the three-state model separation rate followed the same dynamics as before the 2003 reform.

6. Estimation and Results

Correcting for the recall bias enables us, in this section, to investigate the true evolution of worker flow trends over the period 1998-2012 in both our models: E-U and E-U-I. We are then able to link changes in the job finding and separation rates to the 2003 New Labor Law implemented in Egypt in 2004.

6.1 Corrected descriptive statistics

Our estimations of the recall error terms allow us to obtain in table 1 the estimated results for $\hat{\phi}$, $\hat{\psi}$, $\hat{\psi}_E$, $\hat{\psi}_U$ and $\hat{\psi}_I$ for both models, namely E-U and E-U-I.

The corrected trends of the separation, job finding and three-state transition rates are hence obtained as follows in figures 4, 5 and 6. Indeed, as we have already shown in the descriptive time series obtained from overlapping the two surveys (ELMPS 2006 and ELMPS 2012), the separation is underestimated and this bias is larger when the individual must appeal to distant memory. For the job finding rate, the transition rates are slightly overestimated. The setting of our correction model succeeds in adjusting these trends to reflect as close as possible the prevailing labor market flows of the economy using the available data. These figures also show that the correction of the separation rates is more important than the one of the job finding rates. This was expected given the nature and extent of the recall as well as the design bias earlier discussed in the data section. As we compare our corrected separation and job finding rates in 1999 in figure 4 to the empirical rates we obtain from ELMPS98 in 1998 in figure 1, we find that our methodology allows us to obtain a very good proxy to the true level of these rates as we go backwards in time.

As we replot the steady-state unemployment rates using the corrected separation and job finding rates[8] for each of the two models, we obtain much more reasonable curves (figures 4 and 5): our corrected theoretical unemployment rate shares approximatively the same average of the aggregate empirical unemployment rate (obtained from stocks). Nevertheless, it seems more cyclical than the prevailing empirical unemployment rate, suggesting that it contains more information.

6.2 Before and after the reform

After correcting the labor market flows from the recall error, we compute the steady-state unemployment rate ($u = \dfrac{s}{s+f}$), our proxy to the prevailing unemployment rate in the economy. Figure 7 shows the relationship between the GDP growth rate and the corrected steady-state unemployment rate in Egypt over the period 1999-2011. We note that before the year 2004, the year of implication of the new labor law, there had been a classical negative relationship between the unemployment rate and the GDP growth, which portrays an Okun's law relation between unemployment and economic growth. However, after the reform, this negative relationship got distorted. We note a substantial increase in the unemployment rate, accompanied by a rapid growth of GDP levels. In order to be able to explain such a paradox, and because the reform can have different effects on job finding and separation rates, we decompose its impact by analyzing these two components of the unemployment rate.

Our econometric methodology extracts the cyclical component from the trends of the labor market flows, making it possible to detect the structural break observed in our time series,

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[8] Finding and Separation rates obtained in the three-state model are not of the same level as the rates in the two-state. This is pretty intuitive and normal since in the first model, an individual can only occupy one of two states (E or U), the transitions involved are therefore only EU and UE. In the three-state E,U,I model, the finding and separation rates take into consideration any other type of transition or state an individual could have gone through before entering employment or exiting to unemployment. The probabilities calculated are therefore conditional on the existence of a third state in the labor market, namely inactivity and all related potential transitions.

which shows the impact of the new labor law implemented in 2004. We first limit our analysis to individuals being either employed or unemployed. At first glance, figure 14 shows that the new labor law has led to positive effects on both separation and job finding rates. Our regression results in figure 9, however, reveal that only the increase in separation rates was significant at the 1% level. With a very significant rise in the separations and an insignificant change in the job findings, it becomes intuitive that the normal net effect of the reform explains the rise in the unemployment rates after 2004. Yet, to verify the contribution of each of these components to the unemployment variability, we perform counterfactual plots of the unemployment rate in the next section.

The full story of the Egyptian labor market is, however, never complete as one excludes flows entering and exiting. According to Yassine (2013), the new entrants (inactivity to employment) constitute a substantial flow of workers that one can not ignore when analyzing the Egyptian labor market. As a matter of fact it has been argued that, being a developing country, looking at participation rates might portray a better picture of the health of the labor market. Consequently, the detrended job finding and separation rates are reconstructed but this time for a three-state model where individuals can either be employed, unemployed or inactive. By modeling all possible labor market flows, we calculate separation and job finding rates, but this time accounting for the existence of the inactivity state. Our results are robust and coherent with the two-state E/U system. The 2003 reform led to a significant increase in the separation rates and barely any impact on the job finding rates. Looking at the more detailed labor market transitions, we show that even though the structural break observed in 2004 favored the unemployment-to-employment (Λ_{UE}) flows, as well as inactivity-to-employment (Λ_{IE}) labor market flows, the impact has been insignificant for

both (the coefficients when ($\hat{\gamma} \neq 0$) were insignificant for these flows.). The introduction of the dummy at the time of the reform neither improved the fit of the regressions for (Λ_{IE}) nor (Λ_{UE}). On the other hand, the coefficients of the dummy γ for the regressions of (Λ_{EI}) and (Λ_{EU}) were statistically significant (Table 4). It's important to note at this point that the E-to-I has been slightly affected negatively after the 2003 law. This impact was only significant at the 10% level and was mainly dominated by the very significant increment of the E-to-U flows. All regressions' estimations used in this section are illustrated in appendix 9. We also redo our regressions, by detrending our flows using the Hodrick and Prescott (1997) filter, in appendix 9, showing that we obtain the same robust results.

In general, we note that the residuals of the regressions that omit the 2003 reform are non-stationary. For the significant cases (especially separations), the residuals become centered around zero when the reform is taken into account. This supports the significant impact of the dummy variable reported in the tables 2, 3 and 4.

7. Counterfactuals and Implications
Having shown the effects of the reform on labor market flows (the components of unemployment), we were able to deduce that the dynamics of the separation rates have a much more dominant impact, especially after the new 2003 labor law, on the variability of the unemployment rate than its job finding peer.

To be able to verify this observation and using the estimates of equations 3, 4, 7 and 8, we construct counterfactual experiments. After extracting the cyclical component of the worker flows driven by the output gap, and then focussing only on the structural changes on the labor market, we can construct two time series: the first assumes that the reform has no impact on

the structural worker flows ($\hat{\gamma} = 0$) and the other takes the estimates of the 2003 reform into

account ($\hat{\gamma} \neq 0$). We therefore plot the evolution of the unemployment rate after the reform, assuming the separation rates have followed the same dynamics before the law. In other words, these time series assume that the separation rates remained unaffected by the reform. This scenario captures the impact of the reform on the variability of the unemployment rate if and only if the law had an impact on the Egyptian labor market's job finding rates. Figures 11 and 12 show that, whether we take into consideration the existence of a third state of inactivity in the market or not, the relative contribution of the separation rates to the Egyptian unemployment dynamics is substantial and significant. The structural increase in the unemployment rates after the reform is mainly due to the increase in separation rates. The positive responses (decrease in unemployment) due to the insignificant increase in the job finding rates were definitely outweighed by the significant impact of the augmented separations (figure 11). Adding inactivity as a third state in the economy, the positive impact of the job findings on the unemployment is no more observed (since job findings hardly changed in this model) and all the unemployment variations are attributed to the separations increase in this case. The Egyptian unemployment rate was therefore more responsive and had a larger elasticity vis-a-vis the variation in the level of the separation rate. It is true that it's important for an economy, in order to promote higher productivity levels associated with economic growth, to increase job destruction (i.e., separations). This phenomenon should, however, be accompanied by new productive jobs being created at a much greater magnitude; in other words, a more proportional increase in the job findings. This assures a healthy dynamic labor market with natural unemployment rates maintained at low levels. Generally, the law achieved only part of its double-sided mission, where the firing process was to some extent facilitated. Yet it has not been offset by sufficiently increased and facilitated hiring. As a matter of fact, the law did not affect the hiring process in the Egyptian labor market by any means. In simple words, more jobs were being destroyed than before the law, while the same number of jobs were being created. A normal consequence would be a rise in unemployment even if the economy has been experiencing rising rates of economic growth.

8. Conclusion

This paper addresses a very important question: namely, the impact of labor market reforms that introduce flexibility in developing countries. We use the experiment of the implementation of the 2003 Egypt labor law on the dynamics of the Egyptian labor market, one of the most rigid markets at the end of the 1990s. This reform came to action in 2004, with the aim of enhancing the flexibility of the hiring and the firing processes. Given the two components of unemployment - separation and job finding rates - we measure the impact of the reform on each. Using constructed synthetic retrospective panel datasets from the Egypt labor market panel surveys 2006 and 2012, we are able to build a model to control for the recall and design bias such retrospective data sets are likely to encounter. We are therefore able to obtain the corrected trends of separation and job finding rates over the period 1999-2011. These time series of worker flows, that even official statistics fail to reproduce, are extremely important to be able to understand the behavior of the dynamics of the Egyptian labor market.

Our findings suggest that new labor market reform significantly increased the separation rates and had no significant impact on the job finding rates. Having decomposed the impact of the new law on both components and also by using counterfactual experiments, we were able to conclude that the dynamics of the separation rates have had an increasing dominant role in accounting for the changes in the unemployment rate in Egypt, especially after 2004. With increased separations and unchanged job findings, the unemployment rates in the Egyptian labor market were shifted upwards after 2004. Such a conclusion explained the unresolved, persistent paradox of increasing rates of economic growth accompanied by persistent non-changing or increasing unemployment rates: as in the Aghion and Howitt (1994) model, separations are the corollary of the destruction of low productive jobs; the new growth leading to reduce the time horizon of the jobs and thus separations in a more flexible labor market. To overcome this problem, it is then necessary to accompany these labor market reforms by an active policy leading to updating employee's knowledge necessary to be directed

towards the new technologies: this can convert the destruction process into a capitalization effect à la Mortensen and Pissarides (1994).[AG1] From a policy evaluation point of view, the law achieved only part of its mission, where the firing (particularly to unemployment) process was largely facilitated. Yet it has not been offset by a sufficiently increased and facilitated hiring.

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Figure 1: Empirical Versus Theoretical Unemployment Rate, Male Workers between 15 and 49 Years of Age
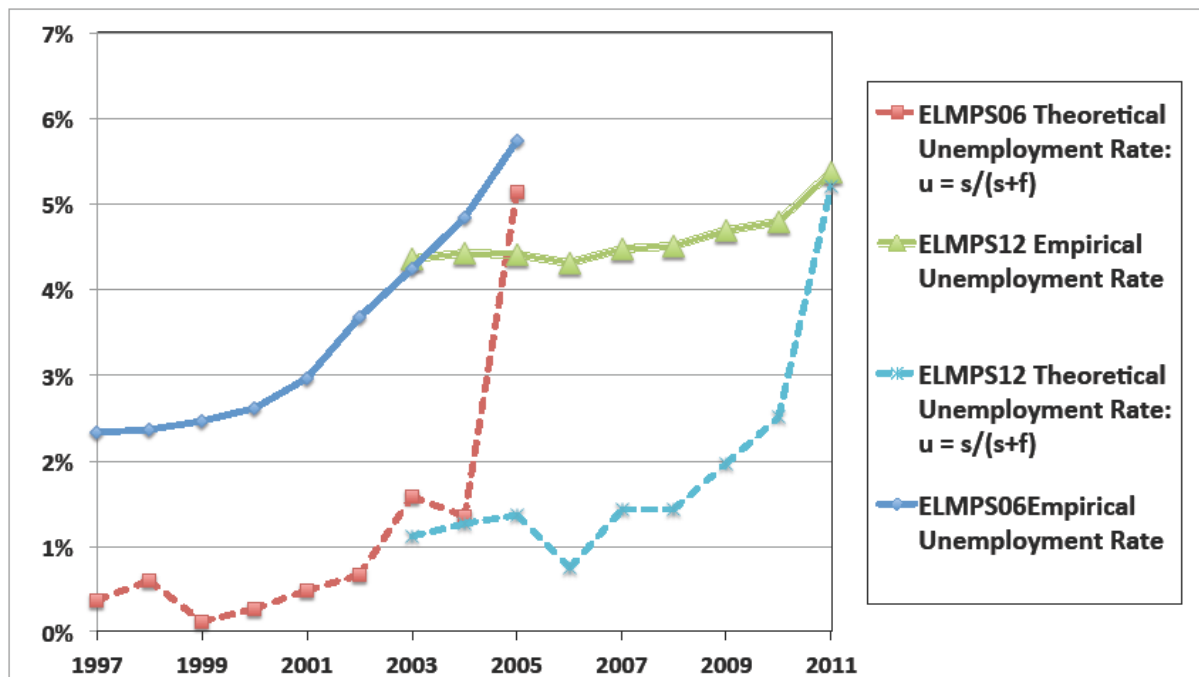

Source: LFSS surveys by CAPMAS and Authors' own calculations using ELMPS12.

Figure 2: Evolution of Job Finding And Separation Rates for Workers between 15 and 49 Years of Age Over the Period 1999-2011 in Egypt, Using ELMPS 2006 and ELMPS 2012

| a. Job Finding Rates | b. Job Separation Rates |
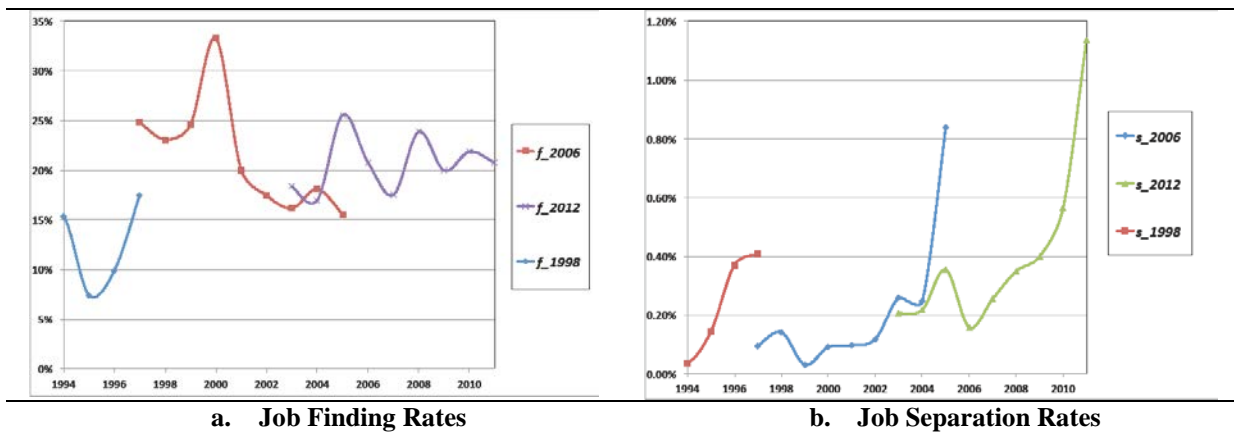
Source:Authors' own calculations using ELMPS12 and ELMPS06.

Figure 3: Steady-State Unemployment Rates, with A Constant Versus Decreasing Population Growth Rate, Male Workers between 15 And 49 Years of Age

| a. **Working Age Population Growth** | b. **Steady-State Theoretical Unemployment Rate** |
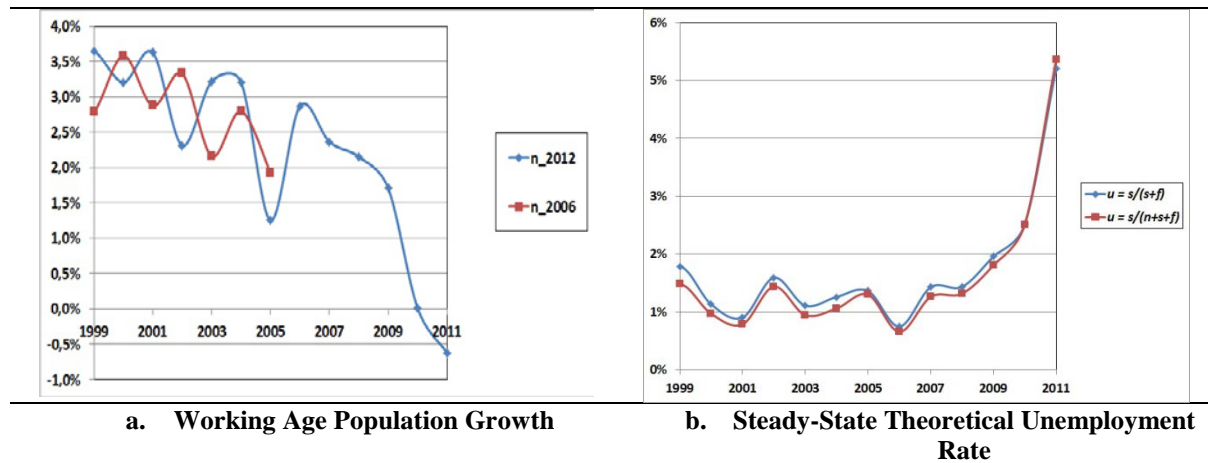
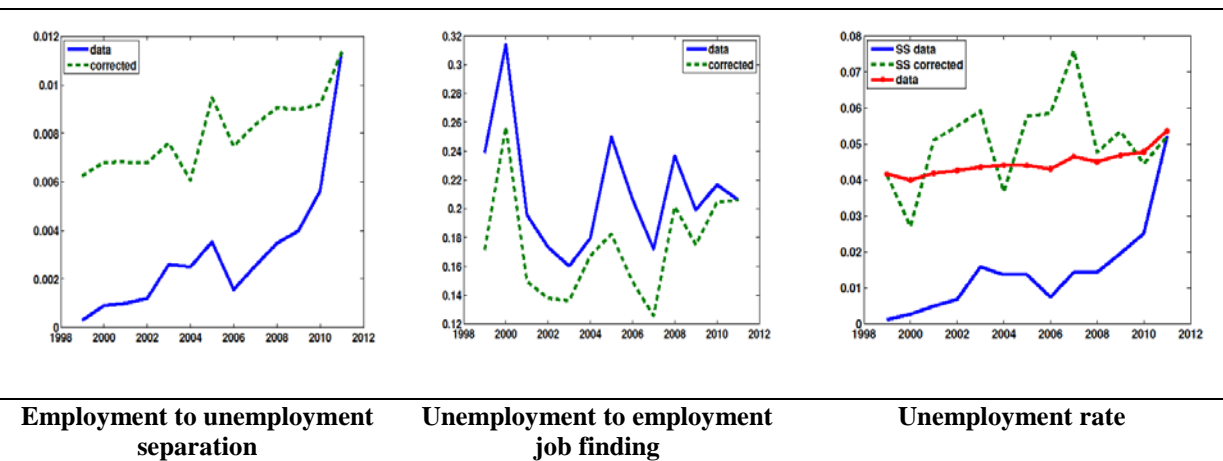Source:Authors' own calculations using ELMPS12 and ELMPS06.

Figure 4: Job Finding, Separation and Unemployment Rates in Egypt for Male Workers between 15 And 49 Years of Age, Corrected for Recall Bias, Two-State Employment/Unemployment Model

| **Employment to unemployment separation** | **Unemployment to employment job finding** | **Unemployment rate** |

Figure 5: Job Finding, Separation, Unemployment Rates in Egypt for Male Workers Between 15 and 49 Years of Age, Corrected for Recall Bias, Three-State Employment/Unemployment/Inactivity Model

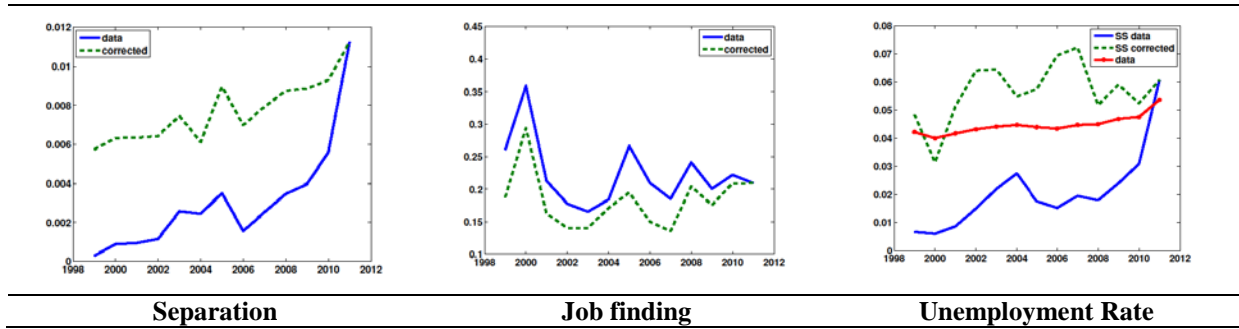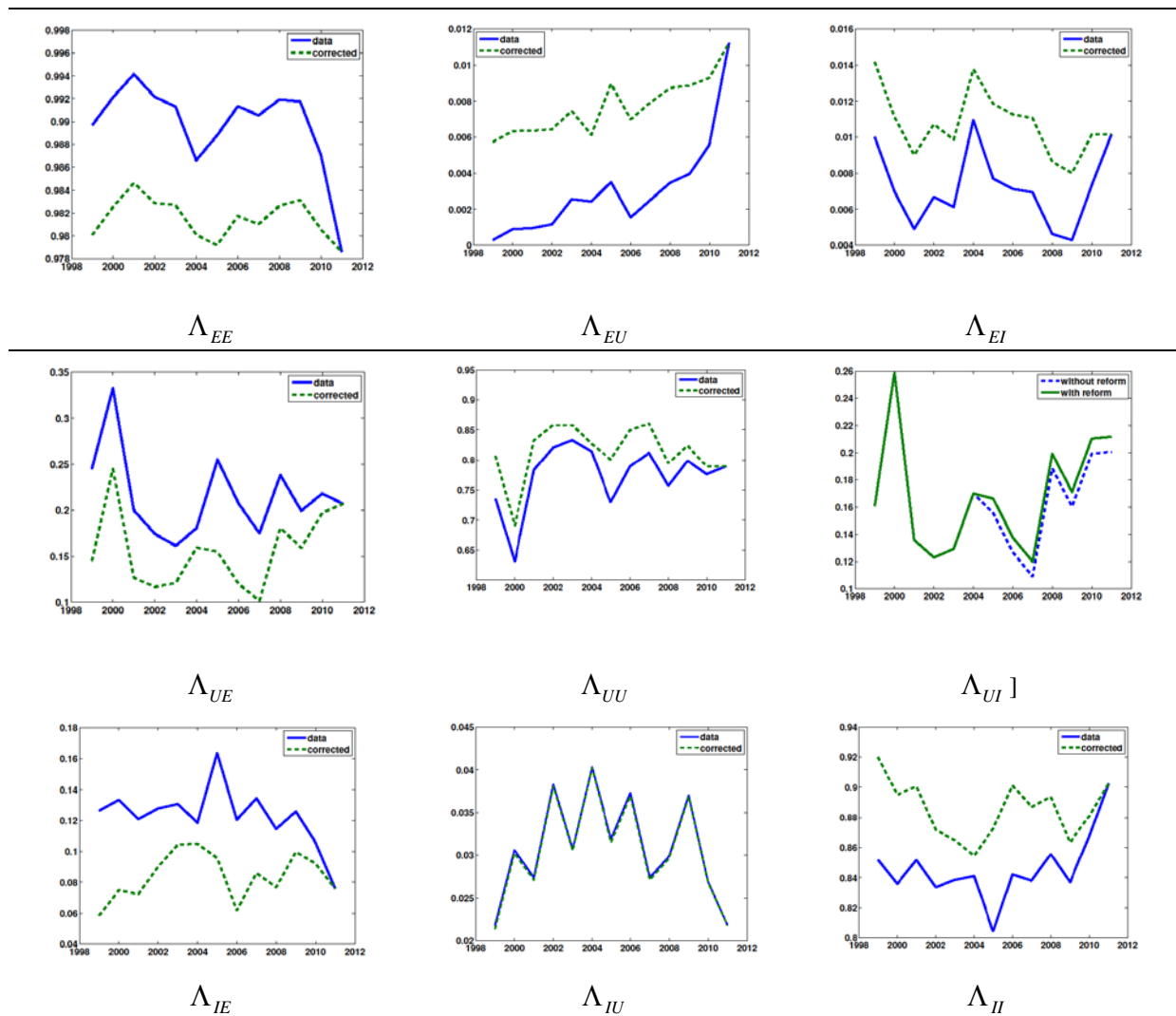| Separation	Job finding	Unemployment Rate

Figure 6: All Transition Rates in Egypt for Male Workers between 15 and 49 Years of Age, Corrected for Recall Bias, Three-State Employment/Unemployment/Inactivity Model

$$\Lambda_{EE} \qquad \Lambda_{EU} \qquad \Lambda_{EI}$$

$$\Lambda_{UE} \qquad \Lambda_{UU} \qquad \Lambda_{UI} \,]$$

$$\Lambda_{IE} \qquad \Lambda_{IU} \qquad \Lambda_{II}$$

Figure 7: GDP Growth Rate and Corrected Steady-State Unemployment Rate in Egypt for Male Workers between 15 And 49 Years of Age
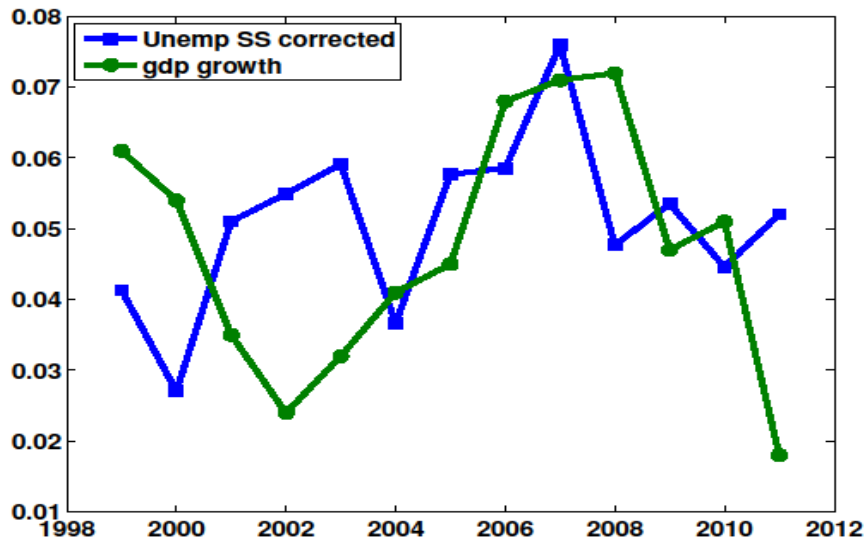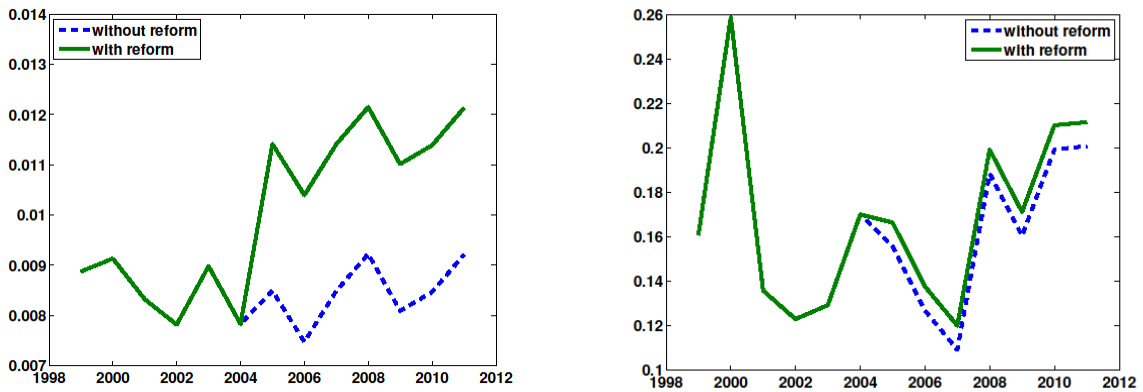

Figure 8: Trends of Job Finding and Separation Rates with and without the New Labor Market Reform in 2004, a Two-State E/U Model

E-to-U separation rate	U-to-E job finding rate

Figure 9: Job Finding and Separation Rates with and without the New Labor Market Reform in 2004, a Three-state E-U-I Model

| Separation rate | Job finding rate |

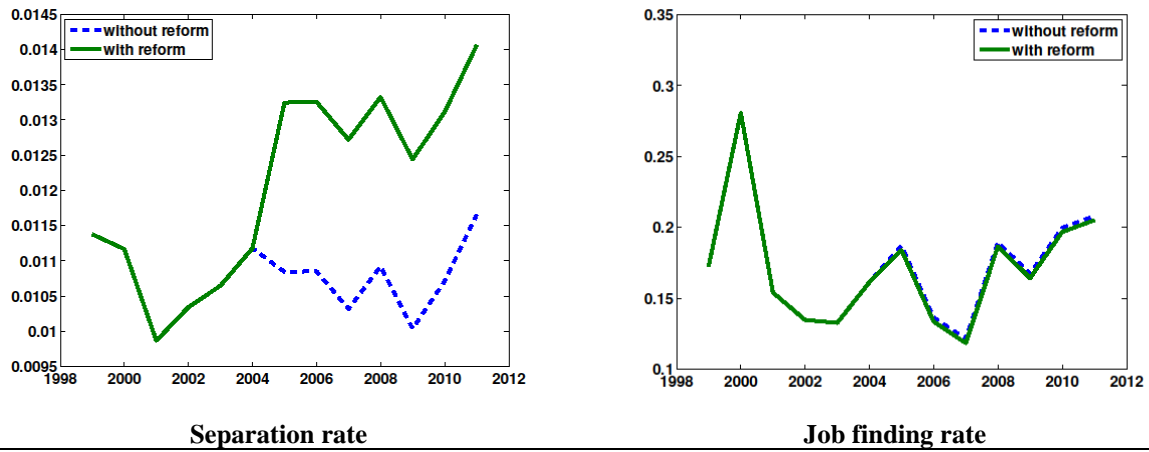**Figure 10: Trends of Labor Market Transition Rates with and without the New Labor Market Reform in 2004, a Three-state E-U-I Model**

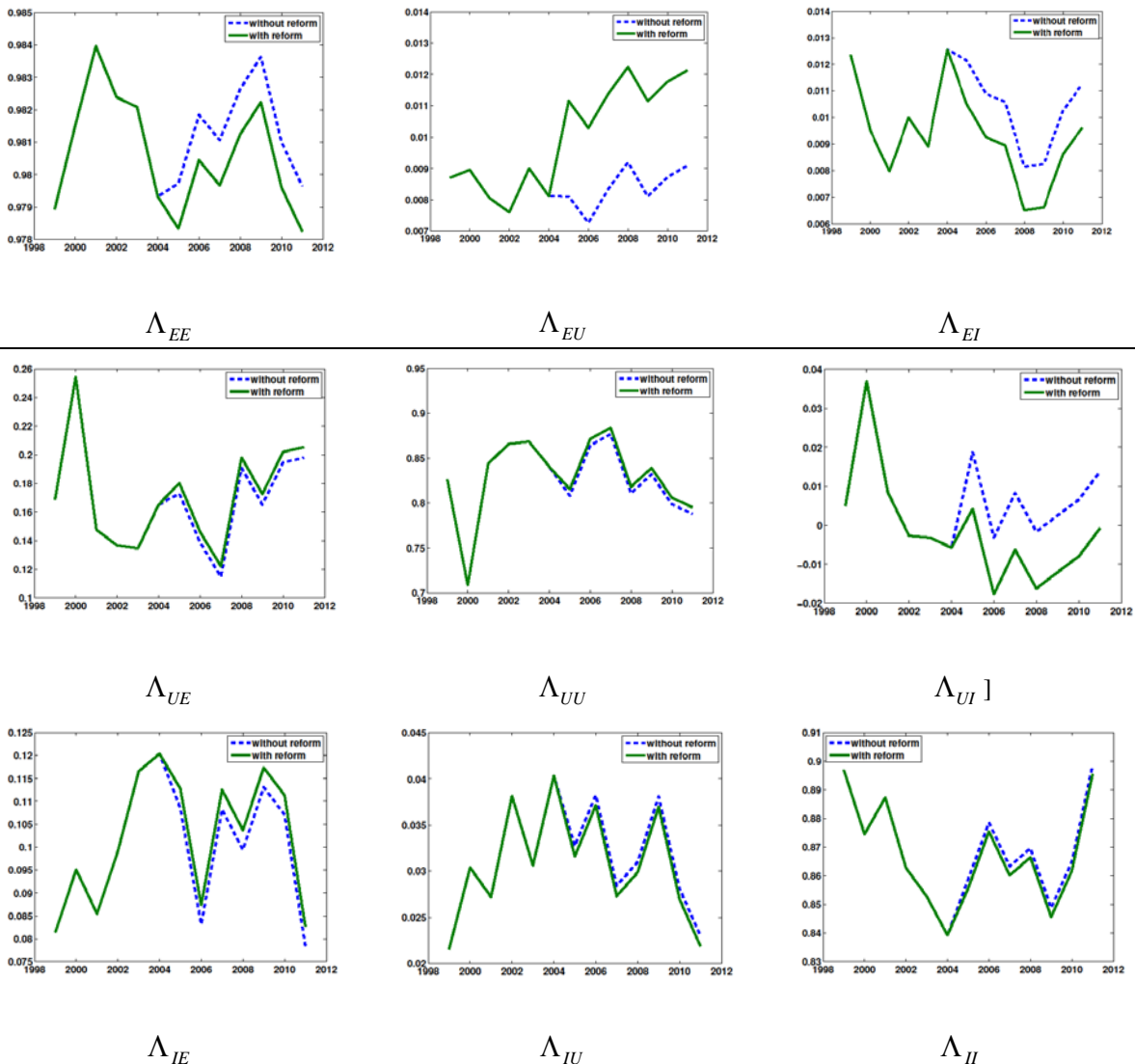Λ_{EE}　　　　Λ_{EU}　　　　Λ_{EI}

Λ_{UE}　　　　Λ_{UU}　　　　Λ_{UI}]

Λ_{IE}　　　　Λ_{IU}　　　　Λ_{II}

Figure 11: Counterfactual Evolution of Unemployment Rate If Separation Rates Followed the Same Dynamics before the Labor Market Reform in 2004, a Two-state E-U Model
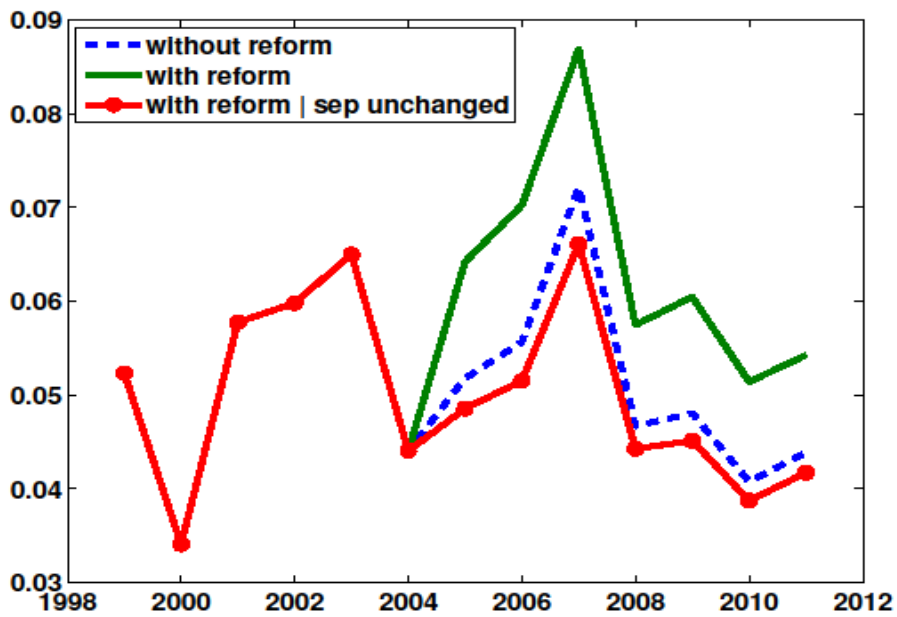

Figure 12: Counterfactual Evolution of Unemployment Rate If Separation Rates Followed The Same Dynamics before the Labor Market Reform in 2004, a Three-state E-U-I Model
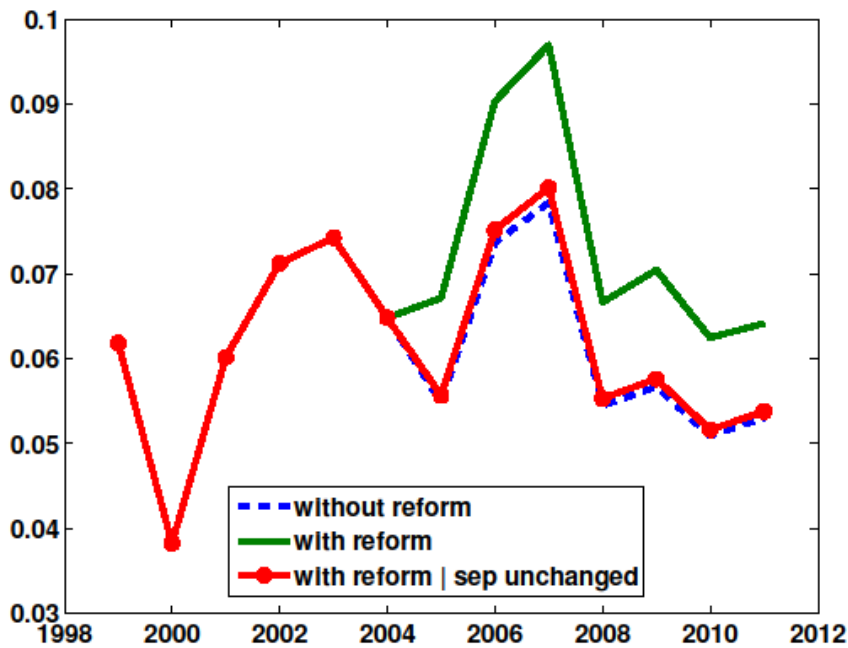
Table 1: Estimation of Recall Error Terms

	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011
Model 1: E-U							
$\hat{\phi}$	0.006	0.0059	0.0058	0.0056	0.005	0.0036	0
$\hat{\psi}$	-0.1002	-0.0874	-0.0732	-0.0576	-0.0403	-0.0212	0
Model 2: E-U-I							
$\hat{\psi}_E$	0.0096	0.0096	0.0095	0.0093	0.0086	0.0065	0
$\hat{\psi}_U$	-0.071	-0.0602	-0.0489	-0.0373	-0.0253	-0.0129	0
$\hat{\psi}_I$	-0.0682	-0.0589	-0.0489	-0.0380	-0.0263	-0.0136	0

Appendix

OLS Regression Estimations

We report in tables 2 and 3 the OLS regression estimations, of the two-state E-U model, for the equations 3 and 4 (where Δy_t is used as an approximation for the difference between the observed and the potential output), as well as the equations 5 and 6 (where y_t^{HP} is the detrended output series using the Hodrick and Prescott (1997) filter).

$$x_t = \alpha \Delta y_t + b + \varepsilon_t \quad for\ x = f, s \tag{3}$$

$$x_t = \alpha \Delta y_t + b + l_a \gamma + \varepsilon_t \quad for\ x = f, s \tag{4}$$

$$x_t = \alpha y_t^{HP} + b + \varepsilon_t \quad for\ x = f, s \tag{5}$$

$$x_t = \alpha y_t^{HP} + b + l_a \gamma + \varepsilon_t \quad for\ x = f, s \tag{6}$$

Table 2: OLS regression results, a two-state E-U model

	f	f	s	s
α	-0.1436	-0.2577	-0.0122	-0.0430***
b	0.1633***	0.1629***	0.0086***	0.0085***
γ		0.0108		0.0029***

Table 3: OLS Regression Results, a Two-state E-U Model (with HP filter)

	f	f	s	s
α	0.6980	0.6880	-0.0033	-0.0072
b	0.1564***	0.1532***	0.0080***	0.0067***
γ		0.0062		0.0024***

In table 4, the three-state E-U-I ols regression estimations for the following equations 7, 8, 9 and 10 are illustrated.

$$x_t = \alpha \Delta y_t + b + \varepsilon_t \quad for\ x = s, f, \Lambda_{EE}, \Lambda_{EU}, \Lambda_{EI}, \Lambda_{UE}, \Lambda_{UU}, \Lambda_{UI}, \Lambda_{IE}, \Lambda_{IU}, \Lambda_{II} \tag{7}$$

$$x_t = \alpha \Delta y_t + b + l_a \gamma + \varepsilon_t \quad for\ x = s, f, \Lambda_{EE}, \Lambda_{EU}, \Lambda_{EI}, \Lambda_{UE}, \Lambda_{UU}, \Lambda_{UI}, \Lambda_{IE}, \Lambda_{IU}, \Lambda_{II} \tag{8}$$

$$x_t = \alpha y_t^{HP} + b + \varepsilon_t \quad for\ x = s, f, \Lambda_{EE}, \Lambda_{EU}, \Lambda_{EI}, \Lambda_{UE}, \Lambda_{UU}, \Lambda_{UI}, \Lambda_{IE}, \Lambda_{IU}, \Lambda_{II} \tag{9}$$

$$x_t = \alpha y_t^{HP} + b + l_a \gamma + \varepsilon_t \quad for\ x = s, f, \Lambda_{EE}, \Lambda_{EU}, \Lambda_{EI}, \Lambda_{UE}, \Lambda_{UU}, \Lambda_{UI}, \Lambda_{IE}, \Lambda_{IU}, \Lambda_{II}$$
$$\tag{10}$$

Table 4: OLS Regression Results, a Three-state E-U-I Model

	f	f	s	s		
α	-0.0570	0.2447	0.0020	-0.0302***		
b	0.1748***	0.1727***	0.0107***	0.0107***		
γ		-0.0029		0.0024***		
	Λ_{UE}	Λ_{UE}	Λ_{UU}	Λ_{UU}	Λ_{UI}	Λ_{UI}
α	0.1259	0.0485	-0.2484	-0.3243	0.1224	0.2758
b	0.1682***	0.1679***	0.8259***	0.8257***	0.0059	0.0064
γ		0.0074		0.0072		-0.0146*
	Λ_{EE}	Λ_{EE}	Λ_{EU}	Λ_{EU}	Λ_{EI}	Λ_{EI}
α	0.0043	0.0190	-0.0167	-0.0487***	0.0124	0.0296
b	0.9813***	0.9814***	0.0085***	0.0084***	0.0102***	0.0102***
γ		-0.0014		0.0030***		-0.0016*
	Λ_{IE}	Λ_{IE}	Λ_{IU}	Λ_{IU}	Λ_{II}	Λ_{II}
α	-0.3293	-0.3744	-0.0148	-0.0029	0.3441	0.3774
b	0.0998***	0.0997***	0.0313***	0.0314***	0.8688***	0.8690***
γ		0.0043		-0.0011		-0.0032
With HP filter	f	f	s	s		
α	0.8679	0.8712	-0.0149	-0.0183*		
b	0.1828***	0.1838***	0.0106***	0.0095***		
γ		-0.0020		0.0021***		

Figure 13: Trends of Job Finding and Separation Rates with and without the new labor market reform in 2004, a two-state E/U model, HP filter used to detrend the labor market flows

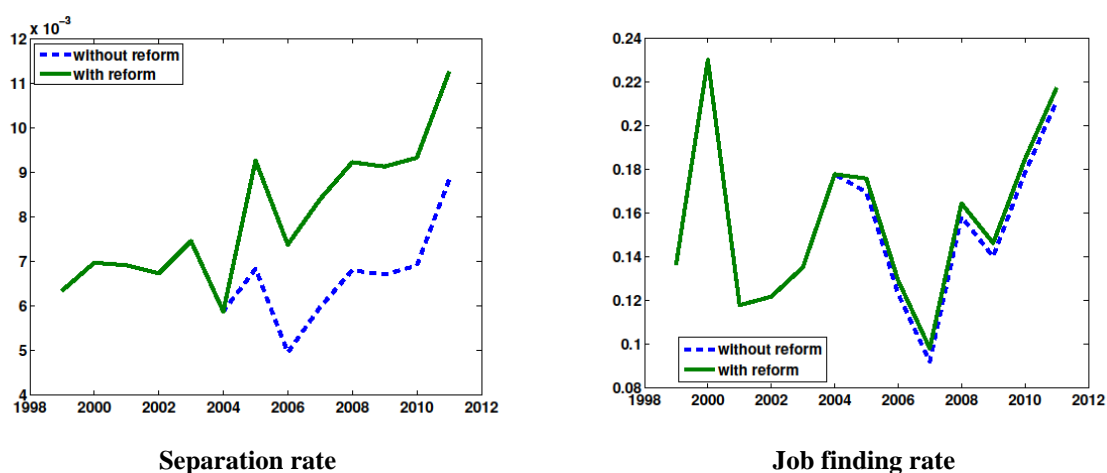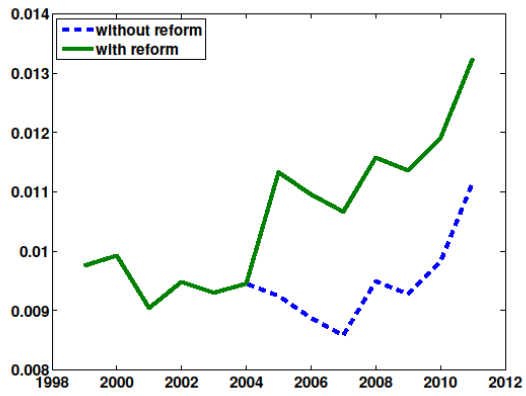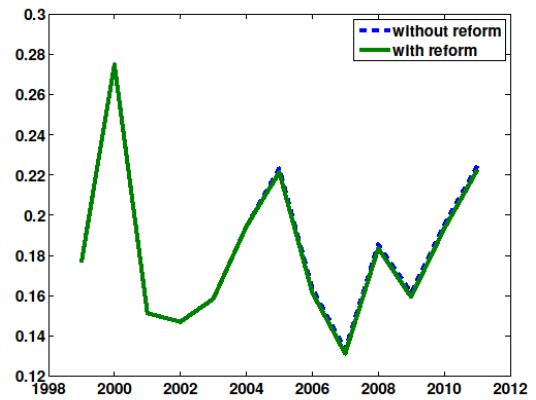**Separation rate**

Job finding rate

Figure 14: Trends of Job Finding and Separation Rates with and without the New Labor Market Reform in 2004, a Three-state E/U/I model, HP Filter Used to Detrend the Labor Market Flows

Separation rate

Job finding rate