POLICY RESEARCH WORKING PAPER 4648

Cyclical Movements in Unemployment and Informality in Developing Countries

Mariano Bosch
William Maloney

The World Bank
Latin American and Caribbean
Chief Economist Office
June 2008

Policy Research Working Paper 4648

Abstract

This paper analyzes the cyclical properties of worker flows in Brazil and Mexico, two important developing countries with large unregulated or "informal" sectors. It generates three stylized facts that are critical to the accurate modeling of the sector and which suggest the need to rethink the approaches to date. First, the unemployment rate is countercyclical essentially because job separations of informal workers increase dramatically in recessions. Second, the share of formal employment is countercyclical because of the difficulty of finding formal jobs from inactivity, unemployment and other informal jobs during recessions rather than because of increased separation from formal jobs. Third, flows from formality into informality are not countercyclical, but, if anything, pro-cyclical. Together, these challenge the conventional wisdom that has guided the modeling the sector that informal workers are primarily those rationed out of the formal labor market. They also offer a new synthesis of the mechanics of the cyclical adjustment process. Finally, the paper offers estimates of the moments of worker flows series that are needed for calibration.

This paper—a product of the Chief Economist Office, Latin American and Caribbean—is part of a larger effort in the department to characterize and understand the dynamics of developing country labor markets and, in particular, informality. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The author may be contacted at wmaloney@worldbank.org.

Cyclical Movements in Unemployment and Informality in Developing Countries

Mariano Bosch
Universidad de Alicante

William Maloney
World Bank

JEL: Gross worker flows, Labor market dynamics, Informality, Developing Countries. J41, J42, J6

We are grateful to Pietro Garibaldi, Alan Manning, Rachel Ngai, Barbara Petrongolo, Chris Pissarides, Santiago Levy and participants at seminars at the LSE and the World Bank for many helpful comments. We thank Lucas Siga and Edwin Goñi for inspired research assistance. The usual disclaimer applies.

I. Introduction.

The flow approach to labor markets has become the basic toolbox to modern labor macroeconomics replacing the usual paradigm of supply and demand in a frictionless environment.[1] This approach has as its central insight that changes in the flows of workers in and out of unemployment tell far richer stories about the functioning of labor markets than changes in the stocks. Particularly notable is the ongoing and energetic debate in both the US and Europe over the relative importance of flows into or out of employment states as the drivers of the cyclical behavior of unemployment.[2]

To date, however, there has been little investigation of employment dynamics in developing countries where we find most of the world's work force, and where macroeconomic fluctuations are often of dramatic magnitudes.[3] A priori, we might expect important differences from the OECD cases due the virtually universal presence of a large informal or unregulated micro firm sector that averages around 50% in Latin America.[4] Traditional views of the sector, with roots in Harris and Todaro's rural migration early work, see informality as disguised unemployment, passively receiving workers who are unable to find a formal sector job.[5] The view of informal workers as the inferior or excluded segment of a dual labor market became highly influential in the International Labor Organization, its Latin America affiliate, the Latin America Regional Employment Program (PREALC), and the World Bank. However, dating at least from Hart's (1972) work in Africa, a parallel stream has stressed the largely voluntary nature of much of the entry into the sector, analogous to the mainstream literature such as Jovanovic (1982), and Evans and Jovanovic (1989), and Evans and Leighton (1989).

[1] See Blanchard (1992), Pissarides (2000) and Rogerson et al. (2006).
[2] Shimer (2007), Elsby (2006), Fijuta and Ramey. (2006 and 2007), Mortensen and Nagypal (2005), Pissarides (2007) and Petrongolo and Pissarides (2008)
[3] This paper supercedes Bosch and Maloney (2006) which dealt with some elements of the present paper but restricted to Mexico. For discussion of the aggregate movements in informality across the cycle, see Fiess, Fugazza and Maloney (2006), Loayza and Rigolini (2007).
[4] See Perry et al. (2007) ch. 2 for a discussion of several measures.
[5] See Fields (2006) for a guide to multi-sectoral models with informal jobs.

As the flow approach to modeling labor markets has become the standard in the literature, a new generation of search models has incorporated an informal sector (See Zenou, 2007, Albrecht et al. , 2006, Bosch, 2004, Kolm and Larsen, 2002 and 2004, Boeri and Garibaldi, 2001 and 2006, and Fugazza, 2004. However, while early US focused search models were firmly rooted in micro evidence from job and worker flows,[6] this new generation of models has had to work with few stylized facts about how the LDC markets adjust along the margins of unemployment and informality.

This paper provides such stylized facts based on measures of gross flows of workers derived from the micro data on employment surveys in Mexico and Brazil over several business cycles. To capture and formalize the dynamics, we follow Geweke (1986) in estimating labor market transitions in a continuous time context to correct for time aggregation[7] and employ recent techniques to decompose the contributions of the inflows and outflows rates to movements in unemployment and relative sectoral employment shares. These decompositions generate several conclusions with implications for the modeling of labor markets in developing countries.

First, as in the US, the unemployment rate is strongly countercyclical. The contemporaneous cyclical correlation with output is around -0.8 and its elasticity -4.3 for Mexico and -4.5 for Brazil. However, in contrast to the US, where estimates of the contribution of the job separation rate to unemployment movements are generally a fraction of that of the job finding rate, separations are strongly countercyclical and very volatile, especially in periods of deep recessions such as the 1995 tequila crises in Mexico and the 1981-1983, 1990-1992 and 1998-1999 in Brazil. Job separations can explain around 40% of all cyclical fluctuations in unemployment, almost twice as much as the explanatory power of fluctuations in the job finding rate. However, strikingly, the relevant separations are largely those from the informal sector. The formal sector shows muted cyclical separation dynamics more similar to those documented for the US.

Second, the sectoral composition of employment is also strongly cyclical. Informal (formal) employment as a share of working age population is generally

[6] See for instance Mortensen and Pissarides (1994).

[7] That is, we control for the fact that the data is collected a fixed time intervals while transitions occur in continuous time.

counter-cyclical (pro-cyclical). On average, a 1% fall in output (from its trend) increases the share of informal employment by 0.20% and decreases the share of formal labor by 0.5%. In all, formal employment as a share of total employment falls between 0.2% and 0.3% for each percentage fall in output (from its trend). This occurs despite *increased* separation rates among informal workers during downturns, and relatively a-cyclical flows in the reverse direction. This paradoxical finding is explained by the large countercyclical fluctuations in the probability of finding a formal job from all other employment states, a finding consistent with the US literature explaining unemployment. Hence, the expansion (contraction) of the informal (formal) sector is not due to increased shedding of labor from the formal sector during downturns, but to the lack of access to formal employment in recessions.

Third, analogous to the US literature (See Nagypal 2004 and Shimer 2005), flows among jobs, or in our case, employment states, are largely procyclical. Of central importance, this includes transitions among the formal and informal sectors. These patterns are therefore not consistent with the view of the informal sector as predominantly the disadvantaged end of a segmented labor market, or disguised unemployment (see Fields, 2006) which would suggest asymmetric flows- procyclical flows from informality to formality, and countercyclical flows in the reverse direction. Instead, the probability of formal workers transiting to an informal job is generally, procyclical, and the correlation of the bilateral cyclical flows between informal self-employment and formality is a relatively high, 0.7 for both countries. Contrary to the view of the informal sector as the safety net for separated workers during downturns, formal to informal outflows actually decrease during downturns thereby mitigating the rise in informality.

Putting the above findings together gives a view of labor market adjustment in LDCs across the business cycle that has elements of the traditional view of informality across downturns, but perhaps with an updated mechanism and without a connotation of overall inferiority of the informal sector. While the symmetrical and procyclical transitions among all sectors suggest that informality is considered a desirable option by a large share of workers, the fact that formal sector hiring falls during downturns while the informal sector does not gives rise to the countercyclical behavior of the informal employment share. However, the simultaneous increase in informal separation rates

into unemployment suggests that the idea of the sector as the flex-wage sector that can absorb excess labor is probably importantly incomplete.

Clearly, caution is advised in generalizing to the developing world from two middle-income Latin countries. However, the similarity of these often counterintuitive results across two data sets and national contexts suggests that neither they nor their implications can be easily dismissed. The right modeling of both inflows and outflows of employment is critical to understanding how developing country labor markets adjust and for making quantitative predictions about the unemployment rate and the relative employment shares over the cycle.

In addition, the insights into the nature of the informal sector- something that has been subject of thirty years of discussion[8]- has important policy implications. While the sector is comprised of heterogeneous actors corresponding to both disguised unemployed and voluntarily entering "entrepreneurs"[9], its exaggerated size in developing countries raises the stakes surrounding the relative proportions dramatically. If the often 50% percent of developing country workers found in the informal sector show dynamics similar to those of the unemployed, then the labor market distortions in the formal sector are indeed large and the case for massive reform, compelling. As we suggest that this is not the case, then the policy focus shifts to understanding the cost-benefit analysis that agents undertake in choosing among sectors. Finally, although beyond the scope of this paper, the differing dynamics of the regulated and unregulated sectors –due to wage or other rigidities, particular characteristics of the micro firm sector, or characteristics of people who choose to enter the sector- may cast light on the factors driving cyclical dynamics more generally.

The next section discusses the data and methodology for estimating the continuous time transition rates underlying the analysis. Section III presents evidence on the cyclical properties of the stocks of workers. Section IV analyzes the gross flows of workers by sector and speculates on what may explain the differing patterns

[8] For a review of the literature and early work on transition matrices in developing country see Maloney (1999, 2005).
[9] For a survey on the methods estimating the size of the informal sector see Schneider and Enste (2000), Perry et. al (2007)

observed. Section V studies the contribution of these flows to the changes in labor force shares identified in section IV and discusses the implications of the theoretical analysis of labor markets in developing countries. Section VI concludes.

II. Data

Mexico

The data for Mexico are drawn from the National Urban Employment Survey (Encuesta Nacional the Empleo Urbano, ENEU) that conducts extensive quarterly household interviews in the 16 major metropolitan areas. The questionnaire is extensive in its coverage of participation in the labor market, wages, hours worked, etc. that are traditionally found in such employment surveys. It is structured so as to track a fifth of each sample across a five quarter period. We have concatenated panels from the first quarter of 1987 to the fourth quarter of 2004. Each individual contributed with four transition pairs. In constructing each quarterly pair, we lose roughly 10% of the sample to attrition. Antman and Mckenzie (2007) conclude after careful analysis of the same data that the bias resulting from this attrition is likely to be very small.

The ENEU has suffered only minor modifications during the covered period but it has substantially changed its geographical coverage. From 1987 to 1992 the survey comprised 16 major urban areas. In 1992, 18 more urban areas were introduced and throughout the following years additional cities were included in the sample to reach 44 at the beginning of 1998. We choose to constraint our sample to the original 16 cities although all results are similar with extended the sample.

Brazil

The data for Brazil are draw from Monthly Employment Survey (Pesquisa Mensal de Emprego, PME) that conducts monthly household interviews in 6 of the major metropolitan regions (covering 25% of the national labor market). The questionnaire is very similar to the ENEU, although some important differences are discussed below. The PME is structured so as to track each household during four consecutive months and then drop them from the sample for 8 months, after which they are reintroduced for another 4 months. The rotation procedure is such that each month one fourth of the sample is substituted by households to form a new panel. Thus, after 4

months the whole initial sample has been rotated and after 8 months a third different sample is being surveyed. After 12 months the initial sample is reencountered. Over a period of two years, three different panels of households are surveyed, and the process starts again with three new panels. We have concatenated panels from the January 1983 to December 2001. Regrettably, the PME was drastically modified in 2002 and it is not possible to reconcile the new and old definitions unemployment. The monthly attrition rate in the PME is between 5% and 10% of the sample.

Both datasets were purged of mismatches along the sex and age dimensions. There are, however, still some issues of comparability, especially in the definition of an informal worker. In the end, these do not appear to have significant impact on the results and the resulting cyclical patterns are quite similar between the two countries.

Defining Informality

Though, generally speaking, there is broad consensus in the literature on what constitutes an informal worker, studying transitions raises some particular definitional complexities that we discuss here.

We follow the International Labour Organization (ILO) in dividing employed workers into three sectors: informal salaried (I), informal self employed (S) and formal sector workers (F).[10] Broadly speaking, formal workers are those working in firms licensed with the government and conforming to tax and labor laws, including minimum wage directives, pension and health insurance benefits for employees, workplace standards of safety etc. Informal workers, on the contrary, are those owners of firms that are largely de linked from state institutions and obligations and their employees who are not covered by formal labor protections.

[10] The ILO defines informality as consisting of all own-account workers (but excluding administrative workers, professionals and technicians), unpaid family workers, and employers and employees working in establishments with less than 5. We have also computed all the calculations presented in this paper considering the informal salaried those workers in small firms who have no social security with extremely similar results.

Getting more specific, adopting what has been called a "labor protections" optic, [11] the first group, the informal salaried, can be defined as those wage employees whose employers do not comply with the legal requirements. This, however, does not tell us whether these workers are working for small informal firms, or for large generally formal firms. In the absence of data on compliance with labor regulations the ILO traditionally recommended classifying informal as workers in small establishments of fewer than 5-10 employees, which tend to be informal along different dimensions. Though there is substantial overlap in these definitions (see Henley et al., 2006 and Perry et al., 2007), conceptually the distinction can be important for our analysis. For instance, a transition from informal to informal under the "labor protections" definition might reflect purely a worker being granted benefits after a period of time but without a corresponding change in position and accompanying job search. Similarly, under the size definition, a measured transition may simply be capturing the growth of the firm, but no change in actual job. Relatedly, an emerging literature discusses firm decisions about whether or not to comply with legislation, and how a growing firm may choose to register and formalize its workers. Formalization along this margin has been studied by De Soto (1989), Rauch (1991), De Paula and Sheinkman (2007) among others. Again, a job "transition" defined as a change in protection status may simply reflect a firm becoming formal.

We classify on the basis of lack of compliance with labor legislation for issues of data comparability. While the Mexican survey reports the establishment size in which the respondent works, the Brazilian does not. Furthermore, compliance is relatively straightforward to capture in these surveys. In Mexico employers have to satisfy the contributions to the social security agency IMSS (or the equivalent for civil servants IMSTS) for their employees. Similarly, employers in Brazil are obliged to register their employees by issuing them a working permit or *carteira* the signing of which guarantees them access to formal labor protections. Therefore those wage employees not registered with the social security agency (in Mexico) or *sem* (without) *carteira* in Brazil are consider informal salaried.

[11] See Perry et al. (2007)

In the end, the selection criterion does not appear critical. We replicate the Mexico results defining very discrete categories based on both worker protections and firm size to ensure that, in fact, we are studying job transitions and the basic patterns remain. The reason is that a relatively small share (around 5-7%) of the workforce in firms of over 10 (presumably formal) reports being without coverage, and the contributions of changes in protection status within firm size categories to overall measured transitions is low. Likewise, we find there are relatively few workers who change protection status and graduate to an adjacent firm size category, capturing, potentially, a position being formalized as a firm formalizes. The bulk of our informal to formal transition are in fact, also transitions from micro firms of under 5 employees to substantially larger firms (non-adjacent firm categories). Given the short time span or our panels, the likelihood of large jumps in firm size seem unlikely. Hence, most of the transitions we are studying are, in fact, transitions among jobs.

The second group associated to informality is the large proportion (between 20% and 30% of the labor force) of independent or self-employed workers (S). This micro entrepreneurial group operating outside the regulatory system has been the focus of much of the literature dating from early work by Hart (1972). More recently, several authors have focused on the decisions of these individuals to work within or outside the regulatory system (most recently, see De Paula and Scheinkman (2007), Loayza Rigolini (2006), Fajnzylber et. al.(2007). Both Mexican and Brazilian labor surveys include two categories to capture this micro entrepreneurial sector, self-employment and owners of firms. Ideally, we would consider all those self employed (excluding professionals and technicians without social security contributions)[12] and the owners of small micro firms. However again, in Brazil, we lack a measure of firm size in the data. We are left here with the choice of dropping all owners of firms or including them as informal self-employment. We again cross checked with the Mexican sample to get some insight of what proportion of self reported owners correspond to large formal firms. It turns out that only 1.5% of the universe of owners run firms with more than 15 employees. Therefore, for Brazil we choose to include all owners as informal self employed aware

[12] There is also a relatively small group of self-employed in Mexico (less than 2% of all self-employed) that although under no legal obligation they satisfy the IMSS quotas. We consider them formal sector workers. In Brazil, however, self-employed do have the legal obligation to pay for social security contributions. This survey however does not provide this information. However, Henley et al. (2006) report that around 95% do not do so.

that there may be a very small proportion of owners of large firms that fall into this category. In all, including or excluding owners as part of the informal self-employed sector does not change the aggregate dynamics of this group in either country, since the bulk (around 85%) correspond to individual independent workers, with the other 15% corresponding to owners of firms.

The remainder of the sample is divided into two non-employment groups identical to those in the advanced country literature: those out of the labor force (O), and the unemployed (U). These are defined as in the mainstream literature.

III. Methodology

Recent analysis on worker flows has put special emphasis on correcting for time aggregation (Shimer, 2007 Elsby et al., 2007 Fujita and Ramey (2006 and 2007) and Petrongolo and Pissarides (2007). Since the data on worker flows is tabulated at discrete quarterly or monthly intervals, average transition probabilities may provide misleading picture of worker mobility since transitions that are reversed within two surveys are missing. When there are only two states of employment, the transition rates can be obtained analytically from the monthly worker flows as in Shimer (2007). However, with more than two states no analytical solution is available and the transition rates have to be simulated. We instead follow an earlier Bayesian procedure (see Geweke 1986) that allows simultaneously estimating the whole transition rate matrix for a set of employment statuses.[13] We briefly discuss the procedure here.

We assume that the observed discrete-time mobility process is generated by a continuous-time homogeneous Markov process X_t defined over a discrete state-space $E = \{1,\ldots K\}$ where K is the number of possible states (job sectors) a worker could be found in.[14] With observations on worker states at regular periodicity we construct a discrete time transition matrix $P(t,t+n)$ where

$$p_{ij}(t,t+n) = \Pr(X(t+n) = j \mid X(t) = i \text{ for } t = 0,1,2,..., \text{and } n = 0,1,2,...$$

[13] This method has also been employed in Fougère and Kamionka (2003),
[14] For early work in this tradition, see Flinn and Heckman 1982 a, b and 1983).

The interpretation of p_{ij} is simply, the probability of moving from state *i* to state *j* in one step (*t*), that is average transition probabilities. Discrete time matrices are easily straight forward to compute as the maximum likelihood estimator for p_{ij} is $p_{ij} = n_{ij} / n_i$, being n_{ij} the total number of transitions from state *i* to state *j* and n_i the total number of observations initially in state *i*. As t $n \to 0$, this gives rise to a *k* x *k transition intensity* matrix *Q* where

$$\frac{dP(t)}{d(t)} = QP(t) \qquad (1)$$

whose solution is given by:

$$P(t) = e^{tQ} \qquad (2)$$

where *Q* is a *k*x*k* matrix whose entries satisfy

$$q_{ij} = \begin{Bmatrix} q_{ij} \in R^+, j \neq i, i, j = 1,...,K \\ q_{ii} = -\sum_{k=2, k\neq i}^{K} q_{ij} \leq 0, j = i, = i = 1,...K \end{Bmatrix} \qquad (3)$$

The q_{ij} elements can be interpreted as the instantaneous transition rates (hazard rates) from state *i* to state *j*.

In practice, the estimation of continuous time transition matrices is subject to a major difficulty. It is possible that none of the solutions obtained for *Q* is compatible with the theoretical model expressed in equation (1) where the elements of *Q* have to satisfy the set of restrictions captured in equation (3). This is known as the embeddability problem. We follow Geweke et al. (1986), who propose a Bayesian procedure for statistical inference on intensity matrices as well as any function of the estimated parameters by using a uniform diffuse prior. The method consists of drawing a large number of discrete time matrices from a previously defined "importance function," assessing their embeddability and constructing confidence intervals of the parameters or functions of interests using only the posterior distribution of those matrices that turn out to be embeddable. This also provides a very natural way of assessing the probability of embeddability as the proportion of the embeddable draws.

We compute the continuous time matrices for every quarter (month in Brazil). All continuous matrices obtained in the paper show high probabilities of embeddability, ranging between 0.98 and 1. Therefore, compatibility of discrete and continuous time estimates does not seem to be an issue in theses particular datasets.

Having obtained the transition rates from the discrete matrices, we then quarterly average the data for Brazil and smooth both Mexican and Brazilian series using a 4 quarter backward moving average as in Fujita and Ramey (2006) to remove high frequency fluctuations in the data. We study the cyclical components of the data by logging and de-trending the series using a HP filter with lambda 1600.

III. Cyclical Patterns of Employment Shares

To set the overall context, we first focus at the evolution of each sector's share of the labor force across 1987-2004 in Mexico and 1983-2001 in Brazil. As a first approximation to the data, Figure 1 shows the unemployment rate and the share of formal employment for both countries. The upper panels show the levels of the series while the lower panels show the HP de-trended cyclical components. The regions corresponding to a recessionary period are shaded to facilitate the visual analysis.[15]

Initial inspection suggests two features of the series common to most developing countries. First, for both countries, the behavior of the unemployment rate denotes that the period of analysis includes a number of significant recessions and rapid periods of growth. Output fluctuations for Mexico (not shown), ranged from 8% below trend in the depths of the 1995 recession to 5% above trend in the posterior recovery. Output in Brazil was slightly less variable oscillating between 4% above and below trend.[16] Second, recessions are generally characterized by increasing unemployment rates and shifts in the composition of employment towards informal activities.[17]

[15] Neither Mexico or Brazil has an institution such as the NBER determining the starting and ending point of a recession, we have shaded those quarters where output is below trend.

[16] Quarterly output data used in the paper is provided by the national statistical institutes, INEGI for Mexico and IBGE for Brazil.

[17] Loayza and Rigolini (2007) show that these countercyclical movements in informality are the average for a broad cross section of developing countries. However, Fiess, Fugazza and Maloney (2007) also show that in numerous Latin American countries, including Mexico, informality behaves procyclically

It is also important to call attention to the decreasing trend in formal employment in Brazil across the 1990s, falling from around 62% at the beginning of the 90s to 52% by the end of the decade. Bosch et al. (2007) identify the principal drivers this secular movement to be the changes in the labor code implicit in the Constitutional Change of 1988, and, to a much lesser extent, trade liberalization. Since the present paper is concerned with the cyclical properties of the labor market, we abstract from this evolution.

These cyclical properties are studied more systematically in Table 1. We show the standard deviations of the individual employment states as a percent of the working age population, the contemporaneous correlation and the implied elasticity with respect to output of the cyclical components of the series. We also show the cyclical behavior of the two series in Figure 1, the unemployment rate, and the share of formal employment.

The first panels show the behavior of inactivity, unemployment and total employment. The patterns found here correspond broadly to those found in the developed country literature: Inactivity is weakly countercyclical; unemployment is strongly countercyclical; and employment is strongly pro-cyclical.

However, the next panel suggests that employment dynamics hide significant changes in employment composition. In both countries, the pro-cyclical behavior of total employment is, overall, driven by the strong pro-cyclicality of formal employment. A 1% increase in output (from its trend) increases formal employment by 0.56% in Mexico and 0.50% in Brazil. Symmetrically, informal employment tends to increase in recessions, especially informal self-employment (0.23% and 0.17% respectively)

Finally, the last panel suggests two notable aspects of the dynamics of the unemployment rate (unemployment as a percentage of the labor force), and the share of formal employment. First, the volatility of U/(U+E) is almost identical to the volatility of U suggesting that the change in the unemployment rate is essentially driven by

---

across some periods. Fundamentally, a recovery driven by a positive shock to the non-tradables sector which is especially intensive in informal workers, will lead to a rise in the relative sector shares and earnings of the informal sector.

changes in the number of unemployed rather than fluctuations of the size of the labor force. Second, the share of formal employment is slightly less volatile than formal employment due to the positive cyclical correlation between formal employment and total employment.

In sum, the behavior of employment shares and the unemployment rate over the business cycle suggests a very traditional interpretation of the role of the informal sector as a shock absorber for the formal sector in times of crises and perhaps disguised unemployment. However, important new insights emerge as we look at the dynamics driving these unemployment changes, and the reallocation of workers between formal and informal sectors.

IV. Cyclical Patterns of Transition Rates and Gross Flows of Workers

To understand the dynamic drivers of these movements, we examine four sets of worker transitions: flows into employment states, flows out employment states, flows between employment states, and flows between non-employment states.

Flows into Employment

Flows from non-employment into employment are remarkably similar between countries and, to certain extent, to patterns found in the US. Figure 2a and 2b and table 2 suggest that these accessions to employment are central to understanding the cyclical evolution of unemployment and formality. The job finding rate in the formal sector is strongly pro-cyclical both from inactivity and unemployment. Its contemporaneous correlation with respect to output ranges between 0.5 and 0.8, and our estimates suggest that a 1% fall in output (from its trend) decreases the job finding rate of formal jobs from unemployment in 3.5% in Mexico and 4.3% in Brazil. This mimics the evidence for the job finding rate in the US.

Critical to our understanding of labor market adjustments is the fact that accessions to informal jobs are far less volatile. The standard deviation of the transition

rate from unemployment into informality is around half of that of the formal sector.[18] Furthermore, while accessions into informal salaried are also procyclical, albeit with weaker correlation with respect to output, inflows into self-employment are countercyclical, from both unemployment and inactivity, suggesting that in recessions some workers may chose this form of employment as employment of last resort in the face of lack of opportunities as a salaried workers. However, in later sections we show that this shift towards informal self-employment is quantitatively small in changing unemployment levels.

Taken together, the rate at which workers leave unemployment decreases in recessions. Hiring in the informal sector does not expand to fully compensate for the reduced access to formal sector jobs and in fact, informal salaried hires fall.[19] Therefore, there is a change in the relative composition in the outflow from unemployment arising from the differential movements in hiring across the cycle. In expansions, for each formal hire (from unemployment), there are on average between 1.3 and 1.7 informal hires, compared to 3 in recessions.[20]

Flows out of Employment

Figures 3a and 3b and table 3 show the complementary flows among the three sectors of employment and the non-employment states, inactivity and unemployment. Recessions are characterized by rapid changes in the rate at which workers transit into unemployment, but far more from the informal sectors than the formal. A 1% fall in output (from its trend) increases the separation rate of informal salaried workers by 4.1% and 5.7% in Mexico and Brazil respectively. Separation from informal self

[18] Except for accessions towards informal self employment in Mexico where volatility is around 80% of volatility of formal accessions

[19] This is consistent with McKenzie (2004) who, using panel data for Argentina analyzes labor market adjustment during the crisis and also finds that self employment does not provide as much of a safety net and outlet for surplus labor as is often thought.

[20] It is possible that these differing job finding behaviors are statistical artifacts arising from the changing composition of unemployment". For example, if in recessions the pool of unemployed workers shifts toward young uneducated workers, who generally have a high propensity to search in the informal sector; this could offset the "real" decrease in the job finding rate in the informal sector. Baker (1992) refers to this as the "heterogeneity hypothesis. We explore this hypothesis following Shimer (2007) and studying changes in the composition of unemployment along three dimensions- age, education and reason of unemployment. We do not find any support for this view.

employment, which implies the destruction of an informal firm, increases by 3.2% and 3.5%, respectively. By contrast, separations from the formal sector increase by a more muted 1.4% and 0.6%, respectively. In a period comprising major crises, such as the Mexican "tequila" crisis of 1995, or the recessions of 1983 and 1992 in Brazil, formal transition rates towards unemployment are only weakly countercyclical, and do not show a strong correlation with output, -0.41 and -0.16 for Mexico and Brazil respectively.[21] These findings suggest that, consistent with the US evidence, job separations from "formal" jobs are not the principle drivers of unemployment, but that separations from the informal sectors may well be. Although exploring the factors driving the different behavior of the two sectors is beyond the scope of this paper, what is clear is that the view of the informal economy as a competitive flex-wage sector that readily adjusts to absorb unemployed workers, especially those shed by the formal sector, is importantly incomplete.

Flows into inactivity, on the other hand, show only minor fluctuations with the business cycle and are either acyclical, or weakly procyclical (with the exception of the self-employed in Brazil), a pattern also found for the US by Hall (2005) and Shimer (2007).

Flows among Employment Types: Formality-Informality

In the US, job to job flows dwarf in magnitude the flows in and out of employment (see Nagypal, 2004 and Shimer, 2005). Our data however only permits us to look at flows among defined sectors. This, on the one hand will under-estimate total job to job flows, since we miss transitions within formality or informality, and on the other may over estimate them if formal-informal transitions occur within jobs. In all, sector to sector flows account for around 60 to 70% of all transitions in Mexico and Brazil, and are therefore key to understanding the compositional pattern of employment

[21] One exception to this general pattern is the 2001 recession in Mexico which was characterized by an increase in job separation in the formal sector but not in the self employed sector and relatively modestly in the informal salaried sector. The most plausible explanation is that this recession was not systemic as the 1995 crisis was, but mainly caused by the slowdown of the U.S. economy that affected primarily the largely formal manufacturing export sector in the north of the country (see Kaplan and Martinez, 2004, and Fiess, Fugazza and Maloney, 2007)). This emphasizes the importance of sectoral shocks to understanding overall labor dynamics.

and worker mobility. Figures 4a, 4b, and 4c, and Table 4 characterize these inter-sectoral transitions, including the cross-correlation between pairs of bi-lateral flows.

Search models predict that flows among jobs are procyclical and the cross correlations high, and in the US, this is the case. However, traditional queuing models where the informal sector is largely disguised unemployment would suggest that movements from informality into formality should be strongly procyclical, while the reverse flow should be the opposite, much like separations towards unemployment. In both Brazil and Mexico access to formality from the informal sectors is strongly pro-cyclical as we found it to be from unemployment and inactivity (correlations range from 0.3 to 0.74). However, flows from formality into informal self-employment in both countries are also pro-cyclical, of equivalent magnitude to the reverse flows in Brazil, although somewhat less so in Mexico. The lower panels of figure 4a, confirm the logical correlate- that the pairs of bilateral flows are highly positively correlated. The HP de-trended series of S-F and F-S transition rates show strong positive correlations (0.68 and 0.76 for Mexico and Brazil respectively).

The flows from formal into informal salaried work are more ambiguous in the two cases. In Brazil entry into informal salaried work from formality is procyclical, but less so than the reverse flows and in Mexico, again, the correlation is weakly negative implying countercyclical behavior. Even still, the bilateral correlation between the F-I and I-F flow is positive at 0.17.

Overall, the patterns of sector to sector transitions are far more consistent with the job to job search models in the mainstream literature where, in periods of labor market tightness, workers search across available jobs *in both sectors*, or when workers are involuntarily separated in the normal churning process but find another before entering the unemployment pool, than to models where informal workers are queuing for superior formal jobs. The idea that workers might be searching across the formal and informal sectors is consistent with motivational responses of workers entering self employment in 1992 that roughly 70% of the sector had entered for either reasons of greater flexibility or income (Maloney 1999). The more ambiguous results for informal

salaried work are consistent with findings of substantially less voluntary entry (Perry et. al. 2007).

That said, the informal sector is clearly very heterogeneous and other data from the Mexican ENEU that is suggestive that there is a component of informality that does correspond to disguised unemployment. Figure 4d plots the proportion of workers who respond positively to the question "Have you been looking for a job over the last two months" and who had not changed employment status from the quarter before as a possible proxy for the degree of dissatisfaction with the current job coupled with the availably of alternative jobs. Search intensity is generally higher in the informal sector, perhaps, reflecting the relative youth of the informal salaried sector, although the magnitudes (and hence differences) are not large: in the upturns of mid-1990 and to 2000 search rates were equal across sectors at roughly 1-2%. However, the share searching is strongly countercyclical implying that as the labor market becomes slack and the acess ot the formal sector from all sectors decreases, the dissatisfaction increases. This is especially true in the informal sectors where the percentage searching for better jobs peaks at just under 7% during the 1995 crisis, a gap of slightly over 4% points over the formal sector, suggesting that, in fact, the sector contained more workers who were forced into bad matches. This would make sense if, during the crisis, only the informal sector was hiring: though the job finding rate in the sector is reasonably acyclical, the fact that unemployment is increasing does imply that it informality is absorbing more unemployed as a share of the workforce than during booms. Consistent with the transition patterns, however, the percentage dissatisfied is a relative minority of the sample.

Flows among Non-Employment Types: Unemployment and Inactivity

Finally, figure 5 and table 5 depicts how inactivity and unemployment interact over the business cycle. Perhaps the most remarkable fact is the strong negative correlation between output and the inflow rate into unemployment from inactivity (-0.52 in Mexico and -0.72 in Brazil). This suggests that in recessions, inactive workers enter the market, increasing the number of unemployed. This is reinforced by the fact that fewer unemployed leave the labor force. Together, these imply a further increase in

the number of unemployed in recessions that, as we see in the next section, is of quantitative importance.

V. Quantifying the Impact of Changes in Gross Flows of Workers.

Much of the current discussion in the US literature focuses on identifying the relative importance of each of these flows to the evolution of cyclical unemployment. The issue is important to realistic modeling of labor markets, both in industrialized and, as this section argues, for developing countries. In our case, where we cannot take formal employment as the exclusive complement to unemployment, the task becomes more complex. We are now concerned not only with the evolution of unemployment, but also the evolution of formal relative to informal employment.

In one of the earliest accounting exercises for the UK, Pissarides (1986) argued that the steady state unemployment rate can be simulated as a function of the job finding rate and the job separation rates. To be more precise,

$$u_t^* = \frac{q_t^s}{q_t^s + q_t^f} \tag{4}$$

Where u_t^* is the steady state unemployment rate and, q_t^s and q_t^f are the separation rate and the job finding rate respectively. For the UK, the calculated unemployment rate tracks the actual unemployment rate remarkably closely. To identify the relative contribution of the two rates, Pissarides derived two counterfactual unemployment rates for the UK, one holding q_t^s at its period average level and letting q_t^f vary, and the second holding the job finding rate q_t^f constant and letting the inflow into unemployment q_t^s fluctuate. Graphically the series holding constant the separation rate was remarkably similar to the actual unemployment rate whereas the correlation between the unemployment rate and the constant job finding rate counterfactual was virtually zero. This led Pissarides to argue that job finding rate was the main driver of the unemployment rate in the UK. A similar result was obtained by Shimer (2007) using the same method for the US.

Recently, a number of papers have criticized this method of "unemployment accounting." Fujita and Ramey (2006 and 2007) argue that reliable conclusions are difficult with such visual inspections, and that the attribution of the change of unemployment to one flow or the other was difficult since the decomposition is not an exact one.[22] As an alternative, Fujita and Ramey (2006) offer an analytical decomposition of equation (4).[23] Since the decomposition is exact, the total variance of the cyclical unemployment rate can be easily attributable either to the variability of the separation rate or the job finding rate. Although technically appealing this analytical decomposition is difficult to operationalize when we are interested in more than just two employment states. Incorporating informal salaried and self employed sectors in addition to inactivity in our framework expands the number of states to five and makes an analogous exercise less straightforward to implement.[24] The variance of the unemployment rate can no longer be attributed neatly to particular components of the respective flows, since the steady state unemployment rate depends multiplicatively on all *n*x*n*-*n* flows, where *n* is the number of employment states.

Hence, we proceed in the spirit of Pissarides (1986) and Shimer (2007) while acknowledging the method's limitations. In the appendix, we also attempt to cross check our results following Fujita and Ramey, 2007, by imposing some strong assumptions for tractability and obtain qualitatively very similar results. First we calculate the steady state values of our labor market by solving

$$\begin{aligned}
O(q^{ou}+q^{oi}+q^{os}+q^{of}) &= Uq^{uo}+Iq^{io}+Sq^{so}+Fq^{of}\\
U(q^{uo}+q^{ui}+q^{us}+q^{uf}) &= Oq^{ou}+Iq^{iu}+Sq^{su}+Fq^{fu}\\
I(q^{oi}+q^{ui}+q^{is}+q^{if}) &= Oq^{oi}+Uq^{ui}+Sq^{si}+Fq^{fi}\\
S(q^{os}+q^{us}+q^{si}+q^{sf}) &= Oq^{os}+Uq^{us}+Iq^{is}+Fq^{fs}\\
F(q^{fo}+q^{fu}+q^{fi}+q^{fs}) &= Oq^{of}+Uq^{uf}+Iq^{if}+Sq^{sf}
\end{aligned} \tag{5}$$

and adjusting the resulting stocks so the corresponding shares sum to unity. Here, the q^{xy} are the transition rates from sector *x* to sector *y* and *O, U, I, S* and *F* are the number

[22] That is, the two counterfactual series do not have to add up to the steady state unemployment rate.
[23] This decomposition was first suggested by Elsby et al. (2007).
[24] Petrongolo and Pissarides (2007) introduce out of the labor force as an additional state and implement Fujita and Ramey technique for US and a set of European countries. They decompose the steady state unemployment rate in four components two of which cab be interpret as "loosely" corresponding to the transitions between employment/unemployment and inactivity.

of inactive, unemployed self employed, informal salaried and formal salaried workers respectively.

We focus on two main indicators of the labor market, the unemployment rate and the share of formal employment. From equations (5) we compute the unemployment rate $u^* = \frac{U^*}{(1 - O^*)}$ and the share of formal employment $f^* = \frac{F^*}{(F^* + I^* + S^*)}$ in the steady state for every period. Even with five employment states the quarterly unemployment rate is virtually indistinguishable from the simulated unemployment rate. The correlation between the HP de-trended unemployment rate in and the steady state unemployment rate from equations (5) is 0.97 in Mexico and 0.99 in Brazil. The correlation for the share of formal employment is somehow lower, but still substantial, 0.83 and 0.85 for Mexico and Brazil respectively.

To quantify the relative contributions of each flow, we simulate the counterfactual unemployment rates and the share of formal employment when each of the 20 possible flows in equation (5) is allowed to individually vary. Following Shimer (2007), we then compute the covariance of the HP de-trended counterfactual series with both the HP de-trended steady state unemployment rate and share of formal employment. Table 6a shows this set of covariances as a proportion of the variance of the HP de-trended steady state unemployment rate and share of formal employment. They can be interpreted as the contribution of the variability of a particular flow to the total cyclical variability of the unemployment rate (or the share of formal employment). A few notes of caution are in order. First, as noted above, the decomposition is not an exact one and hence the sum of the contributions does not necessarily add up to one. It is however, a very good approximation for the unemployment rate in Mexico and Brazil (0.94 and 1.06) and for the share of formal employment in Mexico (1.05). However, it performs less well for the share of formal employment in Brazil (1.50), perhaps because of the sensitivity of the technique to the changing trend in the share of formal employment in Brazil during the 90´s.

The messages that emerge are remarkably similar in both countries. First, the fluctuation of separations from employment (both from formal and informal employment) into unemployment is the single main contributor to changes in the unemployment rate. They account for 40% and 37% of variance in the unemployment rate in Mexico and Brazil respectively, significantly more than the 21% and 27% attributable to changes in the outflow rate towards employment. While this result seems the converse of the evidence in the US, where the job finding rate dominates US unemployment dynamics,[25] closer scrutiny shows that the division between formal and informal employment is crucial. Most of the variation (75% in Mexico and 86% in Brazil) in total separations is driven by movements in the separation rates of informal workers (both informal salaried and self-employed), while the opposite is true of the job finding rate where it is the outflow from unemployment (and inactivity) towards formal employment that contributes far more (16% in Mexico and 17% in Brazil) to changes in unemployment rate than changes in the job finding rate of informal jobs (5% in Mexico and 10% in Brazil). This result is consistent with the distinctive patterns of job finding and job separation rates of the two sectors noted in the previous section. It also suggests that were Mexico and Brazil to be like the US in having a dominant formal salaried sector, our results might not be so different from those found there.

Finally, reallocation across sectors and exit from the labor force does not seem to contribute substantially to the changes in the unemployment rate. However, the remaining variance (another 26% in Mexico and 36% in Brazil) can be fully attributed to the relationship between unemployment and inactivity, a result also consistent with the US evidence (See Shimer, 2007, and Petrongolo and Pissarides, 2007).

[25] This topic is still a matter of deep controversy. While Pissarides (2007) argues that the consensus in the literature is that around 1/3 of unemployment volatility is attributable to changes in the job separation rate and 2/3 to the job finding rate, Shimer argues that at most the contribution of the job separation rate is ¼ and it is declining over time. However, Fujitja and Ramey (2007) argue that the fluctuation of the separation rate may account up to 50% of total unemployment rate variability. These estimates only consider two states (unemployment and employment). Perhaps a better benchmark for our results is the cases where inactivity is explicitly considered. Shimer (2007) points at a 23% contribution of the job separation rate vs a 50% of the job finding rate and Petrongolo and Pissarides (2007) 33% vs 58% respectively for the US.

Despite the dominance of job separations in determining unemployment, fluctuations in the share of formal employment are almost entirely driven by strong procyclical formal hiring and especially from the informal sectors. In Mexico, where the decomposition is more precise, around 63% of total cyclical variance in the proportion of informal jobs can be attributed to changes in the rate at which informal workers access formal employment. Another 27%, can be attributed to changes in the job finding rate of the unemployed and inactive workers. Separation from formal employment accounts for only 10% and is more than compensated by the much more volatile job separation rate of informal workers, so the net total (formal and informal) job loss behaviour of the economy tends to reduce the variability of the share of formal employment by around 10%.

Strikingly, the direct outflows from formal employment into informal employment contribute little, 12%, in Mexico or even negatively, -24%, in Brazil. In fact, looking only at recessionary periods (Table 6b), in both countries the contribution is negative, (-5% in Mexico and -26% in Brazil). This implies that the reduction in the share of formal employment in recessions does not occur because of increased exits towards informality. In fact, the negative contributions suggest that the shut down in formal hiring would have led to even larger contractions in the absence of a reduction in separations towards informal employment.

VI. Conclusions

This paper uses recent techniques from the mainstream literature on labor market dynamics to make two contributions. First, for two developing economies, it offers the first decompositions of the dynamic determinants of cyclical unemployment and formal employment that are methodologically comparable to those in the advanced countries. Second, it explores the implications of observed dynamic patterns for the debate over the nature of the informal sector and its role in cyclical adjustments. We find that in many ways and, despite their large informal sectors, Mexico and Brazil appear to be of the same phylum as their advanced country counter parts with many similar labor market dynamics. However, there are also important differences and, we provide quantitative guidelines for the calibration of models of developing country labor markets, or those with large informal sectors. To summarize:

First, unemployment is strongly countercyclical. Separations appear to play a substantially larger role in unemployment movements than in the US. However, this is largely the contribution of the informal sector, not the modern formal sector which shows more muted fluctuations, similar to its advanced country analogue.

Second, we identify, on average, a generally procyclical evolution of the relative formal/informal labor shares. This occurs despite *increased* separation rates from informality into unemployment during downturns, and a-cyclical flows in the reverse direction. This paradoxical combination is explained by the large countercyclical fluctuations in the probability of finding a formal job from all other employment states. Hence, consistent with the US literature explaining unemployment, the relative expansion of the informal sector is not primarily due to increased shedding of labor from the formal sector during downturns.

Third, analogous to the US literature, flows among employment states are largely procyclical and intense, *including* those among the formal and informal sectors. This is not consistent with the view of the informal sector as predominantly the disadvantaged end of a segmented labor market and more consistent with standard job matching models. The finding that informality appears more as a job alternative than disguised unemployment for most workers implies that we need to focus less on segmenting distortions, and more on the cost-benefit analysis that agents undertake in choosing among sectors. In particular, as stressed by Levy (2007), we need to be more attentive to the impact of subsidies to becoming informal broadly construed, with attendant implications for aggregate productivity and worker welfare, on the decisions of the marginal worker.

Together, these findings give a view of labor market adjustment in LDCs across the business cycle that has elements of the traditional view of informality expanding across downturns, but perhaps with an updated mechanism focusing on relative hiring rates, and without a connotation of overall inferiority of the informal sector.

From the point of view of modelling and calibrating a labor market with informal jobs, two findings merit emphasis. First, explaining unemployment volatility

necessarily implies taking into consideration the highly volatile job separation rates of the informal workers. Models arguing that the informal sector is a flexible competitive, frictionless market will be unable to generate the large fluctuations of the unemployment rate observed in less developed countries. And second, volatility of the share of formal employment is almost entirely determined by access to formal employment, especially from informal jobs. Much like access towards employment can explain most of the variability in the unemployment rate in the US. Neither job separations towards unemployment nor to other informal jobs are able to explain much of formal employment variability.

References:

Albrecht, J., W., Navarro, L. and Vroman, S. B., (2006) "The Effects of labor Market Policies in an Economy with an Informal Sector," IZA Discussion Paper No. 2141

Antman, F. and D. J. McKenzie (2007) "Earnings Mobility and Measurement Error: A Pseudo-Panel Approach" *Economic Development and Cultural Change*,University of Chicago,56(1):125-161.

Blanchard, O. J. & Diamond, P., (1992). "The Flow Approach to Labor Markets," *American Economic Review*, vol. 82(2), pages 354-59, May.

Baker, M. (1992) "Unemployment Duration: Compositional Effects and Cyclical Variability," *American Economic Review*, 82(1): 313-321.

Boeri T., Garibaldi, P. (2006), "Shadow Sorting" CEPR discussion paper.DP5487.

Boeri T., Garibaldi P. (2001) "Shadow Activity and Unemployment in a Depressed Labor Market". IGIER Working Paper No. 77, Bocconi University, IGIER, Milano, Italy. 13 June.

Bosch, M. (2004) "Start Up Costs, Informality and Policy Complementarities". Mimeo LSE.

Bosch, M. and W. F. Maloney (2006) "Gross Worker Flows in the Presence of Informal Labor Markets: the Mexican Experience 1987-2002" World Bank Policy Research Working Paper 3883.

Bosch, M. and W. F. Maloney (2007) "Comparative Analysis of Labor Market Dynamics Using Markov Processes: An Application to Informality," IZA Discussion Paper 3038, World Bank Policy Research Working Paper 4429.

Bosch, M., Goni E., and W. F. Maloney (2007). "The Determinants of Rising Informality in Brazil: Evidence from Gross Worker Flows," IZA Discussion Papers 2970, Institute for the Study of Labor (IZA), World Bank Discussion Paper 4375.

De Paula, A and J. Sheinkman (2007), The Informal Sector," UCLA Department of Economics, Mimeo

De Soto, H. (1989). *The Other Path: The Invisible Revolution in the Third World.* New York: Harper and Row.

Elsby, M., G. Solon, and R. Michaels (2007) "The Ins and Outs of Cyclical Unemployment," NBER Working Paper No. 12853, January 2007.

Ericson, R. and A. Pakes (1992), "An Alternative Theory of Firm & Industry Dynamics", Cowles Foundation Paper 1041

Evans, D.S. and L. S. Leighton (1989), “Some Empirical Aspects of Entrepreneurship,” *American Economic Review* 79(3): 519-535.

Evans, D. S., & B. Jovanovic (1989), An Estimated Model of Entrepreneurial Choice under Liquidity Constraints. *Journal of Political Economy*, 97(4), 808–827.

Fajnzylber, P., W. F. Maloney and G. Montes Rojas (2007) “Micro-Firm Dynamics in Less Developed Countries: How Similar Are They to Those in the Industrialized World? Evidence from Mexico” *World Bank Economic Review*, Vol. 20:3 pp389-420.

Fields G. S. (2006) "A Guide to Multisector Labor Market Models". World Bank Labor Market Conference, Washington, DC November 18-19, 2004

Fiess, N. and M. Fugazza and W. Maloney (2006) “Informal Labor Markets and Macro Economic Fluctuations,” mimeo, World Bank.

Flinn, C. J. and J. J. Heckman (1983) “Are Unemployment and Out of the Labor Force Behaviorally Distinct Labor Force States, *Journal of Labor Economics* 1(1):28-42.

Flinn, C. J. and J.J. Heckman (1982a) “Models for the Analysis of Labor Market Dynamics,” in *Advances in Econometrics*, R. Basmann and G. Rhodes, eds. Greenwich, Conn.: JAI 1982.

Flinn, Christopher J. and J. J. Heckman (1982b), “New Methods for Analyzing Structural Models of Labor Force Dynamics,” *Journal of Econometrics* 18 (1982) 115-68.

Fougère, D. and T. Kamionka (2003), "Bayesian Inference for the Mover-Stayer Model in Continuous Time, with an Application to Labour Market Transition Data," *Journal of Applied Econometrics*, 18: 697-723.

Fujita, S. and Ramey, G. (2007) “The Cyclicality of Separation and Job Finding Rates,” *International Economic Review*, forthcoming

Fujita, S. and Ramey, G. (2006), “The Cyclicality of Job Loss and Hiring” Working Papers 06-17, Federal Reserve Bank of Philadelphia.

Fugazza, M. and J. F. Jacques, 2004, “Labor Market Institutions, Taxation and the Underground Economy, *Journal of Public Economics,* 88: 395-418.

Geweke J., R. Marshall and Gary A. Zarkin (1986) “Exact Inference for Continuous Time Markov Chain Models,” *Review of Economic Studies* 53(4). Pp653-69

Hall, R. (2005); “Employment Efficiency and Sticky Wages: Evidence Flows in the Labor Market,” *Review of Economics and Statistics* 87(3)397-407.

Hart, K. (1972). "Employment, Income and Inequality: A Strategy for Increasing Productive Employment in Kenya". Geneva: International Labor Organization.

Harris, J. R. and M. P. Todaro (1970), “Migration, Unemployment and Development: A Two-Sector Analysis,” *American Economic Review* 60(1): 126-142.

Henley, A., G.R. Arabsheibani, and F.G. Carneiro, (2006) "On Defining and Measuring the Informal Sector," World Bank Policy Research Working Paper No. 3866

Jovanovic, B. (1982). “Selection and Evolution of Industry,” *Econometrica*, 649-670.

Kaplan, D., G. Martinez and R. Robertson (2003), “Worker-and Job-Flows in Mexico.” Mimeo, Instituto Tecnologico Autonomo de Mexico.

Kolm, A.S. and B. Larsen, B. (2004) "Does Tax Evasion Affect Unemployment and Educational Choice?" Working Paper 4-2004, Department of Economics, Copenhagen Business School.

Kolm, A.S. and B. Larsen (2002), "Moral Cost, the Informal Sector and Unemployment" Working Paper 1-2001, Department of Economics, Copenhagen Business School.

Levy, S. (2007). “Can Social Programs Reduce Productivity and Growth? A Hypothesis for Mexico”. IPC working paper 37. Michigan Ann Arbor.

Loayza, N. and J. Rigolini (2006). “Informality Trends and Cycles,” *World Bank Policy Research Working Paper 4078*, Washington, DC..

Lucas, R. Jr. (1978), “On the Size Distribution of Business Firms”. *Bell Journal of Economics,* The RAND Corporation, 9(2): 508-523.

Maloney, W. F. (1999) Does Informality Imply Segmentation in Urban Labor Markets? Evidence from Sectoral Transitions in Mexico, *The World Bank Economic Review*, 13(2) 275-302.

Maloney, W. F. (2004) “Informality Revisited,” *World Development* 32(7): 1159-1178.

Mazumdar, D. (1975) “The Urban Informal Sector” Working Paper 211, World Bank, Washington, DC.

McKenzie, D (2004) “Aggregate Schocks and Urban Labor Market Responses: Evidence from Argentina’s Financial Crisis,” *Economic Development and Cultural Change,* University of Chicago Press, vol. 52(4): 719-58.

Menzio, G. (2005), “High-Frequency Wage Rigidity,” Northwestern University.

Mortensen, D. T and Pissarides, C. (1994), "Job Creation and Job Destruction in the Theory of Unemployment," *Review of Economic Studies*, 61: 397-415.

Mortensen, D. T. and E. Nagypal (2005), “More on Unemployment and Vacancy Fluctuations,” Northwestern University.

Nagypal, E. (2004). “Reallocation over the Business Cycle: The Importance of Job-to-Job Transitions” Draft, Northwestern University, July 2004.

Perry, G., W. Maloney, O. Arias, P. Fajnyzlber, A. Mason and J. Saavedra, *Informality: Exit and Exclusion*. Washington, D.C., World Bank, ©2007.

Petrongolo, B. and Pissarides, C. (2008) "The Ins and Outs of European Unemployment". *American Economic Review, P&P*, May 2008.

Pissarides, C. A.(2000). *Equilibrium Unemployment Theory*. Cambridge: MIT Press.

Pissarides, C. A. (2007). “The Unemployment Volatility Puzzle: Is Wage Stickiness the Answer?,” The Walras-Bowley lecture, North American Summer Meetings of the Econometric Society, Duke University, June 21-24, 2007

Schneider, F. and Enste, D. (2000). "Shadow Economies: Size Causes, and Consequences," *Journal of Economic Literature*, 38(10): 77-114.

Shimer, R. (2007), “Reassessing the Ins and Outs of Unemployment” Mimeo, University of Chicago.

Shimer, R. (2005) “The Cyclicality of Hires, Separations, and Job to Job Transitions,” *Federal Reserve of St. Louis Review*, July/August. 87 (4), pp. 493-507.

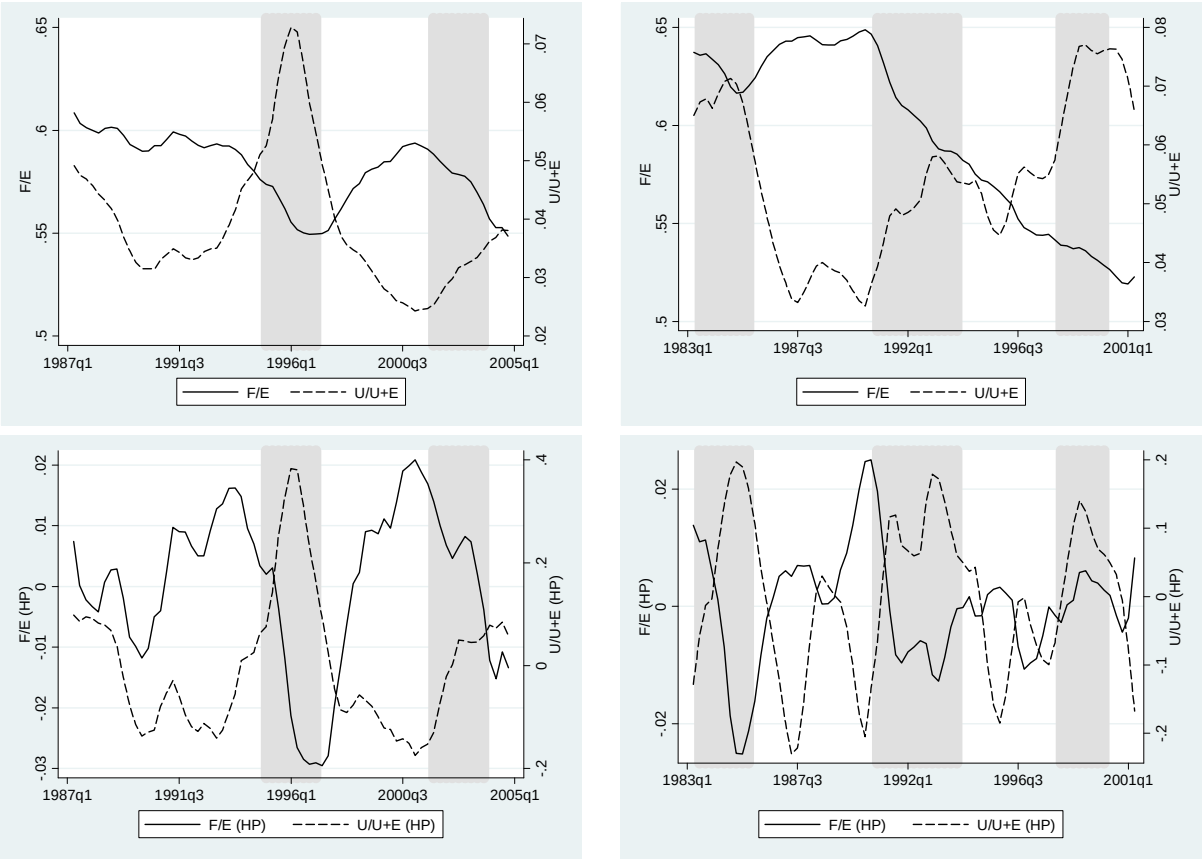
Rauch, J. E., 1991. "Modeling the Informal Sector Formally," *Journal of Development Economic*s, Elsevier, vol. 35(1), pages 33-47,

Rogerson, R., Shimer, R. and Wright, R. (2005), “Search Theoretic Models of the Labor Market” *Journal of Economic Literature*, 43 (4): 959-988.

Zenou, Y. “Job Search and Mobility in Developing Countries. Theory and Policy Implications,” Forthcoming *Journal of Development Economics*.

Figure 1: Unemployment Rates and Share of Formal Employment (Trends and Cycle): Mexico an Brazil

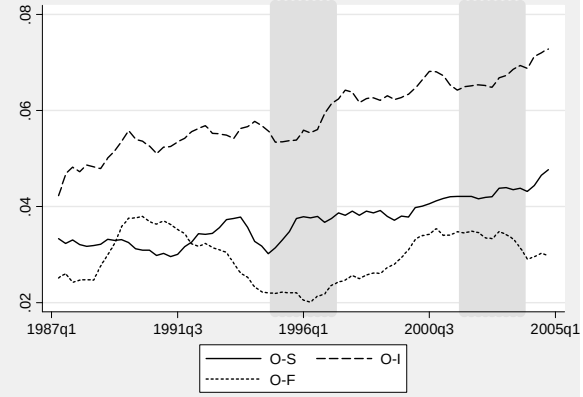
Mexico Brazil

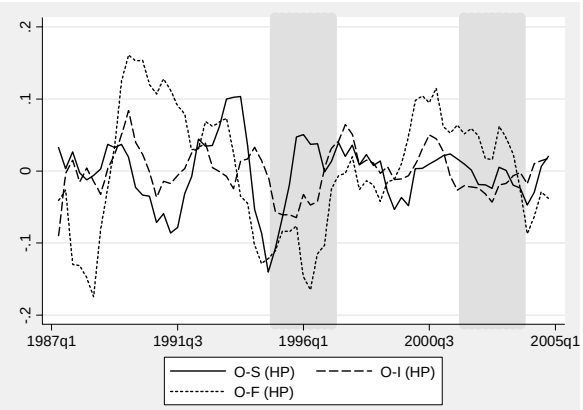


Notes: The share of formal employment, F/E, is constructed as the number of formal workers over total employment. Unemployment rate, U/(U+E), corresponds to the number of unemployed workers over the total labour force. The series have been smoothed using a 4 quarter moving average to remove high frequency fluctuations. The bottom panels shows the series logged and de-trended using an HP filter with lambda 1600. Data for Mexico (left panels) is drawn from the quarterly National Urban Labor Survey (ENEU) from 1987:Q1 to 2004:Q4. Data for Brazil (right panels) is drawn from the Monthly Employment Survey (PME), quarterly averaged from 1983:Q1 to 2001:Q2. Shaded areas indicate recessions.

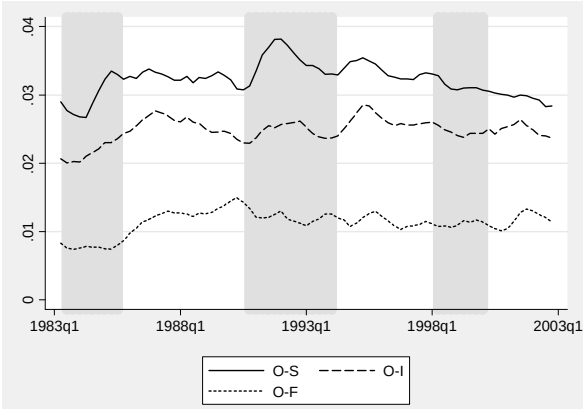
Figure 2a: Job Finding Rates from inactivity (Trends and Cycle): Mexico an Brazil

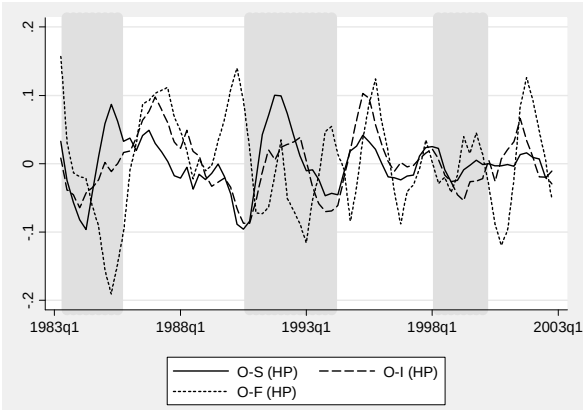
Mexico





Brazil

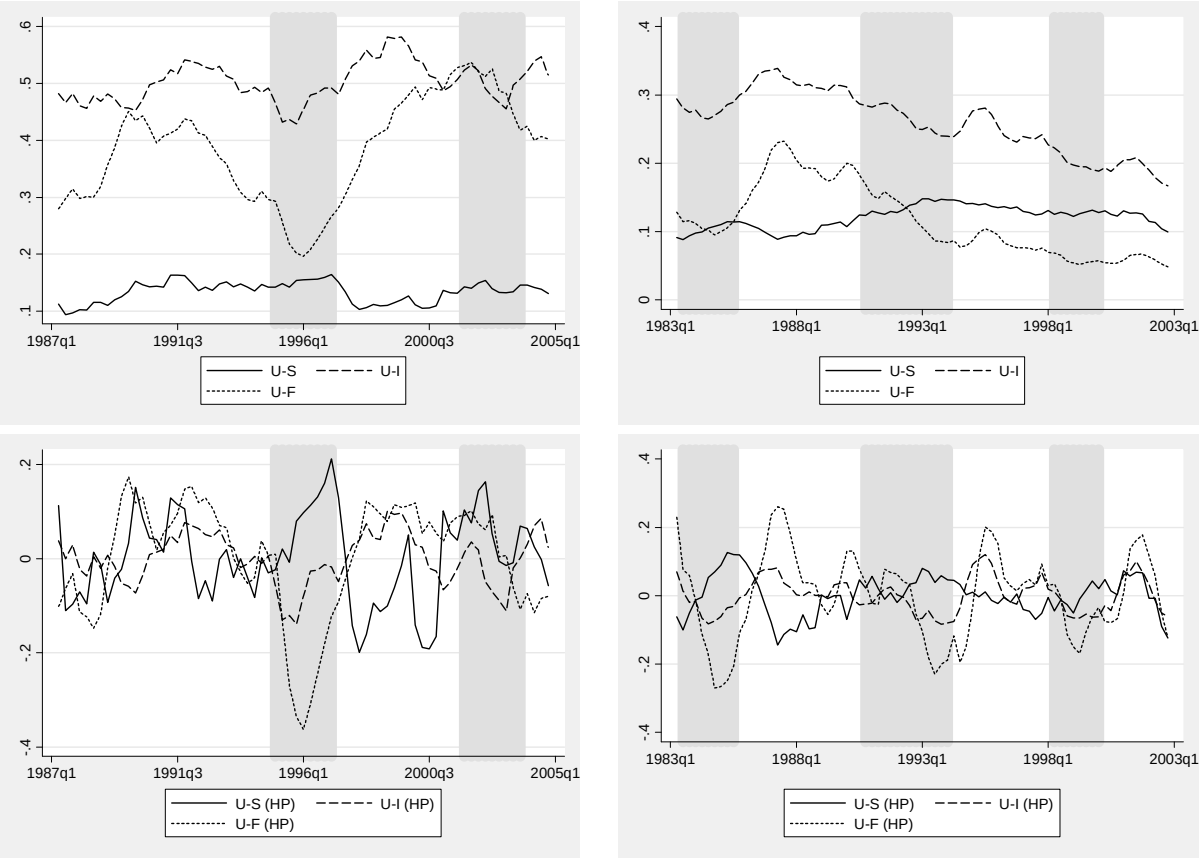




Notes: The graph shows the transition rates from inactivity (O=Out of the Labor Force) into the three employment sectors (S=Informal Self-employed, I=Informal Salaried, , F=Formal Sector). Transition rates are inferred from the continuous time transition matrix for each period obtained following the procedure by Geweke et al. (1986) outlined in Section III. Computations are based on 10.000 Monte Carlo replications. The series have been smoothed using a 4 quarter moving average to remove high frequency fluctuations. The bottom panels shows the series logged de-trended using an HP filter with lambda 1600. Data for Mexico (left panels) is drawn from the quarterly National Urban Labor Survey (ENEU) from 1987:Q1 to 2004:Q4. Data for Brazil (right panels) is drawn from the Monthly Employment Survey (PME), quarterly averaged from 1983:Q1 to 2001:Q2. Shaded areas indicate recessions.

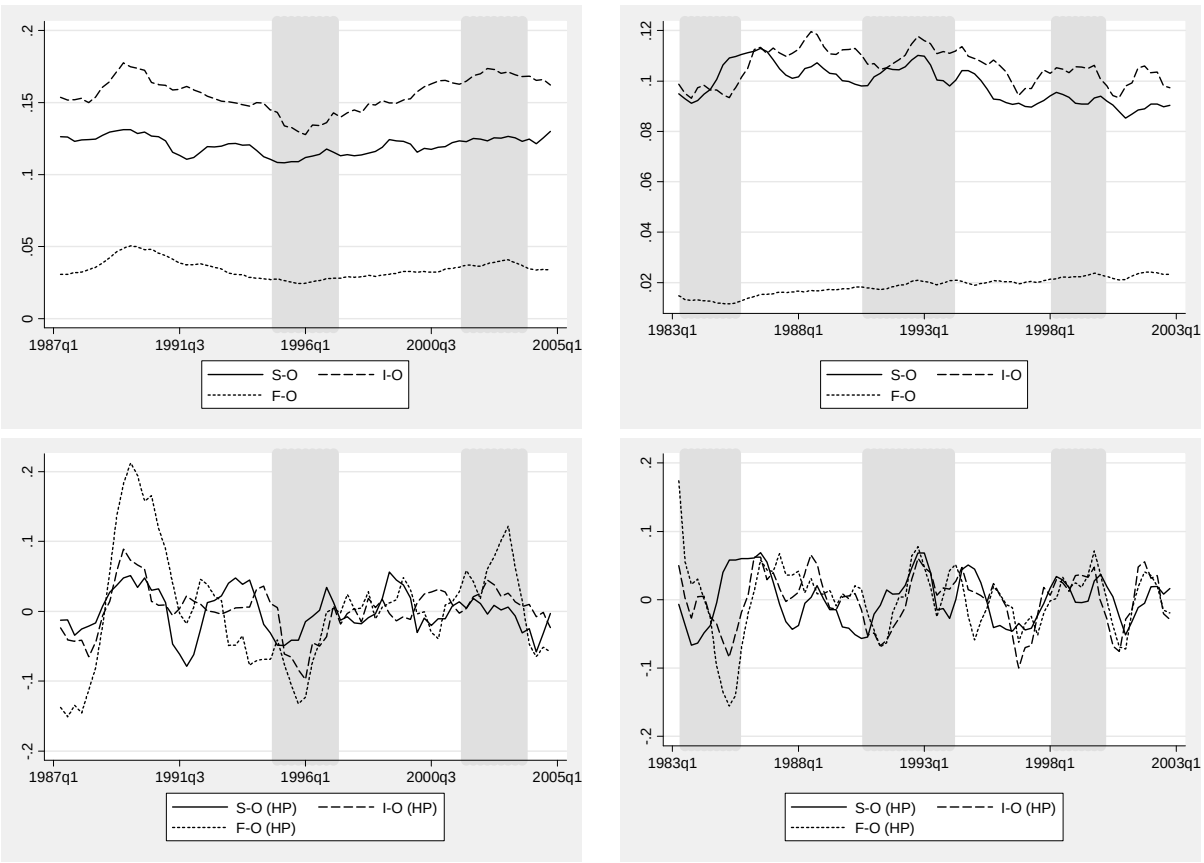
Figure 2b: Job Finding Rates from Unemployment (Trends and Cycle): Mexico an Brazil

Mexico Brazil



Notes: The graph shows the transition rates from unemployment (U=Unemployment) into the three employment sectors (S=Informal Self-employed, I=Informal Salaried, , F=Formal Sector). Transition rates are inferred from the continuous time transition matrix for each period obtained following the procedure by Geweke et al. (1986) outlined in Section III. Computations are based on 10.000 Monte Carlo replications. The series have been smoothed using a 4 quarter moving average to remove high frequency fluctuations. The bottom panels shows the series logged and de-trended using an HP filter with lambda 1600. Data for Mexico (left panels) is drawn from the quarterly National Urban Labor Survey (ENEU) from 1987:Q1 to 2004:Q4. Data for Brazil (right panels) is drawn from the Monthly Employment Survey (PME), quarterly averaged from 1983:Q1 to 2001:Q2. Shaded areas indicate recessions.

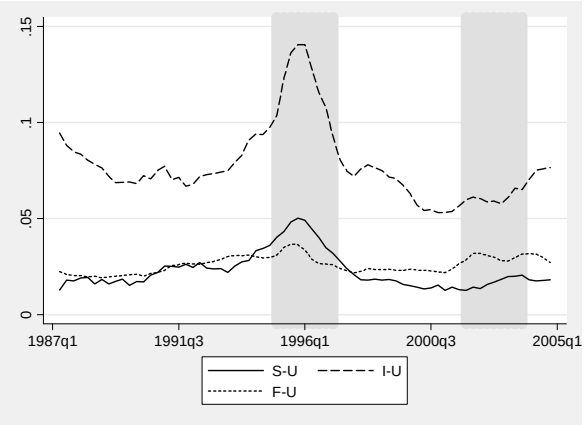
Figure 3a Job separation Rates towards Inactivity (Trends and Cycle): Mexico an Brazil

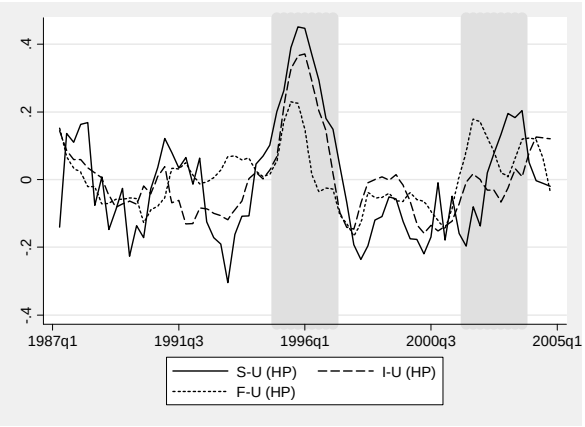


Notes: The graph shows the transition rates from the three employment sectors (S=Informal Self-employed, I=Informal Salaried, , F=Formal Sector) into Inactivity (O=Out of the Labor Force). Transition rates are inferred from the continuous time transition matrix for each period obtained following the procedure by Geweke et al. (1986) outlined in Section III. Computations are based on 10.000 Monte Carlo replications. The series have been smoothed using a 4 quarter moving average to remove high frequency fluctuations. The bottom panels shows the series logged and de-trended using an HP filter with lambda 1600. Data for Mexico (left panels) is drawn from the quarterly National Urban Labor Survey (ENEU) from 1987:Q1 to 2004:Q4. Data for Brazil (right panels) is drawn from the Monthly Employment Survey (PME), quarterly averaged from 1983:Q1 to 2001:Q2. Shaded areas indicate recessions.

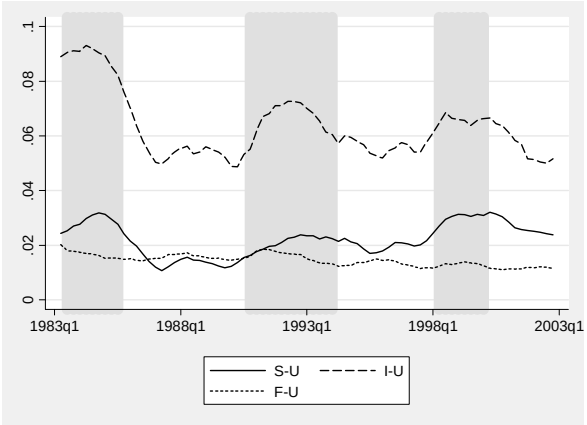
Figure 3b: Job separation Rates towards Unemployment (Trends and Cycle): Mexico an Brazil

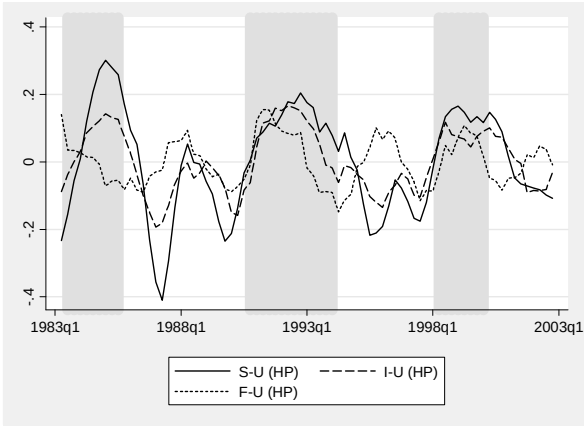
Mexico





Brazil

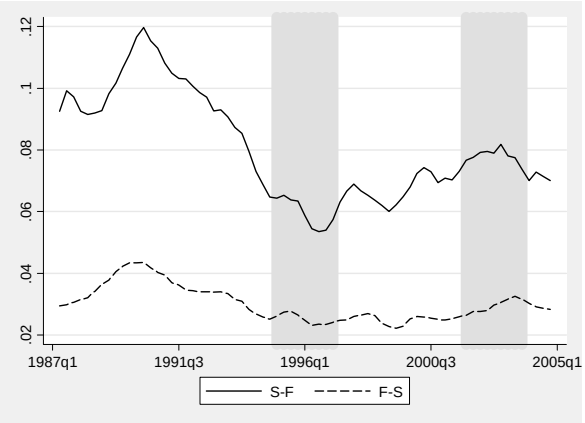


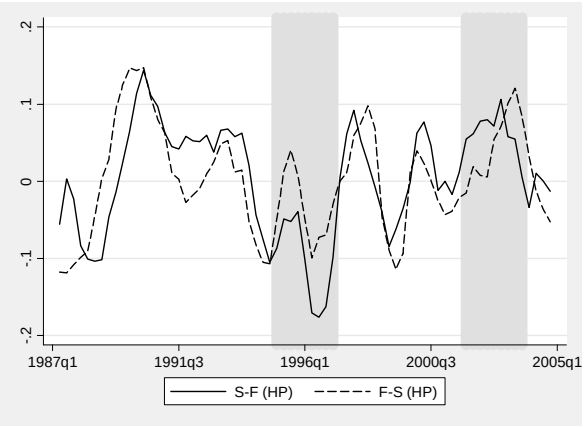


Notes: The graph shows the transition rates from the three employment sectors (S=Informal Self-employed, I=Informal Salaried, , F=Formal Sector) into unemployment (U=Unemployment). Transition rates are inferred from the continuous time transition matrix for each period obtained following the procedure by Geweke et al. (1986) outlined in Section III. Computations are based on 10.000 Monte Carlo replications. The series have been smoothed using a 4 quarter moving average to remove high frequency fluctuations. The bottom panels shows the series logged and de-trended using an HP filter with lambda 1600. Data for Mexico (left panels) is drawn from the quarterly National Urban Labor Survey (ENEU) from 1987:Q1 to 2004:Q4. Data for Brazil (right panels) is drawn from the Monthly Employment Survey (PME), quarterly averaged from 1983:Q1 to 2001:Q2. Shaded areas indicate recessions.

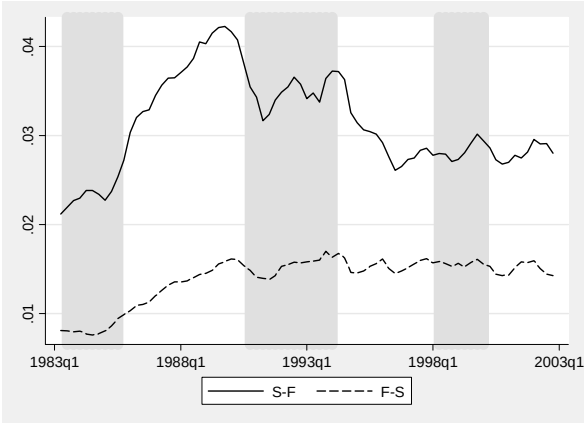
Figure 4a: Cross Sectoral Flows (F-S) (Trends and Cycle): Mexico an Brazil

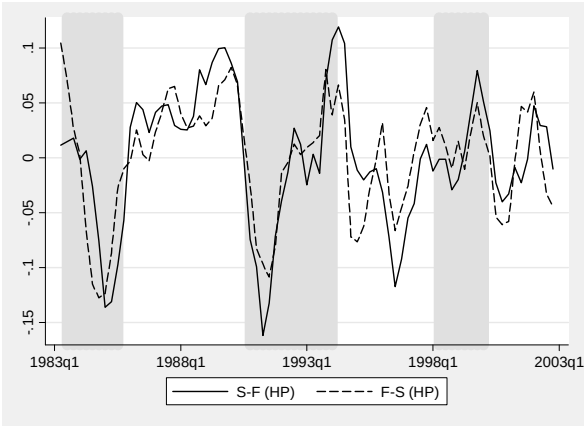
Mexico





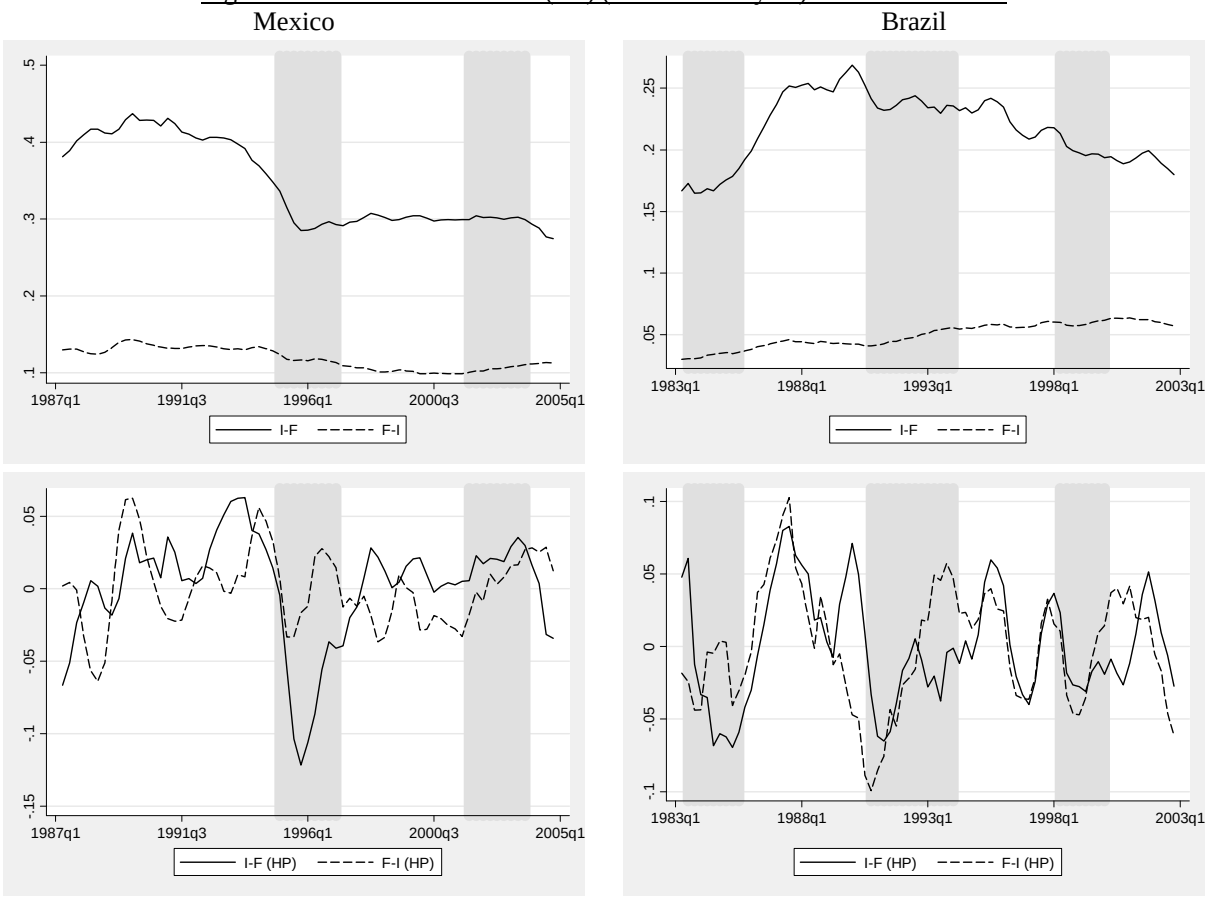
Brazil





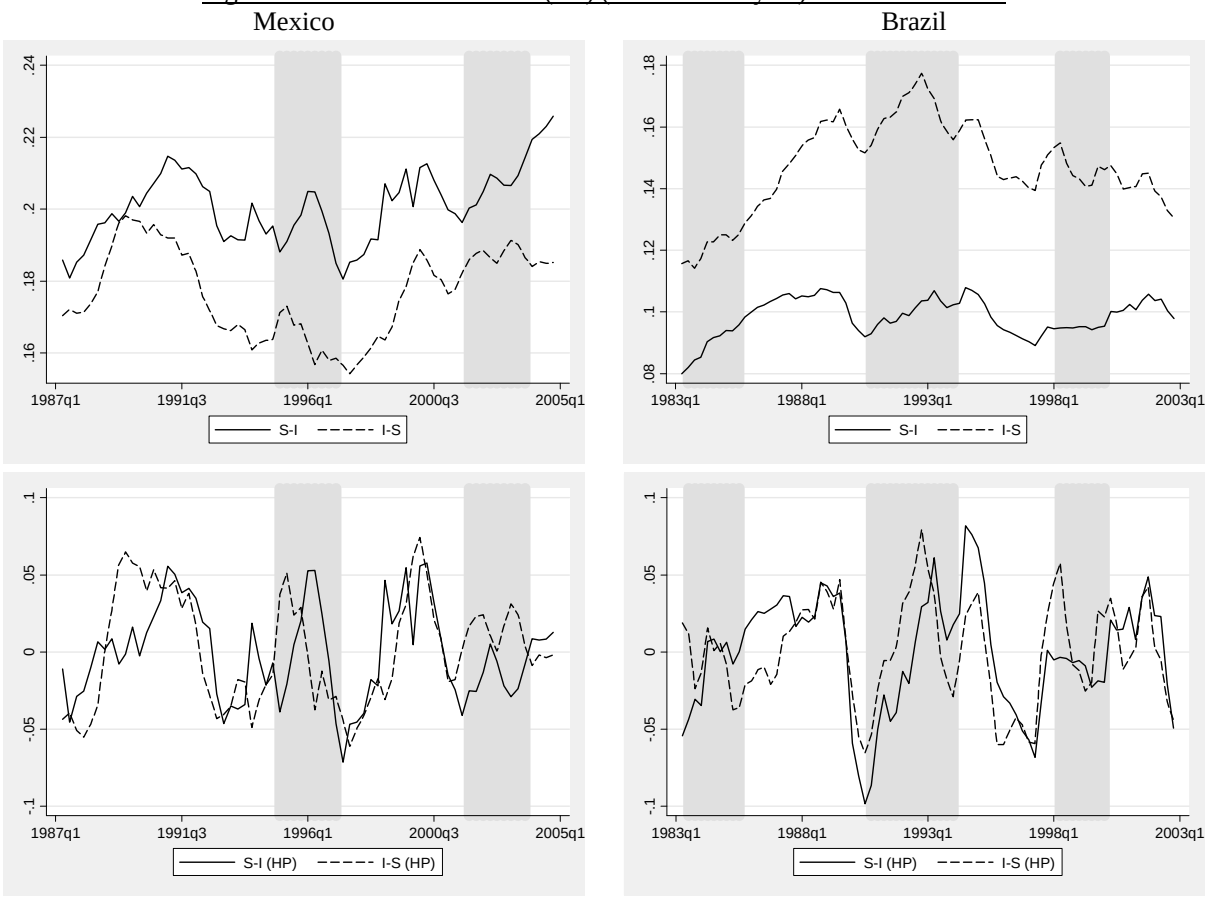
Notes: The graph shows the transition rates between informal self-employed (S=Informal Self-Employed) and the formal sector (F=Formal Sector). Transition rates are inferred from the continuous time transition matrix for each period obtained following the procedure by Geweke et al. (1986) outlined in Section III. Computations are based on 10.000 Monte Carlo replications. The series have been smoothed using a 4 quarter moving average to remove high frequency fluctuations. The bottom panels shows the series logged and de-trended series using an HP filter with lambda 1600. Data for Mexico (left panels) is drawn from the quarterly National Urban Labor Survey (ENEU) from 1987:Q1 to 2004:Q4. Data for Brazil (right panels) is drawn from the Monthly Employment Survey (PME), quarterly averaged from 1983:Q1 to 2001:Q2. Shaded areas indicate recessions.

Figure 4b Cross Sectoral Flows (I-F) (Trends and Cycle): Mexico an Brazil



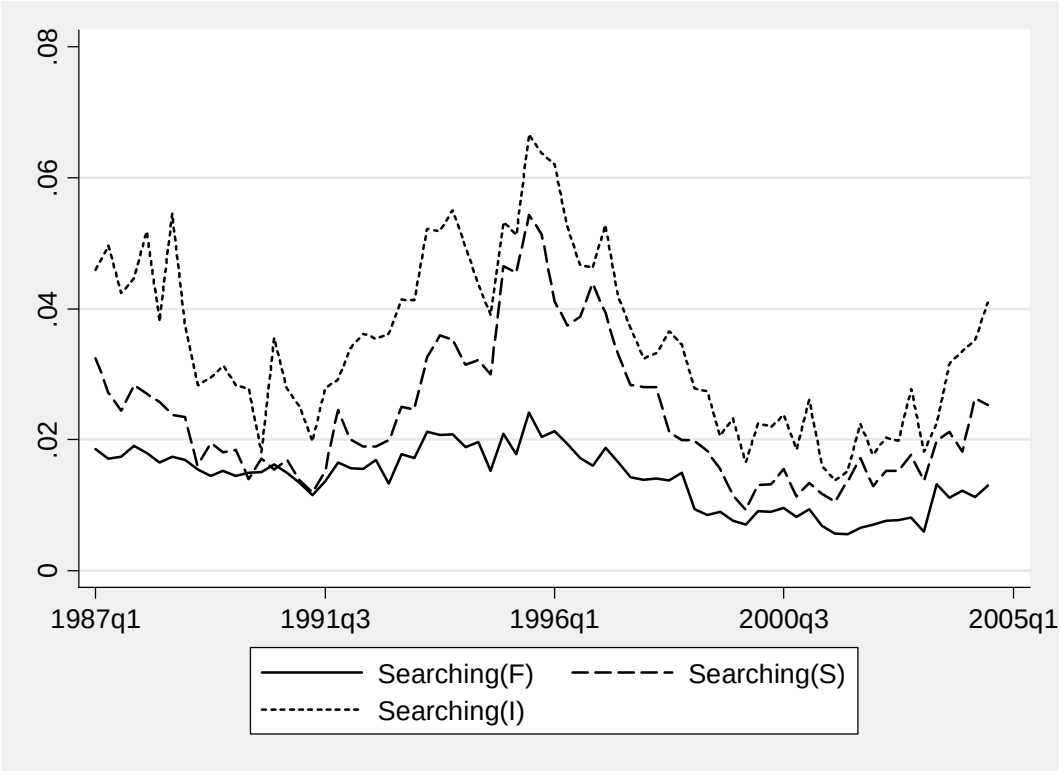
Notes: The graph shows the transition rates between informal self-employed (S=Informal Self-Employed) and the informal salaried (I=Informal Salaried). Transition rates are inferred from the continuous time transition matrix for each period obtained following the procedure by Geweke et al. (1986) outlined in Section III. Computations are based on 10.000 Monte Carlo replications. The series have been smoothed using a 4 quarter moving average to remove high frequency fluctuations. The bottom panels shows the series logged and de-trended using an HP filter with lambda 1600. Data for Mexico (left panels) is drawn from the quarterly National Urban Labor Survey (ENEU) from 1987:Q1 to 2004:Q4. Data for Brazil (right panels) is drawn from the Monthly Employment Survey (PME), quarterly averaged from 1983:Q1 to 2001:Q2. Shaded areas indicate recessions.

Figure 4c Cross Sectoral Flows (S-I) (Trends and Cycle): Mexico an Brazil



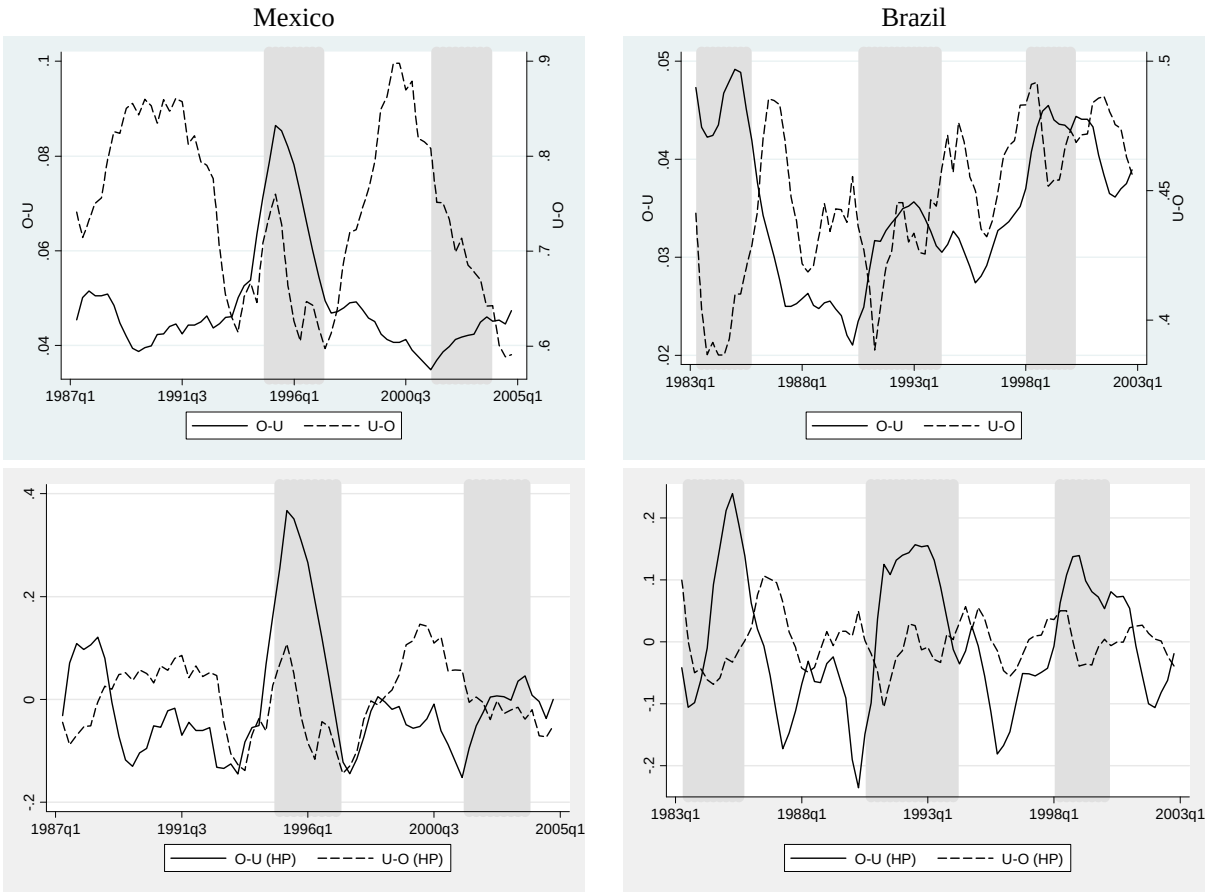
Notes: The graph shows the transition rates between informal salaried (I=Informal Salaried) and the formal sector (F=Formal Sector). Transition rates are inferred from the continuous time transition matrix for each period obtained following the procedure by Geweke et al. (1986) outlined in Section III. Computations are based on 10.000 Monte Carlo replications. The series have been smoothed using a 4 quarter moving average to remove high frequency fluctuations. The bottom panels shows the series logged and de-trended using an HP filter with lambda 1600. Data for Mexico (left panels) is drawn from the quarterly National Urban Labor Survey (ENEU) from 1987:Q1 to 2004:Q4. Data for Brazil (right panels) is drawn from the Monthly Employment Survey (PME), quarterly averaged from 1983:Q1 to 2001:Q2. Shaded areas indicate recessions.

Figure 4d: Searching While Employed: Mexico



Note: Quarterly data from the National Urban Labor Survey (ENEU) 1987:Q1 to 2004:Q4. Searching (j) refers to the proportion of employed workers in sector j who claim to be looking for a new job and have not changed employment status in the previous quarter.

Figure 5 Cross Sectoral Flows (U-O) (Trends and Cycle): Mexico an Brazil



Notes: The graph shows the transition rates between inactivity (O=Out of the Labor Force) and unemployment (U=Unemployed). Transition rates are inferred from the continuous time transition matrix for each period obtained following the procedure by Geweke et al. (1986) outlined in Section III. Computations are based on 10.000 Monte Carlo replications. The series have been smoothed using a 4 quarter moving average to remove high frequency fluctuations. The bottom panels shows the series logged and de-trended using an HP filter with lambda 1600. Data for Mexico (left panels) is drawn from the quarterly National Urban Labor Survey (ENEU) from 1987:Q1 to 2004:Q4. Data for Brazil (right panels) is drawn from the Monthly Employment Survey (PME), quarterly averaged from 1983:Q1 to 2001:Q2. Shaded areas indicate recessions.

Table 1: Cyclical Properties of Employment States Mexico and Brazil

	Mexico			Brazil		
Series	St. Dev	Correlation	Elasticity	St. Dev	Correlation	Elasticity
O	0.010	-0.157	-0.059	0.012	-0.123	-0.070
U	0.130	-0.878	-4.235	0.109	-0.816	-4.421
E	0.008	0.753	0.234	0.011	0.535	0.288
S	0.015	-0.415	-0.235	0.016	-0.219	-0.172
I	0.019	-0.243	-0.170	0.026	0.030	0.038
F	0.019	0.780	0.560	0.016	0.616	0.498
U/U+E	0.129	-0.889	-4.263	0.110	-0.817	-4.475
F/E	0.013	0.674	0.325	0.010	0.431	0.210

Notes: The table shows the standard deviation, the correlation with output and the elasticity with respect to output of the logged and HP filter de-trended of different employment statuses for Mexico and Brazil. The series have been smoothed using a 4 quarter moving average to remove high frequency fluctuations. O=Out of the Labour Force, U=Unemployment, E=Employment, S=Informal Self-Employed, I=Informal Salaried, and F=Formal Sector, all as proportions of working age population. Data for Mexico (left panels) is drawn from the quarterly National Urban Labor Survey (ENEU) from 1987:Q1 to 2004:Q4. Data for Brazil (right panels) is drawn from the Monthly Employment Survey (PME), quarterly averaged from 1983:Q1 to 2001:Q2.

Table 2: Cyclical Properties of Transition Rates out of Employment: Mexico and Brazil

	Mexico			Brazil		
Series	St. Dev	Correlation	Elasticity	St. Dev	Correlation	Elasticity
O-S	0.045	-0.076	-0.127	0.040	-0.135	-0.280
O-I	0.032	0.353	0.420	0.043	0.442	0.972
O-F	0.085	0.573	1.812	0.073	0.527	1.983
U-S	0.094	-0.433	-1.511	0.059	-0.600	-1.752
U-I	0.055	0.366	0.748	0.052	0.617	1.628
U-F	0.120	0.798	3.554	0.128	0.652	4.285

Notes: The table shows the standard deviation, the correlation with output and the elasticity with respect to output of the logged and HP filter de-trended transition rates from non employment (O and U) into employment (S,I and F) for Mexico and Brazil. Transition rates are inferred from the continuous time transition matrix for each period obtained following the procedure by Geweke et al. (1986) outlined in Section III. Computations are based on 10.000 Monte Carlo replications. The series have been smoothed using a 4 quarter moving average to remove high frequency fluctuations. O=Out of the Labour Force, U=Unemployment, E=Employment, S=Informal Self-Employed, I=Informal Salaried, and F=Formal Sector, all as proportions of working age population. Data for Mexico (left panels) is drawn from the quarterly National Urban Labor Survey (ENEU) from 1987:Q1 to 2004:Q4. Data for Brazil (right panels) is drawn from the Monthly Employment Survey (PME), quarterly averaged from 1983:Q1 to 2001:Q2.

Table 3: Cyclical Properties of Transition Rates into of Employment: Mexico and Brazil

	Mexico			Brazil		
Series	St. Dev	Correlation	Elasticity	St. Dev	Correlation	Elasticity
S-O	0.032	0.108	0.128	0.037	-0.298	-0.563
I-O	0.035	0.402	0.519	0.039	0.135	0.271
F-O	0.081	0.240	0.720	0.051	0.125	0.325
S-U	0.167	-0.716	-3.156	0.154	-0.725	-3.485
I-U	0.118	-0.665	-4.141	0.093	-0.730	-5.742
F-U	0.093	-0.416	-1.440	0.072	-0.162	-0.600

Notes: The table shows the standard deviation, the correlation with output and the elasticity with respect to output of the logged and HP filter de-trended transition rates from employment (S,I and F) into non employment (O and U) for Mexico and Brazil. Transition rates are inferred from the continuous time transition matrix for each period obtained following the procedure by Geweke et al. (1986) outlined in Section III. Computations are based on 10.000 Monte Carlo replications. The series have been smoothed using a 4 quarter moving average to remove high frequency fluctuations. O=Out of the Labour Force, U=Unemployment, E=Employment, S=Informal Self-Employed, I=Informal Salaried, and F=Formal Sector, all as proportions of working age population. Data for Mexico (left panels) is drawn from the quarterly National Urban Labor Survey (ENEU) from 1987:Q1 to 2004:Q4. Data for Brazil (right panels) is drawn from the Monthly Employment Survey (PME), quarterly averaged from 1983:Q1 to 2001:Q2.

Table 4: Cyclical Properties of Transition Rates among Employment Sectors: Mexico and Brazil

	Mexico				Brazil			
Series	St. Dev	Correlation	Elasticity	Cross Cor	St. Dev	Correlation	Elasticity	Cross Cor
S-I	0.030	-0.013	-0.014	0.424	0.037	0.008	0.014	0.621
I-S	0.035	0.092	0.122		0.033	-0.187	-0.314	
I-F	0.038	0.574	0.798	0.174	0.039	0.740	1.467	0.486
F-I	0.026	-0.273	-0.269		0.041	0.319	0.658	
S-F	0.074	0.425	1.171	0.670	0.061	0.303	0.946	0.761
F-S	0.069	0.179	0.416		0.053	0.353	0.951	

Notes: The table shows the standard deviation, the correlation with output and the elasticity with respect to oput of the logged and HP filter de-trended transition rates across employmetn states (S,I and F) for Mexico and Brazil. We also report the cross correlation among bi-lateral flows. Transition rates are inferred from the continuous time transition matrix for each period obtained following the procedure by Geweke et al. (1986) outlined in Section III. Computations are based on 10.000 Monte Carlo replications. The series have been smoothed using a 4 quarter moving average to remove high frequency fluctuations. O=Out of the Labour Force, U=Unemployment, E=Employment, S=Informal Self-Employed, I=Informal Salaried, and F=Formal Sector, all as proportions of working age population. Data for Mexico (left panels) is drawn from the quarterly National Urban Labor Survey (ENEU) from 1987:Q1 to 2004:Q4. Data for Brazil (right panels) is drawn from the Monthly Employment Survey (PME), quarterly averaged from 1983:Q1 to 2001:Q2.

Table 5: Cyclical Properties of Transition Rates among Non- Employment Sectors: Mexico and Brazil

	Mexico			Brazil		
Series	St. Dev	Correlation	Elasticity	St. Dev	Correlation	Elasticity
O-U	0.115	-0.517	-2.207	0.109	-0.715	-3.937
U-O	0.074	0.536	1.407	0.043	0.381	0.813

Notes: The table shows the standard deviation, the correlation with output and the elasticity with respect to output of the logged and HP filter de-trended transition rates across non-employmetn states (O and U) for Mexico and Brazil. Transition rates are inferred from the continuous time transition matrix for each period obtained following the procedure by Geweke et al. (1986) outlined in Section III. Computations are based on 10.000 Monte Carlo replications. The series have been smoothed using a 4 quarter moving average to remove high frequency fluctuations. O=Out of the Labour Force, U=Unemployment, E=Employment, S=Informal Self-Employed, I=Informal Salaried, and F=Formal Sector, all as proportions of working age population. Data for Mexico (left panels) is drawn from the quarterly National Urban Labor Survey (ENEU) from 1987:Q1 to 2004:Q4. Data for Brazil (right panels) is drawn from the Monthly Employment Survey (PME), quarterly averaged from 1983:Q1 to 2001:Q2.

Table 6a: Contribution to the Unemployment Rate and Share of Formal Employment Volatility.

	Unemployment Rate		Share of Formal Employment	
	Mexico	Brazil	Mexico	Brazil
Job Separations Rates	**0.40**	**0.37**	**-0.10**	**-0.03**
I-U	0.22	0.18	-0.11	-0.08
S-U	0.08	0.14	-0.09	-0.14
F-U	0.10	0.05	0.10	0.19
Job Finding Rates	**0.21**	**0.27**	**0.27**	**0.54**
O-F	0.03	0.04	0.10	0.28
U-F	0.13	0.13	0.17	0.25
O-I	0.02	0.02	-0.01	-0.01
U-I	0.04	0.11	-0.04	-0.04
O-S	0.00	0.00	0.02	0.03
U-S	-0.01	-0.03	0.03	0.03
Job Reallocation Rates	**0.05**	**0.06**	**0.81**	**1.12**
I-F	0.03	0.06	0.50	0.87
S-F	0.00	0.01	0.13	0.36
F-I	0.00	-0.02	0.08	-0.07
F-S	0.02	-0.01	0.04	-0.17
I-S	0.00	0.02	0.05	0.10
S-I	0.00	0.00	0.01	0.03
Exit of the labor force	**0.02**	**0.00**	**0.03**	**-0.04**
I-O	0.00	0.00	0.01	0.01
S-O	0.00	0.00	0.00	-0.02
F-O	0.02	0.00	0.02	-0.03
Unemployment-Inactivity	**0.26**	**0.36**	**-0.06**	**-0.09**
U-O	0.03	0.08	-0.01	-0.03
O-U	0.23	0.28	-0.05	-0.06
Total Contributions	0.94	1.06	0.95	1.50

Notes: The table presents the contribution of the cyclical component of each flow to cyclical volatility of the unemployment rate and the share of formal employment for Mexico and Brazil following Shimer (2007). We compute the covariance between the HP de-trended steady state unemployment rate (and share of formal employment) with the counterfactual of the series derived from setting all the possible flows at their average level and allowing only the flow of interest to vary. We present the covariance as a proportion of the variance of the series. O=Out of the Labour Force, U=Unemployment, E=Employment, S=Informal Self-Employed, I=Informal Salaried, and F=Formal Sector. Data for Mexico is drawn from the quarterly National Urban Labor Survey (ENEU) from 1987:Q1 to 2004:Q4. Data for Brazil is drawn from the Monthly Employment Survey (PME), quarterly averaged from 1983:Q1 to 2001:Q2.

Table 6b: Contribution to the Unemployment Rate and Share of Formal Employment Volatility: Recessions

	Unemployment Rate		Share of Formal Employment	
	Mexico	Brazil	Mexico	Brazil
Job Separations Rates	**0.41**	**0.37**	**-0.19**	**-0.06**
I-U	0.24	0.19	-0.16	-0.09
S-U	0.09	0.15	-0.15	-0.14
F-U	0.09	0.03	0.12	0.17
Job Finding Rates	**0.20**	**0.21**	**0.34**	**0.69**
O-F	0.02	0.05	0.11	0.36
U-F	0.12	0.13	0.26	0.26
O-I	0.01	-0.01	-0.02	0.01
U-I	0.06	0.07	-0.05	-0.03
O-S	0.00	-0.01	0.00	0.06
U-S	-0.02	-0.02	0.04	0.03
Job Reallocation Rates	**0.05**	**0.07**	**0.94**	**0.89**
I-F	0.03	0.06	0.74	0.80
S-F	0.01	0.01	0.18	0.35
F-I	-0.01	-0.01	-0.01	-0.02
F-S	0.01	-0.01	-0.04	-0.25
I-S	0.00	0.02	0.09	0.05
S-I	0.00	0.00	-0.02	-0.04
Exit of the labor force	**-0.03**	**-0.08**	**0.00**	**-0.16**
I-O	-0.01	0.00	0.03	-0.01
S-O	-0.01	0.02	0.04	-0.06
F-O	-0.02	-0.10	-0.07	-0.09
Unemployment-Inactivity	**0.23**	**0.41**	**-0.08**	**-0.10**
U-O	-0.01	0.07	-0.01	-0.03
O-U	0.24	0.34	-0.07	-0.07
Total Contributions	0.86	0.98	1.00	1.26

Notes: The table presents the contribution of the cyclical component of each flow to cyclical volatility of the unemployment rate an the share of formal employment for Mexico and Brazil in recessions following Shimer, 2007. We define recession as output below trend. We compute the covariance between the HP de-trended steady state unemployment rate (and share of formal employment) with the counterfactual of the HP de-trended series derived from setting all the possible flows at their average level and allowing only the flow of interest to vary. We present the covariance as a proportion of the variance of the series. O=Out of the Labour Force, U=Unemployment, E=Employment, S=Informal Self-Employed, I=Informal Salaried, and F=Formal Sector. Data for Mexico is drawn from the quarterly National Urban Labor Survey (ENEU) from 1987:Q1 to 2004:Q4. Data for Brazil is drawn from the Monthly Employment Survey (PME), quarterly averaged from 1983:Q1 to 2001:Q2.

Table A.1: Contribution to the Unemployment Rate and Share of Formal Employment Volatility using Fijuta and Ramey Decomposition.

	Unemployment Rate					Formal Employment				
	Inflows	Outflows-F	Outflows-I	Outflows-S	Error	Inflows	Outflows-I	Outflows-S	Outflows-U	Error
Whole Sample										
Mexico	0.82	0.20	0.02	-0.03	-0.01	0.69	0.08	0.01	0.19	0.04
Brazil	0.69	0.22	0.11	-0.03	0.01	1.22	-0.21	-0.16	0.18	-0.02
Recession										
Mexico	0.76	0.24	0.04	-0.01	-0.02	0.84	-0.05	-0.01	0.17	0.05
Brazil	0.65	0.26	0.09	0.00	0.00	1.31	-0.15	-0.22	0.08	-0.02

Notes: The table presents the contribution of the cyclical component of each flow to cyclical volatility of the unemployment rate an the share of formal employment for Mexico and Brazil following Fujita and Ramey, 2007. We define recession as output below trend. O=Out of the Labour Force, U=Unemployment, E=Employment, S=Informal Self-Employed, I=Informal Salaried, and F=Formal Sector, all as proportions of working age population. Data for Mexico (left panels) is drawn from the quarterly National Urban Labor Survey (ENEU) from 1987:Q1 to 2004:Q4. Data for Brazil (right panels) is drawn from the Monthly Employment Survey (PME), quarterly averaged from 1983:Q1 to 2001:Q2.

Appendix: Fujita and Ramey Approach to Unemployment Accounting

We briefly show the alternative procedure for unemployment accounting designed by Fujita and Ramey (2007). Considering only employment and unemployment, they show that the unemployment rate can be closely approximated by its steady state value

$$u_t \approx u_t^* = \frac{q_t^s}{q_t^s + q_t^f} \tag{A.1}$$

Where u_t is the current unemployment rate, u_t^* is the steady state unemployment rate and, q_t^s and q_t^f are the separation rate and the job finding rate respectively. Log linearizing around the trend values of u_t^* gives

$$\ln \frac{u_t^*}{\bar{u}^*} = (1-\bar{u}^*) \ln \frac{q_t^s}{\bar{q}^s} - (1-\bar{u}^*) \ln \frac{q_t^f}{\bar{q}^f} \tag{A.2}$$

Where, $\bar{u}^*$, $\bar{q}^s$ and $\bar{q}^f$ are the trend components of the steady state unemployment rate, the separation rate and the job finding respectively. In (A.2) the cyclical component of the steady state unemployment depends separately on the deviations of the inflows and outflow from their trend with a residual term. This can be expressed as,

$$du_t^* = du_t^s + du_t^f + e_t \tag{A.3}$$

The variance of du_t^* can then be written as

$$Var\,(du_t^*) = \text{cov}(du_t^*, du_t^s) + \text{cov}(du_t^*, du_t^f) + \text{cov}(du_t^*, e_t) \tag{A.4}$$

The total contribution of the inflow and outflow rates can be expressed as proportion of total variation in u_t^* where the weights or "beta values" mapping each of the three components in the right hand side of equation (5) to changes in du_t^* are,

$$\beta^s = \frac{\text{cov}(du_t^*, du_t^s)}{Var(du_t^*)} \qquad (A.5)$$

$$\beta^f = \frac{\text{cov}(du_t^*, du_t^f)}{Var(du_t^*)}$$

$$\beta^e = \frac{\text{cov}(du_t^*, e_t)}{Var(du_t^*)}$$

And where $\beta^s + \beta^f + \beta^e = 1$.

Incorporating the informal sector

Incorporating informal salaried and self employed sectors expands the number of states to five and makes an analogous exercise somewhat less straightforward to implement. The variance of the unemployment rate can no longer be attributed neatly to particular components of the respective flows. Therefore, in order to operationalize (A.2) for our data, we make two important assumptions. First, as most of the studies for the US we abstract from flows in and out of inactivity. This way we get comparable estimates of those of Fujita and Ramey (2007). Second, we constrain the inflow rate into unemployment and formal employment to be common from all sectors. As the discussion above suggests, inflow rates into unemployment and formality are reasonably homogenous from every other sector of employment (countercyclical and procyclical, respectively). Outflows are not, however, and we leave those unconstrained. Those from unemployment into formal employment are strongly procyclical while mildly countercyclical towards informal self-employment. Those from formal employment towards unemployment are very different from those towards other (informal) employment sectors.

Under these assumptions the unemployment rate and the proportion of formal employment (as share of the labor force) are given by their steady state values.

$$u_t \approx u_t^* = \frac{q_t^{A-U}}{q_t^{A-U} + q_t^{U-S} + q_t^{U-I} + q_t^{U-F}} \qquad (A.6)$$

$$f_t \approx f_t^* = \frac{q_t^{A-F}}{q_t^{A-F} + q_t^{F-S} + q_t^{F-I} + q_t^{F-U}}$$

Where, q_t^{A-U} and q_t^{A-F} represents the average rate of entering unemployment and formal employment from every other sector respectively[26], and $q_t^{U-S} + q_t^{U-I} + q_t^{U-F}$ and $q_t^{F-S} + q_t^{F-I} + q_t^{F-U}$ represent the outflow rates form unemployment and formal employment.

These assumptions do not do great violence to our simulations: the calculated steady state unemployment rate are, again, virtually identical to the actual series and their correlations are over 0.9 for both countries. This suggests that we are capturing most of the relevant variation.

Analogous to equation (A.4), we decompose total variation in unemployment and formal employment into flows into unemployment, and the outflows towards formality and informality.

$$Var\,(du_t^{*}) = \text{cov}(du_t^{*}, du_t^{A-U}) + \text{cov}(du_t^{*}, du_t^{U-S}) + \text{cov}(du_t^{*}, du_t^{U-I}) + \text{cov}(du_t^{*}, du_t^{U-F}) + \text{cov}(du_t^{*}, e_t) \quad \text{(A.7)}$$

where

$$du_t^{A-U} = (1-\bar{u}_t^{*}) \ln \frac{q_t^{A-U}}{\bar{q}^{A-U}}$$

$$du_t^{U-j} = -(1-\bar{u}_t^{*}) \frac{q_t^{U-j}}{\sum_j q_t^{U-j}} \ln \frac{q_t^{U-j}}{\bar{q}^{U-j}}, \forall j = S, I, F$$

Similarly, the variance in formal employment can be decompose as,

[26] q_t^{A-U} and q_t^{A-F} are calculated by estimating a two by two instantaneous transition matrix following the procedure in Section III. In estimating q_t^{A-U} we divide the observations between employment and unemployment and hence q_t^{A-U} is equivalent to the separation rate q_t^{s} in equation (3). When estimating q_t^{A-F} we pool together unemployment and informal employment. There fore, q_t^{A-F} is the average inflow rate towards formal employment from unemployment an informal employment.

$$Var\,(df_t^{\,*}) = \mathrm{cov}(\,df_t^{\,*}, df_t^{\,A-F}) + \mathrm{cov}(\,df_t^{\,*}, df_t^{\,F-S}) + \mathrm{cov}(\,du_t^{\,*}, df_t^{\,F-I}) + \mathrm{cov}(\,df_t^{\,*}, df_t^{\,F-U}) + \mathrm{cov}(\,df_t^{\,*}, e_t) \quad \text{(A.8)}$$

where

$$df_t^{\,A-F} = (1 - \bar{f}_t^{\,*}) \ln \frac{q_t^{A-F}}{\overline{q}^{A-F}}$$

$$du_t^{\,F-j} = (1 - \bar{f}_t) \frac{q_t^{F-j}}{\sum_j q_t^{F-j}} \ln \frac{q_t^{F-j}}{\overline{q}^{F-j}}, \forall j = S, I, U$$

Table A.1 reports the decomposition in (A.7) and (A.8) for the whole sample and periods of recessions. The emerging message in both countries is qualitatively very similar to the results presented in earlier sections. Once we abstract from inactivity, between 70 to 80% of variance in unemployment is due to fluctuations in separation rates from the various sectors of employment. Another 20% is due to changes in the outflow rate towards formal employment. Also consistent with the findings of the previous section, and the US literature, only 10-20% of changes in formal employment are accounted for by fluctuations in the outflow rate from the sector with the majority being driven by the strong procyclicality of hiring. In Mexico, 70% variation in formal employment is accounted for by variations in inflows while in Brazil, the number exceeds 100%. That is, the shut down in hiring would have led to even larger contractions in the absence of a strong reduction in separations. This, of course, implies that the outflow rate towards informality is positively correlated with the variability of formal employment. This is a pattern that is common for both countries in times of recessions.