

# The Determinants of Rising Informality in Brazil:

Evidence from Gross Worker Flows

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## Abstract

This paper studies gross worker flows to explain the rising informality in Brazilian metropolitan labor markets from 1983 to 2002. This period covers two economic cycles, several stabilization plans, a far-reaching trade liberalization, and changes in labor legislation through the Constitutional reform of 1988. First, focusing on cyclical patterns, the authors confirm that for Brazil, the patterns of worker transitions between formality and informality correspond primarily to the job-to-job dynamics observed in the United States, and not to the traditional idea of the informal queuing for jobs in a

segmented market. However, the analysis also confirms distinct cyclical patterns of job finding and separation rates that lead to the informal sector absorbing more labor during downturns. Second, focusing on secular movements in gross flows and the volatility of flows, the paper finds the rise in informality to be driven primarily by a reduction in job finding rates in the formal sector. A small fraction of this is driven by trade liberalization, and the remainder seems driven by rising labor costs and reduced flexibility arising from Constitutional reform.

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This paper—a product of the Chief Economist Office, Latin America and Caribbean Region—is part of a larger effort in the department to understand labor market dynamics and the nature of 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](mailto:wmaloney@worldbank.org).

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# **The Determinants of Rising Informality in Brazil: Evidence from Gross Worker Flows<sup>\*</sup>**

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## **I. Introduction**

In a single decade, from the mid 1990 to 2000, the share of the Brazilian metropolitan area work force unprotected by labor legislation and thereby classified as “informal” rose an astronomical 10 percentage points. This episode is of relevance for several reasons.

First, such movements have been relatively common over the last decade: Urban informality increased in Argentina from 1992 to 2003 by 10 percentage points; in Venezuela from 1995 to 2003 by 8 percentage points.<sup>1</sup> To the degree that such increases represent the progressive exposure of the work force to risk and loss of other benefits, they are intrinsically worrying.

Second, understanding the causes of these movements can contribute to our understanding of the drivers of informality more generally. Brazil offers several dramatic policy changes across the period that theory suggests could affect gross labor flows and their volatility and hence the steady state size of the formal sector: a far reaching trade reform, and the establishment of a new Constitution in 1988 that had substantial impacts on labor costs and flexibility.

Third, unlike Argentina or Venezuela, Brazil offers an excellent panel data set that, with perhaps the exception of Mexico, is one of the very few in the developing world to have a sufficient time dimension for us to study the shifts in magnitudes of gross labor flows associated with two complete business cycles and the secular recomposition of the labor force.

This paper first applies recent advances in the study of labor market dynamics over the business cycle, introduced by Shimer (2005b) and Hall (2005) and confirms for Brazil the patterns identified for the US and for Mexico by Bosch and Maloney (2006):

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<sup>1</sup> See Gasparini and Tornarolli (2006)

the informal sector does not, as a first approximation, correspond to the disadvantaged sector of a segmented market.<sup>2</sup> That said, the relatively higher volatility of job finding rates in the formal sector leaves the informal sector absorbing more labor during downturns.

The paper then explores the determinants of the secular changes in gross labor flows that drove the increase in informality across the 1990s. We find that the driving dynamic was a reduction in formal sector hiring across the period. In explaining this reduction, trade liberalization had a statistically significant but relatively minor role while the changes in labor market legislation associated with the Constitutional reform appear more important.

### *Background*

As can be inferred from Table 1, in 1980, roughly 35% of the Brazilian labor force was found either managing small micro firms either as employers or independent self-employed, or working for firms of various sizes without a signed work card that would guarantee access to benefits. The implications of such a large uncovered sector have been the subject of sharp debate for decades. The dominant perspective with intellectual roots dating at least from Harris and Todaro (1970), equates the sector with underemployment or disguised unemployment- the disadvantaged sector of a market segmented by rigidities in the “formal” or covered sector of the economy. However, another emerging view keys more off the mainstream self-employment literature in the

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<sup>2</sup> In one of the first works studying gross job flows, Blanchard and Diamond (1991) argued that slowdowns of the economy are characterized by a significant increase in the number of workers transitioning from employment into unemployment. Consistent with this, Davis and Haltiwanger (1990 and 1992) in a series of papers using establishment data showed that job destruction is countercyclical. Both sets of findings constituted empirical support for the predominant search and matching models in the Mortensen and Pissarides tradition. See Mortensen and Pissarides (1994, 1999a and 1999b), Petrongolo and Pissarides (2001) and Pries and Rogerson (2005), Rogerson et al. (2005) for a review of these models and their implications. However, recently Shimer (2005b) and Hall (2005) have argued that, in fact, job separations are largely acyclical, while the finding rate is highly procyclical. That is, contrary to the conventional wisdom, unemployment rises because jobs become hard to find, not because they are destroyed. Further, Shimer (2005b) argues that the response of vacancies and unemployment to productivity shocks predicted by a standard search model explains only around 10% of the observed volatility of the job finding rate. Explaining these stylized facts, Shimer (2005b) and Hall (2005) argue, requires introducing wage rigidities into standard matching models.

style of Lucas (1978), Jovanovic (1982) and Evans and Leighton (1989), and argues that, as a first approximation, the sector should be seen as an unregulated, largely voluntary self-employed/micro firm sector.<sup>3</sup>

While the informal sector in all likelihood contains both types of actors, disguised unemployed and entrepreneurs, its exaggerated size in developing countries raises the stakes surrounding the relative proportions dramatically: if the roughly 35-60 percent of the Latin American 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 to eliminate segmentation, compelling. However, should the dynamics correspond more to a voluntary small firm sector that offers an alternative, but not obviously inferior income source then aggregate labor force dynamics may differ from what has been found in the US, but will not necessarily suggest pathology.

In all likelihood, there are elements of both at work. The lower opportunity cost of being self-employed in poor countries may raise the share of uncovered self-employed workers in developing countries (See Blau 1987, Maloney 2001). On the other hand, minimum wages or union wage setting have clearly proved able to generate segmented markets. In an intermediate position, in theoretical frameworks in the matching tradition (Mortensen and Pissarides 1994, 1999a, 1999b, Pries and Rogerson 2005), firing costs or other labor taxes may lead to a reduction in labor demand without inducing segmentation *per se*. That is, workers are still indifferent between formal and informal sectors, but the formal sector demand curve has shifted down. Further, the institutional framework can also generate incentives for workers to opt out of formality: subsidized social services delinked from the labor contract, or labor taxes passed on to workers that do not correspond to an equally valued benefit all shift the labor supply curve to the left. Thus, it is entirely possible for the formal and informal labor markets to be very integrated in the sense of offering jobs of similar quality at the margin, while the institutional structure may be characterized by substantial distortions (see Maloney 2004, Levy 2006).

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<sup>3</sup> For a review of the literature and early work on transition matrices in developing country see Maloney (1999, 2004)

Clearly, this debate over the causes of informality extends to the drivers of *changes* in the share of informality as well and this gives the Brazilian case its salience. Far reaching trade reform began in the mid 1980s but intensified around 1990. As Table 2 shows, import penetration ratios rose and effective rates of protection fell significantly. In a matching model, the resulting reduction in rents would lead to a reduction in the value of a vacancy and hence to a reduction in hiring in the formal sector, although not necessarily segmentation, leaving the residual of the work force to recur to the informal sector. To date, the most thorough test of the hypothesis of a relationship between trade liberalization and informality was undertaken by Goldberg and Pavcnik (2003) who, exploiting sectoral variation in protection across time, found no relationship between the share of informality and the reduction in trade protection in Brazil, and a modest relationship in Colombia. However, Gonzaga, Menezes Filho, and Terra (2006) identify important effects of the Brazilian trade liberalization on the allocation of workers between skilled and unskilled-intensive sectors as well skill-unskilled earnings differentials suggesting non-trivial impacts on the labor market that might have an informal sector counterpart. By extending the series on protection levels and studying the behavior of job finding and job destruction rates in response to protection variables, we are able to revisit this question in the context of gross worker flows and find evidence of a significant, albeit very modest, impact of trade reforms on informality.

The 1988 Constitutional changes had important implications for the labor code in several areas that theory predicts could lead to increasing informality. First, there was a generalized increase in labor costs and reduction in formal employer flexibility. Maximum working hours per week were reduced from 48 to 44, overtime remuneration was increased from 1.2 to 1.5 times the normal wage rate; vacation pay was raised from one to 4/3 of the monthly wage, and maternity leave increased from 90 to 120 days.<sup>4</sup> Second, some limitations on the power of organized labor were relaxed. Unions were no longer required to be registered and approved by the Ministry of Labor; decisions to

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<sup>4</sup> Paes de Barros and Corsueil (2001) among others also note that the maximum continuous work day was reduced from 8 to 6 hours although the exact meaning of this is unclear given that 8 hours remains the standard work day.

strike were left entirely to union discretion, the required advance notification to the employer cut from five to two days, and strikes in certain strategic sectors were no longer banned. Finally, firing costs were raised. The penalty levied on employers for unjustified dismissal, a category encompassing most separations considered legitimate for economic reasons in the US, increased by four times from 10% to 40% of the accumulated separation account (FGTS, Fundo de Garantia por Tempo de Serviço).

To date, the most comprehensive work relating these changes to the functioning of the labor market was undertaken by Paes de Barros and Corseuil (2001) who find that separation rates decreased after the Constitutional changes for short employment spells and increased for longer spells, but find inconclusive results on the impacts on flows into informality from the formal sector. However, again, matching models suggest that several of these reforms would lead to a reduction in hiring (job finding) rates as opposed to the separations that Paes de Barros and Corsueil study. By exploiting cross industry variation in proxies related to these reforms, we find suggestive evidence that the Constitutional reform had very strong impacts through this second channel.

We begin by exploring the cyclical behavior of gross labor flows to shed light on the nature of the role of the informal sector in the labor market. We then examine the determinants of the movements in flows that underlie the secular increase in informality across the period.

## **II. Data**

We draw on the Monthly Employment Survey (Pesquisa Mensal de Emprego, hereafter PME<sup>5</sup>) that conducts extensive monthly household interviews in 6 of the major metropolitan regions<sup>6</sup> and covers roughly 25% of the national labor market. 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. The PME is

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<sup>5</sup> For descriptions of the methodology underlying the Pesquisa Mensal de Emprego, see Sedlacek, Barros and Varandas (1990), IBGE (1991) and Oliveira (1999).

<sup>6</sup> São Paulo, Rio de Janeiro, Belo Horizonte, Porto Alegre, Recife and Salvador.



structured as a rotating panel, tracking each household across four consecutive months and then dropping it from the sample for 8 months, then reintroducing it again for another 4 months. Each month one fourth of the sample is substituted with a new panel. Thus, after 4 months the whole initial sample has been rotated, after 8 months a third different sample is being surveyed, and after 12 months the initial sample is interviewed. Over a period of two years, three different panels of households are surveyed, and the process starts again with three new panels. To minimize problems induced by attrition that increases with the time between interviews, we focus exclusively in the first two observations. Regrettably, the PME was drastically modified in 2002 and it is not possible to reconcile the new and old definitions for unemployment and job sectors.<sup>7</sup> Hence, our analysis begins in 1983 but stops at 2002.

There is broad consensus in the literature on the definition of informality from a labor market perspective both in the mainstream and Brazilian literature. A comprehensive survey of work studying the size and evolution of the Brazilian informal sector in the labor market can be found in Ulyssea (2005) and a summary of stylized facts of the eighties and nineties is detailed in Ramos and Reis (1997), Ramos (2002), Ramos and Brito (2003), Veras (2004), and Ramos and Ferreira (2005a,b). We follow this literature in definition by dividing employed workers into three sectors: formal salaried (F)-public employees and workers whose contract is registered in his/her work-card or *carteira de trabalho*<sup>8</sup> that entitle the worker to labor rights and benefits; informal salaried (I), salaried workers in private firms without *carteira*; and informal self employed (S.E.). Ideally, following the ILO we would distinguish by firm size as well, focusing on establishments of fewer than 5-10 as informal employees, however the PME does not tabulate this information and hence, we rely purely on the basis of lack of signed *carteira*- as the critical distinguishing characteristic.<sup>9</sup>

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<sup>7</sup> We are grateful to Lauro Ramos for providing the old PME dataset for 2002.

<sup>8</sup> According to the Brazilian legislation, registered workers are the ones whose labor contract is registered on their work-card. This registration entitles them to several wage and non-wage benefits such as 30 days of paid holiday per year, contribution for social security, right to request unemployment benefit in case of dismissal, monetary compensation if dismissed without a fair cause, maternity and paternity paid leave and so on.

<sup>9</sup> 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

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.L.F.), and the unemployed (U). The behavior of these two groups has also received substantial attention in the US literature and, while not the focus of our analysis, we document how similarly they behave in Brazil. Tables 1 and 3 retrieve the sector sizes and some worker characteristics for all five different sectors.

### **III. Overview: The Brazilian Labor Market, 1983-2002**

#### *Movements in employment shares*

We first focus at the evolution of each sector's share of the labor force from 1983-2002. The period from the late 1980s to the first half of the 1990s was a turbulent one, comprising a persistent hyperinflation and six major stabilization plans designed to control it, a Constitutional change, and several other reforms including a dramatic reduction in barriers to trade. Across the whole period Brazil experienced one major and two minor recoveries, the 1990 crises, and slow downs in 1999 and 2001 (see Figure 1). Figure 2 plots the unemployment rate and the share of workers out of the labor force and Figure 3 the sizes of formal, informal and self employed sectors. Table 1 provides more detail for 1983, 1989 and 2002, and Table 3 the corresponding worker characteristics.

We divide the period into 4 periods, broadly linking the evolution of the macro economy and the labor markets.

*Period 1: Recovery (1985-1989).* The recovery from the recession of the early 1980's reduced unemployment to levels hovering around 2%. Triple-digit inflation

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establishments with less than 5. In fact, Bosch and Maloney (2006) find that in Mexico, the ILO's criteria of small firm size and ours of lack of registration are similar in motivation conceptually and lead to a great deal of overlap. 75% of informal workers are found in firms of 10 or fewer workers. Since owners of firms or self-employed are not obliged to pay social security contributions for themselves, we in fact consider them as informal self-employed with no social security contributions (and hence without the benefits that are perceived by salaried workers holding a *carteira*).

persisted despite the 1986 Cruzado Plan, which created a new currency, eliminated monetary correction, and froze wages and prices. 1988-89 saw the reforms of the Constitution and labor legislation.<sup>10</sup>

*Period 2: Plan Collor and structural reforms (1990-1994).* The economy entered a deep recession and record inflation rates in 1990. The Collor Plan undertook sweeping economic reforms and greater integration into the world economy and in September/October 1991, the exchange rate was again pegged. Despite the modest increment in unemployment during this episode (rising from 2% to 3%), it was here that the secular trends in formal and informal shares became pronounced.

*Period 3: Recovery (1995-1998).* The Tequila crises led to only a slight slowdown in mid-1995 after which Brazil experienced a period of recovery with low and stable rates of unemployment, but continued sustained growth of the informal sector.

*Period 4: External shocks (1999-2001).* The Asian and Russian crises of 1999 contributed to abandoning the peg of the Real to the US dollar and a modest recession. In addition, the 2001 slow down of the U.S. economy led to a minor economic slowdown. Unemployment increased mildly around 1 percentage point across the period and growth resumed at a steady rate in 2002.

By the end of this period, informality appears to have leveled off at a new plateau roughly 10 percentage points above its level at the beginning of the 1990s at roughly 50% of the employed workforce. This trend is now well documented in the literature (see for example Ramos and Ferreira (2005ab), Ramos and Reis (1997), The World Bank and IPEA (2002)). Ramos (2002) suggests that the increasing informality was associated with a structural component rather than with a cyclical one and stresses the increasing share of services/nontradables (typically an absorber of informal labor) along with the reduction of manufacturing/tradable sectors (traditional absorber of the formal workforce), but

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<sup>10</sup> See Paes de Barros and Corseuil (2001) for a summary of the most influential labor related constitutional changes.

finds that only 25% of the rise can be explained by such an intersectoral reassignment. Similarly, Goldberg and Pavcnik (2003) find that when decomposing the change in the share of informal workers in total employment between 1987 and 1998 into within and between industry shifts, eighty-eight percent of the increase in the informal employment in Brazil stems from movement of workers from formal to informal jobs *within* industries.<sup>11</sup> Hence, the source of the documented trend is largely working through the composition of subsectors of workers, formal and informal, as opposed to the structure of the economy.

#### **IV. Gross Flows of Workers**

The analysis of gross worker flows in Brazil is rendered complicated by the substantial macro volatility just documented that accompanied the secular tendencies that are our primary interest. In particular, it is difficult to know whether we are seeing a change in how the labor market adjusts to shocks due to micro economic reforms, or the secular adjustment to a new macro policy regime. In what follows, we will attempt to tease these apart. Generally speaking, we find patterns of overall gross flows of workers and their complement, duration within sectors, that are consistent with previous work in Mexico and, in many cases, the OECD, that suggest that the informal sectors behave much more like alternative modes of employment than unemployment. However, there is strong evidence of a sharp change in the early 1990s.

To understand both cyclical and secular movements, we study the transition of workers among the distinct various sectors of work. The transition probabilities among sectors are generated, as in Bosch and Maloney (2006) by assuming an underlying continuous time Markov process can be estimated from the discrete transition data. The details on the estimation process are in Annex 1.

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<sup>11</sup> Similar results are reported by Bosch and Maloney (2006) for the Mexican case.

Table 4 reports the summary of transition intensities through the workforce pooling the entire 1983 to 2002 sample. These average results show that duration in unemployment is very short (a bit more than one month) while inactivity (OLF) is close to ten months with the probability of acceding to a job correspondingly higher in the former. Relative durations of employment types are similar to those found elsewhere for Mexico and Argentina: informal salaried workers show the lowest duration (2 months), informal self employed the next longest (4 months) and formal salaried the longest at roughly 10 months.<sup>12</sup> Raw durations (Figure 4) show substantial secular decline of roughly 35% in the formal sector across the period and complementary movements in Informal Salaried and unemployment from the late 1980s. Both may be consistent with the shifting of longer tenure workers from the formal to the informal salaried sector and greater difficulty in leaving unemployment.

To study cyclical movements, we first time-aggregate the underlying monthly data to quarterly averages. We then follow Shimer (2005a) and remove the trends of the quarterly averages of each variable using a Hodrick Prescott Filter. Finally, we smooth the results by computing moving averages of the filtered series with a centered window of three quarters. The middle periods of these rolling windows are depicted in Figure 4 along with filtered GDP. As is the case in Mexico and the US, countercyclical movements are observed in the durations of the three employment sectors. However, in the early 1990s, the pattern becomes muddier. The very high correlations between detrended durations of formal and informal salaried employment (0.83) suggests that the factors determining turnover (i.e: macroeconomic conditions dictating quitting or firing) affect formal and informal jobs in a similar fashion. The non-employment sectors also reveal the patterns now standard in the mainstream literature and in Mexico: duration of unemployment moves countercyclically reflecting the ease of finding jobs during upturns, while duration in OLF is procyclical, likely reflecting voluntary inactivity.<sup>13</sup>

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<sup>12</sup> See Bosch and Maloney (2005)

<sup>13</sup> Our findings are consistent with those of Flinn and Heckman (1983) for the US that, in Brazil as well, OLF and unemployment are distinct labor market states.

These changes in duration correspond, of course, to swings in separation and transition rates and here again we find great similarities in behavior across the sectors. The probabilities of transiting between formality and the two sectors of informality (Figure 5) suggest pro-cyclical patterns of job allocation across all sectors of employment and the movements are highly correlated within pairs of bilateral flows, especially in the case of self-employment and formality: the de-trended series of S-F and F-S transition rates, and I-F and F-I transition rates show correlations of 0.84 and 0.44 respectively. These patterns correspond closely to the pro-cyclical patterns in job-to-job flows observed in U.S. literature on job-to-job flows (Shimer 2005c) that are generally attributed to workers finding better jobs in tighter job markets, or when workers are involuntarily separated in the normal churning process but find another before entering the unemployment pool. They are less consistent with the informal sector being the disadvantaged sector in a segmented labor market which would imply negative correlation between these flows across the business cycle. That said, again, the raw series suggest a structural change occurring, in the early 1990s. Flows between SE to F diverge with F to SE staying high and the reverse falling. The comovements among F and I broadly reverse sign across the same period.

Figures 6a show the flows from each of the employment sectors into unemployment and inactivity. For all sectors, as found for the US by Blanchard and Diamond (1991) and Hall (2005), flows into inactivity are pro-cyclical whereas flows into unemployment are clearly countercyclical and dramatically so during the 1983 and 1999 crisis. That said, consistent with Mexico, formal separations are relatively invariant while the informal show the largest volatility in separations, perhaps reflecting the risk attending informal micro enterprises and the necessary adjustments via quantities to cope with economic fluctuations. But it is not the case that the informal sectors are playing the role of disguised unemployment. Table 5 shows that the correlation of the HP de-trended flows from formality into unemployment, informal salaried and self employed work with respect to unemployment rate are 0.10 and -0.19 and -0.56 respectively suggesting very different motivations for entry.

Figure 6b suggests a mirroring asymmetry: the job finding rate in the formal sector is highly pro-cyclical and very volatile (see Table 5). This is also true for the job finding rate from inactivity. However, the job finding rate in the informal sector although noisy is reasonably constant, including during the crisis.

To summarize, the broad patterns of duration, transitions among sectors and into and out of unemployment are all suggestive that the three sectors of work are far more similar than they are distinct. The flows among them are far closer to the salaried sectors observed in the US with the informal sector providing competing options rather than a traditional segmentation view. The different cyclical volatilities of entry and exit with respect to unemployment, also found in Mexico, do have important resonance with the debate in the mainstream literature (see Bosch and Maloney 2005) over labor market functioning and, in addition are critical to how the labor market adjusts to shocks.

## **V. Accounting for Changes in Unemployment and Sectoral Shares with Gross Flows**

Much of the motivation of the analogous US literature has been the desire to understand how much of changes in unemployment rates are driven by changes in job-finding, job separation and job reallocation probabilities. We have the same general interest in developing countries, but in addition, would like to understand the dynamics underlying the secular movements in sectoral shares discussed above. We follow Shimer's (2005a) strategy of isolating the impact of a given type of gross flows on the aggregate sector sizes by using the generated instantaneous transition probabilities to construct the predicted steady state values of our five possible states for each period. We then compute the size of the sector that would result if we allow one particular transition to vary and leave all the other transitions constant at their average values during the period (see Annex 2).

### *Unemployment*

The upper and lower panels of Figure 7a show the impact of changes of flows into and out of unemployment and the formal sector on their respective sector sizes. Two points merit attention. First, Figure 7a suggests that flows from OLF into unemployment (lower panel) appear to have an inordinate explanatory power until the early 1990s and maintain a contribution across the entire sample. This is somewhat distinct from the Mexican case where flows from the informal sectors into unemployment were dominant drivers of the size of the sector. Second, consistent with the discussion above, reduced accessions to formality appear to be the most important factor on the outflows side. But again, there is some difficulty in teasing out cyclical from secular effects. The sharp rise in unemployment during the 1998 recession seems a combination of a substantial, but not unprecedented increase in flows into the labor force from inactivity layered on a secular decrease in the ability to get formal and informal salaried jobs.

### *Formality*

Until the early 1990s, fluctuations in the size of the formal sector were more than accounted for by procyclical changes in flows into the sector, which were partially offset by the procyclical movements in separations: That is, in downturns fewer people quit, but even fewer were able to get jobs. (Figure 7b) This is consistent with the findings for salaried employment in the US, and with the general story from Mexico about how LDC labor markets adjust to adverse shocks. During the 1983-85 crisis, flows into formal employment from all sectors and unemployment (Figure 7b) fell dramatically, leaving the informal sectors, which show more constant hiring rates during the crisis, to account for a rising share of workers. In a sense then, as Bosch and Maloney (2006) note for Mexico, the informal sectors serve the role of a shock absorber of a sort, just not in the traditional sense of an immediate destination for separated formal workers. But it is important to highlight that during the recovery, transitions into informality from formal work rise as do transitions into informal salaried work from unemployment. The upturn provides new



opportunities in the small firm sector with the attractions that independence and possibly better money it offers.

The upper and lower panels of Figure 7b document a break in the determinants in the size of the formal sector beginning in the early 1990s driven by two important innovations. First, the flows into formal employment from other sectors during the 1995-1998 recovery did not increase in anywhere near the same magnitudes that they did in the 1986-1990 recovery. Second, formal separations to all sectors, which previously behaved in a procyclical fashion that, as mentioned above, offset the forces driving the sector's procyclical evolution, now appear to reinforce them. The reduction in flows from All to F, and in particular from S.E. & I, explains the majority of the decline in the size of the formal sector from 1990 on, with the remainder explained by the now secularly increasing separation rate. This finding of the importance of the reduction in formal hiring may partly explain why Paes de Barros and Corsueil (2001), focusing exclusively on separations, found no impact of the Constitution on the informal sector. The task in the next section is to isolate what drove these changes in gross flows, and in particular the fall in hiring rates.

## **VI. Constitutional Change or Trade Reforms? Determination of the Dynamics and Size of the Formal Sector**

As discussed above, the trade and constitutional reforms have received the most attention in explaining the observed increase in informality and, to the degree possible we will attempt to explain the changes in gross labor flows with proxies for these reforms.

*Trade Liberalization:* We employ two proxies for the liberalization of the trade regime, Muendler's (2002) import penetration ratio, and Kume et al.'s (2003) real effective trade protection rates, both measured by industrial sector for the period 1987-1998. Data is drawn from Pinheiro and Bacha de Almeida (1994) to complete both series for the period 1983-1986 and from Nassif and Pimentel (2004) to complete the import penetration series up to 2002. Effective protection is preferred to nominal tariffs as before 1988 non-

tariff barriers implied that most tariffs were redundant, that is the tariffs exceeded the differential between internal and external prices (see Hay 2001 and Kume et. al. 2003). We assume that individual firms take these changes as exogenous and hence use the complete series. Since our interest in the end, is to identify the maximum contributions of trade variables to the evolution of the dependent variables, rather than identify individual effects, we include both variables simultaneously despite some clear conceptual overlap. Figure 8 shows the dramatic effects of reforms: a reduction to one-third of the level of effective protection (from 1988 to 2002) and doubling of import penetration rates (during the same period). This, along with the fact that higher reductions in the formal hiring rates observed in diverse industries (see Figure 9) appear accompanied by higher import penetration ratios<sup>14</sup> suggests that trade liberalization may have been important.

We develop three proxies to capture the impact of elements of the Constitutional reforms discussed in the introduction. Unlike the trade variables, we do not have a continuous series of arguably exogenous innovations across time, but rather a reform implemented at one moment.<sup>15</sup> Hence, we are especially dependent on the cross sectional variation in the impact of the reforms for identification. We calculate pre-reform values for formal workers by sector and then interact them with a dummy for the Constitution. This effectively exploits the cross sectional impact of the reforms across several dimensions.

*Union density:* As discussed above, the reforms generally shifted power toward the unions and hence we would expect sectors with greater union representation to be more affected. The National Household Survey (Pesquisa Nacional Por Amostra de Domicílios<sup>16</sup> PNAD), a complementary employment survey with greater coverage but no

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<sup>14</sup> The relation between changes in hiring rates and effective protection seems to be orthogonal before controlling for any other effect.

<sup>15</sup> Impacts of Constitutional changes appear to be of different magnitude for formal and informal workers. For instance, Figure 8 shows a differentiated evolution of the aggregate incidence of overtime and of the tenure of workers before dismissal between both sectors. Nevertheless the time variation of the proxies can certainly be treated as exogenous and attributed to the Constitutional change just for the periods in the neighborhood of 1988.

<sup>16</sup> Data to compute the union density by industrial sector and to identify the sources of provision of health services before reforms was drawn from this source.

panel dimension, asks workers if they are affiliated with a union and from this we calculate density by industrial sector over all years where the variable is tabulated (1986, 1988 for the pre constitutional change period and 1992 to 1999, but 1994 for the remainder). As in Saba (2001), we restrict the sample to individuals of 18 to 65 years of age, economically active in the formal sector, and earning a positive wage.

*Firing Costs:* The Constitutional reform raised the penalty on employers upon firing a worker from 10% to 40% of the mandatory workers separation account, the FGTS, the accumulation of which, in turn, is a function of tenure. In the spirit of Gonzaga (2003) and Heckman and Pages (2000), we propose that sectors with longer tenure at firing would find the Constitutional change more onerous and approximate firing costs by average tenure (in years). The PME asks fired workers about their tenure in the previous job and we, again, aggregate to get a measure of tenure by industry.

*Overtime:* The Constitution reduced the legal limit from 48 to 44 hours per week. We expect that industries with a larger share of the of the work force working more than the new legal limit, as reported by the PME, would face the largest adjustments.

In all three cases, we fix the values to the average observed before the constitutional change in order to be sure that the cross sectional variation is not endogenously driven after the constitutional change. Figure 9 depicts in scatter plot the relationship between the changes of formal hiring rates (before and after 1988) and the level of each of our proxies for the different industrial sectors and shows that, unconditionally, higher reductions in formal hiring rates are coupled with higher values of labor costs, of firing costs and of unionization.

We estimate four specifications in which the dependent variable is either the creation rate of formal jobs (inflows to formal from all other sectors), the destruction rate of formal jobs (outflows from formal to unemployment sector), the size of the formal sector, and what Goldberg and Pavcnik (2003) call “industry formality differentials” –

differentials conditioned on worker characteristics.<sup>17</sup> We confirm Goldberg and Pavcnik's (2003) findings that the vast majority (88%) of the change in informality takes place within sectors and hence seek identification off the variation in the impact of reforms across sectors.

All the dependent variables are computed yearly for each of the 18 industries<sup>18</sup> from 1983-2002, based on the PME and are defined above. The yearly destruction and creation rates are pooled instantaneous transitions computed using monthly data following the procedure of Geweke et. al. (1986) outlined in Annex 2. The formal sector size and the industry differentials corresponds to annual averages computed using the monthly inputs from the PME . The latter were obtained following Goldberg and Pavcnik (2003).<sup>19</sup>

Our core specification is

$$Y_{jt} = \alpha_j + \alpha_t + \overline{TRADE}_{jt} \beta_{TRADE} + \overline{D*CC}_j \beta_{D.CC} + u_{jt}$$

where  $Y_{jt}$  represents one of four dependent variables,  $\alpha_j$  and  $\alpha_t$  represents the industry and year fixed effects respectively.  $\overline{TRADE}_{jt}$  is a vector containing both effective tariffs

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<sup>17</sup> Industry differentials come from the following model:  $F_{ijt} = H_{ijt} \beta_{Ht} + I_{ijt} INDDIF\_F_{jt} + \varepsilon_{ijt}$  where  $F_{ijt}$  is an indicator for whether a worker  $i$  employed in industry  $j$  at time  $t$  works in the formal sector,  $H_{ijt}$  is a vector of worker characteristics: gender, age, age<sup>2</sup>, education indicators (primary, secondary, superior) with associated coefficients  $\beta_{Ht}$  and  $I_{ijt}$  is a set of industry indicators (determining worker  $i$ 's industry affiliation) with associated coefficients  $INDDIF\_F_{jt}$  (industry formality differentials)

<sup>18</sup> Non Metallic, Metallic, Mechanical, Electrical, Transport, Furniture, Paper, Rubber, Leather, Chemicals, Petroleum, Personal Care, Plastic, Textile, Apparel, Food, Beverage, Tobacco (see Table 2).

<sup>19</sup> Following Goldberg and Pavcnik, we first use a linear probability model to regress the informal dummy indicator on a vector of worker characteristics and on a set of industry indicators representing the workers' industry affiliation. The coefficients on industry indicators can be considered "industry informality differentials" stripped of worker characteristics which are then pooled over time and regressed on trade related industry characteristics using industry fixed effects and in first differences specifications. Their results are based on Brazilian PME and on Colombian National Household Survey. In the first case they suggest that there is no statistical relationship between industry's exposure to trade and probability of working in the informal sector, in the second, they report that tariffs' declines are associated with an increase in informal employment prior to labor market reforms and suggest that compared to labor market rigidities, trade policy is of secondary importance in determining the incidence of informality.

and imports penetration and  $\overline{D^*CC_j}$  is a vector of the constitutional variables interacted with a dummy variable capturing the constitutional change of 1988. Again, though, in theory, the two trade variables should be capturing similar things, since we are more interested in “soaking up” as much explanatory power from the trade liberalization that might be correlated with the constitutional variables than identifying the specific effect of an individual variable, we include them both.

We begin with five preliminary univariate specifications to explore the explanatory power of each of the component variables individually and then with the static specification above. Finally, because we expect that reforms may not work through the labor market instantaneously, we include two lags of all variables and then proceed to more parsimonious specifications.

Preliminary analysis of the data reveals substantial trending in the variables suggesting that the above specifications may yield spurious results. However, Levin Lin Chu (2002) panel unit roots tests reject non-stationarity in the residuals of the non-dynamic levels specification suggesting that we can treat it as capturing a cointegrating relationship. However, as a robustness check, we also estimate a pooled first difference estimator. All specifications are estimated using Cross Section Weighted Least Squares and the inference is based on robust (Huber-White) standard errors clustered by industry.

### *Results*

Table 6 reports the estimation of the univariate and static specifications. Although these are very preliminary models, they generate two suggestive findings. First, the postulated explanatory variables appear most statistically significant in explaining job creation, somewhat less sector size and industry differential, and finally very little of job destruction. Second, both sets of variables appear to have explanatory power for all dependent variables, albeit to greater or lesser degree.

Results of our preferred specification (in levels) are reported in Table 7a. Introducing dynamics improves the specifications which appear overall well specified, with most variables entering significantly. Since the trade variables never enter significantly beyond the contemporaneous, we dropped dynamic terms for them. The difference specifications in Table 7b are very similar though generally showing lower levels of significance. The negative autoregressive terms in the latter suggest over-differentiation lending support to the appropriateness of the levels specification.<sup>20</sup>

Trade openness, and in particular, import penetration enters significantly and of predicted sign in all specifications with the exception of job destruction. This is consistent with Goldberg and Pavcnik's findings for Colombia, although it conflicts with those for Brazil where they found no effect of import penetration, albeit with very different specifications.

The proxies for constitutional change also emerge as significant and generally of predicted sign with, again, the least satisfactory results appearing in job destruction. With the exception of a non significant impact on job separations, tenure enters of predicted overall effect in the industry differentials and creation specifications. The positive contemporaneous value swamps the expected sign on the first lag in the sector size specifications to leave an overall unexpected sign. Overtime enters as predicted in all specifications with the exception of destruction where it enters negatively. Union power enters strongly significantly as a negative factor in job creation and a positive factor in destruction, and less significantly, but still of similar effect in industry differentials. The strongly positive effect on sector size, while perhaps not unintuitive in itself, nonetheless suggests a different dynamic than the other specifications.

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<sup>20</sup> It provides useful information besides to help to check consistency of the specifications in levels. For example, although the regression to explain formal job destruction in levels proved to fit the explained variable with a high degree of adjustment, its specification in difference showed to have a poor adjustment and be mainly driven by the AR process of the dependent, reinforcing in some sense the results found by Paes de Barros. This does not occur with the model of job creation that proved also to be consistent and not mainly driven by the AR process in the specification in differences.

These results are somewhat at odds with Paes de Barros and Corseuil (2001) who found no impact of constitutional proxies on labor demand, although since they employ a manufacturing survey that cannot separate formal and informal workers the way that it is done here,<sup>21</sup> to the degree that the sampled firms may simply be hiring the same number of workers, but granting fewer signed work cards, the results could be consistent with our findings. However, perhaps more consistent with their inability to explain job destruction rates, these are our least satisfactory specifications. Paes de Barros and Corseuil also use the PME in a difference in differences analysis of hazard rates of the termination of formal employment in the next month conditioned on current duration. In this sense, they are examining a very similar phenomenon to our separation rates.<sup>22</sup> They get ambiguous results in the hazard and transition intensities rates out of employment finding that separation rates have decreased after the constitutional changes for the short employment spells and increased for longer spells.<sup>23</sup> The finding that resolves both Paes de Barros and Corseuil and our weak modeling of job destruction, with our reasonably strong modeling of sector size and industry differentials are the the strong specifications for job creation. Here, all explanatory variables enter of expected sign and of a high degree of significance.

The difference specifications are broadly consistent although the negative autoregressive terms suggest that, in fact, we may be over differencing. Trade protection has similar signs although here effective rates of protection are the most important (only

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<sup>21</sup> The sample also differs in not covering firms of under 5 workers and in a different spatial coverage than the PME. They generate their finding by running the coefficients from monthly estimates of the autoregressive term and the short run elasticity with respect to wages on an indicator for the constitutional change and controlling for a set of basic macroeconomic variables.

<sup>22</sup> Although they identify two additional possible sources of cross sectional variation (quits versus layoffs and short versus long employment spells), the formal-informal partition of the worker population constitutes the preferred alternative of treatment (formal) and control (informal) groups.

<sup>23</sup> When they regress monthly estimates for the aggregated hazard rate on an indicator for the constitutional change, an indicator for the group (treatment and control), a set of macroeconomic indicators and interactions between the group indicator and each of the macroeconomic indicators and also on the constitution indicator, they do not find evidence of any effect of the constitution change on the informal sector. For some cases, they observe that differences between the formal sector's turnover variation (pre and post the constitutional change) and the informal workers' turnover variation are positive for some spells and negative for others. For example, for the shortest spell (duration of employment less than 3 months) they found that the turnover variation in the informal workers was greater than in the formal cases, lower for the intermediate spell (duration of employment between 3 and 12 months) and almost equal for the longest spell (duration of employment between one and two years).

for industry differentials and creation) and import penetration is not. Both union power and overtime enter as negative factors in size and creation and a contributor to destruction in all specifications and significantly. Tenure enters somewhat counter-intuitively in all differenced specifications.

Figure 10 attempts to quantify the relative contribution of these determinants by presenting simulations based on the estimated coefficients of the levels specification for creation, destruction, and formal sector size. Overall, the fitted values capture the evolution of these series reasonably well. We then examine the impact of trade liberalization by holding the trade variables at their initial values and using the model to simulate the evolution of formality. Although the impact on destruction is meager, the impact on job creation between 1990 and 2002 is important: job creation would have been higher by 5 percentage points, or about 20% of the total change in job creation.

We repeat this exercise but this time suppressing the effects of our proxies for constitutional change. We find that with no constitutional changes, the job creation rate would have maintained a constant average of roughly 70% (i.e. two times its value at the end of the 1990s) while the destruction rate would have increased only in 0.5 percentage points. Hence, the impact of the reforms comes virtually entirely through an impact on hiring rates in the formal sector.

We approach measuring the impact on sector size in two ways. The first is to repeat the above exercise with the coefficients from the aggregate regression on size. In fact, the lower panel of Figure 10 suggests that the reform covariates explain little with most predictive power coming through the time dummies. Formal sector size would have been 3 percentage points or 4% higher in the absence of trade liberalization with the constitution contributing modestly.

However, the first two panels of Figure 11 suggest that, in fact the reform covariates were very important to the trajectories of job creation and destruction leading to far less creation and, in the case of the Constitution, far less destruction. Hence, our



second approach follows Shimer and simulates what the changing creation and destruction rates imply for the steady state level of formality in the same way as was done in Figure 7. Figure 11 suggests that the impacts of the reforms were now quite large.<sup>24</sup> There is a modest contribution of trade variables (3 percentage points or 21% of the reduction in formality), but a large impact of the constitutional changes (13 percentage points or 76% of the reduction in formality). The second panel suggests that the net effect of the Constitution was so large precisely because reduced creation, which the Constitutional reforms impacted negatively, had much larger impact on overall size than destruction which the Constitution generally reduced.

### *Other possible explanations*

In the simulations above, the trade variables explain under 5% of the secular movements in informality. The remainder is driven largely by discrete indicator variables interacted with cross sectional variation in constitutional proxies. Ideally, we might have more time series variation that could concretely rule out other possible phenomena not related to labor market legislation. We briefly review two possible candidates.

First, along with the Constitutional reforms affecting labor markets were initiatives changing the nature of health system implemented in the early 1990s that granted universal access to health services.<sup>25</sup> Carneiro and Henley (2003) suggest that

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<sup>24</sup> Formula (4) of Annex 2 takes the following form under this assumption:  $f = \frac{q^{nff}}{q^{nff} q^{fnf}}$ . Notice also that to perform this simulation, we use as a destruction rate the probability of transiting from the formal to all non formal sectors (not just only employment)

<sup>25</sup> See Annex 3 for details. Among the changes contemplated in the Social Security System Reform of 1991 (which comprises pensions, health, and social aid), health related amendments are the only candidates to be considered as possibly determinants. Although pensions reforms loosened the requirements to perceive a pension (age for eligibility and required years of services were lowered) and increased the benefits of recipients (see de Carvalho 2002 for a summary of the characteristics of the Brazilian security system before and after the reform), two reasons reduce its suitability to explain the composition and dynamics of the labor market: first, benefits are computed as a function of documented past earnings over the cumulated time of services except for those perceiving the minimum pensions hence in any of those cases there is no incentive for workers to move between formality or informality because of potential gains in switching due to pensions; second, the reforms should have exerted more effects over the elder population close to retirement which is not the critic mass driving the size and dynamics of the labor sectors.

uncovered employment may have risen because employees and employers collude to avoid costly contributions to a social protection system that is perceived to be inappropriate, inefficient and poor value for the money.<sup>26</sup> In principle, then, a universalization of health care de-linked from the labor market may have changed the cost benefit analysis of being enrolled in, and hence contributing to, formal sector benefits programs. In the end, they conclude that this is unlikely, not only because public health services continued to be thought of as substantially worse than the formal sector product,<sup>27</sup> but also because the effective supply of these services was available even for non contributors several years before the reforms took place (see Table 8), and little progress had been made on implementing the measures contemplated in the 1991 Social Security Reform.

Second, there was an increase in the magnitude of flows from the rural to the urban areas across the 1990s that, in principle, were it all directed toward the informal sector, might explain part of the rise.<sup>28</sup> Two facts lead us to discard this hypothesis. First, while there was a decrease in the size of the rural sector relative to the urban across the period, the population growth of the “metropolitan” areas that the PME is representative of (see Table 9) was roughly equivalent to that observed in non-metropolitan areas. Hence, there cannot have been substantial net migration into our sample.<sup>29</sup> This is consistent with the fact that the average schooling of informal workers increased significantly over the nineties and the schooling gap between formal and informal

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<sup>26</sup> Their estimates suggest that the earnings premium needed in the marketplace to compensate covered workers for having to make social security contributions varies between 7.5% and 12.2% of the mean uncovered hourly wage.

<sup>27</sup> The public system acts as a floor, available to all but used primarily by the lower classes (Jack 2000). Although evaluation of standards for minimum quality in infrastructure, human resources, ethical, technical and scientific procedures in hospitals have been implemented, these practices are far from being universal in the services network (PAHO 2005)

<sup>28</sup> See Ramos and Ferreira (2005ab) for a comprehensive description of the regional patterns of the Brazilian workforce.

<sup>29</sup> Even if all of the rural workforce contraction observed during the nineties would have been a consequence of emigration towards urban zones, it would have only explained 13% of the increase of the urban’s workforce (or 19% of the increase in the urban informal workforce under the assumption that all the rural incoming workers inserted to this sector exclusively). The size of the urban and rural workforce (as well as of the metropolitan and non metropolitan ones) and the size of the formal/informal sectors are computed using the PNAD. This survey covers urban and rural areas of the whole country except for the rural areas of the Northern Region (which comprises the following *Unidades da Federação*: Rondônia, Acre, Amazonas, Roraima, Pará and Amapá).

workers also decreased substantially suggesting that these are not poorer immigrants from the countryside entering the metropolitan workforce. In fact, Curi and Menezes Filho (2006) show that formal-informal transitions have been more intensive among more qualified workers. Second, *ceteris paribus*, an increase in the supply of unskilled workers in metropolitan areas should have translated into reducing relative informal/formal wages and Figure 12 suggests that this was not the case.

In fact, Figure 12 also suggests that for roughly the period 1994-1997, the expansion of informality was accompanied by a rise in informal earnings relative to the formal sector<sup>30</sup>. Fiess, Fugazza and Maloney (2006) find this is correlated with an appreciation of the exchange rate and consistent with a demand shock to the informal (nontradable) sector that raised both demand for workers and earnings in the sector. That is, part of the rise in informality is due to a normal reallocation of workers to a sector that is intrinsically informal. However, on either side of this interval, the behavior appears to suggest increasing segmentation accompanying the rise in the sector size which is consistent with the story we're discussing here.

## VII. Conclusions

This paper has sought to explain the evolution of the Brazilian labor market, and in particular, the expanding informal sector, through the lens of gross labor flows. It shows that the dynamics of the formal salaried sector in Brazil correspond closely to those established in Mexico and to those found by Shimer for the United States of relatively constant job separation rates, but varying job finding rates. As in Mexico, the informal sector shows more constant hiring rates across the cycle, consistent with a greater degree of wage flexibility. These findings confirm for Brazil, Bosch and Maloney's view of the adjustment of LDC labor markets across the cycle that has elements of the traditional view of informality across the crisis, but perhaps with an updated mechanism, and without a connotation of overall inferiority of the sector.

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<sup>30</sup> Ulyssea (2006) shows that the gap between the gross wage of formal and informal workers has fallen from 1995-2005 nevertheless the opposite can be said about the controlled (by workers characteristics) wage gap.

Transitions among *all* sectors, formal and informal, are broadly pro-cyclical and highly correlated to each other, providing some of the strongest evidence that most transitions into informality correspond to job-to-job transitions in the mainstream literature, and less to disguised unemployment. This is consistent with motivational responses of workers entering informal self employment in the PNAD that over 62% of the sector stated that they did not want a formal job. However, during downturns, the formal salaried sector stops creating new jobs, as is the case in the United States and Mexico, but, net, the informal sector does not.

However, the secular 10 percentage point contraction of formal employment across the 1990s suggests other forces at play. We establish that trade liberalization played a relatively small part in this increase, but find suggestive evidence that several dimensions of the Constitutional reform, in particular, regulations relating to firing costs, overtime, and union power, explain much more. Both effects work mostly through the reduction in hiring rates, rather than separation rates that have been investigated in the literature to date. Overall, the findings confirm the importance of labor legislation to firms' decisions to create new formal sector jobs in Brazil.

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## Annex 1. Estimation of Continuous Time Transition Probabilities

We calculate the transition probabilities across sectors by assuming that the observed discrete-time mobility process is generated by a continuous-time homogeneous Markov process  $X_t$  defined over a discrete state-space  $E = \{1, \dots, K\}$  where  $K$  is the number of possible states (job sectors) a worker could be found in. The worker is observed at equally distanced points of time. Starting from the discrete tabulations, one can construct a discrete time transition matrix  $P(t, t+n)$  where

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

being  $p_{ij}$  the probability of moving from state  $i$  to state  $j$  in one step ( $n$ ). 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  $n \rightarrow 0$ , this gives rise to a  $k \times k$  transition intensity matrix  $Q$  where

$$\frac{dP(t)}{dt} = QP(t) \tag{1}$$

whose solution is given by:

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

where  $Q$  is a  $k \times k$  matrix whose entries satisfy

$$q_{ij} = \left\{ \begin{array}{l} q_{ij} \in R^+, j \neq i, i, j = 1, \dots, K \\ q_{ii} = - \sum_{k=2, k \neq i}^K q_{ik} \leq 0, j = i, i = 1, \dots, K \end{array} \right\} \tag{3}$$

Thus,  $q_{ij}$  elements can be interpreted as the instantaneous rates (hazard rates) of transition from state  $i$  to state  $j$ . These must be seen as reduced form estimates combining both the disposition of workers to move to a different state as well as the available “spaces” in that state: a workers desire to take a certain job and the availability of that job, quits and fires etc.

In practice, the estimation of the continuous time transition matrix form is subject to two major difficulties. First of all, solution to equation 2 may not be unique. This is known as the aliasing problem. That is, it is possible for an observed discrete time matrix to have been generated by more than one underlying continuous matrix. On the other hand 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) approach that proposes a Bayesian procedure for statistical inference on intensity matrices as well as any function of the estimated parameters by using a uniform diffuse prior which allows establishing the probability of embeddability of the discrete-time matrix<sup>31</sup>. 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.<sup>32</sup>

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<sup>31</sup> Additional useful inferences can be obtained from estimation of the intensity matrix. For instance, duration times in state  $i$  can be shown to be distributed exponentially  $d_i \sim \exp(-q_{ii})$ , allowing us to retrieve the mean duration time in each sector as  $E(d_i) = -q_{ii}^{-1}$

<sup>32</sup> The probability of embeddability of all instantaneous transition matrices is in the range between 1 and 0.98

## Annex 2. Identifying the drivers of the steady state shares

Following Shimer (2005a) we construct the predicted steady state values of our five possible states for each period using the instantaneous transition probabilities generated above by solving

$$\begin{aligned}
 o(q^{ou} + q^{oi} + q^{os} + q^{of}) &= uq^{uo} + iq^{io} + sq^{so} + fq^{of} \\
 u(q^{uo} + q^{ui} + q^{us} + q^{uf}) &= oq^{ou} + iq^{iu} + sq^{su} + fq^{fu} \\
 i(q^{oi} + q^{ui} + q^{is} + q^{if}) &= oq^{oi} + uq^{ui} + sq^{si} + fq^{fi} \\
 s(q^{os} + q^{us} + q^{si} + q^{sf}) &= oq^{os} + uq^{us} + iq^{is} + fq^{fs} \\
 f(q^{fo} + q^{fu} + q^{fi} + q^{fs}) &= oq^{of} + uq^{uf} + iq^{if} + sq^{sf}
 \end{aligned} \tag{4}$$

and adjusting the resulting stocks so the corresponding shares sum to unity. Here,  $q$  is the discrete probability of transition calculated in the immediately previous period and where  $o$ ,  $u$ ,  $i$ ,  $s$  and  $f$  are the number of inactive, unemployed self employed, informal salaried and formal salaried workers. Following Shimer (2005a), we then compute the size of the sector that would result if we allow one particular transition to vary (i.e. transitions from formal salaried work into unemployment) and leave all the other transitions constant at their average values during the period. This allows us to isolate the impact of a given type of gross flows on the aggregate sector sizes.

### Annex 3. Brazilian Health Care System

There are two main aspects of Brazilian Health System reforms: coverage and financing.

#### *Coverage*

Extended coverage of health care was not exclusive of the post 1988 Constitution ages in Brazil. Lobato and Burlandy (2000) points out that from the 1970s on, social security coverage was extended to workers who previously had none, but benefits continued to be linked to contributions. In addition, emergency care was expanded to cover the whole population, independent of an individual's affiliation with social security. This provoked an unprecedented increase in the demand for services. The Instituto Nacional de Assistência Médica da Previdência Social (INAMPS, national institute of medical care and social security), contracted more and more often with third parties to care for the increasing clientele. This gave the private sector a progressively more important role in service provision. As a result, the publicly owned network shrank and deteriorated. By 1976, for example, only 27% of all hospital beds were public, while 73% belonged to the private sector.

With the intention to decentralize and universalize the provision of health services, several reforms were introduced. Succinctly, the transformation of the Brazilian Health system occurred in three phases<sup>33</sup>

Phase	Year	Law	Actions
1. Integrated Health Actions (Acoes Integradas de Saude – AIS)	1984	Resolução 06/84 Resolução 07/84, MS/MPAS/MEC/ CIPLAN	AIS shifted some supply to under-utilized public hospitals, and coordinated the functions of INAMPS with the Ministry of Health
2. Unified and Decentralised Health Systems (Sistemas Unificados e Descentralizados de Saúde – SUDS)	1987-1988	Decreto no 94657 Ministério da Previdência e Assistência Social, Instituto Nacional de Assistência Médica da Previdência Social.	SUDS led to a transfer of INAMPS staff and facilities to state health secretariats, with the central agency acting solely as a funding conduit (and being renamed the INSS - Instituto Nacional de Segurança Social). Decentralisation became more complete as state and municipal health secretariats assumed control of staff and facilities.
3. Single Health System (Sistema Unico de Saúde –	1988 1990	Constitution Lei Orgânica da	While the SUS in many ways continues the efforts to decentralise the system as provided in the first two phases of health

<sup>33</sup> Chenani et. al. (2003), Jack (2000)

SUS).	1991	Saúde: Laws 8080 and 8142  Regulation of “Sistema Nacional de Seguridade Social” SNSS: Laws 8212 and 8213	reform, several measures reflect a partial re-centralisation of federal authority <sup>34</sup> . In 1993 INAMPS was abolished and integrated into the Ministry of Health under the umbrella of the SAS, Secretaria de Ações de Saúde. The main function of the SAS is to transfer funds to state health secretariats.
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Nevertheless, neither decentralization nor universalization were accomplished after these reforms: by 1997, less than 3% of the municipalities qualified for complete decentralization and management of health services (Martinez 1999); by 2001, while 89.06% of the municipalities qualified to provide basic attention only 10.14% qualified for complete decentralization and management (de Souza 2002)

### *Financing*<sup>35</sup>

Breaking the link between benefits and contributions jeopardized the public health system. Normatively, 1988 Constitution determined that SUS should be financed from:

- The social security budget which is funded through salary based compulsory contributions by employers (incidents *sobre folha de salaries* –i.e. payroll checks-, *sobre o faturamento* – i.e. on gross profit - e sobre o lucro liquido das empresas – i.e. on net profits) and employees;
- General taxation through federal, state and municipal budgets
- Other sources

Positively however, because neither the Constitution nor the social security budget specified the amount of resources designated for health, the budget directives law (Lei de Diretrizes Orçamentárias) fixed a minimum equal to 30% of the social security budget. This minimum has not been met, however, since 1993, when the Social Security Institute suspended the transfer of resources to the Ministry of Health. This caused a deep financial crisis in the sector. In 1992, for instance, resources from compulsory

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<sup>34</sup> Harmeling (1999)

<sup>35</sup> For a comprehensive analysis refer to Reis, Ribeiro and Piola (2001).

contributions represented 55% of the public budget for health. From 1993 on, SUS began to rely upon extraordinary contributions and central government transfers to make up its budget, which amounted to 60% of its total resources in 1995. A special tax on banking transactions was imposed in 1996 to solve the problem. On the other hand, states and municipalities increased the allocation of their own resources to finance the system (Lobato 2000).

**Table 1. Shares of the five employment sectors: 1983, 1989 and 2002**

	<b>Jan-83</b>	<b>Dec-89</b>	<b>Nov-02</b>
Out of the Labor Force	38.74	39.40	43.53
Unemployed	3.86	1.41	4.02
Informal Self Employed	11.62	12.95	13.80
Informal Salaried	9.15	7.69	10.54
Formal Sector	35.74	37.98	27.67
Unassigned	0.89	0.55	0.44

Author's calculations using the PME.

**Table 2. Effective Protection and Import Penetration before and after the Trade Reforms**

<b>Industry</b>	<b>Effective Protection Rate</b>			<b>Import Penetration Ratio</b>		
	1983	1990	1998	1983	1990	2002
Nonmetallic Mineral Goods	-19.6	38.8	15.4	0.8	1.3	3.8
Metallic Mineral Goods	34.2	15.8	14.2	1.5	2.4	4.9
Machinery and Equipment	93.3	41.5	18.6	8.8	7.3	20.1
Electrical and Electronic Equipment and Components	129.3	62.5	24.5	14.5	13.7	24.5
Vehicle and Vehicle Parts	-6.5	351.1	129.2	8.2	9.1	13.5
Wood Sawing, Wood Products and Furniture	35.2	29.4	15.1	0.5	0.4	2.3
Paper Manufacturing, Publishing and Printing	6.7	22.6	14.7	1.7	2.5	4.3
Rubber	-21.4	70.2	16	2.3	4.9	16.0
Non petrochemical Chemicals	86.4	25.2	24.2	8.4	12.8	17.4
Petroleum Refining and Petrochemical		38.5	5.7	3.8	3.8	8.8
Pharmaceutical Products, Perfumes and Detergents	103.95	35.8	10	1.9	6.7	12.4
Plastics	28.3	50.7	21.9	1.8	2.2	11.5
Textiles	36.7	49.2	24.9	1.1	2.8	10.1
Apparel and apparel accessories	46.7	67	26.1	0.3	0.5	2.0
Footwear and Leather and Hide Products	30.3	28.8	19.4	1.7	4.4	7.0
Plant Product Processing (including tobacco)	5.7	30.6	15.4	0.1	3.3	1.6
Food	26.1	80.6	20.8	0.9	2.1	2.7
Beverages	-1.1	94.5	24.1	2.6	2.9	3.1

Source: Effective Protection rates come from Pinheiro and Bacha de Almeida (1994) for 1983 and from Kume et al. (2003) for 1990 and 1998. Import Penetration Ratios come from Pinheiro and Bacha de Almeida (1994) for 1983, from Muendler (2002) for 1990 and from Nassif and Pimentel (2004) for 2002.



**Table 3. Characteristics of employed workers: 1983, 1989 and 2002**

	<b>Age</b>	<b>School</b>	<b>Hours</b>	<b>Wage</b>
Jan-83				
Informal Self Employed	40.08	5.34	38.56	0.76
Informal Salaried	29.89	4.89	42.44	0.29
Formal Sector	32.39	7.17	39.59	1.00
Dec-89				
Informal Self Employed	40.29	6.17	39.19	1.00
Informal Salaried	30.33	5.54	41.09	0.40
Formal Sector	32.99	7.67	38.69	1.00
Nov-02				
Informal Self Employed	42.06	8.18	40.98	1.06
Informal Salaried	33.72	8.09	40.46	0.59
Formal Sector	35.63	9.68	40.87	1.00

Author's calculations using the PME. The table shows the mean age, years of schooling (school) weekly hours of work (Hours) and the relative average wage with respect to the formal sector.

**Table 4. Pooled continuous time intensity matrix 1983-2002**

	<b>O.L.F.</b>	<b>U</b>	<b>S.E.</b>	<b>I</b>	<b>F</b>
<b>O.L.F.</b>	(0.1015) <i>0.00002</i>	0.0343 <i>0.00001</i>	0.0314 <i>0.00001</i>	0.0244 <i>0.00001</i>	0.0114 <i>0.00001</i>
<b>U</b>	0.4385 <i>0.00015</i>	(0.8883) <i>0.00021</i>	0.1186 <i>0.00009</i>	0.2360 <i>0.00013</i>	0.0952 <i>0.00008</i>
<b>S.E.</b>	0.0953 <i>0.00003</i>	0.0220 <i>0.00002</i>	(0.2434) <i>0.00005</i>	0.0956 <i>0.00003</i>	0.0305 <i>0.00002</i>
<b>I</b>	0.1028 <i>0.00004</i>	0.0598 <i>0.00004</i>	0.1421 <i>0.00005</i>	(0.5142) <i>0.00009</i>	0.2094 <i>0.00006</i>
<b>F</b>	0.0187 <i>0.00001</i>	0.0139 <i>0.00001</i>	0.0139 <i>0.00001</i>	0.0491 <i>0.00001</i>	(0.0956) <i>0.00002</i>
<b>Duration</b>	9.8532 <i>0.00082</i>	1.1257 <i>0.00013</i>	4.1081 <i>0.00038</i>	1.9450 <i>0.00016</i>	10.4560 <i>0.00099</i>

Note: Pooled instantaneous transition matrix computed using monthly data from the Monthly Labor Survey (PME) from Jan 1983 to Dec 2002 following the procedure by Geweke et al. (1986) outlined in Annex 1. Computations are based on 10,000 Monte Carlo replications. Standard errors are reported in italics. OLF=Out of the Labor Force, U=Unemployment rate, I=Informal Salaried, SE=Informal Self-employed, F=Formal Sector.

**Table 5. De-Trended Flows: Standard Deviations and Correlations**

	Standard Deviations	Correlations		
		U/W.A.P.	F/E.A.P.	G.D.P.
<b>Shares</b>				
O.L.F./W.A.P.	1.61	0.55	-0.83	-0.14
U/W.A.P.	0.82	1.00	-0.60	-0.49
S.E./E.A.P.	2.86	0.48	-0.96	-0.16
I/E.A.P.	2.02	0.68	-0.92	-0.05
F/E.A.P.	4.60	-0.60	1.00	0.12
<b>De-trended Flows</b>				
O.L.F. to U	0.70	0.77	-0.26	-0.52
O.L.F. to S.E.	0.24	-0.18	0.01	-0.07
O.L.F. to I	0.21	-0.35	0.05	0.41
O.L.F. to F	0.18	-0.61	0.30	0.44
U to O.L.F.	4.38	-0.34	0.00	0.30
U to S.E.	1.50	0.03	-0.11	-0.50
U to I	2.54	-0.64	0.14	0.58
U to F	3.67	-0.64	0.27	0.67
S.E. to O.L.F.	0.77	-0.13	0.04	-0.11
S.E. to U	0.56	0.75	-0.25	-0.59
S.E. to I	0.79	-0.23	0.10	0.12
S.E. to F	0.50	-0.56	0.29	0.31
I to O.L.F.	1.08	-0.37	0.14	0.09
I to U	1.07	0.69	-0.23	-0.68
I to S.E.	1.27	-0.34	0.17	-0.08
I to F	2.22	-0.68	0.28	0.47
F to O.L.F.	0.20	-0.28	0.13	-0.03
F to U	0.21	0.10	0.08	-0.19
F to S.E.	0.17	-0.56	0.21	0.23
F to I	0.37	-0.19	-0.08	0.23

Note: Transition rates among sectors inferred from the continuous time transition matrix for each period using monthly data from the Monthly Labor Survey (PME) from Jan 1983 to Dec 2002 following the procedure by Geweke et al. (1986) outlined in Annex 1. Computations are based on 10.000 Monte Carlo replications. OLF=Out of the Labor Force, U=Unemployed, I=Informal Salaried, SE=Informal Self-employed, F=Formal Sector AP=Active Population, WAP=Working ages population, EAP=Employed in working ages population. The series have been averaged per quarter and de-trended using a HP filter with smoothing parameter  $10^5$

**Table 6. Model in levels (contemporaneous)**

Dependent: Sector Size	1	2	3	4	5	6
Effective Tariff	<b>0.92</b> 2.98					<b>-2.82</b> 2.62
Imports Penetration		<b>-1.14</b> 4.49				<b>-4.45</b> 3.76
Tenure			<b>1.66 ***</b> 0.23			<b>1.06 ***</b> 0.22
Overtime				<b>-11.50 ***</b> 1.94		<b>1.09</b> 1.56
Union					<b>16.56 ***</b> 2.65	<b>12.57 ***</b> 2.78
C	<b>80.40 ***</b> 0.14	<b>80.52 ***</b> 0.31	<b>77.31 ***</b> 0.43	<b>84.84 ***</b> 0.76	<b>76.98 ***</b> 0.53	<b>75.80 ***</b> 1.11
R2 (Weighted)	0.995	0.994	0.995	0.994	0.994	0.994
R2 (Unweighted)	0.96	0.96	0.96	0.96	0.97	0.97
Durbin Watson	0.70	0.69	0.75	0.71	0.75	0.75
Dependent: Industry Differential	1	2	3	4	5	6
Effective Tariff	<b>0.06</b> 0.07					<b>0.09</b> 0.09
Imports Penetration		<b>-0.36 ***</b> 0.14				<b>-0.42 ***</b> 0.10
Tenure			<b>-0.02 *</b> 0.01			<b>-0.03 *</b> 0.02
Overtime				<b>0.03</b> 0.06		<b>0.09</b> 0.07
Union					<b>0.03</b> 0.10	<b>0.21</b> 0.14
C	<b>4.12 ***</b> 0.00	<b>4.15 ***</b> 0.01	<b>4.17 ***</b> 0.03	<b>4.11 ***</b> 0.02	<b>4.12 ***</b> 0.02	<b>4.13 ***</b> 0.05
R2 (Weighted)	0.999	0.998	0.998	0.999	0.999	0.998
R2 (Unweighted)	0.95	0.95	0.95	0.95	0.95	0.95
Durbin Watson	1.15	1.09	1.12	1.15	1.14	1.08
Dependent: Creation	1	2	3	4	5	6
Effective Tariff	<b>0.38 ***</b> 0.13					<b>0.46 ***</b> 0.11
Imports Penetration		<b>-0.65 ***</b> 0.10				<b>-0.51 ***</b> 0.09
Tenure			<b>-0.05 *</b> 0.03			<b>-0.06 **</b> 0.03
Overtime				<b>-0.16 **</b> 0.07		<b>-0.38 ***</b> 0.07
Union					<b>-0.16</b> 0.12	<b>-0.02</b> 0.13
C	<b>0.40 ***</b> 0.01	<b>0.46 ***</b> 0.01	<b>0.51 ***</b> 0.06	<b>0.48 ***</b> 0.03	<b>0.45 ***</b> 0.03	<b>0.70 ***</b> 0.04
R2 (Weighted)	0.781	0.770	0.757	0.768	0.761	0.808
R2 (Unweighted)	0.60	0.59	0.60	0.60	0.60	0.60
Durbin Watson	1.64	1.69	1.68	1.63	1.65	1.74
Dependent: Destruction (U)	1	2	3	4	5	6
Effective Tariff	<b>-0.001</b> 0.003					<b>-0.001</b> 0.004
Imports Penetration		<b>-0.003</b> 0.005				<b>-0.006</b> 0.005
Tenure			<b>0.001</b> 0.001			<b>0.001</b> 0.001
Overtime				<b>-0.004</b> 0.003		<b>-0.003</b> 0.003
Union					<b>0.006 **</b> 0.003	<b>0.003</b> 0.003
C	<b>0.012 ***</b> 0.000	<b>0.012 ***</b> 0.000	<b>0.010 ***</b> 0.001	<b>0.013 ***</b> 0.001	<b>0.011 ***</b> 0.001	<b>0.012 ***</b> 0.002
R2 (Weighted)	0.807	0.797	0.812	0.806	0.812	0.792
R2 (Unweighted)	0.37	0.37	0.38	0.37	0.38	0.39
Durbin Watson	1.86	1.87	1.87	1.86	1.87	1.89

Note: For all models, the number of included observations is 20, the number of Cross-section included is 18 and the total pool observations are 360.

## Legend

Coefficients in bold; SD in italics

\*\*\*, \*\*, \* indicate significance at 1%, 5% and 10% level, respectively

Creation	Proxy of formal job creation (% of people moving from OLF, U, SE, I to F out of total OLF, U, SE and I). Pooled (by year) instantaneous transition computed using monthly data from the Monthly Labor Survey (PME) from Jan 1983 to Dec 2002 following the procedure by Geweke et al. (1986) outlined in section III. Computations are based on 10.000 Monte Carlo replications.
Destruction	Proxy of formal job destruction (% of people moving from F to U out of total F). Pooled (by year) instantaneous transition computed using monthly data from the Monthly Labor Survey (PME) from Jan 1983 to Dec 2002 following the procedure by Geweke et al. (1986) outlined in section III. Computations are based on 10.000 Monte Carlo replications.
Sector size	Share of formal (F) on specific sector workforce
Industry differentials	Industry informality differentials (betas coming from 1st stage regression in which F is explained with individual characteristics and industry differentials)
Effective Tariff	Effective protection (scaled by $10^{-3}$ ). Sources are: Kume et al. (2003) for 1987-1998; Pinheiro and Bacha de Almeida (1994) for 1983-1986
Imports Penetration	Imports penetration (weighted imports/consumption). Sources are: Muendler (2002) for 1987-1999; Pinheiro and Bacha de Almeida (1994) for 1983-1986; Nassif and Pimentel (2004) for 1999-2002
Tenure	Dummy (active since 1989) interacted with tenure (in years) of workers fired in the specific industrial sector (average 1983-1987)
Overtime	Dummy (active since 1989) interacted with the proportion of workers working more than 44 hours in the specific industrial sector (average 1983-1987)
Union	Dummy (active since 1989) interacted with union enrollment - understood as % of unionized workers in the specific industrial sector - (average 1986 and 1988)

**Table 7a. Model in levels (dynamic)**

Variable	Sector Size	Industry Differentials	Creation	Destruction
Dependent (-1)	<b>0.64</b> *** <i>0.06</i>	<b>0.46</b> *** <i>0.05</i>	<b>0.07</b> <i>0.07</i>	<b>0.071</b> <i>0.054</i>
Dependent (-2)	<b>0.17</b> *** <i>0.04</i>	<b>0.18</b> *** <i>0.05</i>	<b>0.29</b> *** <i>0.06</i>	<b>0.053</b> <i>0.050</i>
Effective Tariff	<b>-1.08</b> <i>2.02</i>	<b>0.03</b> <i>0.09</i>	<b>0.28</b> * <i>0.16</i>	<b>-0.003</b> <i>0.004</i>
Import Penetration	<b>-8.17</b> ** <i>3.19</i>	<b>-0.31</b> *** <i>0.10</i>	<b>-0.43</b> *** <i>0.15</i>	<b>-0.005</b> <i>0.005</i>
Tenure	<b>0.44</b> *** <i>0.12</i>	<b>0.02</b> * <i>0.01</i>	<b>0.24</b> *** <i>0.04</i>	<b>0.000</b> <i>0.001</i>
Tenure (-1)	<b>-0.24</b> <i>0.16</i>	<b>-0.05</b> *** <i>0.01</i>	<b>-0.32</b> *** <i>0.02</i>	<b>0.000</b> <i>0.000</i>
Overtime	<b>3.21</b> *** <i>0.99</i>	<b>0.23</b> *** <i>0.04</i>	<b>-0.78</b> *** <i>0.04</i>	<b>0.001</b> <i>0.003</i>
Overtime (-1)	<b>-5.56</b> *** <i>1.38</i>	<b>-0.29</b> *** <i>0.06</i>	<b>0.65</b> *** <i>0.06</i>	<b>-0.006</b> *** <i>0.002</i>
Union	<b>0.21</b> <i>1.24</i>	<b>0.11</b> <i>0.10</i>	<b>-0.56</b> *** <i>0.16</i>	<b>0.018</b> *** <i>0.003</i>
Union (-1)	<b>3.07</b> ** <i>1.52</i>	<b>-0.14</b> * <i>0.07</i>	<b>0.51</b> *** <i>0.08</i>	<b>-0.016</b> *** <i>0.002</i>
C	<b>14.80</b> *** <i>3.91</i>	<b>1.53</b> *** <i>0.26</i>	<b>0.49</b> *** <i>0.07</i>	<b>0.012</b> *** <i>0.003</i>
R2 (Weighted)	0.997	0.998	0.765	0.810
R2 (Unweighted)	0.986	0.964	0.736	0.378
Durbin Watson	2.08	2.06	2.10	2.03
Included observations	18	18	18	18
Cross-section included	18	18	18	18
Total pool observations	324	324	324	324

**Legend**

Coefficients in bold; SD in italics

\*\*\*, \*\*, \* indicate significance at 1%, 5% and 10% level, respectively

- Creation Proxy of formal job creation (% of people moving from OLF, U, SE, I to F out of total OLF, U, SE and I). Pooled (by year) instantaneous transition computed using monthly data from the Monthly Labor Survey (PME) from Jan 1983 to Dec 2002 following the procedure by Geweke et al. (1986) outlined in section III. Computations are based on 10.000 Monte Carlo replications.
- Destruction Proxy of formal job destruction (% of people moving from F to U out of total F). Pooled (by year) instantaneous transition computed using monthly data from the Monthly Labor Survey (PME) from Jan 1983 to Dec 2002 following the procedure by Geweke et al. (1986) outlined in section III. Computations are based on 10.000 Monte Carlo replications.
- Sector size Share of formal (F) on specific sector workforce
- Industry differentials Industry informality differentials (betas coming from 1st stage regression in which F is explained with individual characteristics and industry differentials)
- Effective Tariff Effective protection (scaled by  $10^{-3}$ ). Sources are: Kume et al. (2003) for 1987-1998; Pinheiro and Bacha de Almeida (1994) for 1983-1986
- Imports Penetration Imports penetration (weighted imports/consumption). Sources are: Muendler (2002) for 1987-1999; Pinheiro and Bacha de Almeida (1994) for 1983-1986; Nassif and Pimentel (2004) for 1999-2002
- Tenure Dummy (active since 1989) interacted with tenure (in years) of workers fired in the specific industrial sector (average 1983-1987)
- Overtime Dummy (active since 1989) interacted with the proportion of workers working more than 44 hours in the specific industrial sector (average 1983-1987)
- Union Dummy (active since 1989) interacted with union enrollment - understood as % of unionized workers in the specific industrial sector - (average 1986 and 1988)

**Table 7b. Model in differences**

Variable	Sector Size	Industry Differentials	Creation	Destruction
Dependent (-1)	<b>-0.34</b> *** <i>0.06</i>	<b>-0.45</b> *** <i>0.05</i>	<b>-0.68</b> *** <i>0.13</i>	<b>-0.653</b> *** <i>0.043</i>
Dependent (-2)	<b>-0.30</b> *** <i>0.06</i>	<b>-0.25</b> *** <i>0.05</i>	<b>-0.12</b> *** <i>0.13</i>	<b>-0.290</b> *** <i>0.045</i>
Effective Tariff	<b>0.51</b> <i>2.57</i>	<b>0.24</b> *** <i>0.08</i>	<b>0.52</b> *** <i>0.17</i>	<b>0.000</b> <i>0.005</i>
Import Penetration	<b>1.88</b> <i>5.22</i>	<b>0.01</b> <i>0.24</i>	<b>-0.28</b> <i>0.25</i>	<b>0.007</b> <i>0.008</i>
Tenure	<b>0.40</b> *** <i>0.11</i>	<b>0.03</b> *** <i>0.01</i>	<b>0.26</b> *** <i>0.02</i>	<b>0.000</b> <i>0.000</i>
Tenure (-1)	<b>0.02</b> <i>0.11</i>	<b>-0.03</b> *** <i>0.01</i>	<b>-0.12</b> *** <i>0.04</i>	<b>-0.001</b> <i>0.001</i>
Overtime	<b>4.46</b> *** <i>1.16</i>	<b>0.26</b> *** <i>0.06</i>	<b>-0.99</b> *** <i>0.09</i>	<b>0.004</b> ** <i>0.002</i>
Overtime (-1)	<b>-7.71</b> *** <i>1.36</i>	<b>-0.29</b> *** <i>0.06</i>	<b>-0.12</b> <i>0.13</i>	<b>0.014</b> *** <i>0.002</i>
Union	<b>-0.82</b> <i>1.25</i>	<b>0.19</b> *** <i>0.07</i>	<b>-0.58</b> *** <i>0.08</i>	<b>0.017</b> *** <i>0.003</i>
Union (-1)	<b>-6.86</b> *** <i>1.25</i>	<b>-0.27</b> *** <i>0.07</i>	<b>0.20</b> * <i>0.11</i>	<b>0.002</b> <i>0.002</i>
C	<b>-1.03</b> *** <i>0.12</i>	<b>-0.03</b> *** <i>0.01</i>	<b>0.01</b> <i>0.01</i>	<b>-0.001</b> *** <i>0.000</i>
R2 (Weighted)	0.417	0.672	0.076	0.436
R2 (Unweighted)	0.401	0.538	0.673	0.405
Durbin Watson	2.08	2.07	2.19	2.17
Included observations	17	17	17	17
Cross-section included	18	18	18	18
Total pool observations	306	306	306	306

**Legend**

Coefficients in bold; SD in italics

\*\*\*, \*\*, \* indicate significance at 1%, 5% and 10% level, respectively

x(-1) First lag of x

x(-2) Second lag of x

Creation Proxy of formal job creation (% of people moving from OLF, U, SE, I to F out of total OLF, U, SE and I). Pooled (by year) instantaneous transition computed using monthly data from the Monthly Labor Survey (PME) from Jan 1983 to Dec 2002 following the procedure by Geweke et al. (1986) outlined in section III. Computations are based on 10.000 Monte Carlo replications.

Destruction Proxy of formal job destruction (% of people moving from F to U out of total F). Pooled (by year) instantaneous transition computed using monthly data from the Monthly Labor Survey (PME) from Jan 1983 to Dec 2002 following the procedure by Geweke et al. (1986) outlined in section III. Computations are based on 10.000 Monte Carlo replications.

Sector size Share of formal (F) on specific sector workforce

Industry differentials Industry informality differentials (betas coming from 1st stage regression in which F is explained with individual characteristics and industry differentials)

Effective Tariff Effective protection (scaled by  $10^{-3}$ ). Sources are: Kume et al. (2003) for 1987-1998; Pinheiro and Bacha de Almeida (1994) for 1983-1986

Imports Penetration Imports penetration (weighted imports/consumption). Sources are: Muendler (2002) for 1987-1999; Pinheiro and Bacha de Almeida (1994) for 1983-1986; Nassif and Pimentel (2004) for 1999-2002

Tenure Dummy (active since 1989) interacted with tenure (in years) of workers fired in the specific industrial sector (average 1983-1987)

Overtime Dummy (active since 1989) interacted with the proportion of workers working more than 44 hours in the specific industrial sector (average 1983-1987)

Union Dummy (active since 1989) interacted with union enrollment - understood as % of unionized workers in the specific industrial sector - (average 1986 and 1988)

**Table 8. Sources of provision of health services before reforms: % structure by labor sector in 1981**

<b>Where did the person receive attention</b>	<b>S.E.</b>	<b>I</b>	<b>F</b>
Public network	47.80	58.93	46.65
Private network	51.01	40.33	52.26
Both	1.19	0.74	1.09

<b>Who paid the attention:</b>	<b>S.E.</b>	<b>I</b>	<b>F</b>
Particular	<b>55.93</b>	<b>39.86</b>	<b>30.50</b>
Social Security	<b>33.39</b>	<b>46.30</b>	<b>35.37</b>
Pre paid	3.83	2.30	6.63
Employer	3.16	5.84	<b>24.15</b>
Other	3.02	4.88	2.44
More than one	0.67	0.82	0.91

Note: These results are based on the sample of working household heads and the members of their household (the employment category of the household head is assigned to the rest of the members of the household)

Source: PNAD 1981, non urban dwellers excluded.

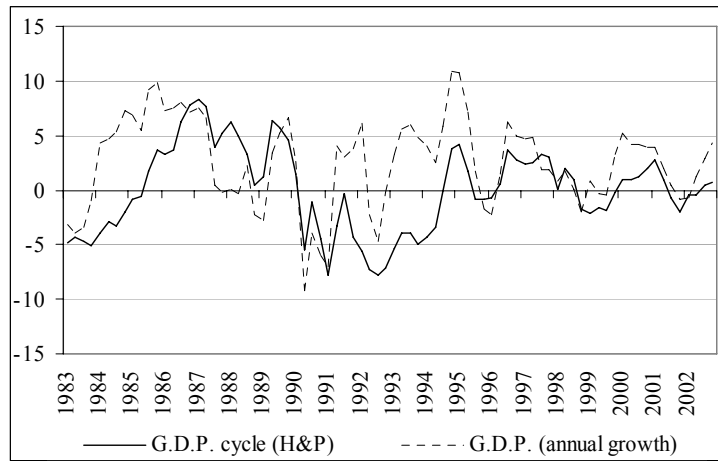
**Table 9. Shares of Formal and Informal sectors with respect the Working ages population (in percentages)**

	Survey	Urban	Rural	Metropolitan	Non Metropolitan
F	PNAD 1981	57.37	18.51	65.57	38.92
	PME 1983			63.25	
I and S.E.	PNAD	42.63	81.49	34.43	61.08
	PME			36.75	
<b>Workforce under 15 y.o. (PNAD) in MM</b>		<b>55.12</b>	<b>19.56</b>	<b>24.81</b>	<b>49.87</b>
F	PNAD 1990	54.57	26.68	61.04	42.16
	PME			61.34	
I and S.E.	PNAD	45.43	73.32	38.96	57.84
	PME			38.66	
<b>Workforce under 15 y.o. (PNAD)</b>		<b>70.20</b>	<b>22.52</b>	<b>30.07</b>	<b>62.66</b>
F	PNAD 2001	46.78	20.00	51.52	38.95
	PME			52.96	
I and S.E.	PNAD	53.22	80.00	48.48	61.05
	PME			47.04	
<b>Workforce under 15 y.o. (PNAD)</b>		<b>102.80</b>	<b>18.21</b>	<b>39.87</b>	<b>81.14</b>

Source: PNAD and PME. PME's figures correspond to September of the corresponding year.

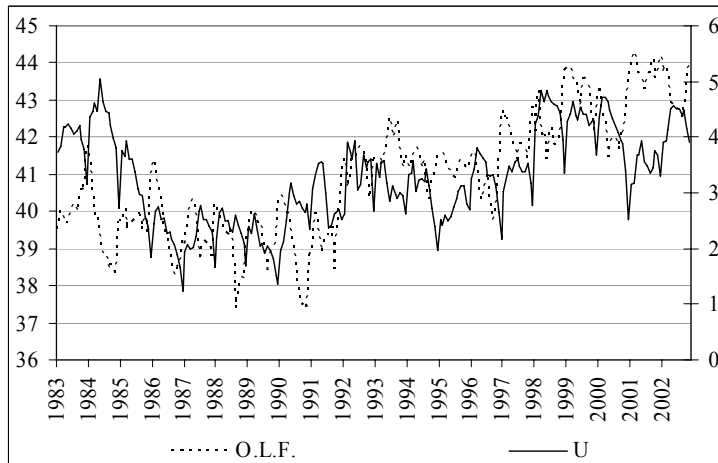


**Figure 1. GDP cycle\***



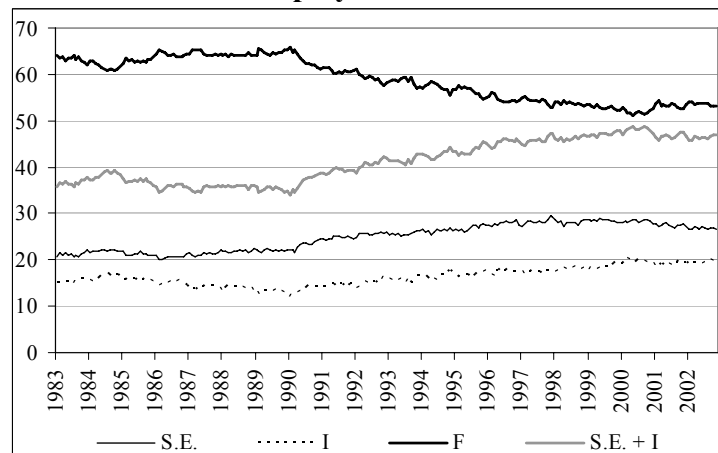
\* H&P filter applied with smoothing parameter  $10^5$

**Figure 2. Share of Out of the Labor Force\* (O.L.F) and Unemployment\* (U)**

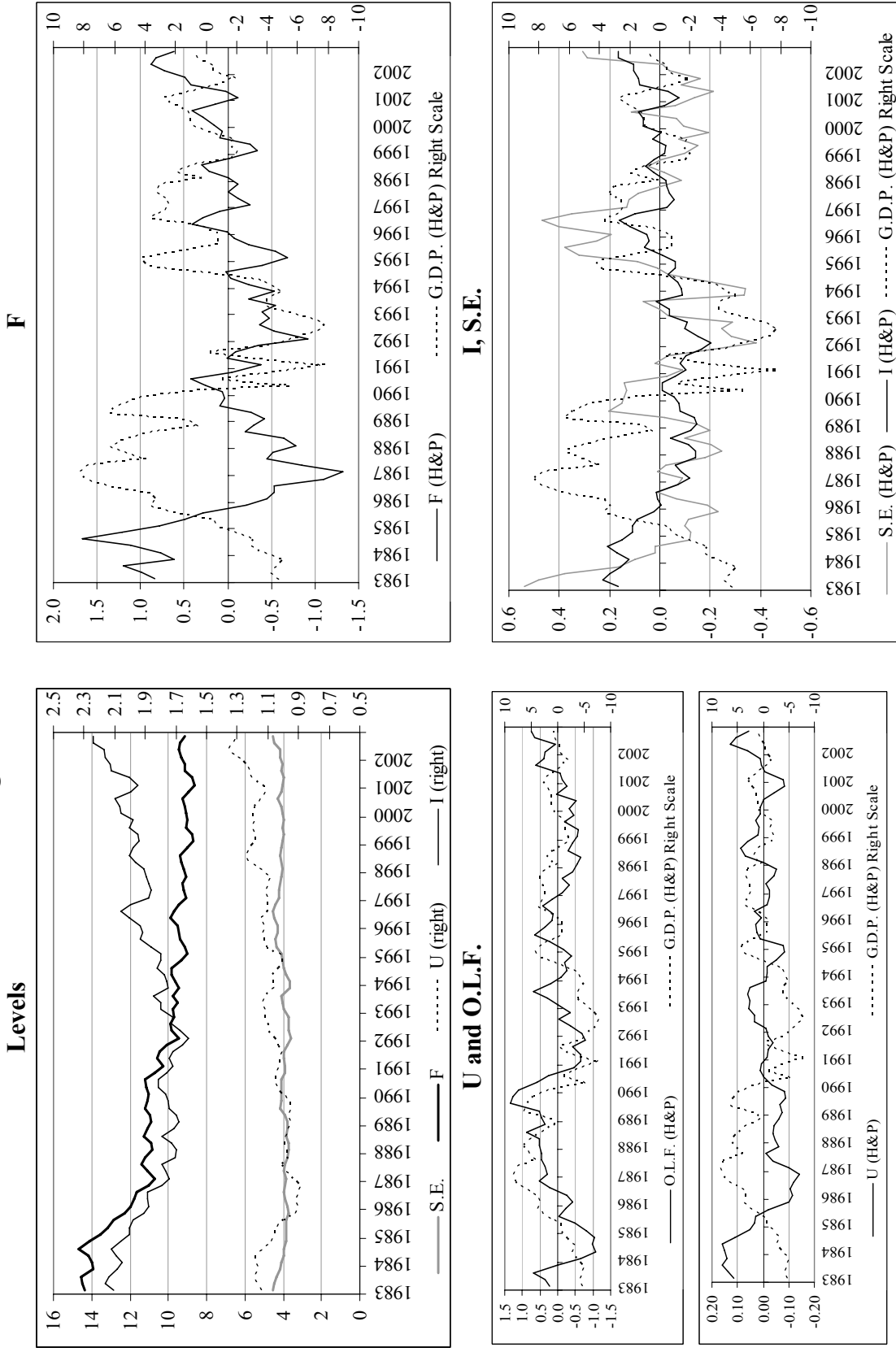


\*Out of working ages population.

**Figure 3. Share of Formal (F), Informal (I) and Self-employment (S.E.) sectors out of Employed workforce**

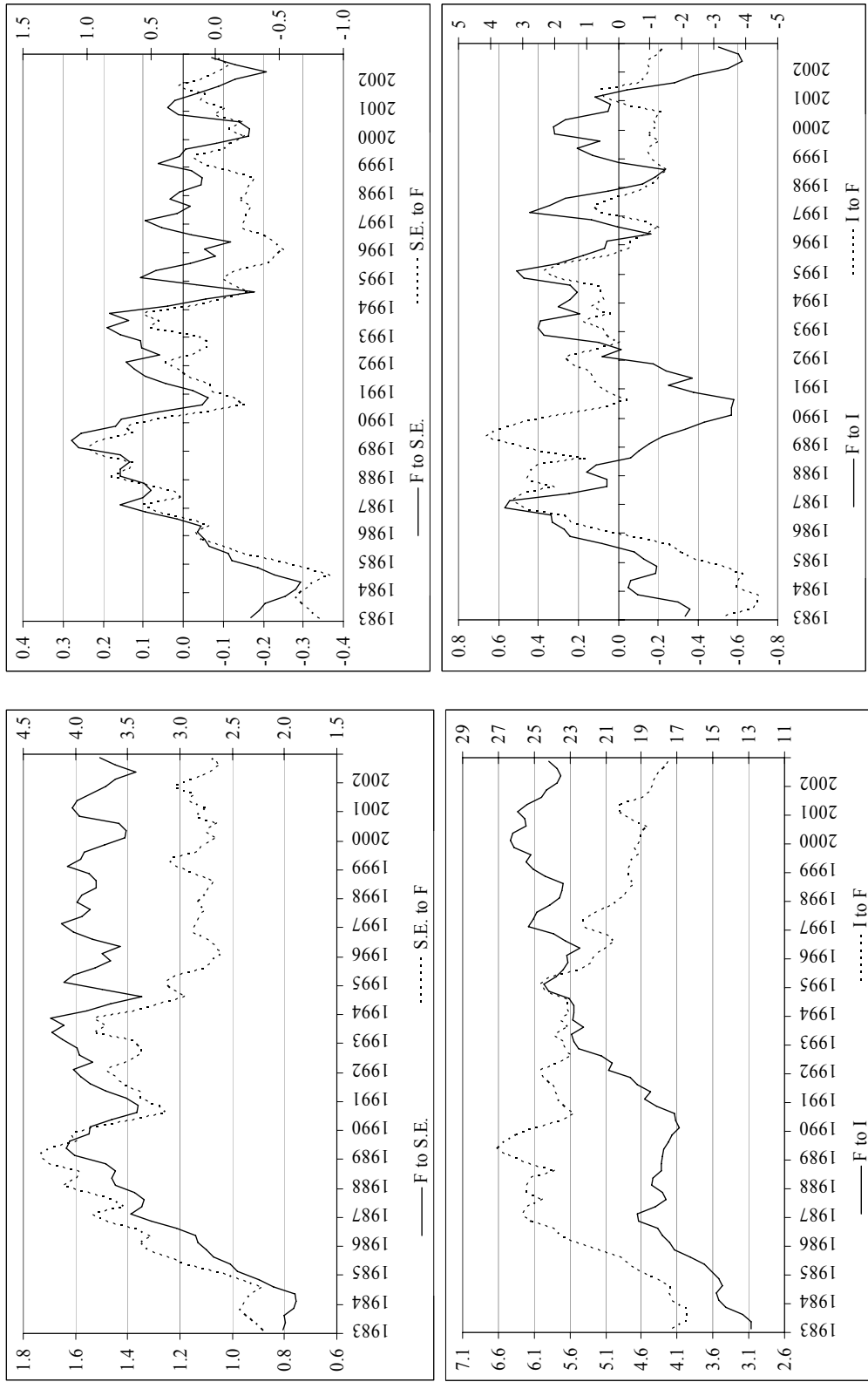


**Figure 4. Mean Duration**



Note: Mean duration inferred from the continuous time transition matrix for each period using monthly data from the Monthly Labor Survey (PME) from Jan 1983 to Dec 2002 following the procedure by Geweke et al. (1986) outlined in Annex 1. Computations are based on 10,000 Monte Carlo replications. The series have been averaged per quarter, de-trended using a HP filter with smoothing parameter  $10^5$  (except in the case of the panel "Levels") and smoothed using a 3 quarter moving average smoother. OLF=Out of the Labor Force, U=Unemployment rate, I=Informal Salaried, SE=Informal Self-employed, F=Formal Sector.

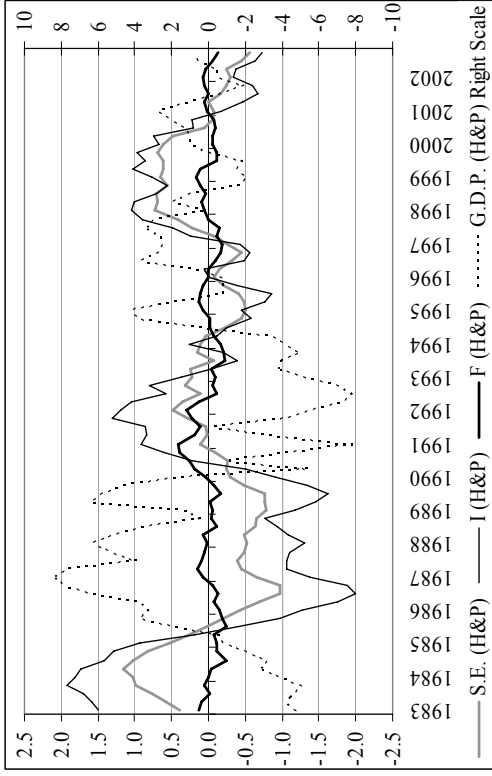
**Figure 5. Bilateral flows between employment categories**  
**5a. In Levels** **5b. De-trended**



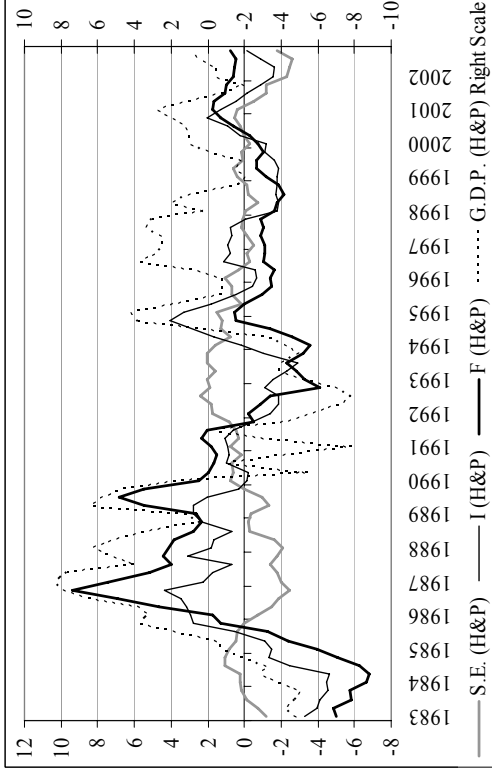
Note: Transitions rates inferred from the continuous time transition matrix for each period using monthly data from the Monthly Labor Survey (PME) from Jan 1983 to Dec 2002 following the procedure by Geweke et al. (1986) outlined in Annex 1. Computations are based on 10.000 Monte Carlo replications. The series have been averaged per quarter, de-trended using a HP filter with smoothing parameter  $10^5$  (except in the case of the panels titled as "In Levels") and smoothed using a 3 quarter moving average smoother. OLF=Out of the Labor Force, U=Unemployment rate, I=Informal Salaried, SE=Informal Self-employed, F=Formal Sector.

**Figure 6. Job Creation and Destruction**

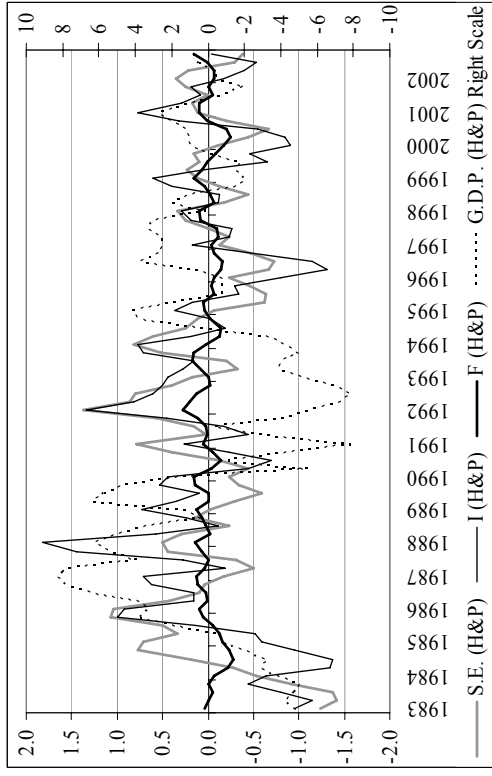
**6a. Job destruction  
Towards U**



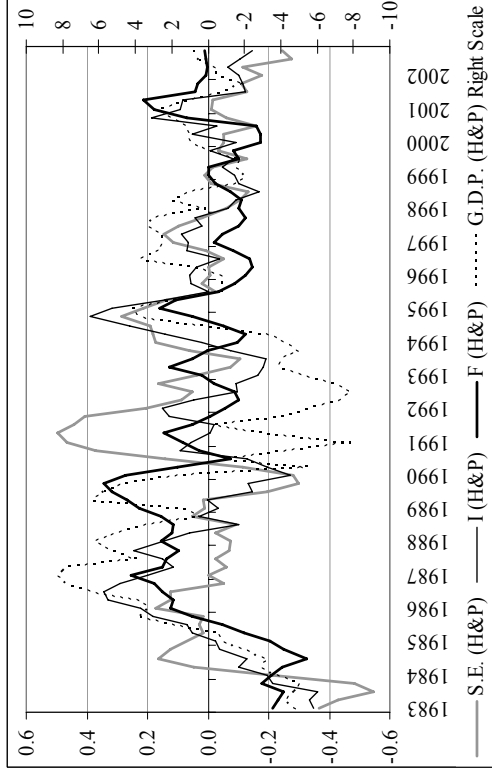
**6b. Job creation  
From U**



**Towards O.L.F.**

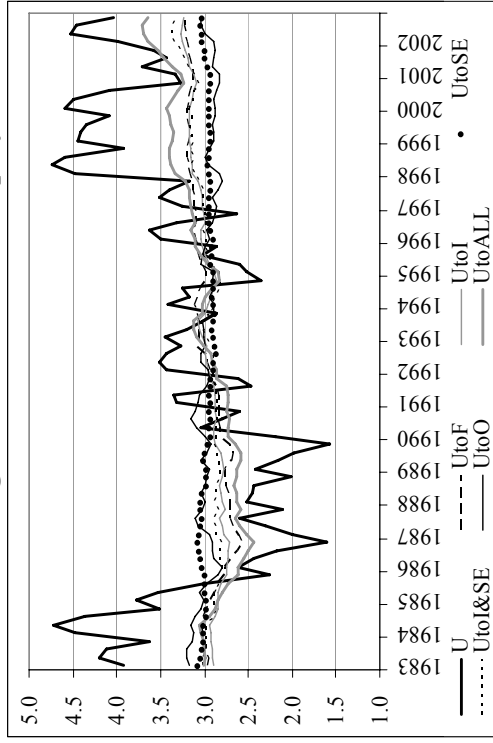


**From O.L.F.**

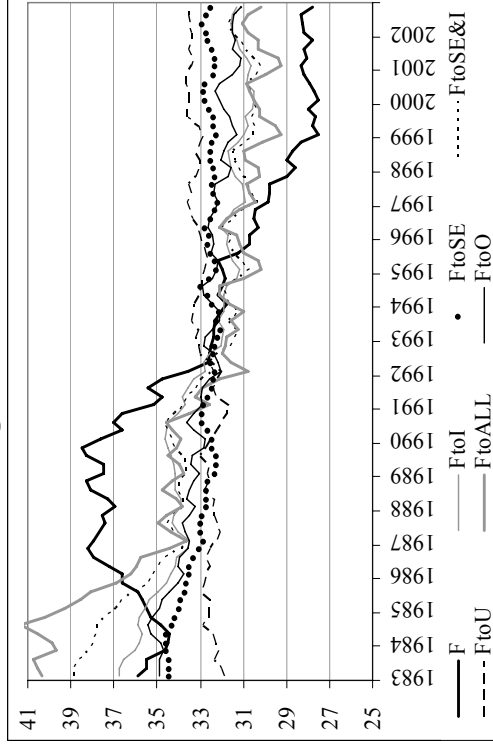
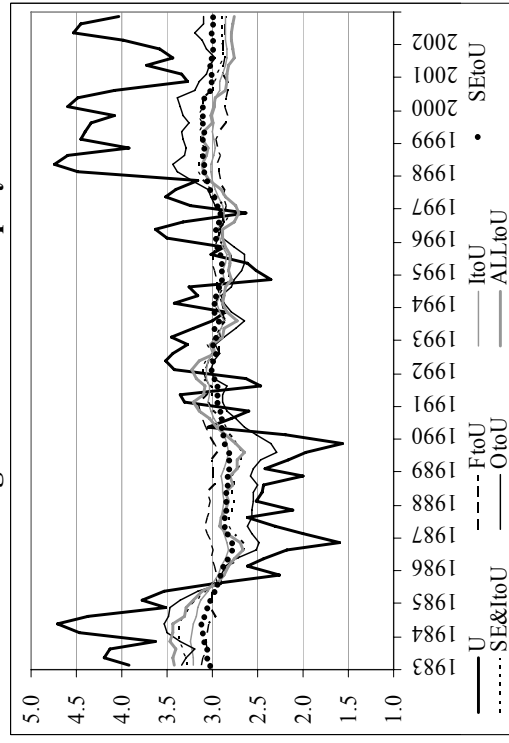


Note: Creation/Destruction rates inferred from the continuous time transition matrix for each period using monthly data from the Monthly Labor Survey (PME) from Jan 1983 to Dec 2002 following the procedure by Geweke et al. (1986) outlined in Annex 1. Computations are based on 10,000 Monte Carlo replications. The series have been averaged per quarter, de-trended using a HP filter with smoothing parameter  $10^5$  (except in the case of the panels titled as "In Levels") and smoothed using a 3 quarter moving average smoother. OLF=Out of the Labor Force, U=Unemployment rate, I=Informal Salaried, SE=Informal Self-employed, F=Formal Sector.

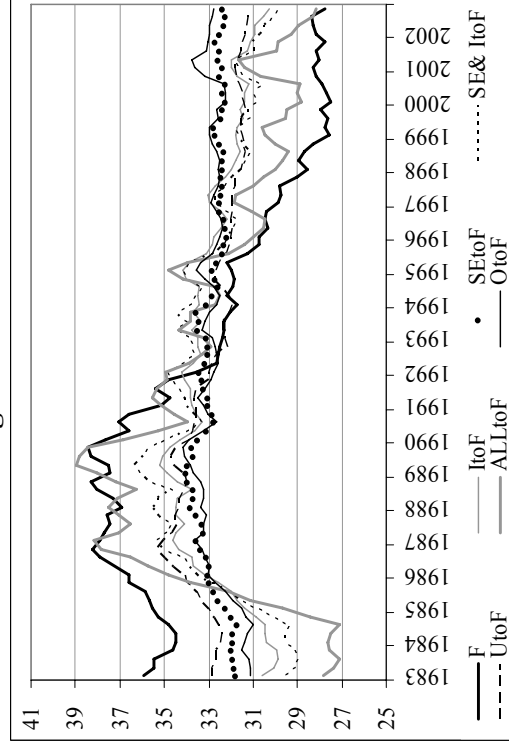
**Figure 7. Actual and predicted Size of unemployment and formal sector**  
**7a. Controlling outflows from Unemployment**  
**7b. Controlling outflows from Formal**



**Controlling inflows to Unemployment**

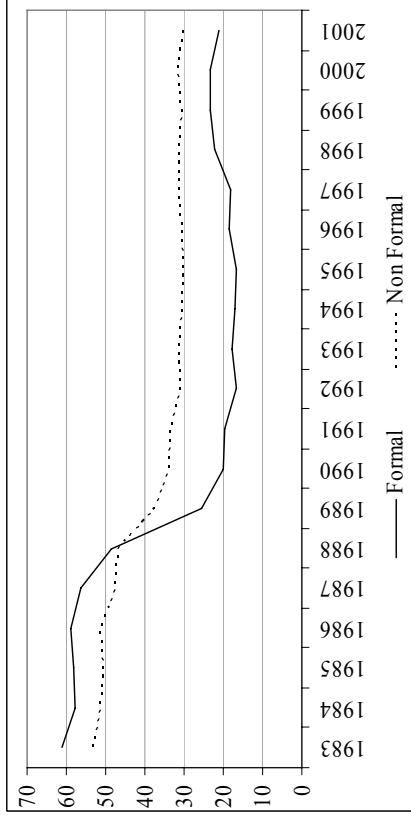
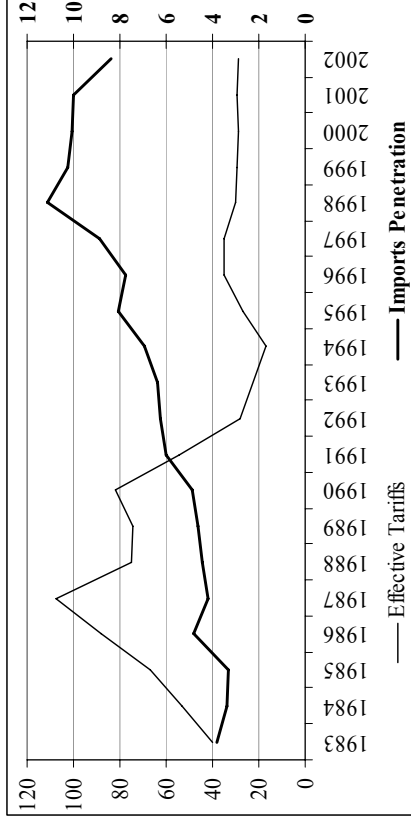


**Controlling inflows to Formal**

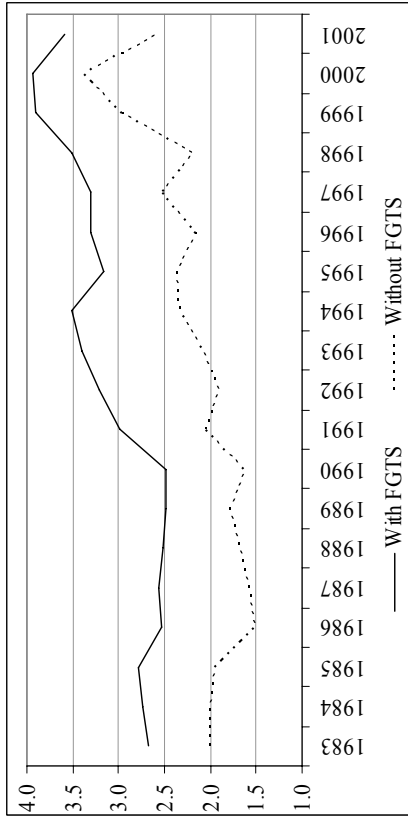


Note: U (Actual unemployment rate) and F (Actual size of the formal sector) are constructed using monthly data from the Monthly Labor Survey (PME) from Jan 1983 to Dec 2002. These series have been averaged per quarter. U (F) to  $i$  corresponds to the steady state size of U (F) derived from equation 4 resulting from applying the 1983-2002 average transition rate of all the possible flows except for the transition rate from U (F) to U (F) (F) to  $i$ ;  $i$  to U (F) corresponds to the steady state size of U (F) derived from equation 4 resulting from applying the 1983-2002 average transition rate of all the possible flows except for the transition rate from  $i$  to U (F). O=Out of the Labor Force, I=Informal Salaried, SE=Informal Self-employed, ALL=SE, I and F (when predicting U), ALL=O, U, I and SE (when predicting F)

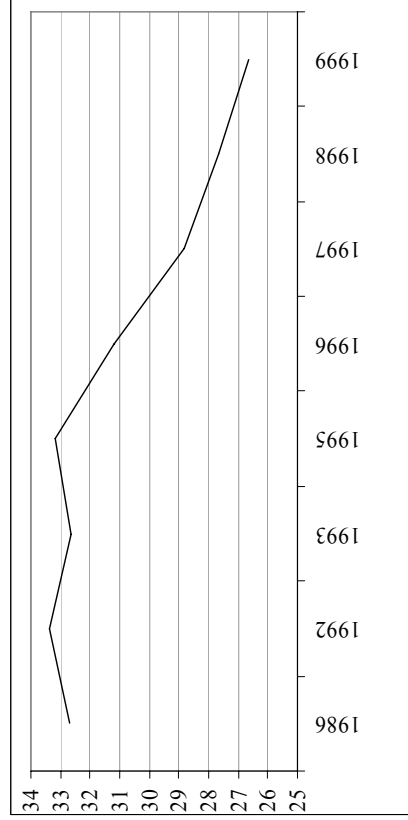
**Figure 8. Evolution of Trade Openness and of the variables used to measure Constitutional changes**  
**Trade Openness**



**Years of tenure of fired workers**



**Union enrollment**

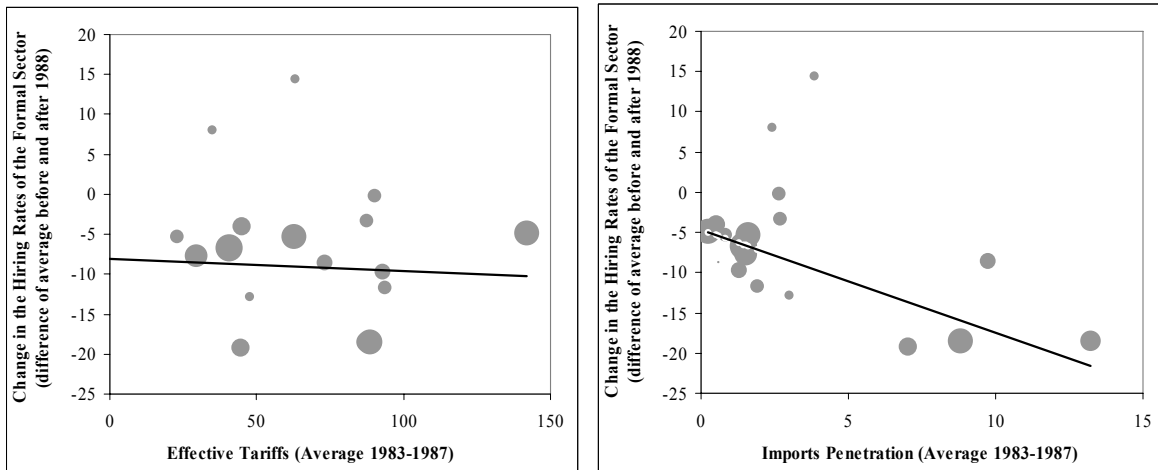


Notes:

Figures correspond to weighted averages of all industrial sectors (with weights given by the size of each industrial sector). Definitions of plotted variables correspond to those described in Table 7.

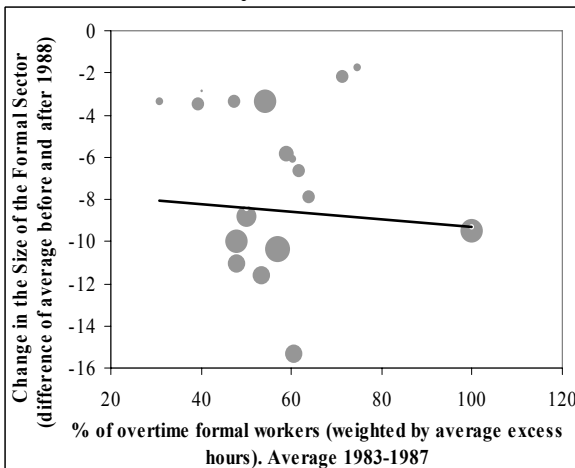
FGTS = Fundo de Garantia de Tempo de Serviço (Length of Service Guarantee Fund). Basically, under the FGTS every firm in Brazil has to deposit 8% of its current formal employees wages (8.5% since September 2001) in an account opened in the worker's name in a state bank. Other than some exceptions, workers can only withdraw money from these accounts in case they are fired without a "justified reason". In this case, they have access to the FGTS account balance plus a firing penalty paid directly by the employer.

**Figure 9. Trade Openness and Control Variables of Constitutional Changes Vs. Hiring Rates/Size of the Formal Sector**  
**A. Trade Openness**

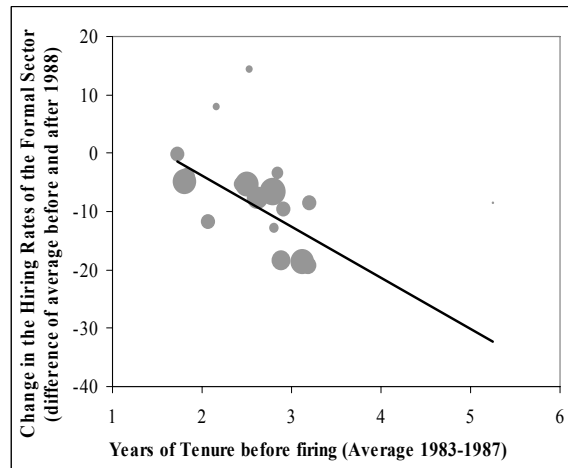


**B. Control Variables of Constitutional Changes**

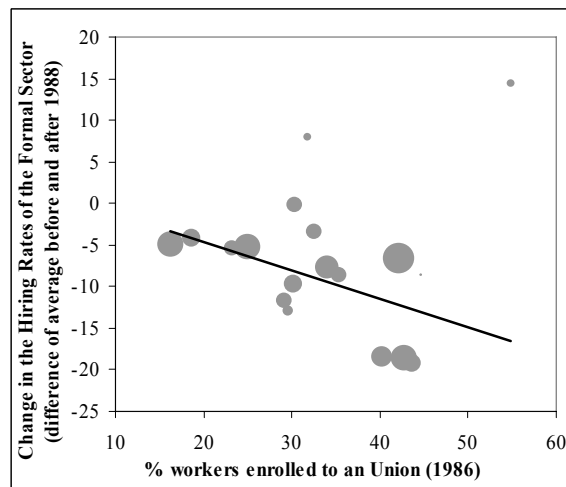
**Overtime by formal workers**



**Tenure of fired formal workers**

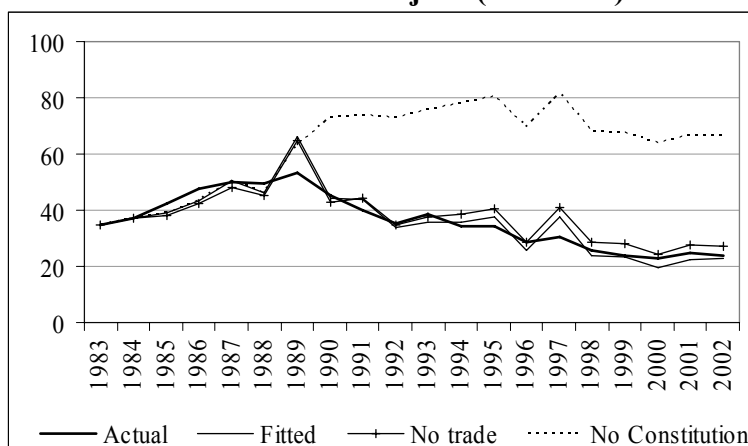


**Union enrollment**

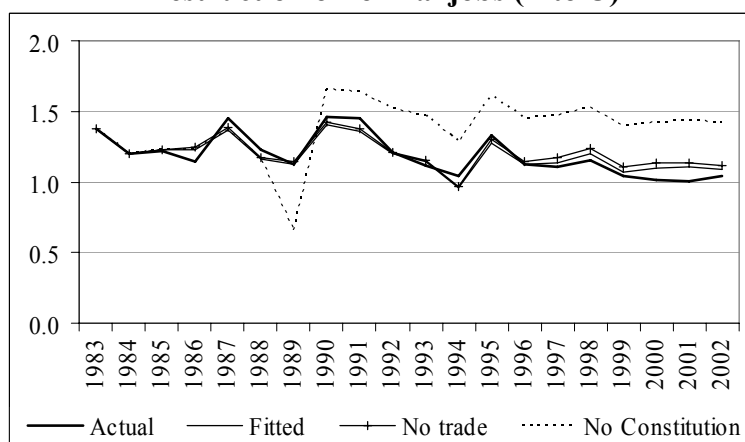


Note: Bubbles' sizes reflect the relative size of the industrial sector. The regression lines are obtained from WLS univariate regressions where weights are determined by the size of the industrial sector.

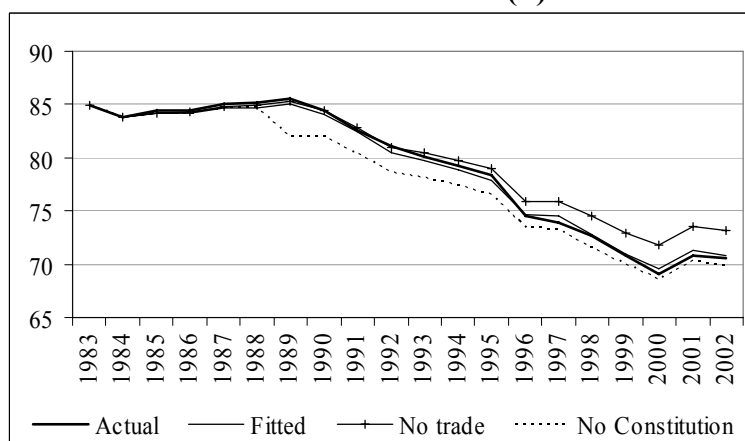
**Figure 10. Simulations of the impact of trade and firing costs**  
**Creation of formal jobs (ALL to F)**



**Destruction of formal jobs (F to U)**



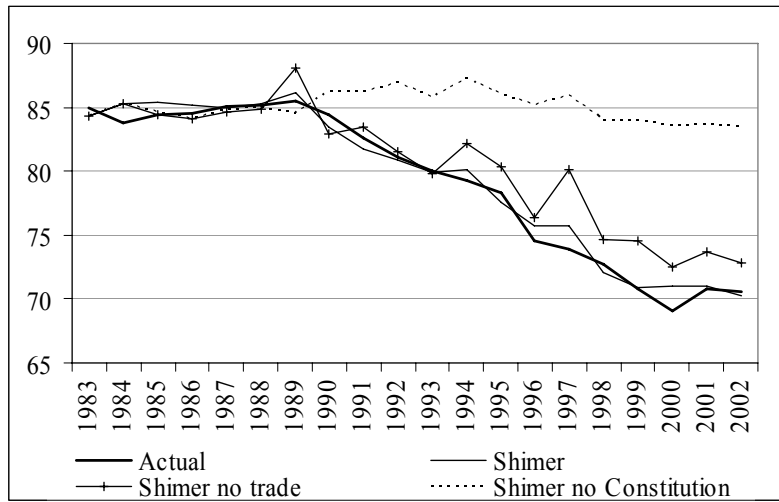
**Size of formal sector (F)**



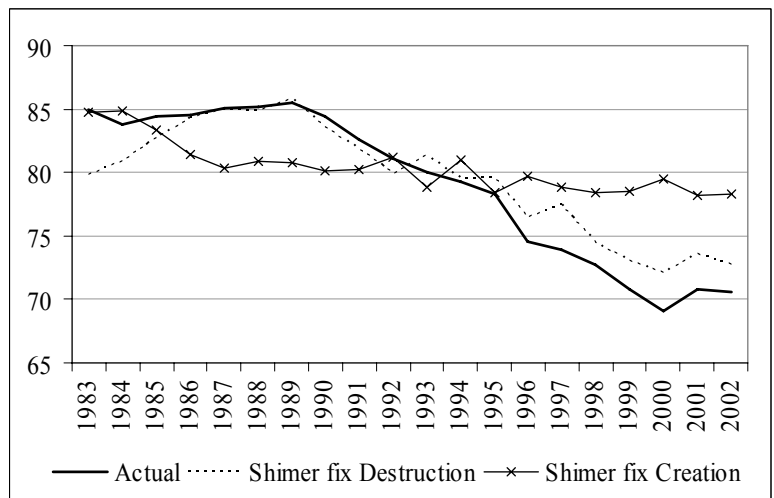
Note: Creation (ALL to F) and Destruction (F to U) “actual” rates are inferred from the continuous time transition matrix for each period using yearly pooled data from the Monthly Labor Survey (PME) from Jan 1983 to Dec 2002 following the procedure by Geweke et al. (1986) outlined in Annex 1. Computations are based on 10.000 Monte Carlo replications. Fitted rates are estimated from regressions reported in Table 7. Simulated rates estimated from regressions reported in Table 7 fixing Effective Tariff and Imports Penetration to its initial values (“No trade” scenario) or setting the Dummy to be 0 in all periods (“No Constitution” scenario). In all cases, the series correspond to the Industry Sector average (compounded by sub-sectoral inputs weighted by the participation of each Industry Sub sector)



**Figure 11. Actual and predicted size of the industrial formal sector**

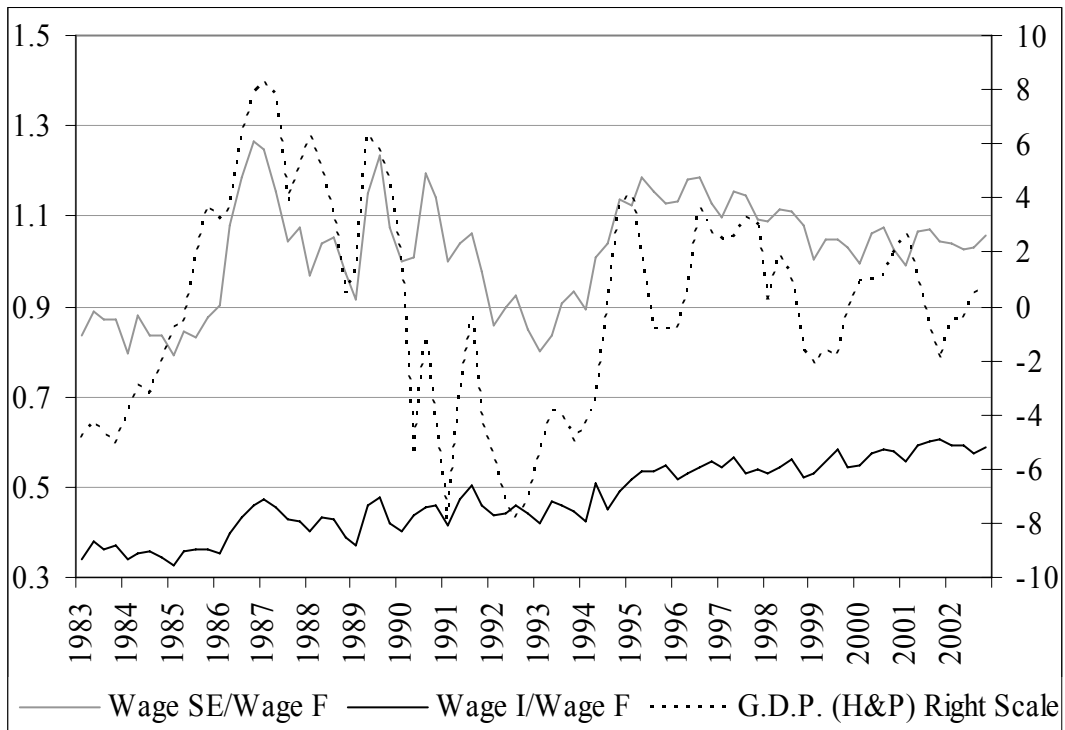


Note: the actual size of the formal sector is constructed using monthly data from the Monthly Labor Survey (PME) from Jan 1983 to Dec 2002. This series has been aggregated per year and corresponds to the Industry sector average (compounded by sub-sectoral inputs weighted by the participation of each Industry Sub sector). The predicted sizes are obtained applying equation in footnote 24 on the fitted values coming from regressions of Table 7 under the neutral and “no trade” and “no Constitution” scenarios.



Note: the actual size of the formal sector is constructed using monthly data from the Monthly Labor Survey (PME) from Jan 1983 to Dec 2002. This series has been aggregated per year and corresponds to the Industry sector average (compounded by sub-sectoral inputs weighted by the participation of each Industry Sub sector). The predicted sizes are obtained applying equation in footnote 24 and correspond to the steady state size of F applying the 1983-2002 average transition rate of F to ALL and ALL to F respectively. F = formal, ALL = not formal.

**Figure 12. Relative wages between sectors**



Note: Monthly Labor Survey (PME) from Jan 1983 to Dec 2002. The series have been averaged per quarter. I=Informal Salaried, SE=Informal Self-employed, F=Formal Sector.