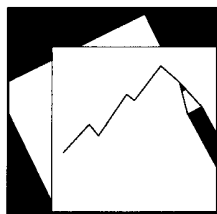


# Working Paper

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INTERNATIONAL MONETARY FUND



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## Institutions, Informality, and Wage Flexibility: Evidence from Brazil

*Marcello Estevão and Irineu de Carvalho Filho*

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## IMF Working Paper

Western Hemisphere Department

### **Institutions, Informality, and Wage Flexibility: Evidence from Brazil**

**Prepared by Marcello Estevão and Irineu de Carvalho Filho\***

Authorized for distribution by Steve Phillips and Alfred Schipke

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### **Abstract**

Even though institutions are created to protect workers, they may interfere with labor market functioning, raise unemployment, and end up being circumvented by informal contracts. This paper uses Brazilian microeconomic data to show that the institutional changes introduced by the 1988 Constitution lowered the sensitivity of real wages to changes in labor market slack and could have contributed to the ensuing higher rates of unemployment in the country. Moreover, the paper shows that states that faced higher increases in informality (i.e., illegal work contracts) following the introduction of the new Constitution tended to have smaller drops in wage responsiveness to macroeconomic conditions, thus suggesting that informality serves as a escape valve to an over-regulated environment.

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Authors' E-Mail Addresses: [mestevao@imf.org](mailto:mestevao@imf.org); [idecarvalhofilho@imf.org](mailto:idecarvalhofilho@imf.org)

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## I. INTRODUCTION

Labor market institutions that are designed to guarantee a minimum standard of pay and benefits may instead affect the operation of labor markets in ways that harm workers' interests. While regulations—such as minimum wage laws, centrally-mandated wage changes, and benefits unrelated to individuals' productivity—are sometimes intended to correct market imperfections, they create wedges between market conditions and wages, and may impede the efficient allocation of labor by muting the response of wages to gaps between the supply of job-seekers and available vacancies. As a result, such regulations may raise equilibrium unemployment rates. Moreover, stricter regulations may create incentives for workers and firms to circumvent them through informal employment arrangements, thus reestablishing market signals to wage formation and job allocation. On the negative side, informal work arrangements also have some negative economic implications: in particular, they may (i) sacrifice the beneficial effects of regulations in creating a climate conducive to human capital accumulation; (ii) narrow the tax base (Alm, Bahl and Murray 1991; Schneider and Enste 2000); (iii) create incentives for inefficiently small firm size (e.g., Levy 2007); (iv) channel resources into evading detection; and (v) enforcement of labor regulations may have strong negative effects on unemployment and welfare (Ulyssea 2010).

The complex relationship between regulations, informal contracts and high unemployment has been a key component of the Brazilian economy in past decades. Brazil has a relatively high degree of regulatory intervention in labor markets, which might account for some of its high unemployment rates and widespread informality. The bulk of these regulations dates back to the 1930s and 1940s when government intervention was on the rise and unions were viewed as devices to control workers instead of representing them (Ericksson 1977; Levine 1998). But important aspects of this heavy-handed approach to labor relations have intensified with the constitutional reform of 1988, albeit the motivations were quite different as the country initiated a journey back into a full democratic regime. With the 1988 constitution, additional complexities were added to existing regulations and non-wage labor costs were further raised. In the 1990s, other institutional changes undid some of the rigidity introduced by the 1988 constitution, and recent declines in the unemployment rate and in the extent of labor market informality in the country may reflect those changes besides obvious cyclical factors.

This paper examines how the sensitivity of wages to labor market conditions has changed over time and how those changes relate to the evolution of labor market (and macroeconomic) institutions in Brazil. In addition, it examines the question of whether the existence of an informal labor market that does not need to abide by labor regulations has the effect of mitigating wage-setting rigidities originated from inflexible institutions. The evidence presented here is based on estimates of “wage curves” as defined in Blanchflower and Oswald (1994), and a novel (albeit, straightforward) insight: the sensitivity of real wages

to unemployment rates will depend on the degree that wage setting is shielded from labor market conditions.<sup>1</sup>

Using the wage curve framework, we show that the sensitivity of real wages to movements in state-level unemployment rates declined after the 1988 Constitution, which indeed introduced regulations dictating work benefits independently of labor market conditions. As an example that key labor market institutions shield wage-setting from conditions outside the firm or sector, our results also show that unionization reduces the sensitivity of real wages to labor market slack. On the other hand, the estimates show that in states with more labor market informality, wage-setting is more sensitive to local unemployment after 1988. Thus, as labor market informality surged in the 1990s, it seems reasonable to conjecture that informality served to undo some of the rigidities introduced by the 1988 Constitution. The estimates also suggest that wages became more responsive to unemployment after 1999, which could be related to the introduction of a credible inflation-targeting regime that coordinated inflation expectations and wage demands, and thus left a larger role for labor market conditions in wage negotiations. It may also in part reflect some regulatory changes in the 1990s and an increased degree of economic openness.

The paper is organized as follows: The next section provides a brief description of how labor market regulations evolved in Brazil. Section III discusses the microeconomic database used in the empirical work, and developments in the unemployment rate and labor market informality in the past twenty-five years. Section IV presents the analytical framework used to interpret the results and estimates of the real wage/unemployment elasticity for Brazil. Section V concludes the paper with a discussion of policy implications.

## II. LABOR MARKET REGULATIONS IN BRAZIL<sup>2</sup>

Brazil's labor code is complex and pervasive in its coverage. The labor laws were consolidated into the *Consolidação das Leis do Trabalho* (CLT) in 1943, which establishes an extensive set of rules determining individual and collective rights and duties of workers, unions, and firms. In particular, the CLT determines that all workers have a booklet—the *carteira de trabalho* (work card)—in which changes in their work history are recorded. By signing this document, workers and firms are committed to contribute to the social security system and abide by a set of minimum working conditions, including minimum wages, maximum hours of work and overtime, minimum payment for overtime work, pre-paid vacations, paid maternity leave, protections against unjustified dismissals, and pre-

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<sup>1</sup> Baltagi, Blien and Wolf (2009) argue that the finding of a small slope in the wage curve for Germany reflects the centralized system of wage setting in that country.

<sup>2</sup> For a longer description of key aspects of the Brazilian labor regulations, see Adrogué (2005), Amadeo, Gill and Neri (2002), and Paes de Barros and Corseuil (2004).

notification of firing. Labor courts are the ultimate arbitrator of disputes, which can be costly and protracted, and are also perceived by some analysts as worker-biased.<sup>3</sup>

The modifications to the CLT since the mid-1960s through the 1990s have tended to increase labor costs and shield wage setting from changes in labor market conditions. The 1960s saw a rise in government intervention in labor relations with the introduction of further mandatory wage benefits (e.g., the “thirteenth salary” and family allowance), and of the Wage Adjustment Law determining the minimum rate of wage change for all workers in the economy in 1965.<sup>4</sup> An individual severance fund (FGTS) replaced the prohibition against firing a worker after he or she has reached 10 years of service; while this change was aimed at enhancing labor market functioning, its design has been criticized for favoring high job turnover (Gonzaga 2003).

The constitutional reform of 1988 gave more freedom and autonomy to labor unions and drastically reduced the cases when government could intervene in labor relations, changes which could have increased the role of market signals during wage negotiations. However, the labor courts continued to have an important role in settling labor disputes: reliance on court decisions limits the role of negotiations between firms and employees, creating a “legalist” approach to labor disputes often detached from labor market conditions. The new constitution also increased variable labor costs and the level of dismissal penalties, which could have increased firms’ incentives to establish informal (and thus, illegal) work contracts with their employees.

The 1990s saw some reversal of these regulations. In 1995, the Wage Adjustment Law was abolished, eliminating an important instrument of incomes policy used by the government and allowing wages to respond more freely to labor market conditions. In 1997, the government introduced legislation allowing employers to hire new workers on temporary contracts, during which non-social security related payroll taxes would be waived and dismissal barriers would be lower. These contracts had to be approved in collective agreements, however, and according to some observers, they were rarely used (see Gonzaga, 2003). In 1998, firms were allowed to calculate hours worked based on a rolling four-month period instead of on a weekly basis, thus increasing schedule flexibility.

### **III. MEASURING UNEMPLOYMENT AND INFORMALITY**

There are two main databases with information on labor market conditions in Brazil. The PNAD (National Household Survey) is collected at an annual frequency almost every year and is representative of the whole country, with the exception of the sparsely populated rural

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<sup>3</sup> See World Bank (2002).

<sup>4</sup> As inflation increased, the adjustment period and specific formula, which always depended on inflation and sometimes incorporated an expectations component, changed many times over the years.



areas of the Northern states.<sup>5</sup> The PME (Monthly Employment Survey) is done every month and covers only the six largest metropolitan regions: São Paulo, Rio de Janeiro, Belo Horizonte, Salvador, Recife, and Porto Alegre. Both surveys have detailed information on individual characteristics and labor market condition. Because of its high frequency and timeliness, the PME is the basis for the official statistics on the unemployment rate. Both surveys also track information on workers who do not have a signed work card (*sem carteira assinada*), and, thus, are “informal,” and workers who are self-employed, a category that might reflect tax or regulation avoidance.

Information from the PNAD shows that the national unemployment rate increased from 1989 until 2003, and then it shifted to a declining trend in 2004 (Figure 1).<sup>6</sup> For the six largest metropolitan areas, there is a methodological break in the unemployment series of the PME, so one cannot compare the unemployment levels across the whole span of the data, but the pattern mirrors the one that emerges from the PNAD, with unemployment following an increasing trend starting in 1989 through 2004, and declining thereafter.

PNAD’s wider geographic coverage and better tracking of informal labor relations since 1989 make it a more reliable database to study changes in wage flexibility in Brazil. While all informal workers—by definition—do not have a signed work card, the reverse is not true: public servants and military personnel do not have a signed card either but enter in a formal work relationship by signing a contract with the government. While for many years both the PME and the PNAD have asked individuals whether they have a signed work card, the PNAD has included a follow-up question since 1989 on whether the individual has a contract with the government, while the PME did so only beginning in 2002. Thus, up to 2002, the PME does not provide an accurate measure of neither the trend nor the level of informality.

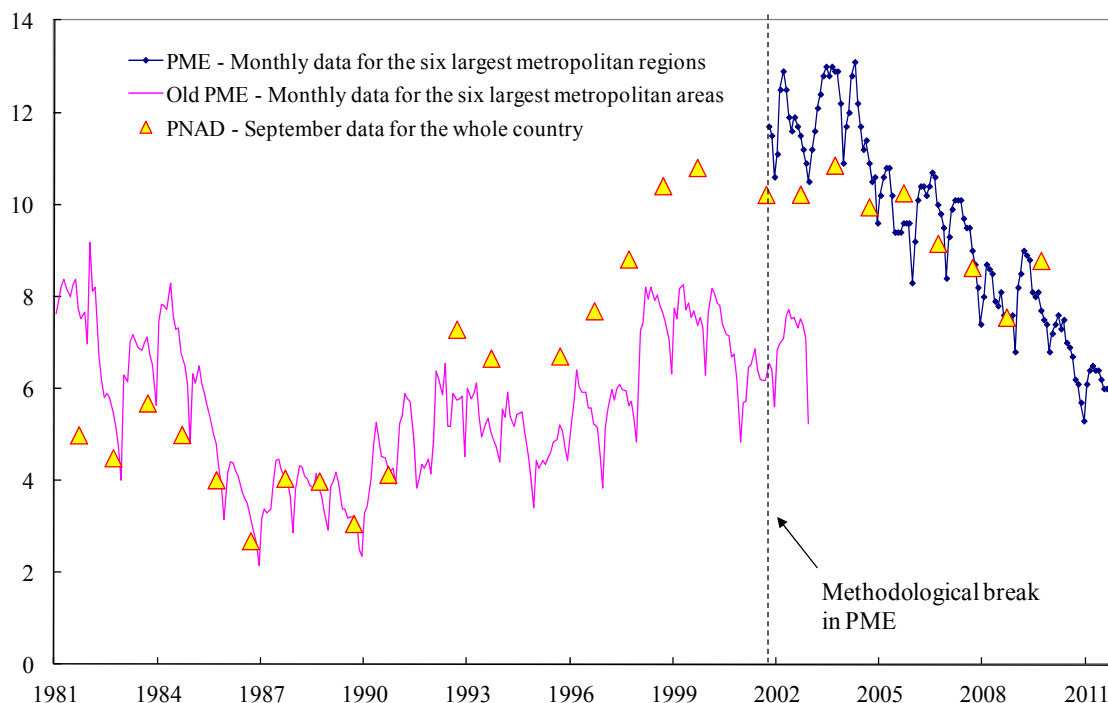
According to the PNAD, labor market informality showed a slight upward trend up to 2002 and has subsequently retreated a bit (Figure 2). Individuals without a formal work contract (“*sem carteira*”) comprised 20½ percent of total employment in 1989 rising to around 23 percent in 2002, then declining to about 20 percent in 2009. The share of self-employed workers went from 18.2 percent in 1989 to a peak of 21.1 percent in 1999 before retreating to around 18.0 percent in 2009. The share of “formal” employment, defined as the remaining individuals once workers without formal contracts and the self-employed are excluded—the measure on which the media often focuses—declined from 61.3 percent in 1989 to 56½ percent in 2002, before it trended upwards again, up to more than 60 percent in 2009, the end of our sample.

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<sup>5</sup> For more detailed information on the PNAD and data definitions used in this paper, see Appendix I.

<sup>6</sup> The unemployment rate is defined as the ratio between the jobless people who are looking for a job during the survey’s reference week and the number of individuals in the labor force (employed workers and job seekers). It refers to the whole country and includes all sectors of activity. Information for 1991, 1994 and 2000 were not collected by the IBGE.

**Figure 1. Brazil: Unemployment Rate  
(In percent)**

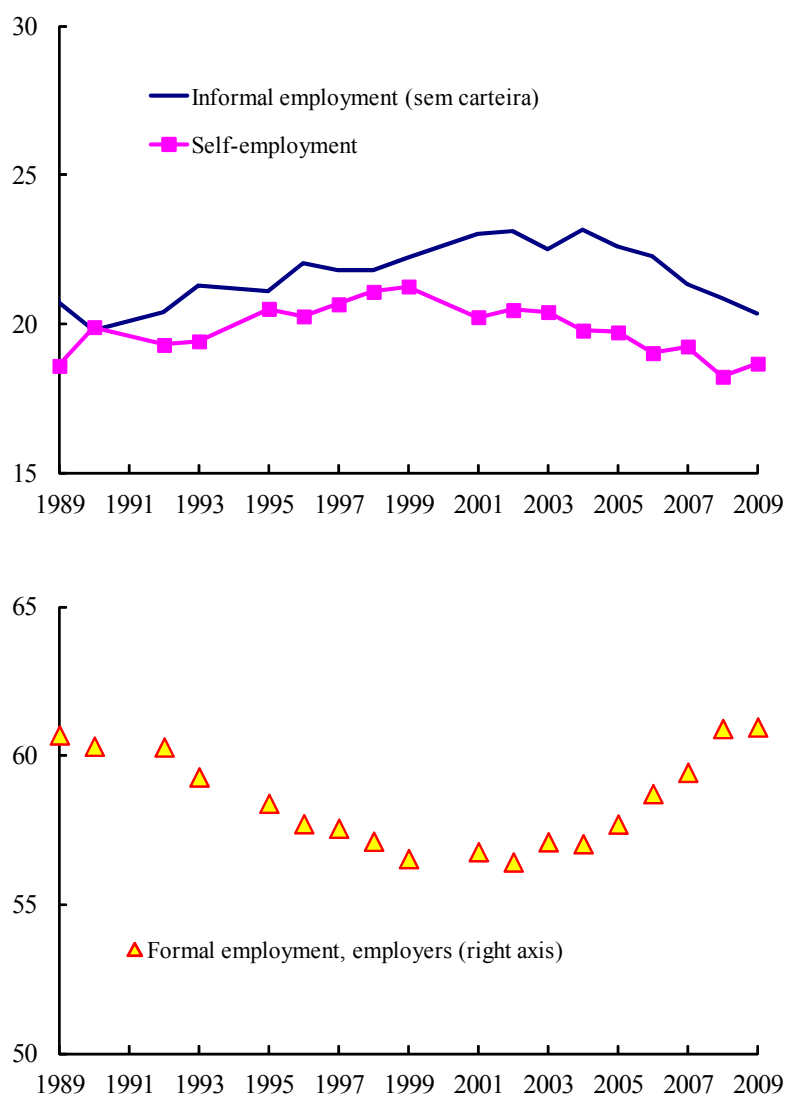


Source: PNAD-IBGE, PME-IBGE, and author's aggregation.

The trend increase in informality in the 1990s was stronger in the largest six metropolitan regions, suggesting important shifts in the geographical composition of informality in the country (Figure 3). Aggregations from PNAD data show that, as a result of the steeper upward trends in informality in the largest metropolitan regions, the share of formal workers in those urban centers declined from 67½ percent in 1989 to 57 percent in 2002. As was the case for the country as a whole, formality increased a bit since then. Consistent with the information from the PME, which is limited to large metropolitan areas, the share of self-employment and workers without formal contracts declined somewhat after 1999 (Figure 4). The relative opening of the economy in the 1990s and the sustained growth of the world economy in the 2000s have increased demand for Brazilian commodities, boosting growth in the agricultural Center-West region, which reduced informality in agriculture.<sup>7</sup> Our wage curve estimates rely on the wide variability of informality across states and time periods, measured either as the fraction of workers *sem carteira* or as fraction of self-employed workers.

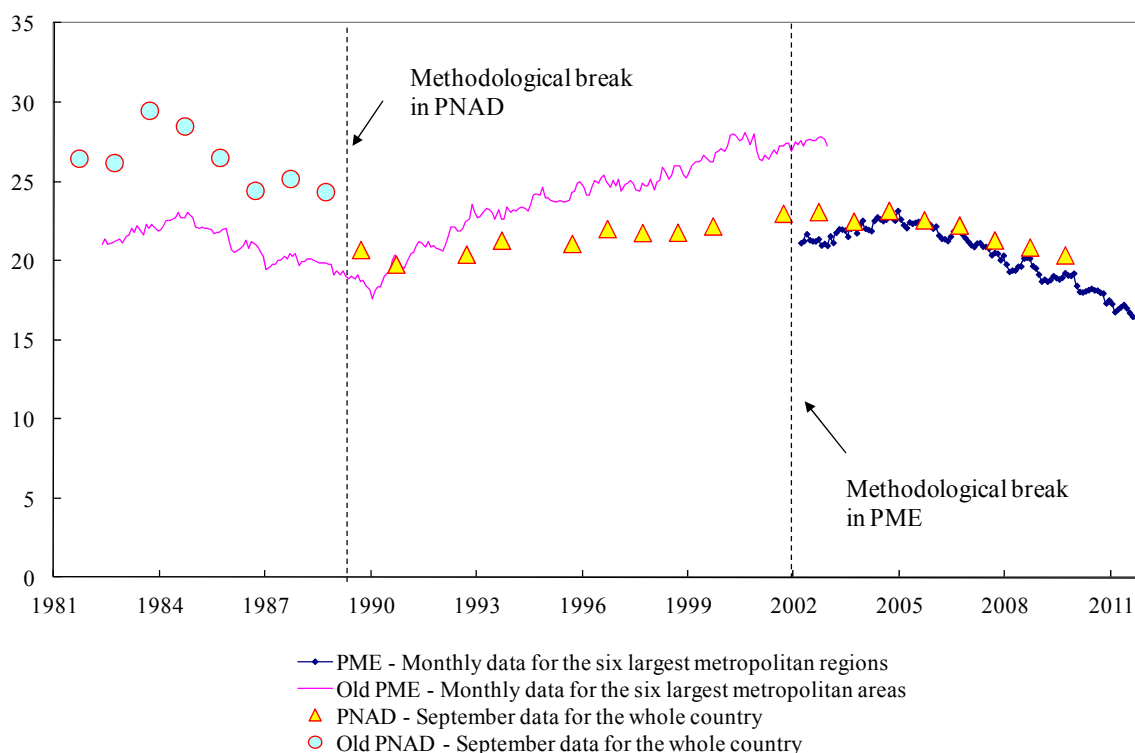
<sup>7</sup> There have been other compositional changes in the pool of informal workers, which reflect structural shifts in the Brazilian economy as documented in Ramos and Ferreira (2005).

**Figure 2. Composition of Work: Informal, Self-Employed and Formal Work  
PNAD, Brazil (In percent of total employment)**



Source: PNAD-IBGE and author's aggregation.

**Figure 3. Informal Working Arrangements: PME Compared to PNAD  
(In percent of total employment)**



Source: PME/IBGE, PNAD/IBGE, IPEADATA, authors' own calculations.

#### IV. MODELING LABOR MARKET FLEXIBILITY<sup>8</sup>

This section uses a formal model of the equilibrium relationship between wages and unemployment to assess how regulations and other structural factors affect the response of wages to changes in labor market conditions, as well as the role of informality within this adjustment mechanism.

##### A. The Theory

Different theoretical models imply a negative correlation between the level of real wages and the unemployment rate, a relationship known as the “wage curve.” Based on a model in which firms and unions bargain over wages but firms set employment unilaterally to maximize profits, the following relationship can be derived (see Appendix II for one such model):

<sup>8</sup> Layard et al (1991) present a pertinent discussion of different labor market models with equilibrium unemployment.

$$w = f(u; b, \tau, o), f_b, f_\tau > 0 \text{ and } f_u < 0 \quad (1)$$

where  $w$  stands for the real hourly wage;  $b$  and  $\tau$  are, respectively, the real income a worker would receive if unemployed and the gap between labor income taxes and unemployment income taxes (variables that affect the relative cost of unemployment);  $o$  represents other structural factors determining the position of the wage curve (e.g., technological progress); and  $u$  is the unemployment rate.<sup>9</sup>

The steepness and position of the wage curve will depend on regulations affecting workers' bargaining power and the alternative cost of being unemployed, and on product market conditions, among other factors. Wages will vary with the unemployment rate because the latter affects workers' fears of not finding a job if dismissed. For example, when unemployment rises, firms can pay lower wages to get the same effort from their workforce as the threat of losing a living income is higher. Whenever workers' bargaining power is weaker—maybe because the influence of the unemployed (the *outsider*) on wage formation is increased due to institutional changes—their ability to insulate wages from labor market conditions is diminished, which implies a larger elasticity of wages with respect to the unemployment rate.<sup>10</sup>

Changes in regulation away from a legalistic wage-setting framework toward another framework more closely related to labor market conditions will also increase this elasticity. Stronger product market competition makes output, and, thus, employment, more sensitive to cost variations, which tends to curb insiders' power and increase the influence of outsiders in wage formation. (This effect helps to explain the opposition of unions to the globalization of production in the 1990s and 2000s.) However, variations in the shadow cost of holding a job—maybe because of a rise in non work benefits, ( $b$  in equation 1) or labor income taxation—will shift the curve, leaving the wage/unemployment rate elasticity unchanged. Higher productivity through continued technological progress will also allow firms to pay better wages for a given rate of unemployment without affecting the wage/unemployment elasticity.<sup>11</sup>

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<sup>9</sup> Note that the logic of the wage curve is very different from that underlying the Phillips curve, as it pertains to the level of real wages rather than the change in nominal wages.

<sup>10</sup> Indeed, stronger unions are in general associated with stronger bargaining power for workers, higher wages given the unemployment rate (i.e., their relevant wage curve lies above the one for nonunionized workers) but lower wage sensitivity to external conditions. For instance, using data for the United States, Estevão and Tevlin (2003) show that wage setting is less affected by product market conditions in industries with a more unionized workforce.

<sup>11</sup> This paper does not study shifts in the wage curve in view of the large measurement errors in key variables, including technological growth and state-level inflation (de Carvalho Filho and Chamon 2011 argue that CPI inflation in Brazil may have been severely biased during the nineties).

With this broad framework in mind, we can lay down possible channels for how changes in regulations and economic structure in Brazil could have affected the sensitivity of wages to the unemployment rate:

- The new constitution promulgated in 1988 altered labor benefits and costs. Less government intervention in wage setting could have increased the sensitivity of wages to the unemployment rate, but higher job protection could have lowered it.
- The elimination of the Wage Adjustment Law in 1995 had the potential to increase the sensitivity of wages to labor market conditions.
- Wage flexibility could also have increased in the 1990s and 2000s as the Brazilian economy became more open to international trade, which raised product market competition.<sup>12</sup>
- The introduction of the inflation-targeting framework in 1999 could have increased the sensitivity of real wages to the unemployment rate in Brazil, as wage-driven inflation would trigger higher interest rates, thus rendering the wage-setting process more sensitive to labor market conditions.<sup>13</sup>

Strict regulations could prevent wage flexibility in the formal sector, but they could be circumvented by agreements between employers and employees outside the legal framework. Many regulations are translated into higher production costs and protection of insiders from changes in market conditions (through job protection mechanisms, for instance). In this case, workers and firms could have an incentive to bargain over work conditions outside the legal framework. Because Brazilian courts have often upheld workers' rights even in the absence of formal contracts, individuals who accept informal work arrangements do not thereby forfeit their right to legal recourse, but it is an empirical question whether and by how much do their work arrangements replicate the ones for formal workers. As discussed in the introduction, the hypothesis in this paper is that market influences on wage bargaining are likely to be stronger, the greater the size of the local informal sector. As an additional look at how institutions created to protect workers affect wage flexibility, we also look at the effect of unionization on the wage sensitivity to labor market conditions.

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<sup>12</sup> Ferreira and Rossi (2003) estimate that nominal tariffs averaged 118 percent in 1987, and were later reduced to only 12.9 percent in 1997. Goldberg and Pavcnik (2003) found no relationship between trade liberalization and informality in Brazil.

<sup>13</sup> See Berger, Hefeker, and Schob (2004) for a discussion of the conditions under which the ability of unions to obtain nominal wage adjustments that are inconsistent with equilibrium real wages and price stability diminishes in the presence of a strong monetary authority.

## B. Econometric Methodology

The wage curve can be estimated using microeconomic information from the PNAD, and the log-linear specification proposed by Blanchflower and Oswald (1994) and other researchers:

$$\ln w_{ist} = a + X'_{ist}b + g \ln u_{st} + d_t + d_s + e_{ist} \quad (2)$$

where  $\ln$  refers to natural log,  $w_{ist}$  is the real hourly wage rate<sup>14</sup> of individual  $i$  in state  $s$  in year  $t$  adjusted for changes in technology<sup>15</sup>,  $X_{ist}$  is a vector of dummies for individual observable characteristics (gender, age, education, occupation, industry of work, metropolitan area, and, after 1989, “self-employed” and “without a formal contract”),  $u_{st}$  is the unemployment rate in state  $s$  in year  $t$ ,  $d_t$  and  $d_s$  are respectively temporal and state dummies, and  $e_{ist}$  is an i.i.d. error term.<sup>16</sup>

The econometric methodology needs to avoid possible inefficient estimation that would result from the existence of covariance among individuals that is not entirely attributable to either their measured characteristics or the local unemployment rate. To address this concern (discussed in Moulton, 1986, 1990), the two-step estimation approach proposed by Card (1995) is used. In a first step, the estimated equation excludes the local unemployment rate, but includes interactive state and time dummies, whose coefficients can be interpreted as the average state wage in time  $t$  once individual characteristics are controlled for:

$$\ln w_{ist} = a + X'_{ist}b + \sum_{s,t} \omega_{st} \cdot 1_{States=s} \cdot 1_{Time=t} + e_{ist} \quad (3)$$

In a second step, the adjusted wage variable is regressed on time and region effects as well as on the regional unemployment rate lagged one period to minimize composition effects that can affect the “economic” relationship between unemployment and wages.<sup>17</sup>

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<sup>14</sup> Hourly real wages were defined as the ratio of monthly labor income to 4.3 times the hours worked in the reference week. The National Index of Consumer Prices (INPC), centered at the PNAD reference week, as proposed by Courseuil and Foguel (2002), was used to deflate wages.

<sup>15</sup> Technological progress allows wages to increase even if the unemployment rate remains unchanged. Following Blanchard (1997), technological progress is measured as total factor productivity growth adjusted for the labor share. This measure assumes that technology changes are labor augmenting (Harrod neutral) to allow for balanced growth in a dynamic setup. The results in this paper are not sensitive to using the TFP measure by Ferreira, Ellery and Gomes (2008).

<sup>16</sup> Note that the time dummies’ coefficients cannot be interpreted as structural wage curve shifts as they capture every factor with time-only variation, including likely measurement errors.

<sup>17</sup> Composition effects would occur if low skill workers are more prone to lose their jobs during periods of high unemployment, thereby reducing average wages, even if wages are not flexible, as in Solon, Barsky and Parker 2004.

$$\omega_{st} = \alpha + \beta * \ln u_{st-1} + d_t + d_s + e_{st} \quad (4)$$

The elasticity of wages with respect to the unemployment rate may vary with time and the degree of labor market informality. The effect of changes in regulations and economic structure could be captured by interactive terms between the unemployment rate and year dummies, while the effect of informal labor relations could be proxied by the size of the informal labor market in a specific state and time period, as in:

$$\omega_{st} = \alpha + \sum_{\tau} \beta_{\tau} \ln u_{st-1} + d_t + d_s + e_{st} \quad (5)$$

where the  $\beta_{\tau}$  represent year specific slopes of the wage curve. We can also test hypothesis about structural breaks on the wage curve.

$$\omega_{st} = \alpha + \beta * \ln u_{st-1} + \phi * T_T * \ln u_{st-1} + \delta * \ln in_{st-1} * \ln u_{st-1} + d_t + d_s + e_{st} \quad (6)$$

where  $T_T$  represent a dummy with 1's for the post-T period and 0's for the period before T; and  $in_{st-1}$  represents the extent of labor market informality in state  $s$  in period  $t-1$  to match the lag structure for the unemployment rate. In estimating this equation, two variables were used to measure the degree of labor market informality: (i) the number of workers without a formal contract ("*sem carteira*") as a share of total employment in state  $s$  at time  $t-1$ ,  $\ln(scart_{st-1})$ ; (ii) and the sum of workers without a formal contract and the self-employed as a share of total employment in state  $s$  at time  $t-1$ ,  $\ln(inf_{st-1})$ . Both variables are normalized to equal zero at their sample mean.

### C. Estimation Results<sup>18</sup>

#### Estimates Based on Cross-Sectional Variation by States

Estimates of the elasticity of real wages to local unemployment rates (a measure of real wage flexibility) in Brazil based on the cross-sectional variation of unemployment by states vary depending on the sample coverage. For the full sample (1981–2009), the elasticity is  $-0.092$  (Table 1, column 1) which is statistically indistinguishable from the  $-0.1$  coefficient found in

<sup>18</sup> This subsection discusses only the final estimation of the wage curve. The first-step estimates may be obtained directly from the author. The first-step estimations use 1,220,800 observations for the period 1981–1988, and 2,571,500 observations for 1989–2009. The results show that wages increase with age (at a declining rate), and education, with a significant jump for individuals with more than high-school education. Wages are higher for men and white individuals; highest in the finance and business services; and public administration and the social sector, followed by manufacturing, construction, trade and other services; and lowest in agriculture and undefined activities; higher in metropolitan areas; and lower for self-employed individuals, but even lower for individuals without a formal work contract.



many applications for advanced economies.<sup>19</sup> However, this estimate hides considerable variation over time. Dynamic tests found a structural break in the wage curve for Brazil in 1989 and 1999.<sup>20</sup> Hence we re-estimate the regression assuming two breaks in the series—the first in 1988 coinciding with the passing of the Constitution, the second one based on the finding of a structural break in 1999. While for the initial pre-1988 Constitution period the elasticity is

-0.117, it shrinks in absolute value by 0.084 during the period 1989–1998, then it reverts to its early 1980s values from 1999 onwards (column 2).

In order to analyze the effect of the interaction between unemployment rates and other dimensions of labor market performance, such as informality or unionization, we restrict the sample to 1989–2007 from which we can obtain temporally consistent series for those variables. Column 3 reports an elasticity of -0.025 for the period 1989–2009 which is lower (in absolute value) than the typical estimates for advanced economies. Column 4 confirms that the finding of low elasticity in the 1989–1998 period holds when we drop the observations pre-1988. This finding is further illustrated by Figure 4 which plots the time series of the real wage-unemployment elasticity, along with confidence intervals.

The results also show strong evidence that a higher proportion of undocumented workers (i.e., employees without a formal labor contract) goes hand in hand with a more fluid functioning of labor markets (column 5); there is some suggestive evidence that a broader measure of informality which includes self-employed and undocumented workers is also correlated with greater responsiveness of real wages to local unemployment conditions (column 6); consistent with the hypothesis that institutions shield wage setting from conditions outside the firms, there is evidence that a greater unionization rate reduces the responsiveness of real wages to local unemployment conditions (column 7).

To shed more light on the role of undocumented workers and unionization on labor market functioning, we then calculate the frequency distribution of elasticities derived from the estimates in the columns 4 and 6 of Table 1, accounting for the frequency distribution of those local labor market characteristics. The results are shown in Figure 5. The two charts at the top show results for the period immediately after the passing of the 1988 Constitution.

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<sup>19</sup> Blanchflower and Oswald (1994) pioneered estimates for industrial countries of -0.1 using microeconomic data similar to the PNAD. Subsequent work has shown a bunching around this value. Sanz-de-Galdeano and Turunen (2005) report figures around -0.1 or higher for euro-area countries. Estevão (2003) found a -0.1 elasticity in a panel of OECD countries. Blanchflower (2001) found elasticities between -0.1 and -0.3 for Central and Eastern European countries.

<sup>20</sup> We have performed the Quandt likelihood ratio test for testing for a break in an unknown break date. The hypothesis of no structural break can be rejected at the 5percent level (for critical values and methodology, Stock and Watson 2003, pp. 468-472). When we perform Chow tests for individual years, we find breaks in 1987-1988 and 1999, 2001-2004. The largest Chow statistic is found in 2003.

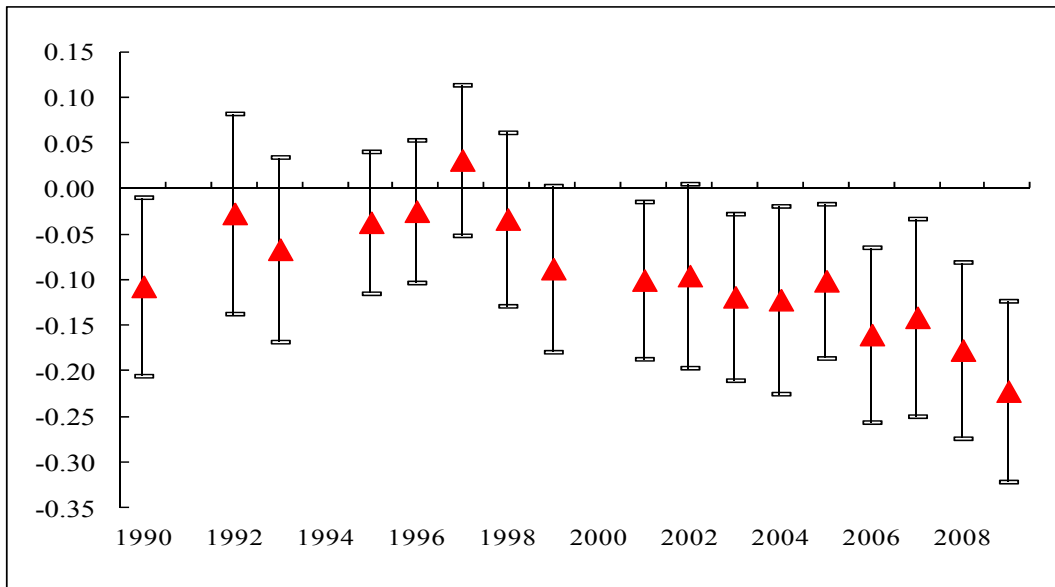
The results for the 1989–1998 period show an elasticity distribution around zero when unemployment rates are interacted with informality measures, and a positive elasticity when unemployment rates are interacted with unionization rates (available only for the period 1992–1998). For the period starting in 1999, the results are consistent with more flexibility in real wages.

**Table 1. Wage Curve Estimates for Brazil: Estimates Based on Cross–Sectional Variation by States**

	1	2	3	4	5	6	7	8
Sample	81-09	81-09	89-09	89-09	89-09	89-09	89-09	89-09
Lagged unemployment (in logs)	-0.092*** [0.0167]	-0.117*** [0.0208]	-0.025 [0.0197]	0.019 [0.0211]	-0.014 [0.0205]	-0.016 [0.0201]	0.011 [0.0196]	0.026 [0.0217]
Lagged unemployment (in logs) X 1989-1998		0.084*** [0.0237]						
Lagged unemployment (in logs) X 1999-2009		-0.015 [0.0231]		-0.099*** [0.0201]				-0.096*** [0.0202]
Lagged unemployment (in logs) X undocumented rate (in logs)					-0.039* [0.0222]			-0.030 [0.0216]
Lagged unemployment (in logs) X informality rate (in logs)						-0.073* [0.0372]		
Lagged unemployment (in logs) X unionization rate (in logs)							0.046*** [0.0118]	
Time dummies	yes	yes	yes	yes	yes	yes	yes	yes
State dummies	yes	yes	yes	yes	yes	yes	yes	yes
Number of observations	623	623	425	425	425	425	375	425
R <sup>2</sup>	0.92	0.92	0.93	0.93	0.93	0.93	0.94	0.93

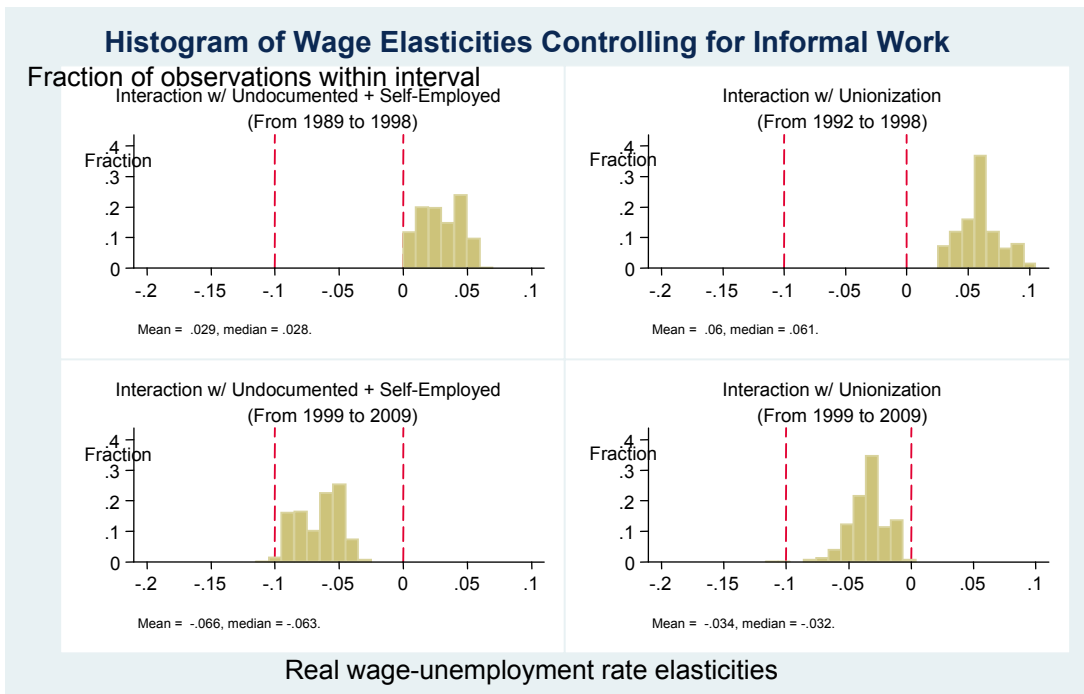
Notes: The dependent variable is ln(real hourly wage adjusted for technology and individual characteristics). The lagged undocumented, informality and unionization rates are log deviations from their sample means. Standard errors are reported in square brackets.

Figure 4. Real Wage-Unemployment Rate Elasticities: Estimates Based on Cross-Sectional Variation by States



Note: The coverage of the reported confidence intervals is 95 percent.

Figure 5. Histogram of Wage Elasticities Controlling for Informal Work



Source: Authors' own estimation based on PNAD-IBGE data.

The increased degree of labor market flexibility since the late 1990s may, in part, have reflected a more credible monetary framework after 1999. A credible monetary framework changes the bargaining situation between unions and firms, as they do not expect the central bank to accommodate an increase in nominal wages if that would result in higher inflation. It is possible that, in this regime, the sensitivity of wages to unemployment changes increase, as insiders' bargaining power is reduced, raising the influence of outsiders in wage setting. Other factors could also be behind the structural break in 1999, possibly including the protracted effect of the economic opening beginning in the late 1980s or the abolition of the Wage Adjustment Law in 1995.<sup>21</sup>

## V. CONCLUSIONS AND POLICY IMPLICATIONS

This paper uses estimated wage curves to document the evolution of real wage flexibility in Brazil from 1981 to 2009. The results suggest that wages became less responsive to labor market conditions by the end of the 1980s. We cannot pin down precisely the cause for this change, but the passing of a new Constitution in 1988 which tightened labor regulations seems to be an important factor. However, the estimates also show that the elasticity of wages with respect to the unemployment rate increased after 1999 to the mid-range of international estimates. This improvement may reflect the introduction of the inflation-targeting regime in 1999—which could have strengthened market discipline on wages—or the protracted impact of structural changes, including greater openness to international trade. As a result of higher flexibility, the macroeconomic shocks to state labor markets of the last decade have been better absorbed by real wage adjustments than in the 1990s, when unemployment rates surged.

This paper also examined the effect of both informality and unionization in the functioning of labor markets. A large proportion of undocumented and self-employed workers in a labor market was found to be correlated with greater real wage sensitivity to labor market conditions. On the other hand, greater unionization rate in a labor market was found to be associated with a lower real wage flexibility. These results are consistent with the hypothesis that labor market institutions and regulations affecting the market signals used during wage setting, and that informality may serve as an escape valve to circumvent these institutions and regulations.

The importance of informality in increasing wage flexibility in Brazil demonstrates the rigidity of labor market regulations in the country. However, as already noted, even though widespread informality greases the labor market, there has been some research showing that informality has many dark sides, including possible deleterious effects on productivity growth. First, informal workers tend to be less attached to their jobs, reducing the incentive

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<sup>21</sup> As discussed before, other structural changes could have shifted the wage curve without affecting the wage/unemployment rate elasticity—a possibility not researched in this paper—raising the equilibrium unemployment rate. For instance, Camargo and Reis (2008) show that the increase in the value of pensions per member of the household during the 1990s is correlated to larger unemployment rates for low-skill workers. This effect is consistent with a wage-curve shift resulting from a decline in the alternative cost of being unemployed, which would raise the wage needed for an individual to accept a job.

for firms to invest in their human capital. Second, because larger firms cannot escape government inspection, firms hiring workers informally have an incentive to remain small and are thus unable to exploit economies of scale. As a result, larger firms tend to be more productive but also pay taxes and end up facing unfair competition from smaller, non-tax paying firms. With a reduced market for its goods and services, firms in the formal sector also face smaller incentives to invest and grow. The deleterious effects of informality tend to be magnified because informality is “contagious;” once a firm hires workers without a formal contract, a network of informal relations (characterized by tax evasion) with suppliers and customers may need to be established to avoid detection. These suppliers and customers may need to be informal as well to cover their relationship with an informal firm. As a result, informality spreads through the economy.<sup>22</sup> These issues need further research.

The results in this paper suggest that labor market reforms need to be designed carefully to encourage participation in the formal economy without affecting wage flexibility. For example, changing the focus from employment protection toward better insurance mechanisms for the unemployed would weaken the segmentation between job-holders and job-seekers and reduce incentives for informality, while improving the safety net for the unfortunate. More generally, targeting regulations at the basic factors that affect workers’ welfare—insurance against bad shocks and a minimum living income—without increasing rigidities and costs would reduce the role of informal labor relations (and their potential negative side effects).

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<sup>22</sup> The effects of informality on firm size, productivity, and informality of suppliers and corporate customers is studied in de Paula and Scheinkman (2006).

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## Appendix I. The PNAD

The PNAD is a household survey conducted as a stratified sample every year, excluding Census periods and rare occasions. For the sample period used in this paper, 1981–2009, data for 1991, 1994 and 2000 are not available. It aims at providing basic information for research on social and economic issues in Brazil. Because of its wide mandate, the PNAD always has general demographic information as well as data on education, work, income and housing conditions. Additional information is provided depending on the survey year covering migration, fertility, health, nutrition and a variety of other themes. The survey covers the whole population residing in Brazil, with sampling according to both individual and household characteristics, with the exception of the rural areas of Rondônia, Acre, Amazonas, Roraima, Pará e Amapá.

The labor and monthly income variables used in this paper are based on information for the survey's reference week, which is in September, and on the individual's main job. The **working-age population** is defined as individuals older than 10 years of age. To be part of the **labor force**, the individual needs to either have a job or be unemployed and searching for a job in the reference week. **Hours worked** in that week multiplied by 4.3 are used to calculate hourly wages, which is then deflated by the deflator for the PNAD proposed by Corseuil and Foguel (2002), which is based on INPC (National Consumer Price Index) of the reference week.<sup>23</sup> **Workers without a formal labor contract** are individuals who responded “no” to the question on whether they have a signed work card (*sem carteira assinada*) but are not public servants or military personnel. However, before 1989 the follow-up question on whether an individual is a public servant or a military personnel did not exist, which prevented the use of this variable in the earlier part of the sample. The **self-employed** group comprises individuals with an occupation and monetary remuneration working without an employer, but possibly with a partner, and not hiring paid employees in the week of reference.

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<sup>23</sup> de Carvalho Filho and Chamon (2008) argue that during the period of economic reforms starting in the late eighties in Brazil, price indexes may have substantially overstated inflation, thereby understating real income growth.

APPENDIX II. A Model<sup>24</sup>

Firms are assumed to determine employment by maximizing short-run profits given the negotiated wages and the stock of capital.<sup>25</sup> On the other hand, unions take into consideration the employment effects when negotiating the wage. The profit maximization problem of firm  $i$  is:

$$\text{Max}_{N_i} \Pi_i = P(Y_i^d)Y_i - W_i(1 + t^e)N_i \quad (1)$$

$$\text{s.t. } Y_i = T_i K_i^\alpha N_i^{1-\alpha} \quad (1a)$$

$$Y_i^d = \left( \frac{P}{P_i} \right)^\varepsilon, \quad \varepsilon > 1 \quad (1b)$$

$$Y_i^d = Y_i \quad (1c)$$

where  $W_i$ ,  $P_i$ ,  $P$ ,  $N_i$ ,  $T_i$ ,  $K_i$ ,  $t^e$ , and  $\varepsilon$  represent, respectively, the bargained wage, firm-level price, economy-wide average price level, employment at the firm, total factor productivity, capital, the payroll tax rate paid by the firm, and the absolute value of the price elasticity of demand. The production function is assumed to be Cobb-Douglas in (1a), the demand for output is a function of its relative price with the aggregate price level taken as exogenous in (1b), and there are no costs to adjust labor to its optimal value. Solving this maximization problem and using the assumption that firms are identical—implying that the subscript  $i$  can be dropped for all the variables in the first order condition of (1)—firms' optimal demand for labor is:

$$N = \left( \frac{W(1 + t^e)}{P} \frac{\varepsilon}{(\varepsilon - 1)(1 - \alpha)} (TK^\alpha)^{\frac{1-\varepsilon}{\varepsilon}} \right)^{\frac{\varepsilon}{\alpha(1-\varepsilon)-1}} \quad (2)$$

Note that the elasticities of labor demand to exogenous changes in the negotiated wages or in social security taxes,  $\varepsilon_{NW}$ , and the share of labor costs in profits,  $\lambda$ —to be used below—depend only on the demand elasticity,  $\varepsilon$ , and on the labor intensity of production,  $(1-\alpha)$ .

<sup>24</sup> This model is based on Estevão and Nargis (2002).

<sup>25</sup> The assumption of capital exogeneity determines the short-run character of the model in which an analysis of the optimal long-run growth path is irrelevant. Nickell and Layard (1997) and Daveri and Tabellini (2000) have focused somewhat on the relationship between the equilibrium unemployment rate and the optimal rate of capital accumulation.

The bargaining problem can be described as the maximization of a Nash function subject to this labor demand function:

$$\underset{W}{Max} \Omega = \left[ N^\gamma \left( \frac{W}{C} - A \right) \right]^\theta \Pi \quad (3)$$

s.t.  $N = N(W)$ , from firm's profit maximization,

where  $N$ ,  $W$ , and  $\Pi$  represent, respectively, employment, wage, and profits for a firm;  $\theta$  measures workers' relative bargaining power and  $\gamma$  indicates how much unions care about employment.  $C$  is the consumer price index adjusted for the fiscal wedge between earned wages and workers' take-home pay. Defining  $P_C$  as the net-of-tax consumer price index,  $t^c$  as the consumption tax rate,  $t^d$  as the income tax rate, and  $t^{ss}$  as the social security tax rate,  $C$  can be written as:

$$C = P_C \left[ \frac{1 + t^c(X, T)}{(1 - t^d(X, T))(1 - t^{ss}(X, T))} \right] \quad (4)$$

Where  $X$  represents the observable individual characteristics of workers and  $T$  is an index of technological growth and both are the determinants of the individual consumption, income and social security tax rates in (4). In equation (3),  $A$  represents workers' outside opportunities, which can be expressed as:

$$A = (1 - u) \frac{W}{C} + u \frac{B(X, T, P_C(1 + t^c))}{C_U} \quad (5)$$

where  $u$ ,  $W$ ,  $B$ , and  $C_U$  are the unemployment rate, aggregate wages, worker's income when unemployed, and the consumer price index adjusted for the fiscal wedge on the income received when unemployed. The worker's income when unemployed is determined by individual characteristics, technological growth—which influences an individual's productivity in non-market activities—and consumer prices through indexation mechanisms.<sup>26</sup> The unemployment rate is a proxy for the probability of finding work elsewhere in case of disagreement during the bargaining process.

The first-order condition of this bargaining problem yields:

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<sup>26</sup> Blanchard and Katz (1997) enumerate the variables that might affect an individual's income when unemployed and pay particular attention to the importance of technological growth.

$$\frac{\theta\gamma\left(\frac{W}{C} - A\right)\varepsilon_{NW} + \frac{W}{C}}{\frac{W}{C} - A} = \lambda \quad (6)$$

or

$$\frac{W}{C} = mA, \quad (7)$$

where  $m = \frac{\theta\gamma\varepsilon_{NW} - \lambda}{1 + \theta\gamma\varepsilon_{NW} - \lambda} = m(\theta, \gamma, \lambda(\varepsilon, \alpha), \varepsilon_{NW}(\varepsilon, \alpha))$ .

In words, real wages corrected for the tax wedge are a markup over workers' alternative income. This markup is higher when workers' bargaining power is stronger, when the demand for output and the demand for labor are less elastic, when the labor intensity of production is less, and when unions care less about the level of employment. Using the formula for  $A$  as in equation (5) yields a wage locus,

$$W = \frac{mu}{1 - m(1 - u)} B(X, T, P_C(1 + t^c)) \frac{C}{C_U} \quad (8)$$

Equations (2) and (8) determine equilibrium in the labor market for a given size of the labor force. Wages are higher when the ratio between the fiscal wedge on labor income and the fiscal wedge on unemployment benefits is larger. Therefore, to the extent that employed and unemployed individuals pay the same consumption price including taxes, indirect taxation (and the level of consumer prices) cancels out. If it were available, the tax-adjusted unemployment income would be the right "deflator" for wages in the estimation of the wage/unemployment locus described in (8).

The relationship between wages and unemployment as generated in equation (8) can be summarized as:

$$\frac{W}{B(X, T, P_C(1 + t^c))} = \tau(X, T, P_C(1 + t^c)) * f(m, u), f_m > 0 \text{ and } f_u < 0 \quad (9)$$

where,  $W$ ,  $B$  and  $\tau$  stand for the nominal hourly wage, the income a worker would receive if unemployed, and the tax wedge between labor income and unemployment income;  $m$ , as defined in (7) by  $m(\theta, \gamma, \lambda(\varepsilon, \alpha), \varepsilon_{NW}(\varepsilon, \alpha))$ , is a composite structural parameter determining the position of the wage curve for a given tax wedge and its steepness;  $u$  is the unemployment rate.

For a given rate of unemployment, wages will depend on how large the unemployment income corrected for its relative tax liabilities and on the structural parameter  $m$ . Ceteris

paribus, the larger the unemployment income the bolder will be wage demands because in case of disagreement during the bargaining process the alternative scenario of being unemployed becomes less unattractive. When the unemployment rate increases, so does the probability of not finding a job, and wage demands will be more subdued. Whenever unions' bargaining power becomes weaker ( $\theta$  is larger), or whenever unions give more value to employment levels vis-à-vis higher wages ( $\gamma$  is larger), the parameter  $m$  decreases and wages will be lower for a given rate of unemployment. These are pure "wage moderation" effects. Wage moderation also affects the sensitivity of wages to changes in the unemployment rate.

Changes in production technology and product market conditions may also affect the relationship between wages and unemployment through variations in the other parameters in  $m$ . If technology is more labor intensive, such that  $(1-\alpha)$  is higher, wage demands will be weaker because workers will incorporate the stronger effect of higher wages on employment. This would be reflected in lower share of labor costs in profits ( $\lambda$ ), or higher elasticity of labor demand to exogenous changes in negotiated wages or in social security taxes ( $\varepsilon_{NW}$ ), or both. The same argument holds if the elasticity of product demand ( $\varepsilon$ ) is larger.

Finally, changes in the tax wedge between labor income and unemployment income ( $\tau$ ) also shifts equation (9), which explains why many researchers have focused on the evolution of tax wedges in OECD countries to try to understand labor market developments.