**Minimum Wages, Enforcement and Informalization of the Labor Market:
Evidence from Brazil**

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Abstract

This paper examines the impact of minimum wage legislation and its enforcement on the wages and transitions of workers across employment states. I test whether the new higher state minimum wages imposed in Brazil in 2002 contribute to the 'informalization' of the labor market and whether the enforcement of labor regulations plays a part. Monthly panel data on individuals in the metropolitan areas of six states (PME) for the 2002-2008 period is combined with minimum wage and labor court data, both of which vary across cities and over time. Preliminary findings are that: a) higher minimum wages lead to higher wages for male employees in the formal private sector, especially among the less educated; b) state level minimum wages have less of an effect on wages than do the federal minimum wages; c) higher enforcement of labor legislation (proxied by court level data) does not have an effect on wages; d) higher minimum wages increase the probability that a formal sector worker becomes informal or self-employed, but lowers the probability that a formal sector worker leaves the labor force or becomes unemployed relative to staying in the formal sector; c) higher minimum wages reduce hires to the formal sector but it is not clear from which labor force state. Enforcement, by this measure, has no effect. Hence the government can affect informalization of the labor market by the degree to which it increases the minimum wage.

1. Introduction

The growth of informal employment around the world has been a concern of many economists and policy makers who are preoccupied with the loss of social protection and the riskier and less well paid working conditions that it implies. In the context of developing countries, several researchers have argued that the rise in informality is the result of the high labor costs and rigid labor legislation – for instance in the form of enforced high minimum wages -- that decrease formal sector demand (e.g., Heckman and Pagés, 2000). Yet, in some areas, the underlying analysis has not been as complete as would be desirable. For example, the literature has not estimated jointly the effects of minimum wage legislation and its enforcement, nor has it used panel data to estimate these effects on labor flows across several labor market states.[1]

This paper provides the first analysis of the joint effects of minimum wage legislation and its enforcement on the labor market in a developing country. In particular, I use panel data from the new methodology Brazilian Monthly Labor Force Survey (PME) for the years 2002-2008 to estimate the effects of (a) changes in federal and state minimum wages and (b) enforcement of labor legislation (proxied by new labor court data that vary over metropolitan areas and over time) on wages and labor market flows into and out of the formal sector. In doing so, I contribute to the literatures on the informality,[2] the effect of labor regulations (specifically minimum wages) on the labor market,[3] and the impact of enforcement of labor legislation on the labor market.[4]

The paper is structured as follows. Section 2 presents the conceptual framework and definition of the formal v. informal labor market, as well as what we know about their relative characteristics in Brazil. Section 3 contains a brief review of the literature on the impact of minimum wages on the formal and informal sectors in Brazil. The data -- micro data, as well as the structure and evolution of minimum wages and the enforcement data -- are described in

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[1] In a recent paper Almeida and Carniero (2007) for instance use one year of the Brazilian Monthly Labor Force Survey to estimate an enforcement effect in a cross-sectional setting.
[2] E.g., Boeri and Garibaldi, 2006; Bosch, Goni and Maloney, 2007; Galiani and Weischelbaum, 2007.
[3] E.g., Faynzilber, 2001; Gindling and Terrell, 2007; Kugler 1999, 2003.
[4] E.G., Almeida and Carneiro, 2007; Kaplan and Sadka, 2007.

Section 4. Section 5 contains the empirical tests and findings for the analysis of wages; the findings for the employment transitions are presented in Section 6. Section 7 concludes.

2. Conceptual framework and definition of informality

2.1 The conceptual framework

A simple theoretical model of competitive labor markets predicts that at a given positive level of enforcement, an increase in a binding minimum wage will induce employers to reduce the number of formal-contract workers demanded. If these displaced workers spill over to the informal sector, there will be an increase in the number of informal sector workers employed (at a lower wage).[5] I allow for three other labor market states -- self-employment, unemployment and out-of-the labor force – and the displaced formal sector workers may hence also flow into these sectors rather than (or in addition to) the informal sector. The effect of an increase in the minimum wage on informal sector employment (wage) is hence *a priori* ambiguous, although it is unlikely to be negative (positive).

If we allow for (initially) unobserved heterogeneity in individual worker productivity, the formal sector firms may respond to an increase in the minimum wage by restructuring employment – laying off low productivity workers and hiring high (expected) productivity workers from other sectors or substituting capital for labor. Our data permit us to identify these flows in terms of worker's education and sector of origin.

The degree to which labor legislation is enforced may also be expected to play a role. With little enforcement, employers and employees have greater latitude to enter into informal contracts. The question is whether with increased enforcement, holding minimum wages constant, we observe higher formal sector wages and corresponding labor market flows. Suppose that at a low level of enforcement large and medium size firms employ both formal and informal sector workers (as is common in Brazil), while small firms are informal (as is common in many

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[5] Labor supply to the two sectors may be seen as either segmented as in the traditional dual sector models of minimum wage (e.g., Gramlich, 1976) or informality (e.g., Majumdar, 1976), or as a choice by workers based on a benefit-cost analysis of informality (e.g., Heckman and Hotz, 1986).

countries). Increasing enforcement will then induce large profitable firms to increase the number of workers registered as formal, while some unprofitable large firms may go out of business and some may break up into small informal firms. It follows that with higher enforcement the net wage and employment effects depend on the relative size of these three effects.

2.2 Informal sector definition and characteristics

The burgeoning literature assessing the scale and determinants of the informal sector (e.g., Gasparini and Tornarolli, 2006; Maloney, 2004) is generating a vast array of findings, largely because the range of empirical definitions of informality is quite broad. Although data constraints dictate the use of different definitions, it is dangerous to interpret them as a single phenomenon because each one is conceptually different.

In this paper I am interested in assessing the extent to which increased regulation of the labor market creates incentives for employers and employees to circumvent legislation, by creating jobs that are not covered by protective labor legislation. Hence, the formal sector in this paper is defined as the sector where workers are covered by labor legislation in their main job; in the Brazilian data we can define them as "workers who are members of a social security program or carrying a signed labor card (*carteira de trabalho assinada*)." Members of social security programs obtain defined benefit pensions, permanent disability benefits and life insurance through joint contributions of the employer and employee. Workers who are not members qualify for a flat rate old age pension equal to the minimum wage. Having a labor card (also referred to as being registered or having a signed work contract) means that the worker is entitled to protection under labor law, including a maximum working week (currently 44 hours), paid vacations, maternity leave, due notice of dismissal, a minimum overtime premium and an entitlement to compensation in the event of a non-justified dismissal. The informal worker does not carry this card and is not assured of protection under labor law.

The level of informality is relatively high in Brazil and there is some disagreement as to whether or not it rose in the 1990s. According to Soares (2004) the proportion of non-registered workers among the employed rose from about 30% in 1990 to 38% in 1999. On the other hand,

using the same (PNAD) data, Henley et al. (2006, Table 2) report that the share of non-registered workers among employees rose only slightly, from 21% in 1992 to 24% in 1999 (and 2001). Moreover, according to my calculations, using the PME data (described below), the share of informal workers also remained fairly constant from 2002 to 2008 in each of the six major metropolitan areas of Brazil (see Figure 1). If anything, there may be a slight rise in the shares of the employed without a signed work card during 2002-2004 and a slight decline in thereafter. Although it is not surprising that the share is highest in Recife (between 23% and 25%), a relatively poor city, it is remarkable that the share is similarly high in Sao Paulo, one of the richest cities.[6] Porto Alegre, on the hand, has the lowest rates (between 18% and 20%).

Several studies have described the relative characteristics of the informal and formal workers in Brazil. Workers without signed cards are more likely to be female, less educated and earning a lower hourly wage than registered workers (Soares, 2004). According to Henley et al. (2007) during 1992-2001 approximately 60% of the primary educated workers had no signed work card v. an average of about 39% for workers with a secondary education and 30% for university educated workers (although the shares for the two higher education groups were rising throughout the period while they remained constant for those with a primary education). Moreover, informal sector workers are far more likely to be earning less than the minimum wage (Camargo, Gonzaga, Neri, 2000). Using quantile and decomposition techniques, Tannuri-Pianto and Pianto (2002) find that both high and low earning individuals in the informal sector earn less than their counterparts in the same quantile in the formal sector not only because they are less skilled but because they also receive lower returns to their skills. However, individuals at the bottom of the informal sector earnings distribution also receive positive rewards to their unobservable characteristics and hence they may be selecting into this sector based on unobservables.

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[6] The closeness of our rates with those from the PNAD data are notable given our data is restricted to metropolitan areas and the PNAD is nationally representative, including rural areas.

3. Main Findings in the Minimum Wage Literature in Brazil

The large body of Brazilian literature written over the last three decades has generally found that minimum wage legislation has compressed the wage distribution in both the formal and informal sectors. What is in question is the magnitude of the wage and employment effect in the formal sector and the sign of the employment effect in the informal sector. Moreover, little is understood about the impact of the minimum wage on flows across labor market states (unemployment and employment) or between the formal and informal sectors, and the extent to which these flows are demand v. supply driven.

Perhaps the first study to find that minimum wage levels impact wages in the informal sector was by Souza and Baltar (1980) who coined the term "lighthouse effect." Since then several other studies have also found with more recent data, that minimum wage increases also increase the wages of employees without a signed labor card. For example, Camargo, Gonzaga, Neri (2000) find that the minimum wage is more binding in the informal sector, with 15% of workers earning exactly one minimum wage, compared to 10% in the formal sector. However, the numeraire effect is the dominant effect in the formal sector, with 6% of workers earning an exact multiple (other than one) of the minimum, versus just 5% of informal workers. On the other hand, the effect on employment in the informal sector varies from being negative (Fajnzylber, 2001; Lemos, 2004) to being positive (Carneiro, 2000; Carneiro et al., 2001) For example, Carneiro et al. (2001) find an elasticity of informal employment of 0.0004 to 0.003 with respect to the minimum wage.

The estimated wage and employment elasticities of minimum wages in the formal sector have the expected positive and negative signs, respectively, but their significance is inconsistent and the magnitudes are highly dependent on specification. Among the studies which find the largest wage elasticities is that of Velloso (1990) who estimated that a 1% increase in the real minimum wage would result in 0.36% to 0.63% increase in real formal wages, and a 0.43% to 0.6% increase in informal wages. More recently, Fajnzylber (2001), using panel observations on individuals from Brazil's monthly household labor survey (PME) from 1982-1997, finds

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relatively large and significant wage effects at the lower end of the wage distribution (up to 1.43% wage change for a 1% change in the minimum wage, for workers earning less than 0.9 of the minimum wage), declining monotonically with wage. Soares (2002), who also uses the individual panels in the PME data, but only from the post-inflationary period of 1994-1999, conducts a difference-in-difference analysis of the effects of minimum wage changes, and finds smaller employment elasticities than Fajnzylber, with most significant results disappearing after dropping the very large (>40%) 1995 increase in the minimum wage.

Among the lowest employment elasticities found are those of Lemos (2006) and Carneiro et al. (2001). Lemos (2006) uses aggregate employment and average wages for various groups in the PME data and estimates positive and significant wage elasticities but the effect on employment is almost nil. Similarly, Carneiro et al. (2001) use aggregate time-series employment data from 1982-1999 and estimate a long-run elasticity of formal employment of -0.001 to -0.024; short-run estimates are of the expected sign and significant at the 5% level. Furthermore, they show that formal employment is pro-cyclical, while informal employment is countercyclical. Positive elasticities of the nominal wage with respect to productivity, the tax wedge (a proxy for labor cost), and inflation are estimated, and a negative elasticity with respect to unemployment. Results were similar for both the formal and informal sectors.

In the last decade, realizing that analyses of employment and unemployment levels may hide real effects of changes in minimum wages or other labor laws, studies have increasingly focused on individual employment transition probabilities. Fajnzylber's (2001) analysis of the effects of minimum wages on transition probabilities from employment into unemployment or out of the labor market yielded employment elasticity estimates of approximately -0.1 for those low-wage workers who were originally in formal employment, and -0.25 for those who were in informal employment relationships. McIntyre (2004) finds that minimum wage increases raise informality rather than unemployment. He concludes: "Informal behavior is complementary so that violating the minimum wage encourages agents to violate other laws. This complementarity can be substantial among the poorly educated. Informal work carries a wage penalty of 23% of

salary." Finally, Bosch, Goni and Maloney (2007) have studied gross worker flows to explain the rising informality in Brazilian metropolitan labor markets from 1983 to 2002. The conclude that as in Bosch and Maloney's (2006) study of Mexico, the informal sector absorbs more workers during cyclical downturns and hence the rise in informality is driven by a reduction in job finding rates in the formal sector which "seems to be driven" by the rising labor costs and reduce flexibility arising from the 1988 constitutional reform.

4. Data

The analysis in this paper draws on three sets of data: a) the minimum wages and wage floors set by the national and state level decrees; b) enforcement of labor legislation; and c) the Brazilian labor force survey, the Monthly Employment Survey or *Pesquisa Mensal de Emprego* (PME). Each is described sequentially in this section.

4.1 Brazilian Minimum Wage Legislation

The core of Brazilian labor law used today was formalized in the "Consolidação das Leis do Trabalho" (CLT) of May 1943. The CLT gave the system of labor courts a pre-eminent role in the enforcement of contracts and dispute arbitration. In 1988, the new Constitution tremendously increased the protection and cost of labor, while keeping most of the CLT intact. The Constitution essentially established minimum employment standards that are comparable to those in parts of Europe today.[7] In addition a nationally unified minimum wage (henceforth federal minimum wage) was mandated (Article 7, paragraph IV) and was to be set at the 'level necessary to pay for necessities of a worker and his/her family, including a place to live, food, education, health, leisure, clothing, hygiene, transportation and social security,' with periodic adjustments to maintain purchasing power.

On June 14, 2000, a law was enacted to allow the return of state-level "wage floors," which had existed from the 1940s to 1988.[8] Whereas these state minimum wages do not apply to

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[7] For example, workers are entitled to a maximum working week of 44 hours, an overtime premium of 50%, a minimum of 25 days of vacation, a 13th month pay, four months of paid maternity leave, and 5 days of paid paternity leave.

[8] They were called "wage floors" to preserve constitutionality since Article 7, paragraph IV of the constitution only allows one minimum wage. However, paragraph V mandates "wage floors" commensurate with the level and

public or other municipal employees, they supersede the federal minimum wage for employees not covered by wage agreements written into law, or any other collective bargaining agreements. Today four states have legislated separate minimum wages. The first state to do so was Rio de Janeiro, which in December of 2000 instituted a three-tiered, occupation-specific set of minimum wages. Rio Grande do Sul followed suit in July of 2001 with a similar 4-tiered system. Parana instituted such wage floors in 2006, and São Paulo is the most recent state to institute a similar law, in August 2007.[9] Because the micro panel data we use do not include Parana, we examine the changes in the state minimum wages in Rio de Janeiro (RJ), Rio Grande do Sul (RGS) and São Paulo (SP).

Appendix Tables A1 and A2 summarize the categories of workers that are covered by each of the state minimum wages ('wage floors') in RJ, RGS and SP, respectively. The number of categories varies over these three states. Rio de Janeiro increased the number of categories from five in 2002 to six in 2003 and eight categories in 2008 while the structure of minimum wages in Rio Grade do Sul has remained constant at four. São Paulo introduced three minimum wages in 2007. Moreover the features of the categories differ: in Rio Grande do Sul the structure is driven by an industrial classification whereas the structures in São Paulo and Rio de Janeiro are determined primarily by an occupational classification. In Rio de Janeiro, the sixth category in 2003 was achieved by splitting the first wage category into two, leaving agricultural and forest workers at the lowest wage and raising the wages of the remaining workers (domestics, cleaning services, etc.) to category two. This meant that all workers originally in category two were now bumped up to category three, etc. The two additional categories added by RJ in 2008 were for workers previously not covered by their state minimum wage; one was for lawyers and accountants.[10]

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difficulty of a job. State-level "wage floors," because they indicate specific occupations to be covered, are thus considered admissible. We will refer to them as state minimum wages throughout this paper.
[9]*Jornal da Tarde*, 29 June 2007, "SP terá mínimo de R$ 410."
http://www.fetraconspar.org.br/piso_regional/sp.htm#07.
[10] The political economy of these disparate decisions is being looked into, as is a way to control for potential endogeneity problems inherent in the wage setting process.

Table 1 and Figure 2 indicate for the 2002-2008 period the various levels of the federal minimum wage and state minimum wages for Rio de Janeiro, Rio Grande do Sul, and São Paulo. Note that in the state of Rio de Janeiro, for example, the wage floors started in 2002 at R$240 per month at a time when the national minimum wage was R$180. All three states have adjusted their state minim wage levels on an annual basis, with the levels remaining above the federal minimum. Figure 2 plots the time trends of the real state and federal minimum wages deflated by the price indices specific to each of the state's major metropolitan areas (Rio de Janeiro, Porto Alegre and São Paulo) to April 2002 price levels.[11] It is clear that there was a definite upward trend in real minimum wages in Brazil over the period, with more rapid growth after April 2005. The saw-toothed pattern is evident but indicative of relatively low inflation over the period. Also evident is that the three sets of regional minimum wages were all set above the Federal minimum, with those in the state of Rio Grande do Sul being set much higher than those of Rio de Janeiro.

Employees in these states who are not working in jobs or occupations included in the state minimum wage categories and all workers in the remaining 22 states in Brazil are covered by the federal minimum wage. Hence, we show in Table 2 the percentage point increases in the nominal federal and state minimum wages at each point over 2002-2008 period. The table highlights more clearly than Figure 2 how the federal and state minimum wages were adjusted in different months, and not always the same month of each year. For identification, it is notable that after 2003, there is no variation in the percentage increases across the five occupational within Rio de Janeiro or across the four industrial categories within Rio Grande do Sul.

4.2 *Enforcement of Labor Legislation – Brazilian Labor Court system[12]*

The Brazilian labor court system is an independent judiciary tasked in the 1943 CLT and the 1988 Constitution with dealing with labor law disputes between workers or unions and

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[11] This price index is available on http://www.sidra.ibge.gov.br/snipc/tabelaINPC.asp.
[12] This section draws from José Márcio Camargo (2006) as well as discussions with labor lawyers and businessmen in Brazil by Brooke Helppie.

employers. The system's role was further expanded in 1999, and has been seen by employers as a powerful institution since 1943.[13] Like other court systems in Brazil, this judiciary has expanded rapidly as the society has become more litigious.

There are three levels within this system: local courts (*varas*), regional courts, and the superior labor court. When cases are appealed at the *vara*, they move to one of the 24 regional labor courts. The Superior Labor Court (Tribunal Superior do Trabalho) has the final word on all cases in this system.

Varas are the courts where individual workers or unions file their cases; under limited circumstances, an employer may file a case at a *vara*. Common subjects of claims include severance payments, additional fines for dismissal without cause, overtime, vacation pay, other mandated wage and non-wage payments such as unpaid or late wages, payments for inadequate notification of dismissal, and informal employees demanding a formal contract. The employer is then notified and invited to provide documents proving innocence. *The employer bears the full burden of proof.*

Typically, hearings are held with a judge and both parties present. At this hearing the employer may provide a counter-offer, and the employee is given the opportunity to accept this, at which point the dispute has been settled. If the employee does not accept the offer, the judge mediates between the parties to come up with an agreement satisfactory to both (the "Conciliation" stage). Over 40% of disputes are resolved at this stage; this is fairly consistent as seen from annual data over 2001-2007.[14]

If a case is not decided in the Conciliation stage, the judge will then decide the case. Camargo's (2006) study of 200 cases in Minas Gerais revealed that over 80% of cases decided by a judge were decided at least in part in favor of the worker; average time to decision was 700 days from filing. Not surprisingly, employers consider the labor judiciary to be biased in favor of

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[13] This is anecdotal evidence from interviews with employers in Brazil by Brooke Helppie.
[14] Source: Conçiliações nas Varas do Trabalho, under Varas do Trabalho, in Estatistica, at http://www.tst.gov.br/. Downloaded June 10, 2008.

workers. Anecdotal evidence suggests that employers are counseled by lawyers that they will typically have to pay some portion of the worker's claim, even in cases where the worker's claims are fabricated, unless they can absolutely prove the worker wrong. Costs to employers are thus whatever monetary settlement is ordered (these averaged R$1,000 in Camargo's study), plus a 2% fee for the court; employees pay nothing. This system is quite costly to employers and the economy in general. In 2006, R$1.1 billion were paid to workers in Rio de Janeiro, R$1.5 billion to workers in Sao Paulo, R$0.58 billion in Minas Gerais, R$0.69 billion in Rio Grande do Sul, R$0.54 billion in Bahia and R$0.83 billion in Pernambuco, for a total cost of R$5.3 billion.[15]

An employer can appeal a case to the regional court however, this process takes years. Appealing to the Superior Court takes yet more time. The implication of this is that workers have an incentive to resolve the dispute in the conciliation phase; employers may choose to settle, or take their chances with appeals.

Data are available on the number of cases filed and the number of cases resolved at the *vara* level in a given year and in a given state. We also know how many unresolved cases flowed into the docket from the previous year (the "case residual"). The measure of enforcement of the labor law used in this paper is the number of cases resolved in a year as a share of the case residual from the previous year plus the number of new cases filed in the year. The interpretation of this variable is: the larger the share of resolved cases, the more enforcement of the labor law. Given that these cases are at the lowest labor court, they can signal to workers the ability to get recourse. However, at least one caveat is in order: this potentially interesting variable proxying enforcement has only annual variability across the six cities. As seen in Figure 3, which plots of this variable in each state over 2002-2008, there is not much change over time within each city, although the trends does vary across these six cities. The relative levels -- Belo Horizonte and Recife courts have a much better record than those of Sao Paulo and Rio de Janeiro (the lowest on the scale) -- beg for an explanation.

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[15] Source: Relatorios Gerais da Justiça do Trabalho, http://www.tst.gov.br/.

4.3 Micro Data: Pesquisa Mensal de Emprego (PME)

The analysis is carried out on the *Pesquisa Mensal de Emprego* (PME), which was redesigned in sampling frame and substance in 2001, with the "new methodology" data coming online in 2002. We use monthly PME data from January 2002 through April of 2008, the most recent data available to us. The survey covers the largest metropolitan areas in six states: Bahia (Salvador), Pernambuco (Recife), Minas Gerais (Belo Horizonte), Rio de Janeiro, Rio Grande do Sul (Porto Alegre) and São Paulo. The sample within each metropolitan area is random but the relative size of the samples across the areas is proportional to the population in each. This dataset includes roughly 100,000 individual observations per month, with between 12,000 and 20,000 per city, according to population size.

The PME is structured as a rotating panel where each household is surveyed for four consecutive months, off the roster for eight months, and then again surveyed for another four months. This means that each month one fourth of the sample is being substituted by a new set of households. Over a period of two years, three different panels of households are surveyed, and the process starts again with three new panels. In addition to household identifiers, it is possible to identify each individual in the household over time. Since this is a "roof" survey -- the physical address is what is surveyed, and whoever is living in it at the time -- no attempt was made to follow individuals or households per se. Hence, care must be taken in matching individuals over time, which we do by matching on birthdates over consecutive months.

There is considerable attrition in the sample of individuals over time, with virtually no respondents appearing in the second wave of monthly interviews and sharp declines in the number of individuals we see with three and four monthly observations. Hence, to avoid selectivity issues, I use only data on the first two consecutive months we observe an individual in the panel analysis.

The questionnaire is extensive in its coverage of labor market variables, including questions about the job (including earnings) in the previous month and labor force activity within the previous week, as well as human capital variables. There are questions on whether or not the

worker has a signed worker card, the worker's employment status, whether the enterprise is public v. private, etc. Hence, I am able to define a "formal worker" as an employee in a private enterprise who has a signed work card. Informal workers are employees in a private enterprise without a signed work card. Self-employed workers are considered separately as are employees of public enterprises.

The enforcement and minimum wage data are appended to all individuals in the PME who are working or unemployed and previously having had a job. The enforcement data appendage is based on the individuals' areas of residence in each year. The minimum wage data appendage is based on the characteristics of the individual's job at time t. For Rio de Janeiro and Sao Paulo I was able to match the two-digit level occupational classification in the PME to the occupations specified for each of their wage levels while for Rio Grande do Sul, I used the two - digit industrial classification in the PME. All those individuals whose occupation or industry of work was not covered by the state minimum wages (which includes all individuals in the three other states in the data) the applicable minimum wage is the federal minimum wage in month t.

The analysis in this paper is carried out on males within the ages of 14 and 70 with two consecutive observations.[16] This sample size is about 457,000 men, when we exclude those who ever worked in the public sector. The means and standard deviations of selected variables in the analytical sample are provided for each metropolitan area in appendix Table A3.

Figure 4 plots the median real log wage of men in the formal sector in each metropolitan area (using city-specific CPI), as well as the real Federal minimum wage, over time. It is clear that the median wage in all cities is far above the federal minimum. Real wages held fairly constant for four of the six cities: the exceptions were Sao Paulo, which experienced a slight decline and Salvador, which experienced a slight rise in its real wage.

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[16] In the next version of the paper, I plan to extend the analysis to women who are in the formal sector at time t=0.

5. Test of the Impact of Minimum Wage on Wages

The standard method for looking at the effect of minimum wage legislation is to look for spikes in the wage distribution at or around the minimum wage. Given the number of minimum wages in two of the cities in Brazil, we simplify the graphical analysis by plotting the kernel density estimate of the log wage minus log minimum wage for each worker. A zero indicates that the worker is earning the legal minimum wage. The analysis is based on the hourly wage and hourly minimum wage in order to allow analysis of both full-time and part-time workers.

The kernel density estimates for all men formally employed at time t=0, using all the monthly data over 2002-2008 and the minimum wage that applies to each individual, is provided in Figure 5. The first panel is for all men, and the subsequent panels are for more and less educated men, respectively. There is weak evidence that the minimum wage is binding: although there is no spike at zero, there is censoring from below the minimum wage level.

The heterogeneous effect of the federal minimum wage across the six cities is demonstrated by the kernel density estimates for all male workers in Figure 6. These distributions are calculated by using the federal minimum with data for June of each year, as this is typically one month after the new wage is in effect. We see that in the three wealthier cities (Rio de Janeiro, Sao Paulo and Porto Alegre), the minimum wage has a less notable impact as wages are for the most part far above the minimum wage. In Recife and Salvador, there appears to be a more binding minimum wage, which is somewhat the case for Belo Horizonte as well.

In Figure 7, kernel density estimates are plotted only for male workers in the formal sector for whom the state minimum wages apply. Again, although there is no spike at the minimum wage, there is clear censoring from below.[17]

In order to determine more precisely the effect of minimum wages on wages, I estimate an individual fixed effect regression using data on the first two consecutive monthly observations of men who are in the formal sector at t=0 and again at t=1. Since I am interested in learning

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[17] Minimum wage legislation is typically more binding for women than men. In the next version of the paper I plan to replicate this analysis for women.

whether the state minimum wages have a different effect from the federal minimum wage, I estimate the following equation:

$$ln\ddot{W}_{it} = \alpha_0 ln\ddot{M}W_{it} + \alpha_1 ln\ddot{M}W_{it} * StateMW + \ddot{\mu}_{it} \qquad (1)$$

where lnWit = the log of the real hourly wage (in Reais) of an individual worker i in month t. The explanatory variables include the log of the real minimum wage that applies to that worker ($ln\ MW_{it}$), which can be either a federal or a state minimum wage. I include an interaction of the $lnMW$ with *StateMW*, a dummy variable equal to one if the state minimum wage applies to that worker, and zero otherwise. Hence, the coefficient α_0 is an estimate of the average effect that the federal minimum wage has on wages of men in the formal sector over time and the estimate of α_1 indicates whether the effect of the state minimum wages differs from that of the federal minimum.

In order to test whether enforcement makes a difference, I also estimate a specification that includes *Enf_ST*, a variable for enforcement at the state level that ranges between 0 and 1, and varies by state (*S)* and year (*T)*:

$$ln\ddot{W}_{it} = \alpha_0 ln\ddot{M}W_{it} + \alpha_1 ln\ddot{M}W_{it} * StateMW + \alpha_2 Enf_{ST} + \alpha_3 (\ln MW * Enf_{ST})$$
$$+ \alpha_4 (\ln MW * Enf_{ST} * StateMW) + \ddot{\mu}_{it} \qquad (2)$$

I re-estimate equations (1) and (2) including a city-specific consumer price index (City CPI) to determine if the effect is affected when controlling for inflation. Finally, these equations are estimated for all formal sector male workers with a primary education or less ("less educated") and for those with some secondary or more education ("more educated") to learn whether minimum wages are impacting the wages of lower wage workers more than higher wage workers.

Table 3 presents the findings from estimating these various wage equations. Beginning with the estimates of equation (1), the findings in the first three columns of Panel A, indicate that increases in the Federal minimum wage significantly increase wages of male employees in the formal sector. The elasticity is 0.071 for all men; it is larger for the less educated (0.112) and smaller for the more educated (0.061). When controlling for inflation (Panel B), the elasticity of the wage with respect to the federal minimum wage declines marginally (e.g., from 0.07 to 0.06 for all

men) and remains significantly different from zero. Estimates of the effect of the State minimum wages are smaller than those of the Federal minimum – the elasticity is 0.034 and significant at 1% for all men. Again the elasticity is estimated to be higher for less educated than for more educated, but the difference is not statistically significant (0.038 v. 0.033). When controlling for inflation, the point estimate for the state minimum wage falls to 0.026 and is only significant at the 5% confidence level. In future estimation, we may want to consider longer term dynamic effects, using several lags, as well as leads in the MW variable.

The results from estimating equations (2), which includes enforcement, are presented in columns 4-6 of Table 3. The addition of the enforcement variable in Panel A, does not change the elasticity of the federal minimum wage appreciably, but its lowers the point estimates and nullifies the effect of state minimum wages on wages. Moreover, the enforcement variable does not significantly impact wages of individuals under either the federal or state minimum wage regime. We suspect that this is being driven by the fact that the enforcement variable has only annual variation and identification is driven by changes in this variable over time within each city. Hence we are in search of better data at this time.

6. Tests for Effect of MW and Enforcement on Flows into and out of the Formal Sector

In this section I examine the effect of minimum wages and enforcement of labor regulations on the flows of workers into and out of the formal sector. I am interested in learning the extent to which employers may reduce formal employment (either through separations or hires) with increases in the minimum wage. Similarly, does higher enforcement increase flows into formal employment and/or flows out of formal employment (e.g., to unemployment).

We begin by observing the stationary Markov matrix of gross flows of workers across states in Table 4 and find several interesting patterns. First, as expected, formal employment is more stable than informal or self-employment: a male worker with a formal sector job has a 93% probability of staying there in the next month, whereas these probabilities for the informal and

self-employed are 71% and 83%, respectively).[18] We also find that the labor market is not segmented across the formal-informal-self-employment divide. There are significant flows from the formal sector to the informal and self-employed sectors and *vice versa*. In particular, it is interesting to note that: a) a formal sector employee is more likely to become an informal employee in the next period than a self-employed individual and b) the flows out of informal to formal employment are only slightly higher than are the flows out of informal employment to self-employment.

To test if increases in the minimum wage and enforcement of labor regulation are pushing people out of the formal sector, I estimate a multinomial logit on formal sector employees at time t = 0, to learn what is the probability that in time t = 1 they become: a) IF - informal employees; b) SE – self-employed; c) U - unemployed; or d) OLF - out of the labor force, with the following specification (where the base is "stay as a formal employee in time t = 1."):

$$EMP_{it} = \beta_0 + \beta_1(\Delta lnMW) + \beta_2 Enf_{ST} + \beta_3(\Delta lnMW * Enf_{ST}) + X'_{it}\phi$$
$$+ \sum_s \sigma_s S + \delta CPI_{ct} + \mu_{it} \tag{3}$$

where EMP_{it}, equals 0 if the individual *i* remains employed in the formal sector at time *t=1* while EMP_{it} = 1 if the individual is either IF, SE, U or OLF at time *t =1*. The $\Delta lnMW = lnMW_t - lnMW_{t-1}$ (percentage change in the minimum wage). The *X* vector contains human capital variables (age and education dummies for groups) at time *t = 0* to control for life cycle and educational patterns in mobility. State fixed effects *S* are included as well as the city-specific CPI variable (*CPI*) that varies monthly, to control for other demand conditions. Equation (3) is estimated with and without enforcement.

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[18] This implies that a formal sector job lasts on average about 15.2 months whereas an informal job lasts only 3.5 months. [These seem very low and I need to check this further. The self-reported variable "tenure on the job" indicates that the average duration of a formal sector job is 62 months and that of an informal job is 36 months, which seems more reasonable.]

The findings from estimating these flow equations are presented in Table 5. The principal finding is that a one percent increase in the nominal minimum wage (holding inflation constant) increases the mean probability that a formal sector worker becomes either an informal or self-employed worker rather than stay in the formal sector (by 1 percentage point in both cases, as seen in the marginal analysis). In contrast, it lowers the probability that a formal worker becomes unemployed or leaves the labor force relative to staying in the formal sector. The latter finding is peculiar and will be explored further in the next version of this paper. As in earlier findings, there is no statistically significant impact of the enforcement variable on flows out of the formal sector. One might expect stronger enforcement to decrease the flows from formal into informal but it appears there not sufficient variation in this variable as it is not significant in any of the specifications. In future estimation I will examine the effect of changes in inspections on firms by the Ministry of Labor as a robustness check for enforcement.

To test whether higher minimum wages dampens hiring in (flows into) the formal sector, I estimate the probability that a worker is hired in the formal sector (v. any other sector) in a given month and also examine where they are being hired from (i.e., the status of the worker in the previous month). I test for overall hiring by re-estimating equation (3) with a linear probability model, where the dependent variable is a dummy for new formal employment (NFE) = 1 if a person is hired in the formal sector at time $t=1$ and 0 otherwise, conditional on being hired into any sector in that month. I would expect new hires in the formal sector to be diminished relative to hires in other sectors (IE or SE) with higher MWs; on the other hand, I would expect new hires to be increased with higher enforcement, if most firms survive and conform to enforcement. The coefficient estimate on the minimum wage, in the first column of Table 6, indicates that a 1 percent increase in the minimum wage reduces hiring in the formal sector, relative to other sectors by 13.5 percentage points.

The remaining columns in Table 6 indicate the probability that a new hire from a given state at t=0 is hired into formal employment v. another sector (IE or SE) at t=1. For example, the coefficient on the percent change in the MWs in the second column indicates how the probability

that a worker in the informal sector at t=0 being hired into the formal sector at t=1 (v. self-employment) is affected by changes in the minimum wage. None of the coefficients on the minimum wage variable are significant in any of these columns, indicating that we cannot detect any effect. However, this may be due to the fact that the sample sizes are relatively small. Finally, we note that the estimates indicate that increases in enforcement have no significant effect on hires.

7. Conclusions

This study presents estimates of the effects of increased enforcement of labor regulation and increased levels of minimum wages on the wages and labor market flows (separations and hires) of male employees in the formal sector. There is evidence that increases in minimum wages increase the wages of formal sector employees, especially those who are less educated (less than primary schooling) compared to those who are more educated. It is also found that increases in the new higher state minimum wages are not having as great of an impact on wages as the federal minimum. Whereas there is some support for the hypothesis that minimum wages increase informalization (outflows from the formal sector to the informal sector and to self-employment), there is also a puzzling finding that higher minimum wages may decrease outflows from the formal sector to unemployment and out of the labor force. Finally, there is some evidence that workers may reduce labor costs by decreasing hiring in the formal sector when minimum wages are raised. The results using this enforcement variable indicate there is no effect of enforcement on either wages or labor market flows out of or into the formal sector.

This is a work in progress. In the next version of this paper I hope to:

a) understand what is driving the results in the mutinomial logit for outflows from unemployment (I am planning to try different specifications as well as check that the minimum wage variable is coded accurately for the workers who are out of the labor force and unemployed in the following period);

b) test for the impact of minimum wages on wages and employment flows through both leads and lags of the changes in the minimum wage;

b) acquire additional data for robustness checks of the enforcement variable. Data on inspections of firms by the Ministry of Labor (in order to ascertain that there are no violations of the labor code) may be available by industry at the state level, on a monthly basis.

c) understand better the political economy of the new state minimum wages and search for potential instrumental variables;

d) replicate the analysis for women given that it is likely that they are more affected than men by minimum wage increases and their enforcement.

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Table 1: Levels of Federal and State Minimum Wages

Rio de Janeiro, State Minimum Wages

Date Valid	Values for various occupational categories	Federal Minimum
1/1/2002 - 2/28/2003	R$240, R$250, R$260, R$270, R$280	R$180, becomes R$200 in April 2002
3/1/2003 - 1/1/2004	R$265, R$276, R$286, R$296, R$306, R$316	R$200, becomes R$240 in April 2003
1/1/2004- 12/31/2004	R$290, R$305, R$316, R$327, R$338, R$349	R$240, becomes R$260 in May 2004
1/1/2005 - 12/31/2005	R$310, R$326, R$338, R$350, R$362, R$373	R$260, becomes R$300 in May 2005
1/1/2006 - 12/31/2006	R$351.32, R$369.65, R$383.05, R$396.65, R$410.25, R$422.72	R$300, becomes R$350 in May 2006
1/1/2007 - 12/31/2007	R$404, R$424, R$440, R$456, R$471, R$486	R$350, becomes R$380 in May 2007
1/1/2008 - 12/31/2008	R$447 , R$ 470, R$ 487, R$504, R$522, R$538, R$632, R$874, R$1200	R$380, becomes R$415 in April 2008

Rio Grande do Sul, State Minimum Wages

Date Valid	Values for various occupational categories	Federal Minimum
8/1/2001 - 4/31/2002	R$230, R$235, R$240, R$250	R$180
5/1/2002 - 4/31/2003	R$260, R$266, R$272, R$283	R$180, becomes R$200 in April 2002
5/1/2003 - 4/31/2004	R$312, R$319.2, R$326.4, R$339.6	R$200, becomes R$240 in April 2003
5/1/2004 - 4/31/2005	R$338, R$345.8, R$353.6, R$367.9	R$240, becomes R$260 in May 2004
5/1/2005 - 4/31/2006	R$374.67, R$383.32, R$391.96, R$407.81	R$260, becomes R$300 in May 2005
5/1/2006 - 4/31/2007	R$405.95, R$415.33, R$424.69, R$441.86	R$300, becomes R$350 in May 2006
5/1/2007 - 4/31/2008	R$ 430, R$ 440, R$ 450, R$ 468	R$380, becomes R$415 in April 2008

Sao Paulo State Minimum Wages

Date Valid	Values for various occupational categories	Federal Minimum
8/1/2007- 05/01/2008	R$415, R$450, R$490	R$380, becomes R$415 in April 2008

Table 2- Nominal Minimum Wage Increases
(% Change from previous minimum wage)

Year	Month	Federal Min	Rio Grande do Sul				Rio de Janeiro					
			Grp 1	Grp 2	Grp 3	Grp 4	Grp 1	Grp 2	Grp 3	Grp 4	Grp 5	Grp 6
2002	May	11.11%	13.04%	13.19%	13.33%	13.20%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2003	March	0.00%	0.00%	0.00%	0.00%	0.00%	10.42%	15.00%	14.40%	13.85%	13.33%	13.33%
	May	20.00%	20.00%	20.00%	20.00%	20.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2004	January	0.00%	0.00%	0.00%	0.00%	0.00%	9.43%	10.51%	10.49%	10.47%	10.46%	10.46%
	May	0.00%	8.33%	8.33%	8.33%	8.33%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	June	8.33%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2005	January	0.00%	0.00%	0.00%	0.00%	0.00%	6.90%	6.89%	6.96%	7.03%	7.10%	7.10%
	May	0.00%	10.85%	10.85%	10.85%	10.85%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	June	15.38%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2006	January	0.00%	0.00%	0.00%	0.00%	0.00%	13.33%	13.33%	13.33%	13.33%	13.33%	13.33%
	May	0.00%	8.35%	8.35%	8.35%	8.35%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	June	16.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2007	January	0.00%	0.00%	0.00%	0.00%	0.00%	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%
	May	8.57%	5.98%	5.98%	5.98%	5.98%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2008	January	0.00%	0.00%	0.00%	0.00%	0.00%	10.70%	10.70%	10.70%	10.70%	10.70%	10.70%
	April	9.21%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Table 3: Regression on Log Nominal Wage Levels of Male Employees in the Formal Sector at t=0 and t=1, All and by education (OLS with Individual Fixed Effects)

Panel A:

	All	More Educated	Less Educated	All	More Educated	Less Educated
ln MW	0.071	0.061	0.112	-0.251	-0.219	-0.333
	(0.016)***	(0.020)***	(0.027)***	(0.092)***	(0.115)*	(0.145)**
ln MW*State	-0.038	-0.028	-0.074	0.192	0.146	0.326
	(0.010)***	(0.012)**	(0.019)***	(0.088)**	(0.106)	(0.151)**
Enforcement				-0.250	-0.190	-0.308
				(0.130)*	(0.166)	(0.195)
lnMW*Enforce				0.500	0.435	0.678
				(0.140)***	(0.177)**	(0.219)***
lnMW*Enforce*State				-0.379	-0.284	-0.658
				(0.155)**	(0.187)	(0.265)**
Constant	1.234	1.365	0.922	1.400	1.490	1.129
	(0.00409)***	(0.00527)***	(0.00601)***	(0.0878)***	(0.111)***	(0.132)***
Observations	295152	207947	86388	295152	207947	86388
Number of Individuals	147576	104264	43546	147576	104264	43546

Note: Robust standard errors in brackets. *significant at 10%; ** significant at 5%; *** significant at 1%.

Marginal Effects

	All	More Educated	Less Educated	All	More Educated	Less Educated
ln State MW	0.034	0.033	0.038	0.022	0.028	0.006
P-Value	0.005	0.027	0.047	0.237	0.220	0.841

Panel B:

	All	More Educated	Less Educated	All	More Educated	Less Educated
ln MW	0.060	0.050	0.101	-0.226	-0.193	-0.309
	(0.016)***	(0.020)**	(0.027)***	(0.0915)**	(0.115)*	(0.145)**
ln MW*State	-0.034	-0.024	-0.071	0.177	0.130	0.311
	(0.0098)***	(0.0115)**	(0.0188)***	(0.0876)**	(0.106)	(0.151)**
Enforcement				-0.170	-0.107	-0.243
				(0.130)	(0.166)	(0.196)
lnMW*Enforce				0.444	0.379	0.628
				(0.140)***	(0.177)**	(0.220)***
lnMW*Enforce*State				-0.349	-0.254	-0.632
				(0.155)**	(0.187)	(0.265)**
City CPI	0.428	0.439	0.371	0.406	0.423	0.338
	(0.072)***	(0.091)***	(0.112)***	(0.071)***	(0.091)***	(0.113)***
Constant	0.668	0.782	0.436	0.810	0.873	0.642
	(0.095)***	(0.121)***	(0.147)***	(0.132)***	(0.168)***	(0.206)***
Observations	295152	207947	86388	295152	207947	86388
Number of Individuals	147576	104264	43546	147576	104264	43546

Note: Robust standard errors in brackets. *significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4: Monthly Transition Matrix

T=0 Employment Status	T=1 Employment Status					
	FE	**IE**	**SE**	**UE**	**OLF**	**Total**
Formal Employees	**147,580**	4,972	1,663	1,345	2,434	157,994
(FE)	**93.41%**	3.15%	1.05%	0.85%	1.54%	100.00%
Informal Employees	6,175	**40,693**	5,177	2,031	3,171	57,247
(IE)	10.79%	**71.08%**	9.04%	3.55%	5.54%	100.00%
Self-Employed	1,808	5,426	**60,354**	1,569	3,296	72,453
(SE)	2.50%	7.49%	**83.30%**	2.17%	4.55%	100.00%
Unemployed	1,349	2,722	1,852	**20,530**	8,794	35,247
(UE)	3.83%	7.72%	5.25%	**58.25%**	24.95%	100.00%
Out of Labor Force	1,858	3,685	3,554	9,387	**115,650**	134,134
(OLF)	1.39%	2.75%	2.65%	7.00%	**86.22%**	100.00%
Total	158,770	57,498	72,600	34,862	133,345	**457,075**
	34.74%	12.58%	15.88%	7.63%	29.17%	**100.00%**

Table 5: Flows from Formal Employment into Other States (Multinomial Logit Analysis)

	From Formal Employment at time t-1 into the following states in time t (base is Formal):							
	Informal Employees (IE)	Self-Employed (SE)	Unemployed (U)	Out of the Labor Force (OLF)	Informal Employees (IE)	Self-Employed (SE)	Unemployed (U)	Out of the Labor Force (OLF)
% Change of Minimum Wage	0.321	1.210	-10.034	-9.942	0.317	1.201	-10.038	-9.955
	(0.244)*	(0.467)**	(0.327)***	(0.250)***	(0.244)	(0.466)**	(0.328)***	(0.251)***
Variation of Enforcement					-0.574	0.451	3.441	-0.113
					(2.304)	(3.662)	(4.288)	(3.363)
% Ch. MW * Var. Enforce.					22.552	20.783	64.973	32.295
					(34.430)	(63.517)	(24.926)**	(21.242)
Lag Age 14-30	0.464	-0.408	0.372	0.920	0.464	-0.408	0.372	0.920
	(0.048)***	(0.145)**	(0.085)***	(0.066)***	(0.048)***	(0.146)**	(0.085)***	(0.066)***
Lag Age 31-40	-0.245	0.464	-0.383	-0.183	-0.245	0.464	-0.386	-0.184
	(0.038)***	(0.068)***	(0.072)***	(0.059)**	(0.038)***	(0.068)***	(0.072)***	(0.059)**
Lag Age 41-50	-0.217	0.768	-0.467	0.063	-0.217	0.768	-0.467	0.062
	(0.045)***	(0.072)***	(0.090)***	(0.064)	(0.045)***	(0.0720)***	(0.091)***	(0.064)
Lag Age 51-60	0.125	0.962	-0.575	0.684	0.124	0.962	-0.577	0.683
	(0.059)*	(0.091)***	(0.145)***	(0.073)***	(0.059)*	(0.091)***	(0.145)***	(0.073)***
Lag Age 61-70	0.527	0.735	-0.832	1.100	0.527	0.735	-0.837	1.099
	(0.103)***	(0.191)***	(0.385)*	(0.122)***	(0.103)***	(0.191)***	(0.385)*	(0.122)***
1-3 yrs ed	-0.348	-0.517	-0.312	-0.450	-0.348	-0.517	-0.310	-0.448
	(0.125)**	(0.178)**	(0.298)	(0.144)**	(0.125)**	(0.178)**	(0.298)	(0.145)**
4-7 yrs ed	-0.162	-0.533	0.064	-0.435	-0.162	-0.533	0.064	-0.435
	(0.107)	(0.149)***	(0.252)	(0.122)***	(0.107)	(0.149)***	(0.252)	(0.122)***
8-10 yrs ed	-0.210	-0.510	0.021	-0.556	-0.210	-0.510	0.020	-0.557
	(0.109)	(0.153)***	(0.253)	(0.125)***	(0.109)	(0.153)***	(0.253)	(0.125)***
11+ yrs ed	-0.291	-0.435	-0.041	-0.922	-0.291	-0.435	-0.043	-0.922
	(0.106)**	(0.148)**	(0.249)	(0.123)***	(0.106)**	(0.148)**	(0.249)	(0.123)***
Salvador	-0.688	-0.735	-0.379	-0.755	-0.688	-0.735	-0.380	-0.755
	(0.061)***	(0.108)***	(0.109)***	(0.088)***	(0.061)***	(0.108)***	(0.109)***	(0.088)***
Belo Horizonte	-0.358	0.035	-0.357	-0.230	-0.359	0.035	-0.353	-0.230
	(0.051)***	(0.084)	(0.097)***	(0.068)***	(0.051)***	(0.084)	(0.097)***	(0.068)***
Rio de Janeiro	-0.632	-0.841	-1.490	-1.703	-0.632	-0.841	-1.466	-1.691
	(0.056)***	(0.102)***	(0.127)***	(0.094)***	(0.056)***	(0.103)***	(0.127)***	(0.095)***
Sao Paulo	-0.365	-0.547	-0.338	-0.670	-0.365	-0.546	-0.334	-0.670
	(0.049)***	(0.089)***	(0.094)***	(0.072)***	(0.049)***	(0.089)***	(0.094)***	(0.072)***
Porto Alegre	-0.367	0.018	-0.787	-0.673	-0.367	0.018	-0.798	-0.678
	(0.053)***	(0.087)	(0.105)***	(0.074)***	(0.053)***	(0.087)	(0.106)***	(0.074)***
Lag Low Tenure	0.734	0.284	1.082	0.358	0.734	0.284	1.080	0.358
	(0.032)***	(0.061)***	(0.060)***	(0.047)***	(0.032)***	(0.061)***	(0.060)***	(0.047)***
City CPI	-0.417	0.114	0.323	0.479	-0.418	0.113	0.332	0.482
	(0.094)***	(0.168)	(0.197)	(0.152)**	(0.094)***	(0.168)	(0.197)	(0.152)**
Constant	-2.373	-4.348	-4.881	-3.816	-2.372	-4.347	-4.890	-3.819
	(0.169)***	(0.279)***	(0.374)***	(0.242)***	(0.169)***	(0.279)***	(0.374)***	(0.243)***
Pseudo R-squared	0.052				0.052			
Model chi-square	5250.976				5255.568			
Observations	157,994				157,994			

Standard errors in bracket, * significant at 10%; ** significant at 5%; *** significant at 1%

Notes: Recife is the base city and "no education" the base for the education variables.

Marginal Effects:

dy/dx is for discrete change of dummy variable from 0 to 1	Informal Employees (IE)	Self-Employed (SE)	Unemployed (U)	Out of the Labor Force	Informal Employees (IE)	Self-Employed (SE)	Unemployed (U)	Out of the Labor Force
δ(change in status)/δ (% Ch. MW)	0.013	0.013	-0.054	-0.102	0.013	0.013	-0.054	-0.102
	(0.007)*	(0.004)***	(0.001)***	(0.002)***	(0.007)*	(0.004)***	(0.002)***	(0.003)***
δ(change in status)/δ Enforce.					-0.017	0.004	0.019	-0.001
					(0.065)	(0.034)	(0.023)	(0.035)
δ(change in status)/δ (% Ch. MW* Enforcement)					0.609	0.180	0.349	0.320
					(0.968)	(0.587)	(0.137)	(0.219)

Table 6: Flows into Formal Employment - New Hires (Linear Probability Analysis)

	From the following states in time t-1 into formal employment at time t:									
	All	Informal Employees (IE)	Unemployed (U)	Self-Employed (SE)	Out of the Labor Force (OLF)	All	Informal Employees (IE)	Unemployed (U)	Self-Employed (SE)	Out of the Labor Force (OLF)
% Ch. in MW	-0.135	-0.021	-0.125	0.008	0.115	-0.136	0.006	-0.127	0.011	0.107
	(0.053)**	(0.132)	(0.122)	(0.128)	(0.121)	(0.053)**	(0.131)	(0.122)	(0.129)	(0.121)
Variation of Enforcement						-0.566	-1.777	-1.600	0.815	0.086
						(0.891)	(1.678)	(2.286)	(1.950)	(1.822)
% Ch. MW* Var. Enforce.						-2.339	14.890	-0.060	15.950	-6.433
						(7.143)	(19.600)	(15.890)	(32.470)	(11.460)
Lag Age 14-30	-0.098	-0.069	-0.036	0.019	-0.062	-0.098	-0.069	-0.037	0.020	-0.063
	(0.012)***	(0.024)***	(0.025)	(0.045)	(0.023)***	(0.012)***	(0.024)***	(0.025)	(0.045)	(0.023)***
Lag Age 31-40	-0.004	0.024	0.012	0.000	-0.023	-0.004	0.023	0.011	0.000	-0.023
	(0.014)	(0.029)	(0.026)	(0.027)	(0.032)	(0.014)	(0.029)	(0.026)	(0.027)	(0.032)
Lag Age 41-50	-0.033	0.017	-0.032	-0.046	-0.003	-0.033	0.018	-0.031	-0.045	-0.003
	(0.015)**	(0.033)	(0.031)	(0.026)*	(0.035)	(0.015)**	(0.033)	(0.031)	(0.026)*	(0.035)
Lag Age 51-60	-0.094	-0.015	-0.066	-0.052	-0.061	-0.094	-0.017	-0.066	-0.051	-0.060
	(0.019)***	(0.051)	(0.043)	(0.031)*	(0.034)*	(0.019)***	(0.051)	(0.043)	(0.030)*	(0.034)*
Lag Age 61-70	-0.138	-0.082	-0.191	-0.113	-0.080	-0.138	-0.080	-0.192	-0.112	-0.080
	(0.028)***	(0.069)	(0.032)***	(0.030)***	(0.045)*	(0.028)***	(0.069)	(0.032)***	(0.030)***	(0.045)*
1-3 yrs ed	-0.010	0.012	0.015	0.007	-0.147	-0.010	0.012	0.012	0.007	-0.146
	(0.025)	(0.052)	(0.052)	(0.034)	(0.053)***	(0.025)	(0.052)	(0.052)	(0.034)	(0.053)***
4-7 yrs ed	0.014	0.043	0.035	0.018	-0.122	0.014	0.043	0.034	0.018	-0.122
	(0.022)	(0.046)	(0.047)	(0.029)	(0.051)**	(0.022)	(0.046)	(0.047)	(0.029)	(0.051)**
8-10 yrs ed	0.099	0.089	0.097	0.044	-0.057	0.099	0.090	0.096	0.044	-0.057
	(0.024)***	(0.048)*	(0.048)**	(0.035)	(0.053)	(0.024)***	(0.048)*	(0.048)**	(0.036)	(0.053)
11+ yrs ed	0.202	0.145	0.219	0.072	0.025	0.202	0.144	0.217	0.071	0.025
	(0.023)***	(0.048)***	(0.048)***	(0.036)**	(0.055)	(0.023)***	(0.048)***	(0.048)***	(0.036)**	(0.055)
Salvador	0.064	-0.031	0.076	0.025	0.003	0.064	-0.028	0.076	0.025	0.002
	(0.018)***	(0.034)	(0.037)**	(0.029)	(0.033)	(0.018)***	(0.034)	(0.037)**	(0.029)	(0.033)
Belo Horizonte	0.088	0.075	0.105	0.104	0.089	0.088	0.075	0.104	0.104	0.089
	(0.014)***	(0.030)**	(0.029)***	(0.025)***	(0.023)***	(0.014)***	(0.030)**	(0.029)***	(0.025)***	(0.023)***
Rio de Janeiro	0.163	0.040	0.097	0.122	0.046	0.163	0.040	0.097	0.122	0.047
	(0.020)***	(0.042)	(0.043)**	(0.038)***	(0.044)	(0.020)***	(0.042)	(0.043)**	(0.038)***	(0.044)
Sao Paulo	0.073	0.016	0.071	0.043	0.031	0.072	0.015	0.069	0.043	0.032
	(0.015)***	(0.031)	(0.028)**	(0.024)*	(0.026)	(0.015)***	(0.031)	(0.028)**	(0.024)*	(0.026)
Porto Alegre	0.189	0.104	0.267	0.153	0.110	0.188	0.102	0.266	0.155	0.110
	(0.016)***	(0.035)***	(0.039)***	(0.032)***	(0.035)***	(0.016)***	(0.035)***	(0.039)***	(0.032)***	(0.035)***
City CPI	0.194	0.098	0.162	0.304	0.249	0.194	0.096	0.163	0.303	0.251
	(0.031)***	(0.066)	(0.064)**	(0.064)***	(0.057)***	(0.031)***	(0.066)	(0.064)**	(0.064)***	(0.057)***
Constant	-0.135	-0.059	-0.157	-0.362	-0.131	-0.135	-0.058	-0.156	-0.361	-0.132
	(0.047)***	(0.099)	(0.097)	(0.088)***	(0.091)	(0.047)***	(0.099)	(0.098)	(0.087)***	(0.091)
Observations	8084	1539	2036	1184	1706	8084	1539	2036	1184	1706
R-squared	0.073	0.036	0.078	0.069	0.067	0.073	0.037	0.078	0.069	0.068

Standard errors in bracket, * significant at 10%; ** significant at 5%; *** significant at 1%

Notes: Recife is the base city and "no education" the base for the education variables.

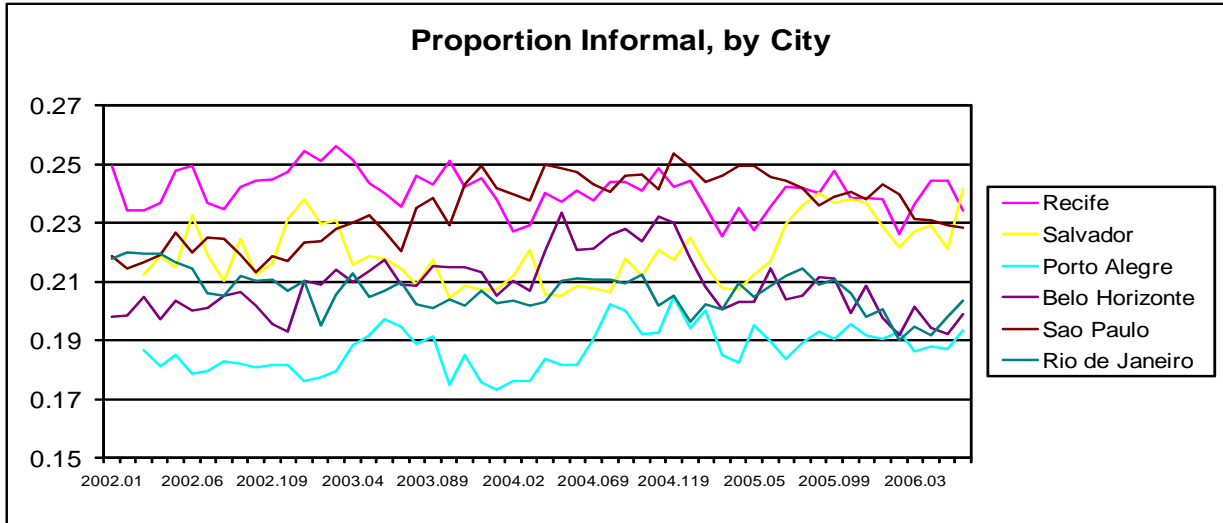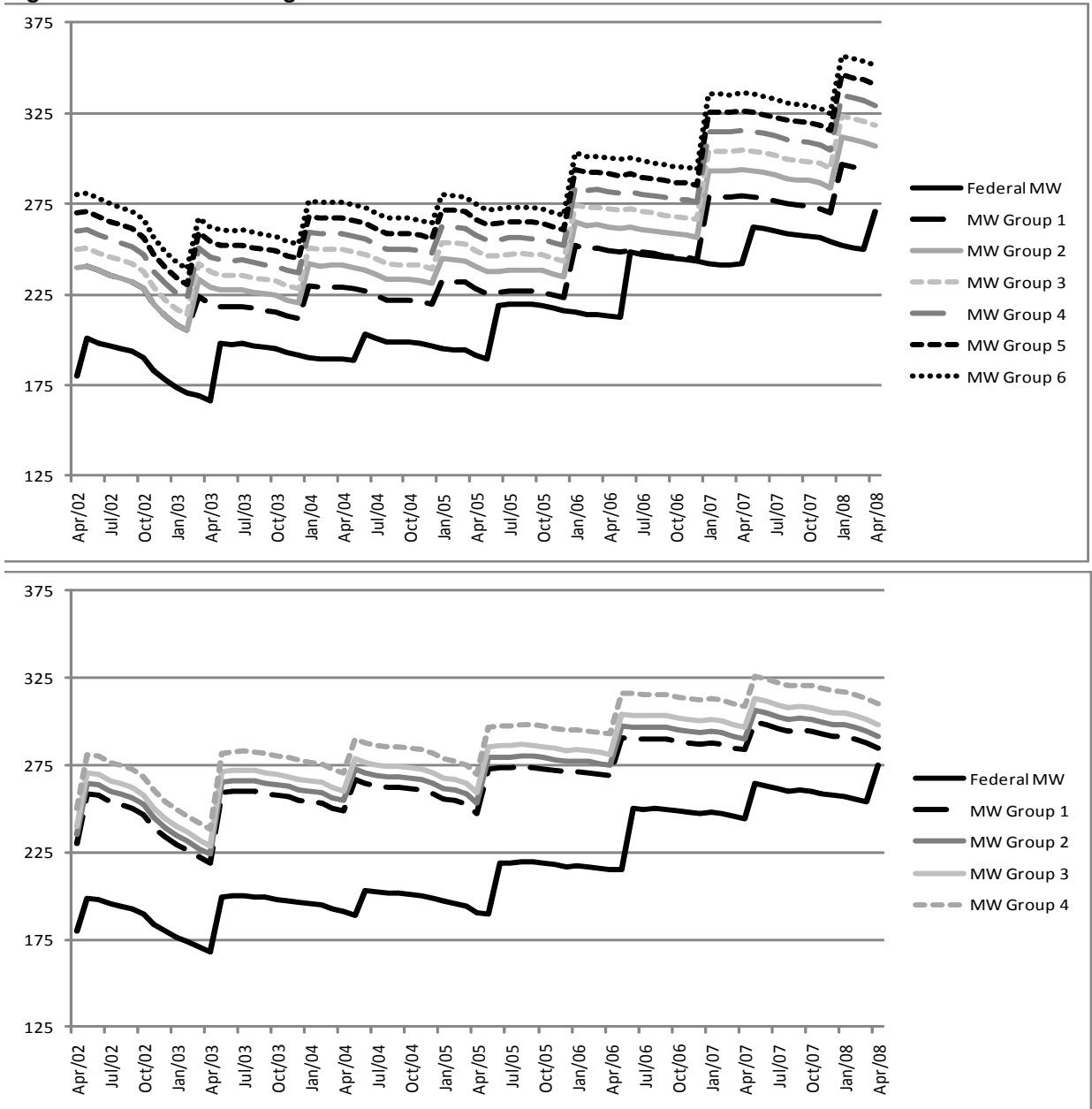**Figure 1: Proportion of total employment in each city that is informal**

Proportion Informal, by City

Legend:
- Recife
- Salvador
- Porto Alegre
- Belo Horizonte
- Sao Paulo
- Rio de Janeiro

Figure 2: Real Minimum Wages in Rio de Janeiro and Rio Grande do Sul*

*Metropolitan consumer price indices used to deflate in each.

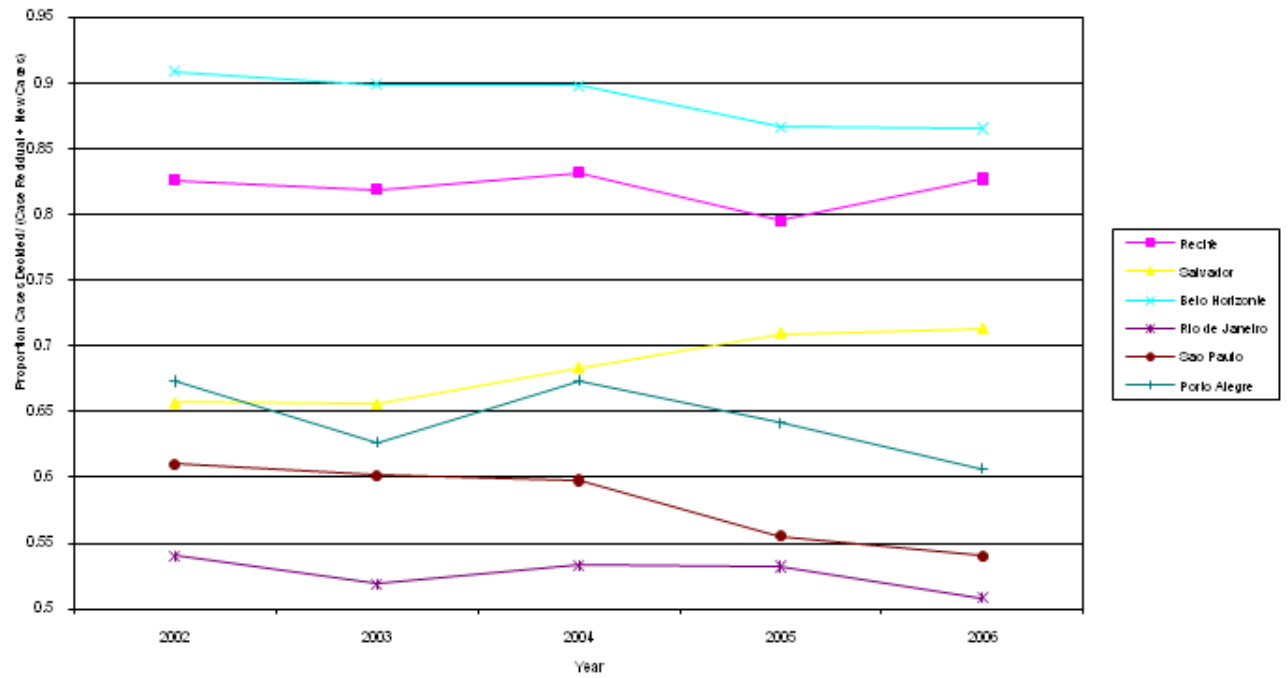Figure 3 Enforcement -- Efficiency of Labor Courts
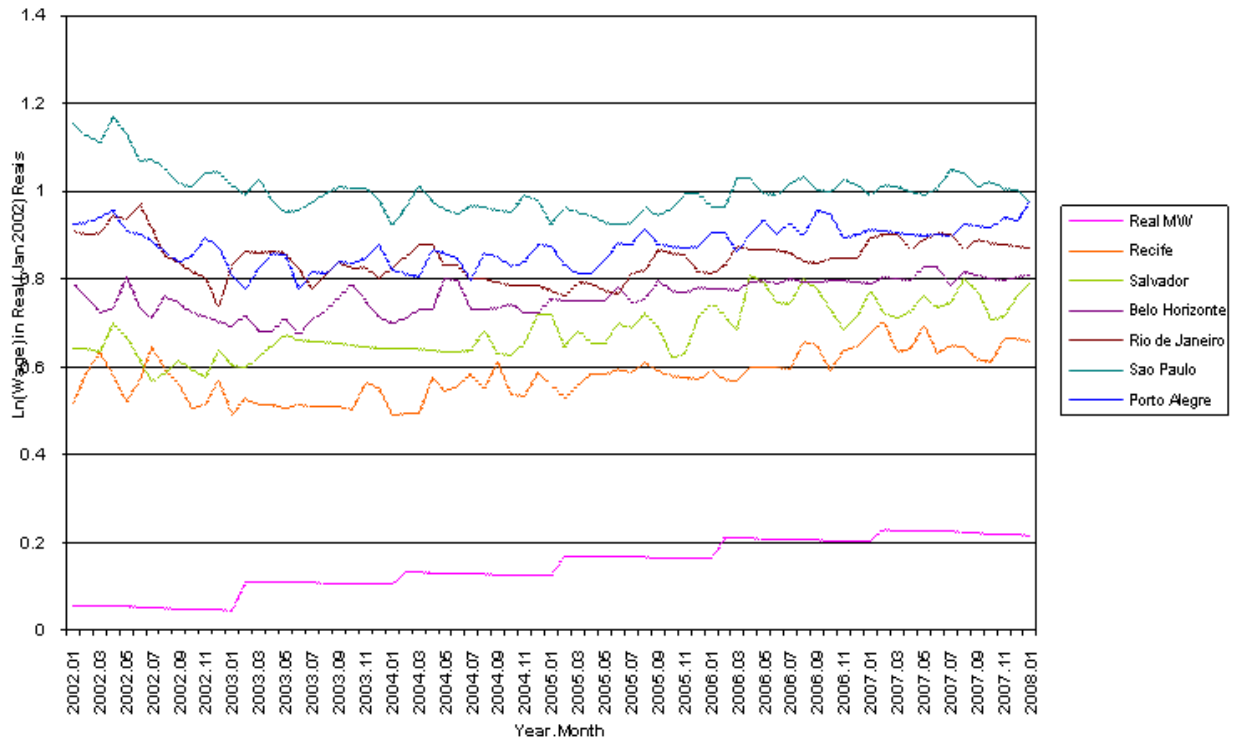
Fig 4 -Median Ln(Real Wage) v. Ln(National MW)

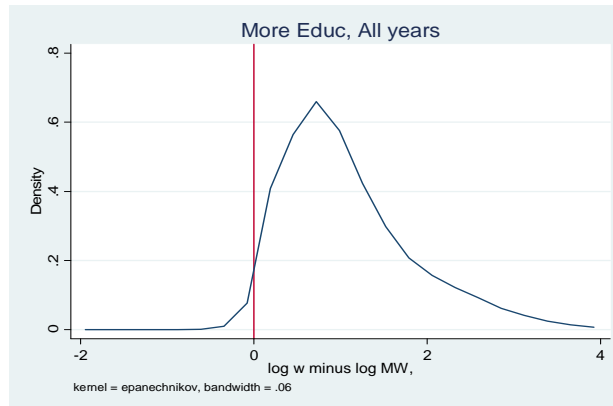**Figure 5: Kernel Density Estimates of the Ln W - Ln MW for Male Formal Sector Workers, 2002-2008, All and by Eductation**
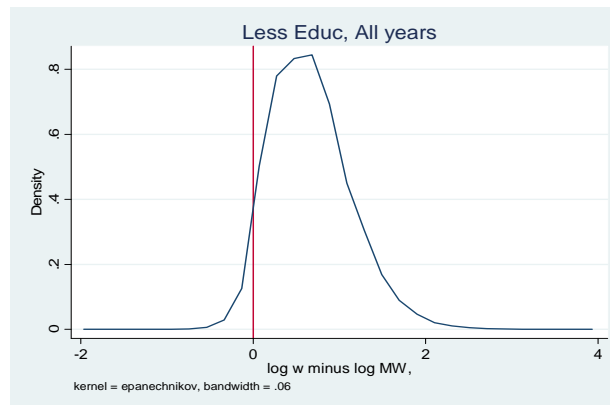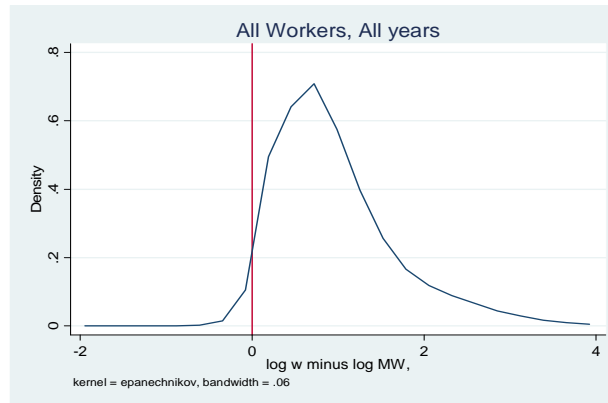
Figure 6: Kernel Density Estimates of the Ln W - Ln Federal MW for Male Formal Sector Workers, 2002-2008, by Metropolitan Area
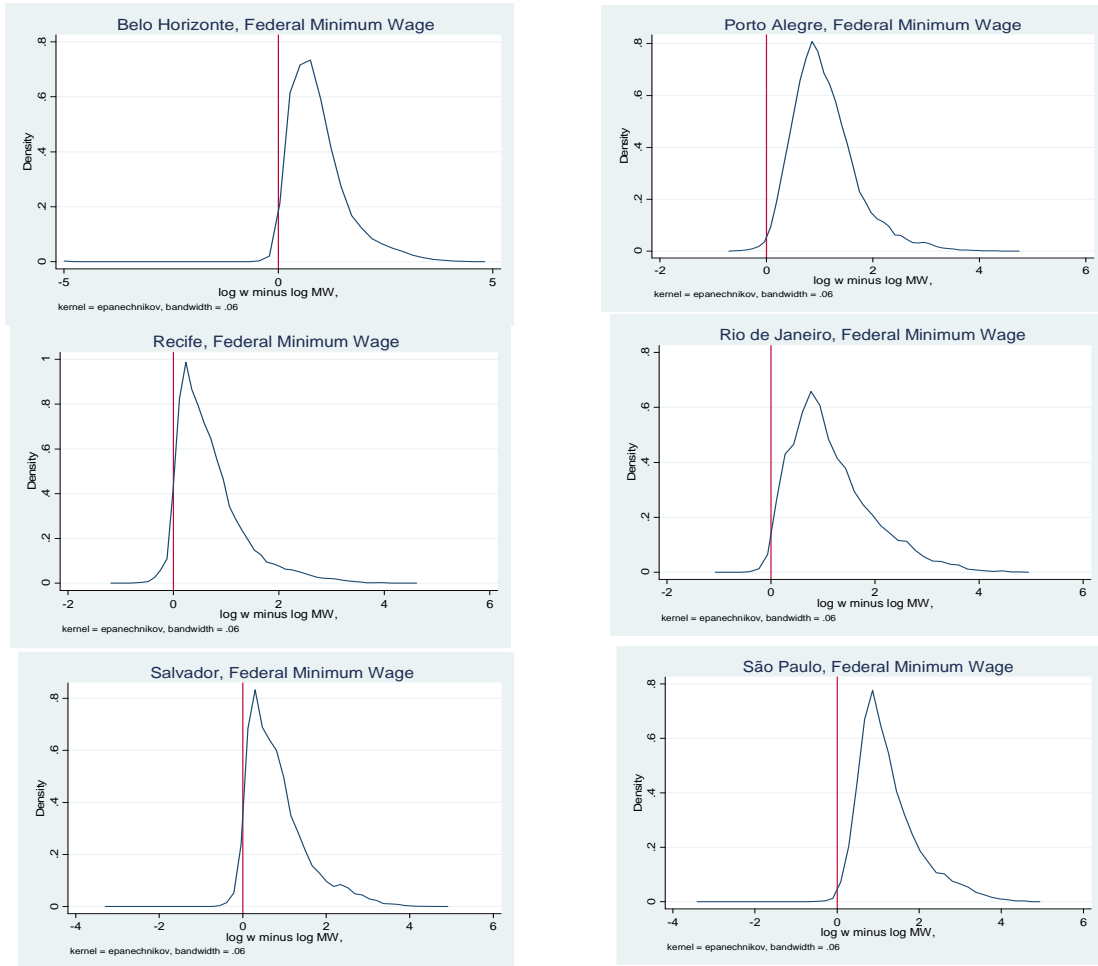
Figure 7: Kernel Density Estimates of the Ln W - Ln State MW for Male Formal Sector Workers who are covered by State MWs (pooled 2002-2008 data)
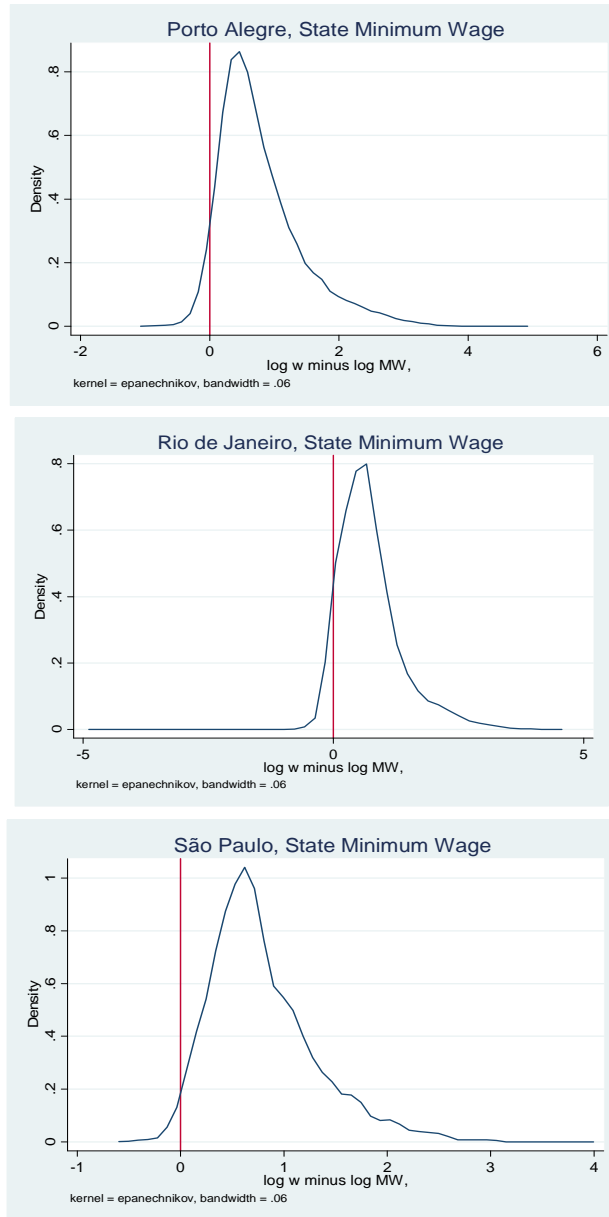

Porto Alegre, State Minimum Wage

kernel = epanechnikov, bandwidth = .06

Rio de Janeiro, State Minimum Wage

kernel = epanechnikov, bandwidth = .06

São Paulo, State Minimum Wage

kernel = epanechnikov, bandwidth = .06

Table A1: Rio de Janeiro - Occupational categories covered by each minimum wage level

	2002	2003-2007 (very few, minor, changes in these years)	2008
Wage Level 1	Para empregados domésticos; trabalhadores agropecuários e florestais; serventes; trabalhadores de serviços de conservação, manutenção, limpeza de edifícios, condomínios; empresas comerciais, industriais, áreas verdes e logradouros públicos, não escritório, empregados do comércio não especializados; cumim e barboy; trabalhadores braçais não classificados sob outras epígrafes.	Para os trabalhadores agropecuários e florestais;	Para os trabalhadores agropecuários e florestais;
Wage Level 2	Para classificadores de correspondência e carteiros; trabalhadores em serviços administrativos; cozinheiros; operadores de caixa; lavadeiros e tintureiros; barbeiros, cabeleleiros, manicure e pedicure; operadores de máquinas e implementos de agricultura; pecuária e exploração florestal, trabalhadores de tratamento de madeira, de fabricação de papel e papelão; fiandeiro, tecelões e tingidores; trabalhadores de curtimento; trabalhadores de preparação de alimentos e bebidas; trabalhadores de costura e estofadores; trabalhadores de fabricação de calçados e artefatos de couro; vidreiros e ceramistas; confeccionadores de produtos de papel e papelão; dedetizador; pescador; vendedores; trabalhadores do serviço de higiene e saúde; trabalhadores de serviço de proteção e segurança; trabalhadores de serviço de turismo e hospedagem.	Para empregados domésticos, serventes, trabalhadores de serviços de conservação, manutenção, empresas comerciais, industrias, áreas verdes e logradouros públicos, não especializados, contínuo e mensageiro; auxiliar de serviços gerais e de escritório; empregados do comércio não especializados, cumim e barboy;	Para empregados domésticos, serventes, trabalhadores de serviços de conservação, manutenção, empresas comerciais, industrias, áreas verdes e logradouros públicos, não especializados, contínuo e mensageiro; auxiliar de serviços gerais e de escritório; empregados do comércio não especializados, cumim e barboy;
Wage Level 3	Para trabalhadores da construção civil; despachantes; fiscais; cobradores de transporte coletivo (exceto trem); trabalhadores de minas, pedreiras e condadores; pintores, cortadores, polidores e gravadores de pedras, pedreiros, trabalhadores de fabricação de produtos de borracha e plástico e garçon.	Para classificadores de correspondência e carteiros, trabalhadores em serviços administrativos, cozinheiros, operadores de caixa, inclusive de supermercados, lavadeiras e tintureiros, barbeiros, cabeleireiro, manicure e pedicure, operadores de máquinas e implementos de agricultura; pecuária e exploração florestal; trabalhadores de tratamento de madeira, de fabricação de papel e papelão, fiandeiro, tecelões e tingidores, trabalhadores de curtimento, trabalhadores de preparação de alimentos e bebidas, trabalhadores de costura e estofadores, trabalhadores da fabricação de calçados e artefatos de couro, vidreiro e ceramistas, confeccionadores de produto de papel e papelão, dedetizador, pescador, vendedores, trabalhadores dos serviços de higiene e saúde, trabalhadores de serviços de proteção e segurança; trabalhadores de serviços de turismo e hospedagem, moto-boys;	Para classificadores de correspondência e carteiros, trabalhadores em serviços administrativos, cozinheiros, operadores de caixa, inclusive de supermercados, lavadeiras e tintureiros, barbeiros, cabeleireiro, manicure e pedicure, operadores de máquinas e implementos de agricultura; pecuária e exploração florestal; trabalhadores de tratamento de madeira, de fabricação de papel e papelão, fiandeiro, tecelões e tingidores, trabalhadores de curtimento, trabalhadores de preparação de alimentos e bebidas, trabalhadores de costura e estofadores, trabalhadores da fabricação de calçados e artefatos de couro, vidreiro e ceramistas, confeccionadores de produto de papel e papelão, dedetizador, pescador, vendedores, trabalhadores dos serviços de higiene e saúde, trabalhadores de serviços de proteção e segurança; trabalhadores de serviços de turismo e hospedagem, moto-boys;
Wage Level 4	Para administradores, capatazes de exploração agropecuárias florestais; trabalhadores de usinagem de metais; encanadores, soldadores, chapeadores, caldereiros e montadores de estruturas metálicas; trabalhadores das artes gráficas; condutores de veículos de transportes; trabalhadores da confecção de instrumentos musicais, produtos de vime e similares; trabalhadores de derivados de minerais não metálicos; trabalhadores de movimentação e manipulação de mercadorias e materiais; operadores de máquinas da construção civil e mineração; telefonistas, telegrafistas e barman.	Para trabalhadores da construção civil, despachantes, fiscais, cobradores de transporte coletivo (exceto trem), trabalhadores de minas, pedreiras e contadores, pintores, cortadores, polidores e gravadores de pedras, pedreiros, trabalhadores de fabricação de produtos de borracha e plástico, garçons;	Para trabalhadores da construção civil, despachantes, fiscais, cobradores de transporte coletivo (exceto trem), trabalhadores de minas, pedreiras e contadores, pintores, cortadores, polidores e gravadores de pedras, pedreiros, trabalhadores de fabricação de produtos de borracha e plástico, garçons;

Table A1 continued:

Wage Level 5	Para trabalhadores de serviço de contabilidade e de caixas; operadores de máquinas de contabilidade e de calcular; operadores de máquinas de processamento automático de dados; secretários, datilógrafos e estenógrafos, chefes de serviços de transportes e comunicações; supervisores de compras e de vendas, compradores, agentes técnicos de vendas e representantes comerciais; mordomos e governantas; trabalhadores de serventia e comissários (serviços de transporte de passageiros); agentes de mestria, mestre, contramestres, supervisor de produção e manutenção industrial; trabalhadores metalúrgicos e siderúrgicos; operadores de instalações de processamento químico; trabalhadores de tratamento de fumo e de fabricação de charutos e cigarros; operadores de estação de rádio, televisão e equipamento de sonorização e de projeção cinematográfico; operadores de máquinas fixas e de equipamentos similares, sommelier e maitre de hotel; ajustadores mecânicos, montadores e mecânicos de máquinas, veículos e instrumentos de precisão; eletricistas eletrônicos; joalheiros e ourives; marceneiros e operadores de máquinas de lavrar madeira; supervisores de produção e manu	- Para administradores, capatazes de explorações agropecuárias, florestais, trabalhadores de usinagem de metais, encanadores, soldadores, chapeadores, caldeireiros e montadores de estruturas metálicas, trabalhadores das artes gráficas, condutores de veículos de transportes, trabalhadores de confecção de instrumentos musicais, produtos de vime e similares, trabalhadores de derivados de minerais não metálicos, trabalhadores de movimentação e manipulação de mercadorias e materiais, operadores de máquinas da construção civil e mineração, telegrafistas e barman, trabalhadores de edifícios e condomínios	- Para administradores, capatazes de explorações agropecuárias, florestais, trabalhadores de usinagem de metais, encanadores, soldadores, chapeadores, caldeireiros e montadores de estruturas metálicas, trabalhadores das artes gráficas, condutores de veículos de transportes, trabalhadores de confecção de instrumentos musicais, produtos de vime e similares, trabalhadores de derivados de minerais não metálicos, trabalhadores de movimentação e manipulação de mercadorias e materiais, operadores de máquinas da construção civil e mineração, telegrafistas e barman, trabalhadores de edifícios e condomínios
Wage Level 6		Para trabalhadores de serviços de contabilidade e caixas, operadores de máquinas de contabilidade e de calcular, operadores de máquinas de processamento automático de dados, secretários, datilógrafos e estenógrafos, chefes de serviços de transportes e comunicações, telefonistas e operadores de telefone e de telemarketing, trabalhadores da rede de energia e telecomunicações, supervisores de compras e de vendas, compradores, agentes técnicos de vendas e representantes comerciais, mordomos e governantas, trabalhadores de serventia e comissários (serviço de transporte e passageiros), agentes de mestria, mestre, contramestres, supervisor de produção e manutenção industrial, trabalhadores metalúrgicos e siderúrgicos, operadores de instalações de processamento químico, trabalhadores de tratamentos de fumo e de fabricação de charutos e cigarros, operadores de estação de rádio, televisão e de equipamentos de sonorização e de projeção cinematográfico, operadores de máquinas fixas e de equipamentos similares, sommelier, e maitre de hotel, ajustadores mecânicos, montadores e mecânicos de máquinas, veículos e instrumento de	Para trabalhadores de serviços de contabilidade e caixas, operadores de máquinas de contabilidade e de calcular, operadores de máquinas de processamento automático de dados, secretários, datilógrafos e estenógrafos, chefes de serviços de transportes e comunicações, telefonistas e operadores de telefone e de telemarketing, trabalhadores da rede de energia e telecomunicações, supervisores de compras e de vendas, compradores, agentes técnicos de vendas e representantes comerciais, mordomos e governantas, trabalhadores de serventia e comissários (serviço de transporte e passageiros), agentes de mestria, mestre, contramestres, supervisor de produção e manutenção industrial, trabalhadores metalúrgicos e siderúrgicos, operadores de instalações de processamento químico, trabalhadores de tratamentos de fumo e de fabricação de charutos e cigarros, operadores de estação de rádio, televisão e de equipamentos de sonorização e de projeção cinematográfico, operadores de máquinas fixas e de equipamentos similares, sommelier, e maitre de hotel, ajustadores mecânicos, montadores e mecânicos de máquinas, veículos e instrumento de
Wage Level 7			para trabalhadores de serviços de contabilidade de nível técnico
Wage Level 8			Para professores de Ensino Fundamental (1ª a 5ª anos), com regime de 40 (quarenta) horas semanais, e técnicos de eletrônica e telecomunicações.
Wage Level 9			para advogados e contadores empregados.

Table A2: Rio Grande do Sul (Porto Alegre) - Occupational Categories Covered by Each Minimum Wage Level (2002-2008)

Wage Level 1

a) na agricultura e na pecuária;

b) nas indústrias extrativas;

c) em empresas de pesca;

d) empregados domésticos;

e) em turismo e hospitalidade;

f) nas indústrias da construção civil;

g) nas indústrias de instrumentos musicais e brinquedos;

h) em estabelecimentos hípicos.

Wage Level 2

a) nas indústrias do vestuário e do calçado;

b) nas indústrias de fiação e tecelagem;

c) nas indústrias de artefatos de couro;

d) nas indústrias do papel, papelão e cortiça;

e) em empresas distribuidoras e vendedoras de jornais e revistas e empregados em bancas, vendedores ambulantes de jornais e revistas;

f) empregados da administração das empresas proprietárias de jornais e revistas;

g) empregados em estabelecimentos de serviços de saúde.

Wage Level 3

a) nas indústrias do mobiliário;

b) nas indústrias químicas e farmacêuticas;

c) nas indústrias cinematográficas;

d) nas indústrias da alimentação;

e) empregados no comércio em geral;

f) empregados de agentes autônomos do comércio.

Wage Level 4

a) nas indústrias metalúrgicas, mecânicas e de material elétrico;

b) nas indústrias gráficas;

c) nas indústrias de vidros, cristais, espelhos, cerâmica de louça e porcelana;

d) nas indústrias de artefatos de borracha;

e) em empresas de seguros privados e capitalização e de agentes autônomos de seguros privados e de crédito;

f) em edifícios e condomínios residenciais, comerciais e similares;

g) nas indústrias de joalheria e lapidação de pedras preciosas;

h) auxiliares em administração escolar (empregados de estabelecimentos de ensino).

Table A3: Means and Standard Deviations of Selected Variables by City for Male Workers (averages for June 2002-2008)

	Recife	Salvador	Belo Horizonte	Rio de Janeiro	Sao Paulo	Porto Alegre	All
Mean Nominal Wage	736.15	810.48	966.16	1014.258	1211.54	1029.31	996.2422
Std. Deviation Nominal Wage	1209.62	1373.21	1486.75	1650.52	2035.32	1319.78	1609.11
Median Nominal Wage	400.00	400.00	528.00	600.00	700.00	600.00	600
Mean Nominal Wage increase ($lnMW_t - lnMW_{t-1}$)	1.17%	1.27%	1.26%	1.18%	1.30%	1.28%	1.25%
Mean Real Wage (deflated by City CPI)	544.39	610.06	709.00	773.39	946.22	770.21	754.602
Std. Deviation Real Wage (deflated by City CPI)	902.56	1035.15	1099.89	1246.46	1614.19	989.33	1234.484
Mean city cpi	1.35	1.32	1.35	1.31	1.28	1.34	
Mean Enforcement	0.820	0.684	0.887	0.527	0.581	0.644	0.679
Total no. individuals (in LF + out of LF)	117,048	131,010	167,938	156,356	211,134	130,664	914,150
% Formal employment (out of total LF + OLF)	26.48	30.48	37.29	33.18	37.94	38.31	34.52
% Informal employment (out of total LF + OLF)	12.27	12.07	11.82	12.31	14.86	11.36	12.63
% Self-employed (same) %	15.99	17.65	15.09	19.35	14.63	16.15	16.34
% Unemployed (same)	8.93	10.08	6.69	5.8	8.46	5.73	7.58
% OLF (same)	36.33	29.72	29.11	29.35	24.11	28.45	28.93