

The Effects of the Minimum Wage in Brazil on the Distribution of Family Incomes: 1996-2001

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Abstract: The Brazilian economy has long relied on the minimum wage, having first implemented a minimum in 1940. Shortly after taking office in 2003, Brazil's President raised the minimum wage by 20 percent and promised to double the value of the minimum wage before his term ends in 2006. The usual rationale for minimum wage increases is to bring about beneficial changes in the income distribution, by raising incomes of poor and low-income families. The goal of this paper is to evaluate the efficacy of the minimum wage in Brazil in bringing about these changes in the income distribution. We examine data drawn from Brazil's major metropolitan areas, studying the years after Brazil's hyper-inflation ended. The estimates provide no evidence that minimum wages in Brazil lift family incomes at the lower points of the income distribution; if anything some of the evidence points to adverse effects on lower-income families.

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I. Introduction

The usual rationale for minimum wage increases is to bring about beneficial changes in the income distribution, by raising incomes of poor and low-income families. The effects of minimum wages on the distribution of family incomes in developing countries have received very little attention. This paper evaluates the efficacy of the minimum wage in Brazil in bringing about these types of changes in the distribution of family income. The Brazilian case is of great interest for a few reasons. First, the Brazilian economy is characterized by a high level of inequality; apart from the Central African Republic, Malawi, Nicaragua, and South Africa, Brazil has the highest income inequality in the world (World Bank, 2003), with a Gini coefficient that has fluctuated between 0.58 and 0.63 over the past 25 years (see www.ipea.gov.br, January 2003). Second, the minimum wage has been used intensively in Brazil, including semi-annual increases in the early 1980s, very frequent increases during the high inflation period through the mid-1990s, and annual increases since then. At the same time, poverty rates have decreased since the early 1980s (Ferreira, et al., 2000), although this of course may be attributable to many factors. And shortly after taking office in 2003, Brazil's President raised the minimum wage by another 20 percent and promised to double the value of the minimum wage before his term ends in 2006 (Wall Street Journal, April 1, 2003).

The Brazilian economy first implemented a minimum wage in 1940.¹ Figure 1 shows the recent history of minimum wage legislation in Brazil. The top graph in the figure shows the real value of the minimum wage over this period, and the bottom graph shows the percent change in the real minimum wage in months in which the legislated minimum wage increased. Figure 2 displays information on inflation in Brazil over this period. From the two figures, it is clear that during the periods of rapid inflation the nominal minimum wage was raised frequently, while between these increases the real value of the minimum wage declined sharply. Apparently anticipating these latter declines, when the minimum wage was increased in this period, it was increased sharply. Inflation returned to low levels beginning in

¹ Carneiro (2001) and Foguel (1998) provide a more detailed history of the minimum wage in Brazil.

1995 (with inflation slowing even more by 1996), and minimum wage legislation responded, settling into a pattern of yearly real increases generally in the range of five to 20 percent.

While there is a budding research literature on the effects of minimum wages in Brazil generally, there have been almost no analyses that attempt to directly estimate the causal effects of the minimum wage on the distribution of family income in Brazil. Rather, like the earlier literature on this question in the United States, the existing work relies on simulating the effects of the minimum wage (Ramos and Reis (1995), Neri, et al. (2000), IPEA (2000), and Barros, et al. (2000, 2001). But such simulations are problematic, because they ignore a number of dimensions along which workers and families may bear the effects of minimum wages or adjust to minimum wage changes, including indirect effects on higher-wage workers via spillovers or relative demand shifts, changes in employment or hours (conditional on working) of directly affected workers, and changes in employment or hours of other family members. Given the difficulties of predicting these responses, it is preferable to conduct a “before-and-after” analysis of the effects of minimum wages on the distribution of family incomes, to more reliably estimate the effects of minimum wages on this distribution.

II. Previous Research

In general, the distributional effects of minimum wages have received relatively little attention in research on minimum wages. Rather, the emphasis has been on their employment effects. The research literature for the United States typifies this near-exclusive focus on employment effects. Of the two major surveys of the literature on minimum wage effects in the United States (Brown, et al., 1982; Brown, 1999), the first focuses exclusively on employment and unemployment effects, and the second identifies only a handful of studies of the effects of minimum wages on the distribution of family incomes. Furthermore, most of this work (an exception is Neumark, et al., 2002) typically only tried to simulate the effects of minimum wages, rather than to use some version of a “before-and-after” research design to infer the actual effects of minimum wages on the distribution of incomes. Generally speaking, though, neither type of study suggests that minimum wages are very effective in helping poor or low-income families, and in the before-and-after studies minimum wages if anything appear to increase

poverty in the United States. This literature is quite unanimous in concluding that the reason minimum wage increases do not deliver much (if any) benefit to poor and low-income families in the United States is that minimum wages are not well-targeted at these families (Burkhauser, et al., 1996).

Research on the effects of minimum wages in Brazil is more sparse. Carneiro (2001) and Corseuil and Servo (2002) provide relatively recent reviews of this work, which we summarize more briefly and update in this subsection. Unlike the literature from the United States, the central question in the Brazilian research has been the impact of minimum wages on wages, reflecting the low-unemployment economies of the 1970s and 1980s and the subsequent hyper-inflationary period that generated strong interest in effects of minimum wages on real wages. The early debates were inconclusive regarding the effect of the minimum wage on average wages (Bacha, et al., 1972; Bacha and Taylor, 1978; Macedo and Garcia, 1978; Souza and Baltar, 1979; Velloso 1990), whereas more recent papers using more sophisticated techniques suggest that minimum wages have an impact not only on the lowest-wage workers in Brazil, but also on higher-wage workers. Fajnzylber (2002) provides the most detailed analysis of wage effects, using methods developed in Neumark, et al. (2004) that estimate the effects of minimum wages at rather finely-divided points of the wage distribution. For the period 1982-1997, he finds that wages of workers throughout the wage distribution appear to be increased by minimum wages. For formal-sector workers, for example, he finds elasticities that begin above one for those just below the minimum, and fall to about 0.4 for those making 40 times the minimum. In addition, he finds effects for informal-sector workers as well as self-employed workers. This evidence of minimum wage effects on wages well above the minimum and outside the formal sector suggests that minimum wages may have played a key role in indexation of wages paid to all workers; indeed, Carneiro (2001) explains that from 1979 until 1987 the minimum wage figured directly in indexation formulae, before its role was officially revoked. Maloney and Nuñez Mendez (2004) and Soares (2002) also report evidence from later data that minimum wages are binding in Brazil, with a spike in the wage distribution at the minimum wage evident in both the formal and informal sectors.

Fewer papers have estimated the employment effects of minimum wages in Brazil. Foguel (1998) compares employment and unemployment changes in regions differentially affected by minimum wages, where the regional variation was generated by the transition from region-specific minima to a national minimum wage between 1982 and 1987, and finds that a 10-percent increase in the minimum raises the unemployment rate by about 0.5 percentage points, with approximately half of the increase due to job loss and the other half due to new labor market entrants. Lemos (forthcoming) finds evidence that tends to suggest modest disemployment effects (typically an elasticity smaller in absolute value than 0.1), and often finds no statistically significant disemployment effect. Carneiro (2001) discusses some additional work that also tends to find at most quite modest disemployment effects of minimum wages in Brazil. And Fajnzylber (2002) uses his estimated earnings effects for workers and all individuals to back out implied employment elasticities that are in the range of -0.05 to -0.35 .

The key question with which this paper is concerned, however, is with whether minimum wages in Brazil achieve the goal of improving living standards for low-income families. We already noted that in the United States minimum wages appear to fail to do this, in part because many of the low-wage workers who gain from minimum wages are not in poor or low-income families. There is less reason to believe that this characterization holds true in Brazil, given its high degree of inequality and high degree of poverty (discussed below). Both of these lead to many more minimum wage workers in Brazil, and a higher share of minimum wage workers who are the primary breadwinners in their families. Moreover, if there really are substantial spillover effects considerably above the minimum wage, there may be more beneficial effects on low-income families even if they do not have minimum wage workers, although some of the costs of these higher wages may be borne by lower-income families as well.

A few studies have addressed the effects of minimum wages on the distribution of family incomes in Brazil. Neri, et al. (2000) use some of the older methods from the literature for the United States to simulate the poverty reduction effects of an increase in the minimum wage. The simulations show a six percent reduction in poverty when accounting for wage effects at multiples of the minimum, and assuming no disemployment effects. Barros, et al. (2000) also study the poverty effects of minimum

wages, using longitudinal data for 1995-1998 and decomposing the change in the poverty rate between the month before and the month after an increase in the minimum wage into the parts attributable to movements in wages of workers (and sectors) whose wages are sensitive to minimum wage increases, and workers (and sectors) that should not be sensitive. The results suggest that an increase in the minimum wage is associated with a decrease in poverty—as measured by the wage of the individual and not considering the employment effects—which is particularly strong in the uncovered informal sector. When unemployment effects are included (Barros, et al., 2001), the poverty reduction effects disappear. Using 1989 data for Brazil, Ramos and Reis (1995) find that a 25 percent increase in the minimum wage would lead to a slight decrease in inequality and poverty rates. The small impacts of the minimum are attributed to the existence of a large informal sector (which was assumed to not be affected by the minimum wage), the low value of the minimum, and the fact that less than 20 percent of minimum wage earners are in poor households while one-third are in the upper half of the household per capita income distribution. Finally, a study by the Instituto de Pesquisa Economica Aplicada (IPEA, 2000), which uses a more complex general equilibrium framework to simulate the effects of the minimum wage in Brazil, concludes that the minimum wage was irrelevant in combating poverty. As noted earlier, the main contribution of our research on the distributional effects of minimum wages in Brazil is to develop a framework that attempts to obtain direct causal estimates of the effects of minimum wages on family income, rather than relying on simulations.

III. Data, Data Issues, and Descriptive Analyses of Minimum Wage Workers and Low-Income Families

Data

The data set we use for our analysis is the Brazilian Monthly Employment Survey (Pesquisa Mensal do Emprego, or PME). Beginning in 1982, the PME surveys households in the six largest metropolitan areas in Brazil. The six metropolitan areas encompass, but extend beyond, the following cities: Salvador (in the state of Bahia), Recife (Pernambuco), Belo Horizonte (Minas Gerais), Rio de Janeiro (Rio de Janeiro), Porto Alegre (Rio Grande do Sul), and São Paulo (São Paulo). We refer to each metropolitan area by the city name.

The survey is monthly, covering between 23,000 and 38,000 households per month, with an average of about 31,000. It has a rotation group structure not unlike the Current Population Survey (CPS) in the United States. When households enter the survey they are interviewed for four months, not interviewed for the next eight months, and then interviewed for four additional months. One difference is that panels are started up every two years, rather than every year. The interview covers earnings in the previous month and labor force activity in the previous week. Also paralleling the CPS, the PME is a “roof” survey, interviewing whatever household is living at the address in the survey month, with no attempt to follow individuals or households that move. Researchers can attempt to match individuals or households at the same addresses across months of the survey, which is potentially of some value (e.g., Fajnzylber, 2002). However, attrition over the sample period is quite extensive (as high as 40 percent, according to our analysis), and therefore in this study we use all observations in each month of the PME, treating the data set as a sequence of representative cross-sectional data sets.

Families and Incomes

Our main concern in this paper is with family-level income. Households in Brazil sometimes include relatives, domestic workers, and boarders. We retain relatives, to allow for extended families, but drop non-relatives from the small proportion of households (1.4 percent) where they are present. This can lead to minor non-random selection of individuals and families into the sample; for example, a family of a domestic worker living in the household of an employer would be dropped.

When we look at families, we use all earnings, and include any family members whether or not they have any income. There are two limitations of these data relative to, for example, what can be used for distributional analyses for the United States. First, we are not aware of methods of defining poverty for Brazil that are as “officially” established as the U.S. measures. In the absence of a poverty measure, we do not want to look simply at family income, but rather family income on some sort of per capita basis. A poverty line like in the United States is based on equivalence scales with which to scale family income relative to needs, depending on the number of individuals and their ages. Per capita family income measures fail to take account of these differences in needs across families. We look briefly at

poverty, following Ferreira, et al. (2000) in defining poverty as approximately twice the “indigent” poverty threshold, and applying this poverty line to different periods and regions using spatial and time deflators (as explained below).² But given the absence of an official poverty measure, and the very high share of families that can be classified as poor, we do not focus the empirical analysis on poverty per se, but rather on changes in family income per capita at the low end of the income (per capita) distribution.

Second, the PME does not report income from all sources, but only earnings (including from self-employment). While estimates of the effects of the minimum wage on earnings are of course informative, they do not fully capture the effects on economic resources available to families, as public or private transfer payments may respond to the employment, hours, and earnings effects of minimum wages. On the other hand, the focus on earnings better isolates the labor market effects of minimum wages.

We also look briefly at some descriptive information on minimum wage workers in Brazil and at how minimum wages affected individual-level wages. For these latter analyses we restrict attention to those individuals with positive earnings, aged 16 to 65. Finally, since earnings are reported on a monthly basis, and the minimum wage is defined on a monthly basis, we simply work with monthly earnings (or wages). Some refinements to an analysis of wages might be forthcoming from constructing hourly wages and hourly minimum wages, but since our central focus is on family incomes this is tangential.

Inflation and Sample Period

We use national and regional deflators to convert all wage and income measures to Reais (R\$) as of October 2002.³ In our view, the rampant inflation in Brazil through the mid-1990s (see Figure 2) makes it extremely difficult to obtain reliable estimates of the effects of minimum wages using this period. Price deflators are calculated on a monthly basis, and wages were indexed on a monthly basis, but when inflation rates are sometimes 50 percent or higher per month, it becomes difficult to compare deflated values measured at different times within a month (such as a minimum wage at the beginning of

² Ferreira, et al. (2000) provide a comprehensive discussion of issues involved in measuring poverty in Brazil. A thorough analysis of the implications of using alternative methods of adjusting household income or measuring poverty is beyond the scope of this paper.

³ Deflators for the six metropolitan areas are available from the web site of the Instituto Brasileiro de Geografia e Estatística web site (<http://www.sidra.ibge.gov.br/bda/>, viewed September 2004).

a month and earnings reported in a particular week in the PME). We are also concerned that in estimating relationships between minimum wages and other income or wage measures the massive amount of variation induced by the price deflator in the hyper-inflationary period will dominate any real variation induced by minimum wages. We have some suspicion that this may partially underlie the strong associations between minimum wages and wages at levels well above the minimum that have been estimated for Brazil in the work described in Section II—work that covers the hyper-inflationary period.

More generally, we strongly suspect that in a hyper-inflationary period relative prices of goods, different types of labor, and other inputs are sufficiently noisy that such a period constitutes a less-than-ideal time to estimate the effects of minimum wages, which after all have their primary effect by raising the price of low-wage labor relative to other inputs. As a result, we have decided to study only the period beginning in 1996, which comes about a year after which hyper-inflation had been eliminated and when inflation had returned to more normal levels; we start in 1996 rather than 1995 because some of our analyses require using data from the previous year, and we do not want to use data prior to 1995. The first month covered by the sample is May of 1996 so that the earliest wage information we use in constructing some of our variables is for 1995. The sample goes through August of 2001, the most recent data available.

Descriptive Statistics of Minimum Wage Workers and Low-Income Families

Prior to explaining our core analysis, we provide some descriptive information on minimum wage workers and low-income families in Brazil, based on the PME data. Here we use micro-level data, whereas below, when we look at distributional effects of minimum wages and other effects, we use metropolitan area-by-month aggregates.

Because in the analysis of individuals we are interested in those working for a wage, we exclude individuals either not employed or not working in the survey week, which cuts the sample by more than half. We also drop observations with missing earnings data or in unpaid work, which cannot be classified by their earnings. Since we want to be able to characterize minimum wage workers with regard to age

and relationship to household head, we also drop a small number of observations for which these data are missing. These restrictions leave us with a sample of 2,380,622 individuals.

In looking at families, because we want to measure family income, we include all family members in the household, regardless of age or employment status. We drop any families in which income data for an employed member are missing, although we retain families with individuals doing unpaid work. Also, because we study earnings and not income from all sources, we exclude families with retired household heads with no earnings; retirees are defined as those classified as retired and who receive a pension. These restrictions leave us with data on 1,417,120 families.

Table 1 provides the descriptive statistics on wages for individuals, by metropolitan area. The table reports the proportion with a wage below the minimum, and with a wage equal to the minimum; the proportion above the minimum is the residual. Overall, 8.4 percent of workers earn less than the minimum, and 7.0 percent earn exactly the minimum. The metropolitan areas of Salvador and Recife are the lowest-wage ones, and in them between 30 and 33 percent of workers earn a wage less than or equal to the minimum. In contrast, São Paulo is the highest-wage metropolitan area, with only 5.6 percent earning at or below the minimum. Rio de Janeiro and Porto Alegre also have low shares of workers earning a wage less than or equal to the minimum (9.0 to 10.6 percent), but the shares are about double São Paulo's. Although not reported in the table, the distribution of minimum wage workers by demographic group is as expected, with female and younger workers more likely to earn the minimum wage or less, and household heads more likely to have a wage exceeding the minimum. Similarly, higher education and literacy are strongly associated with a lower likelihood of earning the minimum wage or less. Also, not surprisingly given the greater inequality in Brazil, the share of young workers earning the minimum is quite a bit lower than in the United States.

Table 1 also reports the breakdown by sector of employment. In Brazil, all individuals carry a generic "employment contract" (*carteira de trabalho*), which lists the federal laws protecting workers. Upon employment, the employer is required to sign and date this contract, thus formally agreeing to abide by the federally mandated labor laws. Individuals whose employers have not signed their work contracts

are considered “informal sector employees,” comprising 11.1% of the labor force in recent estimates; other informal sector workers include the self-employed (23.4%), unpaid (11.2%), domestic servants (7.6%), and agricultural workers (6.5%) (Neri, 2002). There are many self-employed workers earning less than the minimum wage, and a very small share (3.4 percent) at the minimum. There are virtually no employers who report earnings at or below the minimum wage. In the formal sector, fewer than one percent of workers earn below the minimum, versus 11.6 percent in the informal sector. This is not surprising since the minimum wage does not legally apply in the latter. But we also see that the share at the minimum is higher in the informal sector (11.4 percent) than in the formal sector (7.0 percent), suggesting that the minimum is still used as a reference point for wage setting in the informal sector.

Table 2 turns to families.⁴ While families cannot be classified as “minimum wage,” our goal here is to distinguish low-income and higher-income families and to provide information on where minimum wage workers are located, as well as other characteristics of these families. We break out families with no earnings from those with some earnings, and also classify the remaining families as poor or non-poor based on twice the indigent poverty threshold, following Ferreira, et al. (2000).⁵ Table 2 shows that despite using regional deflators to define poverty, a much higher fraction of families are poor in the lower-wage metropolitan areas. In Salvador (which Table 1 showed had the highest fraction of workers earning the minimum wage or less) 44 percent of families have non-zero earnings but are poor, and 51 percent overall are poor, and in Recife the corresponding numbers are 52 percent and 59 percent of families. The metropolitan areas in Belo Horizonte, Rio de Janeiro, and Porto Alegre have fewer poor families—in the 32 to 39 percent range. Finally, in São Paulo, where wages are highest, the percentage poor is much lower. Not surprisingly, female-headed families are more likely to be poor (49 percent of families, versus 33 percent for male-headed families).

⁴ The PME classifies families as subgroups of the household while we define them as groups of individuals related to the household head, leaving out of our sample domestic employees and their families, and boarders.

⁵ Ferreira, et al., generate the “indigent” poverty threshold based on the costs of a minimum food basket in 1996, equivalent to R\$ 65 monthly per capita income at São Paulo Metropolitan Area prices (www.ipea.gov.br, viewed January 2003).

Bearing more directly on how minimum wage changes might affect poor or low-income families, among families with an employed head the percentage poor is lower than the average, while hours of work for those who are employed differ little for heads in poor versus non-poor families. Whether the head of household is employed at a wage at or below the minimum is strongly associated with poverty status. In particular, 87 percent of families where the head earns the minimum wage or less are poor. Note, though, that this does not necessarily imply that minimum wages must help poor families, if the benefits from minimum wage increases tend to go to other low-wage workers who are not heads of poor families.

The descriptive statistics on the sector of employment indicate that poverty is more common in families with heads of household who are self-employed. The poor are slightly under-represented in families with heads employed in the formal and informal sectors, and vastly under-represented among families with heads in the employer sector. The fact that families with heads in the self-employed and informal sectors are more likely to be poor emphasizes that the benefits of minimum wage increases may be limited, although as noted earlier there is some evidence for Brazil that minimum wages increase wages in the informal sector.

IV. Empirical Methods and Results

Defining the Minimum Wage “Treatment” Variable

The PME data set that we use gives us observations on individuals in households in six metropolitan areas (in six states) on a monthly frequency over the 1996-2001 period. We are ultimately interested in how minimum wages affect the distribution of family (per capita) income. But first we need to choose a way to define the “effect” of the minimum wage. Because in this sample period the minimum wage in Brazil is set nationally, there is no legislated regional variation. We also know from the descriptive statistics reported above that because of variation in wage levels across the six metropolitan areas, the share of minimum wage workers varies widely, implying that far more workers will be bound by the minimum wage in the lower-wage metropolitan areas (e.g., Salvador and Recife). What we would like to have, then, is a minimum wage variable that captures both times-series variation in the level of the

minimum wage, as well as cross-sectional variation in the “bite” of the minimum wage.⁶ To gauge how well a minimum wage variable works, we focus on its estimated effects on wages at the lower end of the wage distribution, for which there are unambiguous predictions regarding the effects of minimum wages. Because of some suggestions that the minimum wage in Brazil is binding in both the formal and informal sectors (Maloney and Nuñez Mendez, 2004; Neri, et al., 2000) we report the effects on wages of the two sectors combined. However, since nothing is known about why the minimum is binding in the informal sector nor the process by which it adjusts, while the motivation for wage adjustments and the process is better known for the formal sector, we also present the estimated effects for the formal sector. Particular differences between the estimates when the informal sector is or is not included also help to test the validity of the treatment variable, as explained below. In the main analysis of the effects of minimum wages on the distribution of family incomes, we use all workers regardless of sector, given the policy interest in overall distributional effects.

A natural candidate for a minimum wage treatment variable is one that captures the percentage below the minimum wage, as this should increase more (and be higher in general) for the low-wage metropolitan areas. To define this variable, for any given metropolitan area-month cell in the data set we estimate the percentage of individuals three months earlier whose wages were below the contemporaneous minimum wage. We chose a short span to ensure that most of the variation was driven by legislated changes in the minimum wage, but not so short that the estimates would be influenced by the simultaneous determination of the percentage below with wages and employment.

Letting ‘ i ’ denote individual, ‘ j ’ denote metropolitan area, and ‘ t ’ denote month, the fraction affected in metropolitan area j and month t is

$$(1) \quad PB_{jt} = P(w_{ijt-3} < MW_t) \times 100,$$

where w is the wage, MW is the minimum wage, and P is the probability that the condition in parentheses holds, estimated from the sample.

⁶ Lemos (forthcoming) discusses alternative ways of specifying the minimum wage variable.

In Figure 3, the time-series of this measure of the minimum wage is plotted for each of the six metropolitan areas. In addition, a vertical line is displayed for the month of each legislated increase in the minimum wage within the sample period.⁷ The graph reveals two expected results. First, the percentage below jumps up considerably immediately following each minimum wage increase. Second, both between minimum wage increases and more so just after minimum wage increases, the “percentage below” minimum wage variable is highest in the low-wage cities (such as Recife and Salvador) and lowest in the high-wage cities (such as Sao Paulo and Porto Alegre), where the effect of minimum wage increases on the percentage below is slight. Both of these results reflect properties that we want the percentage below minimum wage variable to reflect.⁸

To further explore whether the percentage below variable provides a good measure of the “treatment” effect of the minimum wage, we estimated regressions for centiles of the wage distribution—specifically the 10th, 20th, 30th, and 50th centiles—as functions of the percentage below. More precisely, we use the mean of the centiles in the range of plus or minus five centiles; e.g., the 10th centile reported is the mean of the 5th through 15th centiles. We found that this reduced the noise in the data, and since there is no clear criterion for exactly what centile we should be studying, this may convey more information about how the wage distribution changes than looking just at the 10th centile. The most complete specification is

$$(2) \quad w^c_{jt} = \alpha + \beta PB_{jt} + C_j \gamma + M_t \delta + \varepsilon_{jt}.$$

In this regression w^c is the c^{th} centile of the real wage distribution in metropolitan area j in month t , C is a vector of dummy variables for metropolitan areas, M is a set of dummy variables for each month in the sample, and ε is a random error term assumed to be independent of the right-hand side variables. For this equation, as for the more fundamental equation (3) below that estimates the effects of minimum wages on the distribution of family incomes, β identifies the effects of the minimum wage on the

⁷ The vertical line for the May 1996 increase is omitted since no contrast with earlier data is possible given our sample period.

⁸ The graph also shows that the decline in the percentage below following minimum wage increases is slower in the later years, when inflation was more moderate.

dependent variable. Specifically, when PB is high, the current minimum wage is high relative to the wage distribution one quarter prior, indicating a high contemporaneous “bite” of the minimum wage (i.e., the minimum wage relative to wages). Thus, if minimum wages increase wages at the c^{th} centile, we should find evidence that β is positive. Inclusion of the month dummy variables allows for aggregate changes over time unrelated to actual effects of minimum wages, but possibly correlated with them, and inclusion of the metropolitan area dummy variables allows for persistent differences in the levels of wages and the percentage below the minimum that are apparent in Figure 3. With the time and metropolitan area dummy variables included, β is identified from changes in the dependent variable, and how these differ in metropolitan areas where the percentage below increased by relatively more. Equation (2) and all other regressions for which results are reported in the tables were estimated using GLS with an AR1 error process. The estimator allows a different error variance across metropolitan areas (in part because the sample sizes differ somewhat), and a different autocorrelation parameter for each metropolitan area.⁹

The regression results for equation (2) are reported in Table 3, for the formal and informal sectors combined in Panel A, and the formal sector only in Panel B. The first specification excludes the dummy variables for both metropolitan areas and months. Not surprisingly, then, the estimates for this specification do not reveal the expected positive effects of the percentage below the minimum on the lower centiles of the wage distribution; the exclusion of the metropolitan area effects, in particular, generates a negative correlation between wage levels and the percentage below not because of minimum wage effects, but because the minimum wage is more binding in metropolitan areas with low wage levels. In contrast, when the metropolitan area fixed effects are included (with or without the month dummy variables), we identify the effects from changes within metropolitan areas, and find these positive effects on the lower centiles of the wage distribution. The effects are concentrated at the 20th centile when the formal sector and informal sectors are combined, but at the 10th centile when attention is restricted to the

⁹ Estimated autocorrelations were rarely above 0.8 once metropolitan area and month dummy variables were included, and were generally in the range of 0.6 to 0.7. The allowance for serial correlation across the observations for the metropolitan areas within each state will, to some extent, capture persistence across observations generated by repeated observations on individuals and families.

formal sector. This is as expected; since the informal sector includes more low-wage workers, when these workers are included the 10th centile decreases to wage levels that are far below the minimum, and those with wages that may be bound by the minimum are now nearer the 20th centile, thus moving the effects of the minimum higher up into the distribution. This difference in findings when the informal sector is included or excluded helps validate the percentage below the minimum as correctly capturing the treatment.

To interpret the units, note that wages are measured in October 2002 R\$, the percentage below is measured on a scale of zero to 100, and the 20th centile of the wage distribution for the formal and informal sectors (for all metropolitan areas combined) is R\$ 245.5. Thus, as an example, the coefficient of 0.48 in the last row of column (2) in Panel A implies that a minimum wage that binds an additional 10 percent of the workforce generates a wage increase of R\$ 4.80 at the 20th centile of the wage distribution, or a 2.0 percent increase. To provide a rough sense of how large a minimum wage increase would bind an additional 10 percent of the workforce, note that the 30th centile of the wage distribution is R\$ 314.6; thus we can approximate a minimum wage increase that binds an extra 10 percent of the workforce as an increase of R\$ 69.1 (the difference between the 30th and 20th centiles), or a 28.1 percent increase. In this case, the estimate would suggest an elasticity of the 20th centile with respect to the minimum wage of about 0.07 (4.8/69.1).

Of course this wage analysis only accounts for the influence of minimum wages on wages of those who remain employed. It does not try to capture effects on earnings that also account for changes in employment. To the extent that we are interested in understanding the effects of minimum wages on inequality, it is important to account for non-earners and changes in their representation, and indeed in the main analysis of family income that follows we do this. The preceding estimates, though, are concerned simply with assessing the variable that we use to capture the treatment effect of a higher minimum, and for these purposes the conditional analysis is sufficient.

The Effects of the Minimum Wage on the Distribution of Family Incomes

The analysis of the effects of minimum wages on the distribution of family incomes extends the specification used above to study the effects on the wage distribution. The high poverty rates (using the Ferreira, et al., 2000, measure) documented in Table 2 imply that in studying the effects of minimum wages on the distribution of family incomes in Brazil, the key question is not so much whether minimum wages reduce poverty, but rather whether minimum wages increase incomes among the poor. That is, given that in most areas of Brazil the poverty line as defined here is above the 30th, 40th, or even 50th centile of the family income distribution, it is probably unreasonable to expect minimum wage increases to have much effect on whether or not families are poor. But minimum wages could, in principle, be expected to have more pronounced effects on the lower tail of the family income distribution. Given, in addition, the absence of a widely-used poverty measure, a richer description of the effects of minimum wages on the distribution of incomes among the poor is more informative and arguably more important to policymakers than estimates of the effects on the share of families that are poor. As a consequence of these considerations, our distributional analysis focuses on the effects of minimum wages on the 10th, 20th, and 30th centiles of the family income distribution.

In particular, we now estimate regressions for family income of the form:

$$(3) \quad FI^c_{jt} = \alpha + \sum_{k=0}^K \beta_k PB_{jt-k} + C_j \gamma + M_t \delta + \varepsilon_{jt}.$$

Equation (3) differs from equation (2) in a couple of key respects. Most importantly, we are now looking at family income, with FI^c denoting the c^{th} centile of the distribution of (per capita) family income. As before, we include metropolitan area dummy variables C to account for different income levels across the six metropolitan areas, and month dummy variables M to allow for common aggregate changes. Finally, note that equation (3) includes lagged measures of the percentage below the minimum PB . We do this to allow the evolution of effects on family income, which are potentially an amalgam of

some effects that may occur quickly (such as wage increases) and others that may arise more slowly (such as employment reductions).¹⁰

The key parameters, of course, are the β 's—in particular the sum of these in specifications including lags. If minimum wage increases raise incomes at the bottom of the family income distribution, then we should find positive estimates of β (or sums of β 's) at the lower centiles of the distribution. With the inclusion of the city and month dummy variables, the estimates of these parameters are essentially difference-in-difference estimates, as they identify the effects of minimum wages from the extent to which changes in centiles of the family income distribution differ depending on changes in how much the minimum wage cuts into the wage distribution.

The presumption underlying these specifications is that increases in the minimum wage in lower-wage metropolitan areas, resulting in larger increases in the percentage below, will generate larger changes in the lower centiles of the distribution of family incomes as compared to higher-wage metropolitan areas. There is one caveat to this view, however. In examining the effects of minimum wages on wages, we rightly had in mind an unambiguous prediction—that minimum wages should raise wages of low-wage workers. However, when studying distributional effects the predictions are ambiguous. It is conceivable that where minimum wages are binding on few workers they deliver some benefits but impose little cost, whereas when they are binding on more workers there are higher benefits but also higher offsetting costs, so that increases in the extent to which minimum wages are binding may not deliver larger net effects, even though the underlying shifts are more pronounced. This could happen, for example, because when more workers' wages are affected prices are pushed up more, there are fewer substitution possibilities, and the disemployment effects are correspondingly stronger, still leading to estimates of β near zero. Regardless of this ambiguity, though, evidence that β is zero would unambiguously indicate that minimum wage increases do not deliver larger beneficial effects on the

¹⁰ Neumark, et al. (2002) find this pattern in the effects of minimum wages on the distribution of family incomes in the United States, with the more adverse employment effects not arising instantaneously, but within a year.

distribution of family incomes in the lowest-wage metropolitan areas where—presumably—policymakers are most interested in helping low-income families.

The results of this empirical analysis are reported in Table 4. The first specification reported is for models with neither metropolitan area effects nor time dummy variables. As with the wage estimates, these specifications yield strong negative coefficients for the lower centiles of the family income distribution, but this presumably stems from across-metropolitan area differences generating a negative correlation between the percentage below the minimum and the lower centiles of the family income distribution. This is clear in the estimates of specification 2, where upon adding the metropolitan area fixed effects all three coefficient estimates for the 10th-30th centiles become positive, with the estimate for the 20th centile statistically significant at the five-percent level.

The third specification also includes the month dummy variables, and we regard this specification as our “baseline” because it does not confound minimum wage effects with other aggregate changes. The estimates of specification 3 provide stronger evidence of a positive effect of an increase in the minimum wage on family income at the 20th centile. There is, however, no evidence of effects at the 10th or 30th centiles. To interpret the coefficient for the 20th centile, for example, the estimate of 0.148 implies that a minimum wage increase that binds an additional 10 percent of the workforce raises family income at the 20th centile by R\$ 1.48; this is a very small effect, representing an increase of less than 1.5 percent relative to the 20th centile of the family income distribution, which is R\$ 99.64.¹¹

A key limitation of specification 3, however, is that it captures only the contemporaneous effects of a higher minimum wage. If wages respond quickly but employment or hours adjustments (reflecting labor demand changes, as well as possible labor supply shifts among family members) occur more slowly, then the effects of minimum wages may appear different with a somewhat longer horizon. In particular, if the net effect is a decrease in labor demand but adjustment occurs with a lag, then more deleterious effects might appear if we allow lags of the minimum wage variable.

¹¹ The 20th centile of the family income distribution is lower than the 20th centile of the (monthly) wage distribution cited earlier because the latter distribution excludes those with zero earnings.

Evidence on the longer-run effects of minimum wage increases is reported in specifications 4-6, which progressively add an additional lag of the minimum wage variable, up to the point where lags up to three quarters are included. We chose this stopping point because with an additional quarter's lag, given that minimum wage increases often occur in the same month in different years, the contemporaneous minimum wage variable and four-quarter lag were highly correlated, even conditioning on metropolitan area and month dummy variables.¹² For each specification we report the individual coefficient estimates, as well as the summed effect across the minimum wage variables included, which gives the cumulative effect of minimum wage increases through the included lag.

The estimates reported in Table 4 for specifications 4-6 tell a fairly consistent story. Like for the contemporaneous specification, with only one lag of the minimum wage variable there appear to be modest beneficial effects of minimum wages on the distribution of family incomes. For the 20th centile, in particular, the summed effect in specification 4 is positive and significant at the 10-percent level. However, once longer lags are included the evidence changes rather dramatically. In specification 5, the estimated effects of the two-quarter lag of the minimum wage variable are negative and significant at the five- or 10-percent level at the 20th and 30th centiles (and nearly at the 10th), indicating that minimum wages result in lower incomes at the lower centiles of the family income distribution. And in specification 6, with lags through three quarters, stronger evidence of negative effects emerges, and the summed effects at the 10th, 20th, and 30th centiles are all negative and significant at the five- or 10-percent level.¹³ These effects are not trivial. For example, at the 20th centile the summed effect of -0.592 in

¹² The partial correlation coefficient in a regression for the four-quarter lag on the contemporaneous percentage below was 0.86. Nonetheless, the estimates of the coefficients at a lag of four quarters were no longer statistically significant and suggested that the minimum wage effects taper off at this long of a lag; the problem is that given the high degree of collinearity with the contemporaneous minimum wage variable, we cannot have great confidence that this tapering off occurs after four quarters, and it might well be that the minimum wage effects we find persist for longer.

¹³ Note also that with the addition of the lagged effects, the evidence of positive shorter-run effects tends to disappear. This is what we would expect. When the omitted lagged effects are excluded, like in specification 3, the estimates of the contemporaneous effect are biased by this omission, with the bias in the upward (i.e., positive) direction if the coefficient of the lagged variable is negative and the correlation between the omitted and included variable (conditional on the other variables) is also negative. The later specifications show that the coefficients on lagged minimum wages are negative. And because we condition on metropolitan area fixed effects, the partial correlations between contemporaneous and lagged values of the percentage below the minimum wage in the

specification 6 (for the 20th centile) implies a cumulative effect of a minimum wage increase that binds an additional 10 percent of the workforce of –R\$ 5.92, or –5.9 percent; given the earlier calculation, this suggests an elasticity of –0.21. Moreover, these estimates provide no support for the view that minimum wages in Brazil lift family incomes at the lower points of the income distribution, except in the very short run.

Validating and Understanding the Distributional Estimates: Other Effects of Minimum Wages

The estimates of the effects of minimum wages on the distribution of family incomes suggest that, in Brazil, minimum wages have not delivered net gains to low-income families, although the very short-run effects may appear positive. We would presume that the finding of positive effects in the very short-run and then longer-run adverse effects would come about as the result of offsetting positive and negative impacts of minimum wages. We have already seen evidence of positive short-run wage effects, which must generate the short-run gains in family income at the bottom of the distribution; although it is likely that these effects taper off. In this subsection we examine whether there is in fact some evidence of offsetting longer-run negative employment or hours effects.

Evidence on this question is presented in Table 5; we omit the specifications without month and metropolitan area dummy variables. We use essentially the same framework as the analysis in Table 4 to estimate effects of minimum wages on employment and hours of both household heads and family members excluding the heads, estimating regressions of the form

$$(4) E_{jt}, H_{jt} = \alpha + \sum_{k=0}^K \beta_k PB_{jt-k} + C_j \gamma + M_t \delta + \varepsilon_{jt},$$

where E is an employment rate for the household,¹⁴ and H a measure of monthly hours. The hours equation is estimated both unconditionally and for those who are employed.

The estimates generally show that, once lags of the minimum wage variable are included, there is evidence of negative employment effects among household heads. These estimates appear to correspond

specifications we report are always negative.

¹⁴ It is coded as either zero or 100 when we look exclusively at household heads, and can take on intermediate values when we look at non-heads, of whom there may be more than one.

to the income reductions we saw in Table 4 for the parallel specifications. There is no statistically significant evidence of net hours reductions in columns (2) and (3); the estimate of the effect on unconditional hours is negative, consistent with employment declines, but the estimate for conditional hours is positive, indicating possible offsetting hours increases among those who remain employed. To interpret the estimated effects, the estimate of -0.156 in column (1) for specification 4 implies that a minimum wage increase that binds an additional 10 percent of the workforce reduces employment—after the passage of a few quarters—by 1.56 percentage points. Using the earlier calculation, the implicit minimum wage increase is about 28 percent, and the employment rate is about 75 percent among household heads, implying an employment elasticity of -0.07 .¹⁵

The last three columns of Table 5 turn to non-heads, averaging across them in the family. The evidence for the non-heads suggests some weak positive effects on employment and hours, although the summed effects are only significant in the specifications with fewer lags. Employment and hours increases among non-heads likely reflect labor supply increases in response to employment and hours declines among heads. Because non-heads are less likely to work in the formal sector, a labor supply increase among non-heads is more likely to occur in the informal or self-employed sector, where employment may not be constrained by the higher minimum, but wages are lower. On net, then, we might expect any employment and hours increases among non-heads to at best only partially offset earnings declines among heads, which is consistent with the overall declines in family incomes at the lower end of the distribution caused by minimum wage increases.

Sensitivity Analysis for the Effects of the Minimum Wage on the Distribution of Family Incomes

Finally, we report on some sensitivity analyses regarding the distributional effects of the minimum wage. First, to this point we have used as our treatment variable the percentage below the minimum based on the wage distribution one quarter earlier, using a lag of three months rather than one month to mitigate endogeneity problems. The first specification in Table 6, however, reveals that when

¹⁵ Of course these are overall disemployment effects; the sharper income declines we find for the lower-income families presumably reflect the concentration of these disemployment effects among lower-wage workers and lower-income families.

the wage distribution from only one month ago is used instead, the evidence of adverse effects is no longer present, but there is, as before, no evidence that minimum wages increase incomes at the bottom of the distribution. The same conclusion emerges from specification 2, which uses first differences to eliminate the city-specific effects, instead of the within-group transformation (i.e., using city-specific dummy variables). Specification 3 takes this one step further, adding metropolitan area dummy variables to the first-difference specification, which lets each metropolitan area have its own time trend. The estimates are less precise, as we would expect, but the qualitative conclusions are unchanged, and the point estimates are more consistent with the income declines at the bottom of the distribution reported in Table 3.

Finally, the model to this point includes year and metropolitan area fixed effects. These control for common aggregate economic shocks across metropolitan areas, and fixed differences across metropolitan areas, but not shocks that differ across regions. To address the potential for bias from these omitted shocks, the last specification in Table 6 verifies that the results are insensitive to including the employment rate for each metropolitan area-month cell, with a flexible specification that interacts the rate with the metropolitan area dummy variables to allow different effects of employment rates by city. In addition, although not reported in Table 6, we also estimated the same models reported in Table 4 for the share of families below the poverty line as defined by Ferreira, et al. (2000)—i.e., twice the indigent poverty threshold. Once the lags were included, there was no evidence of an impact of minimum wages on this share, consistent with the earlier discussion about minimum wage effects likely being more pronounced among lower-income poor families. Overall, then, the conclusion that the minimum wage in Brazil does not help those at the bottom of the income distribution is robust, and some of the evidence points to adverse effects on the incomes of these families.

V. Conclusions

The purpose of this study is to examine whether the minimum wage in Brazil has beneficial effects on the distribution of family incomes, in particular raising incomes of low-income families. While such distributional effects are the most common rationale for minimum wages, economic theory makes no

prediction that they will occur. Minimum wages *are* predicted to reduce employment, and research for both Brazil and the United States tends to confirm this prediction. But all this implies is that minimum wages will harm some workers while benefiting others. The distributional effects depend on the magnitudes of the gains and losses, and where they occur in the income distribution—a purely empirical question. Research for the United States finds no gains to low-income families from minimum wage increases, and if anything increases in poverty. However, in Brazil, because the income distribution is very different, with more inequality generally and a greater number of heads of household earning a wage at or near the minimum, the distributional effects of minimum wages with regard to family income may be quite different.

To examine the effects of minimum wages on the distribution of family incomes in Brazil, we examine data drawn from Brazil's major metropolitan areas. We study the years 1996-2001, after Brazil's hyper-inflation ended, when the period of very frequent minimum wage changes ended, and during which the relative price differentials set by a minimum wage should have been much more apparent and persistent. We use a research design that identifies the effects of minimum wages from both cross-sectional and time-series variation in the extent to which the minimum wage was binding, with the time-series variation driven by legislated increases, and the cross-sectional variation driven by differences in wage levels across metropolitan areas affected by identical nominal minimum wage increases.

We look at evidence on both the effects of minimum wages on the distribution of family incomes, about which there are no firm predictions, and at evidence on the effects of minimum wages on outcomes for which there are firm predictions. Turning to the latter first, we find that minimum wages that are binding for many low-wage workers push up wages at the bottom of the wage distribution. But for higher-wage workers there is no impact of minimum wages on wages. We also find some evidence that minimum wages reduce employment. These results serve in part to validate the approach taken in the distributional analysis, and in part to verify that the data are informative about the effects of minimum wages.

Finally, turning to the distributional effects, the estimates provide no evidence that minimum wages in Brazil compress the income distribution—lifting family incomes at the lower points of the income distribution—and if anything sometimes indicate that minimum wages have the opposite effect of reducing family incomes in the lower tail of the distribution. Overall, then, we do not regard the evidence as lending support to the view that minimum wages in Brazil have beneficial distributional effects from the perspective of low-income families.

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Figure 1: Real and Legislated Minimum Wage (R\$ in 2002)

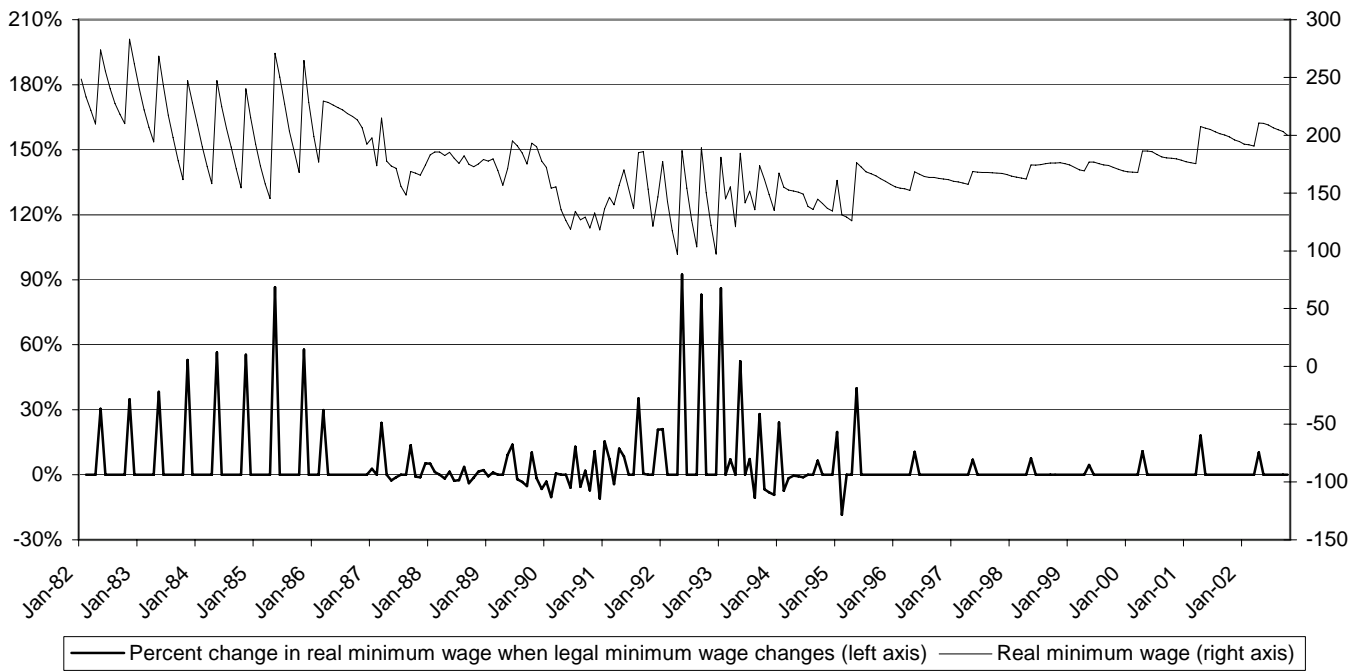


Figure 2: Monthly Inflation Rate and Change of Currency, 1982-2002

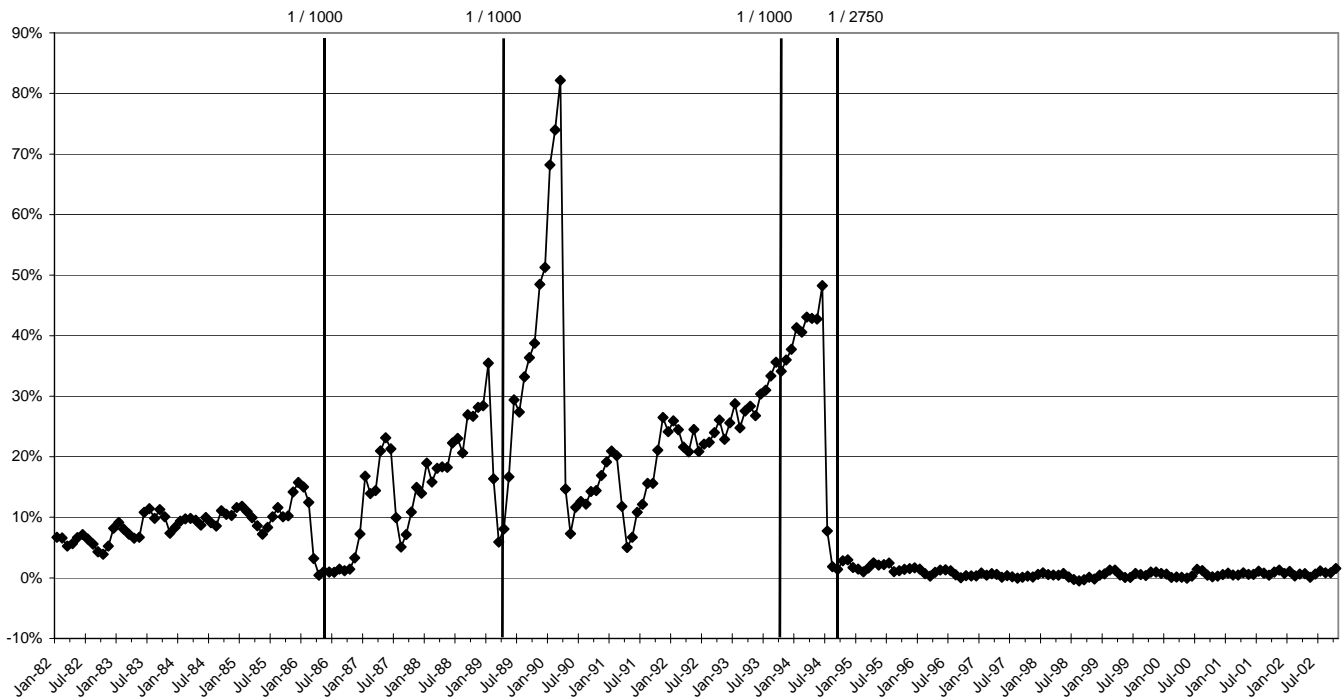


Figure 3: Percentage Below Minimum Wage by Metropolitan Area, Formal and Informal Sector

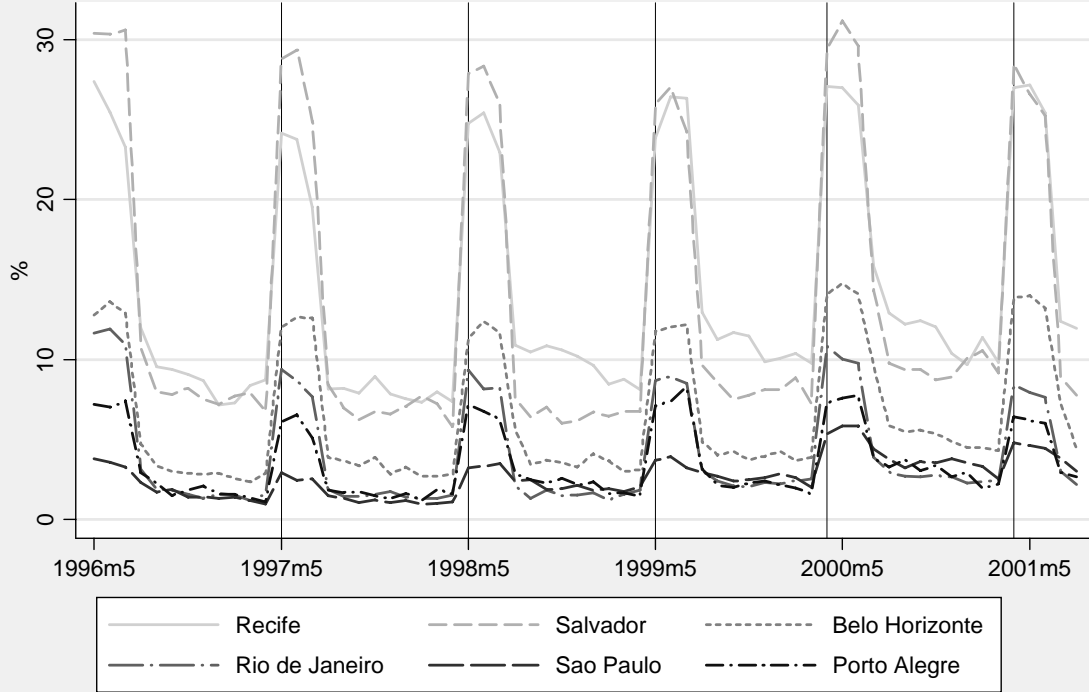


Table 1: Characteristics of Minimum Wage Workers in Brazil, 1996-2001

	Wage < MW	Wage = MW	N
All	.084	.070	2,380,622
Metropolitan areas:			
Salvador	.165	.160	303,387
Recife	.181	.121	283,696
Belo Horizonte	.078	.078	477,088
Rio de Janeiro	.050	.056	424,177
Porto Alegre	.048	.042	362,695
São Paulo	.040	.016	529,579
Sector:			
Self-employed	.213	.034	558,161
Employer	.006	.006	96,311
Formal sector	.007	.070	1,107,687
Informal sector	.116	.114	618,463

“Self-employed” means that one has no paid workers, and “employer” means that one has at least one paid employee. Formal-sector workers are those who have a signed work card, and informal-sector workers are those who do not.

Table 2: Characteristics of Poor and Non-Poor Families in Brazil, 1996-2001

	No earnings	Poor with non-zero earnings	Non-poor	N
All	.049	.323	.628	1,417,120
Metropolitan areas:				
Salvador	.073	.441	.486	183,808
Recife	.066	.524	.410	175,802
Belo Horizonte	.037	.349	.613	262,618
Rio de Janeiro	.038	.279	.683	261,723
Porto Alegre	.046	.279	.675	224,444
São Paulo	.047	.186	.767	308,725
Household head:				
Men	.033	.301	.666	1,072,864
Women	.099	.391	.509	344,256
Schooling				
Employed, hours > 0	.001	.279	.721	1,056,001
Average hours if employed	33.4	41.9	43.6	1,056,001
Employed at wage ≤ MW	--	.873	.127	96,877
Average monthly wage if employed	--	306.3	1399.0	1,090,376
Self-employed	--	.376	.624	302,587
Employer	--	.049	.951	65,144
Employed in formal sector	--	.246	.754	501,322
Employed in informal sector	--	.292	.701	220,078

Table reports proportion in each earnings/poverty category, except for entries labeled “average.” Following Ferreira, et al. (2000), per capita family poverty lines are defined as approximately twice the “indigent” poverty threshold, which they measured for 1996 in São Paulo, based on 2,288 calories per day (R\$ 65.07 monthly). Average monthly wages are denominated in October 2002 R\$.

Table 3: Regressions for Centiles of the Wage Distribution, Formal and Informal Sectors, 1996-2001

	Percentage below minimum			
	10 th	20 th	30 th	50 th
	(1)	(2)	(3)	(4)
A. Formal and informal sectors:				
No time effects, no metropolitan area effects	0.04 (0.08)	-0.24 (0.17)	-0.73 (0.23)	-1.32 (0.34)
Add metropolitan area effects	0.21 (0.05)	0.43 (0.05)	0.06 (0.10)	-0.06 (0.13)
Add month dummy variables	0.09 (0.10)	0.48 (0.10)	-0.19 (0.15)	-0.12 (0.25)
B. Formal sector only:				
No time effects, no metropolitan area effects	0.41 (0.11)	0.14 (0.15)	0.05 (0.18)	0.01 (0.25)
Add metropolitan area effects	0.50 (0.05)	0.12 (0.12)	0.05 (0.13)	0.06 (0.15)
Add month dummy variables	0.58 (0.11)	-0.02 (0.14)	-0.01 (0.16)	0.14 (0.30)

The percentage below the minimum is defined based on the current minimum wage and the wage distribution three months ago. Wages are expressed in October 2002 R\$. Standard errors are reported in parentheses. Three-stage GLS estimates with an AR1 error process are reported. The estimator allows a different error variance across metropolitan areas (heteroscedasticity), and a different autocorrelation parameter for each metropolitan area. There are 64 monthly observations on each metropolitan area covering the period May 1996 to August 2001, or 384 observations on metropolitan area-month pairs. The centiles used are the mean of the centiles including the specified centile, and plus or minus five centiles. In each sub-panel, the description of the specification is cumulative. So in the specifications in labeled “add month dummy variables” metropolitan area effects are also included. The percentage below is measured on a scale of zero to 100, so the coefficient should be interpreted as the effect on real monthly earnings of a minimum wage increase that “binds” an additional one percent of the workforce.

Table 4: Estimates of Minimum Wage Effects on Lower Centiles of the Per Capita Family Income Distribution, 1996-2001

Centiles of the family income distribution:		10 th	20 th	30 th
		(1)	(2)	(3)
1. No time effects, no metropolitan area effects:				
	Percentage below minimum	-0.149 (0.063)	-0.211 (0.090)	-0.319 (0.117)
2. Add metropolitan area effects:				
	Percentage below minimum	0.032 (0.024)	0.073 (0.031)	0.035 (0.034)
3. Add month dummy variables:				
	Percentage below minimum	-0.005 (0.049)	0.148 (0.057)	0.017 (0.079)
4. Add percentage below minimum lagged one quarter:				
	Percentage below minimum	-0.006 (0.056)	0.157 (0.067)	0.032 (0.092)
	Percentage below minimum, lagged one quarter	-0.027 (0.054)	0.043 (0.065)	0.021 (0.089)
	Summed effect	-0.033 (0.091)	0.200 (0.110)	0.053 (0.151)
5. Add percentage below minimum lagged two quarters:				
	Percentage below minimum	-0.023 (0.059)	0.130 (0.072)	-0.011 (0.097)
	Percentage below minimum, lagged one quarter	-0.027 (0.063)	0.000 (0.079)	-0.052 (0.106)
	Percentage below minimum, lagged two quarters	-0.094 (0.059)	-0.151 (0.072)	-0.255 (0.098)
	Summed effect	-0.145 (0.140)	-0.022 (0.172)	-0.318 (0.232)
6. Add percentage below minimum lagged three quarters:				
	Percentage below minimum	-0.100 (0.073)	-0.003 (0.089)	-0.153 (0.122)
	Percentage below minimum, lagged one quarter	-0.095 (0.076)	-0.113 (0.093)	-0.174 (0.127)
	Percentage below minimum, lagged two quarters	-0.121 (0.079)	-0.247 (0.097)	-0.336 (0.132)
	Percentage below minimum, lagged three quarters	-0.125 (0.072)	-0.229 (0.090)	-0.228 (0.123)
	Summed effect	-0.440 (0.254)	-0.592 (0.314)	-0.892 (0.427)

The contemporaneous percentage below variable is defined in terms of the current minimum wage and the wage distribution three months back. Income is expressed in October 2002 R\$. Standard errors are reported in parentheses. Three-stage GLS estimates with an AR1 error process are reported. The estimator allows a different error variance across metropolitan areas (heteroscedasticity), and a different autocorrelation parameter for each metropolitan area. See notes to Table 3 for details.

Table 5: Estimates of Minimum Wage Effects on Employment and Hours, 1996-2001

		Household heads			Excluding household heads		
		Employed	Hours	Hours if employed	Employed	Hours	Hours if employed
		(1)	(2)	(3)	(4)	(5)	(6)
1. With metropolitan area effects and month dummy variables:							
	Percentage below minimum	.011 (.013)	-.003 (.009)	-.010 (.009)	.017 (.030)	-.005 (.015)	-.022 (.011)
2. Add percentage below minimum lagged one quarter:							
	Percentage below minimum	.004 (.015)	-.010 (.010)	-.018 (.010)	.024 (.035)	-.015 (.017)	-.042 (.012)
	Summed effect	-.012 (.024)	-.020 (.017)	-.023 (.017)	.068 (.057)	-.018 (.028)	-.074 (.020)
3. Add percentage below minimum lagged two quarters:							
	Percentage below minimum	.004 (.016)	-.002 (.011)	-.009 (.011)	.059 (.034)	.018 (.017)	-.023 (.013)
	Summed effect	-.004 (.037)	.020 (.027)	.015 (.027)	.255 (.082)	.147 (.040)	.015 (.032)
4. Add percentage below minimum lagged three quarters:							
	Percentage below minimum	-.028 (.020)	-.014 (.015)	-.001 (.015)	.026 (.044)	.009 (.022)	-.031 (.017)
	Summed effect	-.156 (.072)	-.045 (.051)	.049 (.053)	.113 (.154)	.097 (.077)	-.027 (.059)

All notes from Table 4 apply. The employment equation is estimated with OLS, using a variable coded as zero or 100 for household heads (equivalent to estimating a linear probability model, and multiplying the estimated coefficients by 100), and coded as the percentage employed for the specification excluding the household heads. In specifications 2-4, only the contemporaneous effects and the summed contemporaneous plus lagged effects are reported.

Table 6: Sensitivity Analyses of Estimates of Minimum Wage Effects on Lower Centiles of the Per Capita Family Income Distribution, 1996-2001

Centiles of the family income distribution:		10 th	20 th	30 th
		(1)	(2)	(3)
1. Define percentage below based on the wage distribution from one month ago instead of three months ago:				
	Summed effect	-0.195 (0.145)	0.119 (0.159)	0.135 (0.230)
2. First differences instead of within-group estimator:				
	Summed effect	0.048 (0.035)	0.076 (0.055)	0.092 (0.074)
3. First differences instead of within-group estimator, including metropolitan area dummy variables:				
	Summed effect	0.033 (0.277)	-0.465 (0.382)	-0.304 (0.516)
4. Include employment rate for metropolitan area-month cell, interacted with metropolitan area dummy variables:				
	Summed effect	-0.023 (0.285)	-0.431 (0.387)	-0.326 (0.524)

See notes to Table 4. Specifications are identical to those in panel 6 of Table 4, except as noted. All specifications include time effects and metropolitan area effects, and the contemporaneous percentage below as well as the percentage below lagged one through three quarters. Only the summed effects are reported.