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Political Variables as Instruments for the Minimum Wage

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Political Variables as Instruments for the Minimum Wage*

Sara Lemos

Abstract

A number of recent empirical studies have found no evidence that the minimum wage adversely affects employment. Explanations for such non-negative estimates include new theoretical approaches, empirical identification and data issues. In this paper we examine the robustness of such estimates to concerns about bias arising from the simultaneous determination of employment and the minimum wage. We use a number of novel political variables as instruments to control for this source of endogeneity. We exploit the personal characteristics of the politicians voting on minimum wage bills, their voting behavior and their electoral process. Our main conclusion is that the weak relationship between minimum wages and employment does not appear to be driven by endogeneity.

KEYWORDS: minimum wage, labour costs, political variables, instrumental variables, Brazil

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1 Introduction

In the early 1980s the consensus was that a 10% increase in the minimum wage reduced employment by 1% to 3% (Brown, 1999). More recently, a number of studies have found no evidence of adverse employment effects (Card, 1992; Card and Krueger, 1995 and 2000; Card et al., 1999; Machin et al., 2003). Explanations for such non-negative estimates include new theoretical approaches as well as concerns about empirical identification and data issues (Brown, 1999; Neumark and Wascher, 1992 and 2000; Card and Krueger, 1995 and 2000; De Fraja, 1999). For example, within a monopsony framework minimum wage increases need not reduce employment (Card and Krueger, 1995; Dickens et al., 1999), although some are skeptical of monopsony power among firms that hire minimum wage workers (Brown, 1999). One explanation for non-negative effects, however, that has yet to be more extensively investigated is that such effects might be an upwardly biased estimate of an underlying negative effect. If this is the case, existing findings could lead policymakers to inadvertently raise minimum wages more generously than they would otherwise do.

In a standard reduced form employment equation, such bias might result from the simultaneous determination of employment and the minimum wage variable (Card and Krueger, 1995; Dolado et al., 1996; Sobel, 1999). This is because more generous minimum wage increases might be related to stronger macroeconomic performance. Further endogeneity can be caused by the use of average wages or prices in the denominator of a normalized minimum wage or by the use of wages to calculate a wage gap measure (Katz, 1970; Kim and Taylor, 1995). The instruments that have been used in the literature to circumvent the problems arising from endogeneity are lags of the minimum wage or lags of average wages (Dickens et al., 1999; Dolado et al., 1996; Card and Krueger, 1995; Kim and Taylor, 1995; Machin and Manning, 1994; Neumark and Wascher, 1992). The underlying identifying restriction in these studies is that the errors are serially uncorrelated. However, the presence of unknown forms of serial correlation might invalidate these instruments. Furthermore, if the series of minimum wages and wages are highly persistent, their lagged levels are only weakly correlated with subsequent differences, which again might invalidate these instruments (Bound et al., 1995; Blundell and Bond, 1998). As a result, such instruments might be correcting little bias and an associated non-negative employment effect estimate might still be upwardly biased.

The main contribution of this paper is to further test whether the weak relationship between employment and minimum wages is driven by simultaneity bias. We estimate the minimum wage employment effect using a number of novel political variables as instruments. We show that our instruments are strongly correlated with the minimum wage and uncorrelated with the error term and its past lags. This ensures the validity of these instruments even in the presence of an unknown form of serial correlation in the errors or high persistency in the series of minimum wages. We use three independent sources of variation to define such instruments. We exploit the personal characteristics of the politicians voting on minimum wage bills, their voting behavior and their

electoral process. We define over 20 instruments and argue in each case that they only affect employment indirectly via the minimum wage.

The data we exploit are from a Brazilian monthly household panel survey from 1982 to 2000. In Brazil, minimum wage increases are large and frequent and the proportion of workers directly affected is large, unlike in most of the countries studied in the literature. As a result, the effect of the minimum wage on wages is sizeable (Fajnzylber, 2001; Lemos, 2004a), which leads us to expect to observe the negative effects predicted by theory. However, the effect on employment has been found to be small and not always negative (Neumark et al., 2004; Lemos, 2004a). Using our instruments, we test whether such weak employment effect is upwardly biased.

Our main conclusion is that the weak relationship between minimum wages and employment is not driven by endogeneity in Brazil. The prior evidence in the literature that the minimum wage has no adverse effect on employment in Brazil is robust to several different instruments. The significance of such findings is that policy makers can use the minimum wage as a social policy without destroying too many jobs in Brazil. The remainder of this paper is organized as follows. In Section 2 we describe our data and in Section 3 we present our empirical model. Our instruments are introduced in Section 4. Section 5 reports the results and Section 6 shows several robustness checks.

2 Data

The minimum wage data we use is from the Labor Ministry (Ministerio do Trabalho). The minimum wage was first introduced in Brazil in 1940. The real minimum wage steeply declined over the next twenty years, despite some adjustments during the boom of the 1950s. Since the mid 1960s, when the dictatorship began governing the country, the real minimum wage has been systematically devalued. This is primarily because the government believed the high rates of inflation were driven by wage increases. The minimum wage continued to devalue throughout the 1980s and for most of the 1990s, even after the end of the dictatorship. Since the mid 1990s, the real minimum wage has been fairly stable, under conditions of relatively low inflation. In Figure 1 we plot the real minimum wage for Brazil during our sample period.¹ The real minimum wage clearly shows a negative trend between January 1982 and January 2000.² Minimum wage increases during this period were subject to the

¹Regional minimum wages existed until April 1984. In Figure 1, we use the national average across the six metropolitan regions named below between January 1982 and April 1984.

²The deflator we use is the National Consumer Price Index (INPC) disaggregated by metropolitan regions (IPC) to reduce measurement error likely to arise if regional differences are disregarded. Furthermore, because the IPC is centered on the 15th, and wages are usually paid on the 5th of each month, we use a geometric mean to centre them on 1st. Finally, we apply a correction of 21.99% to the official inflation rate in July 1994. This is necessary because there were two currencies in the country then: Cruzeiros Reais and Real (URV). The inflation rate was much higher if measured in Cruzeiros Reais but the official index published the inflation rate measured in Real. See Neri (1995) and Azzoni et al. (1998) for discussions

Figure 1 - REAL MINIMUM WAGE AND EMPLOYMENT RATE IN BRAZIL, 1982-2000

rules of five different stabilization plans. The increases were large and frequent, but quickly eroded by the subsequent inflation, resulting in the saw-toothed pattern depicted.

The other data we use is from the Brazilian Monthly Employment Survey (PME). The PME is a rotating household panel similar to the US Current Population Survey (CPS). Households are interviewed for four consecutive months, not interviewed for the following eight months, and then interviewed again for four additional months. In the PME the panels are refreshed every two years, rather than every year, as in the CPS. This data has been collected by the Brazilian Institute of Statistics and Geography (IBGE) for the six main Brazilian metropolitan regions (Salvador, Recife, Belo Horizonte, Rio de Janeiro, Sao Paulo and Porto Alegre) since January of 1982. We aggregate the data across regions and across months; the average number of observations per region-month cell is 13,000.

The data shows considerable variation across regions, and we exploit this in order to identify the minimum wage effect on employment in our econometric models below. In Table 1 we show statistics for the poorest and the richest regions in the sample, respectively Recife and Sao Paulo. The employment rate, defined as the proportion of employed workers in relation to the working population (those working and those looking for a job), is lower in Recife. Figure 1 shows that the employment rate has been relatively stable over time; its raw correlation with the real minimum wage is 0.16. Earnings are also lower in Recife, where the fraction of workers at the minimum wage is larger. Table 1 shows that the "fraction at" is 14.4% in Recife, whereas it is 4.2% in Sao Paulo.³ This is large when compared to the 4% "fraction at" in the private sector in the US in 1993 (Dolado et al., 1996). "Fraction at" shows considerable variation over the sample period, as illustrated in Figure 2. This is the main minimum wage variable that we use in the econometric models below, in the Card and Krueger (1995) tradition.

on these and other issues related to deflation methods in the Brazilian high inflationary environment. We performed robustness checks using INPC rather than IPC, and also IPCA (National Wide Consumer Price Index). We further performed robustness tests using these indexes centered on the 1st and with no correction in July 1994. The results were robust to these changes.

³"Fraction at" is here defined as $0.98W_t^{NW} \leq W_t \leq 1.02W_t^{NM}$, where W^{NM} is the monthly nominal minimum wage and W is monthly nominal wages for all (formal and informal sector) workers. The bounds account for the measurement error introduced by rounding approximations. This is because in the presence of high inflation, as was the case in Brazil for much of our sample period, people tend to report rounded wages. We have performed robustness checks using the hourly nominal minimum wage and hourly nominal wages and found robust results. The hourly minimum wage rate was obtained by dividing the monthly minimum wage by 44x4.3 after, and 48x4.3 until September 1988. That is because the Constitution of October 1988 shortened the workweek from 48 to 44 hours, affecting salaried workers in general. The hourly wage rate was obtained by dividing the monthly earnings by the number of weekly hours worked multiplied by 4.3.

Figure 2 - FRACTION AFFECTED IN BRAZIL, 1982-2000

Table 1 - DESCRIPTIVE STATISTICS ACROSS REGIONS

Variables	Recife (poor region)	Sao Paulo (rich region)
I - Percentage of Population		
aged 0 to 14 years old	0.18	0.15
aged 15 to 24 years old	0.27	0.25
aged 25 to 64 years old	0.47	0.53
aged over 65 years old	0.07	0.07
women	0.45	0.43
student	0.31	0.22
enrolled in schooling	0.38	0.31
literate	0.86	0.95
elementary education (8 years of schooling)	0.43	0.38
secondary education (11 years of schooling)	0.14	0.14
graduates	0.08	0.11
retired	0.13	0.11
in urban areas	0.93	0.97
II - Percentage of Workers		
metallurgic industry	0.07	0.19
building construction	0.03	0.04
commerce	0.09	0.09
services	0.26	0.29
public sector	0.07	0.05
informal sector	0.23	0.36
III - Economy Wide		
employment rate	89.8%	92.6%
"fraction at"	14.4%	4.2%
log price index	-9.01	-9.13
log real minimum wage	4.95	5.09
log nominal minimum wage	-5.77	-5.76
log necessary minimum wage	-7.49	-8.43
log 25th percentile real earnings distribution	4.94	5.73
log 50th percentile real earnings distribution	5.39	6.23
log 75th percentile real earnings distribution	6.02	6.80
log average real earnings distribution	5.53	6.30
log standard deviation real earnings distribution	0.88	0.84
IV - Percentage of Politicians		
left wing	0.27	0.31
pro-worker	0.45	0.54
among the 100 most influential politicians in the country	0.09	0.28
voting in favour of a minimum wage increase	0.62	0.46
sample size	2475815	3708834

3 Model Specification

A simple empirical employment equation standard in the literature (Brown, 1999) is:

$$\Delta \ln N_{rt} = \alpha + \beta^M \Delta \ln W_{rt}^M + \lambda \Delta X_{rt} + f_r + f_t + \epsilon_{rt} \quad (1)$$

where N_{rt} is the employment rate, W_{rt}^M is the real minimum wage, X_{rt} are labor supply shifters, f_r and f_t are region and time fixed effects, and ϵ_{rt} is the error term in region r and month t , $r = 1, \dots, 6$, and $t = 28, \dots, 214$.⁴ Regional dummies model region growth specific trends.⁵ Supply shifters are the proportion of the total population who are younger than 10 years old, between 10 and 24 years old, women, illiterates, retirees, students, living in urban areas, with completed basic education (8 years) and high school education (11 years); the average years of schooling in the total population; the proportion of the working population in the informal, public, construction and metallurgy sectors, and the proportion holding two jobs. We assume that the model is correctly specified and that the errors are serially uncorrelated. (We later test this assumption). All models in the paper are White-corrected and sample size weighted to account for the relative importance of each region and for heteroskedasticity arising from aggregation.

The typical minimum wage variables used in the literature are the real minimum wage and the "Kaitz index", which is defined as the ratio of the minimum wage to average wage adjusted for coverage of the legislation (Kaitz, 1970). However, because the nominal minimum wage is constant across regions in Brazil, these "relative minimum wage" variables do not ensure identification, as the variation in the ratio is driven by the variation in the denominator (Welch and Cunningham, 1978). Consequently, "degree of impact" measures are becoming common in the literature (Brown, 1999). Examples are "fraction affected" (Card, 1992), which is defined as the proportion of workers earning a wage between the old and the new minimum wage, and "fraction at" (Dolado et al., 1996), which we defined in Section 2. The rationale is that an increase in the nominal minimum wage affects a different proportion of people across

⁴PME is available since 1980, but it suffered a major change in its questionnaire in 1982: some variables were included, some suffered definition changes, procedures related to non-response and attrition were introduced, etc. (Neri, 1996). To avoid contamination by measurement error associated to such major changes, and as we already have a long enough time period, we do not utilize the first few waves of data in our regression analysis.

⁵A few authors have exploited the rotating panel feature of household surveys such as PME to control for individual fixed effects. Such models estimate the effect of the minimum wage on labor force participation (Abowd et al, 2000) or on the number of hours worked (Neumark et al., 1998). In this study, we estimate the effect of the minimum wage on the employment rate, which is only defined at the regional level. This enables us to compare our estimates with most of those available in the literature with the aim to test whether the latter are upwardly biased. Furthermore, this enables us to exploit the regional impact of a national minimum wage increase in Brazil, where regional differences are great, following the now standard approach in the minimum wage literature developed in Card (1992) and Card and Kruger (1995).

regions depending on the initial level and shape of the wage distribution in each region. Although these two variables are closely related, "fraction affected" does not capture the erosion of the minimum wage in relation to other wages, while "fraction at" does. This is because "fraction affected" is constant at zero when the minimum wage is constant (Brown, 1999). Thus, in a similar fashion to Card and Krueger (1995), we use "fraction at" in place of the log real minimum wage in Equation (1) to ensure identification of the effect of the minimum wage on employment. The new equation is:

$$\Delta \ln N_{rt} = \alpha + \beta^F F_{rt} + \lambda \Delta X_{rt} + f_r + f_t + v_{rt} \quad (2)$$

where F_{rt} is "fraction at" as defined in Section 2 and v_{rt} is the new error term.

Nonetheless, the interpretation of "fraction at" in Equation (2) is not straightforward. This is because the coefficient of interest, β^F , is informative of the change in employment given a change in the proportion of workers earning one minimum wage but not given a change in the minimum wage itself. A more intuitive and policy relevant minimum wage variable is the interaction of the minimum wage with "fraction at". This gives a weighted minimum wage, where the impact of a national minimum wage increase in each region is measured by the proportion of workers earning one minimum wage in that region. Thus, we modify Equation (2) in the following way:

$$\Delta \ln N_{rt} = \alpha + \beta^M \Delta \ln W_{rt}^M + \beta^F F_{rt} + \beta F_{rt} \Delta \ln W_{rt}^M + \lambda \Delta X_{rt} + f_r + f_t + u_{rt} \quad (3)$$

where u_{rt} is the new error term. The change in the employment given by a marginal change in the minimum wage is given by $\beta^M + \beta F_{rt}$. We can evaluate this derivative at the average "fraction at" across all regions (11.6%) or at the average "fraction at" for a particular region (e.g. 14.4% in Recife and 4.2% in Sao Paulo, as shown in Table 1). However, as discussed above, β^M identifies the effect of the inverse of the deflator – not the effect of the nominal minimum wage – on employment. The effect of the nominal minimum wage has been controlled for in the model because it is expanded out in the time effects and thus the other coefficients in the equation are adequately estimated. Thus, we interpret the β coefficient as deviation from the mean effect that would have been captured by β^M , but instead is captured by the time effects. Therefore, our coefficient of interest here is β . To illustrate, if β was -1, then a 1% increase in the minimum wage would decrease employment by 0.04% in Sao Paulo and by 0.14% in Recife.

We argue that both the real minimum wage and "fraction at" are simultaneously determined with employment. This is likely to be the case because more generous minimum wage increases are related to a stronger macroeconomic performance. Following such increases, relative wage bargains determine the workers' position in the wage distribution, and thus who earns the minimum wage, i.e. the "fraction at". Consequently, an exogenous or predetermined variable that affects employment, only via the minimum wage and via "fraction at",

is necessary to ensure identification in our GMM estimation. We now introduce the political variables we use as such instruments.

4 Political Instruments

Our primary goal here is to define variables that measure the relative importance, or the weight of each region when voting on national bills such as the minimum wage. Card and Krueger (1995, p. 134) argue, "Politicians from states in which an increase in the minimum wage is expected to have a strong effect on wages or employment opportunities might oppose the increase, whereas those from states in which the expected effect is smaller might support it." The impact of the increase in each region determines the political support (the relative weight) of that region to the increase (Sobel, 1999; Becker, 1983). First, politicians in each region decide how much support to give to the national minimum wage bill in time $t - 1$ (by considering, for example, wages, employment, "fraction at", etc. in time $t - 2$, $t - 3$, etc.). Then, the final increase is determined as a regional weighted average in time t . The size of the national increase then determines how many people remain at the minimum wage in time t (i.e. "fraction at"), how many people slip under the minimum wage (i.e. non-compliance) and how many people lose their jobs (i.e. employment) in each region. Thus, one measure of the impact of the increase in each region is the size of "fraction at" in that region. Therefore, we expect a high correlation between the measures of regional political support and "fraction at" across regions (see Section 4.5).

The crucial assumption is that the amount of political support for a proposed minimum wage bill does not affect employment directly, but only through its effect on the "fraction at". This is because the political support measure is a predetermined variable. Political support is linked to current "fraction at" through lagged "fraction at" as described above. In other words, the channel through which political support measures are valid instruments is that they are "proxies" for lagged "fraction at", which is itself a valid instrument. (In Section 5.1 we show that lags of "fraction at" have high explanatory power as instruments for current "fraction at", as indicated in row 3 and column 3 of Table 4.) Therefore, political support measures fulfill the two necessary conditions for a valid instrument. Firstly, they are not endogenous as they have no direct effect on employment, because they are determined one period before. Secondly, they are relevant in the sense that they are correlated to current "fraction at" through being correlated with lagged "fraction at".

We define our measures of regional political support in 21 different ways using three independent sources of variation. We exploit the personal characteristics of the politicians voting on minimum wage bills, their voting behavior and their electoral process. Our instruments are summarized in Figure 3 and Table 2, which also reports their raw correlations with the real minimum wage and with "fraction at". We carefully argue why each of these variables is a valid instrument in Sections 4.1 to 4.4 and in Section 4.5 we discuss the dimensions of variation of each of the instruments. In Section 5.2 we show that our instruments pass relevance and overidentifying restriction tests. We then probe

Table 2 - CORRELATIONS BETWEEN THE POLITICAL INSTRUMENTS AND BOTH THE "FRACTION AT" AND THE MINIMUM WAGE

IV	minimum wage	fraction at	political instrument	intuition
I - Politicians Data				
IV1	0.62	0.40	no. of politicians from each sampled region out of the 100 most influential politicians in the country	the more influential and the more pro-increase the congressmen are, the higher the minimum wage
IV2	0.40	0.44	measure of how worker-sympathetic congressmen from each sampled region are	the higher the mark and the more pro-increase the congressmen are, the higher the minimum wage
IV3	-0.51	-0.56	dummy: 1 if left wing, 0 otherwise for congressmen in IV2 (average)	the more left wing congressmen are, the higher the minimum wage
IV4	-0.54	-0.25	no. of mandates for congressmen in IV2 (average)	the longer the congressmen are in power, the less favorable they are of a higher minimum wage
II - Voting Data				
IV5	-0.59	-0.44	no. of senator votes from each sampled region in favor of the minimum wage increase	the more congressmen in favor of the increase (against a larger increase), the lower the minimum wage
IV6	-0.48	-0.56	no. of deputy votes from each sampled region in favor of the minimum wage increase	as above
IV7	-0.17	-0.20	no. of senator votes from each sampled region against the minimum wage increase	the more congressmen against the increase (in favor of a lower increase), the lower the minimum wage
IV8	-0.49	-0.50	no. of deputy votes from each sampled region against the minimum wage increase	as above
IV9	-0.07	-0.05	no. of senators from each sampled region absent when the minimum wage increase was voted for	the more congressmen absent (the less pressure for a larger increase), the lower the minimum wage
IV10	-0.13	-0.35	no. of deputies from each sampled region absent when the minimum wage increase was voted for	as above
IV11	-0.49	-0.47	dummy for senator's votes in IV5 to IV8: 3 non-secret, 1 secret, and 2 party oriented vote	the lower the minimum wage, the more often non-secret votes are demanded (to expose those against it)
IV12	-0.60	-0.59	dummy for deputy's votes in IV5 to IV8: 3 non-secret, 1 secret, and 2 party oriented vote	as above
IV13	0.29	0.36	voting cycle (linear)	the more often minimum wage bills are voted, the higher the minimum wage (the less inflation erosion)
III - Elections Data				
IV14	-0.35	-0.27	national election cycle (linear)	the closer the elections are, the more generous the minimum wage increase
IV15	-0.34	-0.64	no. of left wing candidates who have been elected as federal deputy from each sampled region	the more left wing the congressmen elected are, the lower the minimum wage was before the elections
IV16	-0.19	-0.34	no. of left wing candidates who have been elected as senator from each sampled region	as above
IV17	-0.25	-0.23	no. of left wing candidates who have been elected as governor from each sampled region	as above
IV18	-0.28	-0.49	no. of left wing candidates who have been elected as state deputy from each sampled region	as above
IV19	-0.11	-0.16	no. of votes for left wing federal deputy candidates in each sampled region	as above
IV20	-0.12	-0.30	no. of votes for left wing governor candidates in each sampled region	as above
IV21	-0.06	-0.15	no. of votes for left wing state deputy candidates in each sampled region	as above

the results of these tests by using several different subsets of political variables that have different sources of variation in Section 5.2. Finally, we also probe the results by using alternative estimation methods in Section 5.4 and different sub-samples in Section 6 and find the results to be robust.

4.1 Politicians Data

We use data from the Brazilian Inter-Union Department of Parliamentary Consultancy (DIAP) to define regional weight in two different ways. Firstly, DIAP ranks the 100 most influential congressmen according to political science criteria (debating, negotiating, voting, articulating, forming opinion, leading, etc.) (DIAP, 1994 to 2002). The more influential politicians representing a particular region are, the more weight we assume that region has in the final minimum wage increase. This measure is based on politicians' personal characteristics and we have no reason to believe it would be simultaneously determined with employment. Table 1 shows that almost 30% of such politicians represent Sao Paulo, while less than 10% represent Recife. The correlation between this measure and both the real minimum wage and "fraction at" is strong and positive, as shown in Table 2.

Secondly, DIAP also ranks every Brazilian politician by attributing marks when they vote in favor of workers on labor related bills (DIAP, 1986, 1990, 1994a and 2002). Regions with higher average marks have more pro-worker politicians, who we assume, are more supportive of more generous minimum wage increases. The pro-worker status is acquired by consistently voting in favor of workers over time. Most of these bills are not directly related to employment (for example: union leader tenure, president mandate length, etc.). However, we also re-defined the pro-worker status using solely the bills which were unrelated to employment. The results were robust to either definition. Table 1 shows that the average mark is higher in Sao Paulo than in Recife, while Table 2 shows a strong positive correlation of this measure and both the real minimum wage and "fraction at". Dummies were also defined for whether these politicians are left or right wing,⁶ and the number of mandates they have held.

4.2 Voting Data

It could be argued that voting data measures the regional weight associated with minimum wage increases more directly. Card and Krueger (1995) used the number of votes in favor and against minimum wage bills to construct a measure of political support across states in the US. We collected similar data across regions from the Brazilian National Congress Daily (DCN). In Brazil, there are two distinct reasons to oppose a minimum wage increase. Either the increase is perceived as too high, in which case it might adversely impact on inflation and on the public deficit; or the increase is perceived as too low, in which case it does not protect workers' standard of living. Examples of both arguments can be found in the newspapers:

⁶Left wing designation according to Figueredo and Limongi (1995).

"The popular movement against the minimum wage of R\$151 toughens up... a circus tent will be installed in front of the Congress to shelter 1,000 retired workers who will camp there until voting on the bill on the 26th. The vigil will include a mass for the "conversion" of deputies and senators in favour of a more generous minimum wage. . . " (Estadao, 19th April, 2000).

"The Government makes the minimum wage increase conditional upon the inflation level, the benefits and pension bill, the Estates and Cities finances. . . Most Congressmen know that a big increase would put at risk the economic stability of the country." (Estadao, 15th January 1998).

In most of the sample period the real minimum wage was deliberately devalued. Hence the more congressmen there were against the increase, the greater pressure there was for a larger increase. Table 2 shows the associated negative and strong correlations.⁷ In this case, we expect a larger proportion of politicians to be in favor of the increase in poorer regions, where a larger increase might affect employment to a greater extent. Table 1 confirms that this proportion is higher in Recife than in Sao Paulo. Card and Krueger (1995) used their political variable as a proxy for otherwise unobservable factors in a state related to the impact of the law, implicitly assuming a direct effect on employment over and above the indirect effect via the minimum wage. In Brazil, the minimum wage debate is more concerned with wage-price inflation spirals and with the impact on the public deficit via social security than with employment, as the two citations above illustrate.

On the one hand, minimum wage increases impact on the public deficit in Brazil via the higher public sector wage bill and also via the higher benefit and pension bill. That is because the public sector is overpopulated by minimum wage workers (7% of them) and because benefits and pensions are linked to the minimum wage. As a result, the fiscal impact of minimum wage increases has often been the key political criterion for determining the size of the increase in Brazil (Foguel et al., 2001). Politicians favoring more generous increases are those who represent organized workers or retirees and beneficiaries, whereas politicians against more generous increases are those supporting the government coalition that are concerned with the impact of the increase on the public deficit.

On the other hand, firms perceive the increase as temporary, anticipating the subsequent accommodating monetary policy and wage-price spiral. Hence they do not adjust employment to avoid adjustment costs (Cox and Oaxaca, 1981; Lemos, 2004a). Because of these two main effects of the minimum wage, politicians are more concerned with the inflationary and fiscal impact of the minimum wage than with employment opportunities when deciding their political support for the increase. Thus we argue that our political variable is not simultaneously determined with employment.

⁷These variables were also defined as proportions of the total number of politicians and the correlations remain robust and negative.

An interesting feature here is that voting can be non-secret, secret, or party oriented. We define a dummy to capture this, which we argue, is an exogenous instrument. For example, during the dictatorship voting was often symbolic. Another example is that non-secret votes (only on demand) are usually a strategy of those favoring a larger increase to expose their opponents:

"In a convoluted session stretching until early morning... due to start at 7pm.... postponed to 8pm, to prevent voting going live on television, exposing the 'situation' Congressmen [those in favour of the Government proposal] ... who did not succeed in making a deal for symbolic voting, which guarantees their anonymity. The opposition Congressmen... insisted on non-secret voting". (Estadao, 11th May 2000).

The lower the minimum wage, the greater the pressure for a larger increase and the more often non-secret votes are demanded. Table 2 shows the associated strong and negative correlations. We weight the number of votes by the voting dummy defined above and generate an additional instrument. This places more weight on the more reliable non-secret votes data, and also represents more democratic times.

Another way to measure the political bargaining process is to consider the frequency of increases, which is here defined as the voting cycle and illustrated in Figure 3.⁸ The more often bills are presented, the higher the minimum wage is and the more inflation erosion is reduced. Table 2 shows positive correlations. We argue that our political variable is not simultaneously determined with employment. On the one hand, during the low inflation period (at the beginning and at the end of our sample period) voting on minimum wage increases takes place at regular intervals of time (6 and 12 months respectively). Thus, voting cycle could be argued to be exogenous. On the other hand, during the hyperinflation period, voting on minimum wage increases still takes place at regular intervals of time, but the length of these intervals is a function of inflation. Recall from our discussion above that during such a period, firms anticipate the inflation spiral and avoid employment adjustment costs. Figure 3 shows little association between the voting cycle and employment growth. Thus we argue that our political variable is not endogenous. Finally, weighting the voting data by the voting cycle, i.e. placing more weight on voting when it is imminent, generates an additional instrument.

4.3 Election Data

Regional affordability is not the only criteria for political support. As a further attempt to collect data with independent variation, consider political propaganda:

⁸We assume that the tension in the bargaining process between any two minimum wage increases grows linearly. The results were robust to other functional forms (exponential, squared, square root and log).

"...around 500 mayors will meet in Brasilia to discuss a strategy to pressure the Congress against ... the minimum wage increase... because the proximity of the election campaign" (Estadao, 11th December 2001).

"... the Government strategy is to postpone the increase above inflation until after October, when the new president will have been elected." (Estadao, 10th July 2002).

Firstly, we assume that incentives for more generous increases depend on the proximity of elections. Sobel (1999, p. 766) specified a model that "shows an incentive for the US congress to time changes in the minimum wage just before elections". In our sample, in every electoral year there was a minimum wage increase – often timed just one or two months before the election. The basic assumption is that voters are myopic, and opportunistic policymakers systematically manipulate minimum wage policy just before elections to maximize their chances of re-election (Lindbeck, 1976). Thus, the timing of elections was used to define an election cycle variable⁹ (Carmignani, 2003), as illustrated in Figure 3. The closer the elections are, the higher the minimum wage is expected to be. Table 1 confirms the expected negative correlations.

As before, the election cycle is determined by regular intervals of time, and thus it could be argued to be exogenous. However, just as politicians time minimum wage increases before elections, they might also time other macroeconomic employment growth policies before elections. Furthermore, there is a great deal of uncertainty associated to elections in Brazil that might affect the investment cycle. If politicians successfully engineer mini booms just before elections, then the election cycle would be endogenously determined with employment and would not be a valid instrument. In that case, we would expect the election cycle to be correlated with employment growth. Figure 3 suggests little association between the two. There is some weak evidence of association in the 1-2 months window around the elections, but no obvious association in the remaining 10-46 months of each election cycle. Thus we are confident that any association between the election cycle and employment growth is concentrated around the surroundings of the election date, and is not enough to contaminate our results. We also argue that the timing of minimum wage increases in Brazil is determined by opportunistic and populist politicians' maneuvers, rather than by macroeconomic performance. Opportunist politicians might time overdue minimum wage increases just before elections. Moreover, such increases might simply restore the purchasing power of an eroded minimum wage. These two features are illustrated in Figures 1 and 3 that show that the real minimum wage is often falling before elections and that its purchasing power is rarely ever recuperated. Finally, our assumption that our instrument is uncorrelated with the error term is conditional on the regressors (we include time dummies to control for common macroeconomic shocks and regional dummies to control for region specific macroeconomic growth).

⁹As before, the election cycle is defined as a linear time trend between two consecutive elections, but the results were robust to other functional forms.

Secondly, we assume that left-wing politicians are in favor of more generous increases. The lower the minimum wage, the greater the popular discontentment is, which increases the number of elected left-wing politicians. Data on the number of elected left wing politicians and on the number of votes for such politicians were used as instruments (Nicolau, 1998).¹⁰ Figure 3 shows the average number of votes for left wing federal deputy candidates across regions over time.¹¹ The underlying assumption is, as before, that any endogeneity coming from the simultaneous determination of these variables and employment is negligible in monthly data because elections happen mostly every 4 years. Finally, as incentives for increases are greater the closer the elections are, we weight the election data by the election cycle and generate an additional instrument.

4.4 Necessary Minimum Wage

Our last instrument is the Necessary Minimum Wage (SMN), defined in the constitution as the minimum subsistence income for an adult worker and their family. The SMN measures the hypothetical past inflation that would have been experienced by minimum wage workers across regions if they consumed the SMN bundle. It is a constructed, not an observed variable, calculated by the Brazilian Inter-Union Department of Statistics and Social Studies (DIESE). This is because the SMN bundle has never been affordable at the prevalent minimum wage. Thus, the SMN is thought to be well correlated with the systematic, but not with the endogenous part of the minimum wage. The SMN does not play a role in wages and employment determination, and thus it is not simultaneously determined with employment. The correlation between the SMN and the minimum wage in differences is 0.53, and the correlation between the SMN and "fraction at" is -0.37.

4.5 Variation Across Regions and Over Time

In sum, we have 3 endogenous variables and 21 instruments. On the one hand, our endogenous variables are the real minimum wage, "fraction at" and the interaction of the two. However, for the purpose of the identification discussion here, we instead refer to the nominal minimum wage to ensure that the instruments are correlated with the minimum wage, not with prices (see Section 3). For this purpose, on the one hand, the variation dimensions of our endogenous variables are as follows: the nominal minimum wage varies only over time, "fraction at" and the interaction of the two vary across regions and over time. On the other hand, our instruments have three dimensions of variation: IV13 and IV14 vary only over time, the remaining instruments vary across regions and every so often over time, and the interaction of them varies across regions and over time.

¹⁰These variables were defined as proportions of the total number of votes and the correlations remained robust and negative.

¹¹Federal deputy candidates are elected in national elections, which only take place every 4 years. The election cycle includes national, state and municipal elections, and thus it varies more often than every 4 years.

Firstly, we defined two instruments at the national level, the voting cycle and the national election cycle (IV13 and IV14). Table 2 (also see Figure 3) shows their raw correlations with the minimum wage. Secondly, our remaining instruments (IV1 to IV12 and IV15 to IV21) are remarkably correlated with the minimum wage at the national level, as indicated in Table 2. Figure 3 shows one such instrument (IV19). In Section 5.2 we show that these instruments have high explanatory power (see Table 4).¹² Thirdly, we argue in Section 4 that political variables defined at the regional level are correlated with "fraction at", which also varies at the regional level.¹³ Table 2 (also see Figure 3) shows the raw correlations between our instruments and "fraction at". In Section 5.2 we show that these instruments are relevant (see Table 4). Finally, we interact some of our instruments that vary across regions with those that vary over time. It can be argued that interactions "fake" the correlation with the endogenous variable and "create" a weak instrument (see Section 5.2). Nonetheless, we had strong *a priori* economic reasoning for such interactions, as discussed above. Furthermore, this issue primarily concerns weak instruments, not interactions *per se* (Angrist et al., 1999; Staiger and Stock, 1997). Incidentally, such interactions produce variation across regions and over time and bring further gains to instrument relevance.¹⁴ That is because instruments that vary across regions only change every so often. For example, the number of votes for left wing federal deputy candidates (IV19) only varies every four years. However, as the election cycle varies every month, the interaction of the two varies across regions and over time. Another example is that the number of deputy votes in favor of a minimum wage increase (IV6) only varies 81/217 months. However, as the voting cycle varies every month, the interaction of the two varies across regions and over time.

¹²Ideally, we would like to specify a structural model of the minimum wage that we could use to illustrate why political variables at the regional level should be correlated with the minimum wage at the national level. However, to concentrate on the main issues of interest here, it suffices to assume that the national minimum wage W^{NM} is a function of both the regional minimum wage W^{RM} and a measure of political support IV (the last two are latent underlying unobserved variables), i.e. $\Delta W^{NM} = f(IV_r, \Delta W_r^{RM})$. The specific functional form is not crucial, but for the purposes of illustration, let us assume that the final national minimum wage increase is a weighted average of regional minimum wage increases, where the weights are the political support measure in each region: $\Delta W^{NM} = \sum_{r=1}^R IV_r \Delta W_r^{RM}$ (see Section 4). Thus, $\text{correlation}(\Delta W^{NM}, IV^*)$ can be written as the $\text{correlation}(IV \Delta W^{RM}, IV^*) \neq 0$, where IV^* is an observed empirical counterpart variable to IV . The assumption that $\Delta W^{NM} = f(IV_r, \Delta W_r^{RM})$ can, however, be disputed. In that case, whether $\text{correlation}(\Delta W^{NM}, IV^*) \neq 0$ becomes an empirical matter. We define IV^* in 19 different ways in Table 2 using three independent sources of variation and find strong correlations. Tests in Table 4 confirm the relevance of our instruments. We dropped the time subscript for simplicity, but recall from Section 4 that political support is predetermined in relation to the minimum wage and "fraction at".

¹³In other words, we argue that the $\text{correlation}(F_r, IV_r^*) \neq 0$.

¹⁴That is, we expect the $\text{correlation}(F_r \Delta W_t^{NM}, IV_r^* IV_t)$ to be stronger than the $\text{correlation}(F_r \Delta W_t^{NM}, IV_r^*)$.

Figure 3 - SELECTED IVS AND EMPLOYMENT GROWTH IN BRAZIL, 1982-2000

5 Results

5.1 Lagged Endogenous Variables as Instruments

Our benchmark uninstrumented β estimates, shown in the first row of Table 3, suggest that a 10% increase in the minimum wage decreases employment by 0.03%. Nonetheless, this estimate is insignificantly different from zero, suggesting that the minimum wage does not adversely affect employment in Brazil between 1982 and 2000. We now use our instruments, to test whether such weak employment effect is upwardly biased.

We begin by using the first to the twelfth lags of the real minimum wage as instruments. As this is the typical instrument used in the literature, it enables us to compare our results to earlier findings. It also allows us to test our assumption of serially uncorrelated errors using the overidentifying restrictions Hansen-Sargan test (Sargan, 1958; Hansen, 1982). Furthermore, it yields estimates that rely exclusively on changes in the real minimum wage, and not on changes in supply factors that might change the size of "fraction at" – and might have not been controlled for in Equation (3). The estimates, shown in the second row of Table 3, are statistically insignificant. The associated F test in the first step of the estimation for the endogenous minimum wage ($\Delta \ln MW_{rt}$) suggests that the instruments have a high explanatory power, as shown in Table 4. However, the F test has been criticized in the literature as being insufficient to measure the degree of instrument relevance in the presence of multiple endogenous variables (Stock et al., 2002; Hahn and Hausman, 2002 and 2003). In this case, a more powerful test is the Cragg-Donald test (Cragg and Donald, 1993; Stock et al., 2002). Table 4 shows that we are not able to reject the null, suggesting that the model is either very weakly identified or underidentified and that the associated bias is fairly large (Stock and Yogo, 2005). We also report a very low Shea R^2 , which suggests that after intercorrelations among the instruments are accounted for, the instruments have little explanatory power (Shea, 1997). This implies that lags of the real minimum wage in levels are not valid instruments to its subsequent differences, which is probably due to the high persistency of the minimum wages series (Blundell and Bond, 1998). The F and Shea R^2 for the other two endogenous variables (F_{rt} and $F_{rt}\Delta \ln MW_{rt}$) indicate that the instruments have no explanatory power either. Furthermore, the Hansen-Sargan test indicates that the presence of serial correlation in the errors invalidates the instruments.

It can be argued that the persistency in the series of the real minimum wage is due to its denominator. A way to assess whether the variation in prices is driving the results is to use lags of the nominal minimum wage as instruments. This yields estimates that rely solely on changes associated with active nominal minimum wage policies, rather than on deliberately passive nominal minimum wage policies that devalue the real minimum wage. However, because the nominal minimum wage is constant across regions in Brazil, the model is not identified. A variable with cross regional variation that is conceptually close to the nominal minimum wage is the necessary minimum wage (SMN), defined in

Table 3 - EMPLOYMENT EFFECT OF A 10% MINIMUM WAGE INCREASE

Model	short run coefficient	standard errors
uninstrumented	-0.03	0.02
IV: lagged real minimum wage	0.01	0.19
IV: necessary minimum wage	0.06	0.08
IV: lagged "fraction at"	-0.29	0.28
IV: political instruments with no interactions	-0.06	0.06
IV: voting data interacted with voting dummy and voting cycle	-0.06	0.06
IV: election data interacted with election cycle	-0.05	0.07
Jackknife		
uninstrumented	-0.03	0.02
IV: political instruments with no interactions	-0.08	0.08
IV: voting data interacted with voting dummy and voting cycle	-0.07	0.08
IV: election data interacted with election cycle	-0.05	0.08
Bootstrap		
uninstrumented	-0.03	0.02
IV: political instruments with no interactions	-0.04	0.07
IV: voting data interacted with voting dummy and voting cycle	-0.05	0.08
IV: election data interacted with election cycle	-0.04	0.08
Dynamic		
uninstrumented	-0.04	0.03
<i>long run coefficient</i>	-0.02	0.02
IV: political instruments with no interactions	-0.03	0.06
<i>long run coefficient</i>	-0.01	0.02
IV: voting data interacted with voting dummy and voting cycle	-0.03	0.07
<i>long run coefficient</i>	-0.01	0.02
IV: election data interacted with election cycle	-0.01	0.07
<i>long run coefficient</i>	0.00	0.02
Teenagers		
uninstrumented	-0.05	0.08
IV: political instruments with no interactions	0.12	0.21
IV: voting data interacted with voting dummy and voting cycle	-0.04	0.24
IV: election data interacted with election cycle	0.07	0.24
Low Educated		
uninstrumented	-0.06	0.04
IV: political instruments with no interactions	-0.15	0.08 *
IV: voting data interacted with voting dummy and voting cycle	-0.14	0.08
IV: election data interacted with election cycle	-0.13	0.08
Low Inflation Period		
uninstrumented	-0.12	0.07
IV: political instruments with no interactions	-0.13	0.09
IV: voting data interacted with voting dummy and voting cycle	-0.09	0.26
IV: election data interacted with election cycle	-0.24	0.25
Formal Sector		
uninstrumented	0.02	0.03
IV: political instruments with no interactions	-0.02	0.06
IV: voting data interacted with voting dummy and voting cycle	-0.02	0.07
IV: election data interacted with election cycle	-0.02	0.07
Informal Sector		
uninstrumented	-0.09	0.07
IV: political instruments with no interactions	-0.21	0.16
IV: voting data interacted with voting dummy and voting cycle	-0.22	0.17
IV: election data interacted with election cycle	-0.19	0.17

(a) The dependent variable is employment rate. The above are estimates of the variable of interest, which is the nominal minimum wage interacted with "fraction at".

(b) Time effects are modelled with month dummies, region effects are modelled with region dummies, and labour supply shifters are included as controls.

(c) Each row within each panel shows "fraction at" estimates using a different set of instruments.

(d) Standard errors are corrected for heteroskedasticity arising from aggregation, where the weights are the square root of the inverse of the sample size.

The standard errors are also White-corrected.

(e) The (*) denotes the estimates that are statistically different from zero at 5% level of singificance.

Table 4 - SPECIFICATION TESTS - for models in Table 3

Model	Hansen-Sargan test		Hausman test		F test		Cragg-Donald test		Shea R ²		fraction at minimum wage	fraction at minimum wage	
	degrees of freedom		degrees of freedom		fraction at minimum wage	fraction at minimum wage	degrees of freedom		degrees of freedom				
	(1)	(2)	(3)	(4)	(5)								
IV: lagged real minimum wage	17.35	9	2.18	3	0.97	2.19	2.81	12,852	0.47	12,3	0.01	0.01	0.02
IV: necessary minimum wage	34.70	10	14.88	3	1.04	0.37	4.62	12,852	0.15	13,3	0.01	0.00	0.06
IV: lagged "fraction at"	29.28	9	4.05	3	3.10	211.16	1.08	13,851	0.88	12,3	0.09	0.56	0.01
IV: political instruments with no interactions	98.37	81	0.76	3	7.49	18.69	493.12	84,841	4.36	84,3	0.16	0.49	0.30
IV: voting data interacted with voting dummy and voting cycle	12.68	17	0.47	3	4.09	13.47	8.66	20,889	14.64	20,3	0.12	0.27	0.24
IV: election data interacted with election cycle	24.89	25	0.66	3	3.37	3.79	10.43	28,881	10.80	28,3	0.12	0.09	0.25
Dynamic													
IV: political instruments with no interactions	93.84	81	0.76	3	5.04	11.99	358.71	84,841	4.04	84,3	0.18	0.48	0.32
IV: voting data interacted with voting dummy and voting cycle	13.62	17	0.14	3	3.63	11.86	7.90	20,889	13.76	20,3	0.14	0.25	0.26
IV: election data interacted with election cycle	30.98	25	1.76	3	2.87	3.70	9.41	28,881	10.09	28,3	0.14	0.08	0.27
Teenagers													
IV: political instruments with no interactions	57.80	81	3.94	3	7.49	18.69	493.12	84,841	4.36	84,3	0.16	0.49	0.30
IV: voting data interacted with voting dummy and voting cycle	14.72	17	2.28	3	4.09	13.47	8.66	20,889	14.64	20,3	0.12	0.27	0.24
IV: election data interacted with election cycle	28.07	25	1.57	3	3.37	3.79	10.43	28,881	10.80	28,3	0.12	0.09	0.25
Low Educated													
IV: political instruments with no interactions	68.58	81	6.00	3	7.49	18.69	493.12	84,841	4.36	84,3	0.16	0.49	0.30
IV: voting data interacted with voting dummy and voting cycle	5.04	17	1.77	3	4.09	13.47	8.66	20,889	14.64	20,3	0.12	0.27	0.24
IV: election data interacted with election cycle	21.70	25	1.47	3	3.37	3.79	10.43	28,881	10.80	28,3	0.12	0.09	0.25
Low Inflation Period													
IV: political instruments with no interactions	93.42	81	1.90	3	23.32	32.27	1472.74	84,841	3.94	84,3	0.55	0.58	0.54
IV: voting data interacted with voting dummy and voting cycle	9.74	17	2.38	3	1.72	5.35	13.39	20,889	11.52	20,3	0.07	0.17	0.39
IV: election data interacted with election cycle	18.55	25	2.10	3	1.16	3.07	10.64	28,881	6.45	28,3	0.06	0.26	0.38
Formal Sector													
IV: political instruments with no interactions	75.75	81	2.21	3	7.49	18.69	493.12	84,841	4.36	84,3	0.16	0.49	0.30
IV: voting data interacted with voting dummy and voting cycle	13.49	17	1.51	3	4.09	13.47	8.66	20,889	14.64	20,3	0.12	0.27	0.24
IV: election data interacted with election cycle	31.52	25	1.49	3	3.37	3.79	10.43	28,881	10.80	28,3	0.12	0.09	0.25
Informal Sector													
IV: political instruments with no interactions	63.70	81	0.81	3	7.49	18.69	493.12	84,841	4.36	84,3	0.16	0.49	0.30
IV: voting data interacted with voting dummy and voting cycle	12.36	17	0.69	3	4.09	13.47	8.66	20,889	14.64	20,3	0.12	0.27	0.24
IV: election data interacted with election cycle	17.00	25	0.50	3	3.37	3.79	10.43	28,881	10.80	28,3	0.12	0.09	0.25

(a) Each row shows specification tests for the associated models in Table 3 using a different set of instruments for the real minimum wage, "fraction at" and the interaction of the two, as indicated.

(b) Columns 1 to 5 show respectively Hansen-Sargan, Hausman, F tests in the first step of the estimation, Cragg-Donald test and the Shea R². F tests and Shea R² are shown for each endogenous variable, i.e. the real minimum wage, "fraction at" and the interaction of the two.

Section 4.4. We argue that the variation in the SMN is more exogenous than the variation in the real minimum wage and "fraction at". The employment effect estimate using the SMN and its first to the twelfth lags as instruments is again statistically insignificant, as shown in the third row of Table 3. The associated F test, Cragg-Donald test and Shea R^2 , shown in Table 4, indicate that the instruments are very weakly correlated with the endogenous variables and that the model is basically unidentified. Furthermore, although the Hausman test shows evidence of endogeneity (Hausman, 1978), the Hansen-Sargan test once again indicates that the presence of serial correlation in the errors invalidates the instruments. Note, moreover, that bias resulting from weak instrumenting might have led us to incorrectly fail to reject the Hausman test's null (Hahn and Hausman, 2002).

Another potential instrument that might not suffer so severely from high persistency, as does the real minimum wage, is lagged "fraction at". The employment effect estimate using the first to the twelfth lags of "fraction at" as instruments are again statistically insignificant, as shown in the third row of Table 3. The associated F test for F_{rt} and $F_{rt}\Delta \ln MW_{rt}$ suggest that the instruments have high explanatory power, as shown in Table 4, although the Shea R^2 was relatively small for $F_{rt}\Delta \ln MW_{rt}$. While this suggests that high persistency does not invalidate the instruments to "fraction at", the model remains unidentified, as the correlation of the instruments with the other two endogenous variables is weak. This is confirmed by the Cragg-Donald test. Furthermore, the Hansen-Sargan test once again indicates that the presence of serial correlation in the errors invalidates the instruments. Consequently, we need excluded instruments, uncorrelated with the error term and all its past history, in order to ensure the consistency of our estimates. We now explore the use of the political variables we defined in Section 4 as such instruments.

5.2 Political Variables as Instruments

We start by using just political instruments with no interactions. That is because it can be argued that interactions generate a weak instrument, as discussed in Section 4.5. The employment effect estimate, using our political variables and their first three lags as instruments, are again statistically insignificant, as shown in the fifth row of Table 3. However, the associated tests, shown in Table 4, are now more encouraging. The F test shows that our instruments are correlated with the endogenous variables, even after intercorrelations among the instruments are accounted for, as shown by the Shea R^2 . As we argue in Section 4, political variables are relevant instruments because they are linked to current "fraction at" through lagged "fraction at", which is itself a highly relevant instrument as shown in Section 5.1. The Cragg-Donald test indicates that the maximum bias we would be accepting is 30% (Cragg and Donald, 1993; Stock et al., 2002; Stock and Yogo, 2005). This is relatively small in the context here, as $\pm 30\%$ bias still leaves us within the confidence interval and is not sufficient to turn our estimate into significant. Furthermore, the Hansen-Sargan test confirms the validity of the instruments. The Hausman test indicates that there is

no evidence of endogeneity between employment and the real minimum wage or "fraction at". Thus, these results suggest that the weak relationship between employment and the minimum wage is not driven by endogeneity.

We test the robustness of these results using the interaction of political variables as instruments. Firstly we use voting data interacted with the voting dummy and the voting cycle together with their first three lags. These results, shown in Tables 3 and 4, confirm that the employment effect estimate is insignificantly different from zero. The associated F test, Cragg-Donald test and Shea R^2 show that the instruments have explanatory power, the Hansen-Sargan test once again confirms the validity of the instruments, and the Hausman test indicates no evidence of endogeneity. The maximum bias we would be accepting now is 10%, which is fairly small. Secondly, we use election data interacted with the election cycle and their first three lags. These results, shown in Tables 3 and 4, are qualitatively the same, although the instruments are now weaker.¹⁵

5.3 Discussion

We find no evidence to support the hypothesis discussed in the Introduction that non-negative employment effects in the literature might be an upwardly biased estimate of an underlying negative effect in the case of Brazil. Our results consistently suggest, across a number of instruments, that the weak relationship between employment and the minimum wage is not driven by endogeneity. This is in line with evidence in the literature that suggests little bias correction when instrumenting for the minimum wage variable (Card and Krueger, 1995; Kim and Taylor, 1995), although some found that instrumented estimates correct some upwards bias (Neumark and Wascher, 1992).

The main criticism, however, with the instrumental variable estimates available in the literature, is that they might be biased towards their uninstrumented counterparts. This is because the lagged minimum wage, the typical instrument in these studies, might be weakly correlated with its subsequent differences. A full assessment of how weak the instruments are in these studies is difficult because statistics reporting the first stage results accounting for intercorrelations among the instruments are largely unavailable. Tests that do not account for such intercorrelations can be misleading as the weak instruments bias can arise even when such tests are significant (Staiger and Stock, 1997; Shea, 1997; Stock et al, 2002). We have demonstrated this is the case in Brazil. We then suggested a number of political variables as instruments that are superior to the typical lagged minimum wage. We show that our instruments have more exogenous variation, are more strongly correlated with the endogenous variables and are uncorrelated with the error term and its lags.

Our main conclusion is that the minimum wage has no adverse effect on

¹⁵Our results are robust to using twelve lags of the political variables as instruments. The associated Hansen-Sargan tests confirm that any potential serial correlation is not sufficient to contaminate the instruments. The F tests Cragg-Donald test and Shea R^2 improve further and the Hausman tests show no evidence of endogeneity. However, the extra lags add little extra relevant information and we took the parsimonious approach of fewer lags.

employment in Brazil between 1982 and 2000. This is in line with prior evidence in the literature (Card and Krueger, 1995; Machin et al., 2003), although it is smaller than the -1% employment effect reported in Brown's (1999) recent survey. Our results are also in line with previous employment effect evidence for Brazil (Lemos, 2004a; Neumark et al., 2004).

5.4 Further Estimation Strategies

We further test whether our instruments are weak by re-estimating Equation (3) using alternative instrumental variable estimators that estimate and correct finite sample bias arising when weak instruments are used. This bias will be quite sizeable and the corrected estimates will substantially differ from those reported in Section 5.2 if our instruments are weak. Conversely, the estimates will be robust if our instruments are sufficiently strong. The results we discuss below indicate that our instruments are sufficiently strong and that our main conclusion that the weak relationship between employment and the minimum wage is not driven by endogeneity is maintained.

The first estimator we use is the one developed by Hahn et al. (2004) based on the jackknife method. We use our three sets of political variables in turn and report the results in Table 3. The estimates are fairly robust and remain insignificantly different from zero. The benchmark uninstrumented estimate is unchanged (compare rows 1 and 8 of Table 3). The estimate using political instruments with no interactions is a little larger than its counterpart. The associated bias is 30%, in line with the maximum bias accepted by the Cragg-Donald test discussed in Section 5.2. The estimate using voting data interacted with voting dummy and voting cycle is also a little larger than its counterpart, but the bias is now 15%, again in line with the Cragg-Donald test. Finally, there is no bias when using the election data interacted with election cycle.

The second estimator we use is the one developed by Flores-Lagunes (2005) based on the bootstrap method. The conceptual idea is similar, but this is computationally less intensive than the Hahn et al. (2004) estimator. We use our three sets of political variables in turn and report the results in Table 3. The results are qualitatively the same. The estimates are fairly robust and remain insignificantly different from zero. The uninstrumented estimate is unchanged and the instrumented estimates have bias of the same magnitudes as before, although now such biases go in the opposite direction.

6 Robustness Checks

We perform four different robustness checks, in turn. We first allow for lagged adjustment in employment following minimum wage increases, then we restrict the analysis in turn to low wage workers, to low inflation periods, and finally to formal and informal sectors. We show that our main conclusion – that the weak relationship between employment and the minimum wage is not driven by endogeneity – remains unchanged.

The usual justifications in the literature for omitting dynamics are that the high voluntary turnover in low wage occupations allows adjustment in employment via non-replacement rather than via firing; and that the announcement of minimum wage increases prior to the enactment date allows anticipated adjustment in employment (Brown, 1999). However, as our earlier results indicate the presence of serial correlation in the errors, we address that by allowing lagged employment responses to minimum wage increases. As employment is usually reported to be AR(2) in the literature, we allow two years for full adjustment by adding 24 lags of the dependent variable in Equation 3. We assume that the new error term is serially uncorrelated. We use our three sets of political variables in turn and report the results in Tables 3 and 4. Our results are robust to this specification change and our main conclusion that the weak relationship between employment and the minimum wage is not driven by endogeneity is unchanged. Both the short and the long run estimates are insignificantly different from zero. The associated tests show that the instruments are valid and that there is no evidence of endogeneity.

Minimum wage increases might not affect overall employment, but might adversely affect the employment of more vulnerable groups (Stewart, 2002). We thus estimate Equation (3) for two such groups: teenagers (between 15 and 19 years of age), as it is usual in the US minimum wage literature (Brown, 1999), and low educated workers (those with 4 or less years of schooling). We use our three sets of political variables in turn and report the results in Tables 3 and 4. Our results are robust to this specification change and our main conclusion that the weak relationship between employment and the minimum wage is not driven by endogeneity is unchanged. The associated tests show that the instruments are valid and that there is no evidence of endogeneity. This indicates that the minimum wage does not adversely affect employment of teenagers or low educated workers in Brazil. These estimates are in line with evidence for US teenagers and for UK low wage workers, where no adverse effects on employment have been documented (Card and Krueger, 1995; Machin et al., 2003).

Firms might respond differently to a minimum wage increase depending on the level of inflation. In high inflation periods, firms may perceive the increase as temporary, anticipating the subsequent accommodating monetary policy and wage-price spiral. Hence they would not adjust employment to avoid adjustment costs (Cox and Oaxaca, 1981). Conversely, more adverse employment effects might be expected in low inflation periods. Thus, estimates for the full sample period might be diluting more adverse employment effects in low inflation periods. We thus estimate Equation (3) restricting our sample to the period after July of 1994, when inflation was brought under control. We use our three sets of political variables in turn and report the results in Tables 3 and 4. Our results are robust to this specification change and our main conclusion, that the weak relationship between employment and the minimum wage is not driven by endogeneity, is unaltered. The associated tests show that the instruments are valid and that there is no evidence of endogeneity. Note, however, that the low inflation period might not have been long enough or there might not have been enough variability in the data in that period to produce more precise estimates.

Nonetheless, our estimates are in line with previous results for Brazil (Lemos, 2004a). Neumark et al. (2004) also found little evidence of adverse employment effects in Brazil in a low inflation period.

One possible impact of the minimum wage is to change the composition of the formal-informal employment without changing overall employment. Aggregate estimates might be camouflaging a negative effect in the formal sector being offset by a positive effect in the informal sector. This is one of the major predictions of the standard Two Sector Model that we now test. We estimate Equation (3) restricting our sample in turn to the formal and informal sectors. For each sector, we use our three sets of political variables in turn and report the results in Tables 3 and 4. Our results are robust to this specification change and our main conclusion, that the weak relationship between employment and the minimum wage is not driven by endogeneity, is unchanged. Both the formal and informal sector estimates are insignificantly different from zero. The associated tests show that the instruments are valid and that there is no evidence of endogeneity. This is in line with previous evidence for Brazil. Lemos (2004b) found insignificant employment effects for both sectors in Brazil for high and low inflation periods. Neumark et al. (2004) estimated not always significant employment effects for the Brazilian formal sector in low inflation periods, where more adverse effects are expected. A possible explanation is that the predictions of the Two Sector Model follow from the assumption of non-coverage, however, the Brazilian informal sector suffers from non-compliance. For example, a minimum wage is still paid in the informal sector, but firms do not comply with other aspects of the labor contract, such as social security taxes, paid holidays, etc. (Amadeo and Camargo, 1997). Maloney and Mendez (2004) question the validity of the standard Two Sector Model to explain minimum wage employment effects in Latin America.

7 Conclusion

In this paper we have investigated the hypothesis that non-negative minimum wage employment effect might be upwardly biased estimates of an underlying negative effect. Such a bias might result from the simultaneous determination of employment and the minimum wage variable. We used a number of novel political variables as instruments to control for this source of endogeneity. The variation we exploited to define such instruments comes from personal characteristics of the politicians voting on minimum wage bills, their voting behavior and their electoral process. Our instruments are superior to those previously used in the literature, namely lagged minimum wage, in the presence of an unknown form of serial correlation in the errors or in the presence of a highly persistent minimum wage series. We demonstrated this was the case in Brazil. We then showed that our instruments have more exogenous variation and are more strongly correlated with the endogenous variables as well as that they are uncorrelated with the error term and its lags. Our results proved to be robust across a number of different instruments, different estimators and different specifications.

Our main conclusion is that the weak relationship between minimum wages and employment does not appear to be driven by endogeneity. The evidence here indicates that the minimum wage has no adverse effect on employment in Brazil between 1982 and 2000. This result is robust across a number of different specifications. Our main conclusion of no adverse employment effect was also maintained when we restricted our sample to vulnerable groups such as teenagers and the low educated. It was again maintained when we restricted our sample to low inflation periods, when more adverse employment effects were expected, and when we restricted our sample to the formal and informal sectors. The principal policy implication of this study is that the minimum wage does not hurt where it hurts most: causing disemployment.

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