DOUBLING THE MINIMUM WAGE AND ITS EFFECT ON LABOUR MARKET OUTCOMES: EVIDENCE FROM BRAZIL

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Abstract

Over the past decade, the real value of the minimum wage in Brazil has nearly doubled and, by international standards, the value of this minimum wage is set at a very high level in comparison to median wages. At the same time, there has been increased compliance with the minimum wage and informality has dropped. A growing proportion of workers in Brazil have therefore been covered by an increasingly "biting" national minimum wage, and the evidence presented in this paper suggests a significant impact of the minimum wage on the Brazilian earnings distribution. This paper is the first to assess the impact of this recent rise in the minimum wage on labour market outcomes, and thereby provides an important update of the research on minimum wages in Brazil, most of which uses data going back to the 1980s and 1990s. The results indicate that minimum wage increases in Brazil have had: no effect on employment; (possibly) a very small negative effect on hours worked; and a (very small) negative effect on formality – although this is somewhat larger in the case of youth and the low-skilled. Overall, the findings of this paper are therefore in line with a large and growing body of international evidence that suggests that minimum wages have only a marginal impact on employment outcomes. One caveat, however, is that it is still not possible to analyse the impact of minimum wages on rural labour markets in Brazil, and the results apply to large metropolitan areas only.

Introduction

The real value of the national minimum wage in Brazil nearly doubled between January 2003 and March 2014. This does not just reflect general wage growth in the economy. Indeed, over the same period, and in urban areas, the value of the minimum wage relative to median (average) wages rose by 26.5% (38.3%). In 2013, Brazil's minimum wage was equivalent to nearly 70% of the country's median wage – a ratio significantly higher than what is generally observed in OECD countries (49% on average in 2012). Brazil has therefore seen significant increases in a minimum wage which is set at a high level by international standards.

At the same time, compliance with the minimum wage has improved (the proportion of workers earning below the minimum wage has decreased slightly from 26.2% in 2001 to 20.7% in 2013) and formality[1] has increased (from 46.3% in 2001 to 60.5% in 2013). In other words: a growing proportion of workers in Brazil have been covered by an increasingly "biting" national minimum wage. This has been made possible by a combination of factors including: a relatively simple national minimum wage system; the pressure exerted by unions; as well as credible enforcement efforts by the government (Rani et al, 2013).

Despite such large increases in the minimum wage in Brazil, there has been virtually no research examining its impact on employment outcomes in recent years: nearly all existing evidence is based on data going back to the 1980s and 1990s. Given the size of recent increases in the minimum wage, this

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therefore appears to be a major gap in the literature. Moreover, as pointed out by OECD (2014), none or very little of this earlier research has focused on youth who, arguably, might be a group more likely to be affected by changes in the minimum wage.

A new look at the effect of minimum wages in Brazil should be of interest more generally as well. Indeed, while there is still no consensus in the international literature on the impact of minimum wages on employment[2] there may be relatively less disagreement among economists that large increases in an already high minimum wage would translate into reductions in employment, particularly amongst young and low-skilled workers. The analysis in this paper also contributes to a small but growing literature on the effect of minimum wages in emerging economies (see Broecke, Forti and Vandeweyer, forthcoming for a recent review): given large shares of informal employment and low compliance rates with the minimum wage, the effect of the latter on labour market outcomes might be expected to be different in such settings.

This paper uses Brazil's PME for the years 2003 to 2014 to investigate the impact of changes in the minimum wage on employment, hours worked, and the likelihood of working in a formal job. The paper also investigates heterogeneity in the effect of minimum wage increases by looking at important population sub-groups such as youth and the low-skilled. A range of different methodologies and minimum wage variables are used to test the robustness of the results to differences in specification.

The results indicate that, while minimum wage increases have had a significant effect on the earnings distribution in Brazil, they have had only a small impact on urban labour market outcomes. In the case of employment, the vast majority of estimates are statistically insignificant and, when significant, both positive and negative employment effects are detected. While one (out of 16) estimates for youth is marginally more negative, it appears safe to conclude that, overall, minimum wage rises in Brazil have had no significant impact on employment over the period 2003-2014. While most estimates for hours worked are also insignificant, those that are significant are all negative, but small (-2.3% for a doubling of the minimum wage in the case of youth). There is slightly more evidence of a (small) negative impact on formality, and also that these effects might be larger for youth and the low-skilled: in the case of youth (and in the preferred model based on individual fixed effects), doubling the minimum wage is associated with a 5.0% decrease in formality. While these results indicate that, overall, Brazil's recent increases in the minimum wage have had only a limited impact on the labour market, it is important to point out that these findings only apply to Brazil's six largest metropolitan areas. Data limitations still make it impossible to robustly estimate the impact of minimum wage changes in Brazil's rural areas, where they might be expected to have a greater impact.[3]

The remainder of this paper proceeds as follows. The next section describes the minimum wage system in Brazil and offers a brief review of the existing literature. The data used and some key descriptive statistics are then discussed, followed by the methodology and the results. Some concluding remarks are offered in the final section.

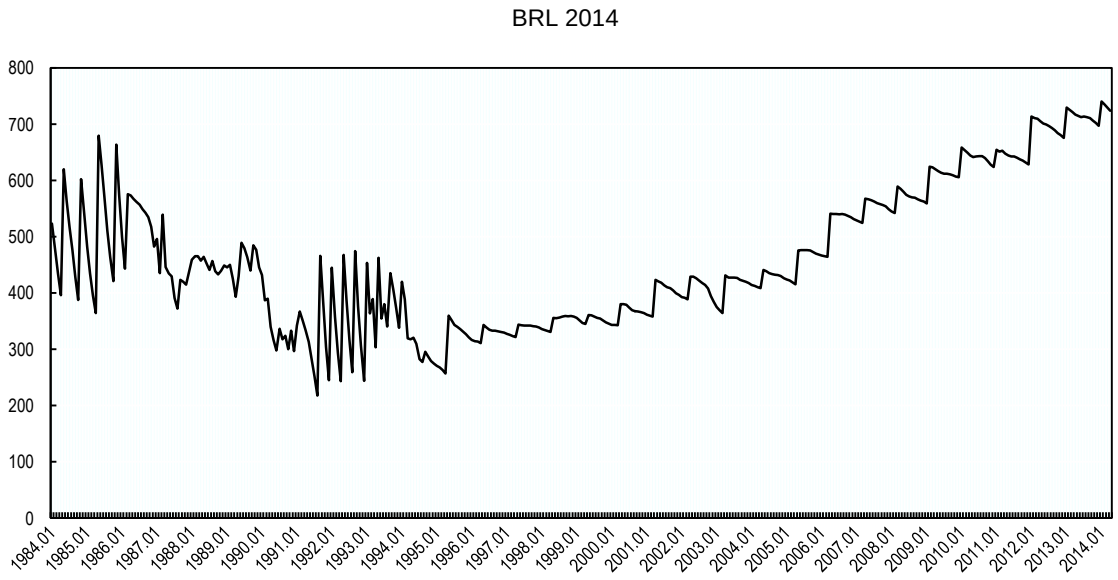
Minimum wages in Brazil, and their effect on labour market outcomes

Brazil has had a minimum wage since July 1940, which was included in the Consolidated Labour Code (*Consolidação das Leis do Trabalho* – CLT) in 1943 and, in 1963, extended to cover rural areas. Initially the minimum wage varied by state and sub-region, but it was turned into a single national minimum wage in 1984 (later consolidated by the 1988 Constitution). Since 2000, however, states have been allowed to set their own minimum wage again[4] as long as it is superior to the national minimum wage. Five states have introduced such wage floors, which vary also by occupational group: Rio de Janeiro in 2000; Rio Grande do Sul in 2001; Paraná in 2006; São Paulo in 2007 and Santa Catarina in 2009. Evidence suggests that compliance with these state minimum wages is extremely low and that they have

had no effect on labour market outcomes (Moura and Neri, 2008; Corseuil, Foguel and Hecksher, 2013).[5] There is no sub-minimum wage available for youth in Brazil.[6]

Figure 1 traces the evolution of the real minimum wage in Brazil since 1984 – the year in which a single national minimum wage was introduced. This unification of the minimum wage occurred at a time of economic crisis, followed by a decade-long period of high inflation which rapidly eroded any increases in the minimum wage that happened during those years. Only in 1994, five stabilisation plans later, did the government finally succeed in controlling inflation. By then, the real value of the minimum wage had fallen by 20%. Once inflation had been stabilised, the real minimum wage started rising again – however it was only in 2006 that the real minimum wage was back at its 1984 level. It was also in 2006, with the Lula government, that a new rule for determining annual increases in the minimum wage was introduced. From then on, the minimum wage would rise by inflation over the past year, plus average economic growth over the past two years – a rule which was renewed in 2011 and to last until 2015.

Figure 1. Evolution of the real minimum wage (1984-2014)



Source: Instituto de Pesquisa Econômica Aplicada (IPEA).

A number of studies have investigated the impact of the minimum wage on employment in Brazil, and these can essentially be divided into two waves: an earlier literature that tended to find small- to medium-sized negative effects of the minimum wage on employment, and a later series of studies carried out by Sara Lemos that found no, or negligible effects.

Amongst the earlier studies, Foguel (1998) exploits the convergence of minimum wages across the regions that took place from the late 1970s to the mid-1980s and, using a difference-in-differences model on data for Brazil's six largest metropolitan areas (PME), estimates that a 10% increase in the minimum wage leads to a 2.3% fall in the employment rate. Fajnzylber (2001) also uses the PME for the period 1982-1997 and, for low-wage, formal workers, finds an employment elasticity of -0.1 – with slightly larger effects for informal workers and youth. Another study that finds relatively small effects of the minimum wage in Brazil is Neumark, Cunningham and Siga (2006), who use the PME for the years 1996 to 2001. Their estimates suggest an employment elasticity of -0.07. Similar effects for Brazil are reported in a review by Carneiro (2001) of some of these early, but harder to obtain, publications. Overall, the estimates obtained for Brazil are in line with Brown (1999) who summarised the effects of minimum wages on

employment in the United States and found that a 10% increase in the minimum wage reduced employment by 1% to 3%. One exception in the case of Brazil is Carneiro and Corseuil (2001) who look at the period between 1982 and 1999 and also use a difference-in-differences model. They find much larger negative employment effects, ranging between -3% and -13% for a 10% increase in the minimum wage.

A slightly more recent wave of studies by Sara Lemos (2004, 2005, 2007, 2009a, 2009b) also uses the PME (mostly for the years 1982 to 2000, although one study uses data up to 2004) and finds essentially no employment effects of the minimum wage in Brazil over this period. Since the publication of these studies, and apart from a couple of papers investigating the effect of state wage floors (Moura and Neri, 2008; Corsueil, Foguel and Hecksher, 2013), there has been no research on the effect of the minimum wage on employment – despite this being the period in Brazil's history during which the real minimum wage increased the most. One exception is Jales (2014), who is unique in using PNAD data (2001-2009), and finds that unemployment is around 10%-22% higher in Brazil than it would have been in the absence of the minimum wage. While this seems large, it is difficult to directly compare these results with those obtained in the previous literature because of the very different methodology employed.

As pointed out by OECD (2014), none or very little of the minimum wage research in Brazil has paid attention to youth who, arguably, might be a group more likely to be affected by changes in the minimum wage. Foguel (1998) finds that the minimum wage has a slightly bigger effect on new entrants to the labour market, while Faynzylber (2001) finds mixed results by age depending on the sector and the part of the wage distribution looked at. At the bottom of the wage distribution (earning less than 1.1 minimum wages), formal salaried teenagers (aged 15-19) are more responsive to minimum wage increases than adults (20+), and the same is found for informal salaried teenagers earning less than 0.9 minimum wages. For the self-employed and those in the informal salaried sector earning around one minimum wage, however, the employment elasticities are larger for adults. Finally, Lemos (2007; 2009b) finds no employment effect for teenagers (aged 15-19).

The labour market can also adjust to changes in the minimum wage through adjustments in the number of hours worked. However, the direction of the impact is difficult to predict. On the one hand, employers may not dismiss workers, but could absorb the additional costs through reductions in the hours they expect their employees to work (in which case minimum wages would have a negative effect on hours worked). Alternatively, workers might be incentivised to work longer hours in response to higher minimum wages – either because it reduces the marginal value of leisure time, or to make up for possible employment losses amongst other household members as a result of the increase in the minimum wage. The relationship between minimum wages and hours worked has barely been investigated in the context of Brazil, and findings are contradictory: Lemos (2004, 2005) finds small negative effects, while Lemos (2009) finds no effect at all, and Neumark, Cunningham and Siga (2006) find some weak positive effects.

In the context of an emerging economy, it is also of interest to estimate the effect that minimum wages might have on informality. Traditional models predict that increases in the minimum wage would result in negative employment effects in the formal sector, in conjunction with positive employment effects in the informal sector (Mincer, 1976; Welch, 1976) – i.e. higher minimum wages raise the level of informality. This is because increases in the price of formal sector workers lead to employment losses in the formal sector, and these displaced workers are subsequently forced to find work in the informal sector, and at a lower wage rate. While Carneiro and Corseuil (2001) confirm that increases in the value of the official minimum wage tend to decrease formal employment and increase informal employment, most other studies in Brazil find either no, or marginally positive, effects of minimum wages on informal employment. Lemos (2009a) finds no proof of employment effects in either formal or informal sectors, while Lemos (2009b) finds some evidence that increases in the minimum wage in fact decrease, rather than increase, employment of informal workers. Similarly, Fajnzylber (2001) finds larger negative employment effects in the informal sector (meaning that informality has a tendency to fall as minimum wages increase)

and Foguel (1998) finds a positive effect of minimum wages on formality, with a 10% increase in the minimum wage leading to a 1.1% increase in formal employment.

These positive effects of minimum wages on the share of formal employment may be somewhat surprising – but are not unusual in the literature on minimum wages in emerging economies (Broecke, Forti and Vandeweyer, forthcoming).[7] A number of theories have been put forward in the literature to try and explain this. One of these argues that a supply effect is at play: as the minimum wage rises, the formal sector gains in attractiveness and informal workers choose to migrate to the formal sector (Fajnzylber, 2001). According to another theory, intra-household substitution effects are the explanation: when the minimum wage increases, household income rises and some household members can therefore afford to withdraw from the labour market (Fajnzylber, 2001). Yet a third line of thought takes a more macro approach, and argues that increases in the minimum wage, through their effects on consumption and aggregate demand, raise the number of (formal) jobs in the economy (Magruder, 2013). A final consideration in this puzzle is that, in Brazil, there is evidence of compliance with the minimum wage even in the informal sector (Souza and Baltar, 1979; Neri, Gonzaga and Camargo, 2001; van Klaveren et al, 2009) – which is a phenomenon more widely observed in Latin American countries (Maloney and Mendez, 2004). Increases in the minimum wage by themselves would therefore not be a sufficient reason to migrate from one sector to another.

Data and summary statistics

The analysis in this paper draws primarily on the PME, Brazil's monthly labour force survey covering the six large metropolitan areas of São Paulo, Recife, Rio de Janeiro, Belo Horizonte, Salvador and Porto Alegre. The PME is a longitudinal survey and has a structure similar to that of the United States' Current Population Survey: individuals are interviewed for four consecutive months, then leave the sample for a period of eight months, after which they return to the survey for another four months. The PME therefore traces each individual over a period of 16 months, with eight monthly observations per person. In this paper, data from January 2003 to March 2014 is used.

Table 1 provides some key summary statistics based on the PME data and shows that there have been some significant improvements in Brazil's urban labour market over the 10-year period under study. The employment rate increased from 59.5% to 65.6%, while unemployment more than halved from 12.5% to 5.5%. In addition, the share of formal employment rose from 60.8% to 73.5%. As indicated previously, the minimum wage grew more than average and median wages over this period, as reflected in the rising Kaitz indices: in 2003, the minimum wage was worth 46.8% of urban median wages, while by 2013 this had increased to 59.2%. At the same time, overall compliance with the minimum wage increased, as evidenced by the slight drop in the proportion earning below the minimum wage from 9.3% to 7.9% while, simultaneously, the fraction earning at the minimum wage increased from 7.8% to 8.7%.

However, labour market outcomes are significantly poorer for young people (aged 15 to 24) and the low-skilled (those with primary education or less) and minimum wages are significantly higher in comparison to median wages for these groups (83.2% for all youth and 97.9% for low-skilled youth). Perhaps unsurprisingly, the incidence of low pay is also much higher amongst these workers: in the case of low-skilled youth, 27.7% report wages below the minimum wage and 21.2% earn at the minimum wage. While the proportion of youth earning below the minimum wage has fallen slightly over the period under study, the proportion of low-skilled youth earning below the minimum wage has increased between 2003 and 2013. That said, the share of low-skilled workers in the total metropolitan working age population has dropped considerably from 56% in 2003 to 39% in 2013. The proportion of workers earning at the minimum wage has increased across all population sub-groups.

While the analysis presented in this paper will be based on the PME data (in line with virtually all previous minimum wage research in Brazil), it is important to emphasise that these data only cover Brazil's six largest metropolitan areas (representing less than a quarter of the total Brazilian population in 2013). While the annual nature of the PNAD makes it unsuitable to analyse the effect of minimum wage changes on employment, it is nevertheless important to highlight that urban labour markets (as described in Table 1 above) have not necessarily behaved in the same as the national labour market in recent years. In particular, they have been improving much faster than the national labour market.

Table 1. Summary statistics PME data (annual averages, 2003-2013)

	All (15-64)		Youth (15-24)		Low-skilled		Low-skilled youth	
	2003	2013	2003	2013	2003	2013	2003	2013
Employment	0.595	0.656	0.429	0.453	0.514	0.523	0.312	0.252
Unemployment	0.125	0.055	0.253	0.140	0.138	0.058	0.295	0.192
Formal	0.608	0.735	0.546	0.717	0.481	0.582	0.385	0.524
Kaitz index (average)	0.264	0.365	0.517	0.677	0.502	0.639	0.739	0.909
Kaitz index (median)	0.468	0.592	0.646	0.832	0.638	0.791	0.841	0.979
Below minimum wage	0.093	0.079	0.144	0.129	0.150	0.152	0.251	0.277
At minimum wage	0.078	0.087	0.123	0.164	0.114	0.132	0.171	0.212
Population (in 1000 persons)	30 317	34 238	8 164	7 308	17 000	13 401	4 671	3 385

Source: Authors' calculations based on PME 2003 and 2013.

To show this, Table 2 reproduces the descriptive statistics from Table 1 using the PNAD data.[8] While employment rates at the national level have been higher than in Brazil's six largest metropolitan areas throughout the period, they have been improving much faster in the latter. Similarly, unemployment rates, while higher in urban areas at the beginning of the period, have been falling much faster than at the national level, and were lower in the large urban areas by the end of the period. One exception is formal employment, which grew faster at the national level – although informality was less common in the large metropolitan areas throughout the period. The Kaitz indices also indicate that minimum wages in Brazil are far more biting than the PME data for large metropolitan areas would suggest: in 2013, Brazil's minimum wage was equivalent to 69.2% of national median wages. For low-skilled youth the Kaitz index even equals 1 (i.e. the minimum wage is as high as the median wage for this group). In rural areas (covering around 13.5% of the Brazilian population), the Kaitz index (median) is as high as 1.51 – although this ratio has been falling over time, suggesting that rural wages have risen faster than urban wages. Finally, compliance with minimum wage laws is much lower outside the metropolitan areas covered by the PME, with 20.7% of the working age population reporting wages below the minimum wage (57.1% when focusing on rural areas only). Compliance is on the rise, however, albeit only slowly amongst the low-skilled (youth). As in urban areas, the low-skilled population is shrinking rapidly, from almost 70% of the total working age population in 2001, to 49% by 2013.

Table 2. Summary statistics PNAD data (2001-2013)

	All (15-64)		Youth (15-24)		Low-skilled		Low-skilled youth		Rural	
	2001	2013	2001	2013	2001	2013	2001	2013	2001	2013
Employment	0.645	0.669	0.513	0.490	0.605	0.584	0.466	0.354	0.760	0.688
Unemployment	0.096	0.066	0.178	0.149	0.099	0.067	0.184	0.178	0.028	0.034
Formal	0.463	0.605	0.383	0.555	0.344	0.434	0.262	0.347	0.161	0.284
Kaitz index (average)	0.344	0.446	0.714	0.802	0.601	0.761	1.021	1.162	1.022	1.038
Kaitz index (median)	0.632	0.692	0.947	0.904	0.900	0.969	1.125	1.000	1.800	1.507
Below minimum wage	0.262	0.207	0.379	0.284	0.360	0.353	0.506	0.494	0.631	0.571
At minimum wage	0.087	0.113	0.117	0.157	0.105	0.134	0.125	0.148	0.079	0.106

Population (in 1000 persons)	107 228	128 495	31 952	30 417	74 308	63 068	22 814	15 788	16 685	17 414

Source: Authors' calculations based on PNAD 2001-2013.

Methodology

To estimate the effect of minimum wage increases on employment, a range of methodologies as well as minimum wage variables will be used.[9] This is primarily to test the robustness of the results to changes in specification, as there are indications from the literature that methodology might matter to both the direction and significance of the coefficient (Chletsos and Giotis, 2015).

Regional models

In the first method, the data is collapsed at the regional level to form a panel containing information on how employment rates, hours worked and formality, as well as a number of explanatory variables, change over time at the regional level. A standard specification (Neumark and Wascher, 1992) is estimated:

$$lnY_{jt} = \beta_0 + \beta_1 lnMW_{jt} + \beta_2 Z_{jt} + \gamma_t + \delta_j + t * \delta_j + \varepsilon_{jt} \quad (1)$$

Where Y_{jt} is the labour market outcome of interest in region *j* at time *t*. The labour market outcomes considered are (i) the employment rate (the number of persons employed over the total labour force); (ii) average hours worked; and (iii) formality (share of workers employed formally). Both the dependent variable and the minimum wage are expressed in logarithms, allowing the estimated coefficient β_1 to be interpreted as an elasticity. Equation (1) further includes region (δ_j) and time (γ_t) fixed effects,[10] as well as region-specific time trends ($t_* \delta_j$).[11] A set of labour supply shifters Z_{jt} are also added: the share of people studying, the share of illiterate people, the share of women, the share of workers with multiple jobs, the share of people with only primary education, the share of people with secondary education, the share of people with tertiary education, and five age groups (less than 10, 10 to 14, 15 to 24, 15 to 64, and 65 and more).[12,13]

Individual models, with and without individual fixed effects

Using the PME, the previous analysis can also be run at the individual level. The model then becomes:

$$Y_{ijt} = \beta_0 + \beta_1 lnMW_{jt} + \beta_2 X_{ijt} + \beta_3 Z_{jt} + \gamma_t + \delta_j + t * \delta_j + \varepsilon_{jt} \quad (2)$$

Where the labour market outcomes Y_{ijt} are now defined for individual *i* in region *j* at time *t*. Employment becomes a binary variable that takes the value of one for employed, and zero for unemployed and inactive individuals; and formality is a binary variable that equals one for people in formal employment and zero for those in informal employment.[14] The binary nature of the employment and informality variables means that they can no longer be expressed in log format, and so the results can no longer be interpreted as elasticities (except in the case of hours worked). The set of city-level supply shifters, Z_{jt}, is the same as in the regional analysis and, as before, region (δ_j) and time (γ_t) dummies as well as a region-specific time trend are included. A vector of individual control variables X_{ijt} is also added to the model, consisting of household size, educational attainment dummies (primary, secondary, tertiary), sex, average age[15] and dummies for ethnicity. The model is run with and without individual fixed effects. When individual fixed effects are included, the non-varying individual characteristics (average age, sex, ethnicity, regional dummies) drop out of the analysis.

Minimum wage variables

Four different minimum wage variables (MW_{jt}) will be used: the real minimum wage; the minimum wage relative to the average wage (Kaitz average); the minimum wage relative to the median wage (Kaitz median); and the fraction of the population at the minimum wage (fraction at).[16] The Kaitz indices have the advantage over the real minimum wage that they take into account how the latter has evolved in relation to median/average wages. Indeed, if the minimum wage just moved in line with average and/or median wages, then one would not expect to see much of an impact on employment. Since median and average wages have evolved differently in Brazil (and give different results), both variables are used in the analysis that follows. The Kaitz indices are both calculated at the regional level taking regional average/median wages into account. 'Fraction at' is an interesting additional variable to explore because it gives a sense of how effective an increase in the minimum wage is.

While these (and other) minimum wage variables have been used in the literature, it is important to stress that they all measure slightly different effects, and that therefore the size of the coefficients are not directly comparable. A 10% increase in the real minimum wage is not the same as a 10% increase in the minimum wage relative to median earnings, which is not the same as a 10% increase in the fraction earning the minimum wage. Equally, different variables will measure employment effects for slightly different groups. This is important to bear in mind when interpreting the size of the coefficients in the analysis that follows.

The minimum wage data used in the analysis is deflated using the *Índice Nacional de Preços ao Consumidor* (INPC) [National Consumer Price Index] time series from the *Instituto Brasileiro de Geografia e Estatística* [National Institute of Geography and Statistics]. This index is calculated separately for each of the six large metropolitan areas, and therefore the real minimum wage variable used throughout this paper also varies at the regional level.

Results

In this section, the methodologies described in the previous section are used to estimate the impact of minimum wages on employment, average hours worked and informality, respectively. In a first instance, however, the extent of the impact of minimum wage changes on the distribution of earnings is analysed to demonstrate that the minimum wage does, indeed, have a significant impact on earnings, particularly (but not only) at the bottom of the earnings distribution.

Earnings distribution

To quantify the impact of minimum wages on the distribution of earnings, regional-level models of the type captured by equation (2) are run using the PME data. However, instead of just collapsing the individual data into city-level variables, earnings decile cells are added as well (i.e. the panel now contains information on each income decile in each city for every month of the period covered by the dataset). As the minimum wage variable, the logarithm of the nominal minimum wage is used, while the consumer price index is added as an additional explanatory variable.[17] The dependent variable is the log of usual earnings from employment (trimmed at the top and bottom percentiles). As in the other geographical models, city and year fixed effects are included, as well as city-specific time trends.

The results in Table 3 show that, as expected, the minimum wage has a significant impact at the bottom of the earnings distribution. In earnings decile 2, for example, where nearly one third of workers earn the minimum wage, a 10% increase in the nominal minimum wage will lead to a 4.2% increase in usual earnings from employment. This impact decreases as one moves up the earnings distribution (and fewer workers earn the minimum wage). Interestingly, the minimum wage appears to have an impact on

workers' wages quite high up the earnings distribution. For example, in decile 6, where no workers earn at the minimum wage, a 10% increase in the minimum wage is still associated with a 1% increase in usual earnings. This is consistent with other findings in the Brazilian minimum wage literature that show that the minimum wage is still used as a benchmark for adjusting wages higher up (Maloney and Mendez, 2004; Van Klaveren et al, 2009). A final remark in relation to Table 3 is that, as expected, the minimum wage has the greatest impact on those earnings deciles containing the largest fractions of youth and low-skilled. One would therefore expect the labour market outcomes of these sub-groups to be most affected by minimum wage changes.

Table 3. Regression results: earnings per decile

Earnings decile	Coefficient	SE	Fraction earning MW	Fraction youth	Fraction low-skilled	Fraction low-skilled youth
1 (lowest)	0.209*	(0.088)	0.295	0.280	0.665	0.157
2	0.421***	(0.048)	0.302	0.286	0.578	0.112
3	0.341***	(0.045)	0.160	0.262	0.511	0.081
4	0.115**	(0.036)	0.084	0.229	0.464	0.058
5	0.060	(0.036)	0.001	0.190	0.424	0.039
6	0.094**	(0.036)	0	0.150	0.384	0.024
7	0.024	(0.039)	0	0.116	0.323	0.014
8	-0.047	(0.044)	0	0.084	0.236	0.006
9	0.011	(0.057)	0	0.051	0.137	0.002
10 (highest)	-0.087	(0.057)	0	0.019	0.050	0.001

Notes: Each regression is based on 810 observations.
Source: Authors' calculations based on PME 2003-2014. ***Significant at the 1% level, **Significant at the 5% level, *Significant at the 10% level

Employment

The results in Table 4 show that the effect of minimum wages on employment outcomes is mostly insignificant and that, when significant, the direction of the impact is ambiguous: three coefficients are negative and four are positive (out of a total of 48 estimates). Looking at the overall working population (i.e. all ages), the effects are also very small, ranging from a 3.1% fall to a 2.1%[18] increase for a doubling of the real minimum wage/median Kaitz index, respectively. In the case of youth, only one coefficient (out of 12) is statistically significant and indicates a 7.8% fall in employment for a doubling of the minimum wage – i.e. a slightly larger fall, although still relative small. In the case of the low-skilled, the only two statistically significant coefficients are both positive and, in the preferred models based on individual fixed effects), there is no indication at all of a negative effect of minimum wage increases on employment. Overall, therefore, it appears relatively safe to conclude that increases in the minimum wage in Brazil over the period 2003-2014 have had no significant effect on employment.

Table 4. Regression results: employment

		Regional	Individual OLS	Individual FE
All	Real minimum wage	-0.022*	-0.019*	0.002
		(0.007)	(0.008)	(0.005)
	Kaitz index (average)	0.013	0.006	0.007
		(0.010)	(0.007)	(0.004)
	Kaitz index (median)	0.015	0.013*	0.012**
		(0.015)	(0.005)	(0.004)

	Fraction at	0.001	0.001	0.001
		(0.001)	(0.001)	(0.000)
	Observations	810	*8 313 094*	*8 313 095*
Youth	Real minimum wage	-0.055	-0.035*	-0.014
		(0.036)	(0.015)	(0.012)
	Kaitz index (average)	-0.011	-0.013	-0.013
		(0.036)	(0.012)	(0.010)
	Kaitz index (median)	0.013	-0.003	-0.001
		(0.049)	(0.010)	(0.009)
	Fraction at	0.002	0.001	0.000
		(0.004)	(0.001)	(0.001)
	Observations	810	*2 052 096*	2 052 096
Low-skilled	Real minimum wage	-0.013	-0.012	-0.002
		(0.015)	(0.012)	(0.007)
	Kaitz index (average)	0.047	0.017	0.006
		(0.020)	(0.010)	(0.006)
	Kaitz index (median)	0.025	0.020**	0.013*
		(0.017)	(0.008)	(0.006)
	Fraction at	-0.001	0.000	0.000
		(0.003)	(0.001)	(0.001)
	Observations	810	*4 008 592*	4 008 593
Low-skilled youth	Real minimum wage	-0.049	-0.017	-0.009
		(0.093)	(0.018)	(0.016)
	Kaitz index (average)	-0.015	-0.012	-0.012
		(0.087)	(0.015)	(0.013)
	Kaitz index (median)	0.018	0.010	0.015
		(0.069)	(0.013)	(0.012)
	Fraction at	-0.007	-0.001	-0.001
		(0.009)	(0.002)	(0.001)
	Observations	810	*1 069 176*	1 069 176

Notes: Robust standard errors clustered at the regional/individual level are included in parentheses. Survey weights are used in all regressions. ***Significant at the 0.1% level, **Significant at the 1% level, *Significant at the 5% level.
Source: Authors' calculations based on PME 2003-2014.

Hours

The impact on employment following an increase in the minimum wage might be felt at the intensive (hours worked) rather than at the extensive margin (number of jobs). Repeating the analysis for hours worked (Table 5) shows that, once again, most results are statistically insignificant. However, when significant, they are all now negative. That said, the size of the effect is very small, with a doubling of the minimum wage leading to a 2.3% reduction in hours worked at most (in the case of youth). Again, in the preferred models using individual fixed effects, there is no indication at all that increases in the minimum wage might have an impact on hours worked.

Table 5. Regression results: hours worked

		Regional	Individual OLS	Individual FE
All	Real minimum wage	-0.018***	-0.019**	0.001
		(0.002)	(0.006)	(0.005)
	Kaitz index (average)	-0.020*	-0.012*	0.002
		(0.007)	(0.005)	(0.004)
	Kaitz index (median)	-0.010	-0.012**	0.000
		(0.007)	(0.004)	(0.004)
	Fraction at	-0.001	0.000	0.000
		(0.000)	(0.001)	(0.000)
	Observations	*810*	*5 149 664*	*5 149 665*
Youth	Real minimum wage	-0.023*	-0.026	-0.001
		(0.009)	(0.015)	(0.013)
	Kaitz index (average)	-0.006	-0.002	0.012
		(0.012)	(0.012)	(0.011)
	Kaitz index (median)	-0.007	-0.012	0.002

		(0.010)	(0.011)	(0.010)
	Fraction at	-0.001	0.001	0.000
		(0.001)	(0.001)	(0.001)
	Observations	*810*	*897 612*	*897 612*
Low-skilled	Real minimum wage	-0.013	-0.016	0.005
		(0.006)	(0.011)	(0.009)
	Kaitz index (average)	-0.022	-0.015	0.003
		(0.011)	(0.009)	(0.008)
	Kaitz index (median)	-0.010	-0.015*	-0.003
		(0.010)	(0.007)	(0.006)
	Fraction at	-0.002**	-0.001	0.000
		(0.000)	(0.001)	(0.001)
	Observations	*810*	*2 061 035*	*2 061 036*
Low-skilled youth	Real minimum wage	-0.027	-0.040	-0.017
		(0.020)	(0.029)	(0.027)
	Kaitz index (average)	-0.006	-0.012	-0.004
		(0.030)	(0.024)	(0.024)
	Kaitz index (median)	0.001	-0.021	-0.011
		(0.025)	(0.020)	(0.021)
	Fraction at	-0.001	0.004	-0.003
		(0.001)	(0.002)	(0.002)
	Observations	*810*	*303 343*	*303 343*

Notes: Robust standard errors clustered at the regional/individual level are included in parentheses. Survey weights are used in all regressions. ***Significant at the 0.1% level, **Significant at the 1% level, *Significant at the 5% level.
Source: Authors' calculations based on PME 2003-2014.

Formality

Another possible adjustment mechanism for the labour market following an increase in the minimum wage is through its impact on formality. As mentioned in the literature review, traditional models predict that increases in the minimum wage would reduce employment in the formal sector while increasing it in the informal one. The models are therefore re-run with formality as the dependent variable, with the results presented in Table 6. A larger number of statistically significant effects are now obtained (16 out of 48), and they are all negative – suggesting that minimum wage increases in Brazil may have had a detrimental effect on formality over the period 2003-2014. In the case of the low-skilled (where 7 out of 12 estimates are statistically significant and negative), the effects are relatively large, implying a 16% fall in formality following a doubling of the minimum wage. When individual fixed effects are introduced, however, only the coefficients associated with the median Kaitz index for low-skilled workers and the total population remain significant and they are smaller in size: doubling the minimum wage is associated with only a 2.5 percentage points drop in formality for low-skilled workers, which is equivalent to a 5.0% drop given a baseline formality rate of 51%.

Table 6. Regression results: formality

		Regional	Individual OLS	Individual FE
All	Real minimum wage	-0.064*	-0.035***	0.012
		(0.023)	(0.010)	(0.007)
	Kaitz index (average)	-0.089**	-0.046***	0.007
		(0.015)	(0.008)	(0.006)
	Kaitz index (median)	-0.057*	-0.040***	-0.011*
		(0.019)	(0.007)	(0.005)
	Fraction at	0.000	0.001	0.000
		(0.001)	(0.001)	(0.001)
	Observations	*810*	*5 149 664*	*5 149 665*
Youth	Real minimum wage	-0.016	-0.016	0.031
		(0.033)	(0.023)	(0.019)
	Kaitz index (average)	-0.054	-0.038*	0.023
		(0.034)	(0.019)	(0.016)
	Kaitz index (median)	-0.042	-0.031*	0.011
		(0.023)	(0.015)	(0.014)

	Fraction at	0.002	0.002	0.001
		(0.002)	(0.002)	(0.001)
	Observations	*810*	*897 612*	*897 612*
Low-skilled	Real minimum wage	-0.133*	-0.056**	-0.010
		(0.040)	(0.017)	(0.011)
	Kaitz index (average)	-0.160*	-0.069***	-0.012
		(0.043)	(0.014)	(0.009)
	Kaitz index (median)	-0.107*	-0.054***	-0.025**
		(0.031)	(0.011)	(0.008)
	Fraction at	0.002	0.001	0.000
		(0.002)	(0.001)	(0.001)
	Observations	*810*	*2 061 035*	*2 061 036*
Low-skilled youth	Real minimum wage	-0.003	-0.025	-0.011
		(0.074)	(0.039)	(0.035)
	Kaitz index (average)	-0.011	-0.031	0.002
		(0.111)	(0.032)	(0.030)
	Kaitz index (median)	0.017	-0.019	-0.008
		(0.061)	(0.027)	(0.027)
	Fraction at	-0.001	0.004	0.004
		(0.004)	(0.003)	(0.003)
	Observations	*810*	*303 343*	*303 343*

Notes: Robust standard errors clustered at the regional/ individual level are included in parentheses. Survey weights are used in all regressions. ***Significant at the 0.1% level, **Significant at the 1% level, *Significant at the 5% level.
Source: Authors' calculations based on PME 2003-2014.

Robustness checks

While individual-level models with individual and time fixed effects may be able to handle much of the unobserved heterogeneity that could bias the results, they cannot deal with the issue of endogeneity. Indeed, since decisions to increase the minimum wage are frequently based on the current state of the economy/labour market, there might be some degree of reverse causality (i.e. minimum wages rise because employment outcomes have been improving). As a result, it is perhaps not surprising that increases in the minimum wage are not associated with significant reductions in employment. To address this issue, the minimum wage variable in equations (1) and (2) is instrumented with its previous value, which should be less related to current labour market outcomes.[19] The results (summarised in panel A of Table 7) do not change the story obtained previously for employment and hours worked. In the case of formality, however, some statistically significant and positive effects are not obtained - which seems strange given that it is unlikely that reverse causality would be present in the case of the formality regressions.

In a second robustness check, the lag of the minimum wage variable[20] is included to allow for possible delays in labour market effects of raising the minimum wage. However, because minimum wage increases in Brazil over the period under study have been relatively predictable (both in terms of their timing as well as in terms of their size), it is unlikely that firms would have needed long adjustment times following minimum wage changes. The results, presented in panel B of Table 7, do not significantly alter the conclusions of this paper regarding the effect of minimum wages on employment and hours worked. Once again, in the case of formality, a couple of positive results that are statistically significant are now obtained.

Table 7. Regression results: Robustness checks (real minimum wage)

		Employment			Hours			Formality		
		Regional	Individual OLS	Individual FE	Regional	Individual OLS	Individual FE	Regional	Individual OLS	Individual FE
Panel A: IV										
All		0.013	0.005	0.016**	-0.016**	-0.018***	0.001	-.032*	-0.012	0.035***
		(0.015)	(0.011)	(0.007)	(0.008)	(0.006)	(0.006)	(0.019)	(0.010)	(0.009)
		810	*8313094*	*8198933*	*810*	*5149664*	*5009307*	*810*	*5149664*	*5009307*
Youth		0.007	-0.017	-0.002	-0.019	-0.026	0.019	-0.016	-0.012	0.052**
		(0.045)	(0.020)	(0.016)	(0.013)	(0.016)	(0.015)	(0.039)	(0.024)	(0.023)
		810	*2052096*	*2003537*	*810*	*897612*	*847039*	*810*	*897612*	*847039*
Low-skilled		0.053**	0.031*	0.017*	0.001	-0.008	0.004	-0.057	-0.025	0.031**
		(0.026)	(0.017)	(0.010)	(0.011)	(0.011)	(0.011)	(0.036)	(0.017)	(0.014)
		810	*4008592*	*3893049*	*810*	*2061035*	*1953073*	*810*	*2061035*	*1953073*
Low-skilled		0.068	0.017	0.028	-0.021	-0.058*	-0.011	.159*	-0.012	0.016
youth		(0.082)	(0.026)	(0.020)	(0.026)	(0.033)	(0.031)	(0.094)	(0.043)	(0.041)
		810	*1069176*	*1024373*	*810*	*303343*	*268265*	*810*	*303343*	*268265*
Panel B: Lagged MW										
All	MW	-0.020	-0.016*	0.000	-0.015***	-0.018***	0.003	-0.029	-0.018*	0.017**
		(0.014)	(0.008)	(0.006)	(0.003)	(0.007)	(0.006)	(0.028)	(0.010)	(0.008)
	Lag MW	-0.005	-0.008	-0.003	-0.008	-0.009	-0.004	-.046**	-0.020**	-0.012
		(0.020)	(0.008)	(0.005)	(0.006)	(0.007)	(0.006)	(0.017)	(0.010)	(0.007)
		804	*6783264*	*6783264*	*804*	*4228616*	*4228616*	*804*	*4228616*	*4228616*
Youth	MW	-0.047	-0.026*	-0.013	-0.008	-0.029*	0.008	-0.014	-0.013	0.037*
		(0.052)	(0.016)	(0.014)	(0.008)	(0.017)	(0.015)	(0.015)	(0.025)	(0.022)
	Lag MW	-0.003	-0.004	-0.004	-0.028**	-0.002	-0.007	0.022	0.016	0.000
		(0.034)	(0.016)	(0.013)	(0.011)	(0.016)	(0.015)	(0.040)	(0.024)	(0.021)
		804	*1621038*	*1621038*	*804*	*719301*	*719301*	*804*	*719301*	*719301*
Low-skilled	MW	-0.016	-0.006	-0.005	-0.006	-0.006	0.009	-0.072	-0.039**	-0.006
		(0.026)	(0.012)	(0.008)	(0.005)	(0.012)	(0.010)	(0.044)	(0.018)	(0.012)
	Lag MW	0.007	-0.010	0.001	-0.014	-0.025**	-0.008	-0.077***	-0.025	-0.020
		(0.022)	(0.012)	(0.008)	(0.008)	(0.011)	(0.010)	(0.018)	(0.017)	(0.012)
		804	*3255552*	*3255552*	*804*	*1693144*	*1693144*	*804*	*1693144*	*1693144*
Low-skilled	MW	-0.027	0.008	-0.009	-0.006	-0.055*	0.005	0.129*	0.040	-0.005
youth		(0.112)	(0.020)	(0.018)	(0.019)	(0.033)	(0.033)	(0.051)	(0.043)	(0.041)
	Lag MW	-0.062**	-0.022	-0.005	-0.036*	-0.004	0.003	-0.152**	-0.045	-0.052
		(0.022)	(0.020	(0.017)	(0.014)	(0.032)	(0.033)	(0.052)	(0.042)	(0.040)
		804	*827789*	*827789*	*804*	*238249*	*238249*	*804*	*238249*	*238249*

Notes: Robust standard errors clustered at the regional/ individual level are included in parentheses (not clustered for IV). Survey weights are used in all regressions.
***Significant at the 0.1% level, **Significant at the 1% level, *Significant at the 5% level.
Source: Authors' calculations based on PME 2003-2014.

Conclusion

This paper has provided an important update of the research on minimum wages in Brazil: despite continued and very large increases in minimum wages over the past decade or so, no research had been carried out to estimate the possible effect of this on labour market outcomes. In addition, the present study attempted to evaluate the impact of increases in the minimum wages on youth and the low-skilled – two groups that have largely been ignored in the previous body of literature.

Employing a variety of methodologies and minimum wage variables, the paper found very little evidence of any impact of the minimum wage on labour market outcomes in Brazil. There appears to be little effect on either employment or hours worked and, while there might be a negative effect on formality, it is again relatively small. While there is some indication that the effects may be more negative for youth and the low-skilled (particularly in the case of formality), the overall effects remain small. Overall, therefore, the findings of this paper are in line with a large and growing body of international evidence that suggests that minimum wages have little noticeable impact on employment outcomes.

However, one important caveat is that the conclusions of this paper, like those of all the other literature on minimum wages in Brazil, are restricted to large, metropolitan areas only. As the descriptive statistics have shown, these urban labour markets have been performing very strongly in recent years, and certainly much stronger than in rural areas. While attempts were also made to estimate the effect of minimum wages in rural areas using the PNAD, the data were found to be inadequate and the results suspicious (and therefore not included in the present study). Unfortunately, this means that a key question in labour market policy in Brazil can still not be answered: whether or not high minimum wages might have a negative impact on the labour market outcome of the majority of workers who live in rural areas/smaller towns and, in particular, on those amongst them that are the youngest and the least skilled. This is therefore a key question for future research and, with the PNAD recently having been turned into a quarterly survey, it looks like the answer might not be too far away.

The paper has highlighted an additional, and related, concern. Despite country-wide progress in the proportion of workers earning at or above the minimum wage, compliance has been stagnant for the low-skilled and has been falling for low-skilled youth. Indeed, the scale of the problem (one in two working low-skilled youths earning less than the minimum wage) merits urgent policy and research attention. The issue is clearly closely related to the challenge of informality (two thirds of low-skilled youths who work do so in the informal sector). While inspections and sanctions may partly help address this issue, it is very possible that non-compliance with the minimum wage for these groups is an issue closely related to the level at which the minimum wage is set. Once again, this highlights the importance of closely monitoring the PNAD *contínua* data in the coming years.

A final comment relates to the general labour market conditions against which the Brazilian minimum wage has been increased. Indeed, as shown by the descriptive statistics presented in the paper, the employment/unemployment rate has increased/decreased significantly over the period under study. While this may point to yet another caveat to the conclusions presented in this paper, it also contains an important policy message for other emerging economies concerned with income inequality: during times of strong economic growth, minimum wages may play an important redistributive role in ensuring that the spoils of growth are more equally shared, with little or no adverse impact on overall employment.[21]

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[1] Formal employment as defined in this paper includes salaried private sector workers and domestic workers with a signed worker's card, public servants and armed forces, and independent workers and employers who contribute to the social security system. Informal employment consists of private sector workers and domestic workers without signed worker's card, independent workers and employers who do not contribute to social security, unpaid workers and workers producing goods for personal consumption (Berg, 2011). This is in accordance with the ILO (2003) definition of informal employment.

[2] For the recent debate in the United States, for example, see Dube, Lester and Reich (2010), Allegretto, Dube and Reich (2011), Allegretto et al (2014), and Neumark, Salas and Wascher, (forthcoming).

[3] Attempts were made to use Brazil's household survey - *Pesquisa Nacional por Amostra de Domicílios* (PNAD) – to estimate the effect of minimum wage changes on the labour market. However, due to the yearly nature of the data, it makes it very difficult to pick up subtle changes in employment as a result of minimum wage changes from all else that is going on. The results indicated very large positive effects of the minimum wage on employment, and these were therefore judged to be too unreliable to be included in the present paper. However, these results are available upon request.

[4] Technically, the term "minimum wage" in Brazil is reserved for the national minimum wage, and state minimum wages should be referred to as "wage floors" (*piso salarial*).

[5] In practice, it is very difficult to estimate the effect of state wage floors on employment outcomes in Brazil due to the fact that the professional categories to which the state wage floors apply cannot be easily mapped to the standard occupational classification used in Brazil's main surveys (PME and PNAD). For this reason, no attempt is made at estimating the separate effect of these state wage floors in the present paper.

[6] For some workers, accommodation and food costs can be deducted from their wages, resulting in below minimum wage pay (Lemos, 2009b)

[7] In developed countries, a number of studies have found positive employment effects of minimum wages (see Schmitt, 2013 for a recent review).

[8] The PNAD only achieved complete geographical coverage in 2004 with the inclusion of the rural areas of the northern regions (Acre, Amapá, Amazonas, Pará, Rondônia and Roraima). In order to have a consistent time series, these northern regions (which accounted for 7.4% of the total Brazilian working age population in 2012) are excluded from the analysis. The characteristics of the restricted sample and the full sample are however very similar.

[9] One commonly used method to assess the impact of minimum wages which will not be used in this paper is the difference-in-differences approach. Under this set-up, the differences in employment outcomes before and after a minimum wage change are compared between a group of workers affected by the change (treatment group) and a group of workers not affected (control group). Ideally, this approach exploits differences in minimum wages across regions, as in the seminal case study on New Jersey and Pennsylvania of Card and Krueger (1994) or, as in Dinkelman and Ranchhod (2012) in the case of South Africa, across different sectors. In the case of Brazil, however, this approach is not feasible given that minimum wages are set at the national level and apply to all workers. Nonetheless, some papers in the literature have defined treatment and control groups based on the position of workers in the wage distribution (see Currie and Fallick, 1996; and Abowd et al, 2000). In this case, the treatment group includes those workers who earn between the old and the new minimum wage levels, while the control group is made up of individuals earning slightly above the new minimum wage. In theory, this control group should differ only very little from the treatment group, except for the fact that these individuals are not directly affected by the change in the minimum wage. Once again, it is difficult to apply this method in the case of Brazil, since minimum wages have been found to affect wages throughout the wage distribution (e.g.: Fajnzylber, 2001; Lemos,

2004). An additional, more general, problem with this method is that those with lower pay have a lower probability of remaining employed even in the absence of a minimum wage change, leading to bias in the estimates. One potential way around this selection issue, however, is to include controls for individuals' wages (see Abowd et al., 2000).

[10] In addition to year dummies, monthly dummies are included for the PME data to account for seasonality.

[11] This is following some recent discussions in the literature (Dube, Lester and Reich, 2010). However, Neumark and Washer (forthcoming) have criticised their methods and Meer and West (2013) also show that including state-specific time trends attenuates the measured effects of the minimum wage on employment if the true effect is in fact on the rate of job growth. While the coefficients obtained in this paper are generally slightly larger when only using a general trend, the findings remain essentially unchanged when including region-specific time trends.

[12] The exclusion of the supply shifters has little effect on the estimated coefficients and their significance.

[13] Many studies also control for demand-side factors, mostly captured through GDP per capita. Additional models were run including GDP per capita at the regional level. These were not chosen as the baseline model, however, because GDP data at the time of writing were only available until 2010, which resulted in a significant drop in the years available for analysis. The results with GDP per capita did not significantly alter the principal conclusions from the paper anyway (results are available upon request).

[14] Given the difficulty of including fixed effects in logit or probit models, a linear probability model (LPM) is used for the employment and formality regressions. In spite of its well-known drawbacks, there are several reasons to prefer the use of LPM over non-linear models, see Angrist and Pischke (2009) and Hellevik (2010). Given that all the fitted values of the OLS regressions and at least 95% of the fitted values of the fixed effects regressions are between 0 and 1, it can be concluded that the linear probability model is a valid estimation technique for these models. In the case of the 'fraction at' minimum wage variable, the predictions were more likely to be outside the 0-1 range, so some caution may be necessary when interpreting those models.

[15] Since the age increase for each person during his interview period should not have an effect on the labour market outcome, average age rather than actual age is used.

[16] Another commonly used variable in the literature is the 'fraction affected', which measures the proportion of workers earning between the old and the new minimum wage. An important drawback of this variable, however, (and the reason why it is not used in this paper) is that it equals zero in all months without minimum wage change, leading to a severe reduction in sample size when estimating elasticities (see Lemos, 2009; and Brown, 1999).

[17] The price index is added to the regression because both earnings and the minimum wage are likely to be correlated with prices.

[18] A 1.9 percentage point fall and a 1.3 percentage point increase on a baseline employment rate of 62.8%.

[19] While the previous minimum wage level is used, current prices and income levels are used to determine the instrument for the real minimum wage.

[20] In an additional robustness test, the lag of the dependent variable was included. In these models, very few coefficients remained significant (with the exception of two small negative effects on hours worked). These estimates are likely to be inconsistent, however, given the combination with fixed effects, which may be a problem in particular when the sampling period is short, as it is in the PNAD and the individual fixed effects models (Nickell, 1981).

[21] Bartolucci (2012) reaches a similar conclusion in the context of European countries: in an expansion, when unemployment is low, the effects of raising the minimum wage are weak.