

The impact of the minimum wage on income and employment in Mexico

Raymundo M. Campos Vázquez, Gerardo Esquivel and Alma S. Santillán Hernández¹

Abstract

This article analyses the effects of a rise in the minimum wage on wages and employment in Mexico. The source of variation is the equalization in late 2012 of the minimum wage in two areas of the country. Using the National Occupation and Employment Survey (ENOE), econometric analyses are performed of cross-section and individual panel data. The results of the first indicate that, on average, the hourly wage in zone B rose by between 1.6% and 2.6% for workers overall and between 1.8% and 3.3% for wage workers. The panel analysis yields similar results. Although the cross-section analysis does not show an impact in terms of employment, the panel data indicate that the probability of being an informal (formal) worker falls (rises) among those affected by the wage rise policy.

Keywords

Minimum wage, employment, income, economic analysis, econometric models, Mexico

JEL classification

J31, J38, O15, O54

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¹ The authors are grateful to the Economic Commission for Latin America and the Caribbean (ECLAC) for its support in the preparation of this article and for the excellent comments and suggestions received.

I. Introduction

The impact of a rise in the minimum wage on income and employment conditions of workers is an extremely important and controversial topic. Among other things, higher minimum wages can have a significant positive effect on family income levels and, therefore, on the ability to exit poverty. However, a rise in the minimum wage can also have negative impacts, such as job loss — in the case of individuals receiving this level of income — or widespread price rises. In fact, should prices and the minimum wage both rise by similar proportions, the wage rise will produce no real gain. These differentiated effects have been researched extensively worldwide and some of these studies are mentioned later.

This article sets forth evidence regarding the impact of the rise in the minimum wage in Mexico. Up to 2012, Mexico had three minimum wage zones denominated A, B and C. Zone A had the highest minimum wage and zone C, the lowest. At the end of November 2012, the government unexpectedly announced that the minimum wage of zone B would be equalized with that of zone A. Comparison of the figures for January 2012 and January 2013 show that this measure raised zone B's minimum wage by 3.1% in real terms (a larger rise than in the other two zones). The step affected an area of the country that accounts for roughly 10% of the population. Although the minimum wage rise was relatively small, the fact that it was a completely exogenous and arbitrary decision that affected one zone but not the others makes it possible to analyse its effects on the income and employment conditions of workers in Mexico.

To this end, we use microdata from the National Occupation and Employment Survey (ENOE) of 2012 and 2013. The analysis was limited to those two years to avoid issues of comparison owing to different wage and employment trends in the different geographical areas. The identification strategy used was the difference-in-difference method: the impact of the change in the zone B minimum wage was compared with what was happening in other zones before and after the minimum wage rise. Two types of data were used: cross-section and panel format (where the same individuals were tracked over time). The second strategy eliminates any time invariant individual bias and is thus more robust than the cross-section approach.

The results show that the rise in the minimum wage had no negative effects in employment terms and, on the contrary, produced some positive impacts. The cross-section data showed an increase in labour income in zone B, although there was no increase in the income of low-income workers (defined as those who receive less than three times the minimum wage). In addition, the rise in the minimum wage does not appear to have affected levels of employment in the sample. The panel information yields similar results in terms of hourly wage and, in some cases, positive effects were seen in relation to the total wage. Lastly, the panel data showed that some individuals who had a formal job before the rise in the minimum wage were more likely to keep it afterwards. Similarly, the probabilities of individuals who had an informal job still having that type of work after the rise in the minimum wage decreased, and the probabilities of them securing a formal job increased.

In sum, the increase in the minimum wage produced by the alignment of zones had no negative effects —but did have some positive effects— on employment in Mexico. Nevertheless, the subject still requires more research because the increase in this instance was relatively small. For that reason, it is not advisable to extrapolate these results to a larger minimum wage rise, or to cases or countries in which the minimum wage is substantially higher (relatively speaking) than it was in Mexico at the time when the rise analysed here was decreed.

The article has five sections following this introduction. Section II reviews the literature and section III discusses the data used and presents descriptive statistics on employment and wages in the different geographical zones of Mexico. Section IV describes the methodology employed and the research results, and section V concludes.

II. Literature review

The theory underlying the common notion that a rise in the minimum wage is harmful to employment is quite simple: the rationale is that a higher minimum wage will lower firms' demand for workers and thus reduce hiring. This argument is so simple that economists did not question it until the early 1990s. The topic came to the fore at that point because the real minimum wage in the United States had dropped by almost 25% in the 1980s (Elwell, 2014), and this led economists to consider the effects that a minimum wage hike might have on employment, poverty levels and income distribution. The great majority of the studies conducted at that time showed that when it starts from relatively low levels, a small rise in the minimum wage has no negative effects on employment.²

Card and Krueger (1994) were pioneers in conducting systematic analysis of the possible consequences of a minimum wage rise in the United States, by means of quasi-experiments to try to capture the marginal effect of such a rise. They examined the effect attributable to the minimum wage rise in New Jersey —from US\$ 4.25 to US\$ 5.05 per hour— on employment in fast food restaurants such as Burger King and KFC. Card and Krueger chose the fast food business as a subject for analysis because it usually hires unskilled workers at low wages —precisely those who may be expected to be the most affected by minimum wage hikes.

As a control group, Card and Krueger used the fast food business in some cities in the neighbouring state of Pennsylvania, given that the minimum wage there remained constant at US\$ 4.25 per hour. The study found no adverse effects on employment and even found some evidence of positive effects. Nevertheless, one of the criticisms of this study was that the trends in employment growth were different in the two states to start with, so that the finding could be an anomaly rather than a universally applicable principle.

Neumark and Wascher (2008) analysed and synthesized the results of over 90 studies subsequent to Card's and Krueger's, on the employment effects attributable to minimum wage changes. These studies include empirical evidence for the United States, some countries of the Organization for Economic Cooperation and Development (OECD), Latin America and Indonesia. The authors conclude that, in general, a rise in the minimum wage reduces employment for less skilled workers. In particular, Neumark and Wascher found wage elasticities of employment ranging from -0.1 to -0.3.

Later, Dube, Lester and Reich (2010) generalized the approach used by Card and Krueger (1994) and made use of differences in wage policy between neighbouring states in the United States to estimate minimum wage effects on income and employment in restaurants and other sectors with a predominant proportion of low-income workers. As well as using a larger number of observations (variations in 1,381 counties), one of the advantages of this study was that the information available covered a longer time period (from 1990 to 2006), which enabled the authors to estimate the long-term effects. Dube, Lester and Reich (2010) concluded that the large negative elasticities obtained in the traditional specifications were due mainly to differences (regional and local) in employment trends that were not related to minimum wage policies. These authors nevertheless found similar results to those of Card and Krueger with regard to employment (that is, a zero impact) and notably positive effects on income.

The interest on the effects of the minimum wage on employment are not limited to the United States. Stewart (2004) analysed the impacts of the introduction of a national minimum wage in the United Kingdom in April 1999, and its subsequent increases in 2000 and 2001. Stewart used

² For a more comprehensive literature review and discussions of the possible impact of the minimum wage on other variables (including price levels) see Campos Vázquez (2015). The discussion of the literature in this section is partly based on that paper.

a difference-in-difference estimator and found no evidence of adverse minimum wage impacts on employment in either case. Another more recent analysis for the United Kingdom also found no evidence of a negative impact (Manning, 2012).

Other studies have focused on developing countries, on the basis that they could be affected differently owing to their higher percentage of unskilled workers. Neumark, Cunningham and Siga (2006), for example, analysed the rise in Brazil's minimum wage, which President Da Silva increased by 20% in 2003 and pledged to double by the end of 2006. These authors found no evidence that the change in the minimum wage had increased income at the lower end of the income distribution, while Lemos (2009) found no effect on employment.

Gindling and Terrell (2009) studied the case of Honduras, analysing the effects of 22 changes in the minimum wage —made between 1990 and 2004— on employment, unemployment and the average wage of workers in different sectors. They found effects only on the income of workers in medium and large firms, where an increase of 1% in the minimum wage led to a rise of 0.29% in the average wage and a relatively large drop (0.46%) in employment. At the same time, the authors found no effects attributable to the minimum wage on the income of workers in small firms or self-employed workers. They did find that a higher minimum wage could create unemployment and transfer employment from large to small firms, which were more likely to disregard the minimum wage rule.

In the case of Mexico, there are no recent studies on the potential impact of minimum wage variations. Bell (1997), whose work focused on the 1980s, when the real minimum wage decreased by 45%, found no significant minimum wage effects on labour income or formal employment. On the basis of data from the National Urban Employment Survey (ENEU) for the period 1989-2001, Bosch and Manacorda (2010) found that wages up to the median of the wage in the formal sector were affected by the minimum wage and that the erosion of their real value with respect to the wage median (37% between 1989 and 1995) increased inequality at the lower end of the distribution in Mexico.

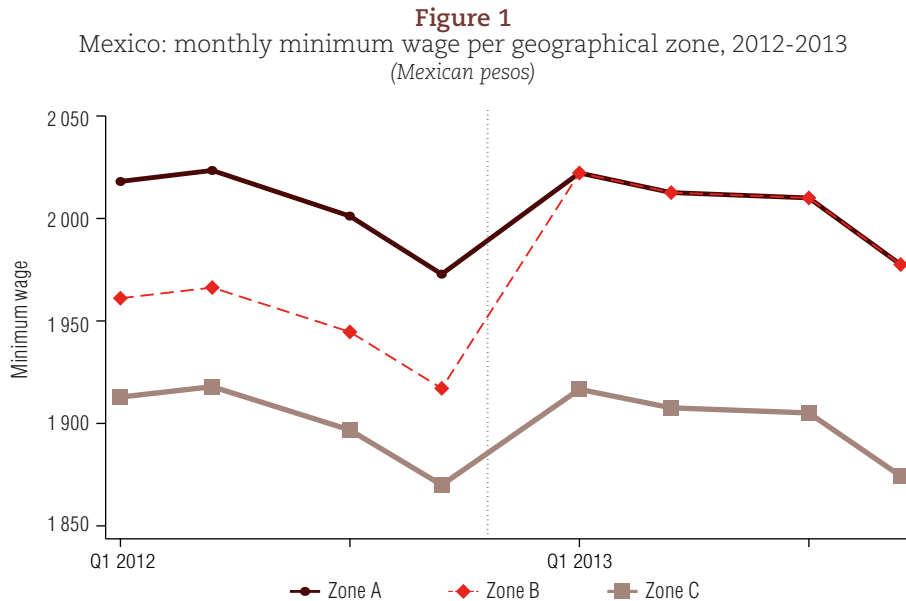
Kaplan and Pérez Arce (2006) analysed the effect of the minimum wage on labour income in Mexico using panel data from the National Urban Employment Survey from 1985 to 2001 and administrative records from the Mexican Social Security Institute (IMSS). They found that changes in the real minimum wage had a positive effect on real labour income, that is, they found evidence supporting the “lighthouse effect” of minimum wages on other income. However, this effect tended to dissipate rapidly further up the distribution and to be smaller than it had been in the 1980s and 1990s. Although there is no evidence for the last decade, if the trend indicated by Kaplan and Pérez Arce (2006) continued, the lighthouse effect may have decreased further still.

III. Data and descriptive statistics

The data used in this work come from the National Occupation and Employment Survey, which contains quarterly data on the labour dynamics of the Mexican population. These are rotating panel data, whereby each quarter 20% of the sample, which has been observed for five consecutive quarters, is replaced. The period studied runs from the first quarter of 2012 to the fourth quarter of 2013. Before progressing further, it is necessary to note a very particular feature of the general minimum wage in Mexico, which is that it fell more than 70% in real terms from its historical peak of the early 1980s.

As noted earlier, until 2012 there were three geographical areas for the minimum wage in Mexico, A, B and C. Zone A had the highest minimum wage and zone C the lowest, while B was an intermediate zone. Figure 1 shows the monthly minimum wage of each of the three geographical areas in the country, deflated by the average national consumer price index for each quarter and converted to June 2014 prices.

The equalization of the minimum wage between zones A and B took place at the end of November 2012. Before that adjustment, the monthly minimum wage in zone B was 1,917 Mexican pesos; after equalization, this rose by 5.48% in real terms.³ In the first quarter of 2013, the minimum wage in zone B was just over 2,000 pesos per month.



Source: Prepared by the authors, on the basis of data from the National Occupation and Employment Survey (ENOE).

Note: June 2014 prices. The vertical line indicates the point at which the equalization between zones A and B took place (November 2012).

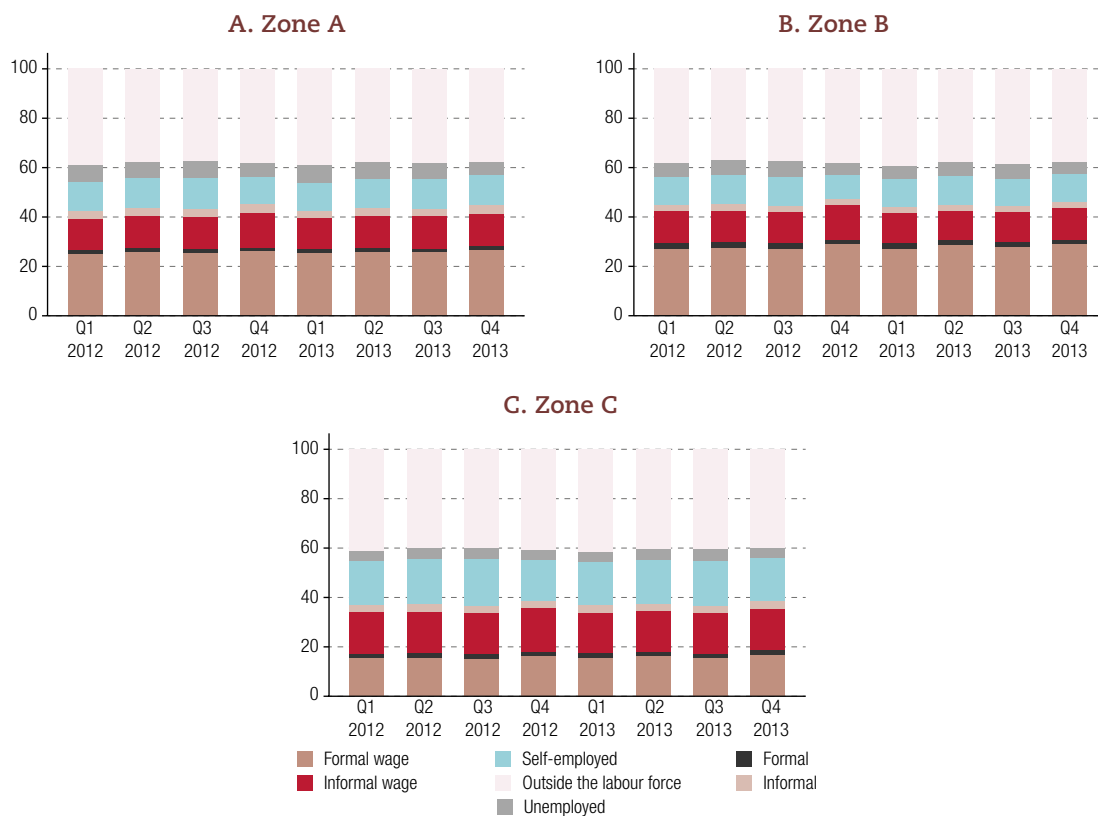
Zone B corresponds to a region accounting for some 10% of the Mexican population aged 15 and over (see annex figure A1.1). Figure 2 shows the composition of the population aged 15 and over by status with respect to economic activity (employed, unemployed, outside the labour force) and type of employment (formal employment, wage employment, informal and formal wage employment and self-employed) in each of the three geographical areas. The labour make-up of zones A and B is relatively similar, since in both just over 40% of those aged 15 and over are outside the labour force and 6% are unemployed. In zone C a larger percentage (around 41%) is outside the labour force and unemployment is lower (4%) than in zones A and B, although the size of the informal sector and self-employment are greater.

Annex figures A1.2 and A1.3 show the evolution of the proportion of workers and unemployed from the first quarter of 2005 until the first quarter of 2013, by geographical zone. It may be observed that in the three geographical areas the proportion of workers remained around 55% throughout the period examined, while the level of unemployment shows similar values and tendencies in zones A and B over the years.

Figure 3 shows the composition of workers aged 15 and over who earn less than three times the minimum wage (at the fourth quarter of 2013). Again, zones A and B have a similar composition: 40% of workers are in the formal sector, less than 20% were self-employed and the rest are informal workers. In zone C, however, the proportion of informal workers was 46% and just 23% had a formal job. These compositions held relatively constant after the minimum wage was equalized.

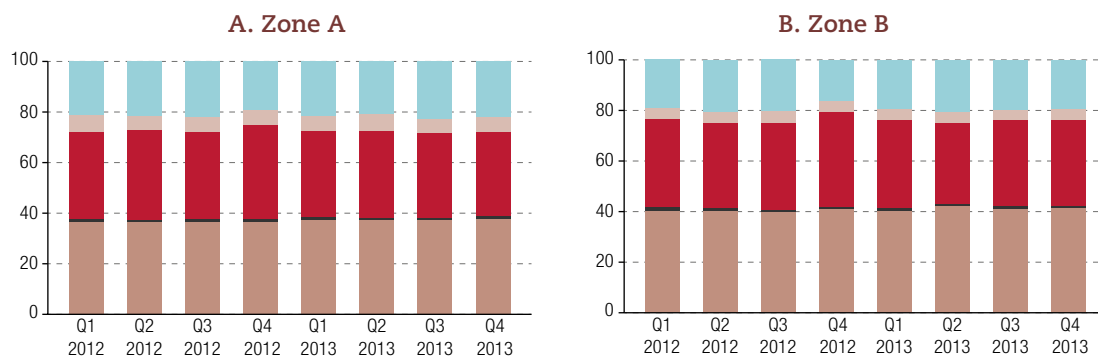
³ In the first quarter of 2013, areas A and C showed an increase of 2.5% in real terms with respect to the real minimum wage in the last quarter of 2012. However, by comparison with the wage at the start of 2012, the rise in zone B was 3.1%, while real minimum wages barely held steady in the other two zones.

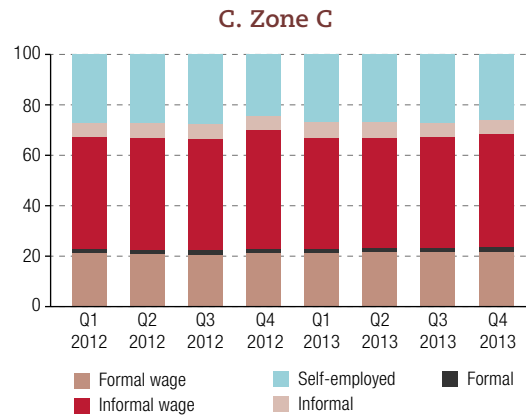
Figure 2
 Mexico: composition of the population aged 15 years and over by economic activity status and type of employment, by geographical zone, 2012-2013
 (Percentages)



Source: Prepared by the authors, on the basis of data from the National Occupation and Employment Survey (ENOE).

Figure 3
 Mexico: composition of workers aged 15 years and over receiving less than three times the minimum wage, by type of employment and geographical zone, 2012-2013
 (Percentages)



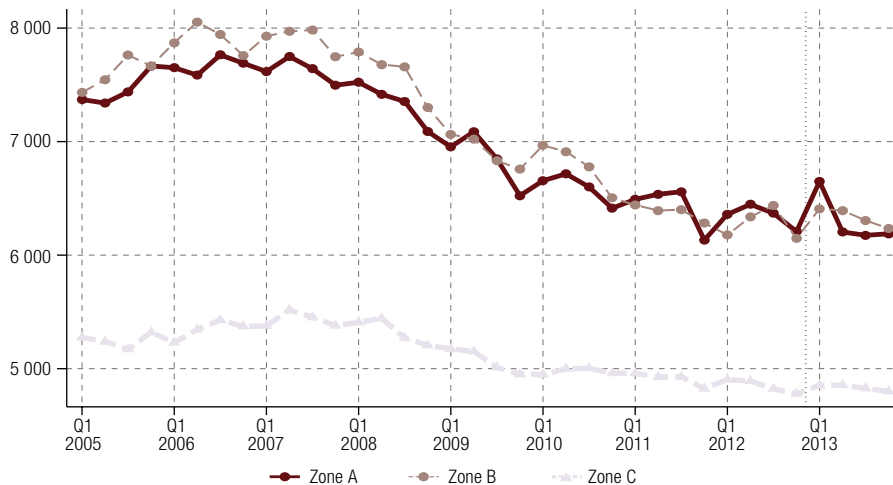


Source: Prepared by the authors, on the basis of data from the National Occupation and Employment Survey (ENOE).

Note: Excludes those not receiving or not specifying income. Minimum wage at fourth quarter of 2013.

Workers' wages are one of the variables of interest in this work; accordingly, figure 4 shows the evolution of the average wage per geographical zone. It may be seen that the average monthly wage has fallen in real terms in all the geographical areas over time and that it is very similar in zones A and B. At the same time, workers in zone C receive, on average, less income than those in the other two zones.

Figure 4
Mexico: average monthly wage by geographical zone, 2005-2013
(Mexican pesos)



Source: Prepared by the authors, on the basis of data from the National Occupation and Employment Survey (ENOE).

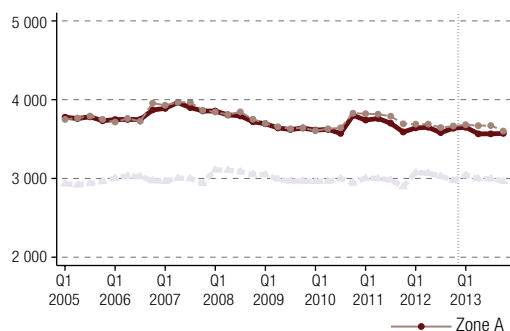
Note: Persons aged 15 years and over. Excludes those not receiving or not specifying income. June 2014 prices. The vertical line indicates the point at which the equalization between zones A and B took place.

In order to obtain indications of the possible effects of minimum wage variation in zone B on the wage received in each of the geographical areas, figure 5 presents the evolution of the monthly and hourly average wage received by workers by income level. In principle, it would be expected that those on the lowest income would be the most affected by the rise in the minimum wage in zone B. However, as figure 5 shows, no substantial changes were observed in the average wage of those workers receiving less than three times the minimum wage after equalization. In any case, the average monthly wage of those on lower incomes in zone B fell in the third quarter after the change, similarly to the pattern on other parts of the country.

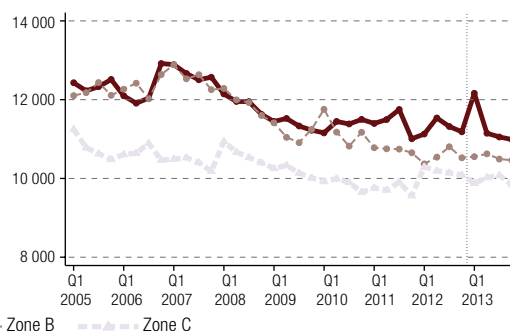
Figure 5

Mexico: average monthly and hourly wage by geographical zone and income level, 2005-2013
(Mexican pesos)

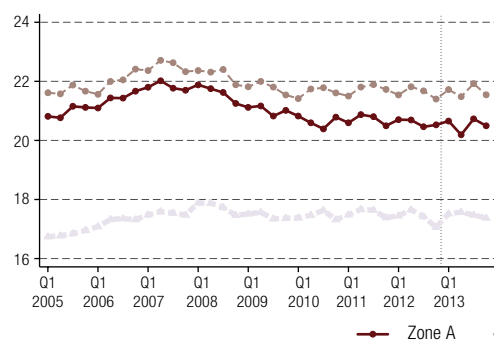
A. Monthly wage of workers receiving less than three times the minimum wage



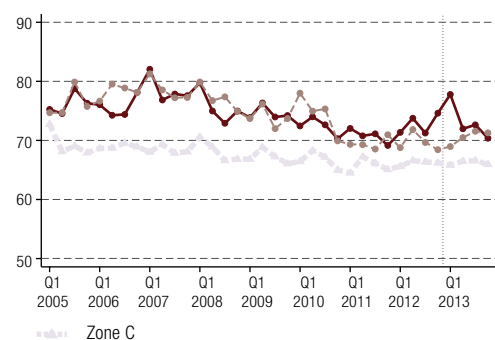
B. Monthly wage of workers receiving more than three times the minimum wage



C. Hourly wage of workers receiving less than three times the minimum wage



D. Hourly wage of workers receiving more than three times the minimum wage



Source: Prepared by the authors, on the basis of data from the National Occupation and Employment Survey (ENOE).

Note: Persons aged 15 years and over. Excludes those not receiving or not specifying income. June 2014 prices. The vertical line indicates the point at which the equalization between zones A and B took place.

With a view to analysing the comparability between individuals in zones A and B before the equalization of the minimum wage, table 1 presents the results of a means difference test for the variables of employment, wages and sociodemographic characteristics. The table shows that before the equalization of the minimum wage, zones A and B had the same proportion of people aged 15 and over forming part of the economically active population (EAP), informal wage workers and individuals with university education. With respect to wages, those in zone B had higher wages (total and hourly) than those in zone A before the equalization of the minimum wage.

At the same time, differences were observed in the composition of zones A and B with respect to activity status and type of employment before the equalization of the minimum wage, insofar as the percentages of unemployed, self-employed workers and informal workers were higher in zone A. However, in zone B there were higher proportions of workers, wage workers, formal workers and formal wage workers than in zone A. Regarding the educational level of those aged 15 and over, zone A had a higher percentage of people with upper secondary education than zone B. In sum, although some characteristics are different, the trends in the figures evolve similarly. The regression analysis controls for characteristics that are observable at the individual level. If these remain constant over time for a single individual, then the panel data strategy eliminates possible biases.

Table 1
Difference in means between zones A and B

	Observations	Zone A	Zone B	t-statistic
Logarithm of monthly wage ^a	99 023	8.4783	8.4876	-1.824*
Logarithm of hourly wage ^a	99 023	3.3369	3.3876	-10.787***
Economically active population	235 421	0.6204	0.6238	-1.545
Unemployed	235 421	0.0654	0.0576	7.091***
Outside the labour force	235 421	0.3796	0.3762	1.545
Worker	235 421	0.5549	0.5661	-5.091***
Wage worker ^b	131 464	0.6975	0.7191	-8***
Self-employed or unpaid ^b	131 464	0.2122	0.1998	5.167***
Formal ^b	131 464	0.5226	0.5505	-9.3***
Informal ^b	131 464	0.4774	0.4495	9.3***
Formal wage worker ^b	131 464	0.4615	0.4865	-8.3***
Informal wage worker ^b	131 464	0.2359	0.2326	1.320
Age	235 421	39.8438	39.5675	3.561***
Without primary	235 421	0.1031	0.1108	-5.5***
Primary	235 421	0.1974	0.1845	7.167***
Secondary	235 421	0.3075	0.3570	-23.619***
Upper secondary	235 421	0.2404	0.1949	23.947***
University	235 421	0.1516	0.1528	-0.688
Urban	235 421	0.8721	0.8413	20.533***
Man	235 421	0.4743	0.4831	-4***

Source: Prepared by the authors, on the basis of data from the National Occupation and Employment Survey (ENOE).

Note: Sample of persons aged 15 years and over observed in 2012. June 2014 prices. Difference significant at *10%, **5% and ***1%.

^a Excludes those not receiving or not specifying income.

^b Limited to those working.

IV. Methodology and results

The aim of this article is to study the possible effects of the increase in the minimum wage in zone B on the employment of workers in that zone. To estimate these effects, the difference-in-difference estimator is used on the basis of cross-section and panel data.

1. Cross-section

To find the difference-in-difference estimator, three econometric specifications are proposed:

$$Y_i = \beta_0 + \beta_1 X_i + \beta_2 * zoneB_i * (D2013_i) + \alpha_i + \epsilon_i \quad (1)$$

$$Y_i = \beta_0 + \beta_1 X_i + \beta_2 * zoneB_i * (D2013_i) + \beta_3 * zoneA_i * (D2013_i) + \alpha_i + \epsilon_i \quad (2)$$

$$Y_i = \beta_0 + \beta_1 X_i + \beta_2 * zoneB_i * (D2013.1_i) + \beta_3 * zoneB_i * (D2013.2_i) + \beta_4 * zoneB_i * (D2013.3_i) + \beta_5 * zoneB_i * (D2013.4_i) + \alpha_i + \epsilon_i \quad (3)$$

Where Y_i is the dependent variable, X_i corresponds to individual variables such as gender, age, age squared, an indicator of urban residence, educational level and interactions between educational level, urban locality and gender. The variables $zoneA_i$ and $zoneB_i$ are dummy variables that indicate whether a worker i belongs to zone A or zone B, respectively (zone C is excluded). The variable $D2013_i$ takes the value of 1 if i is observed in 2013. Variables $D2013.m$ are indicators of the quarter m of 2013, with $m=1,2,3,4$ and ϵ_i is an error term. In equation (1) the control group is formed by workers in geographical areas A and C. Equation (2) analyses the separate effect of zones A and B, with respect to C. Equation (3) analyses the effect on zone B in the quarters following the equalization of the minimum wage. These specifications do not control for unobserved heterogeneity or for individual traits that do not vary over time. This type of control is included later.

The parameter of interest is β_2 . The equations are estimated using Y_i as the employment status of individual i , so that equation (1) provides an estimation of the effect of equalization on the employment status of people in zone B (in relation to the effect on those in the other two geographical zones). Equation (2) shows the effect on employment for people in zones A and B after equalization, in relation to the effect for those in zone C. Lastly, equation (3) shows the effect on employment for people in zone B, with respect to those in the other two zones, but isolating the effect in each quarter after the rise in the minimum wage in zone B. The wage effect will be analysed later.

Table 2 presents the estimates from equation (1). In the column headed “Worker”, the variable Y_i indicates whether i is a worker, while the columns headed “Wage worker”, “Self-employed”, “Formal” and “Formal wage worker” restrict the sample to workers, and Y_i indicates whether i is a wage worker, self-employed, in the formal sector and a formal sector wage earner, respectively. In the columns “Unemployed” and “Outside the labour force”, Y_i shows a value of 1 if i is unemployed or outside the labour force, respectively, otherwise 0.

Table 2
Difference-in-difference estimator, equation (1)

Variables	Worker ^a	Wage worker ^{a,b}	Self-employed ^b	Formal ^{a,b}	Formal wage worker ^{a,c}	Unemployed	Outside the labour force
Zone B*Year 2013	-0.0044 [0.0059]	-0.0023 [0.0052]	-0.0007 [0.0050]	0.0081 [0.0129]	0.0092 [0.0145]	-0.0013 [0.0015]	0.0032 [0.0044]
Observations	1 956 622	953 963	953 963	953 963	676 948	2 278 006	2 278 006
Adjusted R ²	0.2212	0.1130	0.1160	0.2158	0.2569	0.0153	0.2650

Source: Prepared by the authors.

Note: Coefficient significant at *10%, **5% and ***1%. Robust standard errors adjusted at the state level shown in square brackets. Each model incorporates gender, age, age squared, indicators of educational level, urban location and interactions between education level, urban location and gender, quarter indicators and city. Sample of persons aged 15 years or over, observed in 2012 and 2013.

^a Excludes those not receiving or not specifying income.

^b Restricted to workers.

^c Restricted to wage workers.

The results in table 2 show that there were no significant effects on the status of employed, unemployed or outside the labour force in zone B after the minimum wage rise. Annex table A1.1 shows the results of estimating equation (2), which yielded no significant effects on employment either for zone B. The results of equation (3) are shown in annex table A1.2. They indicate that three quarters after the equalization of the minimum wage, the probability of a person in zone B being in employment fell 1.3 percentage points, while the probability of being outside the labour force rose by 0.9 percentage points. In view of the possibility of these effects being biased, because they do not take into account workers' inherent differences, the panel information from the survey was used to re-estimate the earlier specifications.

Table 3 shows the results of the estimation of β_2 from equation (1), using the dependent variable as a logarithm of the wage received by i .⁴ The first two columns of panel A show the estimations for the sample of all those aged 15 or over who received income, while the last two columns show the estimates obtained when the sample is restricted to those receiving an income of less than three times the minimum wage. Panel B in table 3 restricts the estimate to wage workers. There is a significant effect on the hourly wage in the sample that includes all individuals. Specifically, the hourly wage of those in zone B rose by 2% after the increase in the minimum wage, in relation to the hourly wage of those in the other two geographical zones. However, the last two columns do not suggest that this minimum wage rise benefited lower-income individuals. Something similar is seen when the sample is confined to wage workers.

Table 3
Difference-in-difference estimator for effects on wages, equation (1)

Variables	All		Less than three times the minimum wage	
	Monthly wage	Hourly wage	Monthly wage	Hourly wage
Panel A: All				
Zone B*Year2013	0.0126	0.0200***	0.0001	-0.0017
	[0.0081]	[0.0061]	[0.0073]	[0.0053]
Observations	953 963	953 963	647 899	658 872
Adjusted R ²	0.3159	0.2530	0.1843	0.1463
Panel B: Wage workers				
Zone B*Year2013	0.0112	0.0196***	0.0006	-0.0006
	[0.0091]	[0.0045]	[0.0063]	[0.0033]
Observations	676 948	676 948	450 031	472 301
Adjusted R ²	0.3493	0.3289	0.1571	0.1207

Source: Prepared by the authors.

Note: Coefficient significant at *10%, **5% and ***1%. Robust standard errors adjusted at the state level shown in square brackets. Wages at June 2014 prices and in log scale. Each model incorporates gender, age, age squared, indicators of educational level, urban location and interactions between education level, urban location and gender, quarter indicators and city. Excludes those not receiving or not specifying income. Sample of persons aged 15 years or over, observed in 2012 and 2013.

Table 4 shows the results of the estimation of equation (2) for β_2 and β_3 . The results indicate that the hourly wage of individuals in zone B rose by 1.6% after equalization, with respect to the wage of those in zone C. At the same time, the hourly wage of workers in zone A fell by 1.6% after equalization, with respect to those in zone C. These two results suggest that the zone A hourly wage rose by 3.2% over the hourly wage of zone C. Nevertheless, this table does not show any benefit from equalization for the lower-income population. When the sample is restricted to wage workers, the zone B hourly wage rose 1.8% after equalization over the zone C wage, without any appreciable effects on the zone A and zone C hourly wages after equalization.

Table 5 shows that the rise in the hourly wage in zone B after minimum wage equalization produced significant effects in the first two quarters; thereafter, the effect remains positive but is no longer significant. In particular, the hourly wage rose by 2.2% in zone B in the first quarter after the minimum wage hike in that zone, and by 2.6% two quarters after equalization. This effect is also observed when the sample is restricted to wage workers. Specifically, the hourly wage of wage workers in zone B rose by 2.3% in the quarter immediately following minimum wage equalization and by 3.3% two quarters after equalization.

In the case of wage workers, the monthly wage of those in zone B also rose 3% two quarters after minimum wage equalization. The hourly wage of wage workers in zone B receiving less than three times the minimum wage climbed 0.7% in the first quarter after equalization. Meanwhile, the monthly wage of those in zone B rose by 2.5% two quarters after the minimum wage rise.

⁴ The rise in the minimum wage had no significant effect on the probability of wage non-reporting in the survey in zone B with respect to peers in zones A and C.

Table 4
Difference-in-difference estimator, equation (2)

Variables	All		Less than three times the minimum wage	
	Monthly wage	Hourly wage	Monthly wage	Hourly wage
Panel A: All				
Zone B*Year2013	0.0082 [0.0087]	0.0164** [0.0066]	-0.0008 [0.0093]	-0.0038 [0.0062]
Zone A*Year2013	-0.0194* [0.0097]	-0.0158* [0.0086]	-0.0046 [0.0139]	-0.0099 [0.0089]
Observations	953 963	953 963	647 899	658 872
Adjusted R ²	0.3160	0.2530	0.1843	0.1463
Panel B: Wage workers				
Zone B*Year2013	0.0083 [0.0092]	0.0181*** [0.0047]	0.0001 [0.0073]	-0.0025 [0.0034]
Zone A*Year2013	-0.0121 [0.0072]	-0.0064 [0.0047]	-0.0026 [0.0096]	-0.0086 [0.0063]
Observations	676 948	676 948	450 031	472 301
Adjusted R ²	0.3493	0.3289	0.1571	0.1208

Source: Prepared by the authors.

Note: Coefficient significant at *10%, **5% and ***1%. Robust standard errors adjusted at the state level shown in square brackets. Wages at June 2014 prices and in log scale. Each model incorporates gender, age, age squared, indicators of educational level, urban location and interactions between education level, urban location and gender, quarter indicators and city. Excludes those not receiving or not specifying income. Sample of persons aged 15 years or over, observed in 2012 and 2013.

Table 5
Difference-in-difference estimator, equation (3)

Variables	All		Less than three times the minimum wage	
	Monthly wage	Hourly wage	Monthly wage	Hourly wage
Panel A: All				
Zone B*Quarter 1 2013	0.0105 [0.0099]	0.0218*** [0.0079]	-0.0064 [0.0104]	-0.0035 [0.0075]
Zone B*Quarter 2 2013	0.0248* [0.0137]	0.0262** [0.0127]	0.0138 [0.0128]	-0.0057 [0.0108]
Zone B*Quarter 3 2013	0.0114 [0.0124]	0.0196 [0.0139]	0.0031 [0.0091]	0.0071 [0.0074]
Zone B*Quarter 4 2013	0.0040 [0.0084]	0.0119 [0.0078]	-0.0085 [0.0117]	-0.0044 [0.0081]
Observations	953 963	953 963	647 899	658 872
Adjusted R ²	0.3159	0.2530	0.1843	0.1463
Panel B: Wage workers				
Zone B*Quarter 1 2013	0.0093 [0.0101]	0.0235*** [0.0076]	-0.0031 [0.0086]	0.0074* [0.0041]
Zone B*Quarter 2 2013	0.0304*** [0.0098]	0.0330*** [0.0073]	0.0245** [0.0109]	-0.0003 [0.0083]
Zone B*Quarter 3 2013	0.0037 [0.0118]	0.0129 [0.0123]	-0.0074 [0.0072]	-0.0043 [0.0080]
Zone B*Quarter 4 2013	0.0017 [0.0130]	0.0080 [0.0064]	-0.0104 [0.0079]	-0.0067 [0.0046]
Observations	676 948	676 948	450 031	472 301
Adjusted R ²	0.3493	0.3289	0.1571	0.1207

Source: Prepared by the authors.

Note: Coefficient significant at *10%, **5% and ***1%. Robust standard errors adjusted at the state level shown in square brackets. Wages at 2014 prices and in log scale. Each model incorporates gender, age, age squared, indicators of educational level, urban location and interactions between education level, urban location and gender, quarter indicators and city. Excludes those not receiving or not specifying income. Sample of persons aged 15 years or over, observed in 2012 and 2013.

2. Robustness

As proof of robustness, equation (1) was estimated with the wage logarithm as the dependent variable, taking only data from 2012, and considering the policy coming into effect after the third quarter of 2012. Table 6 shows the results of the estimation. It will be seen that there are no significant effects in any case. When the date of the new policy is changed, there are no statistically significant results either.

Table 6
Difference-in-difference estimator, equation (1), robustness

Variables	All		Less than three times the minimum wage	
	Monthly wage	Hourly wage	Monthly wage	Hourly wage
Panel A: All				
Zone B*Date	0.0018	-0.0017	-0.0009	0.0073
	[0.0064]	[0.0066]	[0.0105]	[0.0082]
Observations	482 980	482 980	330 261	330 261
Squared R ²	0.3181	0.2547	0.1874	0.1874
Panel B: Wage earners				
Zone B*Date	-0.0062	-0.0047	-0.0090	0.0006
	[0.0037]	[0.0047]	[0.0065]	[0.0070]
Observations	342 566	342 566	229 467	237 941
Adjusted R ²	0.3526	0.3310	0.1602	0.1223

Source: Prepared by the authors.

Note: Coefficient significant at *10%, **5% and ***1%. Robust standard errors adjusted at the state level shown in square brackets. Wages are at June 2014 prices and log scale. Each model incorporates gender, age, age squared, indicators of educational level, urban location and interactions between education level, urban location and gender, quarter indicators and city. Excludes those not receiving or not specifying income. Sample for individuals aged 15 years and over, observed in 2012. The date indicator takes a value of 1 if it is the third or fourth quarter of 2012, otherwise 0.

3. Uneven effects by gender, age and educational level

In order to determine whether the equalization affected different types of workers in particular, equation (1) was estimated incorporating the variable $zoneBi \cdot D2013i$, combined with the age, gender and education level of i . Table 7 shows the results of that interaction with the log scale of wage worker i as the dependent variable. After the minimum wage equalization, the wage of workers in zone B without primary schooling rose by 13 percentage points. This was observed both for all wage workers and for those receiving up to three times the minimum wage. The hourly wage for this same group also rose after the minimum wage hike: 13% for all wage workers and 10% for those receiving up to three times the minimum wage.

In the case of wage workers and wage workers receiving up to three times the minimum wage in zone B who had primary education, the hourly wage rose 9.3 and 7 percentage points, respectively, after the minimum wage equalization. The monthly and hourly wage of wage workers in zone B with secondary education rose 7 and 8 percentage points, respectively, after the minimum wage hike, while for wage workers earning less than three times the minimum wage, the monthly wage rose by 8 percentage points and the hourly wage by 7 percentage points.

Table 7
Uneven effects on wages by gender, age and educational level

Variables	All		Less than three times the minimum wage	
	Hourly wage	Monthly wage	Hourly wage	Monthly wage
Zone B*Year 2013*Age	-0.0000 [0.0000]	-0.0000 [0.0000]	-0.0000* [0.0000]	-0.0000** [0.0000]
Zone B*Year 2013*Man	0.0087 [0.0131]	0.0193 [0.0128]	-0.0113 [0.0090]	0.0079 [0.0058]
Zone B*Year 2013*No primary	0.1371*** [0.0329]	0.1301*** [0.0391]	0.1301*** [0.0349]	0.0999** [0.0468]
Zone B*Year 2013*Primary	0.0620 [0.0394]	0.0930*** [0.0309]	0.0637 [0.0420]	0.0704* [0.0395]
Zone B*Year 2013*Secondary	0.0695** [0.0283]	0.0822*** [0.0237]	0.0814** [0.0345]	0.0683* [0.0386]
Zone B*Year 2013*Upper secondary	0.0368 [0.0319]	0.0609** [0.0249]	0.0547* [0.0303]	0.0576 [0.0372]
Observations	676 948	676 948	450 031	472 301
Adjusted R ²	0.3494	0.3291	0.1572	0.1209

Source: Prepared by the authors.

Note: Coefficient significant at *10%, **5% and ***1%. Robust standard errors adjusted at the state level shown in square brackets. Each model incorporates gender, age, age squared, indicators of educational level, urban location and interactions between education level, urban location and gender, indicators of quarter and city. Excludes those not receiving or not specifying income. Sample for individuals aged 15 years and over, observed in 2012 and 2013.

4. Analysis of panel data

This section uses information from National Occupation and Employment Survey, taking advantage of the panel structure of the data. Three panel databases were built, observing individuals aged 15 and over at two points in time. The first is of individuals observed in the second quarter of 2012 and the second quarter of 2013. The second database is of individuals observed in the fourth quarter of 2012 and the first quarter of 2013. Lastly, the third database groups individuals observed in the fourth quarter of 2012 and the second quarter of 2013. Those observed in December 2012 are excluded from the second two panels, since this was when the minimum wage was equalized between zones A and B. The three panels were built to analyse the sensitivity of the results and to take into account calendar effects that could differ between geographical areas.⁵

To find the difference-in-difference estimator in panel data, the following equation was calculated:

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 * zoneB_i * (D2013_i) + \alpha_i + a_i + \varepsilon_i \quad (4)$$

where Y_{it} is the dependent variable, X_{it} corresponds to individual variables that change over time, such as age, age squared and education level, $zoneB_i$ indicates whether worker i belongs to zone B, $D2013_i$ takes a value of 1 if i is observed in the year 2013, α_i is an individual fixed effect variable and ε_{it} is an error term. The fixed effect controls for any time invariant differences not observed at the individual level.

⁵ To analyse the effects of minimum wage equalization on contact rates in the second round of observations, equation (4) was estimated using as a dependent variable the dichotomy whereby 1 means that the individual was observed in the second round of panel data and 0 means otherwise. The effects were analysed for different types of samples restricted by activity status in the first round of observation. The estimations are presented in annex tables A1.12 and A1.13. In the first three panels used, individuals in zone B who were outside the labour force were more likely not to be contacted in the following round than those in zones A and C, after the minimum wage equalization. In comparing zones A and B, it was observed that only in one panel were individuals who participated in the labour market in zone B more likely than those in zone A not to be contacted again after the minimum wage was raised.

Equation (4) is estimated to analyse the effects on employment and inactivity; the results are shown in table 8. In the columns headed “Worker”, “Unemployed”, “Outside the labour force” and “Economically active population”, the variable Y_{it} indicates whether i is a worker, is unemployed, is outside the labour force and forms part of the economically active population in quarter t , provided that in the first round of observation i was a worker, unemployed, outside the labour force and formed part of the economically active population, as the case may be, while in the columns headed “Wage worker”, “Self-employed”, “Formal”, “Formal wage earner” and “Informal wage earner”, Y_{it} takes a value of 1 if individual i is a wage worker, self employed, a worker in the formal sector, a formal wage worker or informal wage worker in quarter t and 0 if i if another type of worker, provided that i was a wage worker, self employed, a worker in the formal sector, a formal wage worker and informal wage worker in the first observation round. Importantly, the regression restricts the status of the worker in $t-1$, such that the fixed effect of the individual is captured.

Table 8
Difference-in-difference estimator, equation (4)

Variables	Worker ^a	Wage worker ^{a b}	Self-employed ^{a b}	Formal ^{a b}	Wage worker ^{a c}		Unemployed	Outside the labour force	Economically active population
					formal	informal			
Panel A: second quarter of 2012-second quarter of 2013									
Zone B*Year2013	-0.0249 [0.0223]	0.0136 [0.0192]	-0.0805 [0.0690]	0.0676** [0.0256]	0.0443** [0.0209]	-0.1444*** [0.0347]	-0.0251 [0.0401]	-0.0474*** [0.0150]	-0.0103 [0.0071]
Panel B: fourth quarter of 2012-first quarter of 2013									
Zone B*Year2013	-0.0302 [0.0304]	0.0188 [0.0227]	0.0012 [0.0543]	-0.0110 [0.0404]	-0.0364 [0.0568]	0.0383 [0.0470]	-0.0324 [0.0844]	0.0016 [0.0352]	-0.0136 [0.0147]
Panel C: fourth quarter of 2012-second quarter of 2013									
Zone B*Year2013	-0.0225 [0.0210]	0.0071 [0.0138]	0.1243* [0.0719]	0.0498 [0.0317]	0.0559 [0.0339]	-0.0433 [0.0818]	0.0005 [0.0604]	-0.0048 [0.0339]	-0.0345 [0.0243]

Source: Prepared by the authors.

Note: Coefficient significant at *10%, **5% and ***1%. Robust standard errors adjusted at the state level shown in square brackets. Each model incorporates gender, age, age squared, indicators of educational level and quarter indicators. Sample for individuals aged 15 years and over.

^a Excludes those not receiving or not specifying an income.

^b Restricted to workers.

^c Restricted to wage workers.

The results shown in table 8 indicate that the probability of being a worker in general, being unemployed, being a wage worker and forming part of the economically active population in zone B were unaffected by the minimum wage equalization. On the other hand, when the panel covering the period from the fourth quarter of 2012 to the second quarter of 2013 was used, it was found that the probability of being a self-employed worker in zone B rose by 12.4 percentage points after equalization. In the other two panels no significant effects were found. In the panel from the second quarter of 2012 to the second quarter of 2013, the probability of being an informal worker fell by over 14 percentage points for workers in zone B after the change in the minimum wage, while the probability of continuing to be a formal worker rose 4.3 percentage points. Also in that panel, the probability of being outside the labour force came down by 4.7 percentage points for those in zone B after the minimum wage rise. In summary, the minimum wage equalization had no negative effects on employment and there was some evidence that it helped to reduce the probability of being outside the labour market. Although the results are not completely robust, the equalization appears to have fostered formal employment at the cost of informal wage employment.

Annex tables A1.3-A1.10 show estimations analogous to those in table 8 but for narrower samples. In annex tables A1.3 and A1.4, the sample is limited to those who worked in the formal and formal wage sectors, respectively, in the first round of observation. After minimum wage equalization, those working in the formal sector in zone B were 1.7 percentage points more likely to leave the labour

market and 3.8 points less likely to be workers than those in zones A and C. Among those who were formal wage workers in the first round, it was found that after minimum wage equalization people in zone B were 1.3 percentage points more likely to be outside the labour market, 3.5 points less likely to be unemployed, 3.6 points more likely to be self-employed and 8.4 points less likely to move into the informal wage sector than those in zones A and C. In annex table A1.5, in which the sample is restricted to those who were informal wage workers in the first round of observation, it was found that these were more likely to move into the formal sector and more likely to leave the labour force. Lastly, annex table A1.6 shows that those who were self-employed in the first round also showed a greater probability of moving into the formal sector and a smaller probability of having an informal wage job.

Table 9 shows the results of the estimation of equation (4) with Y_{it} as the logarithm of the wage of individual i in quarter t , on the basis of information from the three panels constructed. In all cases, this includes only those individuals who had valid and positive income in both rounds of observation. As in the cross-section analysis, estimates were performed both for the sample as a whole and for a narrower sample of low-income workers, and the sample of wage workers is considered separately. According to the results for the panel corresponding to the period running from the fourth quarter of 2012 to the second quarter of 2013, the monthly wage of workers in zone B rose by 3.5% after minimum wage equalization with respect to workers in the other two zones and 3.3% for wage workers. No significant effects were found for the other panels.

Table 9
Difference-in-difference estimator for wage effects with panel data, equation (4)

Variables	All		Less than three times the minimum wage	
	Monthly wage	Hourly wage	Monthly wage	Hourly wage
Panel A: second quarter of 2012-second quarter of 2013				
<i>All</i>				
Zone B*Year2013	0.0972*	0.0635	0.0580	-0.0045
	[0.0534]	[0.0424]	[0.0380]	[0.0245]
<i>Wage earners</i>				
Zone B*Year2013	-0.0174	-0.0117	0.0008	0.0055
	[0.0322]	[0.0403]	[0.0379]	[0.0399]
Panel B: fourth quarter of 2012-first quarter of 2013				
<i>All</i>				
Zone B*Year2013	0.0011	0.0337**	0.0130	0.0135
	[0.0109]	[0.0155]	[0.0135]	[0.0169]
<i>Wage earners</i>				
Zone B*Year2013	0.0028	0.0300**	0.0239***	0.0307***
	[0.0101]	[0.0123]	[0.0062]	[0.0077]
Panel C: fourth quarter of 2012-second quarter of 2013				
<i>All</i>				
Zone B*Year2013	0.0353**	0.0343***	0.0320**	-0.0049
	[0.0141]	[0.0117]	[0.0117]	[0.0107]
<i>Wage earners</i>				
Zone B*Year2013	0.0333**	0.0337**	0.0423**	0.0068
	[0.0140]	[0.0133]	[0.0172]	[0.0124]

Source: Prepared by the authors, on the basis of data from the National Occupation and Employment Survey (ENOE).

Note: Sample for individuals aged 15 years and over. Excludes those not receiving or not specifying income in at least one round of observation. Coefficient significant at *10%, **5% and ***1%. Robust standard errors adjusted at the state level shown in square brackets. Wages are at June 2014 prices and in log scale. Each model incorporates gender, age, age squared, indicators of educational level and quarter indicators.

Significant effects were also found in hourly wages. In particular, in two different panels the results indicate that hourly wages rose by around 3% for workers in zone B after the minimum wage rise. This result is valid for all workers and for wage workers. In the third case, the estimated effect is

not significant. In addition, in the case of workers receiving less than three times the minimum wage, significant effects were found for both samples in the panel covering from the fourth quarter of 2012 to the second quarter of 2013. In this case, the monthly wage rose by 3.2% for low-income workers in zone B and by 4.2% for low-income wage workers in that zone after equalization. For the panel covering from the fourth quarter of 2012 to the first quarter of 2013, the monthly wage of workers in zone B was found to have risen 3.4% after the rise in the minimum wage. It is important to note that the increase in the minimum wage in zone B was precisely 3.1% in comparison with the other two zones, so that the results of panel C are consistent with the change in the law. However, the estimated effect is not stable in the other panels. In addition, when the number of hours worked are taken into account, the estimated effect is nil in the majority of cases. This suggests that the rise in the minimum wage could have affected this type of worker only in respect of the hours worked, which would have raised these workers' overall wages without there really being any effect on the hourly wage.

Table 10 shows results analogous to those in table 9, but comparing the effects in zones A and B only. That is, it shows the results of the estimation of equation (4) with Y_{it} as the log of the wage of individual i in quarter t , using only the sample of people working in zones A or B. No statistically significant results were found in the monthly or hourly wage in any of the three panels when the whole sample was used. In the sample of wage workers, only the panel for the fourth quarter of 2012 to the second quarter of 2013 showed the hourly wage rising by 4.5% for those in zone B after minimum wage equalization, compared to wage workers in zone A.

Table 10

Difference-in-difference estimator for effects on 1 wage using different periods, equation (4)

Variables	All		Less than three times the minimum wage	
	Monthly wage	Hourly wage	Monthly wage	Hourly wage
Panel A: second quarter of 2012-second quarter of 2013				
<i>All</i>				
Zone B*Year2013	0.1218 [0.0934]	0.0779 [0.0902]	0.0090 [0.0510]	-0.0402 [0.0449]
<i>Wage workers</i>				
Zone B*Year2013	0.0158 [0.0604]	0.0195 [0.0754]	-0.0127 [0.0546]	-0.0175 [0.0525]
Panel B: fourth quarter of 2012-first quarter of 2013				
<i>All</i>				
Zone B*Year2013	0.0158 [0.0151]	0.0390 [0.0256]	0.0382** [0.0126]	0.0338 [0.0221]
<i>Wage workers</i>				
Zone B*Year2013	0.0105 [0.0106]	0.0261 [0.0206]	0.0521*** [0.0122]	0.0439** [0.0178]
Panel C: fourth quarter of 2012-second quarter of 2013				
<i>All</i>				
Zone B*Year2013	0.0469 [0.0269]	0.0469 [0.0280]	0.0366* [0.0172]	0.0073 [0.0199]
<i>Wage workers</i>				
Zone B*Year2013	0.0379 [0.0218]	0.0455** [0.0202]	0.0425* [0.0225]	0.0136 [0.0182]

Source: Prepared by the authors, on the basis of data from the National Occupation and Employment Survey (ENOE).

Note: Sample for individuals aged 15 years and over working in zone A or B. Excludes those not receiving or not specifying income in at least one round of observation. Coefficient significant at *10%, **5% and ***1%. Robust standard errors adjusted at the state level shown in square brackets. Wages are at June 2014 prices and in log scale. Each model incorporates gender, age, age squared, indicators of educational level and quarter indicators.

At the same time, analysing the case of all workers receiving less than three times the minimum wage, it was found that the panel for the fourth quarter of 2012 to the first quarter of 2013 showed the monthly wage of workers in zone B rising by 3.8% after the equalization of the minimum wage,

with respect to workers in zone A. This effect is of a similar magnitude to that seen in the panel for the fourth quarter of 2012 to the second quarter of 2013, while no significant effects were found in the other panel. Nor were any significant effects found in the hourly wage.

In the case of wage workers, it was observed that in the panel for the fourth quarter of 2012 to the first quarter of 2013, the monthly wage of those in zone B rose by 5.2% with respect to those in zone A after equalization. In the panel for the fourth quarter of 2012 to the second quarter of 2013, the monthly wage of workers in zone B rose by 4.2%.

5. Uneven effects by gender, age and educational level using panel data

In order to determine whether the equalization affected different groups of workers in particular ways, equation (4) was estimated incorporating the variable $zoneB_{it} * D2013_{it}$, combining age, gender and educational level of i . Table 11 shows the results of this interaction with the log wage of wage worker i at time t as the dependent variable. In the case of the largest panel, the hourly wage rose 16.4 percentage points for the lowest-income wage workers in zone B who had secondary schooling, and 13 points for those in zone B who had upper secondary schooling.

After the equalization of the minimum wage, the monthly wage of zone B workers without schooling rose by 11-12 percentage points in two panels, and that of workers with primary schooling rose by between 3.5 and 13 percentage points after the equalization.

Table 11
Uneven effects by gender, age and educational level

Variables	All		Less than three times the minimum wage	
	Monthly wage	Hourly wage	Monthly wage	Hourly wage
Panel A: second quarter of 2012-second quarter of 2013				
Zone B*Year 2013*Age	0.0001*** [0.0000]	0.0001 [0.0001]	0.0000*** [0.0000]	0.0001*** [0.0000]
Zone B*Year 2013*Man	-0.0690 [0.0884]	-0.0469 [0.0850]	-0.0519 [0.0739]	0.0410 [0.0422]
Zone B*Year 2013*No primary	-0.0826 [0.1089]	-0.1277 [0.2542]	-0.0430 [0.1789]	-0.0430 [0.1262]
Zone B*Year 2013*Primary	-0.0625 [0.0561]	-0.0681 [0.1113]	-0.0045 [0.1062]	0.0615 [0.0824]
Zone B*Year 2013*Secondary	0.0151 [0.1265]	0.0339 [0.1421]	-0.0078 [0.1143]	0.1642* [0.0877]
Zone B*Year 2013*Upper secondary	0.0741 [0.1331]	0.1450 [0.1755]	0.0107 [0.1242]	0.1327** [0.0604]
Panel B: fourth quarter of 2012-first quarter of 2013				
Zone B*Year 2013*Age	-0.0000 [0.0000]	-0.0000 [0.0000]	-0.0000** [0.0000]	-0.0000** [0.0000]
Zone B*Year 2013*Man	-0.0071 [0.0200]	0.0212 [0.0218]	-0.0315** [0.0133]	-0.0096 [0.0138]
Zone B*Year 2013*No primary	0.1250* [0.0618]	0.1110* [0.0635]	0.0237 [0.0584]	0.0043 [0.1001]
Zone B*Year 2013*Primary	0.1264* [0.0662]	0.0895 [0.0561]	0.0173 [0.0502]	-0.0366 [0.0602]
Zone B*Year 2013*Secondary	0.1577*** [0.0557]	0.1154* [0.0575]	0.0410 [0.0601]	-0.0293 [0.0684]
Zone B*Year 2013*Upper secondary	0.0812 [0.0570]	0.0756 [0.0592]	-0.0320 [0.0383]	-0.0432 [0.0567]

Table 11 (concluded)

Variables	All		Less than three times the minimum wage	
	Monthly wage	Hourly wage	Monthly wage	Hourly wage
Panel C: fourth quarter of 2012-second quarter of 2013				
Zone B*Year 2013*Age	-0.0000 [0.0000]	0.0000 [0.0000]	-0.0000* [0.0000]	-0.0000 [0.0000]
Zone B*Year 2013*Man	-0.0073 [0.0154]	0.0180 [0.0342]	-0.0131** [0.0055]	0.0217 [0.0239]
Zone B*Year 2013*No primary	0.1081*** [0.0318]	-0.0283 [0.0450]	-0.0059 [0.0680]	-0.0041 [0.0723]
Zone B*Year 2013*Primary	0.0350** [0.0159]	-0.0901*** [0.0264]	-0.0649 [0.0773]	-0.1260** [0.0609]
Zone B*Year 2013*Secondary	0.0598 [0.0356]	-0.0180 [0.0449]	-0.0727 [0.0728]	-0.0581 [0.0682]
Zone B*Year 2013*Upper secondary	0.0392 [0.0431]	0.0181 [0.0391]	-0.0877* [0.0487]	-0.0001 [0.0426]

Source: Prepared by the authors.

Note: Coefficient significant at *10%, **5% and ***1%. Robust standard errors adjusted at the state level shown in square brackets. Each model incorporates gender, age, age squared, indicators of educational level, urban location and interactions between educational level, urban location and gender, quarter indicators and city. Excludes those not receiving or not specifying income. Sample for individuals aged 15 years and over.

V. Conclusions

This work has found at least three results worthy of note. First, in no instance was evidence found of negative effects on employment or on income following the decision to increase the minimum wage in geographical zone B. Second, there is evidence that the decision to align minimum wages in zone B with those in zone A led to an increase in workers' hourly wages and, in some cases, in their total wages. Third and perhaps most important, the rise in the minimum wage in zone B may have shifted the incentives, such that both those who were originally informal wage workers and those who were self-employed showed a greater propensity to move into formal employment. The propensity to remain in formal employment also appears to have increased and, in at least one case, the propensity to be unemployed decreased.

All these results should be treated with caution, however, and they cannot be readily extrapolated to other cases or other economies. There are at least two reasons for this: first, because the increase produced by the wage equalization was relatively small (3.1% in real terms) and, second, because the minimum wage in Mexico has fallen over 70% in real terms in the past three decades, so the slack in Mexican labour markets may very well not apply to other contexts or other economies.

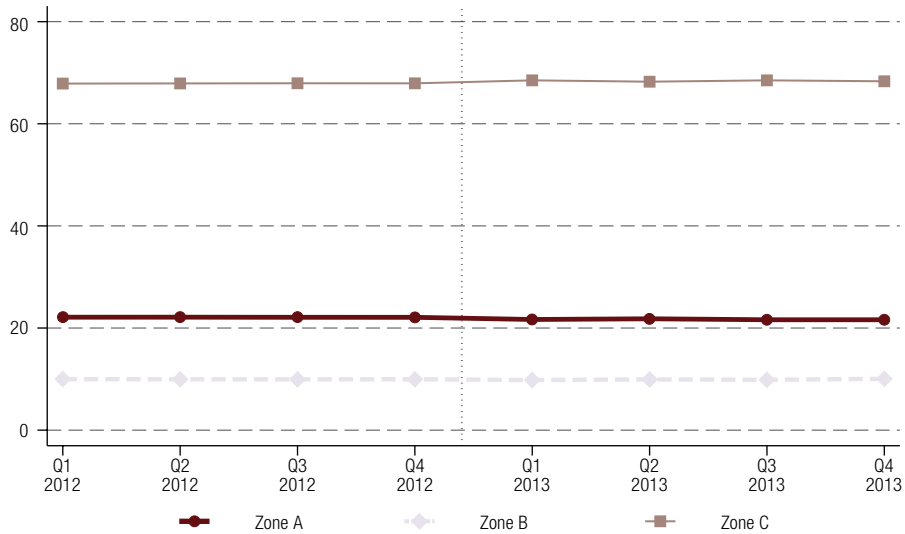
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Annex A1

Figure A1.1

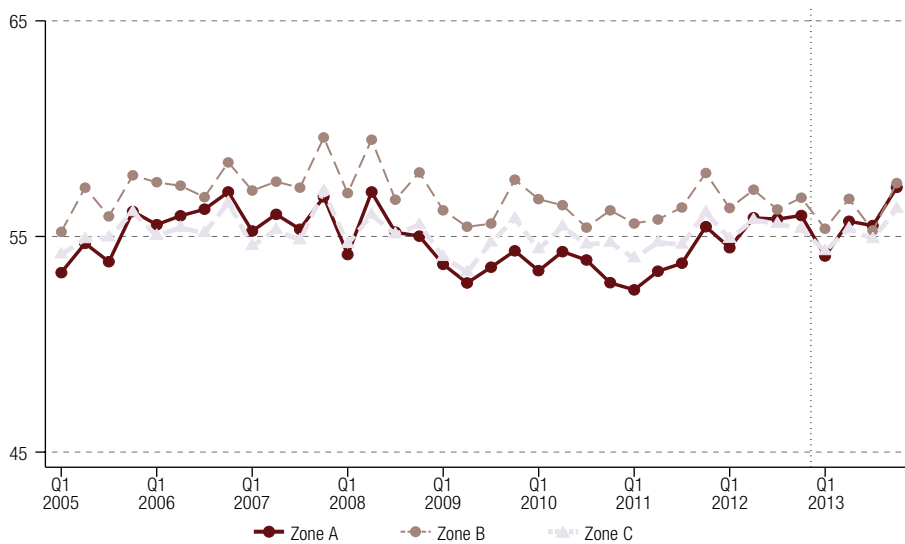
Mexico: population aged 15 years and over by geographical zone, 2012-2013
(Percentages)



Source: Prepared by the authors, on the basis of data from the National Occupation and Employment Survey (ENOE).

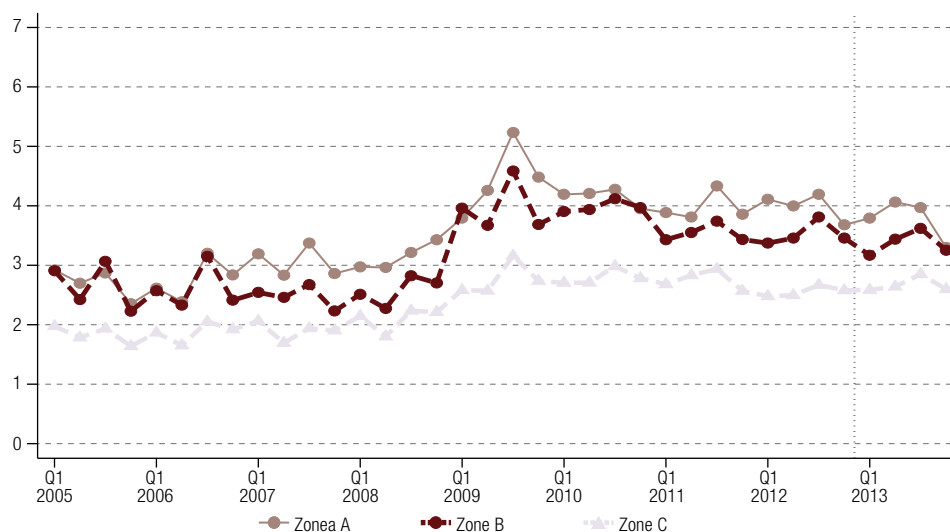
Figure A1.2

Mexico: workers by geographical zone, 2005-2013
(Percentages)



Source: Prepared by the authors, on the basis of data from persons aged 15 years or over.

Figure A1.3
Mexico: unemployed, by geographical zone, 2005-2013
(Percentages)



Source: Prepared by the authors, on the basis of data from persons aged 15 years or over.

Table A1.1
Difference-in-difference estimator including control of zone A, equation (2)

Variables	Worker ^a	Wage worker ^{a,b}	Self-employed ^{a,b}	Formal ^{a,b}	Wage worker ^{a,c}		Outside the labour force
					formal	Unemployed	
Zone B*Year 2013	-0.0046 [0.0059]	-0.0036 [0.0054]	0.0010 [0.0050]	0.0061 [0.0128]	0.0072 [0.0146]	-0.0024 [0.0015]	0.0023 [0.0045]
Zone A*Year 2013	-0.0007 [0.0076]	-0.0057 [0.0045]	0.0074* [0.0037]	-0.0088 [0.0101]	-0.0083 [0.0114]	-0.0045*** [0.0016]	-0.0037 [0.0048]
Observations	1 956 622	953 963	953 963	953 963	676 948	2 278 006	2 278 006
Adjusted R ²	0.2212	0.1130	0.1160	0.2158	0.2569	0.0153	0.2650

Source: Prepared by the authors.

Note: Coefficient significant at *10%, **5% and ***1%. Robust standard errors adjusted at the state level shown in square brackets. Each model incorporates gender, age, age squared, indicators of educational level, urban location and interactions between education level, urban location and gender, quarter indicators and city. Sample of persons aged 15 years or over observed in 2012 and 2013.

^a Excludes those not receiving or not specifying income.

^b Restricted to workers.

^c Restricted to wage workers.

Table A1.2
Difference-in-difference estimator with effects for each quarter of 2013, equation (3)

Variables	Worker ^a	Wage worker ^{a b}	Self-employed ^{a b}	Formal ^{a b}	Wage worker ^{a c}		Unemployed	Outside the labour force
					formal	informal		
Zone B*Quarter 1 2013	0.0016 [0.0054]	0.0048 [0.0043]	-0.0077 [0.0047]	0.0087 [0.0110]	0.0072 [0.0096]	-0.0034 [0.0030]	0.0023 [0.0045]	
Zone B*Quarter 2 2013	0.0000 [0.0085]	-0.0076 [0.0054]	0.0071 [0.0049]	0.0116 [0.0083]	0.0166 [0.0114]	-0.0005 [0.0017]	-0.0016 [0.0058]	
Zone B*Quarter 3 2013	-0.0127*** [0.0043]	-0.0045 [0.0095]	-0.0008 [0.0072]	0.0032 [0.0194]	0.0055 [0.0208]	-0.0002 [0.0026]	0.0092** [0.0044]	
Zone B*Quarter 4 2013	-0.0082 [0.0115]	-0.0035 [0.0072]	0.0002 [0.0059]	0.0084 [0.0162]	0.0079 [0.0205]	-0.0007 [0.0032]	0.0031 [0.0097]	
Observations	1 956 622	953 963	953 963	953 963	676 948	2 278 006	2 278 006	
Adjusted R ²	0.2212	0.1130	0.1160	0.2158	0.2569	0.0153	0.2650	

Source: Prepared by the authors.

Note: Coefficient significant at *10%, **5% and ***1%. Robust standard errors adjusted at the state level shown in square brackets. Each model incorporates gender, age, age squared, indicators of educational level, urban location and interactions between education level, urban location and gender, quarter indicators and city. Sample of persons aged 15 years or over, observed in 2012 and 2013.

^a Excludes those not receiving or not specifying income.

^b Restricted to workers.

^c Restricted to wage workers.

Table A1.3
Difference-in-difference estimator for wage workers only, equation (4)

Variables	Worker ^a	Wage worker ^{a b}	Self-employed ^{a b}	Wage worker ^{a c}		Unemployed	Outside the labour force
				formal	informal		
Panel A: second quarter of 2012-second quarter of 2013							
Zone B*Year2013	-0.0381* [0.0211]	0.0135 [0.0106]	-0.0125 [0.0098]	0.0352* [0.0190]	-0.0217 [0.0130]	0.0096 [0.0077]	0.0176*** [0.0047]
Panel B: fourth quarter of 2012-first quarter of 2013							
Zone B*Year2013	-0.0248 [0.0387]	-0.0205 [0.0164]	0.0034 [0.0064]	-0.0407 [0.0609]	0.0202 [0.0471]	0.0170 [0.0155]	0.0050 [0.0284]
Panel C: fourth quarter of 2012-second quarter of 2013							
Zone B*Year2013	-0.0021 [0.0445]	-0.0026 [0.0107]	0.0221 [0.0192]	0.0519 [0.0334]	-0.0545 [0.0326]	-0.0312** [0.0149]	0.0199 [0.0198]

Source: Prepared by the authors.

Note: Coefficient significant at *10%, **5% and ***1%. Robust standard errors adjusted at the state level shown in square brackets. Each model incorporates gender, age, age squared, indicators of educational level and quarter indicators. Sample of persons aged 15 years or over.

^a Excludes those not receiving or not specifying income.

^b Restricted to workers.

^c Restricted to wage workers. Restricted to those figuring as formal workers in the first observation round.

Table A1.4

Difference-in-difference estimator restricted to those who were formal wage workers in the first period, equation (4)

Variables	Worker ^a	Wage worker ^{a b}	Self-employed ^{a b}	Wage worker ^{a c}		Unemployed	Outside the labour force
				formal ^{a b}	informal		
Panel A: second quarter of 2012-second quarter of 2013							
Zone B*Year2013	-0.0345 [0.0224]	0.0237 [0.0158]	-0.0116 [0.0130]	0.0555** [0.0248]	-0.0206 [0.0159]	0.0099 [0.0069]	0.0131* [0.0069]
Panel B: fourth quarter of 2012-first quarter of 2013							
Zone B*Year2013	-0.0236 [0.0318]	-0.0161 [0.0131]	0.0051 [0.0060]	-0.0197 [0.0506]	0.0203 [0.0458]	0.0161 [0.0159]	0.0038 [0.0251]
Panel C: fourth quarter of 2012-second quarter of 2013							
Zone B*Year2013	-0.0128 [0.0457]	-0.0283* [0.0149]	0.0363** [0.0138]	0.0669** [0.0301]	-0.0842** [0.0344]	-0.0355** [0.0159]	0.0281 [0.0202]

Source: Prepared by the authors.

Note: Coefficient significant at *10%, **5% and ***1%. Robust standard errors adjusted at the state level shown in square brackets. Each model incorporates gender, age, age squared, indicators of educational level and quarter indicators. Sample of persons aged 15 years or over.

^a Excludes those not receiving or not specifying income.

^b Restricted to workers.

^c Restricted to those figuring as formal wage workers in the first observation round.

Table A1.5

Difference-in-difference estimator restricted to those who were informal wage workers in the first period, equation (4)

Variables	Worker ^a	Wage worker ^{a b}	Self-employed ^{a b}	Formal ^{a b}	Wage worker ^{a c}	Unemployed	Outside the labour force
					formal		
Panel A: second quarter of 2012-second quarter of 2013							
Zone B*Year2013	-0.0611* [0.0327]	-0.0352 [0.0416]	0.0125 [0.0374]	0.1079*** [0.0316]	0.1092*** [0.0313]	0.0162 [0.0121]	0.0354*** [0.0112]
Panel B: fourth quarter of 2012-first quarter of 2013							
Zone B*Year2013	-0.0619 [0.0527]	0.0225 [0.0392]	0.0033 [0.0303]	-0.0231 [0.0342]	-0.0158 [0.0339]	0.0709** [0.0287]	-0.0003 [0.0238]
Panel C: fourth quarter of 2012-second quarter of 2013							
Zone B*Year2013	-0.0395 [0.0284]	0.0340 [0.0308]	-0.0148 [0.0265]	0.0640 [0.0566]	0.0773 [0.0555]	0.0476 [0.0424]	-0.0089 [0.0205]

Source: Prepared by the authors.

Note: Coefficient significant at *10%, **5% and ***1%. Robust standard errors adjusted at the state level shown in square brackets. Each model incorporates gender, age, age squared, indicators of educational level and quarter indicators. Sample of persons aged 15 years or over.

^a Excludes those not receiving or not specifying income.

^b Restricted to workers.

^c Restricted to wage workers. Restricted to those figuring as informal wage workers in the first observation round.

Table A1.6
Difference-in-difference estimator restricted to workers who were self-employed
in the first period, equation (4)

Variables	Worker ^a	Wage worker ^{a,b}	Formal ^{a,b}	Wage worker ^{a,c}		Unemployed	Outside the labour force
				formal	informal		
Panel A: second quarter of 2012-second quarter of 2013							
Zone B*Year2013	0.0038 [0.0337]	0.0804 [0.0618]	0.1040* [0.0610]	0.0970** [0.0430]	-0.0166 [0.0299]	-0.0037 [0.0086]	0.0063 [0.0224]
Panel B: fourth quarter of 2012-first quarter of 2013							
Zone B*Year2013	-0.0476 [0.0688]	-0.0059 [0.0432]	0.2143 [0.2032]	-0.0687* [0.0373]	0.0628* [0.0345]	0.0305 [0.0517]	0.0082 [0.0742]
Panel C: fourth quarter of 2012-second quarter of 2013							
Zone B*Year2013	-0.0059 [0.1071]	-0.0569 [0.0657]	-0.0846 [0.0655]	-0.0528* [0.0287]	-0.0041 [0.0557]	-0.0759*** [0.0234]	0.0816 [0.1110]

Source: Prepared by the authors.

Note: Coefficient significant at *10%, **5% and ***1%. Robust standard errors adjusted at the state level shown in square brackets. Each model incorporates gender, age, age squared, indicators of educational level and quarter indicators. Sample of persons aged 15 years or over.

^a Excludes those not receiving or not specifying income.

^b Restricted to workers.

^c Restricted to wage workers. Restricted to those figuring as self-employed workers in the first observation round.

Table A1.7
Difference-in-difference estimator for wages restricted to wage workers, equation (4)

Variables	Worker ^a	Wage worker ^{a,b}	Self-employed ^{a,b}	Formal ^{a,b}	Wage worker ^{a,c}		Unemployed	Outside the labour force	EAP
					formal	informal			
Panel A: second quarter of 2012-second quarter of 2013									
Zone B*Year2013	-0.0051 [0.0345]	0.0204 [0.0275]	-0.0209 [0.0881]	0.0425 [0.0272]	0.0428 [0.0295]	-0.1558*** [0.0306]	-0.0895 [0.0701]	-0.0129 [0.0189]	-0.0269** [0.0092]
Panel B: fourth quarter of 2012-first quarter of 2013									
Zone B*Year2013	-0.0077 [0.0545]	0.0001 [0.0304]	0.0028 [0.1222]	-0.0473 [0.0611]	-0.0624 [0.0706]	0.0420 [0.0773]	-0.1463 [0.0908]	-0.0252 [0.0392]	-0.0353 [0.0266]
Panel C: fourth quarter of 2012-second quarter of 2013									
Zone B*Year2013	-0.0322 [0.0201]	-0.0173 [0.0254]	0.1577 [0.0991]	0.0433 [0.0780]	0.0538 [0.0781]	0.0652 [0.1001]	0.0262 [0.0861]	-0.0518 [0.0371]	-0.0493 [0.0328]

Source: Prepared by the authors.

Note: Coefficient significant at *10%, **5% and ***1%. Robust standard errors adjusted at the state level shown in square brackets. Each model incorporates gender, age, age squared, indicators of educational level and quarter indicators. Sample of persons aged 15 years or over living in zone A or B

^a Excludes those not receiving or not specifying income.

^b Restricted to workers.

^c Restricted to wage workers.

Table A1.8

Difference-in-difference estimator for wages restricted to formal workers, equation (4)

Variables	Worker ^a	Wage worker ^{a,b}	Self-employed ^{a,b}	Wage worker ^{a,c}		Unemployed	Outside the labour force
				formal	informal		
Panel A: second quarter of 2012-second quarter of 2013							
Zone B*Year2013	0.0028 [0.0360]	0.0506* [0.0269]	-0.0228 [0.0190]	0.0422 [0.0293]	0.0084 [0.0145]	-0.0047 [0.0086]	0.0040 [0.0133]
Panel B: fourth quarter of 2012-first quarter of 2013							
Zone B*Year2013	0.0187 [0.0725]	-0.0142 [0.0173]	0.0096 [0.0063]	-0.0553 [0.0730]	0.0411 [0.0603]	-0.0051 [0.0335]	-0.0173 [0.0480]
Panel C: fourth quarter of 2012-second quarter of 2013							
Zone B*Year2013	-0.0072 [0.0394]	-0.0123 [0.0070]	0.0311 [0.0210]	0.0546 [0.0765]	-0.0668 [0.0775]	-0.0186 [0.0270]	0.0132 [0.0308]

Source: Prepared by the authors.**Note:** Coefficient significant at *10%, **5% and ***1%. Robust standard errors adjusted at the state level shown in square brackets. Each model incorporates gender, age, age squared, indicators of educational level and quarter indicators. Sample of persons aged 15 years or over working in zone A or B.^a Excludes those not receiving or not specifying income.^b Restricted to workers.^c Restricted to wage workers. Restricted to those figuring as formal workers in the first observation round.**Table A1.9**

Difference-in-difference estimator for wages restricted to formal wage workers, equation (4)

Variables	Worker ^a	Wage worker ^{a,b}	Self-employed ^{a,b}	Wage worker ^{a,c}		Unemployed	Outside the labour force
				formal ^{a,b}	informal		
Panel A: second quarter of 2012-second quarter of 2013							
Zone B*Year2013	0.0072 [0.0399]	0.0558** [0.0243]	-0.0408* [0.0205]	0.0522* [0.0277]	0.0129 [0.0159]	-0.0005 [0.0098]	-0.0055 [0.0148]
Panel B: fourth quarter of 2012-first quarter of 2013							
Zone B*Year2013	-0.0048 [0.0518]	-0.0159 [0.0142]	0.0092 [0.0063]	-0.0459 [0.0647]	0.0465 [0.0598]	0.0047 [0.0328]	-0.0095 [0.0379]
Panel C: fourth quarter of 2012-second quarter of 2013							
Zone B*Year2013	-0.0452 [0.0475]	-0.0464*** [0.0141]	0.0486*** [0.0138]	0.0664 [0.0768]	-0.1002 [0.0792]	-0.0214 [0.0295]	0.0378 [0.0309]

Source: Prepared by the authors.**Note:** Coefficient significant at *10%, **5% and ***1%. Robust standard errors adjusted at the state level shown in square brackets. Each model incorporates gender, age, age squared, indicators of educational level and quarter indicators. Sample of persons aged 15 years or over working in zone A or B.^a Excludes those not receiving or not specifying income.^b Restricted to workers.^c Restricted to wage workers. Restricted to those figuring as formal wage workers in the first observation round.

Table A1.10

Difference-in-difference estimator for wages restricted to informal wage workers, equation (4)

Variables	Worker ^a	Wage worker ^{a,b}	Self-employed ^{a,b}	Wage worker ^{a,c}		Unemployed	Outside the labour force
				Formal ^{a,b}	formal		
Panel A: second quarter of 2012-second quarter of 2013							
Zone B*Year2013	-0.0079 [0.0485]	-0.0510 [0.0467]	0.0269 [0.0353]	0.0937** [0.0321]	0.1048** [0.0346]	-0.0010 [0.0187]	0.0163 [0.0208]
Panel B: fourth quarter of 2012-first quarter of 2013							
Zone B*Year2013	-0.0665 [0.0685]	0.0221 [0.0520]	0.0117 [0.0445]	-0.0259 [0.0584]	-0.0199 [0.0580]	0.0701* [0.0347]	0.0121 [0.0374]
Panel C: fourth quarter of 2012-second quarter of 2013							
Zone B*Year2013	-0.0417 [0.0429]	0.0250 [0.0591]	-0.0107 [0.0369]	-0.0483 [0.0816]	-0.0401 [0.0824]	0.0513 [0.0424]	0.0043 [0.0286]

Source: Prepared by the authors.**Note:** Coefficient significant at *10%, **5% and ***1%. Robust standard errors adjusted at the state level shown in square brackets. Each model incorporates gender, age, age squared, indicators of educational level and quarter indicators. Sample of persons aged 15 years or over working in zone A or B.^a Excludes those not receiving or not specifying income.^b Restricted to workers.^c Restricted to wage workers. Restricted to those figuring as informal wage workers in the first observation round.**Table A1.11**

Difference-in-difference estimator for wages restricted to self-employed wage workers, equation (4)

Variables	Worker ^a	Wage worker ^{a,b}	Formal ^{a,b}	Wage worker ^{a,c}		Unemployed	Outside the labour force
				formal	informal		
Panel A: second quarter of 2012-second quarter of 2013							
Zone B*Year2013	-0.0363 [0.0523]	-0.0063 [0.0757]	0.0538 [0.0702]	0.0384 [0.0523]	-0.0447 [0.0338]	-0.0267 [0.0160]	0.0823** [0.0315]
Panel B: fourth quarter of 2012-first quarter of 2013							
Zone B*Year2013	0.0776 [0.1129]	-0.0142 [0.1207]	0.1134 [0.2034]	-0.1390 [0.1267]	0.1248** [0.0477]	-0.0386 [0.0882]	-0.0492 [0.0743]
Panel C: fourth quarter of 2012-second quarter of 2013							
Zone B*Year2013	0.0812 [0.1146]	-0.1439 [0.1059]	-0.1787* [0.0895]	-0.1468 [0.1030]	0.0030 [0.0552]	-0.0695* [0.0328]	0.0288 [0.1185]

Source: Prepared by the authors.**Note:** Coefficient significant at *10%, **5% and ***1%. Robust standard errors adjusted at the state level shown in square brackets. Each model incorporates gender, age, age squared, indicators of educational level and quarter indicators. Sample of persons aged 15 years or over working in zone A or B.^a Excludes those not receiving or not specifying income.^b Restricted to workers.^c Restricted to wage workers. Restricted to those figuring as self-employed in the first observation round.

Table A1.12

Effect of minimum wage equalization on contact rates, contrast between zone B and the other zones

Variables	Worker ^a	Wage worker ^{a,b}	Self-employed ^{a,b}	Formal ^{a,b}	Wage worker ^{a,c}		Unemployed	Outside the labour force	EAP
					formal	informal			
Panel A: second quarter of 2012:2-second quarter of 2013									
Zone B*Year2013	0.0000***					0.0000	0.0000***	0.0000***	0.0000***
	[0.0000]					[0.0000]	[0.0000]	[0.0000]	[0.0000]
Panel B: fourth quarter of 2012-first quarter of 2013									
Zone B*Year2013	0.0132	0.0140	0.0025	0.0130	0.0116	0.0192	0.0070	0.0193***	0.0145
	[0.0128]	[0.0152]	[0.0101]	[0.0110]	[0.0112]	[0.0228]	[0.0130]	[0.0053]	[0.0099]
Panel C: fourth quarter of 2012-second quarter of 2013									
Zone B*Year2013	0.0233	0.0119	0.0690**	0.0277	0.0233	-0.0010	0.0086	0.0456***	0.0311
	[0.0208]	[0.0214]	[0.0269]	[0.0231]	[0.0239]	[0.0271]	[0.0229]	[0.0129]	[0.0186]

Source: Prepared by the authors.**Note:** Coefficient significant at *10%, **5% and ***1%. Robust standard errors adjusted at the state level shown in square brackets. Each model incorporates gender, age, age squared, indicators of educational level and quarter indicators. Sample of persons aged 15 years or over.^a Excludes those not receiving or not specifying income.^b Restricted to workers.^c Restricted to wage workers.**Table A1.13**

Effect of minimum wage equalization on contact rates, contrast between zone B and zone A

Variables	Worker	Wage worker ^b	Self-employed ^{a,b}	Formal ^{a,b}	Wage worker ^{a,c}		Unemployed	Outside the labour force	EAP
					formal	informal			
Panel A: second quarter of 2012-second quarter of 2013									
Zone B*Year2013		0.0000	-0.0000			-0.0000	0.0000	-0.0000	0.0000
		[0.0000]	[0.0000]			[0.0000]	[0.0000]	[0.0000]	[0.0000]
Panel B: fourth quarter of 2012-first quarter of 2013									
Zone B*Year2013	-0.0053	-0.0113	0.0500	-0.0081	0.0005	-0.0296	-0.0252	0.0115	0.0020
	[0.0292]	[0.0308]	[0.0378]	[0.0316]	[0.0342]	[0.0330]	[0.0250]	[0.0239]	[0.0262]
Panel C: fourth quarter of 2012-second quarter of 2013									
Zone B*Year2013	0.0132	0.0184	0.0020	0.0152	0.0208	0.0144	0.0263	0.0166	0.0199*
	[0.0151]	[0.0143]	[0.0218]	[0.0174]	[0.0178]	[0.0190]	[0.0228]	[0.0100]	[0.0102]

Source: Prepared by the authors.**Note:** Coefficient significant at *10%, **5% and ***1%. Robust standard errors adjusted at the state level shown in square brackets. Each model incorporates gender, age, age squared, indicators of educational level and quarter indicators. Sample of persons aged 15 years or over living in zone A or B.^a Excludes those not receiving or not specifying income.^b Restricted to workers.^c Restricted to wage workers.