

The Effects of the Minimum Wage on Employment and Wages

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Abstract

The effect of the minimum wage on labor market outcomes is controversial. There are several studies for developed countries with mixed results, but there is a lack of evidence for developing countries. We have access to a panel of workers from the unemployment insurance system in Chile, which allows us to study the effect of four consecutive increases in minimum wages using administrative data. We use several definitions of treatment and control groups, finding consistently a small and positive effect of the minimum wage on formal wages, and non-significant effects on formal employment.

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1 Introduction

The minimum wage is one of the most controversial and debated topics in economic literature. In theory, its policy impact on employment depends on the type of market in which firms compete. In a competitive market, the minimum wage could increase unemployment, while in a market characterized by monopsonic or oligopsonic competition it could lead to an increase in wages and employment. Despite the great quantity of empirical work on the subject in the last 25 years, there is still no consensus on the effects of this policy on employment (Manning, 2016). The reasons for this disagreement are that the results are determined by methodological choices, the data used, the type of worker that is considered affected by the minimum wage, the industry where she works, and the institutional characteristics of the country in question (Chletsos and Giotis, 2015).

Although the literature on the minimum wage is abundant, it is concentrated on developed economies. The conclusions that can be extracted from these studies are hardly applicable to developing countries due to structural differences in labor markets. The consequences of minimum wage policies are particularly important for developing countries due to the difficulty that these have in improving the standards for low income workers and the existence of informal labor markets (Belman and Wolfson, 2016).

The aim of this paper is to contribute to the literature estimating the impact on wages and employment of the annual changes of the minimum wage in Chile between 2008 and 2012. In particular, we estimate the impact of the minimum wage on employment and wages in the formal sector using administrative data. We evaluate the effect using different treatment and control groups.

To carry out these estimations, we construct a sample from the unemployment insurance database, which is a monthly panel that reports information on the labor relationships of the workers in the private formal labor sector of the economy. This data is administrative, and therefore we are able to minimize measurement error. The sample was drawn from firms that in June 2008 employed five or more people. To answer our research question we use a difference-in-differences identification strategy. This methodology allows us to address two potential identification problems: a) eliminate the bias due to permanent differences between the treatment and control groups and b) eliminate the bias due to temporary trends.

Specifically, we define the treatment group as the group of workers that earn the minimum wage on the month before the minimum wage is set to increase. The control group corresponds to the workers that earn a wage above, but close, to the new minimum wage on the month before the minimum wage is set to increase. Then, we compare the wage and employment changes that each of these groups experiments in one or two months after the new minimum wage increases.

Our results indicate that the minimum wage affects the treatment group's wages, which confirms that in Chile the minimum wage is an active constraint. For every Chilean peso that the minimum wage increased, the wages of the treated group increased by between 0.46 and 1.17 pesos. Second, we do not observe an effect of the minimum wage on the probability of being employed in the future. Third, the expected value of a treated worker's income increases when the minimum wage is increased, which is due to the fact that we do not observe an increase in unemployment that counteracts the wage increases.

Taking advantage of a feature of the Chilean legislation we estimate an alternative model, defining a control group that is not affected by the minimum wage, but that has a lower wage than workers that are affected by the minimum wage. This occurs because in Chile some workers can receive a bonus that is a fixed percentage of the current wage, each employer chooses when and how to pay that bonus. Then, a worker with no bonus might earn a wage higher than the new minimum wage, but that wage might still be lower than the wage of a worker that earns the minimum wage plus the bonus, then the first worker is a control worker, and the second worker is a treated worker. This alternative specification confirms the results of the main specification.

We contribute to the literature on minimum wages in three ways. First, this is one of the first studies in Latin America that is undertaken with administrative data. Second, we estimate two specifications that use two definitions of the control group. The first of these control groups includes workers with wages higher than the treatment group, while the second have wages lower than the treated workers. Third, we used several years where the minimum wage changed, allowing to us to include an additional level of robustness to our results.

The rest of this paper is organized as follows. In section 2, we review the international and national literature on the impact of the minimum wage on wages and employment. In section 3, we explain the institutional context of the minimum wage in Chile, why this is a relevant policy, and what are its nuances in the country. In section 4, we show the database used in this study and some stylized facts of the minimum wage. In section 5 we explain the empirical strategy. In section 6, we show the results of our main specification. Finally, in section 7, we undertake the robustness checks.

2 Literature Review

The minimum wage is a controversial policy that has been the subject of a large literature. In this section of the paper we concentrate our literature review on the impact of the minimum wage on wages and employment. First, we analyze the evidence that is available for developed countries, considering the fact that most research has been focused on those economies. Second, we show the evidence available for developing countries. Finally, we summarize the conclusions of the research that is focused on the Chilean labor market.

Until the beginning of the 1990s, there was a broad academic consensus that the minimum wage caused job loss, just as predicted by neoclassical theory under labor market with perfect competition (Manning, 2016). Methodologically, most studies used cross-sectional data or time series. These approaches were criticized due to the lack of a true control group with which to compare to the treated workers. Hence, a “New Minimum Wage Research” arose with the works of Card (1992) and Katz and Krueger (1992). An important finding of the new approach to investigate the effects of minimum wages was the lack of significant effects of the minimum wage on employment.

Since the early 90’s there has been a large quantity of studies on the impact of the minimum wage on employment, and some authors have written a considerable number of literature review articles, looking for an empirical consensus. Neumark and Wascher (2006) undertake a qualitative revision of articles written between 1990 and 2006 with data from different parts of the world, and they find that most studies find negative effects of the minimum wage on employment, although not always statistically significant. Doucouliagos and Stanley (2009) do a meta-analysis of 64 studies published in the United States between 1972 and 2007 which measure the impact of the minimum

wage on youth employment. The authors argue that the best estimations, in their view, find effects on employment close to zero. On the contrary, they find evidence that there is a publication bias in favor of articles that find negative effects. [Chletsos and Giotis \(2015\)](#) analyze 77 articles in 18 countries, finding similar results to [Doucouliagos and Stanley \(2009\)](#). [Boockmann \(2010\)](#) does a meta-analysis of 55 articles that measure the effect of the minimum wage on employment in 15 industrialized countries. The author finds that the effects are heterogeneous across countries and that these differences arise from the institutional characteristics of each nation. In that study, it is observed that 67% of the estimations analyzed show a negative effect of the minimum wage on employment. Finally, that article finds that the most strict labor protection policies tend to intensify the negative effects of the minimum wage on employment.

With regards to the effect of the minimum wage on wages, it is observed by the literature that this policy consistently affects the income distribution in developed countries. The evidence shows that the minimum wage even impacts the wages of workers that are not directly affected by this policy. In line with this, [Autor et al. \(2016\)](#) find that the effects on wages is extensive to percentiles of the wage distribution where the minimum wage is not active. Moreover, [Dickens et al. \(2012\)](#) find that the minimum wage in the United Kingdom has a significant effect on wage inequality for those in the bottom half of the distribution. Specifically, they find the existence of great externalities, and that these are specially large in low income segments of the population.

There is no consensus regarding the effects of the minimum wage in developing economies. [Nataraj et al. \(2014\)](#) carry out a meta-analysis of 15 studies in low income countries, mainly in India and Indonesia, in which they find that minimum wages provoke a displacement of workers from the formal to the informal sector. [Bhorat et al. \(2013\)](#) find that the introduction of a minimum wage in low wage economic activities of the South African economy does not have an impact on employment levels, but it does significantly increase wages in those sectors.

[Lemos \(2009\)](#) finds evidence that the minimum wage in Brazil generates a contraction in the wage distribution of workers in the formal and informal sectors. However, the author does not find an effect on employment in any of these sectors, even when using different definitions of employment. [Maloney and Mendez \(2004\)](#) find that the increase in the minimum wage in Colombia increases the probability that waged workers become unemployed. [Groisman \(2014\)](#) shows that the increase in the minimum wage in Argentina, during the 2000s, did not provoke a fall in employment nor an increase in informal employment. With respect to the effect on wages, [Maurizio and Vázquez \(2016\)](#) find that in Argentina, Brazil, and Uruguay, the increases in the minimum wage had a significant impact on the lower tails of the income distribution, leading to a fall in wage inequality.

In summary, the international literature of the minimum wage finds that: a) this policy has significant effects on the level of wages, even for workers not directly affected by it; b) there is no consensus on the effect of the minimum wage on employment, both in developed and developing countries; and c) in developing countries, there is no consensus on the effects of the minimum wage on the informal market.

For Chile, the research has concentrated on the impact of minimum wage on employment. In general, the results find negative effects on the employment of low skilled workers, but the impact is less consistent when looking at general unemployment ([Ramos and Chamorro, 2013](#)). Most of the articles written for Chile, where aggregate data has been used, find evidence of negative effects of the minimum wage on employment. [Paredes M. and Riveros C. \(1989\)](#), [Chacra Orfali](#)

(1990), Rivera (2002), Cowan et al. (2005), and Wedenoja (2013) use cross-section data and find negative effects. Using time series data, Montenegro (Montenegro) and Montenegro and Pagés (2003) find negative effects, while Bravo and Robbins (1995) and Martínez et al. (2001) find no evidence of an impact on employment. Following the new approach regarding the identification of the effects of the minimum wage, Bravo and Contreras (1998) analyze a natural experiment which considers the minimum wage readjustment of 1998, and find no evidence of an impact on youth employment. Grau and Landerretche (2011) use three identification strategies based on panel data, and find significant effects on income levels and a slight negative effect on the probability of a worker continuing to be employed. However, they do not find evidence that there is an effect on hours worked or on the probability of finding a job for the treated group.

3 Chilean Institutional Context

3.1 Legal and Practical Domain of the Minimum Wage

In this subsection we describe the main institutional characteristics of the minimum wage and show some data that illustrates the relevance of this policy in Chile. We begin by showing the legal reach and the changes that the minimum wage policy has experimented in recent years. Then, we show the percentage of workers affected by this policy, their socioeconomic characteristics, the importance of the minimum wage in Chile compared to developed countries, and the changes in the minimum wage with respect to the economy's average wage.

Chilean law¹ establishes that the minimum wage is unique and obligatory for every labor relationship that involves workers between 18 and 65 year old², whatever the sector of the economy in which they work. The minimum wage is established as a monthly value, assuming that the individual works a full time job of 45 hours per week. In the case of part time work, the minimum wage is proportional to the hours worked. Changes in the minimum wage for the years analyzed in this paper are shown in appendix table A.1.

In June of 2014 the Chilean congress modified the way in which the minimum wage was determined and the length of its applicability. Between 1990 and 2013, the minimum wage was discussed in congressional sessions during each June and went into effect in July for a period of 12 months. In 2013, the debate on the adjustment was overextended until August. This event, and other inconveniences during earlier debates, motivated congress to change the methodology of readjustment, and from that moment onward the minimum wage is readjusted every six months and the amounts are agreed upon once every two years.

Regarding the practical importance of the minimum wage, it can be observed that this policy is relevant for a considerable amount of workers. In 2014, 12.7% of labor relationships between private agents in the formal market involved the minimum wage at least once a year, while 4.9% of labor relationships that lasted the entire year received a payment associated with the minimum wage during all year (Ministerio del Trabajo y Previsión Social, 2015).

The minimum wage is associated with individuals who are socially vulnerable. In approximately 15% of the most vulnerable households in Chile, at least one member of the family received a salary

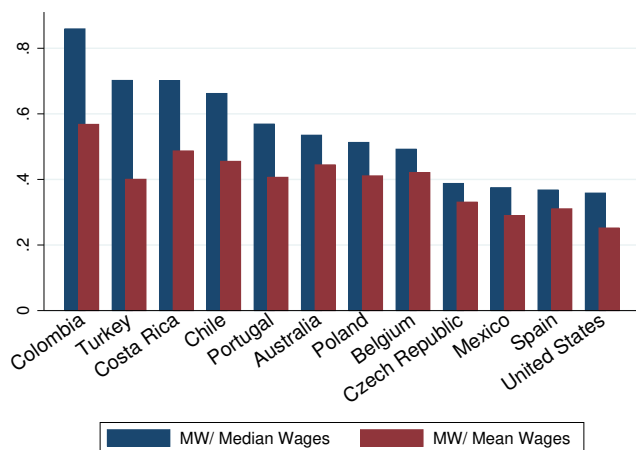
¹The last law enacted on this topic corresponds to law number 20,935.

²The minimum income for people older than 65 or less than 18 years old is 75% of the minimum wage.

linked to the minimum (CASEN 2013). Furthermore, 33.2% of waged workers that are classified as poor receive an hourly wage lower than the minimum, while 23% receives a wage between the minimum and 1.25 times the minimum wage (Ministerio del Trabajo y Previsión Social, 2015).

The minimum wage is particularly relevant for Chile compared to the rest of the countries in the OECD. Currently, 26 of the 34 countries that belong to this organization have minimum wage laws, while in the other eight a large portion of the labor force is covered by collective sectoral agreements in which base wages are negotiated (OECD (2015)). In Chile, the minimum wage is equivalent to 68% of the economy’s median wage and 48% of the average wage, and is topped in the OECD only by Turkey, Colombia, and Costa Rica (see figure 1). This is a sign that the minimum wage policies impact a larger share of workers in developing countries, amongst which is Chile, compared to the other countries in the OECD, in line with the claims in Lemos (2009).

Figure 1. Minimum Wage (MW) as a proportion of median and mean wages in OECD countries



Source: Authors’ calculation with data from OECD stats. Note: for clarity, some countries in the OECD have been excluded. The graph shows twelve countries, in decreasing order of the ratio (Minimum Wage)/(Median Wage). The first four countries shown have the highest ratios, the next four are those with the ratios closest to the OECD average, and the last four economies shown have the lowest ratios in the OECD.

The minimum wage increments were less than the general increase in wages during the years used in this study. Between 2008 and 2012, the real minimum wage increased 15.18%, while the average wage in the economy grew by 17.22%³ (see figure 2). This fact is indicative that during these years, the increases in the minimum wage were relatively small, and therefore it should be difficult to find large scale effects on wages or employment.

³The Real Index of Wages is constructed by the National Institute of Statistics and shows the average changes in income of workers in the public and private sectors.

Figure 2. Evolution of the Real Minimum Wage and of the Average Wage in the Economy.



Source: Authors' own calculations based on data from INE and the Central Bank of Chile. Note: the average wage in the economy is measured based on the Real Index of Compensations.

3.2 The Legal Gratuity and its Impact on Wage Distribution

Chilean legislation establishes that firms are obligated to distribute part of their profits among its workers, through a payment called “legal gratuity” (Labor Code, Art. 42). To comply with this requirement, each company can choose the mechanism that best suits them. The most common mechanism used is to contribute 25% of a worker’s monthly wage to a fund that is payed out once the firm’s earnings are materialized (Ministerio del Trabajo, Dirección del Trabajo, 2015). In this section, we explain how this legislation affects directly the income of those workers that earn the minimum wage.

For an organization to be obligated to pay a legal gratuity, it must satisfy the following requirements: a) it must have commercial objectives, b) it must be for-profit, c) it must practice bookkeeping, and d) it must obtain profits during the commercial year, that is, between January 1st and December 31st. For this legislation, “liquid profits” are defined as profits minus 10% of the employer’s own capital (Labor Code, Art. 42). If a firm has “liquid profits” greater than zero, it has to pay a “legal gratuity” to its workers.

These firms can choose between two mechanisms to pay this benefit to workers. The first modality is regulated by Art. 47 of the Labor Code and consists of apportioning 30% of “liquid profits” obtained during the commercial year amongst all workers, in proportion to the wages obtained by each one of them. This payment can be made in April of the next year at the latest, although it is possible that the firm might want to provide advances with the periodicity that it desires.

The second mechanism is regulated by Art. 50 of the Labor Code and it consists of paying the worker 25% of his or her wages during the commercial year, whatever the “liquid profits” end up becoming. There is a cap for this modality equaling 4.75 minimum wages. Just as the first modality described above, the payment must be made before April of the next year, or the firm can choose to pay before that deadline in installments.⁴

⁴The law establishes that firms cannot pay a wage lower than the minimum and top-up the worker’s wages with the legal gratuity so that in total he or she earns the minimum.

When choosing the mechanism to pay the legal gratuity, the firm must consider two variables: the amount and the frequency with which it will pay. The total amounts that a firm will pay, according to the modality that it chooses, are given by:

1. $0,3 * \Pi_e$
2. $(0,25 * \sum_{i=1}^n w_i) + n_1 * 4,75 * MW$

Where Π_e denotes the firm’s “liquid profits.” Furthermore, $n + n_1$ is the firm’s total workers, where n_1 corresponds to the amount of workers that reach 4.75 minimum wages, while n is the number of workers that do not reach the cap.

The first part of expression 2 corresponds to 25% of the worker’s wages that do not reach the cap, while the second part corresponds to the product of the cap and the number of workers that reach it. Given that the firm’s objective is to maximize profit, these will opt for the modality that minimizes the payment of the legal gratuity.

Firms must also decide the number of payments they will make during the year. The only constraint they face is that the total legal gratuity must be payed in full by April of the next year. Concentrating the payments in a few months can impact the firm’s cash liquidity, and therefore they might prefer to make the payments in a monthly basis.

The data shows that the majority of firms, 76.5%, choose the second mechanism. Of the total number of firms that pay legal gratuity, 93.9% choose to pay in a monthly basis ([Ministerio del Trabajo, Dirección del Trabajo, 2015](#)). Therefore, workers that earn the minimum wage, and get their legal gratuity paid monthly, have an actual income of 125% the minimum wage. For example, in June 2009, approximately 5.8% of workers in the sample received the minimum wage, while 4.2% received the minimum wage plus 25% (see table 1). These are similar in all the years considered in this study, as shown in appendix table [A.3](#).

Table 1. Workers that receive the minimum or 1.25 times the minimum in June 2009

	Number of Workers	Proportion
Minimum Wage	12383	0.058
Minimum Wage + 25%	9044	0.042
Total	213592	

This work is focused on workers that earn the minimum wage plus 25% (minimum plus legal gratuity), we choose this group because allow us to better identify the treated individuals, and because allow us to make comparisons with two control groups, which is a new identification strategy in literature, and provides an additional robustness check.

4 Data

4.1 The Database of the National Unemployment Insurance Scheme

The data used in this study are obtained from the records of the National Unemployment Insurance scheme of Chile.⁵ The database contains monthly information on labor relationships of all waged workers with a job contract in the private sector of the Chilean economy.

The unemployment insurance scheme is a social welfare system designed to protect workers in case they lose their jobs. Each month, the employer is obliged to pay an amount equivalent to 3% of the worker's pre-social security deductions wage to an individual savings account⁶, which allows us to obtain a record of the worker's monthly wages which is backed up by pay-slip. Every time that the employer pays into the unemployment insurance system, a record is created with information on the employee's monthly wage, the type of contract⁷, an employer identifier, and other demographic variables such as gender and age.

This insurance is obligatory for all formal labor relationships in the private sector started after October 2002, and therefore, this database excludes workers that have not been in the formal sector in the last 15 years. During this period, approximately nine million workers have been recorded in the database. In Chile, 69.22% of the workers are formal workers and are part of the unemployment insurance scheme (Reporte de Empleo Trimestral INE), and therefore they constitute the majority of workers when considering the entire Chilean labor market.

The use of this database has two advantages with respect to survey data. The first advantage is that the data is not self-reported by workers but backed up by pay slips, which significantly reduces noise in the variables. Given that in our main specification we define the treatment group as those workers whose wages are exactly equal to the minimum wage, this feature of the database is a critical condition for our empirical approach. The second advantage is that this database allows us to observe the worker month by month, since the unemployment insurance is paid into every month. This is important for the identification strategy since it is possible to observe the wage and the employment status of the workers in the month before and after the readjustment of the minimum wage.

However, we recognize three limitations of this database. First, it does not report the hours worked per month, so we only observe the total monthly wage. This implies that it is not possible to identify workers that earn the hourly minimum wage, but only those that earn the monthly minimum wage with or without legal gratuity. The second limitation is that the database does not explicitly report the amount that the worker receives in the form of legal gratuity, which makes it difficult to define the treated and control groups, as explained in section 5.3. We address both issues in our empirical strategy. Third, this database is not informative about the effect of minimum wage on the informal sector, nor about the effect on the public sector. Notice, however, that the latter is a less relevant limitation given that the wages in the public sector are usually higher than the wages of our treatment and control groups.

⁵These records are compiled by the Superintendency of Pensions and Insurance.

⁶In case the worker loses his or her job, he or she can withdraw the total accumulated amount in this savings account under the rules and guidelines described by the [Labor Directorate \(Dirección del Trabajo\)](#).

⁷Defined term or open ended.

4.2 Description of the Used Sample

For legal and administrative reasons, it is not possible to access the totality of the unemployment insurance database. Therefore, we created a sample that was focused on obtaining information on waged workers that worked in firms which had five or more employees in June 2008. We chose these workers because firms that employ five or more workers concentrate the majority of the labor force of the formal sector. The sample includes the complete wage histories of 1,211,535 workers from January 2008 until December 2012, associated with 6,152 firms. In the next paragraphs we will explain in detail the procedure to construct our sample.

Each observation in the unemployment insurance database has a variable that links the employee with an employer, which allows us to group waged workers by employer in any given month. The first step to construct the sample is to define eligible firms as those that had five or more workers in June of 2008. The second step is to identify the workers that were associated to these firms from January 2008 until December 2012. The third step is to randomly select 5% of these firms, which were associated with 15% percent of all workers.

The last step is to obtain all the observations of the workers that were ever associated to these firms. In particular, we extract all observations between January 2008 and December 2012, even if the worker was not associated to any of these firms in any given month. There are two reasons for this step. First, it allows us to observe the future labor history of the worker if he or she is disassociated from the firm. This is useful because it allows us to separate the workers that are unemployed from those that switch to a firm that is not eligible. Second, it allows us to observe the past labor history of the worker before he or she joined the firm. With this information it is possible to construct variables related to the worker's productivity, like for instance, the average wage that the worker earned in the past and the percent of the time that he or she was employed. This will be useful to construct control variables that will improve the estimations.

By construction, this sample does not consider firms with less than five workers, which are the firms that concentrate the majority of workers that earn the minimum wage. Thus, in our sample, the percent of employees that earn a wage associated to the minimum wage is lower than in the entire population. In fact, in the sample, around 9% of workers earn a wage associated to the minimum wage, while in the Chilean labor market as a whole, this number rises to 12.7%.

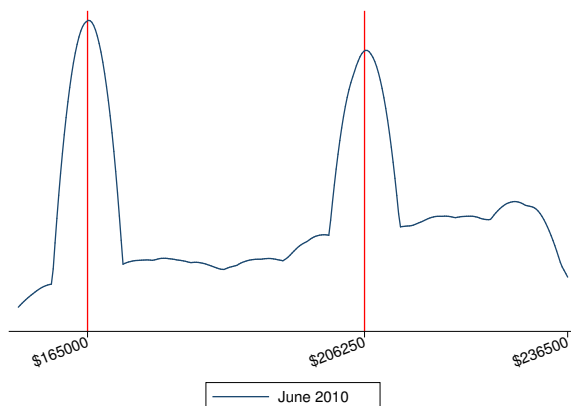
In the sample, 9.4% of workers have more than one job, and therefore, more than one source of wage income. For these cases, we consider only the main wage, defined as the highest wage in the month. If the worker has more than one job with the same wage in both, we randomly select one of these.

This study is focused on the minimum wage readjustments between 2008 and 2012. There are two constraints that force us to choose this period: the availability of data and the legal uniformity of the minimum wage readjustments. First, we start in 2008 simply because the sample has information from January 2008. Second, the sample stops in 2012 because this was the last year in which the minimum wage was defined in June and readjusted in July of the same year.

4.3 The Minimum Wage as an Active Constraint

There are two stylized facts that suggest that minimum wage policy affects income distribution in the economy. First, a particularly large quantity of workers is recorded as earning the minimum wage or the minimum plus the legal gratuity, as observed in figure 3. This is a signal that in the absence of this policy, a significant group of waged workers would earn less than the minimum wage.

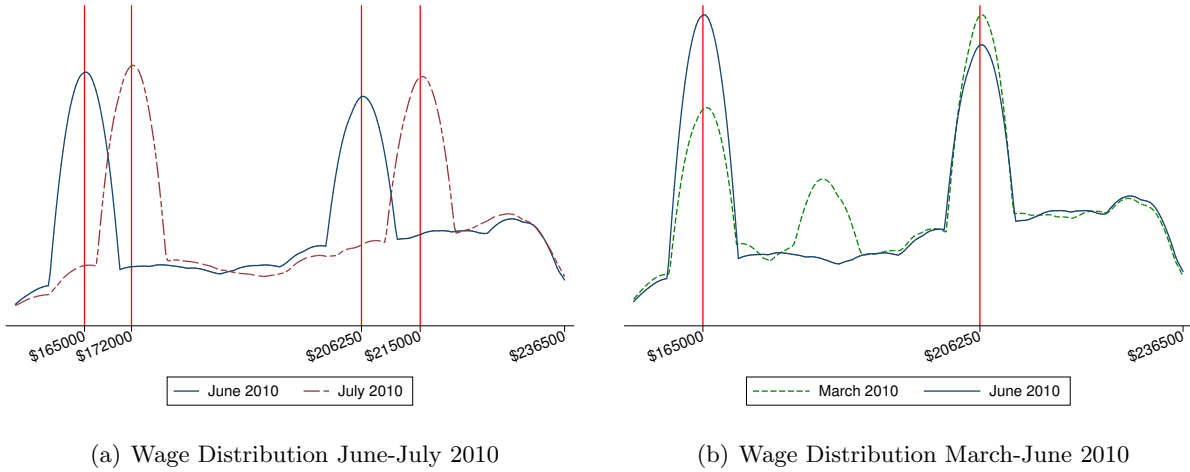
Figure 3. Wage Distribution in June 2010



Note: the first vertical line corresponds to the minimum wage effective June 2010. The second vertical line corresponds to the minimum wage plus the legal gratuity effective in June 2010. For clarity, the range of wages shown is in a neighborhood close to the minimum wage.

The second fact is that, during the months when the minimum wage changes, it can be observed that there is a change in the compensation of workers that receive the minimum wage or the minimum wage plus legal gratuity, as shown in the first panel of figure 4. In contrast, during the months in which there are no readjustments to the minimum wage (March-June), we cannot see important changes in the income distribution, as shown in the second panel of figure 4. This fact is observed for all years analyzed, as shown in detail in appendix figure A.2.

Figure 4. Wage Distribution with and without Minimum Wage Readjustment in 2010



Note: In figure (a), the first vertical line corresponds to the minimum wage effective in June and the second one to the minimum wage effective after the readjustment. The third and fourth lines mark the minimum wage plus legal gratuity, before and after the readjustment, respectively. In figure (b), the first vertical line corresponds to the minimum wage and the second line corresponds to the minimum wage plus legal gratuity. For visual clarity, only the range of wages in a neighborhood close the minimum wage is shown.

4.4 Descriptive Statistics

In this subsection, we show descriptive statistics for the treated and control groups used in the main specification of this study. Due to the particularities of the sample, we impose certain conditions that the worker must satisfy to belong to each of these groups, these conditions are detailed in subsection 5.3. Furthermore, to control for unobservable differences between treated and control groups, we select the observations in each group in a month in which there is no change in the minimum wage (March, $T_i = 0$) and in a month when there is a change (June, $T_i = 1$). This empirical strategy is explained in subsection 5.1.

Tables 2, 3 and 4 show some characteristics of the treated and control groups chosen in different months, by year. It can be seen that the average wage for treated workers during the three months prior to the change in the minimum wage is equal to the minimum wage plus legal gratuity. Meanwhile, it can also be seen that the three-month average wage during the same period for the control group workers is higher than the minimum wage that will go into effect after the treatment. This is consistent with the constraints that we have imposed on individuals to be allocated to either the treatment or control groups. It can be seen that pre-treatment average wage of the control group is higher than that of the treatment group.

In our treatment group, *i.e.*, workers that earned the minimum wage, 79% worked in microenterprise and small firms, while 56% of workers in the control group belonged to those types of firm.

The existence of differences in observable characteristics between treated and control groups suggests that there could also be unobservable differences between these groups. It can also be seen that there are no large differences in observable characteristics for the both groups between T_0 and T_1 .

Table 2. Descriptive Statistics for Treatment and Control Groups: 2008

	Treatment 2008		Control 2008	
	$T_i = 0$	$T_i = 1$	$T_i = 0$	$T_i = 1$
<i>Wages</i>				
Mean wages in last three months	180000	180000	204962	204574
Mean wages of worker	180000	176391	207415	201084
<i>Contract Term</i>				
Indefinite term contract (= 1)	0.73	0.69	0.77	0.74
<i>Firm Size</i>				
Microenterprise	0.37	0.36	0.21	0.25
Small Firm	0.42	0.44	0.34	0.35
Mid Firm	0.06	0.06	0.09	0.09
Big Firm	0.15	0.13	0.36	0.31
N Workers	5103	5353	1000	1000

Note: A worker is considered treated if he or she satisfies the following conditions: a) earned the minimum wage plus legal gratuity, b) earned this wage in the three-month period before the change in minimum wage, and c) never earned more than twice the minimum wage in any given month in the previous year. On the other hand, a worker is considered in the control group if: a) earned a wage greater than the minimum wage plus legal gratuity that will come into effect after the next readjustment, b) had a wage in this range during the last three months prior readjustment, c) never earned a wage higher than twice the minimum wage in any given month in the previous year, and d) did not earn the minimum wage or the minimum wage plus legal gratuity in the previous year. Of all potential controls, we choose 1,000 that have an average wage during the previous three months closest to the mean of the treated group. We choose a treatment and control group in March ($T_i = 0$) and in June ($T_i = 1$). Firm size classification is according to the definition used by the tax authority (SII). Micro: 5 to 10 workers. Small: 11 to 50 workers. Medium: 51 to 100 workers. Large: 100 or more workers. The variable Mean wages of worker is defined as the average wage of the worker since January 2008 to the date when the worker is assigned to a control or treatment group.

Table 3. Descriptive Statistics for Treatment and Control Groups: 2009 and 2010

	Treatment 2009		Control 2009	
	$T_i = 0$	$T_i = 1$	$T_i = 0$	$T_i = 1$
<i>Wages</i>				
Mean wages in last three months	198750	198750	217923	217260
Mean wages of worker	188265	189078	204993	205198
<i>Contract Term</i>				
Indefinite term contract (= 1)	0.77	0.79	0.84	0.80
<i>Firm Size</i>				
Microenterprise	0.35	0.37	0.09	0.09
Small Firm	0.44	0.44	0.23	0.23
Mid Firm	0.07	0.08	0.05	0.07
Big Firm	0.14	0.11	0.62	0.61
N Workers	5262	4705	1000	1000
	Treatment 2010		Control 2010	
	$T_i = 0$	$T_i = 1$	$T_i = 0$	$T_i = 1$
<i>Wages</i>				
Mean wages in last three months	206250	206250	226911	225728
Mean wages of worker	196696	198157	211662	209608
<i>Contract Term</i>				
Indefinite term contract (= 1)	0.81	0.76	0.83	0.81
<i>Firm Size</i>				
Microenterprise	0.34	0.35	0.09	0.09
Small Firm	0.45	0.47	0.23	0.21
Mid Firm	0.08	0.08	0.08	0.09
Big Firm	0.13	0.10	0.60	0.61
N Workers	5135	4713	1000	1000

Note: A worker is considered treated if he or she satisfies the following conditions: a) earned the minimum wage plus legal gratuity, b) earned this wage in the three-month period before the change in minimum wage, and c) never earned more than twice the minimum wage in any given month in the previous year. On the other hand, a worker is considered in the control group if: a) earned a wage greater than the minimum wage plus legal gratuity that will come into effect after the next readjustment, b) had a wage in this range during the last three months prior readjustment, c) never earned a wage higher than twice the minimum wage in any given month in the previous year, and d) did not earn the minimum wage or the minimum wage plus legal gratuity in the previous year. Of all potential controls, we choose 1,000 that have an average wage during the previous three months closest to the mean of the treated group. We choose a treatment and control group in March ($T_i = 0$) and in June ($T_i = 1$). Firm size classification is according to the definition used by the tax authority (SII). Micro: 5 to 10 workers. Small: 11 to 50 workers. Medium: 51 to 100 workers. Large: 100 or more workers. The variable Mean wages of worker is defined as the average wage of the worker since January 2008 to the date when the worker is assigned to a control or treatment group.

Table 4. Descriptive Statistics for Treatment and Control Groups: 2011 and 2012

	Treatment 2011		Control 2011	
	$T_i = 0$	$T_i = 1$	$T_i = 0$	$T_i = 1$
<i>Wages</i>				
Mean wages in last three months	215000	215000	238900	238832
Mean wages of worker	202963	203659	218553	215915
<i>Contract Term</i>				
Indefinite term contract (= 1)	0.78	0.77	0.84	0.82
<i>Firm Size</i>				
Microenterprise	0.34	0.34	0.08	0.06
Small Firm	0.48	0.50	0.21	0.21
Mid Firm	0.06	0.07	0.09	0.10
Big Firm	0.12	0.09	0.63	0.63
N Workers	4838	4327	1000	1000
	Treatment 2012		Control 2012	
	$T_i = 0$	$T_i = 1$	$T_i = 0$	$T_i = 1$
<i>Wages</i>				
Mean wages in last three months	227500	227500	251923	254294
Mean wages of worker	211857	211124	225796	225748
<i>Contract Term</i>				
Indefinite term contract (= 1)	0.78	0.77	0.83	0.80
<i>Firm Size</i>				
Microenterprise	0.30	0.32	0.06	0.08
Small Firm	0.52	0.51	0.22	0.25
Mid Firm	0.07	0.09	0.05	0.07
Big Firm	0.11	0.08	0.67	0.60
N Workers	4443	3930	1000	1000

Note: A worker is considered treated if he or she satisfies the following conditions: a) earned the minimum wage plus legal gratuity, b) earned this wage in the three-month period before the change in minimum wage, and c) never earned more than twice the minimum wage in any given month in the previous year. On the other hand, a worker is considered in the control group if: a) earned a wage greater than the minimum wage plus legal gratuity that will come into effect after the next readjustment, b) had a wage in this range during the last three months prior readjustment, c) never earned a wage higher than twice the minimum wage in any given month in the previous year, and d) did not earn the minimum wage or the minimum wage plus legal gratuity in the previous year. Of all potential controls, we choose 1,000 that have an average wage during the previous three months closest to the mean of the treated group. We choose a treatment and control group in March ($T_i = 0$) and in June ($T_i = 1$). Firm size classification is according to the definition used by the tax authority (SII). Micro: 5 to 10 workers. Small: 11 to 50 workers. Medium: 51 to 100 workers. Large: 100 or more workers. The variable Mean wages of worker is defined as the average wage of the worker since January 2008 to the date when the worker is assigned to a control or treatment group.

5 Empirical Model

5.1 The Empirical Strategy

Irrespective of the database used, there are two empirical obstacles that have to be overcome to correctly estimate the impact of the minimum wage on wages and employment. First, the

individuals directly affected by the policy must be correctly identified. To overcome this challenge, we will impose some constraints to assign workers to the treated or control group, which are detailed in the following paragraphs. The second challenge is to control for the characteristics of each group that are not observable, but that have an impact in the trajectory of wages and the probability of staying employed. To overcome that challenge, we use a difference-in-differences estimation methodology. Specifically, we choose a treatment and control group in a month in which there is a change in the minimum wage (June), and then we choose another set of treatment and control groups in a month in which there is no change in the minimum wage (March) and we compare the changes in wages and employment for each group in the next two months. The treatment group is not necessarily composed of the same workers in March and June, and the same goes for the control group.

There are some characteristics of the database used in this study that do not allow us to easily determine who are affected by minimum wage policies. For instance, information on hours worked during the month and amount of legal gratuity paid are not available in the unemployment insurance data. Therefore, to correctly identify workers affected by the minimum wage and the potential control group, it is necessary that we impose certain constraints on individuals that enter our sample. The fundamental reasons that motivate each of the constraints are detailed in subsection 5.3. We consider a worker as treated if he or she: a) earned exactly the minimum wage plus legal gratuity⁸, b) earned this salary during the last three months, and c) never earned in a month a wage greater than twice the minimum wage in the last year.

On the other hand, we consider as a control group workers who: a) earn a wage which is greater than the minimum wage that will go into effect after the readjustment plus the legal gratuity, b) have earned a wage in this range for the past three months, c) never earned a wage greater than twice the minimum wage in the previous year, and d) have not earned the minimum wage plus legal gratuity in the past year. To compare the treatment group with a relatively similar control group, we selected the 1,000 workers that, satisfying condition a), earned an average wage in the past three months closest to the average wage of the treated.

The second challenge that we identify is that there could be potential unobservable differences between treatment and control groups. If these differences are not controlled for, estimates will be biased. To address this issue we employ a difference-in-differences methodology, where a treated and control group is determined for June and another for March.

To illustrate how a direct comparison of treated and control workers (with one difference as opposed to two) would lead to the wrong conclusion regarding the effect of treatment, we construct table 5. In the first row, we show the wage change for treated and control groups in a month when there is no change in the minimum wage (e.g. March). We observe that between March and April, the average wage of the treated falls while the average wage for the control group rises.⁹ This is precisely the problem that our empirical strategy is designed to solve: there could exist permanent differences between groups even in the absence of changes in policy. The second row of the table

⁸Although we do not possess hours worked, we are certain that those that earned exactly the minimum wage plus legal gratuity were affected by the minimum wage policy. In other words, the probability of an individual earning exactly this amount, but working part-time, is close to zero.

⁹There are various reasons for why the wage of workers that earn the minimum wage plus legal gratuity can fall: a) they can get absentee days discounted, b) they lose the job during that month, or c) they stop receiving the legal gratuity.

shows the change in wages of both groups in the month in which the minimum wage is readjusted, that is, June. It can be seen that between June and July, the wage of the treated group rises more than that of the control group, as would be expected. Note, however, that if the treated and control groups are compared in June, this would lead to an underestimation of the effects of the treatment on wages. This is because when considering a month without readjustment, the wage of the treated falls and that of the controls rises.

Table 5. Comparison of Wage Changes – 2010

	Treatment Group	Control Group
$w_{apr} - w_{mar}$	-2704	2479
$w_{jul} - w_{jun}$	6582	1511

Note: See section 5.3 for treatment and control group definitions. The first row shows average wage changes of treated and control groups between April and March. The second row shows average wage changes for treated and control groups between June and July.

In much the same way as with wages, the differences between treatment and control groups can mean that the probability of remaining employed of each group is different. Table 6 shows changes in employment rates for 2010. The first row of this table shows the fraction of workers assigned to either the treatment or control group in March and remained employed in April. We can observe that in a month during which there was no change in the minimum wage, treated workers are less likely to remain employed than control group workers. This is consistent with the idea that workers that earn the minimum wage have less stable jobs than those that earn a higher wage. However, in a month in which there is a change in the minimum wage, we can observe that the probability of remaining employed is marginally higher for the treated group compared to the control group. In this case, if we were to look only to the month of June, we would be underestimating the percentage increase in employment associated with workers that earn the minimum wage.

Table 6. Changes in Employment - 2010

	Treatment Group	Control Group
e_{apr}	0.975	0.980
e_{jul}	0.986	0.983

Note: See section 5.3 for treatment and control group definitions. The first row shows the fraction of workers that remain employed in April, conditional on being employed in March. The second row shows the fraction of workers that remain employed in July, conditional on being employed in June.

5.2 Estimated Equations

In this subsection we detail the equations that we will use to estimate the effects of the minimum wage on employment and wages. We estimate one equation for employment and two for wages. Equation (1) shows the specification to estimate the effect of the minimum wage on employment:

$$Y_i = \beta_0 + \beta_1 * Trat_i + \beta_2 * T_i + \beta_3 * Trat_i * T_i + \gamma * X_i + e_{it} \quad (1)$$

Where Y_i is a measure of employment that takes the value 1 if the worker i remains employed the next month and 0 otherwise. The binary variable $Trat_i$ takes the value 1 if the individual i

is treated and 0 if he or she belongs to the control group. On the other hand, T_i is equal to 1 if the worker i is assigned to any of these groups in June, and T_i is equal to zero if the worker i is assigned to treatment or control in March. The variable of interest is the difference-in-differences estimator $Trat_i * T_i$. Finally, the vector X_i denotes the set of control variables that are used in this specification, which will be described at the end of this subsection.

It is possible that the minimum wage readjustment does not have immediate effects within one month of taking place, therefore we additionally look for effects in the next two months. To find these effects, we estimate the same equation, but defining a worker as employed if in the next two months he or she earns a wage greater than zero.¹⁰

To find the effect of the minimum wage readjustment on wages, we estimate equation ((2)).

$$w_{i,t+1} - w_{i,t} = \alpha_0 + \alpha_1 * Trat_i + \alpha_2 * T_i + \alpha_3 * Trat_i * T_i + \omega * X_i + e_{it} \quad (2)$$

Where $w_{i,t}$ denotes the wage of the worker i during the month in which he is assigned to either the treatment or control groups and $w_{i,t+1}$ denotes the wage earned by worker i during the next month. We measure the impact of the minimum wage by subtracting the former from the latter. We estimate the equation in two ways, considering: 1) only workers that remain employed, and 2) all workers. We employ these two approaches because in a context where the minimum wage has a relevant impact on unemployment, these two specifications would deliver very different results. To measure the impact that the minimum wage readjustment has on wages in the following two months, we look at the difference between the average wage over the two months after readjustment and the wage of the worker when he is selected, which can be expressed mathematically as $(\frac{w_{t+1} + w_{t+2}}{2} - w_t)$.

In all equations we include the same set of control variables. The first of these is the average of past wages that the worker earned, which is a proxy for the individual’s productivity. The second control variable is the quantity of employees that the worker’s firm has at the time that the worker is chosen for the treatment or control group. We include this variable because it is a proxy for the capacity that the firm has to increase its cost structure without changing the number of workers, since we expect that large firms are more capable to absorb an increase in the minimum wage. The third control variable corresponds to the type of contract between the worker and the firm: fixed or indefinite term. We use these control variables, related to past productivity, because they aim to compensate for the absence of sociodemographic variables such as gender and age.

5.3 Treatment and Control Group Definition

In this subsection we detail the criteria we use to allocate workers to the treatment or control groups, and the reasons behind them. First, we define and motivate the conditions that must be met by a worker to belong to the treatment group. We then do likewise with the conditions for being allocated to the control group.

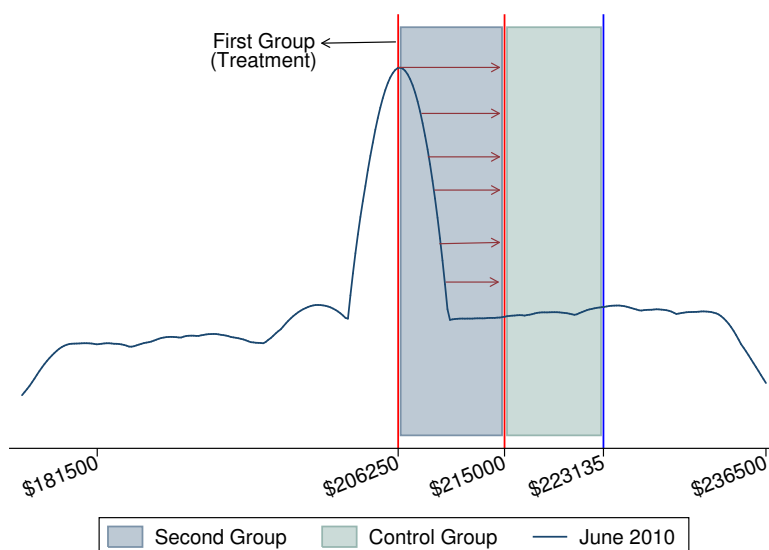
As mentioned in the preceding sections, we consider a worker to be treated if the employee: a) earned the minimum wage plus the legal gratuity, b) earned this wage during the past three months, and

¹⁰We do not look at employment in a longer horizon of three or more months because in September (and December) we observe large wage increases throughout the sample. These increases could have differential effects on treatment and control groups, which would interfere with the identification of the effects of the minimum wage. See appendix figure A.8 for more details on these increases.

c) never earned a wage greater than twice the minimum wage during the previous year.

Condition a) is imposed because we want to allocate to the treatment group workers that were affected by the minimum wage with certainty. In the sample, we can identify two groups of workers whose wages are affected by the minimum wage policy. The first group is composed of employees that earn exactly the minimum wage plus the legal gratuity, whose wage increases after the readjustment to the new minimum wage plus legal gratuity. The second group is composed of workers who earn a wage that is marginally higher than the minimum plus the legal gratuity, but less than what will be the new minimum wage plus legal gratuity after the readjustment. The wage of these workers will also rise to the new minimum wage plus legal gratuity. Figure 5 shows the location in the wage distribution where these groups are and where their wages will shift to after the readjustment.

Figure 5. Wage Distribution in June 2010



Note: The first vertical line corresponds to the minimum wage plus the legal gratuity in June, and the second vertical line corresponds to the new minimum wage plus legal gratuity after the readjustment. The third vertical line corresponds to the wage in June of the control group made up of the 1,000 observations closest to the treatment group wage average. For visual clarity, only a limited range of the wage distribution in a neighborhood around the minimum wage is shown.

There are two difficulties in determining if workers belong to the second group of those affected by the policy. First, since legal gratuity are not explicitly reported in the data, this range of wages is populated by those who receive the legal gratuity and those who do not. These are two very different groups, the workers that receive the legal gratuity, who are indeed affected by the policy, and workers who do not receive the legal gratuity, who earn a base wage that is at least 25% greater than the minimum wage. Clearly, the latter are not directly affected by the policy.

The second difficulty is that, due to the lack of data on hours worked, the employees in this wage range could be working either full time or part time. Those who work full time are affected by the minimum wage policy, because they receive a wage per hour that is consistent with the minimum wage. In contrast, those who work part time are not affected by the minimum, since they are

earning a higher wage per hour.

Taking into account these two difficulties, we decided to consider as treated only waged workers that earn exactly the minimum wage plus the legal gratuity, since we can say with certainty that they are affected by the policy. Notice that under this definition, the workers belonging to the *Second Group* are not considered as treatment nor control groups. However, there is an alternative specification that we estimate to study the robustness of our results, in which this group is part of the treated.

Condition b) establishes that the worker must earn the minimum wage plus the legal gratuity for at least three months. We defined this constraint to avoid defining as treated those workers that earned the minimum wage plus the legal gratuity due to exceptional reasons. Condition c) establishes that a worker cannot be allocated to the treatment group if he or she earned a monthly wage greater than twice the minimum during the past year. This restriction is aimed to exclude workers that in the past earned a high wage for unknown reasons, and that in the past three months earned a wage equal to the minimum plus the legal gratuity. We apply this condition because we observe in the sample that the wages of some of the workers in the treatment group multiply from one month to the next, as shown in Appendix A.6.

Moving on to the conditions that define the control group, we define a worker as belonging to this group if the employee: a) earned a wage greater than the new minimum wage plus legal gratuity that will go into effect after the next readjustment, b) earned a wage in this range during the past three months, c) has never earned a wage greater than twice the minimum wage in the past year, and d) has never earned the minimum wage or the minimum wage plus the legal gratuity in the past year. Moreover, to make the control group as similar as possible to the treatment group, we selected 1,000 workers of the control group that had an average wage in the past three months closest to the average for the treatment group.

Condition a) for the control group is aimed at selecting workers whose wages are never affected by the minimum wage policy. Figure 5 shows where this group is located in the wage distribution. To describe the range where the control group workers are located, we show the wage of worker number 1,000, whose wage is the greatest in this group.¹¹ Condition b) for the control group establishes that the worker must have received a wage greater than the minimum plus the legal gratuity during the past three months. We impose this restriction such that we can establish with high confidence that the control group workers are not affected directly by the minimum wage policy.

Condition c) for the control group says that no worker can be considered in this group if he or she earned a wage greater than the minimum greater than twice the minimum wage in the past year. Just like in the case of the treatment group, this constraint is motivated by the fact that some workers show that their wages multiply month by month, as shown in Appendix A.6. These wage increases are presumably caused by high per hour wage workers that have transitioned from part time to full time. Since we aim to make the control group as similar as possible to the treatment group in observable characteristics, it is necessary to exclude high per hour wage workers.

Condition d) for the control group indicates that a worker cannot be assigned to this group he or she

¹¹Note, however, that not all workers in this wage range are controls, for some of them do not meet the other criteria.

earned the minimum wage or the minimum wage plus the legal gratuity in the past year. The data shows that some potential control group members earned the minimum wage or a wage associated with the minimum wage at least once during their work histories. This fact could be a signal that these workers are affected by the minimum wage, but for circumstantial reasons, they earn a higher wage. In summary, this constraint aims to avoid assigning to the control group workers that could potentially be directly affected by treatment.

Taking into account the four conditions detailed above, we limit the control group to the 1,000 workers that earned an average wage in the past three months that is closest to the new minimum wage. The objective of this sample selection is to make the wages of the control group as similar as possible to the treatment group, while not being directly affected by the minimum wage policy. The choice of this number of control group observations is arbitrary, therefore we show in the appendix the sensitivity of our estimates to this choice. Despite the constraints imposed, there could be workers in the control group that earn an hourly wage much higher than the minimum wage. For instance, workers that in the past twelve months have worked part time and have earned less than twice the minimum wage. We expect these workers to have lower probability of losing their job, given that their productivity is higher than those workers that earn an hourly wage close to the minimum. This could impact the results of the estimations of the effect on employment, making it more likely to find negative effects of the minimum wage.

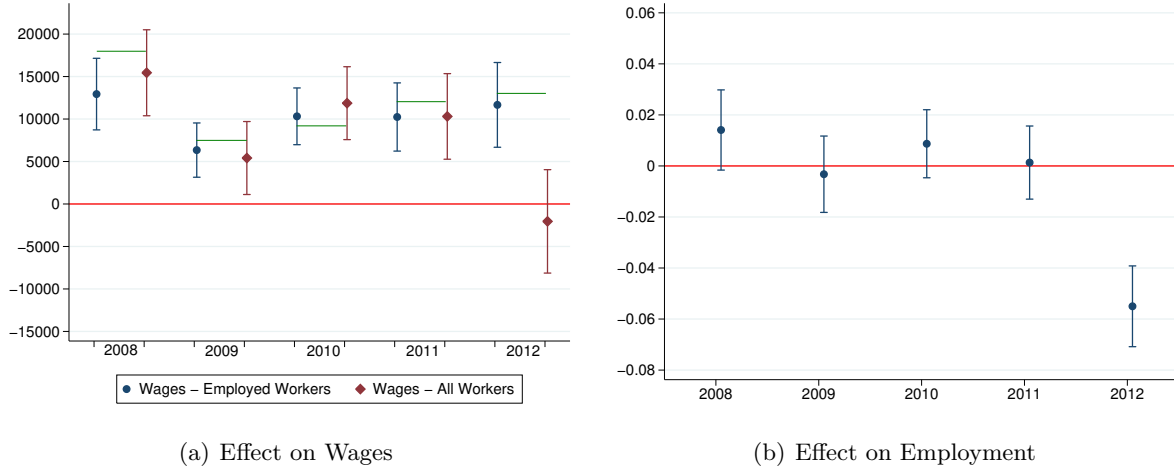
6 Results

Figure 6 shows the results of estimating the main specification, looking at the effects on wages and on employment in the next month. In panel (a) of figure 6, we observe that in every year in our sample the treatment effect is positive (except in 2012 for the measure that includes the unemployed). In the case of workers who remain employed, we find a positive effect that is in most of the cases below the increase in the minimum wage. For every Chilean peso that the minimum wage is readjusted, the wage of workers who remain employed increases between 0.75 and 1.17 pesos, varying by year. Pooling all workers (*i.e.*, including the unemployed), we observe that the effect on wages is still positive and statistically significant, except for the year 2012.

With regards to the effect of the minimum wage on employment status during the next month, in all years but 2012 we find effects around zero, all of them non-statistically significant (see panel (b) of figure 6). In 2012, we observe that employment fell sharply, however there is some evidence that this high and very distinct effect is totally driven by the close of a big firm in April of 2012, which is difficult to attribute to the rise in the minimum wage.¹²

¹²In the Appendix, Figure A.6, we show the effect without considering the workers of this firm in the estimation.

Figure 6. Results of the Main Specification, by Year - Next Month



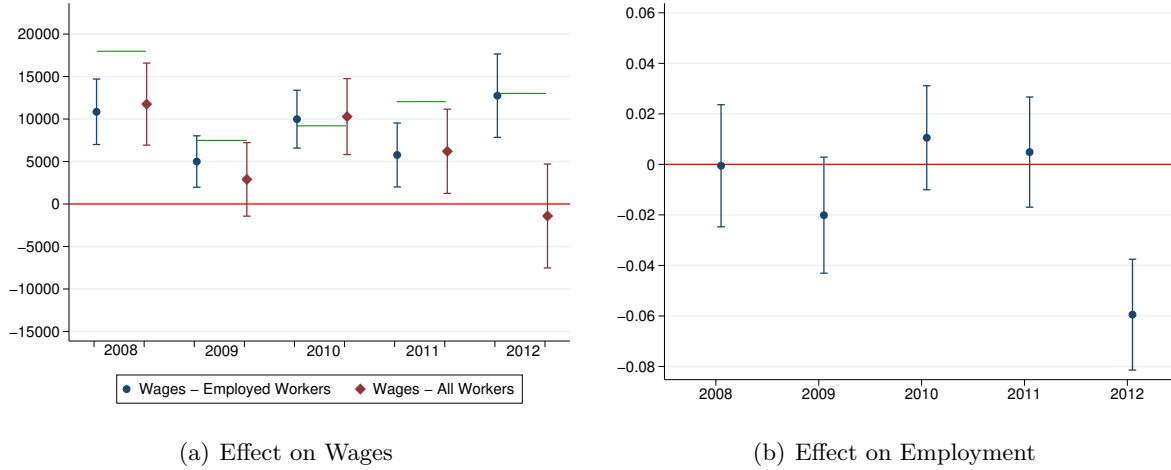
Note: Each point corresponds to the coefficient associated to the difference-in-differences estimator. Each coefficient is shown with its respective 95% confidence interval. The minimum wage readjustment of each year is shown with a horizontal line. These results can be seen in more detail in table A.10. In these estimations, the control group chosen contains 1,000 workers. The sensibility of these results to the number of workers in the control group is shown in appendix A.11.

Figure 7 shows the impact of the minimum wage readjustment on the wages of the next two months. When considering only workers that remained employed, the wage of the treated shows for all years a positive and statistically significant increase. For every Chilean peso that the minimum wage is readjusted, the wage of the workers that remain employed increases between 0.46 and 1.13 pesos, varying by year.

With regards to the effect on employment in the next two months, in all years but 2012 we find no statistically significant effect (see panel (b) of figure 7). As in the case of one month effect, the impact observed for 2012 seems totally driven by the close of a big firm in April of 2012.¹³

¹³In the Appendix, Figure A.7, we show the effect without considering the workers of this firm in the estimation.

Figure 7. Results of the Main Specification, by Year - Next Two Months



Note: Each point corresponds to the coefficient associated to the difference-in-differences estimator. Each coefficient is shown with its respective 95% confidence interval. The minimum wage readjustment of each year is shown with a horizontal line. These results can be seen in more detail in table A.11. In these estimations, the control group chosen contains 1,000 workers. The sensibility of these results to the number of workers in the control group is shown in appendix A.12.

We can extract three conclusions from these results. First, the minimum wage affects the wages of the treated, which is consistent with the idea that in Chile the minimum wage is an active constraint. Moreover, it should be clear that this is not just a mechanic effect of the respect for the minimum wage law, because the estimated parameter represents the difference between the increase in the average wage of the treated (affected by the minimum wage policy) and the increase that this group would have had without the rise in the minimum wage, where the latter is a counterfactual that is estimated by the rise in the average wage of the control group. Second, we do not find a robust negative effect of the minimum wage on the probability of being employed in the future. Third, the expected value of the treated worker’s income increases with minimum wage readjustments due to the fact that we do not observe an increase in unemployment that counteracts the gains in wages.

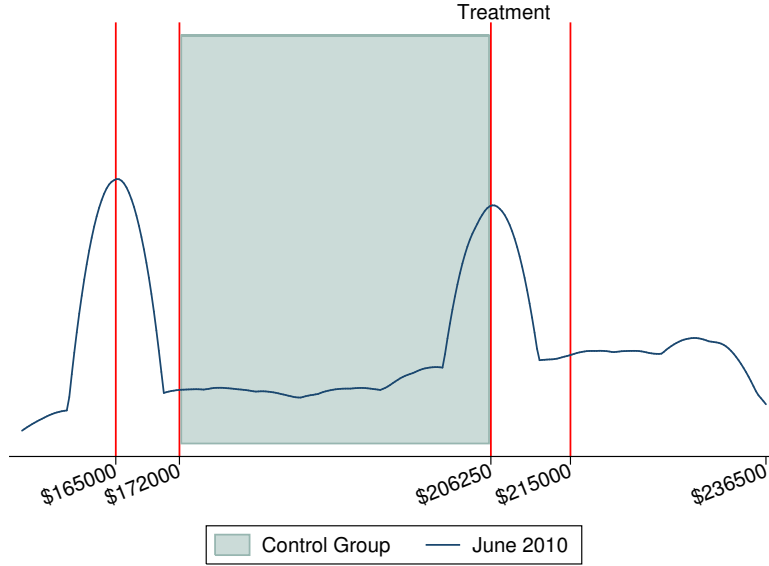
7 Robustness Analysis

7.1 Estimation with Control Group with a Lower Wage

As a first robustness exercise, we estimate a specification similar to the main one but defining a different control group. Instead of selecting workers that earn a wage greater than the new minimum as the control group, we select those that earn less than the treatment group. As shown in figure 8, these workers in the control group earn a wage that is greater than the new minimum and lower than the old minimum plus the legal gratuity. This group of workers is not affected by the minimum wage directly, because by definition they earn a wage that is greater than the new minimum after the readjustment.¹⁴

¹⁴These workers earn a wage lower than the minimum wage plus legal gratuity, and therefore it is not possible that they are receiving the legal gratuity.

Figure 8. Wage Distribution in June 2010

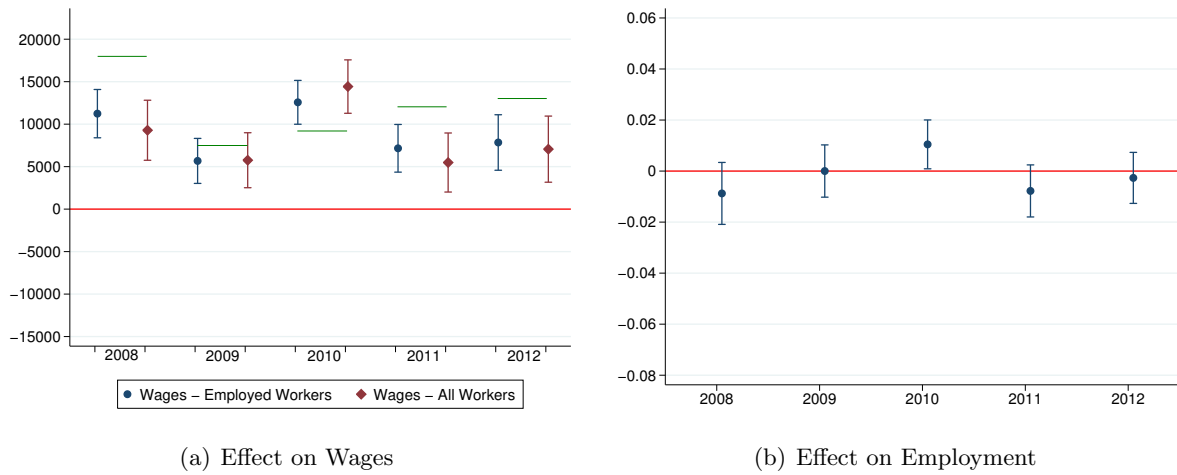


Note: The first vertical line corresponds to the minimum wage in effect in June, the second to the minimum wage after readjustment. The third and fourth lines mark the minimum wage plus legal gratuity before and after the minimum wage readjustment, respectively. For visual clarity, we show only the range in the wage distribution in a neighborhood close to the minimum wage.

It is not trivial determining whom in this group are most similar to the treatment group workers. First, workers that earn a wage close to the minimum are equivalent to the treatment group workers. On the other hand, it is also reasonable to think that those that earn a wage marginally less than the minimum plus legal gratuity are also equivalent to the treated workers. This is why we decide to use as a control group all workers whose wages are in this range and that satisfy the other conditions for belonging to the control group. Just as those workers that belong to the control group in the main specification, these workers earn a wage that is marginally greater than the minimum, so we expect that these two control groups behave in a similar manner.

As in the main specification, we now estimate the effects of treatment in the next month and in the next two months. The results are shown in panel (a) of figure 9. The results show that, considering only workers who remained employed, there are statistically significant wage increases for the treated workers, in every year analyzed. For every Chilean peso that the minimum wage increases, treated worker's wages increased between 0.57 and 1.43 pesos. Furthermore, when including workers who lost their job, we observe very similar results. The similarity between these two measures of the impact on wages is driven by the fact that in all years the impact of minimum wage on employment is around zero, and non statistically significant, as it is shown in panel (b) of figure 9.

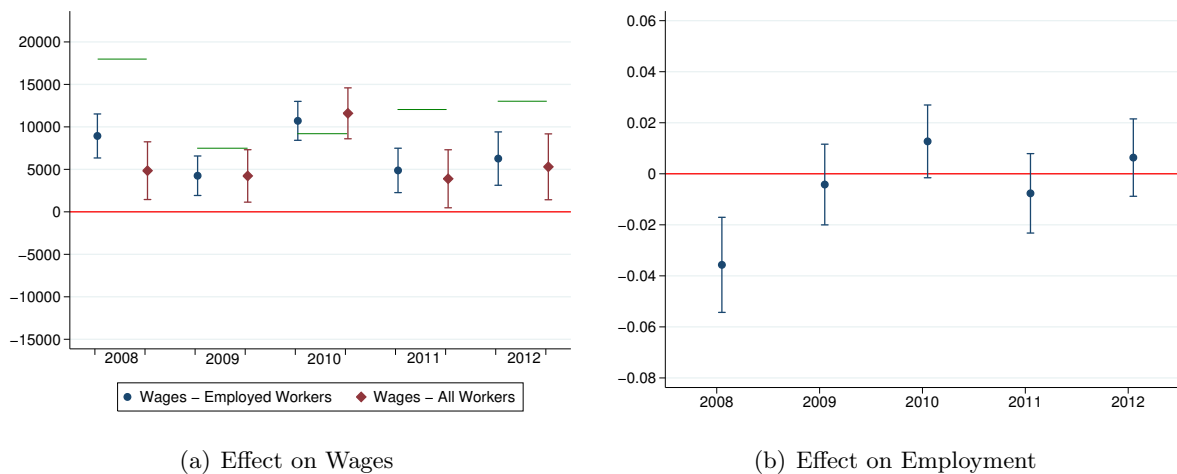
Figure 9. Results of the Specification with a Control Group with lower Wages, by Year - Next Month



Note: Each point corresponds to the coefficient associated to the difference-in-differences estimator. Each coefficient is shown with its respective 95% confidence interval. The minimum wage readjustment of each year is shown with a horizontal line. These results can be seen in more detail in table [A.12](#).

Figure 10 shows the results when we look at the outcome variables during the next two months. The results are very similar as when the outcome variables are evaluated one month after the rise in the minimum wage, but there is a negative and significant effect on employment in 2008.

Figure 10. Results of the Specification with a Control Group with lower Wages, by Year - Next Two Months



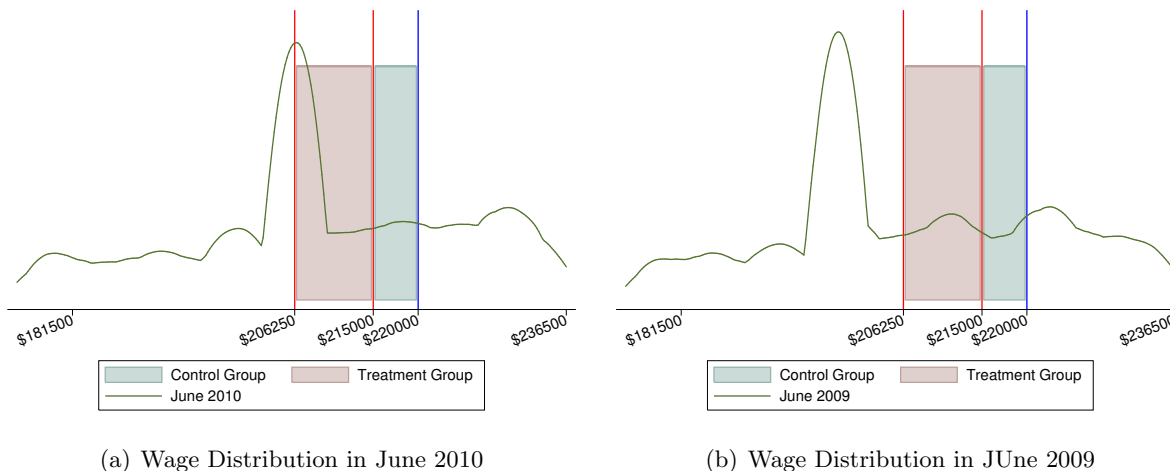
Note: Each point corresponds to the coefficient associated to the difference-in-differences estimator. Each coefficient is shown with its respective 95% confidence interval. The minimum wage readjustment of each year is shown with a horizontal line. These results can be seen in more detail in table [A.13](#).

7.2 Results when Changing the Timing of the Control and Treatment Group selection.

As a second robustness exercise, we re-estimate the main specification but we change the month in which we choose treatment and control groups. In this specification, we choose the members of the treatment and control groups in June of the year *before* the change in the minimum wage. This change of time periods leads to a change in the definition of the treatment group. Besides this change, the conditions that a worker has to meet to belong to the treatment or control group are the same as in the main specification.

The first consequence of this specification change is that workers are no longer selected in March of the year when the treatment occurs, but in June of the previous year. The second consequence is that, unlike the main specification, in this one we include in the treatment group workers that earn a wage greater than the minimum plus the legal gratuity. Specifically, we consider as treated all workers that earn a wage equal or greater than the minimum plus the legal gratuity and less than the new minimum plus the legal gratuity. In panel (a) of figure 11, we show where these treated workers are located in $T_i = 1$ and in panel (b) of figure 11 we show where they are located in $T_i = 0$. The reason to include in the treatment group workers that earn a wage higher than the minimum plus the legal gratuity is practical. As can be seen in panel (b) of figure 11, there are very few workers in June 2009 that earn a wage equivalent to the minimum plus the legal gratuity that will be in effect in 2010 (\$206.250). Obviously, there is no reason to have many workers earning in 2009 a wage which is exactly equal to the minimum wage set in 2010.

Figure 11. Treatment and Control Groups - Estimation Changing the Time Periods



Note: In the left hand side panel, the first vertical line corresponds to the minimum wage in effect in June and the second to the minimum wage in effect after the readjustment, and the third line marks the wage of the 1,000th control group worker. Likewise for the right hand side panel. For visual clarity, we show a range of the wage distribution limited to a neighborhood around the minimum wage.

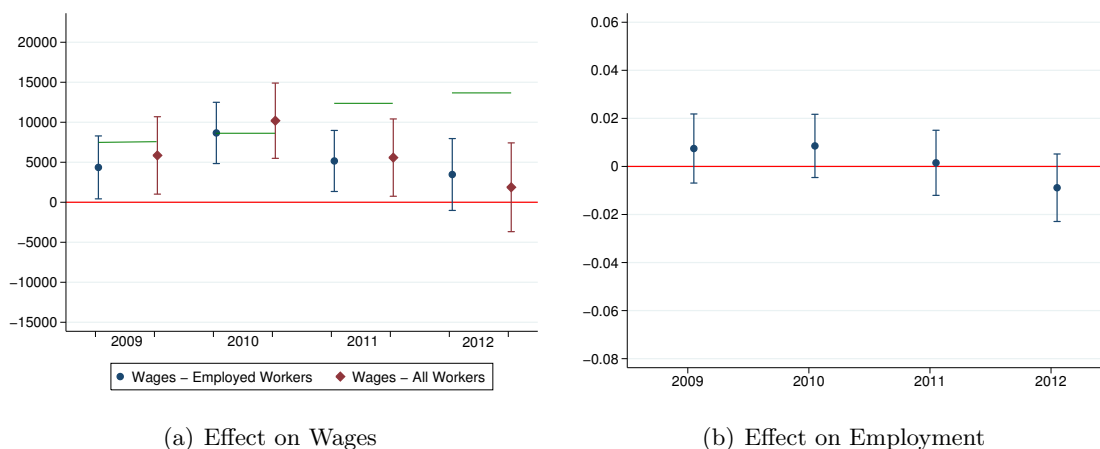
By definition, the treated in $T_i = 1$ and in $T_i = 0$ are located in the same range of nominal wages, and likewise for the control group. This shows that the groups might share certain characteristics. It is important to note that workers that in this specification are considered as treated in $T_i = 0$ are not affected by the readjustment of the minimum wage that occurs in that month. This is because,

by definition, they earn a wage greater than the minimum plus the legal gratuity that was in effect in that year.

The equations that are estimated are similar to the earlier specifications, but the control variables differ. We remove the worker’s past wage as a control variable, and in its place we add the average wage between January and March of each year. Moreover, we include the fraction of the time that the waged worker spent employed between January and March of each year. Since the database records information from January 2008 onwards, it is not possible to construct a control and a treatment group for 2007, and therefore in this robustness exercise we only analyze the years 2009, 2010, 2011, and 2012.

For this specification, panel (a) of figure 12 shows that – including and not including those who lose their jobs – there is a positive and statistically significant effect of the treatment on wages in all years but in 2012, where the point estimate is positive but statistically insignificant. In panel (b) shows that there are no significant effects on employment in any of the years considered.

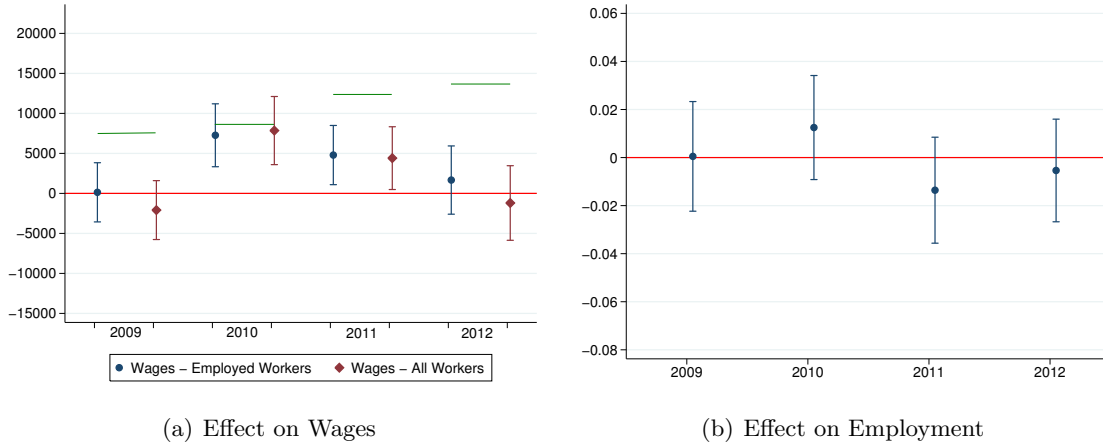
Figure 12. Results of the Specification changing the Time Periods, by Year - Next Month



Note: Each point corresponds to the coefficient associated to the difference-in-differences estimator. Each coefficient is shown with its respective 95% confidence interval. The minimum wage readjustment of each year is shown with a horizontal line. These results can be seen in more detail in table A.14. In these estimations, the control group chosen contains 1,000 workers. The sensibility of these results to the number of workers in the control group is shown in appendix A.13.

When looking at the effects of treatment on the outcomes measured during the next two months (figure 13), we observe very similar results in the case of the effect on employment and less significant effect in the case of wages.

Figure 13. Results of the Specification changing the Time Periods, by Year - Next Two Months



Note: Each point corresponds to the coefficient associated to the difference-in-differences estimator. Each coefficient is shown with its respective 95% confidence interval. The minimum wage readjustment of each year is shown with a horizontal line. These results can be seen in more detail in table A.15. In these estimations, the control group chosen contains 1,000 workers. The sensibility of these results to the number of workers in the control group is shown in appendix A.14.

From this robustness exercise we extract two conclusions. First, we do not observe any effect on employment, which is in line with previous results. Second, when considering and not considering workers that lose their jobs, wages for the treated increase in half of the years, showing a less clear effect comparing to the main specification results.

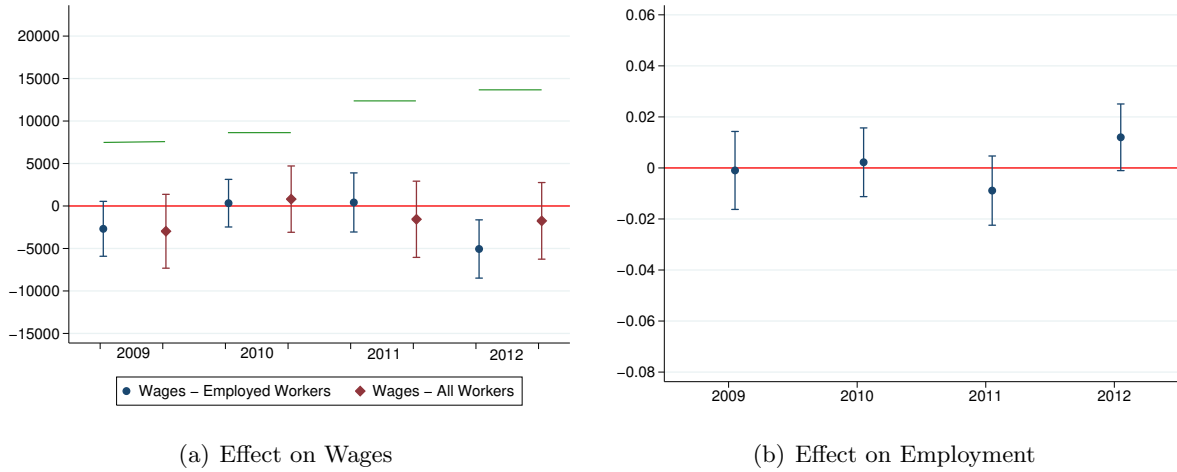
7.3 Falsification Test

The objective of this subsection is to estimate the main specification, but during two months in which there is no readjustment to the minimum wage. Since there is no change in policy that affects wages of the treated workers directly, the results should show that there is no effect on wages nor employment.

The only difference between this specification and the main one is that instead of selecting treated and control group workers in March ($T_i = 0$) and June ($T_i = 1$), we choose them in January ($T_i = 0$) and April ($T_i = 1$). We choose these months because we can replicate the earlier specifications, considering the two time frames discussed earlier: next month and the next two months.

The results of this specification when looking at effects one month ahead show that there are no consistent effect on wages, expected income, nor employment. Figure 14 shows that in almost all years the treatment effect on wages is not statistically significant, and in the year that is statistically significant, the point estimate is negative (in the opposite direction of our the estimates from our main specification). Additionally, the effect on employment is also statistically insignificant, this time in all four years, and also the sign of the point estimates switches from positive to negative.

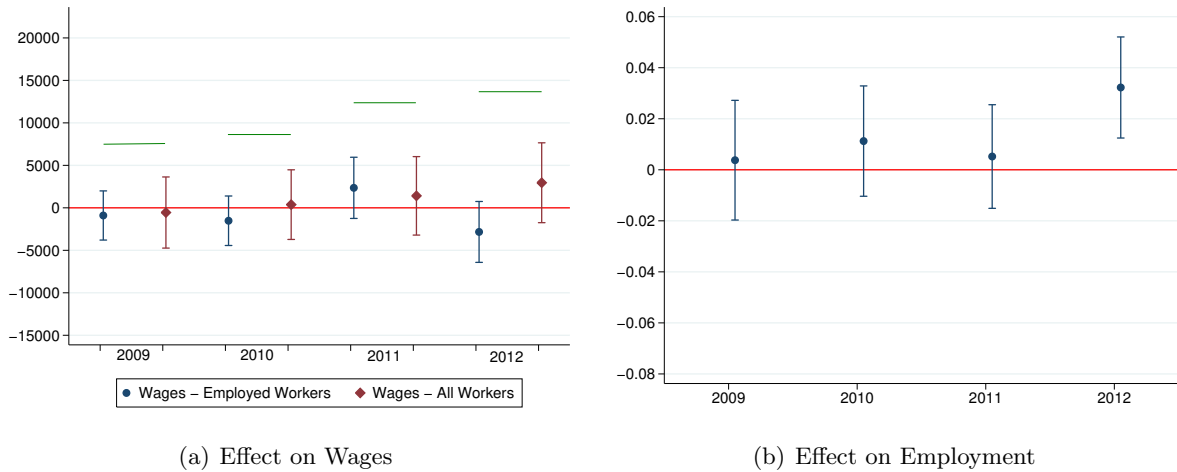
Figure 14. Results of the Fasication Test, by Year - Next Month



Note: Each point corresponds to the coefficient associated to the difference-in-differences estimator. Each coefficient is shown with its respective 95% confidence interval. The minimum wage readjustment of each year is shown with a horizontal line.

When the outcome variables are redefined to take into account the next two months, we observe that for all years the effect on wages is statistically insignificant. In the case of the effect on employment, the point estimates are positive but small, and it is only statistically significant in 2012. Overall, the falsification test supports the idea that the results that we obtain are not driven by confounding factors.

Figure 15. Results of the Fasication Test, by Year - Next Two Months



Note: Each point corresponds to the coefficient associated to the difference-in-differences estimator. Each coefficient is shown with its respective 95% confidence interval. The minimum wage readjustment of each year is shown with a horizontal line.

8 Concluding Remarks

In this study, we estimate the impact of the minimum wage changes on the level of wages and employment of workers affected by this policy in Chile between 2008 and 2012. We use a sample of workers from administrative data that contains monthly labor information of every worker employed in the formal sector. The sample used is focused on workers in firms of 5 or more employees, and therefore it is important to note that the representativeness of the sample used is limited to those firms, and hence the results should be considered valid only for this type of employees. Since our sample consists of formal workers in formal firms, we do not know if the minimum wage has any effect of the informal sector, but since we find no effect on formal employment it is unlikely that the minimum wage had any effect on the informal sector in the 2008-2012 period.

To tackle the usual identification limitations in this literature, we employ a difference-in-differences identification strategy. We choose a group of treated and control workers in the month when the minimum wage is set to increased, that is in June, and another treatment and control group when the minimum wage does not change, for instance in March. The workers included in the treatment group in March are not necessarily those that are included in the treatment group in June, and the same goes for the control group. Then, we compare the changes in wages and employment status, of each of these groups, one and two months after the change in the minimum wage. The main objective of this strategy is to control for unobservable characteristics that differentiate the treatment and control groups, and that could be affecting the results. Finally, we undertake a robustness analysis estimating three additional specifications, in which we make modifications to our main specification by changing one assumption at a time.

From the results of the main specification and the robustness analysis we extract three conclusions. First, we find that the wages of the treatment group workers increase after the rise of the minimum wage. This results may seem trivial, but it is not, since we are showing is that minimum wage readjustments increase worker's wages beyond what firms would readjust in a regular month. If, for instance, the minimum wage increase would be equal to the increase in productivity of an average month, then the treatment effect on wages should be zero, since in the pre-treatment period wages would increase by the same amount as in the post-treatment period. Second, we observe that the expected income of treated workers increases with the minimum wage readjustments. This increase occurs because minimum wage increases lead to an increase in the wages of the treated workers that remained employed, but do not provoke a decrease in the probability of remaining employed. This result implies that, if treated workers were risk-neutral, then their welfare increases with minimum wage increases. Third, we find that there are no significant effects on the probability of remaining employed.

Overall, our findings are in line with several other papers in the literature that find small effects on wages, and nil effects on employment. These results indicate that moderate increases in minimum wage might not have the negative effects that the competitive labor market model implies. Future research should focus on analyzing the effects of minimum wages on firms and overall inequality.

References

- Autor, D. H., A. Manning, and C. L. Smith (2016). The contribution of the minimum wage to US wage inequality over three decades: a reassessment. *American Economic Journal: Applied Economics* 8(1), 58–99.
- Belman, D. and P. Wolfson (2016). What does the minimum wage do in developing countries?: A review of studies and methodologies. *Conditions of Work and Employment Series No. 62*. International Labour Organization.
- Bhorat, H., R. Kanbur, and N. Mayet (2013). The impact of sectoral minimum wage laws on employment, wages, and hours of work in South Africa. *IZA Journal of Labor & Development* 2(1).
- Boockmann, B. (2010). The combined employment effects of minimum wages and labor market regulation: A meta-analysis. *IZA Discussion Paper No. 4983*.
- Bravo, D. and D. Contreras (1998). Is there any relationship between minimum wage and employment?: empirical evidence using natural experiments in a developing economy. *Working Paper No. 157*. Universidad de Chile, Facultad de Ciencias Económicas y Administrativas, Departamento de Economía.
- Bravo, D. and D. Robbins (1995). The Effect of Minimum Wages on Employment in Chile: 1957-1993. *Discussion paper, Harvard University*.
- Card, D. (1992). Do minimum wages reduce employment? A case study of California, 1987-89. *ILR Review* 46(1), 38–54.
- Chacra Orfalí, V. (1990). Efectos del salario mínimo. Aplicación del método Tobit. *Cuadernos de Economía* 27(80), 83–101.
- Chletsos, M. and G. P. Giotis (2015). The employment effect of minimum wage using 77 international studies since 1992: A meta-analysis.
- Cowan, K., A. Micco, A. Mizala, C. Pagés, and P. Romaguera (2005). Un diagnóstico del desempleo en Chile. Inter-American Development Bank and Centro de Microdatos, Universidad de Chile.
- Dickens, R., A. Manning, and T. Butcher (2012). Minimum wages and wage inequality: some theory and an application to the UK. *Working Paper Series 4512*. Department of Economics, University of Sussex.
- Doucoulagos, H. and T. D. Stanley (2009). Publication selection bias in minimum-wage research? A meta-regression analysis. *British Journal of Industrial Relations* 47(2), 406–428.
- Grau, N. and O. Landerretche (2011). The labor impact of minimum wages: A method for estimating the effect in emerging economies using Chilean panel data. *Serie de Documentos de Trabajo No. 329*, Departamento de Economía, Universidad de Chile.
- Groisman, F. (2014). Employment, inequality and minimum wages in Argentina. In D. McCann, S. Lee, P. Belser, C. Fenwick, J. Howe, and M. Luebker (Eds.), *Creative Labour Regulation. Indeterminacy and Protection in an Uncertain World*, Advances in Labour Studies, Chapter 4, pp. 87–125. London: Palgrave Macmillan.

- Katz, L. F. and A. B. Krueger (1992). The effect of the minimum wage on the fast-food industry. *ILR Review* 46(1), 6–21.
- Lemos, S. (2009). Minimum wage effects in a developing country. *Labour Economics* 16(2), 224–237.
- Maloney, W. and J. Mendez (2004). Measuring the impact of minimum wages. Evidence from Latin America. In *Law and employment: lessons from Latin America and the Caribbean*, pp. 109–130. University of Chicago Press.
- Manning, A. (2016). The elusive employment effect of the minimum wage. *CEP Discussion Paper, 1428*. Centre for Economic Performance, London School of Economics and Political Science, London, UK.
- Martínez, C., G. Morales, and R. Valdés (2001). Cambios estructurales en la demanda por trabajo en Chile. *Economía Chilena* 4(2), 5–25.
- Maurizio, R. and G. Vázquez (2016). Distribution effects of the minimum wage in four Latin American countries: Argentina, Brazil, Chile and Uruguay. *International Labour Review* 155(1), 97–131.
- Ministerio del Trabajo, Dirección del Trabajo (2015). Informe de resultados octava encuesta laboral 2014.
- Ministerio del Trabajo y Previsión Social (2015). Informe final comisión asesora salarial.
- Montenegro, C. E. Unemployment, Job Security, and Minimum Wages in Chile: 1960-2001. Washington, DC, United States: World Bank. Mimeographed document.
- Montenegro, C. E. and C. Pagés (2003). Who Benefits from Labor Market Regulations? Chile 1960-1998. *World Bank Policy Research Working Paper 3143*.
- Nataraj, S., F. Perez-Arce, K. B. Kumar, and S. V. Srinivasan (2014). The Impact of Labor Market Regulation on Employment in Low-Income Countries: A Meta-Analysis. *Journal of Economic Surveys* 28(3), 551–572.
- Neumark, D. and W. Wascher (2006). Minimum Wages and Employment: A Review of Evidence from the New Minimum Wage Research. *National Bureau of Economic Research*.
- OECD (2015). Minimum wages after the crisis: Making them pay.
- Paredes M., R. and L. Riveros C. (1989). Sesgo de Selección y el Efecto de los Salarios Mínimos. *Cuadernos de Economía* 26(79), 367–383.
- Ramos, J. and J. Chamorro (2013). Salario mínimo, lo técnico y lo valórico. *Trabajos de Investigación en Políticas Públicas No. 18*. Departamento de Economía, Universidad de Chile.
- Rivera, J. E. (2002). Salario Mínimo ¿Afecta la Probabilidad de estar Empleado? Importancia del Grado de Restrictividad que enfrenta una Persona. Evidencia Empírica para Chile. Master's thesis, Instituto de Economía, Pontificia Universidad Católica de Chile.
- Wedenoja, L. (2013). The employment and wage effects of minimum wages in a context of informality and non-compliance: Evidence from Chile. Cornell University.

A Appendices

A.1 Changes in the Minimum Wage in June of Each Year

Table A.1. Minimum Wage by Year

	Minimum Wage in Effect	Minimum Wage in July	Nominal Change	Real Change
June 2008	144000	159000	10.4	0.9
June 2009	159000	165000	3.8	1.9
June 2010	165000	172000	4.2	3.1
June 2011	172000	182000	5.8	2.3
June 2012	182000	193000	6.0	3.3

A.2 Number of Workers Earning the Minimum Wage

Table A.2. Workers that earn the minimum or 1.25 times the minimum in June of 2008

	Number of Workers 2008	Proportion
Minimum Wage	13316	0.059
Minimum Wage + 25%	10795	0.048
Total	224359	

Table A.3. Workers that earn the minimum or 1.25 times the minimum in June of 2009 - 2010

	Number of Workers 2009	Proportion	Number of Workers 2010	Proportion
Minimum Wage	12383	0.058	12280	0.055
Minimum Wage + 25%	9044	0.042	8983	0.040
Total	213592		222934	

Table A.4. Workers that earn the minimum or 1.25 times the minimum in June of 2011 - 2012

	Number of Workers 2011	Proportion	Number of Workers 2012	Proportion
Minimum Wage	10446	0.045	10039	0.043
Minimum Wage + 25%	8066	0.035	7551	0.033
Total	230282		230880	

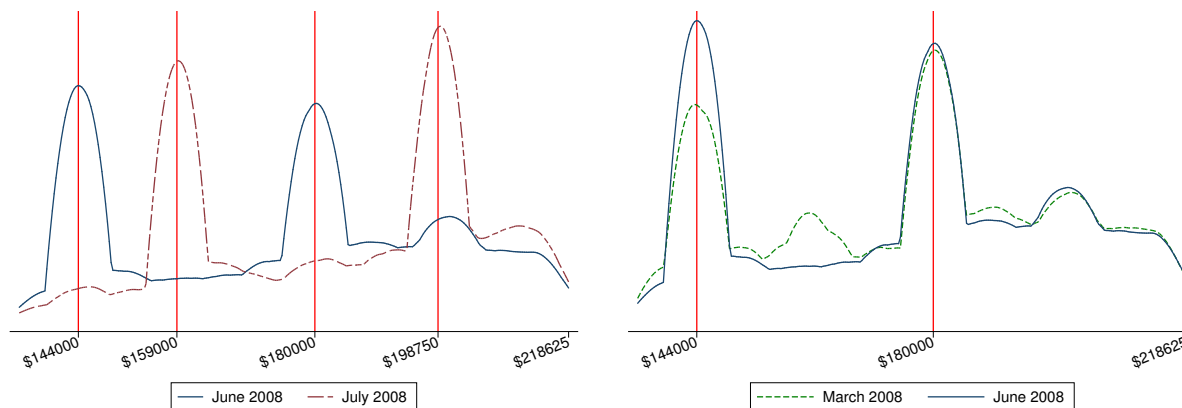
A.3 Wage Caps for Legal Gratuity under Art. 50

Assuming all monthly wages of the worker are the same:

$$\begin{aligned}
 0.25 * \sum_{i=1}^{12} w_j &\geq 4.75 * MW \\
 0.25 * 12 * w_j &\geq 4.75 * MW \\
 w_j &\geq 1.583 * MW
 \end{aligned} \tag{3}$$

A.4 Wage Distributions With and Without the Minimum Wage Readjustment

Figure A.1. Wage Distributions With and Without the Minimum Wage Readjustment - 2008

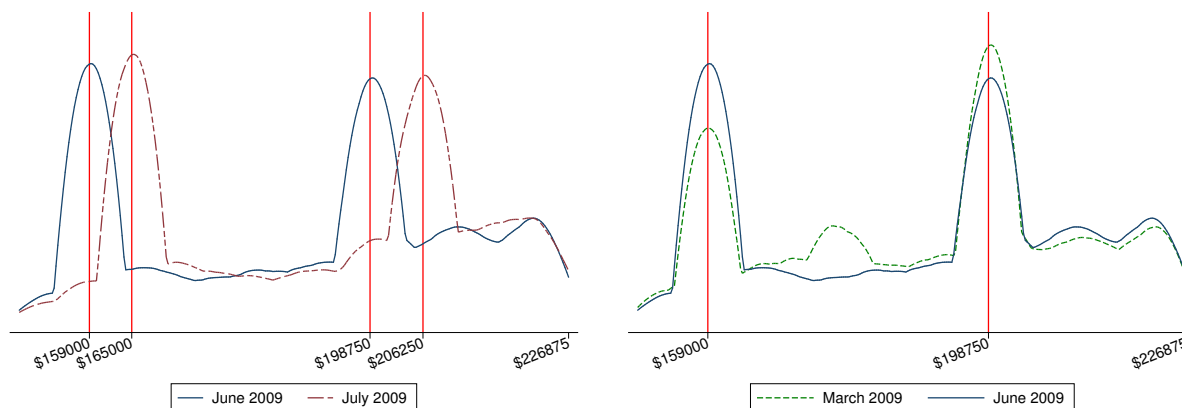


(a) Wage Distribution June - July 2008

(b) Wage Distribution March - June 2008

Note: In figure (a), the first vertical line corresponds to the minimum wage in effect in June, and the second to the one in effect after the readjustment. The third and fourth lines mark the minimum wage plus the legal gratuity before and after the readjustment, respectively. In figure (b) the first vertical line corresponds to the minimum wage and the second to the minimum wage plus the legal gratuity. For visual clarity, the graphs show a range of the wage distribution in a neighborhood around the minimum wage.

Figure A.2. Wage Distributions With and Without the Minimum Wage Readjustment - 2009

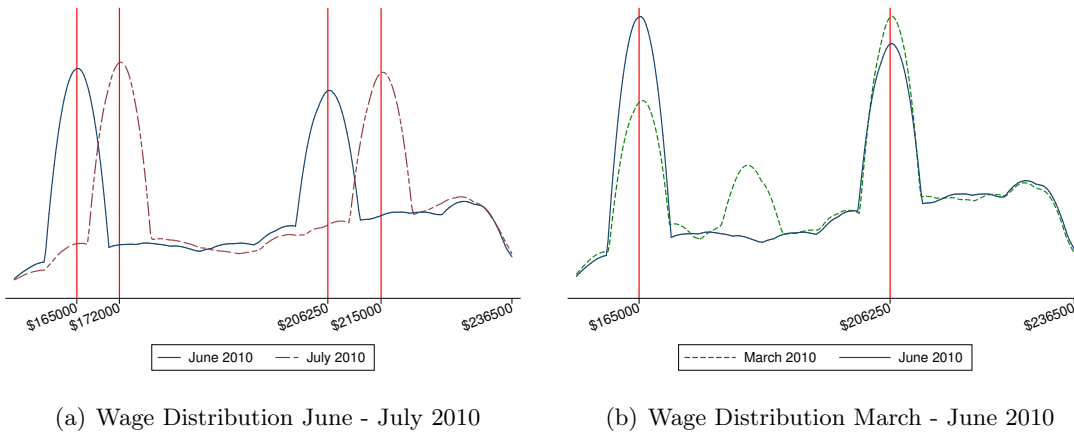


(a) Wage Distribution June - July 2009

(b) Wage Distribution March - June 2009

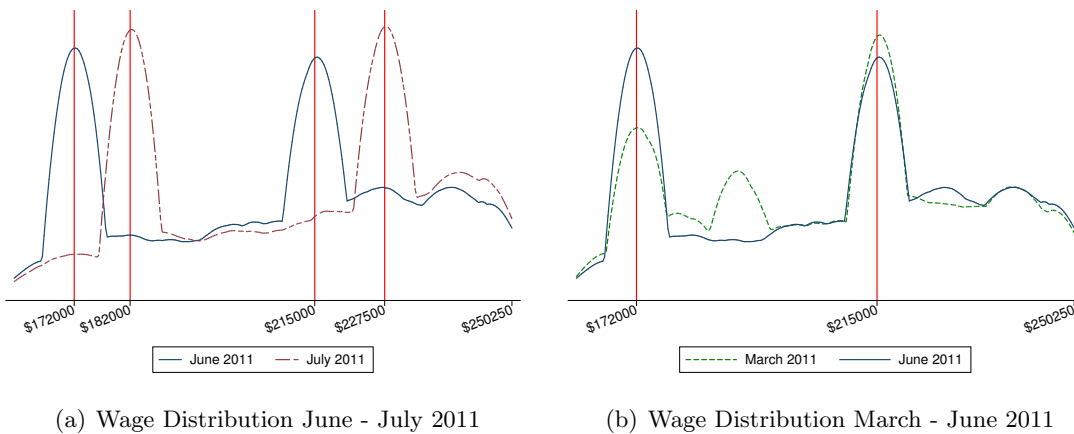
Note: In figure (a), the first vertical line corresponds to the minimum wage in effect in June, and the second to the one in effect after the readjustment. The third and fourth lines mark the minimum wage plus the legal gratuity before and after the readjustment, respectively. In figure (b) the first vertical line corresponds to the minimum wage and the second to the minimum wage plus the legal gratuity. For visual clarity, the graphs show a range of the wage distribution in a neighborhood around the minimum wage.

Figure A.3. Wage Distributions With and Without the Minimum Wage Readjustment - 2010



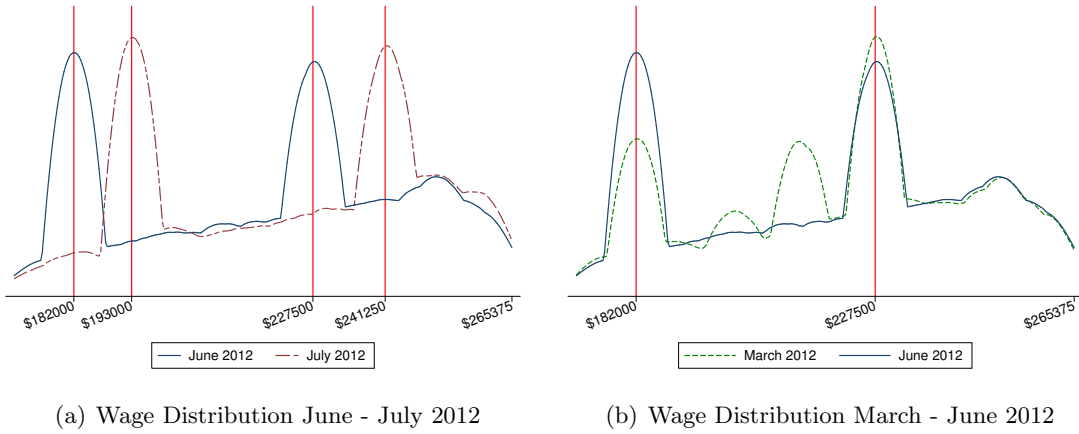
Note: In figure (a), the first vertical line corresponds to the minimum wage in effect in June, and the second to the one in effect after the readjustment. The third and fourth lines mark the minimum wage plus the legal gratuity before and after the readjustment, respectively. In figure (b) the first vertical line corresponds to the minimum wage and the second to the minimum wage plus the legal gratuity. For visual clarity, the graphs show a range of the wage distribution in a neighborhood around the minimum wage.

Figure A.4. Wage Distributions With and Without the Minimum Wage Readjustment - 2011



Note: In figure (a), the first vertical line corresponds to the minimum wage in effect in June, and the second to the one in effect after the readjustment. The third and fourth lines mark the minimum wage plus the legal gratuity before and after the readjustment, respectively. In figure (b) the first vertical line corresponds to the minimum wage and the second to the minimum wage plus the legal gratuity. For visual clarity, the graphs show a range of the wage distribution in a neighborhood around the minimum wage.

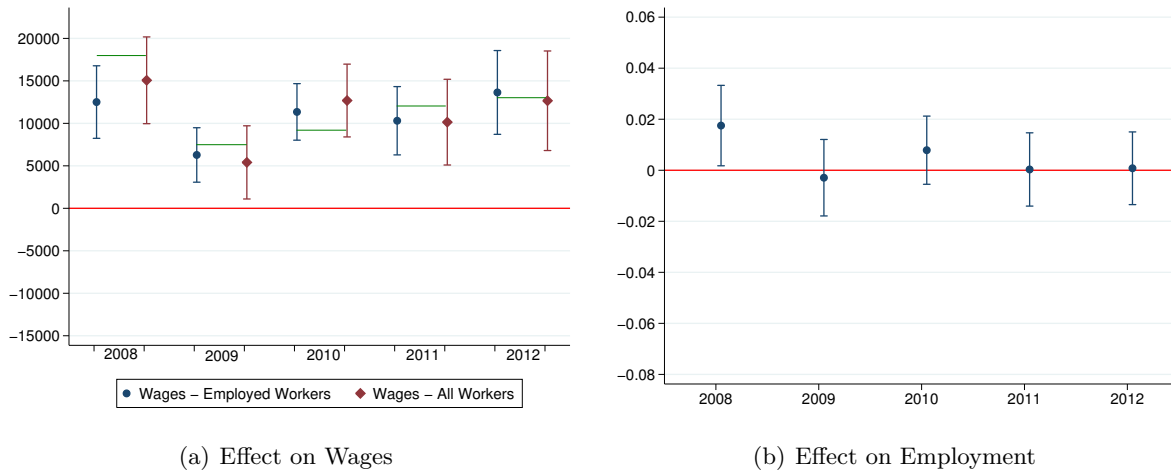
Figure A.5. Wage Distributions With and Without the Minimum Wage Readjustment - 2012



Note: In figure (a), the first vertical line corresponds to the minimum wage in effect in June, and the second to the one in effect after the readjustment. The third and fourth lines mark the minimum wage plus the legal gratuity before and after the readjustment, respectively. In figure (b) the first vertical line corresponds to the minimum wage and the second to the minimum wage plus the legal gratuity. For visual clarity, the graphs show a range of the wage distribution in a neighborhood around the minimum wage.

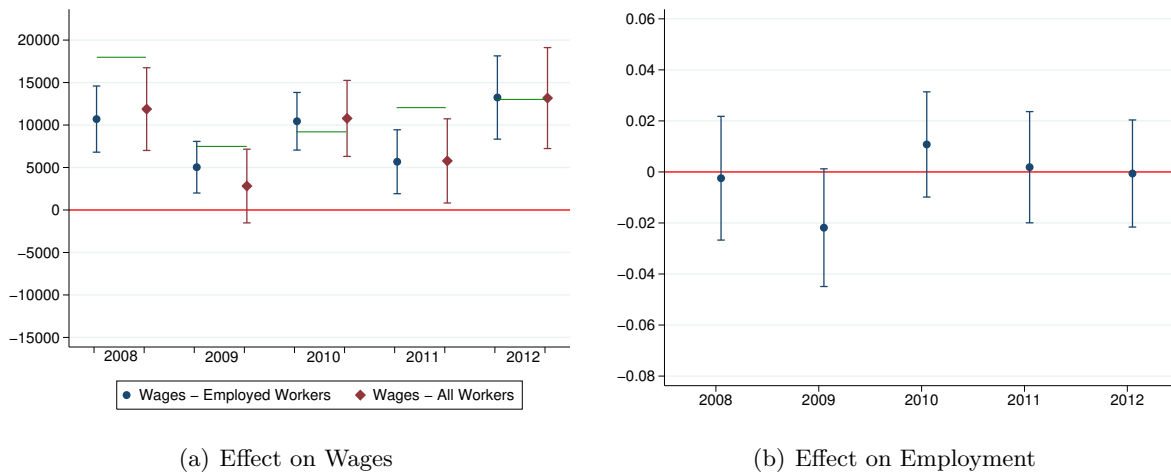
A.5 Estimations without the firm that closes in April of 2012

Figure A.6. Results of the Main Specification, by Year - Next Month



Note: Each point corresponds to the coefficient associated to the difference-in-differences estimator. Each coefficient is shown with its respective 95% confidence interval. The minimum wage readjustment of each year is shown with a horizontal line.

Figure A.7. Results of the Main Specification, by Year - Next Month



Note: Each point corresponds to the coefficient associated to the difference-in-differences estimator. Each coefficient is shown with its respective 95% confidence interval. The minimum wage readjustment of each year is shown with a horizontal line.

A.6 Large Wage Changes

In each treatment and control group, we observed the presence of large wage changes greater than 100%. Due to the nature of wages, it is not reasonable to conclude that these changes are caused by increases in productivity. A likely explanation for these changes is the presence of high hourly wage workers, that were being transitioned from part time (less than 45 hours per week) to full time work. These increases add noise to the estimations, and therefore we include an adequate constraint to determine which workers belong to the treatment and control groups.

Table A.5. Workers per group that show wage increases larger than %100 - Year 2008

	Num. in Group	Num. δ
March Control group	960	58
June Control group	961	46
March Treated group	4961	153
June Treated group	5279	176

Table A.6. Workers per group that show wage increases larger than %100 - Year 2009

	Num. in Group	Num. δ
March Control group	948	68
June Control group	967	44
March Treated group	5365	196
June Treated group	4842	123

Table A.7. Workers per group that show wage increases larger than %100 - Year 2010

	Num. in Group	Num. δ
March Control group	966	42
June Control group	974	36
March Treated group	5217	149
June Treated group	4805	90

Table A.8. Workers per group that show wage increases larger than %100 - Year 2011

	Num. in Group	Num. δ
March Control group	955	63
June Control group	964	43
March Treated group	4902	133
June Treated group	4406	124

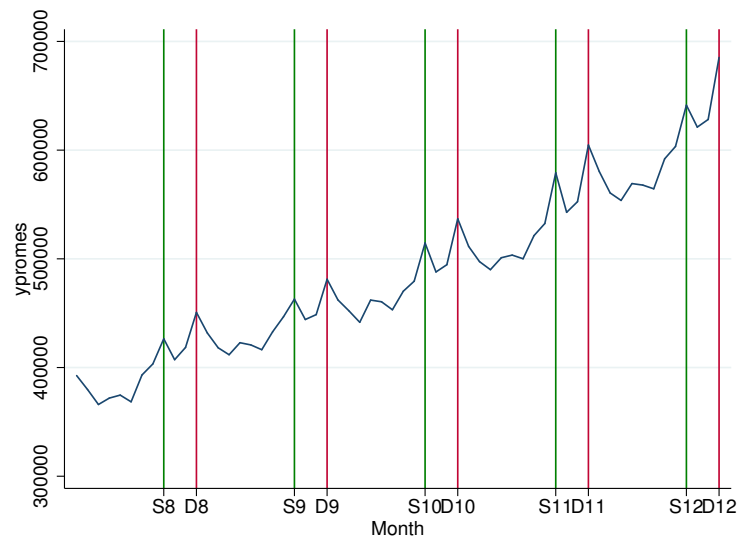
Table A.9. Workers per group that show wage increases larger than %100 - Year 2012

	Num. in Group	Num. δ
March Control group	900	111
June Control group	965	49
March Treated group	4515	116
June Treated group	4020	99

A.7 Exclusion of September-December

It is possible that the minimum wage changes might have an impact many months after the adjustment. However, in this study we report effects on outcomes at most two months ahead, because in September (the third month in the future for workers selected in June) wages increase due to bonuses. Taking into account that these bonuses are not explicitly reported in the data base, it is not possible to control for these wage increases, and therefore we do not look into effects of the minimum wage readjustment in three or more months in the future.

Figure A.8. Monthly Wages in the Sample



Note: Green and red vertical lines marks September and December of each year, respectively.

A.8 Result Tables - Main Specification

Table A.10. Results for the Main Specification - One Month After the Readjustment

Estimations for 2008			
	Wages - Employed Workers	Wages - All Workers	Employment
Trat*Ti	14111.2***	16638.6***	0.01
SE	2204.9	2625.6	0.008
CI (95%)	[9789.2 , 18433.2]	[11492.1 , 21785.2]	[-0.002 , 0.03]
N	12109	12456	12456
Estimations for 2009			
	Wages - Employed Workers	Wages - All Workers	Employment
Trat*Ti	6343.3***	5410.6*	-0.003
SE	1629.4	2190.9	0.008
CI (95%)	[3149.5 , 9537.1]	[1116.1 , 9705.1]	[-0.02 , 0.01]
N	11665	11967	11967
Estimations for 2010			
	Wages - Employed Workers	Wages - All Workers	Employment
Trat*Ti	10317.5***	11866.0***	0.009
SE	1703.7	2188.5	0.007
CI (95%)	[6978.1 , 13657.0]	[7576.2 , 16155.8]	[-0.005 , 0.02]
N	11614	11848	11848
Estimations for 2011			
	Wages - Employed Workers	Wages - All Workers	Employment
Trat*Ti	10239.6***	10306.3***	0.001
SE	2047.4	2569.5	0.007
CI (95%)	[6226.4 , 14252.8]	[5269.5 , 15343.0]	[-0.01 , 0.02]
N	10914	11165	11165
Estimations for 2012			
	Wages - Employed Workers	Wages - All Workers	Employment
Trat*Ti	12069.2***	-1960.8	-0.06***
SE	2540.8	3099.7	0.008
CI (95%)	[7088.7 , 17049.7]	[-8036.7 , 4115.2]	[-0.07 , -0.04]
N	10090	10373	10373

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Note: In each table, the first row shows the coefficient of the variable of interest, the second shows the standard error of the estimated coefficient, and the third shows the 95% confidence interval. In each table, the column “Wages - Employed Workers” shows the result of the wage equation considering the workers that remained employed. The column “Wages - All Workers” shows the result of the wage equation considering all workers. Finally, the column “Employment” shows the results for the employment equation.

Table A.11. Results for the Main Specification - Two Months After the Readjustment

Estimations for 2008			
	Wages - Employed Workers	Wages - All Workers	Employment
Trat*Ti	11038.1***	12123.0***	-0.003
SE	2001.0	2492.6	0.01
CI (95%)	[7115.8 , 14960.3]	[7237.2 , 17008.8]	[-0.03 , 0.02]
N	12204	12456	12456
Estimations for 2009			
	Wages - Employed Workers	Wages - All Workers	Employment
Trat*Ti	4997.6**	2892.8	-0.02
SE	1543.4	2205.8	0.01
CI (95%)	[1972.2 , 8022.9]	[-1430.8 , 7216.5]	[-0.04 , 0.003]
N	11734	11967	11967
Estimations for 2010			
	Wages - Employed Workers	Wages - All Workers	Employment
Trat*Ti	9983.4***	10286.4***	0.01
SE	1737.0	2279.5	0.01
CI (95%)	[6578.6 , 13388.1]	[5818.2 , 14754.6]	[-0.01 , 0.03]
N	11668	11848	11848
Estimations for 2011			
	Wages - Employed Workers	Wages - All Workers	Employment
Trat*Ti	5770.3**	6201.9*	0.005
SE	1919.7	2527.8	0.01
CI (95%)	[2007.4 , 9533.3]	[1247.1 , 11156.8]	[-0.02 , 0.03]
N	10980	11165	11165
Estimations for 2012			
	Wages - Employed Workers	Wages - All Workers	Employment
Trat*Ti	11826.0***	-2058.4	-0.06***
SE	2515.7	3128.8	0.01
CI (95%)	[6894.8 , 16757.2]	[-8191.5 , 4074.8]	[-0.08 , -0.04]
N	10154	10373	10373

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Note: In each table, the first row shows the coefficient of the variable of interest, the second shows the standard error of the estimated coefficient, and the third shows the 95% confidence interval. In each table, the column “Wages - Employed Workers” shows the result of the wage equation considering the workers that remained employed. The column “Wages - All Workers” shows the result of the wage equation considering all workers. Finally, the column “Employment” shows the results for the employment equation.

A.9 Result Tables - Estimation with Control Group with Lower Wages

Table A.12. Results with Control Group with Lower Wage - One Month After the Readjustment

Estimations for 2008			
	Wages - Employed Workers	Wages - All Workers	Employment
Trat*Ti	11238.5***	9283.1***	-0.009
SE	1450.3	1802.3	0.006
CI (95%)	[8395.7 , 14081.4]	[5750.3 , 12816.0]	[-0.02 , 0.003]
N	14129	14552	14552

Estimations for 2009			
	Wages - Employed Workers	Wages - All Workers	Employment
Trat*Ti	5674.2***	5755.4***	0.000010
SE	1351.4	1650.7	0.005
CI (95%)	[3025.4 , 8323.0]	[2520.0 , 8990.9]	[-0.01 , 0.01]
N	15405	15817	15817

Estimations for 2010			
	Wages - Employed Workers	Wages - All Workers	Employment
Trat*Ti	12570.5***	14423.9***	0.01*
SE	1315.9	1603.4	0.005
CI (95%)	[9991.1 , 15149.8]	[11281.0 , 17566.8]	[0.0009 , 0.02]
N	16074	16473	16473

Estimations for 2011			
	Wages - Employed Workers	Wages - All Workers	Employment
Trat*Ti	7158.5***	5486.0**	-0.008
SE	1431.4	1772.8	0.005
CI (95%)	[4352.7 , 9964.3]	[2011.0 , 8961.0]	[-0.02 , 0.002]
N	14470	14828	14828

Estimations for 2012			
	Wages - Employed Workers	Wages - All Workers	Employment
Trat*Ti	7841.8***	7058.4***	-0.003
SE	1666.1	1984.9	0.005
CI (95%)	[4576.0 , 11107.6]	[3167.8 , 10949.0]	[-0.01 , 0.007]
N	13740	14057	14057

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Note: In each table, the first row shows the coefficient of the variable of interest, the second shows the standard error of the estimated coefficient, and the third shows the 95% confidence interval. In each table, the column “Wages - Employed Workers” shows the result of the wage equation considering the workers that remained employed. The column “Wages - All Workers” shows the result of the wage equation considering all workers. Finally, the column “Employment” shows the results for the employment equation.

Table A.13. Results with Control Group with Lower Wage - Two Months After the Readjustment

Estimations for 2008			
	Wages - Employed Workers	Wages - All Workers	Employment
Trat*Ti	8930.7***	4844.3**	-0.04***
SE	1321.3	1732.9	0.010
CI (95%)	[6340.7 , 11520.7]	[1447.5 , 8241.1]	[-0.05 , -0.02]
N	14261	14552	14552
Estimations for 2009			
	Wages - Employed Workers	Wages - All Workers	Employment
Trat*Ti	4248.7***	4226.5**	-0.004
SE	1186.2	1574.1	0.008
CI (95%)	[1923.7 , 6573.7]	[1141.1 , 7311.8]	[-0.02 , 0.01]
N	15496	15817	15817
Estimations for 2010			
	Wages - Employed Workers	Wages - All Workers	Employment
Trat*Ti	10710.7***	11595.8***	0.01
SE	1168.2	1528.6	0.007
CI (95%)	[8420.9 , 13000.5]	[8599.6 , 14592.1]	[-0.002 , 0.03]
N	16157	16473	16473
Estimations for 2011			
	Wages - Employed Workers	Wages - All Workers	Employment
Trat*Ti	4874.4***	3891.3*	-0.008
SE	1333.2	1742.2	0.008
CI (95%)	[2261.1 , 7487.6]	[476.5 , 7306.2]	[-0.02 , 0.008]
N	14560	14828	14828
Estimations for 2012			
	Wages - Employed Workers	Wages - All Workers	Employment
Trat*Ti	6267.2***	5298.4**	0.006
SE	1602.0	1978.1	0.008
CI (95%)	[3127.2 , 9407.3]	[1421.2 , 9175.7]	[-0.009 , 0.02]
N	13825	14057	14057

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Note: In each table, the first row shows the coefficient of the variable of interest, the second shows the standard error of the estimated coefficient, and the third shows the 95% confidence interval. In each table, the column “Wages - Employed Workers” shows the result of the wage equation considering the workers that remained employed. The column “Wages - All Workers” shows the result of the wage equation considering all workers. Finally, the column “Employment” shows the results for the employment equation.

A.10 Result Tables - Time Period Change

Table A.14. Results for Time Period Change - One Month After Readjustment

Estimations for 2009			
	Wages - Employed Workers	Wages - All Workers	Employment
Trat*Ti	4357.2*	4357.2*	0.007
SE	2006.1	2006.1	0.007
CI (95%)	[424.9 , 8289.5]	[424.9 , 8289.5]	[-0.007 , 0.02]
N	10108	10108	10315

Estimations for 2010			
	Wages - Employed Workers	Wages - All Workers	Employment
Trat*Ti	8931.0***	8931.0***	0.006
SE	1951.5	1951.5	0.007
CI (95%)	[5105.6 , 12756.4]	[5105.6 , 12756.4]	[-0.007 , 0.02]
N	9070	9070	9211

Estimations for 2011			
	Wages - Employed Workers	Wages - All Workers	Employment
Trat*Ti	5162.2**	5162.2**	0.002
SE	1946.3	1946.3	0.007
CI (95%)	[1347.0 , 8977.5]	[1347.0 , 8977.5]	[-0.01 , 0.02]
N	10128	10128	10313

Estimations for 2012			
	Wages - Employed Workers	Wages - All Workers	Employment
Trat*Ti	3154.1	3154.1	-0.006
SE	2292.7	2292.7	0.007
CI (95%)	[-1340.0 , 7648.2]	[-1340.0 , 7648.2]	[-0.02 , 0.008]
N	10035	10035	10241

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Note: In each table, the first row shows the coefficient of the variable of interest, the second shows the standard error of the estimated coefficient, and the third shows the 95% confidence interval. In each table, the column “Wages - Employed Workers” shows the result of the wage equation considering the workers that remained employed. The column “Wages - All Workers” shows the result of the wage equation considering all workers. Finally, the column “Employment” shows the results for the employment equation.

Table A.15. Results for Time Period Change - Two Months After Readjustment

Estimations for 2009			
	Wages - Employed Workers	Wages - All Workers	Employment
Trat*Ti	142.6	1173.4	0.001
SE	1886.7	2396.7	0.01
CI (95%)	[-3555.7 , 3841.0]	[-3524.5 , 5871.4]	[-0.02 , 0.02]
N	10170	10315	10315

Estimations for 2010			
	Wages - Employed Workers	Wages - All Workers	Employment
Trat*Ti	7284.9***	8146.7**	0.01
SE	2004.8	2543.7	0.01
CI (95%)	[3355.1 , 11214.7]	[3160.5 , 13132.8]	[-0.01 , 0.03]
N	9095	9211	9211

Estimations for 2011			
	Wages - Employed Workers	Wages - All Workers	Employment
Trat*Ti	4791.4*	4304.3	-0.01
SE	1887.2	2517.1	0.01
CI (95%)	[1092.0 , 8490.7]	[-629.7 , 9238.3]	[-0.03 , 0.009]
N	10181	10313	10313

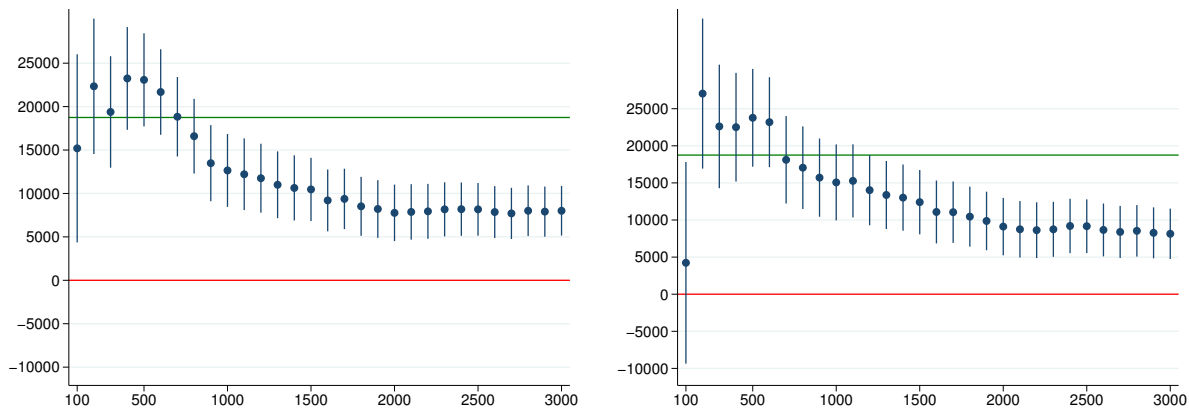
Estimations for 2012			
	Wages - Employed Workers	Wages - All Workers	Employment
Trat*Ti	1389.6	606.4	0.0006
SE	2180.2	2819.6	0.01
CI (95%)	[-2884.0 , 5663.1]	[-4920.5 , 6133.3]	[-0.02 , 0.02]
N	10087	10241	10241

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Note: In each table, the first row shows the coefficient of the variable of interest, the second shows the standard error of the estimated coefficient, and the third shows the 95% confidence interval. In each table, the column “Wages - Employed Workers” shows the result of the wage equation considering the workers that remained employed. The column “Wages - All Workers” shows the result of the wage equation considering all workers. Finally, the column “Employment” shows the results for the employment equation.

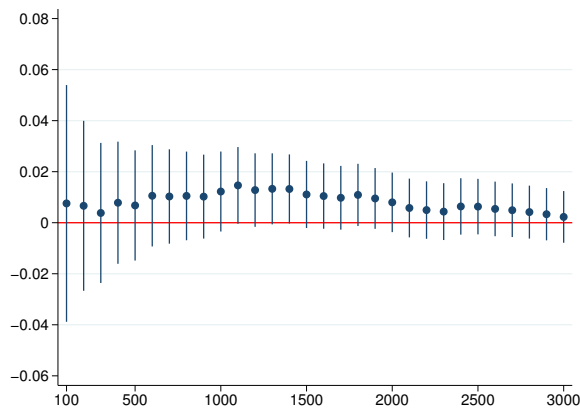
A.11 Changing the Size of the Control Group - Main Specification - Next Month

Figure A.9. Impact of the Minimum Wage one month after readjustment - 2008



(a) Effect on Wages, Only Employed Workers

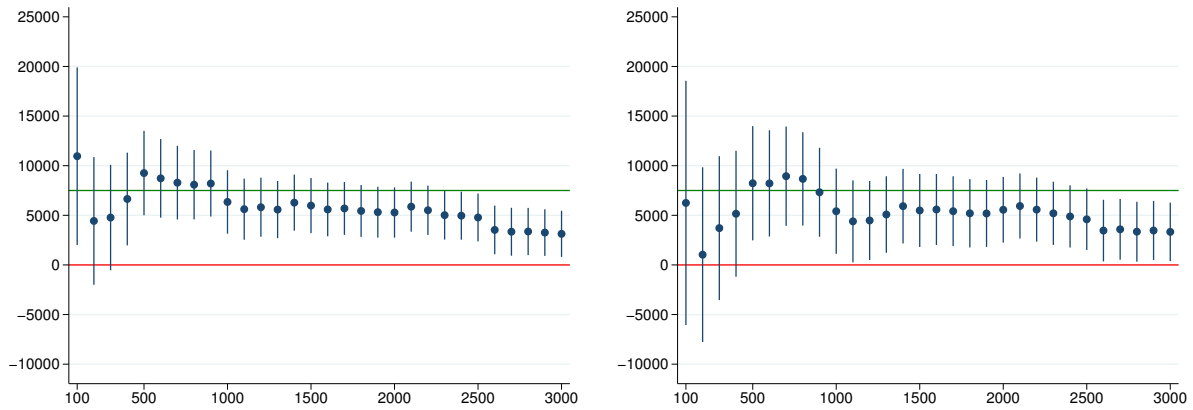
(b) Effect on Wages, All Workers



(c) Effect on Employment

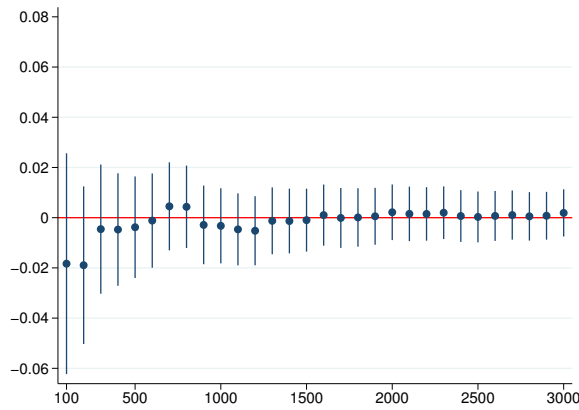
Note: Every point represents the difference-in-differences coefficient, but each estimation has a different size of the control group. The horizontal axis shows the size of the control group for each estimation, and every point represents an estimation with a control group 100 observations larger than the one to the left. The coefficients are shown with their respective 95% confidence interval. The readjustment of the minimum wage in each year is represented with a horizontal line in the wage graphs.

Figure A.10. Impact of the Minimum Wage one month after readjustment - 2009



(a) Effect on Wages, Only Employed Workers

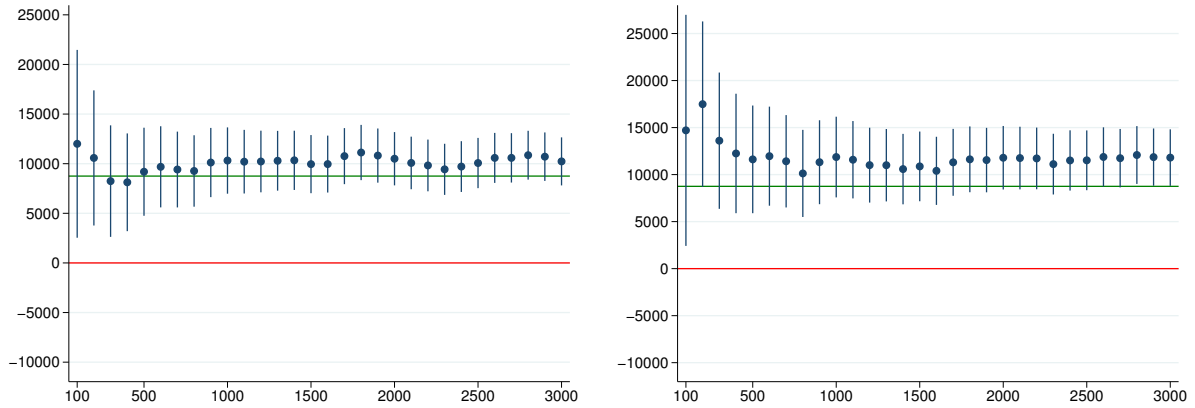
(b) Effect on Wages, All Workers



(c) Effect on Employment

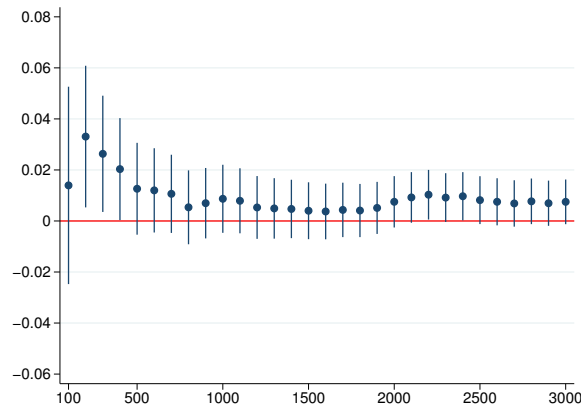
Note: Every point represents the difference-in-differences coefficient, but each estimation has a different size of the control group. The horizontal axis shows the size of the control group for each estimation, and every point represents an estimation with a control group 100 observations larger than the one to the left. The coefficients are shown with their respective 95% confidence interval. The readjustment of the minimum wage in each year is represented with a horizontal line in the wage graphs.

Figure A.11. Impact of the Minimum Wage one month after readjustment - 2010



(a) Effect on Wages, Only Employed Workers

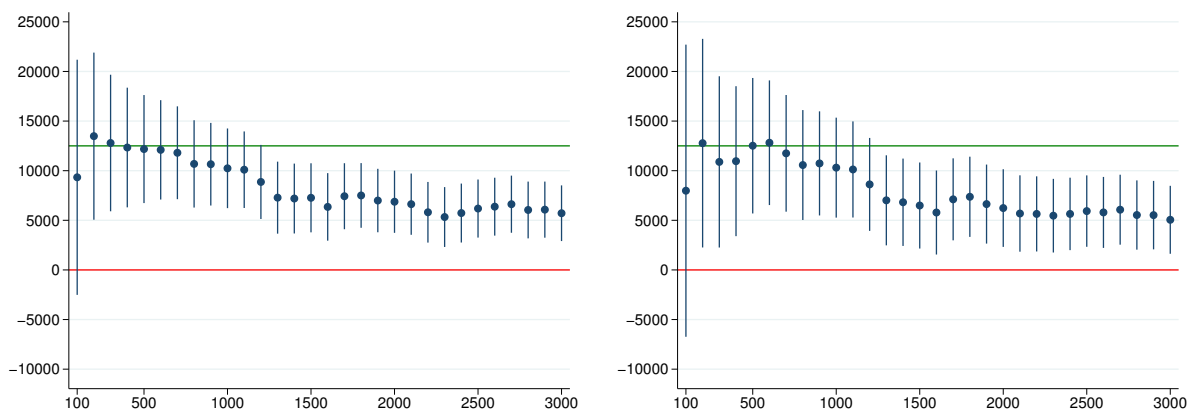
(b) Effect on Wages, All Workers



(c) Effect on Employment

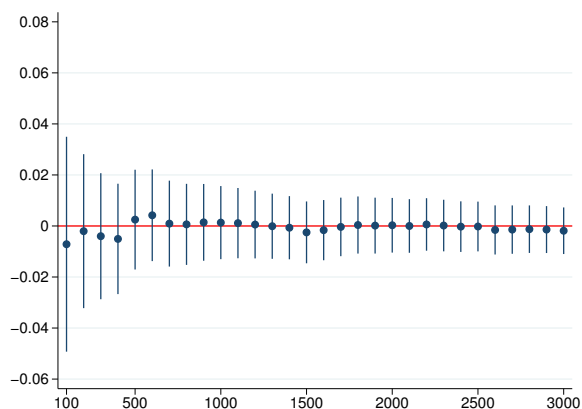
Note: Every point represents the difference-in-differences coefficient, but each estimation has a different size of the control group. The horizontal axis shows the size of the control group for each estimation, and every point represents an estimation with a control group 100 observations larger than the one to the left. The coefficients are shown with their respective 95% confidence interval. The readjustment of the minimum wage in each year is represented with a horizontal line in the wage graphs.

Figure A.12. Impact of the Minimum Wage one month after readjustment - 2011



(a) Effect on Wages, Only Employed Workers

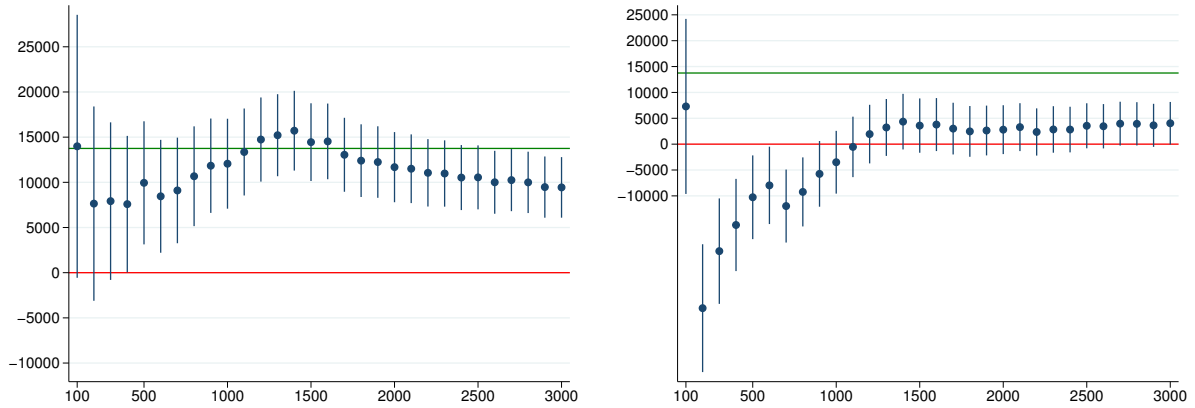
(b) Effect on Wages, All Workers



(c) Effect on Employment

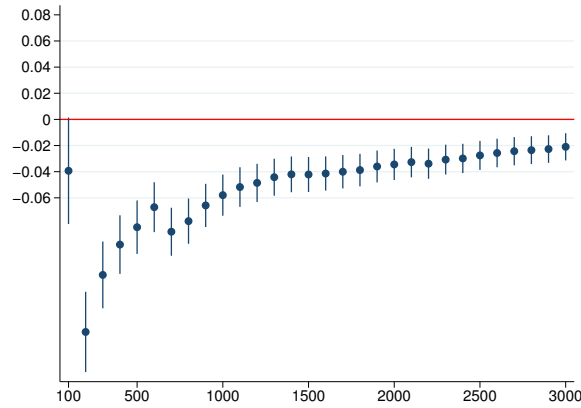
Note: Every point represents the difference-in-differences coefficient, but each estimation has a different size of the control group. The horizontal axis shows the size of the control group for each estimation, and every point represents an estimation with a control group 100 observations larger than the one to the left. The coefficients are shown with their respective 95% confidence interval. The readjustment of the minimum wage in each year is represented with a horizontal line in the wage graphs.

Figure A.13. Impact of the Minimum Wage one month after readjustment - 2012



(a) Effect on Wages, Only Employed Workers

(b) Effect on Wages, All Workers

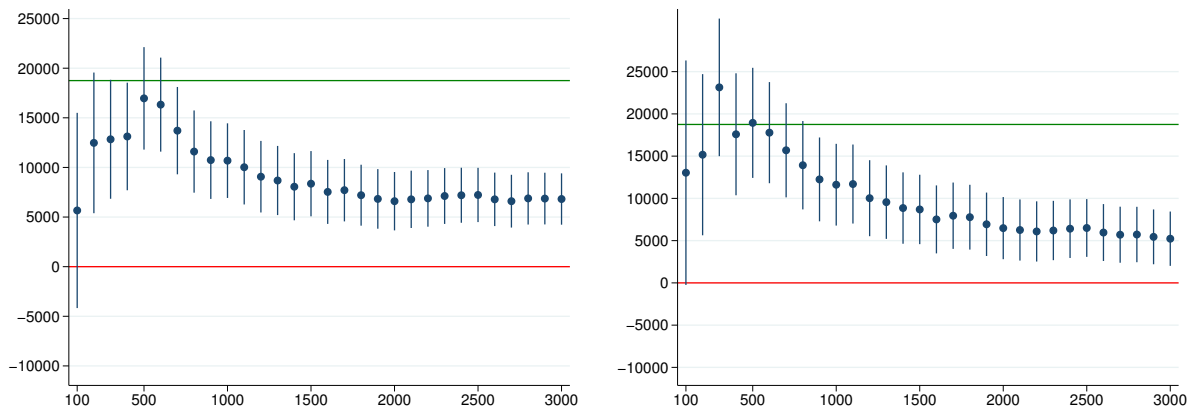


(c) Effect on Employment

Note: Every point represents the difference-in-differences coefficient, but each estimation has a different size of the control group. The horizontal axis shows the size of the control group for each estimation, and every point represents an estimation with a control group 100 observations larger than the one to the left. The coefficients are shown with their respective 95% confidence interval. The readjustment of the minimum wage in each year is represented with a horizontal line in the wage graphs.

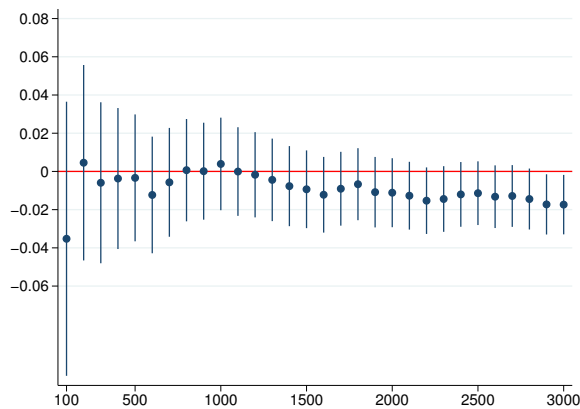
A.12 Changing the Size of the Control Group - Main Specification - Next Two Months

Figure A.14. Impact of the Minimum Wage two months after readjustment - 2008



(a) Effect on Wages, Only Employed Workers

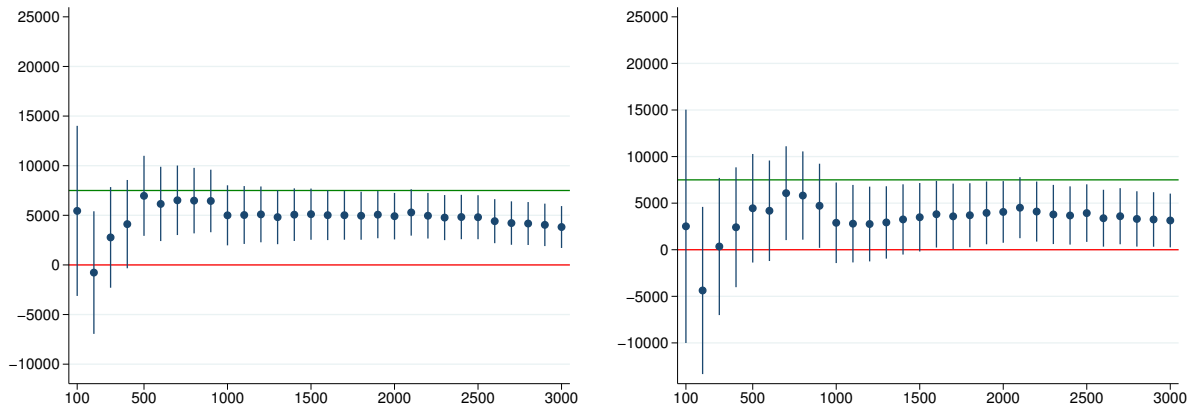
(b) Effect on Wages, All Workers



(c) Effect on Employment

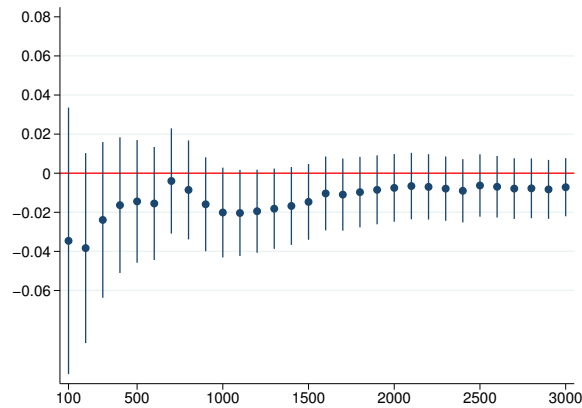
Note: Every point represents the difference-in-differences coefficient, but each estimation has a different size of the control group. The horizontal axis shows the size of the control group for each estimation, and every point represents an estimation with a control group 100 observations larger than the one to the left. The coefficients are shown with their respective 95% confidence interval. The readjustment of the minimum wage in each year is represented with a horizontal line in the wage graphs.

Figure A.15. Impact of the Minimum Wage two months after readjustment - 2009



(a) Effect on Wages, Only Employed Workers

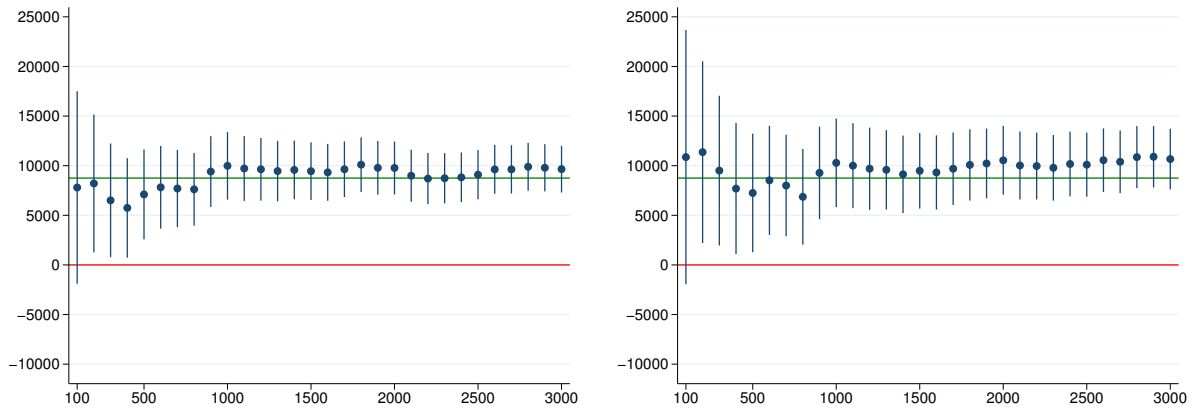
(b) Effect on Wages, All Workers



(c) Effect on Employment

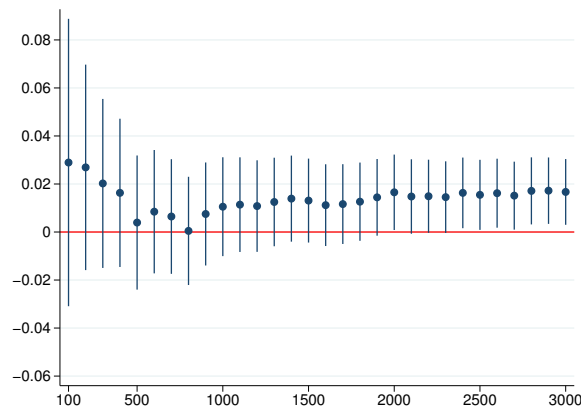
Note: Every point represents the difference-in-differences coefficient, but each estimation has a different size of the control group. The horizontal axis shows the size of the control group for each estimation, and every point represents an estimation with a control group 100 observations larger than the one to the left. The coefficients are shown with their respective 95% confidence interval. The readjustment of the minimum wage in each year is represented with a horizontal line in the wage graphs.

Figure A.16. Impact of the Minimum Wage two months after readjustment - 2010



(a) Effect on Wages, Only Employed Workers

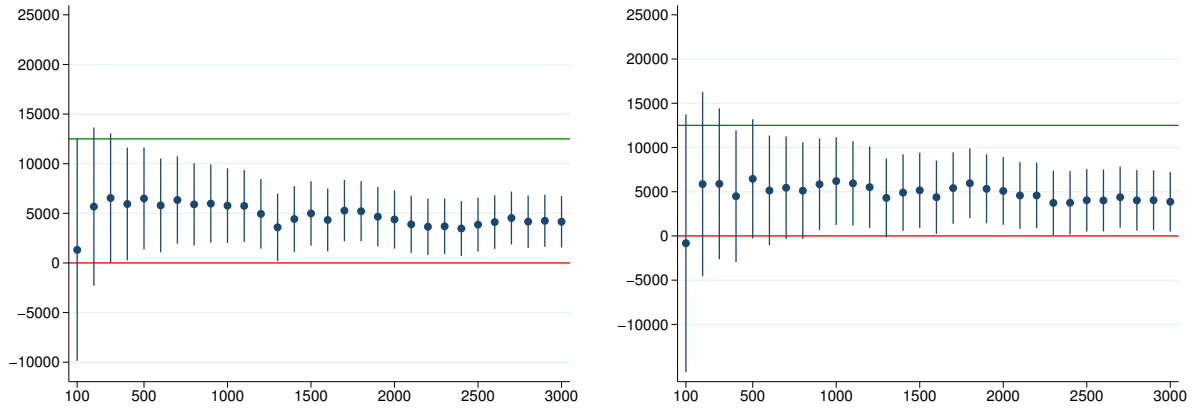
(b) Effect on Wages, All Workers



(c) Effect on Employment

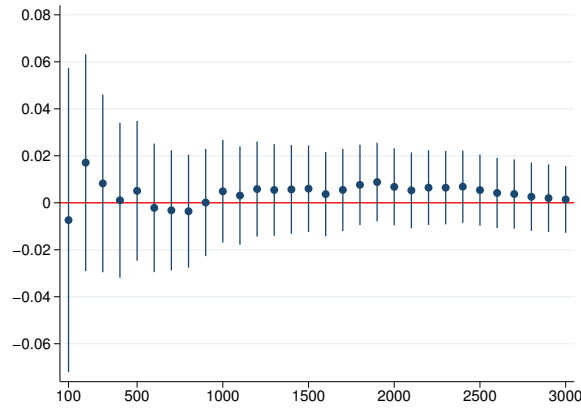
Note: Every point represents the difference-in-differences coefficient, but each estimation has a different size of the control group. The horizontal axis shows the size of the control group for each estimation, and every point represents an estimation with a control group 100 observations larger than the one to the left. The coefficients are shown with their respective 95% confidence interval. The readjustment of the minimum wage in each year is represented with a horizontal line in the wage graphs.

Figure A.17. Impact of the Minimum Wage two months after readjustment - 2011



(a) Effect on Wages, Only Employed Workers

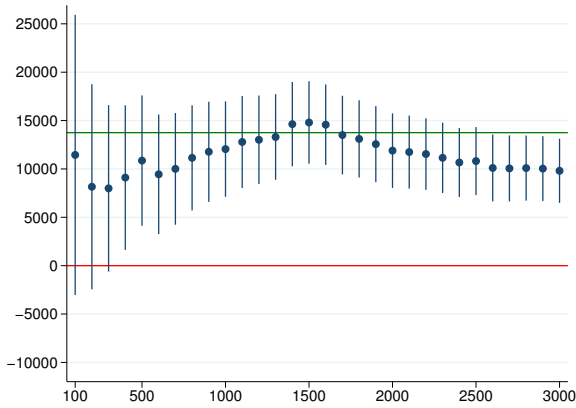
(b) Effect on Wages, All Workers



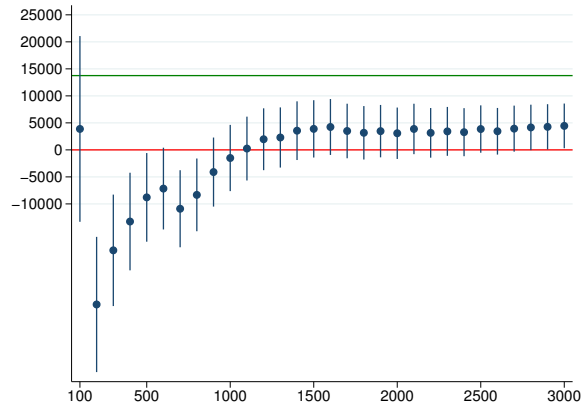
(c) Effect on Employment

Note: Every point represents the difference-in-differences coefficient, but each estimation has a different size of the control group. The horizontal axis shows the size of the control group for each estimation, and every point represents an estimation with a control group 100 observations larger than the one to the left. The coefficients are shown with their respective 95% confidence interval. The readjustment of the minimum wage in each year is represented with a horizontal line in the wage graphs.

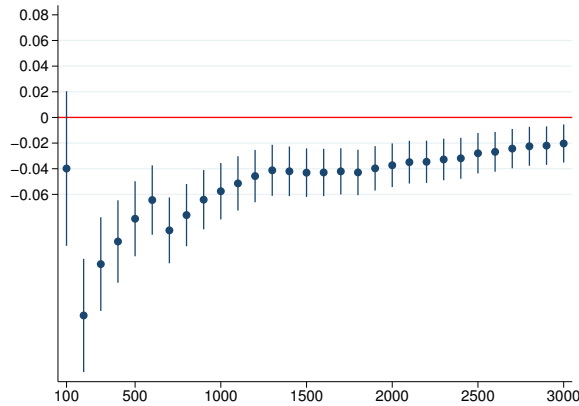
Figure A.18. Impact of the Minimum Wage two months after readjustment - 2012



(a) Effect on Wages, Only Employed Workers



(b) Effect on Wages, All Workers

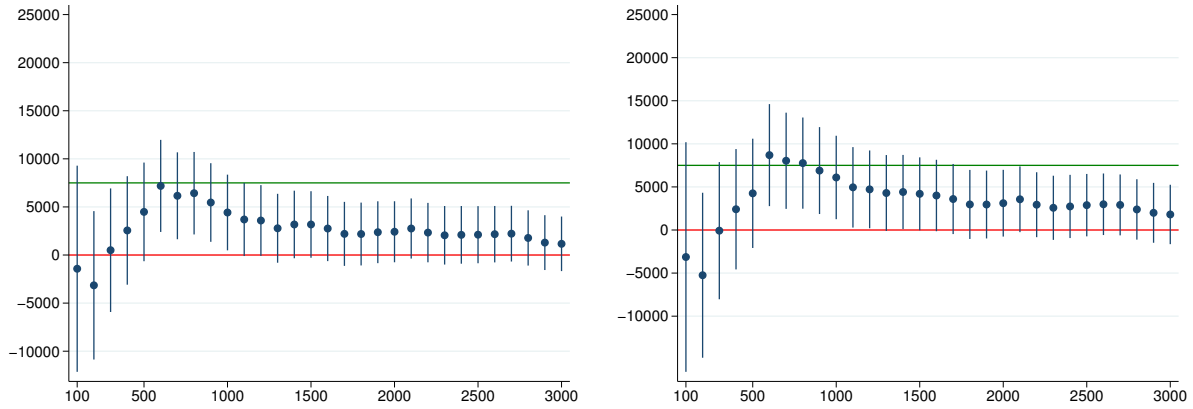


(c) Effect on Employment

Note: Every point represents the difference-in-differences coefficient, but each estimation has a different size of the control group. The horizontal axis shows the size of the control group for each estimation, and every point represents an estimation with a control group 100 observations larger than the one to the left. The coefficients are shown with their respective 95% confidence interval. The readjustment of the minimum wage in each year is represented with a horizontal line in the wage graphs.

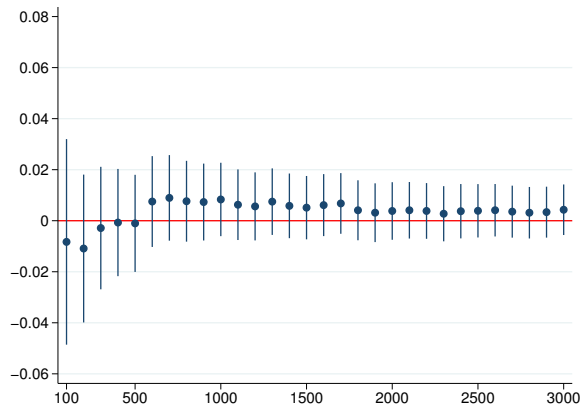
A.13 Changing the Size of the Control Group - Time Period Change - Next Month

Figure A.19. Impact of the Minimum Wage one month after readjustment - 2009



(a) Effect on Wages, Only Employed Workers

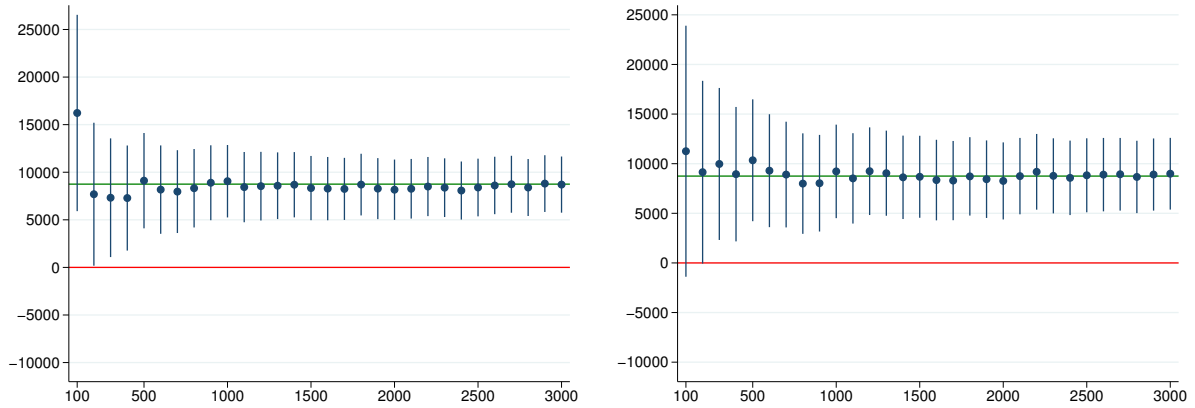
(b) Effect on Wages, All Workers



(c) Effect on Employment

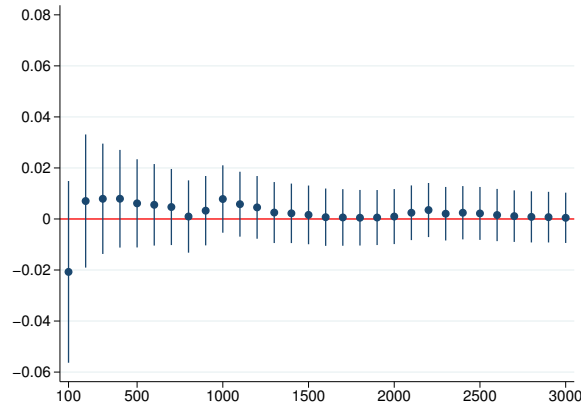
Note: Every point represents the difference-in-differences coefficient, but each estimation has a different size of the control group. The horizontal axis shows the size of the control group for each estimation, and every point represents an estimation with a control group 100 observations larger than the one to the left. The coefficients are shown with their respective 95% confidence interval. The readjustment of the minimum wage in each year is represented with a horizontal line in the wage graphs.

Figure A.20. Impact of the Minimum Wage one month after readjustment - 2010



(a) Effect on Wages, Only Employed Workers

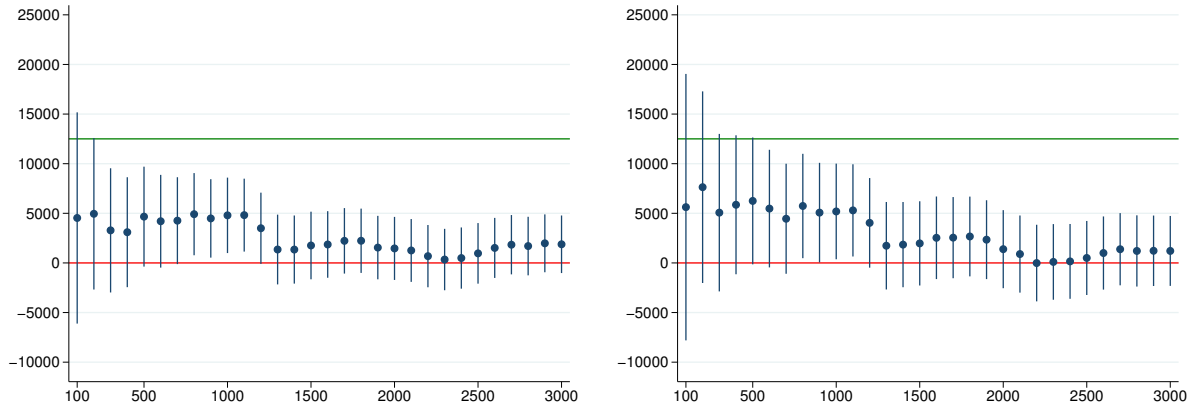
(b) Effect on Wages, All Workers



(c) Effect on Employment

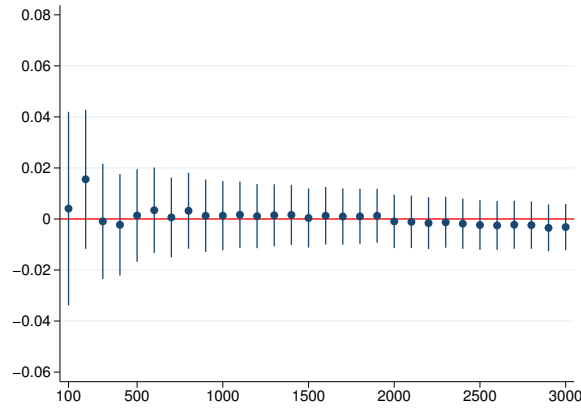
Note: Every point represents the difference-in-differences coefficient, but each estimation has a different size of the control group. The horizontal axis shows the size of the control group for each estimation, and every point represents an estimation with a control group 100 observations larger than the one to the left. The coefficients are shown with their respective 95% confidence interval. The readjustment of the minimum wage in each year is represented with a horizontal line in the wage graphs.

Figure A.21. Impact of the Minimum Wage one month after readjustment - 2011



(a) Effect on Wages, Only Employed Workers

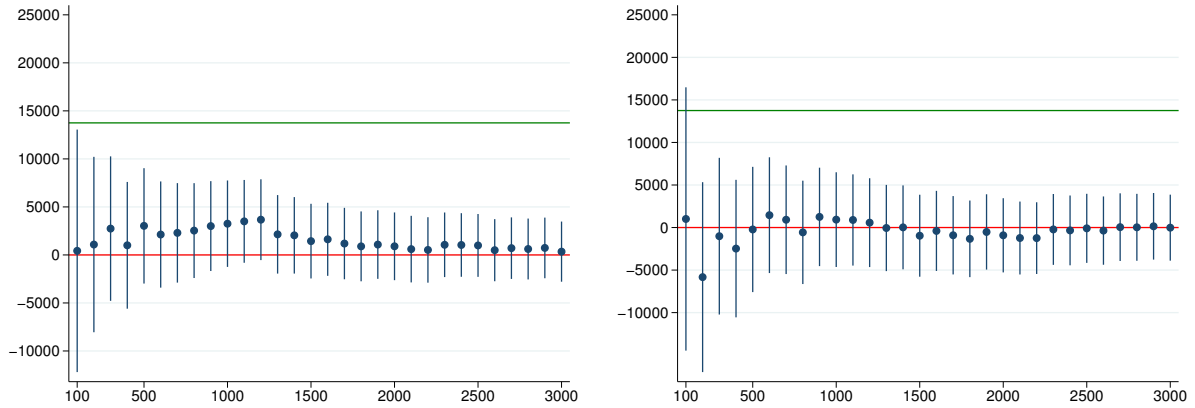
(b) Effect on Wages, All Workers



(c) Effect on Employment

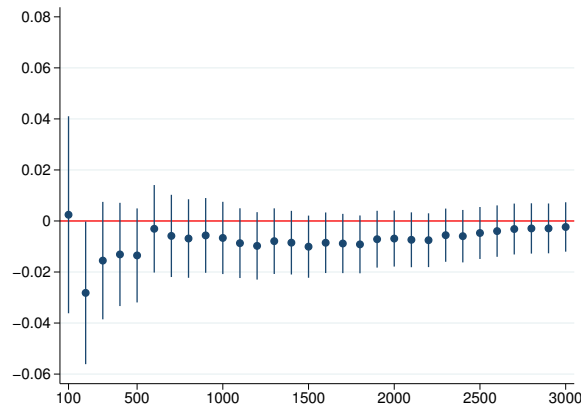
Note: Every point represents the difference-in-differences coefficient, but each estimation has a different size of the control group. The horizontal axis shows the size of the control group for each estimation, and every point represents an estimation with a control group 100 observations larger than the one to the left. The coefficients are shown with their respective 95% confidence interval. The readjustment of the minimum wage in each year is represented with a horizontal line in the wage graphs.

Figure A.22. Impact of the Minimum Wage one month after readjustment - 2012



(a) Effect on Wages, Only Employed Workers

(b) Effect on Wages, All Workers

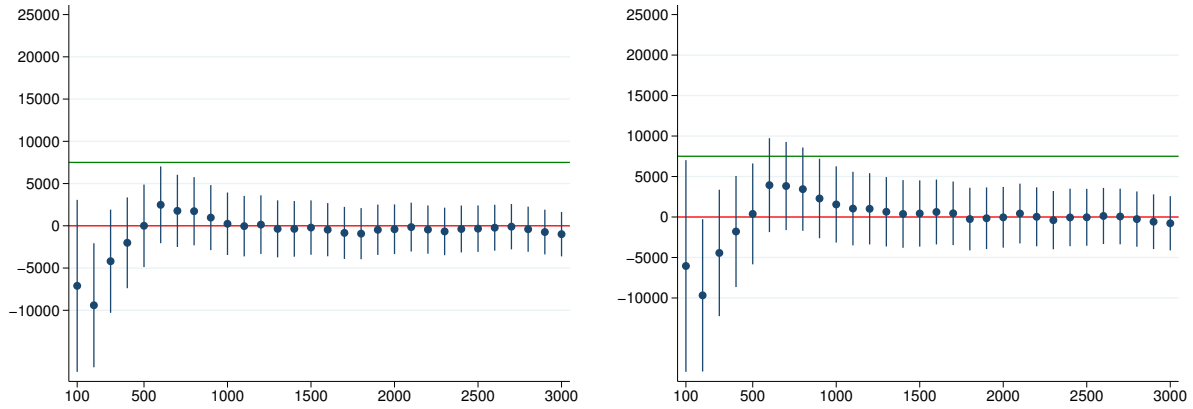


(c) Effect on Employment

Note: Every point represents the difference-in-differences coefficient, but each estimation has a different size of the control group. The horizontal axis shows the size of the control group for each estimation, and every point represents an estimation with a control group 100 observations larger than the one to the left. The coefficients are shown with their respective 95% confidence interval. The readjustment of the minimum wage in each year is represented with a horizontal line in the wage graphs.

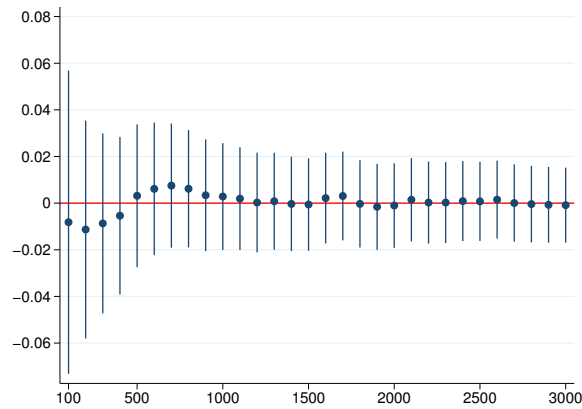
A.14 Changing the Size of the Control Group - Time Period Change - Next Two Months

Figure A.23. Impact of the Minimum Wage two months after readjustment - 2009



(a) Effect on Wages, Only Employed Workers

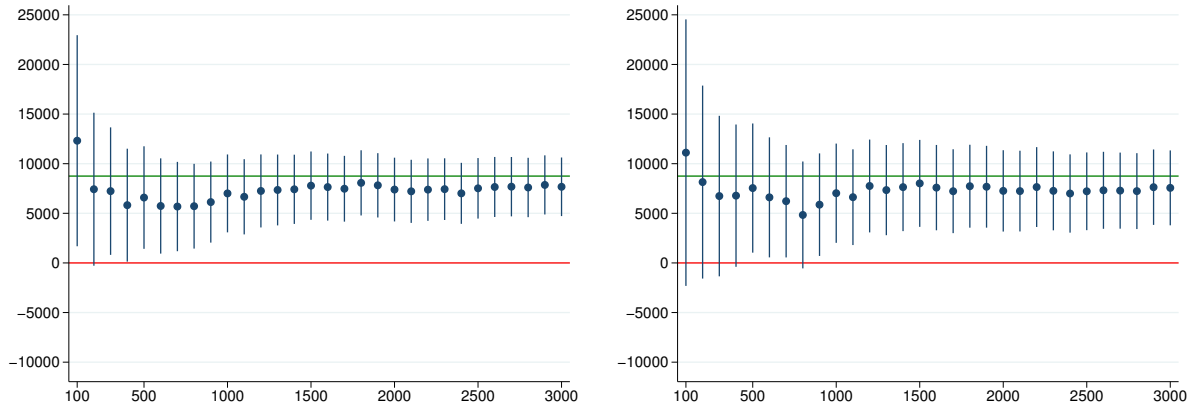
(b) Effect on Wages, All Workers



(c) Effect on Employment

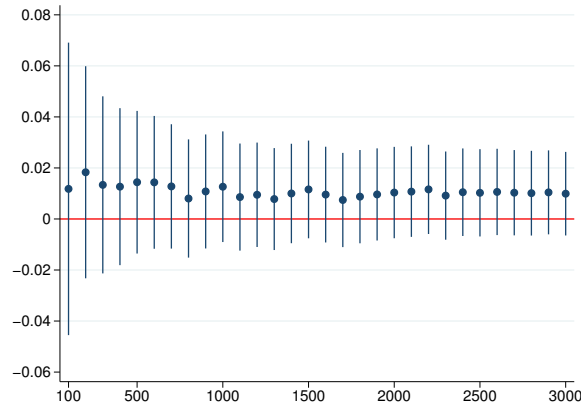
Note: Every point represents the difference-in-differences coefficient, but each estimation has a different size of the control group. The horizontal axis shows the size of the control group for each estimation, and every point represents an estimation with a control group 100 observations larger than the one to the left. The coefficients are shown with their respective 95% confidence interval. The readjustment of the minimum wage in each year is represented with a horizontal line in the wage graphs.

Figure A.24. Impact of the Minimum Wage two months after readjustment - 2010



(a) Effect on Wages, Only Employed Workers

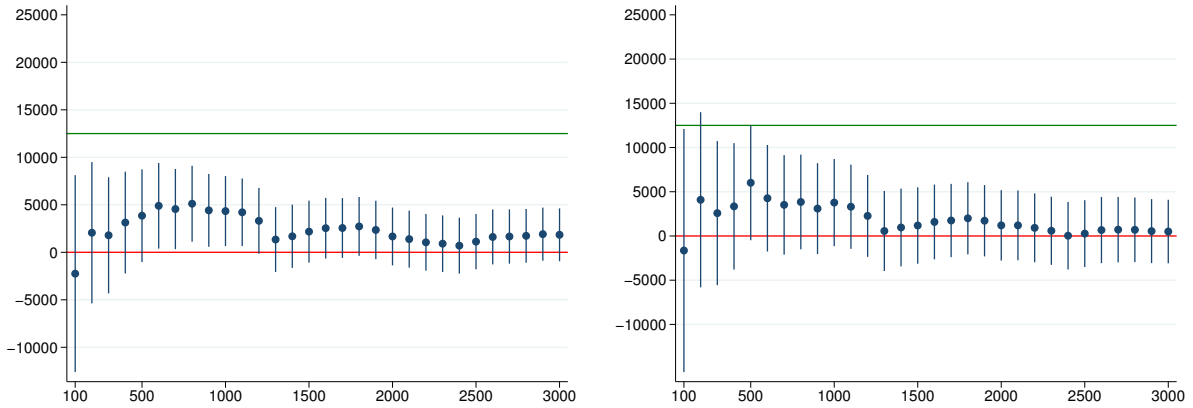
(b) Effect on Wages, All Workers



(c) Effect on Employment

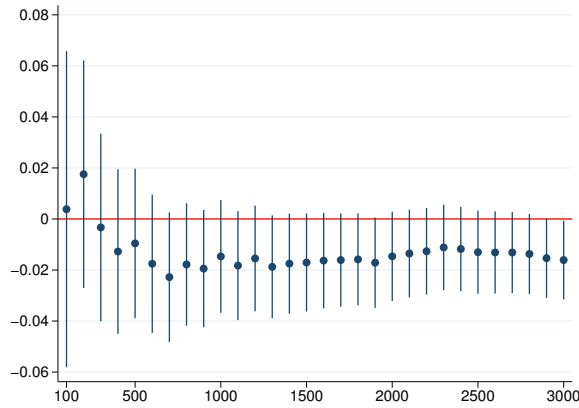
Note: Every point represents the difference-in-differences coefficient, but each estimation has a different size of the control group. The horizontal axis shows the size of the control group for each estimation, and every point represents an estimation with a control group 100 observations larger than the one to the left. The coefficients are shown with their respective 95% confidence interval. The readjustment of the minimum wage in each year is represented with a horizontal line in the wage graphs.

Figure A.25. Impact of the Minimum Wage two months after readjustment - 2011



(a) Effect on Wages, Only Employed Workers

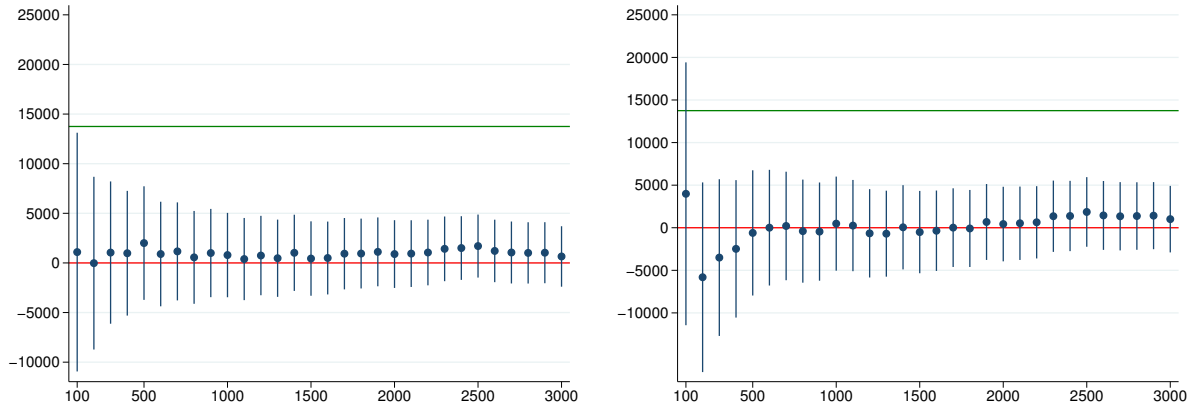
(b) Effect on Wages, All Workers



(c) Effect on Employment

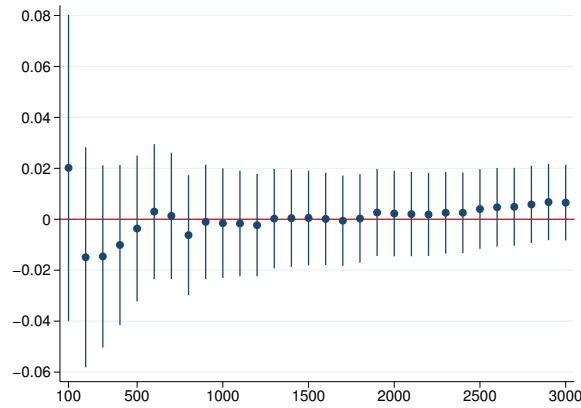
Note: Every point represents the difference-in-differences coefficient, but each estimation has a different size of the control group. The horizontal axis shows the size of the control group for each estimation, and every point represents an estimation with a control group 100 observations larger than the one to the left. The coefficients are shown with their respective 95% confidence interval. The readjustment of the minimum wage in each year is represented with a horizontal line in the wage graphs.

Figure A.26. Impact of the Minimum Wage two months after readjustment - 2012



(a) Effect on Wages, Only Employed Workers

(b) Effect on Wages, All Workers



(c) Effect on Employment

Note: Every point represents the difference-in-differences coefficient, but each estimation has a different size of the control group. The horizontal axis shows the size of the control group for each estimation, and every point represents an estimation with a control group 100 observations larger than the one to the left. The coefficients are shown with their respective 95% confidence interval. The readjustment of the minimum wage in each year is represented with a horizontal line in the wage graphs.