Evidence of the Impacts of Minimum Wage on Labor Market Outcomes: The Case of Bolivia

Abstract

Standard theory in economics suggests that high minimum wages are associated with high unemployment rates. Empirical evidence on this field is still ambiguous across countries. Our aim is to empirically assess the impact of minimum wage increases on labor market outcomes in Bolivia. Since 2006, Bolivia experienced yearly minimum wage increasing rates, ranging from 5% to 22% per year. We exploit the difference in exposure to minimum wage for subsets of population and use a difference in differences approach to estimate the impact of minimum wage on wages and unemployment. However, we also consider other relevant labor market outcomes for a developing country such as formality and self-employed work. We find the same effects for men and women, positive and significant effects on wages, negative effects on employment and some evidence of adjustment mechanisms through other labor market outcomes.

JEL codes: J3, J4
Keywords:

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Acknowledgements

We thank Jorge Dávalos for helpful comments and excellent advice.
This work was carried out with financial and scientific support from the Partnership for Economic Policy (PEP), with funding from the Department for International Development (DFID) of the United Kingdom (or UK Aid), and the Government of Canada through the International Development Research Center (IDRC).
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1 Introduction

The minimum wage (MW) remains one of the most controversial issues in labor economics, economic policy, and politics. On the one hand, a minimum wage could be justified because it provides a basic guarantee for a sufficient income for full-time workers to acquire essential goods and services; with evidence showing that increases in legal minimum wage will also increase the probability that a poor worker's family will move out of poverty (Alaniz et al. 2011). Furthermore, it prevents employers with dominant market positions to take advantage of certain types of employees like women, low-qualified workers, long-term unemployed and individuals with little or no working experience. On the other hand, the existence of a minimum wage could discourage employers from hiring persons covered by the current legislation and, therefore, it would negatively affect the employment rate of certain collectives, possibly women and young people (Lee and Saez 2008).

Bolivia is a country with a large informal labor market. The economic and political contexts of the last 10 years have been a justification for the implementation of economic policies aiming to improve the population's welfare. Among these policies there have been steep raises of the national government-legislated minimum wage. In this context, the paper's objective is to evaluate the impact of steep raises in minimum wage on labor market outcomes, such as overall employment, wages and social security for Bolivian workers.

In order to achieve this objective we use data from the National Household Survey (2005-2013) which has information at the individual level such as employment and wages, and their household characteristics to quantify the effect of minimum wage on wages, hours of work, employment, the probability of having contributions to social security (our definition of formal sector employment) and the probability of being self-employed. Even when some of these issues have been addressed before in the literature for other countries [Maloney and Nuñez (2003) for Latin American countries, Lemos (2004) for Brazil, Dinkelman and Ranchhod (2012) for South Africa, Canelas (2014) for Ecuador, etc.] there is not a broad consensus on the effects of such policy and there is a need to develop scientific evidence that could enlighten the formulation of future policies to improve the conditions of Bolivia's labor markets.

We use a difference in difference approach to estimate the causal effects of minimum wage over labor market outcomes: wage, probability of unemployment, hours of work, the probability of being a formal worker and the probability of switching from salaried to self-employed. We exploit the variability across subsets of population in order to define the exposure to the treatment, which is the minimum wage changes. Our findings show that in 2006, when the first important policy shift occurred with an increase in the nominal minimum wage of 15%, there were heterogeneous impacts on women and men. For women, with the exception of the probability of being self-employed, we find no effect of the policy in any variable, while for men we find positive effects on wages and negative effects on employment as the standard economic theory suggests.

The paper is organized as follows: section 2 describes the literature review; section 3 is the background description of minimum wages in Bolivia; section 4 presents the data and descriptive statistics; section 5 presents the identification strategy and results; and section 6 concludes.

2 Literature Review

Identifying the impact of minimum wage on labor market outcomes has been a topic of interest in applied economics for several years. The existing literature varies on its findings of the impact of minimum wage over employment. Neumark and Wascher (2006) provide a review of the findings in minimum wage literature for the United States and other countries and they point out that most of the studies find negative but not always statistically significant effects of minimum wage over employment. On the other hand, Card and Krueger (1994) find no evidence of a reduction of employment in New Jersey fast-food restaurants; in the same line Card (1992) finds no evidence of a reduction of teenagers' employment due to an increase in federal minimum wage either.

This lack of consensus on the impact of the minimum wage has not only promoted a continuous interest in this field but has also incentive to consider alternative mechanisms through which the minimum wage could affect the labor market. For instance, Zavodny (2000) suggests that in the context of a mandatory minimum wage increase, employers could adjust hours rather than employment levels. However, she does not find conclusive evidence of their hypothesis on teen employment in the US.

The empirical approaches of this literature mostly consisted in exploiting natural experiments to identify the causal effect of minimum wage over labor market outcomes. Card (1992) measures the exposition to the federal minimum wage using the fraction of individuals affected by the 1990 federal minimum wage increase. More recently, Clemens and Whitaker (2014) took advantage of changes in the United States' federal minimum wage between 2007 and 2009 to create two groups of states (bounded and unbounded states by the federal minimum wage) in order to assess its effect on employment during the crisis; and found that minimum wage had negative impacts on employment.[1]

Most of the studies were made in an environment where compliance with the law is not problematic. But, what happens in a scenario where there is little law enforcement and an important informal labor market? In Latin America labor markets are characterized by the presence of two sectors: a covered formal sector entitled to social benefits and an uncovered informal sector which is not. Informality in developing countries has been characterized as large and fragmented, with a vast array of people and economic activities, including home-based work, street vendors, entrepreneurs who employ other workers and self-employed persons.

In this Latin-American context the standard two sector labor market model (Harris and Todaro (1970), Mincer (1976)) predicts that an increase in minimum wage will increase salaries and decrease employment in the formal sector. Some of the workers who lost their job will wait to find another job in the formal sector while others will switch to the informal sector (where according to the model, wages are supposed to be in a competitive equilibrium). This flow of workers across sectors will cause a decrease in salaries and an increase in employment in the informal sector. Even though, evidence for Latin America [Maloney and Nuñez (2003), Lemos (2004) and Khamis (2008)] show that this is not the case and that minimum wage can increase salaries in the informal sector as well, a phenomenon known as the *lighthouse effect*[2].

[1] This identification strategies based on exposition to treatment has not only been used in this literature but also in literature related to other fields such as trade (Autor, Dorn and Hanson, 2014).

[2] The minimum wage set in the formal sector could be sort of reference price, a signal for bargaining, throughout the economy at large.

In this scenario of low law enforcement, Canelas (2014) also took advantage of the variability in states' exposure using the fraction affected measure and found no effects of minimum wage on employment and wages in Ecuador. However, she attributes this lack of impact to the large non-compliance of minimum wage.

Dinkelman and Ranchhod (2012) took advantage of a new wage legislation directed to domestic workers in South Africa, a country where informal employment exists either in the form of non-signed contracts or as lack of social benefits. Since the new legislation defined the same wage floor for all the country at the same time, they used an aggregate variable denominated *wage gap* to capture the effects of the law. The wage gap is defined as the difference between the new minimum wage and the median wage in each region. With this bite variable they used a difference in differences approach to obtain the impact of minimum wage on wages, worked hours and employment status. Their findings suggest that the introduction of the law in this informal sector created incentives to start the formalization of this group; moreover, they found positive effects on salaries and no employment effects.

Our contribution is closely related to this literature. Our aim is to identify the potential effects of minimum wage increases not only on employment but also on other potential mechanisms, such as formality, employment conditions and worked hours. In order to overcome a set of difficulties in the identification of the minimum wage effect, we provide a similar empirical approach to Card (1992), Dinkelman and Ranchhod (2012) and Canelas (2014), and take advantage of the variability in states' exposure. Instead of limiting to the replication of this approach, our study expands on the existing evidence by building cells based on states' and different demographic characteristics to increase variability of the exposure. Moreover, as far as we know, there is no evidence of the effects of Bolivia's yearly minimum wage increases over labor market outcomes; being this document the first attempt to analyze and measure these effect on the country.

3 Minimum Wages in Bolivia

As most of the countries in the region, in the last decade Bolivia has experienced an important economic growth, which constituted a justification to increase the national minimum wage. In Bolivia, the minimum wage is legislated[3] by the central government and its application is flat across all departments, economic sectors and occupations. An important policy shift occurred in May first (national labor day) 2006, when the government set an increase in the nominal minimum wage of 15%[4]; since then, minimum wage started increasing every May first at different rates, ranging from 5% to more than 20% in a year. By 2011 and 2012 the growth of minimum wage reached 20% and 22.6% respectively (Figure 1). There are two important characteristics of these increases: 1) the increase rate is unknown until the day of the announcement, which is contrary to what happens in developed countries where the legislation announces the increase rate over several years; 2) the increase announced in May first is mandatory since January of the same year, in other words, the law requires retroactive payments.

[3] The central government changes the minimum wage by a Decree, so even though we refer to the law, there is no law debate in the parliament.
[4] In January 2006, a new government took office and it is in place since then.

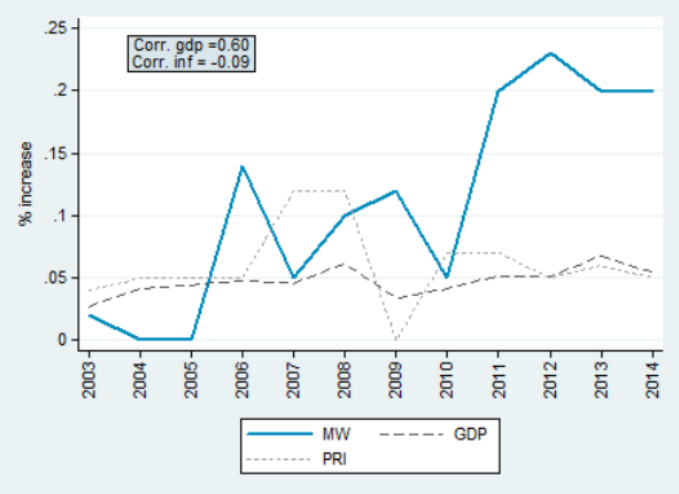


Figure 1: Yearly percentage increase in GDP, prices and minimum wage.

Along with the redistributive income policy, an increase in prices over the last years has been a governmental justification for the magnitude of the changes in minimum wage. During the last four years the percentage increase in minimum wage was significantly over the increase in prices and over the GDP growth (Figure 1), suggesting that minimum wage fixation was not related to the purchasing power or to an increase in productivity, but to other causes such as a favorable external environment and political reasons. Furthermore, even if changes on the national minimum wage responded to an overall economic growth in Bolivia, this growth was determined by favorable prices of minerals and hydrocarbons that specific autonomous departments in Bolivia produce; therefore this economic growth has not been equal across departments. In this context an increase in the national minimum wage is less severe in a department where salaries were higher prior to the passage of the law such as La Paz, while it could have higher impacts in departments with lower salaries such as Oruro. Because these minimum wage increases were not directly related to economic conditions of each department, we consider this policy as an unexpected shock to the labor market that can help us identify the impact since that policy was not discussed with the stakeholders and came as a surprise.

Consistent with the increases in the national minimum wage, since 2006 the government had also increased the general level of wages at a different rate than the minimum wage. These yearly increases of the country's generalized wages ranged among 5% (2010), 10% (2011, 2014) to 12% (2009). Further in the document we discuss how this feature might affect our identification strategy.

Finally, it is also important to mention that labor informality remained a pervasive characteristic of the country, a feature that can affect the mechanisms by which minimum wage impacts labor market outcomes. Between 2005 and 2012 the average proportion of informal employment was 67%. Furthermore, Landa (2008) found that between 1995 and 2005 the percentage of people in Bolivia who transitioned from the formal to the informal sector doubled those who transitioned in the other sense. This same study also showed that female, indigenous and low educated people have higher probabilities of being in the Bolivian informal sector.

4 Data and descriptive statistics

We use Bolivian Household Surveys data, which is the most reliable micro data available in Bolivia. These set of surveys have information on employment, occupation, wages, worked hours, and household and individual characteristics among others.

We define the Working Age Population (WAP) as all the population between 15 and 65 years old inclusive, accordingly to standard definitions. In 2005, WAP represented 57.7% and in 2012, 61.4% of the entire population.

Economically Active Population (EAP) was 74.2% and 72.7% in 2005 and 2012 respectively. Although WAP was balanced among men and women, EAP expose some disparities. 84% of men are in the EAP while only 67% of women are in the EAP. Average unemployment rate for men is 5% and for women 7.4%. Women have less participation in labor market and they also seem to have fewer opportunities when trying to get a job.

As mentioned above, Latin American countries have been characterized for having a significant proportion of informal employment. We consider an individual based informality definition. Under this approach formality could be defined by several measurement criteria based on job characteristics, such as having a signed contract, belonging to a union, being entitled to benefits (e.g. health insurance or pension), working at the public sector, or paying taxes (Elif Öznur and Tansel 2014). This has been known as the legalistic, contract-based or social protection definition of informality and is the definition that will be used throughout this paper. For the purpose of this paper we define informal workers as those who do not have social benefits, that is, all salaried workers that do not contribute to pension funds.

There is a large self-employed group of workers, which is at least as large as the group of salaried workers; we will treat self-employed as an independent category throughout the analysis. Unpaid workers and family workers are also considered independently. They are not salaried workers and therefore we assume they are not affected by the minimum wage because their earnings are related more with its specific economic activity and its performance than with the general wages level. Similar assumptions have been taken previously in the literature such in Lemos (2009).

Since increases in minimum wage would affect directly to those earning the current minimum wage or in a close range, and given data availability, we describe the socio-demographic characteristics of this group by comparing them to other salaried workers. These comparisons will allow us to characterize the direct beneficiary group of the increases in minimum wage. In order to do this, we define a MW Interval (MW Interv) variable to define this direct beneficiary group. This interval is the distance between the MW of the year +/- 0.05 standard deviations from a standardized variable, centered in the MW, instead of the mean[5]. Figure 1 presents variable evolution of the MW interval and rest of salaried workers along the years.

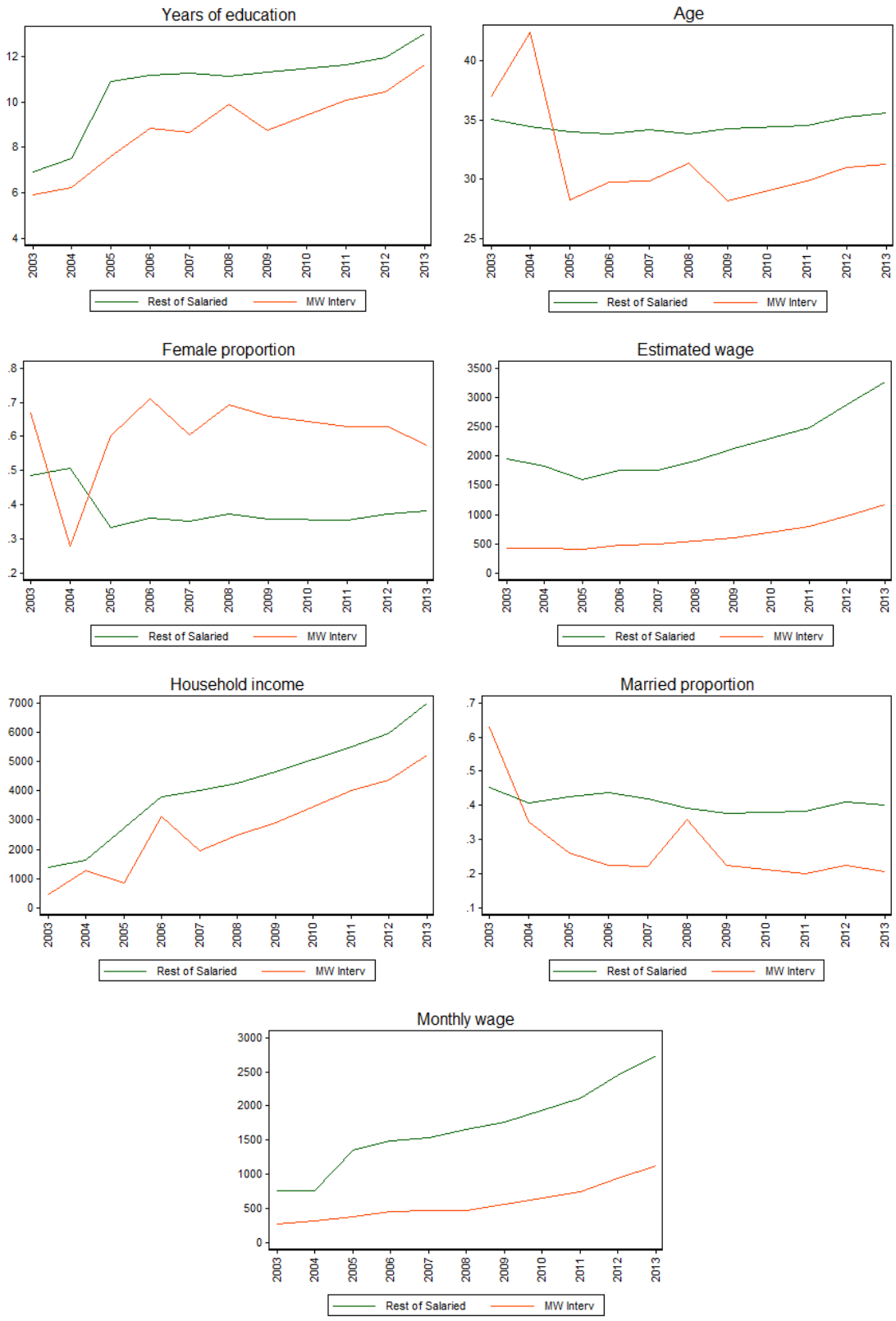


Figure 2. Variables evolution

Note that MW Interval workers seem to be younger, single, less skilled and mostly female compared to the rest of salaried workers. Years of education and household income of both groups increased along the years similarly. Wages also increase for both groups; however the percentage increased seems to be higher for MW interval earners.

5 Identification Strategy and Results

As argued earlier, minimum wage in Bolivia is set at the national level. This setting implies that even when all individuals are exposed to treatment, exposure might be heterogeneous across subsets of the observed population. This was previously suggested by Card (1992) and Dinkelman and Ranchhod (2012). In both papers, authors take advantage of geographical variation in the exposure to treatment and define a "regional bite. This regional bite can be seen as a "natural experiment in which the treatment effect varies across states depending on the fraction of affected workers…" (Card, 1992). ". Likewise Lemos (2009) defines artificial subsets of the population -denoted as cells from now onwards-, from regional and time variation. This paper extends such approach by defining the treatment as a bite at the cell level. Cell's definition is not conditioned on a single (regional/geographical) characteristic but depends on multiple demographics which allow the construction of bites for a larger number of groups/cells. This cells are constructed according to the following criteria:

1. A large number of cells improves identification but may entail small samples within each cell. This implies a tradeoff between number of cells and bite's accurate estimation within each cell. Our aim is to get a large number of cells (e.g. larger than the number of regions) and to have enough observations within each cell.
2. To avoid endogeneity regarding variables selection in cell construction we construct cells based on demographic characteristics (e.g. gender, age, region, etc.) for each year of the data.
3. We consider variables providing statistically significant variability regarding the outcome of interest. Means of treatment exposure are different across groups.

We use the following variables: region, gender, age (dummy for less than 30 years old) and skill level (elementary school, high school and higher education groups) to construct different number of cells. Using all the variables mentioned above we obtain 108 cells for each year. The average number of observations inside each cell is 104 with a standard deviation of 63, thereby ensures a sufficient number of observations within each cell.

We construct three different bites to capture the intensity of minimum wage increases in every cell and to test if the results are robust to different bite specification. The first bite is the *fraction affected,* as in Card (1992) this variable is defined in equation (1) as the proportion of people in year t with earnings between current and next year's minimum wage. We use a second *fraction affected* definition presented in equation (2), which is the proportion of employed people with earnings below next year's minimum wage. We believe the second definition gathers more information considering Bolivia's labor market with imperfect compliance of minimum wage legislation and the possibility of having affected individuals with earnings below previous minimum wage.

$$FAF_{ct} = \frac{\sum_i^{n_c} \mathbf{1}[MW_t < w_{ict} < MW_{t+1}]}{n_c} \quad (1)$$

$$FA_{ct} = \frac{\sum_i^{n_c} \mathbf{1}[w_{ict} < MW_{t+1}]}{n_c} \quad (2)$$

The third bite is the *wage gap* based on Dinkelman and Ranchhod (2012). This bite is the difference between the logarithm of the minimum wage in year t and the logarithm of the median wage for the constructed cell in year *t-1*. This is a measure of the minimum wage intensity.

$$WG_{ct} = \log(MW_t) - \log(median(w_{c,t-1})) \quad (3)$$

We ordered and rank out treatment exposure measures (bites) into percentiles. Table 1 shows descriptive statistics by year. Panel A presents treatment exposure of the wage gap, and panels B and C present exposure to treatment for both of our fraction affected measures. We can observe that the three measures have variability among percentiles; however there are some empty cells in the fraction affected measures. Treatment exposure is increasing along the years; there is an increasing pattern in the median observation, and notoriously increasing for the three measures since 2011. In previous years variability is not that clear which could be related to smaller minimum wage increases.

Year	10th percentile	25th percentile	50th percentile	75th percentile	90th percentile
Panel A. Wage Gap					
2005	-1417.20	-617.20	-417.20	-73.45	-17.20
2006	-1945.00	-765.00	-465.00	-85.00	-15.00
2007	-1709.92	-843.25	-404.25	-123.25	6.75
2008	-1897.58	-1018.41	-497.58	-215.58	2.42
2009	-1566.28	-937.11	-637.11	-237.11	-37.11
2011	-1790.60	-1090.60	-590.60	-190.60	-90.60
2012	-1830.00	-1204.00	-650.83	-180.00	-30.00
2013	-1756.00	-1156.00	-756.00	-121.00	44.00
Panel B. Fraction affected (FAF)					
2005	0.00	0.00	0.00	0.05	0.12
2006	0.00	0.00	0.00	0.03	0.05
2007	0.00	0.00	0.00	0.04	0.11
2008	0.00	0.00	0.00	0.00	0.02
2009	0.00	0.00	0.00	0.00	0.00
2011	0.00	0.02	0.05	0.09	0.17
2012	0.00	0.02	0.06	0.13	0.21
2013	0.00	0.02	0.06	0.14	0.19
Panel C. Fraction affected (FA)					
2005	0.00	0.00	0.06	0.18	0.28
2006	0.00	0.00	0.06	0.23	0.38
2007	0.00	0.01	0.07	0.18	0.42
2008	0.00	0.00	0.02	0.12	0.25
2009	0.00	0.00	0.03	0.08	0.21
2011	0.01	0.03	0.10	0.23	0.37
2012	0.02	0.05	0.13	0.33	0.51
2013	0.03	0.07	0.14	0.34	0.44

Table 1. Treatment exposure for constructed cells

A non-trivial difficulty is to cope with the generalized yearly wage increase set by law. This general wage increase could be considered as a confounder. Therefore, we could be identifying the effect of the generalized wage increase instead of the minimum wage effect. Since this generalized wage increase is aimed to people who earn more than the prevailing minimum wage and that law enforcement is problematic, we construct a variable that captures the proportion of salaried workers who earn more than the minimum wage and who have contributions to social security (a measurement of formality) within each cell.[6]

$$WINC_{ct} = \frac{\sum_i^{n_c} \mathbf{1}[salaried\ worker\ \&\ contributes\ to\ social\ security\ \&\ wage_t > MW_t]}{n_c} \quad (4)$$

The regressions will include one of the three bites (FA_{ct}; FAF_{ct} or WG_{ct}) to identify the minimum wage effect and, the wage increase ($WINC_{ct}$) variable to identify the generalized increase of wages.

We use a difference in differences approach forming year pairs in order to capture the different minimum wage increases (e.g. pair 1 are years 2005-2006, pair 2 are years 2006-2007 and so on). This approach has two variations regarding a standard dif-in-dif model: 1) we have a continuous instead of dichotomous treatment and, 2) there are two interaction terms instead of one. These variations are not an issue for the estimation. We estimate the following equations for every ordered pair of years in our dataset obtaining different parameters for men and women:

$$y_{ict}{}^{\varphi} = \beta_0 + \beta_1 post_t + \beta_2 \varphi_{ct} + \beta_3 post_t * \varphi_{ct} + \beta_4 female + \beta_5 female * post_t + \beta_6 female * \varphi_{ct} + \beta_7 female * \varphi_{ct} * post_t + \beta_8 WINC_{ct} + \beta_9 post * WINC_{ct} + \varepsilon_{ict} \quad (5)$$

$$\varphi = \begin{cases} FAF \\ FA \\ WG \end{cases} \quad (6)$$

Where y_{ict} is a dependent variable, *post* is a dummy variable for year t, WG, FA, FAF and $WINC$ were defined previously. The parameters of interest are β_3 and β_7 that capture the causal effect of the minimum wage increase over the outcome used as dependent variable on men and women. Since we created cells we use clustered errors at the cell level. Recognizing the clustering of individual observations within cells, we control for the presence of an unobserved, cell-level effect in the error term by estimating clustered standard errors at the cell level. Since we have 108 cells, more than 42 which is the rule of thumb following Angrist (2008), this approach will give us robust standard errors.

Our aim is to identify how the minimum wage increase affected wages, employment status, hours worked, and employment sector of individuals. We have two potential sources of bias: Unobserved characteristics specific to each cell can be correlated to the treatment (e.g. young women with primary education are in a cell that has a big bite while highly educated men are in a cell with a low intensity of treatment. This situation can lead to a downward bias in the estimation of salaries since the former group is expected to have a lower wage than the latter group. On the other hand this same endogeneity problem will give us an upward bias for the estimation of the effects on unemployment); and, a selection problem in the estimation of wages. Since we only observe wages for people whose wage is at least as high as their reservation wage.

The endogeneity concern is formally represented by the error components structure presented in equation (7). Our procedure estimation implements the least square dummy variables

[6] Salaried workers are expected to be affected by the general wage increase.

estimator to get rid of u_c.[7] This implies introducing cell specific dummy regressors among explanatory variables.

$$\varepsilon_{ict} = u_c + u_t + u_{ict} \qquad (7)$$

To address the selection problem we re-estimate the results for wages using the Heckman selection model.

$$y_{ict} = \begin{cases} y_{it} \; if \; y_{it} > \bar{y}_{it} \\ 0 \; otherwise \end{cases} \qquad (8)$$

The term $\bar{y}_{it}$ in equation (9) is the unobserved individual reservation wage. We only observe wages and working hours for individuals above the threshold; this situation is a source of potential bias. Heckman's (1979) "selection correction" method has being used to correct this bias.

We consider the pair of years 2005-2006 as a natural experiment, since the first important shift in policy took place in 2006. We find that minimum wage had a positive and significant effect on wages and that the results are robust to different specifications. We find same significant effects for men and women's wages. It is worth noting that the coefficients are almost zero when we use the wage gap bite and that we find no effects on wages.

In the Heckman selection model, we used the number of people forming home as the exclusion restriction, since it is expected that the number of people at home is related to the need of working of an individual, but not with his salary. We found negative and significant rhos, suggesting downward biased parameters due to the people who choose not to work at the actual offered wages. After this correction for selection bias it was possible to identify the parameter increase, but the results are the same.

Dependent Variable	log(wages) (2005-2006)								
	FAF			FA			WG		
	(1)	(2)	Heckman	(3)	(4)	Heckman	(5)	(6)	Heckman
post*bite	1.2771**	1.3407***	1.3980***	1.1838***	1.1703***	1.2497***	0.0000	0.0001	0.0001
	(0.5215)	(0.4519)	(0.4603)	(0.2553)	(0.2238)	(0.2305)	(0.0001)	(0.0001)	(0.0001)
post*bite*female	-0.6648	-0.8372	-0.6160	-0.4608	-0.5599	-0.5270	0.0001	0.0001	0.0001
	(0.7890)	(0.6886)	-0,7605	(0.4589)	(0.4083)	(0.4638)	(0.0001)	(0.0001)	(0.0001)
controls	NO	YES	YES	NO	YES	YES	NO	YES	YES
Obs.	3,084	3,084	5,110	3,084	3,084	5,110	3,073	3,073	5,092
Cells	108	108	108	108	108	108	108	108	108
Rho			-0.396			-0.392			-0.415
lambda			-0.239			-0.235			-0.247
sd_lambda			0.0421			0.0411			0.0437

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 2 Effects on nominal wages (2005 - 2006)

The effects showed above are for the logarithm of nominal wages and a source of concern is that the parameter of interest is capturing the effects of inflation. As a robustness check we run the same model using the logarithm of real wages. To obtain real wages we deflate the nominal wage by the national Price Consumer Index (PCI). We use the national index because in Bolivia until 2008 there was not a PCI at the regional level. The results using this variable confirm our previous remarks.

[7] By the FWL theorem, the Least Square Dummy Variable estimator is equivalent to the within estimator.

Dependent Variable	log(real_wages) (2005-2006)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	1.2771**	1.3407***	1.1838***	1.1703***	0.0000	0.0001
	(0.5215)	(0.4519)	(0.2553)	(0.2238)	(0.0001)	(0.0001)
post*bite*female	-0.6648	-0.8372	-0.4608	-0.5599	0.0001	0.0001
	(0.7890)	(0.6886)	(0.4589)	(0.4083)	(0.0001)	(0.0001)
controls	NO	YES	NO	YES	NO	YES
Obs.	3,084	3,084	3,084	3,084	3,073	3,073
Cells	108	108	108	108	108	108

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3 Effects on real wages (2005 - 2006)

When we estimate using unemployment as the outcome, we find that an increase in minimum wage is associated with a higher probability of being unemployed for both men and women. Consistent with the previous result, we find no evidence of different effects on women. This was expected since there is an increase in the general wages level. The results are in line with what the standard economic theory predicts; moreover if the two sector model applies, this result could be biased toward zero (making this result a lower bound) because some people who lose their formal job could migrate to the informal job market. However, as evidence from Latin American countries suggest an increase in the minimum wage affects formal and informal sectors, if this is the case, minimum wage policy could be generating unemployment in both sectors.

Dependent Variable	Unemployment (2005-2006)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	0.3791*	0.3235**	0.1827	0.1339	0.0001***	0.0000
	(0.2030)	(0.1436)	(0.1580)	(0.1232)	(0.0000)	(0.0000)
post*bite*female	0.2002	0.4204	-0.2101	-0.0814	-0.0000	-0.0000
	(0.3326)	(0.3037)	(0.2021)	(0.1844)	(0.0000)	(0.0000)
controls	NO	YES	NO	YES	NO	YES
Obs.	5,172	5,172	5,172	5,172	5,153	5,153
Cells	108	108	108	108	108	108

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4 Effects on unemployment (2005 - 2006)

As we noted before, the effects of minimum wage increases could also be on the intensity of employment (hours worked); although, we find no evidence of a reduction in the number of hours worked by men or women. This result can be explained because in Bolivia salaries are not fixed by hours worked and people in general cannot decide how many hours they will allocate to work. Another possible explanation is that the income and substitution effects of a greater salary cancel out each other.

Dependent Variable	Hours (2005-2006)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	13.9800	12.3238	5.4394	2.8581	0.0011	0.0011
	(16.9031)	(15.1603)	(9.5363)	(8.2281)	(0.0020)	(0.0017)
post*bite*female	-26.6757	-31.0295	-10.7669	-9.3078	0.0006	0.0006
	(25.1206)	(23.4955)	(12.9414)	(11.8447)	(0.0019)	(0.0018)
controls	NO	YES	NO	YES	NO	YES
Obs.	4,168	4,168	4,168	4,168	4,154	4,154
Cells	108	108	108	108	108	108

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5 Effects on worked hours (2005 - 2006)

As expected, we find a negative coefficient for the probability of having contributions to social security (our definition of formality) for men, but the results are significant at the 10% level for the FA bite. This could be an indication that the standard two sector model applies, this means that increases in minimum wage would be incentivizing employers in the formal sector to fire employees or keeping them but taking away their benefits. This result indicates that the estimation for unemployment is a lower bound. In the case of women, we find no evidence of a significant effect on the probability of having contributions to social security but we find an unexpected coefficient sign.

Dependent Variable	Formal (2005-2006)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	-0.2827	-0.3389	-0.2546*	-0.2432*	-0.0001***	-0.0001***
	(0.2205)	(0.2298)	(0.1343)	(0.1331)	(0.0000)	(0.0000)
post*bite*female	0.2593	0.3261	0.2003	0.2065	0.0000	0.0000*
	(0.2392)	(0.2422)	(0.1498)	(0.1440)	(0.0000)	(0.0000)
controls	NO	YES	NO	YES	NO	YES
Obs.	11,711	11,711	11,711	11,711	11,656	11,656
Cells	108	108	108	108	108	108

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 6 Effects on informality (2005 - 2006)

Our last variable of interest is the effect of minimum wage on the probability of being self-employed. We find a significant and negative effect for men and a significant and positive differential effect for women. Because of the increase in the formal minimum wage, men have the incentive to obtain a salaried job. On the other hand, female remain with the same odds of becoming self-employed, since its parameter in virtually zero. This result could be supported by the hypothesis that women with household responsibilities may select a flexible employment state that is compatible with other activities rather than more rigid formal work arrangements disregarding of the current level of the minimum wage in formal arrangements.

Dependent Variable	Self (2005-2006)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	-0.7948**	-0.9541***	-0.3291	-0.4761**	-0.0000	-0.0000*
	(0.3541)	(0.3010)	(0.2057)	(0.1839)	(0.0000)	(0.0000)
post*bite*female	0.7698**	0.9080***	0.3047	0.4432**	0.0000	0.0000
	(0.3792)	(0.3124)	(0.2128)	(0.1881)	(0.0000)	(0.0000)
controls	NO	YES	NO	YES	NO	YES
Obs.	11,711	11,711	11,711	11,711	11,656	11,656
Cells	108	108	108	108	108	108

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 7 Effects on sector (2005 - 2006)

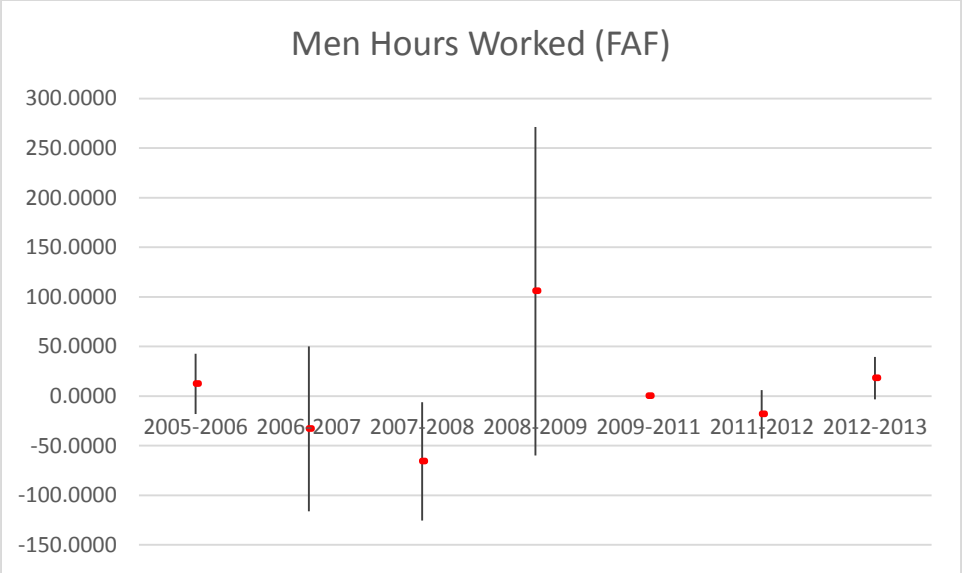
Something that it is important to note is that for almost all the estimations for the different bites, the parameters have the same sign, giving us confidence that our bites are capturing almost the same effect.

Perhaps, the most noteworthy result is that men in the self-employed sector could be using minimum wage as a reference for their earnings margin or are benefited by the minimum wage increase indirectly. We can't be conclusive on this lighthouse effect, since we could be having partial compliance to minimum wage, mainly for informal workers. The two sector model could apply for women. This would explain –with the exception of self-employment- why there are no significant effects on the variables of interest for this latter group.

Since minimum wage in Bolivia changes every year we tried to identify the effects of these changes using the same identification strategy for other pairs of years. These results are not as clean as our preferred estimation, because an increase in minimum wage was expected by agents after 2006. So the effects on the variables of interest are from the unexpected percentage change instead of a clean policy, and expectations across years are hard to estimate. In order to make coefficient comparison across years easy, we plotted the parameter of interest and its confidence intervals to show the effect changes in response to different minimum wage increases. The point is the parameter estimated and the lines represent a 95% confidence interval. In the appendix we show the tables with these results.

As can be seen in the figures below, we find almost no evidence of further effects on the variables of interest across the different pairs of years. From 2006 onwards people will form expectations about the changes in minimum wages and will act accordingly, so exogenous effects are not clear.


Men Unemploymet (FAF)
3.0000
2.0000
1.0000
0.0000
-1.0000
-2.0000
-3.0000
-4.0000
2005-2006
2006-2007
2007-2008
2008-2009
2009-2011
2011-2012
2012-2013


Men Hours Worked (FAF)
300.0000
250.0000
200.0000
150.0000
100.0000
50.0000
0.0000
-50.0000
-100.0000
-150.0000
2005-2006
2006-2007
2007-2008
2008-2009
2009-2011
2011-2012
2012-2013


Men log(wages) (FAF)
8.0000
6.0000
4.0000
2.0000
0.0000
-2.0000
-4.0000
-6.0000
-8.0000
-10.0000
2005-2006
2006-2007
2007-2008
2008-2009
2009-2011
2011-2012
2012-2013

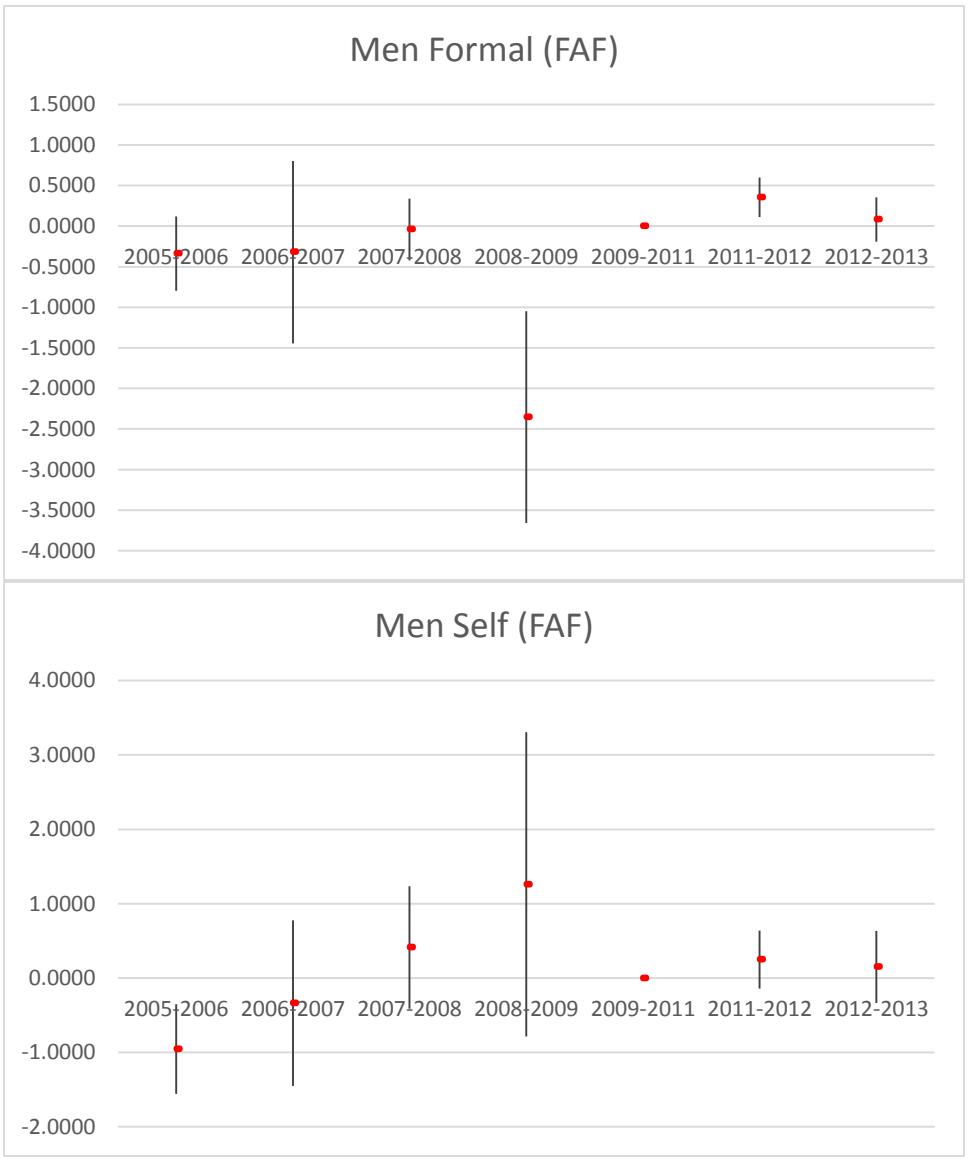


Figure 3. Results for other years.

In order to address concerns regarding cell construction, and to give robustness to our findings, we estimate the effects on the same variables using a more natural bite at the department level. Bolivia has only nine departments so this estimation creates a problem with the standard errors but the parameters of the estimation should not be affected.

Dependent Variable	log(wages) (2005-2006)								
	FAF			FA			WG		
	(1)	(2)	Heckman	(3)	(4)	Heckman	(5)	(6)	Heckman
post*bite	1.3518	2.0677	2.8751	2.2207**	1.9398**	2.2321***	0.0005	0.0003	0.0048***
	(2.9640)	(3.0610)	(3.1202)	(0.7405)	(0.7247)	(0.7456)	(0.0004)	(0.0004)	(0.0002)
post*bite*female	2.0749	0.0844	0.5770	0.5981	-0.0672	0.2021	0.0002	-0.0001	0.0001
	(3.4177)	(2.2348)	(2.7449)	(2.2880)	(1.4191)	(1.6145)	(0.0007)	(0.0004)	(0.0002)
controls	NO	YES	YES	NO	YES	YES	NO	YES	YES
Obs.	3,087	3,087	5,150	3,087	3,087	5,150	3,087	3,087	5,150
Cells	9	9	9	9	9	9	9	9	9
Rho			-0.431			-0.425			-0.418

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 8 Check effects on wages (2005 - 2006)

Dependent Variable	Unemployment (2005-2006)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	2.5229***	0.8799	0.9104**	0.4602*	0.0001	0.0001*
	(0.5830)	(0.6317)	(0.3817)	(0.2108)	(0.0001)	(0.0001)
post*bite*female	-2.6717	-1.1107	-0.4631	-0.0373	0.2428**	0.4038***
	(2.0097)	(1.8677)	(0.6731)	(0.4683)	(0.0743)	(0.0307)
Controls	NO	YES	NO	YES	NO	YES
Obs.	5,194	5,194	5,194	5,194	5,194	5,194
Cells	9	9	9	9	9	9

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 9 Check effects on unemployment (2005 - 2006)

Dependent Variable	Hours (2005-2006)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	-28.0435	-45.5411	23.9170	21.5812	0.0257***	0.0252**
	(87.4490)	(82.5853)	(26.9884)	(26.8998)	(0.0076)	(0.0083)
post*bite*female	-165.2097*	-142.9959	-61.0682	-57.3028	-0.0104	-0.0078
	(86.6084)	(88.8335)	(38.6083)	(34.0947)	(0.0148)	(0.0146)
Controls	NO	YES	NO	YES	NO	YES
Obs.	4,175	4,175	4,175	4,175	4,175	4,175
Cells	9	9	9	9	9	9

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 10 Check effects on worked hours (2005 - 2006)

Dependent Variable	Formal (2005-2006)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	-0.8157**	-0.6302	-0.6275**	-0.6643	0.0000	0.0001
	(0.3461)	(0.5191)	(0.2515)	(0.3865)	(0.0001)	(0.0002)
post*bite*female	1.7124**	1.6330*	0.5274**	0.5207*	0.0001	0.0000
	(0.5138)	(0.7719)	(0.2183)	(0.2628)	(0.0001)	(0.0001)
Controls	NO	YES	NO	YES	NO	YES
Obs.	11,837	11,837	11,837	11,837	11,837	11,837
Cells	9	9	9	9	9	9

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 11 Check effects on informality (2005 - 2006)

Dependent Variable	Self (2005-2006)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	-1.9184	-2.1900	-0.6401	-0.7484	-0.0001	-0.0000
	(1.6269)	(1.2745)	(0.5238)	(0.4709)	(0.0002)	(0.0002)
post*bite*female	2.1064	2.5271	0.6044	0.7289	0.0000	0.0000
	(1.6023)	(1.4839)	(0.5157)	(0.5092)	(0.0001)	(0.0001)
Controls	NO	YES	NO	YES	NO	YES
Obs.	11,837	11,837	11,837	11,837	11,837	11,837
Cells	9	9	9	9	9	9

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 12 Check effects on sector (2005 - 2006)

In general for this pair of years we find that the sign of the coefficients are the same as the ones obtained using the 108 artificially constructed cells. This finding gives us confidence about our estimation since results are robust to different cell specifications.

6 Conclusions

Minimum wage policy is undoubtedly relevant for labor market outcomes. The effects of minimum wage have been mostly ambiguous and even in developed countries there is no consensus on the effects of such policy on wages and employment.

The pair of years 2005-2006 are considered as a natural experiment, since the first important shift in policy took place in 2006 and it turns out to be the best choice since it has a clean effect with no expectations of such an increase. We exploit geographical and demographic variations in the bite of minimum wage in order to identify its impact on labor market outcomes. Our findings suggest that minimum wage policy affected in the same way both men and women's wages and therefore had some impacts over employment and formality outcomes.

We found that an increase in minimum wage is associated with a higher probability of being unemployed but it is independent of the intensity of employment or hours worked. This can be explained because in Bolivia salaries are not fixed by hours worked and people in general cannot decide how many hours they will allocate to work. Finally the probability of being self-employed has a significant and negative effect for men and a significant and positive differential effect for women.

The results are robust to different specifications and corrections. Using the Heckman selection model we found negative and significant rhos, suggesting downward biased parameters due to the people who choose not to work at the actual offered wages. After this correction for selection bias it was possible to identify the parameter increase, but the results remain the same signs. A second robustness check was for the effects of inflation, being that we were using the nominal wage then we run the same model using the logarithm of real wages, confirming our previous remarks. In the third place, we estimate the models using a bite at the department level, obtaining the same results. Besides for almost all the estimations for the different bites, the parameters have the same sign, giving us confidence that our bites are capturing almost the same effect.

Since minimum wage in Bolivia changes every year, we tried to identify the effects of these changes using the same identification strategy for other pairs of years. We find almost no evidence of further effects on the variables of interest across the different pairs of years. From 2006 onwards people will form expectations about the changes in minimum wages and will act accordingly, so exogenous effects are not clear.

Wage improvements for men, occurred despite the high proportion of informality in Bolivia's labor market. These results could be pointing out to the presence of a *lighthouse effect*. Moreover, we find evidence that minimum wage is associated with an increase in the probability of being unemployed. Our results also suggest that minimum wage increases the probability of not contributing to social security (a definition of formality). These results indicate that the policy could be increasing wages but endangering the wellbeing of this group by leaving them without social security and increasing the probability of unemployment.

We believe that the results and conclusions obtained from this research constitute a significant start point for further labor research in Bolivia and similar dual economies across the region. Policy should be aimed towards labor market informality and acknowledge that steep rises in minimum wage could be generating unintended effects on the people who are supposed to receive benefits from the minimum wage.

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Appendix

Here are the results obtained for the other pair of years.

Dependent Variable	Unemployment (2006-2007)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	-1.4810	-1.4786**	-0.5300	-0.5332*	0.0000	0.0000
	(0.8993)	(0.7450)	(0.3250)	(0.2705)	(0.0000)	(0.0000)
post*bite*female	1.8833	1.8694*	0.4805	0.4897*	0.0000	0.0000
	(1.1661)	(1.0358)	(0.3347)	(0.2884)	(0.0000)	(0.0000)
controls	NO	YES	NO	YES	NO	YES
Obs.	5,939	5,939	5,939	5,939	5,922	5,922
Cells	108	108	108	108	108	108

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Dependent Variable	Hours (2006-2007)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	-38.5577	-33.0893	14.7192	12.0693	-0.0015	-0.0022*
	(51.2362)	(41.6122)	(12.9127)	(11.5739)	(0.0014)	(0.0013)
post*bite*female	31.0161	25.4837	-12.7452	-11.6692	-0.0002	0.0004
	(54.2507)	(45.0899)	(14.0324)	(12.9344)	(0.0017)	(0.0016)
controls	NO	YES	NO	YES	NO	YES
Obs.	4,914	4,914	4,914	4,914	4,901	4,901
Cells	108	108	108	108	108	108

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Dependent Variable	log(wages) (2006-2007)								
	FAF			FA			WG		
	(1)	(2)	Heckman	(3)	(4)	Heckman	(5)	(6)	Heckman
post*bite	3.6168***	3.3621***	3.5664***	0.8717*	0.9116**	0.9438**	0.0002***	0.0002***	0.0002***
	(1.0843)	(1.0163)	(1.1148)	(0.4638)	(0.3914)	(0.3970)	(0.0000)	(0.0000)	(0.0000)
post*bite*female	-4.4681***	-4.1128***	-3.8989***	-0.6707	-0.6904	-0.6930	0.0001	0.0000	0.0000
	(1.4922)	(1.3821)	(1.4733)	(0.5550)	(0.4943)	(0.5103)	(0.0001)	(0.0001)	(0.0001)
controls	NO	YES	YES	NO	YES	YES	NO	YES	YES
Obs.	3,742	3,742	5,820	3,742	3,742	5,820	3,733	3,733	5,805
Cells	108	108	108	108	108	108	108	108	108
Rho			-0.219			-0.219			-0.220

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Dependent Variable	Formal (2006-2007)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	-0.2225	-0.3207	-0.0926	-0.0349	-0.0000	-0.0000
	(0.4919)	(0.5622)	(0.1569)	(0.1493)	(0.0000)	(0.0000)
post*bite*female	0.1126	0.2300	0.0865	0.0553	-0.0000	-0.0000
	(0.5099)	(0.5784)	(0.1686)	(0.1586)	(0.0000)	(0.0000)
controls	NO	YES	NO	YES	NO	YES
Obs.	13,088	13,088	13,088	13,088	13,048	13,048
Cells	108	108	108	108	108	108

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Dependent Variable	Self (2006-2007)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	-0.5554	-0.3371	-0.2202	-0.2046	0.0001***	0.0000***
	(0.9540)	(0.5562)	(0.2545)	(0.1854)	(0.0000)	(0.0000)
post*bite*female	0.5156	0.2254	0.2883	0.2406	-0.0000	-0.0000
	(0.9760)	(0.5906)	(0.2454)	(0.1860)	(0.0000)	(0.0000)
controls	NO	YES	NO	YES	NO	YES
Obs.	13,088	13,088	13,088	13,088	13,048	13,048
Cells	108	108	108	108	108	108

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, *
p<0.1

Dependent Variable	Unemployment (2007-2008)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	0.1403	-0.0024	0.0410	-0.0608	0.0000	-0.0000
	(0.4418)	(0.3856)	(0.2244)	(0.2253)	(0.0000)	(0.0000)
post*bite*female	-0.4334	-0.3614	-0.1596	-0.1117	-0.0000	0.0000
	(0.4789)	(0.4260)	(0.2242)	(0.2284)	(0.0000)	(0.0000)
controls	NO	YES	NO	YES	NO	YES
Obs.	5,408	5,408	5,408	5,408	5,358	5,358
Cells	108	108	108	108	108	108

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Dependent Variable	Hours (2007-2008)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	-66.9299**	-65.7946**	-32.4520**	-33.4085**	-0.0004	-0.0004
	(31.1381)	(29.8554)	(15.6814)	(16.0849)	(0.0026)	(0.0026)
post*bite*female	51.9510	51.1968	22.1440	23.6651	0.0003	0.0004
	(32.4080)	(31.1542)	(15.6361)	(16.1033)	(0.0022)	(0.0022)
controls	NO	YES	NO	YES	NO	YES
Obs.	4,605	4,605	4,605	4,605	4,562	4,562
Cells	108	108	108	108	108	108

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Dependent Variable	log(wages) (2007-2008)								
	FAF			FA			WG		
	(1)	(2)	Heckman	(3)	(4)	Heckman	(5)	(6)	Heckman
post*bite	-0.3316	-0.3859	-0.1846	1.3360**	1.4275**	1.6347***	0.0003***	0.0003***	0.0004***
	(1.3529)	(1.3101)	(1.2128)	(0.5537)	(0.5452)	(0.5189)	(0.0001)	(0.0001)	(0.0001)
post*bite*female	1.1875	1.3143	1.1418	-0.8776	-0.9144	-1.0980**	0.0000	-0.0000	-0.0000
	(1.3777)	(1.3364)	(1.2449)	(0.5763)	(0.5704)	(0.5463)	(0.0001)	(0.0001)	(0.0001)
controls	NO	YES	YES	NO	YES	YES	NO	YES	YES
Obs.	3,499	3,499	5,310	3,499	3,499	5,310	3,465	3,465	5,261
Cells	108	108	108	108	108	108	108	108	108
Rho			-0.127			-0.132			-0.162

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Dependent Variable	Formal (2007-2008)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	-0.1097	-0.0411	-0.2042*	-0.1898**	-0.0000	-0.0000
	(0.2301)	(0.1908)	(0.1111)	(0.0877)	(0.0000)	(0.0000)
post*bite*female	0.0172	-0.0432	0.1873	0.1700*	0.0000	0.0000
	(0.2477)	(0.2059)	(0.1211)	(0.0948)	(0.0000)	(0.0000)
controls	NO	YES	NO	YES	NO	YES
Obs.	12,078	12,078	12,078	12,078	11,983	11,983
Cells	108	108	108	108	108	108

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Dependent Variable	Self (2007-2008)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	0.8283*	0.4119	0.0747	-0.1118	-0.0000	-0.0000
	(0.4435)	(0.4112)	(0.3655)	(0.2806)	(0.0000)	(0.0000)
post*bite*female	-0.7210	-0.2581	-0.1007	0.1103	0.0000	0.0001
	(0.4624)	(0.4273)	(0.3637)	(0.2769)	(0.0000)	(0.0000)
controls	NO	YES	NO	YES	NO	YES
Obs.	12,078	12,078	12,078	12,078	11,983	11,983
Cells	108	108	108	108	108	108

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Dependent Variable	Unemployment (2008-2009)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	0.5625	0.7917	0.0029	0.0123	-0.0000	-0.0000
	(0.7044)	(0.7176)	(0.1500)	(0.1423)	(0.0000)	(0.0000)
post*bite*female	-0.1538	-0.3418	-0.0016	-0.0098	0.0000	0.0000
	(0.6772)	(0.7083)	(0.1913)	(0.1822)	(0.0000)	(0.0000)
controls	NO	YES	NO	YES	NO	YES
Obs.	4,935	4,935	4,935	4,935	4,915	4,915
Cells	108	108	108	108	108	108

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Dependent Variable	Hours (2008-2009)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	126.9165*	105.8267	18.8151*	19.4429*	-0.0011	-0.0009
	(68.5836)	(82.8409)	(10.4542)	(10.4920)	(0.0023)	(0.0022)
post*bite*female	-128.9752*	-105.3382	-24.0836**	-23.7238**	-0.0009	-0.0004
	(69.1533)	(83.2775)	(10.9282)	(11.0838)	(0.0028)	(0.0027)
controls	NO	YES	NO	YES	NO	YES
Obs.	4,318	4,318	4,318	4,318	4,299	4,299
Cells	108	108	108	108	108	108

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Dependent Variable	log(wages) (2008-2009)								
	FAF			FA			WG		
	(1)	(2)	Heckman	(3)	(4)	Heckman	(5)	(6)	Heckman
post*bite	-3.3741	-3.6381	-3.2473	0.2569	0.1475	-0.5102	0.0002*	0.0002**	0.0002
	(2.3152)	(2.3718)	(2.6108)	(0.6624)	(0.5318)	(0.4281)	(0.0001)	(0.0001)	(0.0001)
post*bite*female	2.7458	3.0443	2.6374	-0.0427	0.0985	0.8170*	-0.0001	-0.0000	-0.0000
	(2.4577)	(2.4706)	(2.7292)	(0.6793)	(0.5451)	(0.4667)	(0.0001)	(0.0001)	(0.0001)
controls	NO	YES	YES	NO	YES	YES	NO	YES	YES
Obs.	3,188	3,188	4,883	3,188	3,188	4,883	3,178	3,178	4,872
Cells	108	108	108	108	108	108	108	108	108
Rho			0.0533			-0.0493			-0.225

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Dependent Variable	Formal (2008-2009)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	-1.9395**	-2.3544***	-0.3019***	-0.2776***	0.0000	0.0000
	(0.7610)	(0.6526)	(0.0825)	(0.0991)	(0.0000)	(0.0000)
post*bite*female	1.8142**	2.1902***	0.2415***	0.2196**	-0.0000	-0.0000
	(0.7673)	(0.6591)	(0.0903)	(0.1060)	(0.0000)	(0.0000)
controls	NO	YES	NO	YES	NO	YES
Obs.	11,142	11,142	11,142	11,142	11,094	11,094
Cells	108	108	108	108	108	108

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Dependent Variable	Self (2008-2009)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	1.6898	1.2608	0.2871*	0.2630*	0.0000	0.0000
	(1.1184)	(1.0217)	(0.1622)	(0.1346)	(0.0000)	(0.0000)
post*bite*female	-1.7189	-1.3817	-0.2077	-0.1953	-0.0000	-0.0000
	(1.1156)	(1.0196)	(0.1707)	(0.1446)	(0.0000)	(0.0000)
controls	NO	YES	NO	YES	NO	YES
Obs.	11,142	11,142	11,142	11,142	11,094	11,094
Cells	108	108	108	108	108	108

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Dependent Variable	Unemployment (2009-2011)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	0.0000	0.0000	-0.2766	-0.3310*	0.0000*	0.0000
	(0.0000)	(0.0000)	(0.1799)	(0.1811)	(0.0000)	(0.0000)
post*bite*female	0.0000	0.0000	0.0972	0.1570	-0.0000	0.0000
	(0.0000)	(0.0000)	(0.2011)	(0.2021)	(0.0000)	(0.0000)
controls	NO	YES	NO	YES	NO	YES
Obs.	8,435	8,435	8,435	8,435	8,373	8,373
Cells	108	108	108	108	108	108

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Dependent Variable	Hours (2009-2011)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	0.0000	0.0000	-1.6011	-2.3639	-0.0015*	-0.0014
	(0.0000)	(0.0000)	(11.2483)	(9.9729)	(0.0008)	(0.0009)
post*bite*female	0.0000	0.0000	-8.4999	-8.0551	-0.0008	-0.0004
	(0.0000)	(0.0000)	(11.6812)	(10.7670)	(0.0011)	(0.0011)
controls	NO	YES	NO	YES	NO	YES
Obs.	7,427	7,427	7,427	7,427	7,380	7,380
Cells	108	108	108	108	108	108

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Dependent Variable	log(wages) (2009-2011)								
	FAF			FA			WG		
	(1)	(2)	Heckman	(3)	(4)	Heckman	(5)	(6)	Heckman
post*bite	0.0000	0.0000		1.3631***	1.4335***	1.4717***	0.0002***	0.0002***	0.0002***
	(0.0000)	(0.0000)		(0.2718)	(0.2327)	(0.2294)	(0.0000)	(0.0000)	(0.0000)
post*bite*female	0.0000	0.0000		-0.8236**	-0.7027**	-0.7053**	0.0000	0.0000	0.0000
	(0.0000)	(0.0000)		(0.3756)	(0.3226)	(0.2967)	(0.0000)	(0.0000)	(0.0000)
controls	NO	YES	YES	NO	YES	YES	NO	YES	YES
Obs.	5,537	5,537	8,430	5,537	5,537	8,430	5,507	5,507	8,368
Cells	108	108	108	108	108	108	108	108	108
Rho			-0.402			-0.408			-0.512

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Dependent Variable	Formal (2009-2011)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	0.0000	0.0000	-0.1605*	-0.0826	-0.0000***	-0.0000*
	(0.0000)	(0.0000)	(0.0840)	(0.0872)	(0.0000)	(0.0000)
post*bite*female	0.0000	0.0000	0.1289	0.0407	0.0000	0.0000
	(0.0000)	(0.0000)	(0.0885)	(0.0914)	(0.0000)	(0.0000)
controls	NO	YES	NO	YES	NO	YES
Obs.	19,635	19,635	19,635	19,635	19,552	19,552
Cells	108	108	108	108	108	108

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, *
p<0.1

Dependent Variable	Self (2009-2011)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	0.0000	0.0000	-0.2277	-0.3317*	-0.0000	-0.0000
	(0.0000)	(0.0000)	(0.1872)	(0.1954)	(0.0000)	(0.0000)
post*bite*female	0.0000	0.0000	0.2359	0.3379	0.0000	0.0000*
	(0.0000)	(0.0000)	(0.2085)	(0.2116)	(0.0000)	(0.0000)
controls	NO	YES	NO	YES	NO	YES
Obs.	19,635	19,635	19,635	19,635	19,552	19,552
Cells	108	108	108	108	108	108

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Dependent Variable	Unemployment (2011-2012)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	0.2024	0.2461	0.1903	0.2413*	0.0000	0.0000
	(0.2811)	(0.3103)	(0.1328)	(0.1411)	(0.0000)	(0.0000)
post*bite*female	-0.4856	-0.4839	-0.2231	-0.2395	-0.0000	-0.0000
	(0.3066)	(0.3357)	(0.1420)	(0.1484)	(0.0000)	(0.0000)
controls	NO	YES	NO	YES	NO	YES
Obs.	11,483	11,483	11,483	11,483	11,468	11,468
Cells	108	108	108	108	108	108

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Dependent Variable	Hours (2011-2012)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	-19.5083	-18.3418	-10.7928	-12.5449*	(0.0011)	(0.0010)
	(12.8896)	(12.2416)	(6.6441)	(6.7956)	0.0021	0.0014
post*bite*female	0.9046	0.0027	5.1474	6.2375	0.0007	0.0006
	(13.2111)	(12.8634)	(7.6322)	(7.6309)	(0.0010)	(0.0010)
controls	NO	YES	NO	YES	NO	YES
Obs.	10,158	10,158	10,158	10,158	10,146	10,146
Cells	108	108	108	108	108	108

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Dependent Variable	log(wages) (2011-2012)								
	FAF			FA			WG		
	(1)	(2)	Heckman	(3)	(4)	Heckman	(5)	(6)	Heckman
post*bite	0.9029	0.9270	1.0380*	0.9970**	0.9384**	1.0484**	0.0003***	0.0002***	0.0003***
	(0.6424)	(0.6434)	(0.6114)	(0.4020)	(0.4275)	(0.4270)	(0.0001)	(0.0001)	(0.0001)
post*bite*female	-1.0046	-1.1466*	-1.1294*	-0.7865**	-0.7482*	-0.7684**	-0.0001	-0.0001	-0.0001
	(0.6616)	(0.6452)	(0.6244)	(0.3749)	(0.3960)	(0.3911)	(0.0000)	(0.0000)	(0.0000)
controls	NO	YES	YES	NO	YES	YES	NO	YES	YES
Obs.	7,619	7,619	11,476	7,619	7,619	11,476	7,612	7,612	11,462
Cells	108	108	-0.300	108	108	108	108	108	108
Rho			-0.300			-0.337			-0.350

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Dependent Variable	Formal (2011-2012)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	0.3851***	0.3540***	0.1184*	0.1363**	0.0000***	0.0000**
	(0.1315)	(0.1221)	(0.0707)	(0.0609)	(0.0000)	(0.0000)
post*bite*female	-0.3545**	-0.3275**	-0.0985	-0.1079	-0.0000	-0.0000
	(0.1432)	(0.1277)	(0.0798)	(0.0670)	(0.0000)	(0.0000)
controls	NO	YES	NO	YES	NO	YES
Obs.	27,633	27,633	27,633	27,633	27,572	27,572
Cells	108	108	108	108	108	108

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Dependent Variable	Self (2011-2012)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	0.0994	0.2495	0.0745	0.1168	0.0000	0.0000
	(0.2017)	(0.1946)	(0.1098)	(0.0922)	(0.0000)	(0.0000)
post*bite*female	-0.2353	-0.3489	-0.1602	-0.1608	-0.0000	-0.0000
	(0.2273)	(0.2217)	(0.1273)	(0.1109)	(0.0000)	(0.0000)
controls	NO	YES	NO	YES	NO	YES
Obs.	27,633	27,633	27,633	27,633	27,572	27,572
Cells	108	108	108	108	108	108

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Dependent Variable	Unemployment (2012-2013)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	-0.2803	-0.3208	-0.2610	-0.2488	-0.0000	-0.0000
	(0.2826)	(0.2438)	(0.1926)	(0.1565)	(0.0000)	(0.0000)
post*bite*female	-0.0426	0.0183	0.1475	0.1725	-0.0000	-0.0000
	(0.3513)	(0.3064)	(0.1982)	(0.1666)	(0.0000)	(0.0000)
controls	NO	YES	NO	YES	NO	YES
Obs.	12,781	12,781	12,781	12,781	12,767	12,767
Cells	108	108	108	108	108	108

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Dependent Variable	Hours (2012-2013)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	18.1237	18.0213*	13.5745	9.1109	0.0004	0.0004
	(13.2257)	(10.7004)	(8.6419)	(7.6305)	(0.0008)	(0.0008)
post*bite*female	-31.1508**	-32.8855***	-16.9019**	-14.1948**	-0.0009	-0.0008
	(12.9169)	(10.1785)	(8.0722)	(6.8924)	(0.0009)	(0.0008)
controls	NO	YES	NO	YES	NO	YES
Obs.	11,388	11,388	11,388	11,388	11,375	11,375
Cells	108	108	108	108	108	108

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Dependent Variable	log(wages) (2012-2013)								
	FAF			FA			WG		
	(1)	(2)	Heckman	(3)	(4)	Heckman	(5)	(6)	Heckman
post*bite	0.9999**	0.8456*	0.6864*	1.0880***	0.9940***	0.8636***	0.0002***	0.0002***	0.0002***
	(0.4913)	(0.4539)	(0.3840)	(0.3208)	(0.2995)	(0.2834)	(0.0000)	(0.0000)	(0.0000)
post*bite*female	-0.5815	-0.5178	-0.3066	-0.3469	-0.3591	-0.2103	0.0001*	0.0001**	0.0001**
	(0.5226)	(0.4704)	(0.4185)	(0.2981)	(0.2715)	(0.2661)	(0.0000)	(0.0000)	(0.0000)
controls	NO	YES	YES	NO	YES	YES	NO	YES	YES
Obs.	8,561	8,561	12,776	8,561	8,561	12,776	8,551	8,551	12,764
Cells	108	108	108	108	108	108	108	108	108
Rho			-0.340			-0.355			-0.359

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Dependent Variable	Formal (2012-2013)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	0.1030	0.0825	0.0899	0.0640	-0.0000	-0.0000
	(0.1587)	(0.1363)	(0.1508)	(0.1141)	(0.0000)	(0.0000)
post*bite*female	0.0235	0.0248	-0.0200	-0.0505	0.0000	-0.0000
	(0.1940)	(0.1651)	(0.1533)	(0.1173)	(0.0000)	(0.0000)
controls	NO	YES	NO	YES	NO	YES
Obs.	30,835	30,835	30,835	30,835	30,787	30,787
Cells	108	108	108	108	108	108

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Dependent Variable	Self (2012-2013)					
	FAF		FA		WG	
	(1)	(2)	(3)	(4)	(5)	(6)
post*bite	0.5079	0.1512	0.4959**	0.2020	0.0001***	0.0000
	(0.3318)	(0.2423)	(0.2234)	(0.1709)	(0.0000)	(0.0000)
post*bite*female	-0.3995	-0.2337	-0.2959	-0.1527	0.0000	-0.0000
	(0.3486)	(0.2487)	(0.2084)	(0.1563)	(0.0000)	(0.0000)
controls	NO	YES	NO	YES	NO	YES
Obs.	30,835	30,835	30,835	30,835	30,787	30,787
Cells	108	108	108	108	108	108

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1