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Does the Minimum Wage Affect Wage Inequality?

A Study for the Six Largest Latin American Economies *

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September, 2022

Abstract

Minimum wage (MW) policies are widespread in the developing world and yet their effects are still unclear. In this paper we explore the effect of national MW policies in Latin America's six largest economies by exploiting the heterogeneity in the bite of the national minimum wage across local labor markets and over time. We find evidence that the MW has a compression effect on the wage distribution of formal workers. The effect was particularly large during the 2000s, a decade of sustained growth and strong labor markets. In contrast, the effect seems to vanish in the 2010s, a decade of much weaker labor markets. We also find suggestive evidence of a lighthouse effect: the MW seems to have an equalizing effect also on the wage distribution of informal workers.

JEL Classification: J22, J31, J38, K31.

Keywords: Minimum Wage, Wages, Labor Markets, Inequality, Informality, Latin America.

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1 Introduction

The minimum wage (MW) is one of the main policy instruments aimed at affecting labor market outcomes by increasing real wages in the lower tail of the distribution and hence reducing wage inequality. To what extent this instrument is capable of these goals is the subject of a large debate both in the policy arena and in the academic literature.

The issue is particularly relevant in Latin America, where minimum wages are key components of the policy strategies seeking to reduce endemic high inequality levels. In particular, the increase in the MW has been singled out as a relevant factor accounting for the substantial reduction in income inequality experienced by Latin American countries during the 2000s.

In this paper we explore the effect of the MW on the wage distributions of the six largest economies in Latin America over the last two decades. In particular, we exploit the heterogeneity in how binding minimum wages are across local labor markets and over time. To that aim we use harmonized microdata from the national household surveys of Argentina, Brazil, Chile, Colombia, Mexico and Peru, which represent 79 per cent of total population and 86 per cent of total GDP in Latin America.

Our identification strategy lies on the fact that differences in local labor markets earnings distributions imply heterogeneity in the binding nature of the nationally-set minimum wage. We follow the framework initially proposed by Lee (1999) and define the effective minimum wage (EMW) as the difference between the (log) statutory national MW and the (log) wage of a reference percentile high enough such that it is not affected by the policy. The EMW is then a measure of the bite of the national MW in each local labor market: it reflects the different exposure of each region to changes in the statutory national minimum wage. We then regress the wage gap (with the reference percentile) at different percentiles against the EMW, including controls, non-linear terms and fixed effects. To increase the reliability of our estimates we also follow an instrumental variables approach proposed by Autor et al. (2016) and modified by Engbom and Moser (2021) that considers historical wealth of each region as a predictor of the "bindingness" of minimum wages.

We find evidence that the MW has a compression effect on the wage distribution of formal workers. The effect was particularly large during the 2000s, a decade of sustained growth and strong labor markets. In contrast, the effect seems to vanish in the 2010s, a decade of much weaker labor markets. Our results suggest that the positive effect of the MW on wages is particularly significant for male, middle-skilled workers. We also find some evidence for a "lighthouse effect": the MW seems to have an equalizing effect also on the wage distribution of informal workers.

Understandably, given its widespread use as a policy instrument, the literature on minimum wages is vast and growing, both in rich countries (Card and Krueger (2015); Autor et al. (2016); Dube (2019)) and in developing economies (Belman et al. (2015); Broecke et al. (2017); Gindling (2018); Neumark and Corella (2021)). This research has highlighted several channels through which the minimum wage can affect the wage distribution. We typically expect the minimum wage to increase wages of those workers directly reached by the policy, i.e. formal (registered)

workers at the bottom of the wage distribution (Cengiz et al. (2019)). However, several papers find evidence of spillovers, by which the minimum wage also affects the upper tail of the wage distribution (Autor et al. (2016); Engbom and Moser (2021)), and evidence of a lighthouse effect, by which minimum wage regulations may also affect informal wages (Khamis (2013) and Jales (2018)).

There are reasons to study minimum wage policies in the specific context of developing countries. Compared to rich economies, the targeted workforce is larger (Belman et al. (2015); Neumark and Corella (2021)), policy enforcement is lower, and workers and firms may more easily evade regulations by moving into the larger informal sector (Wedenoja (2013); Jales (2018); Ham (2018)). Moreover, weaker macroeconomic conditions often faced by these economies may amplify adverse employment effects (**?**;Silva et al. (2015)).

Given its salience as a policy measure, the literature on minimum wages has been very active in Latin America. Studies typically find equalizing effects in the wage distribution of formal workers, although results differ depending on the initial level of the MW, the extent of the changes, and the degree of enforcement (Maloney and Mendez (2007); Bosch and Manacorda (2010); Alves et al. (2012); Maurizio and Vázquez (2016); Engbom and Moser (2021)). Findings on the employment effects of the MW are not conclusive: some papers find a negative impact (Grau et al. (2011); Borraz and González-Pampillón (2017); Urzua and Saltiel (2021)) while others do not find any significant effect (Lemos (2009); Grau Veloso et al. (2018)).

We make a contribution to this literature in two directions. First, we apply a methodology that was scarcely exploited in the region, probably because is very data-demanding. Second, in contrast to most papers that focus in specific countries and short time periods, we take advantage of a large harmonized database of national household surveys and carry out a comprehensive study for the six largest economies in Latin America over two decades.

The rest of the paper is organized as follows. Section 2 provides context on the minimum wage in Latin America. Section 3 details the empirical strategy followed to estimate the effect of the minimum wage, while Section 4 describes the data used for the analysis. Section 5 presents some basic statistics and Section 6 shows the main results, along with some robustness tests. Finally, Section 7 concludes.

2 Minimum wage and inequality in LA

As in most countries in the world, the minimum wage (MW) is a key policy instrument also in Latin America. MW are set with the aim of increasing wages in the bottom of the distribution, and hence reducing wage inequality. There is considerable heterogeneity across countries in some characteristics of this policy instrument, such as level, frequency and dispersion across groups of workers. While some countries set a uniform minimum wage once a year, others have multiple minimum wages set by industry, region, category, and even educational attainment (e.g. most Central American countries).

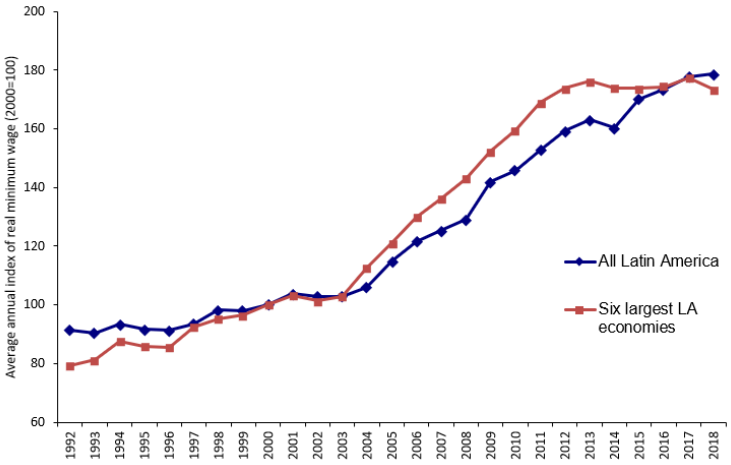
In this paper we focus on the six largest economies of Latin America; Argentina, Brazil, Chile, Colombia, Mexico and Peru, which represent 79 per cent of total population and 86 per

cent of total GDP in Latin America. In these countries the minimum wage is set annually at the national level.[1] The only exception is Mexico, where the minimum wage was determined in different "minimum wage areas" until October 2015 with the aim of reaching the same level of real minimum wage in each area (we work with the national average minimum wage, for more information see Section 4).

Unlike the United States, where the minimum wage is set on an hourly basis, in almost all of the countries studied in this paper it is set monthly with a legal working time of 40 hours per week, the only exception again being Mexico (where the MW wage is set on a daily basis).[2]

Figure 1 shows the evolution of the minimum wage over the last two decades. After a period of moderate increase in the 1990s, the MW strongly grew over the 2000s, and then turned more erratic in the 2010s. For the case of the whole region, the real minimum wage increased at an annual rate of 1.1% between 1992 and 2003; accelerated to 4.7% a year between 2003 and 2013, and then slowed down to 1.8% a year between 2013 and 2018. Changes were similar, although more dramatic, for the group of the six largest economies. The MW grew at an annual rate of 5.5% between 2003 and 2013 and then remained almost constant in the following years.

Figure 1: Average real minimum wage index; 1992-2018



Notes. The countries considered in "All Latin America" group are: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela. The six largest economies are: Argentina, Brazil, Chile, Colombia, Mexico and Peru.
Source. Own elaboration based on CEPAL.

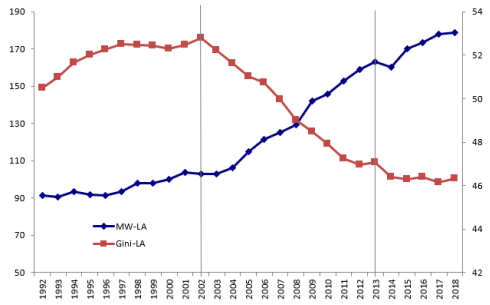
[1] In some years for some countries the minimum wage is not defined at the beginning of the year but in the middle of it, so these countries have 2 minimum wage levels in that year. Meanwhile, in other countries there may be more than two minimum wages per year (e.g. in Argentina due to high inflation). We take the annual average of the minimum wage in these cases.

[2] Thus, when working with minimum hourly wages in our paper we are making the assumption that the monthly minimum wage for an 8-hour working day serves as a reference for employers in case their employees work more (or less) than 8 hours per day.

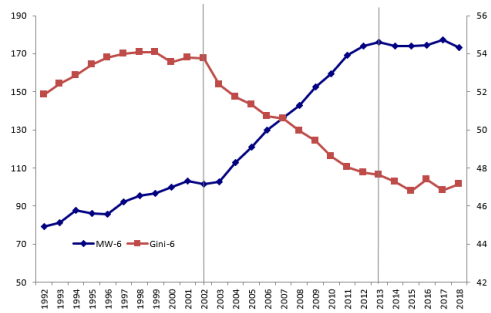
Many analysts and commentators have suggested that the increase in the minimum wage in the 2000s was one of the main drivers of the fall in inequality in Latin America. Just to motivate this issue, Figure 2 shows the evolution of income inequality, as measured by the Gini coefficient. The strong increase in the minimum wage in the 2010s coincides with a substantial fall in inequality. Also, in the 2010s the deceleration in the minimum wage coincides with a slow down in the reduction of inequality. The patterns are similar for the whole region (panel A) and for the six largest economies (panel B). Of course these simple graphs do not prove any relationship between the MW and inequality, but serve as a motivation for the rest of the analysis. Is there causal evidence of an equalizing effect of the minimum wage policies over the wage distribution, and ultimately on the income distribution? The rest of the paper tackles these questions, limiting the analysis to the six largest economies in the region. The similarity between panels A and B suggests that the results might be more general than for this sample of six countries.

Figure 2: Gini coefficient for the income distribution and minimum wage

Panel A: All Latin American countries



Panel B: Six largest economies



Notes. The right axis shows values of the Gini coefficient for the household income distribution. The left axis shows values of the minimum wage index. The countries considered in "All Latin America" group are: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela. The six largest economies are: Argentina, Brazil, Chile, Colombia, Mexico and Peru.
Source. Own elaboration based on households surveys microdata from SEDLAC (CEDLAS and The World Bank).

3 Econometric framework and empirical strategy

Although there is a negative correlation between the minimum wage and inequality, this relationship of course cannot be interpreted as causal inference, since there could be other factors that affected inequality. We address this possible simultaneity by exploiting the geographic variability in the bite of the minimum wage among different regions over time.

This variability is related to two main factors: i) the statutory national minimum wage that varies over time; and ii) differences in regional effectiveness of the national minimum wage due

to different wage distributions across regions.

To study the effect of the minimum wage on the wage distribution, we first define the effective minimum wage or Kaitz index, as the difference between the log statutory national minimum wage and the log wage of a percentile high enough such that the pth percentile of the wage distribution is not (directly or indirectly) affected by the minimum wage. In this study, we set the 75th percentile as the reference percentile, so that EMW is defined by: [3]

$$EMW_{rt} = w_t^{min} - w_{rt}^{p75} \tag{1}$$

EMW is then a measure of the bite of the national minimum wage in each region. It reflects the different exposure of each region to changes in the statutory national minimum wage over the sample period. For instance in a region where the minimum wage is closer to the $p75$ the bite of the MW is larger. This region will have a higher EMW (a less negative $wmin - w(p75)$).

In other words, the intuition behind this identification strategy is that differential regional earning structures allow for variability in the bite of the minimum wage. In poorer regions the statutory national minimum wage is more binding than in other regions with higher wage levels, where their wage distributions are barely affected by changes in national minimum wages.

For example, in the wealthy district of Buenos Aires (Argentina), the EMW has a very low bite: the wage distribution of this region has a high 75th wage percentile relative to other poorer regions of Argentina (and Latin America). Thus, its EMW is among the lowest (more negative) in the country. On the other hand, in the lower income districts of northern Argentina, the 75th percentile of the wage distribution is at a lower level than that of Buenos Aires: this makes the EMW less negative, giving it more bite or effectiveness.

In the next step, we estimate the following equation:

$$w(p)_{rt} - w(p75)_{rt} = \beta_1(p)EMW_{rt} + \beta_2(p)EMW_{rt}^2 + \sigma_{r0}(p) + \sigma_{r1}(p) * t + \gamma_t(p) + \epsilon_{rt}(p) \tag{2}$$

where $w(p)_{rt} - w(p75)_{rt}$ represents the gap between the log real wage at percentile p and the log real wage at percentile 75th, in region r and year t. Time invariant region effects are represented by σ_{r0}, $\sigma_{r1} * t$ represent region-specific trends, γ_t captures time variability (typically year fixed effects or quadratic time trends); while ϵ_{rt} are errors clustered at the regional level.

We are particularly interested in the marginal effect $EMW_{rt} + 2\beta_2(p)EMW_{rt}$ as it captures the idea that a change in the minimum wage is likely to have more impact on the wage distribution where it is more binding. Particularly, if the minimum wage were to compress the wage distribution we would expect to find positive coefficients for wage gaps below the reference percentile (a less negative $w(p) - w(p75)$); and negative coefficients above the reference percentile (a less positive $w(p) - w(p75)$).

The literature suggests that these estimates might be biased, mainly by the presence of

[3] In Section 5 we further discuss the choice of the 75th percentile as the reference percentile. In addition, as robustness checks, we have also carried out the analysis using the 50th and the 90th as alternative reference percentiles (other reference percentiles commonly used in the literature), and conclusions are essentially unchanged. For more information, see Section 6.5.

measurement error or possibly transitory shocks. With this in mind, we instrument EMW_{rt} and its square with a set of instruments similar to those proposed by Autor et al. (2016). In particular, we follow Engbom and Moser (2021) and adapt the IV strategy to the context of countries that, unlike the U.S., do not have minimum wages set at the state level, as it is the case in Latin America. Thus, our 2SLS strategy instruments the effective minimum wage and its square with a set of instruments that combine: (i) the statutory national minimum wage, (ii) its square, and (iii) the log statutory national minimum wage interacted with the average real log median wage for the region over time. Intuitively, the instrument predicts that regions with higher long-term wage levels have lower EMW, which contributes to identifying the minimum wage´s effects on the wage distribution and satisfies the relevance condition. Following the literature, we assume that legal minimum wages are exogenous to other factors affecting regional wage distributions once we have controlled for region fixed effects and region specific time trends[4]. This implies that the concurrent level of the statutory minimum wage relative to the long-term average income level within a region affects the concurrent wage inequality only through its effect on the concurrent bite of the minimum wage. It is expected that changes in the national minimum wage will affect the contemporaneous wage distribution of each region, but will not affect its long-term wealth, after controlling for our set of fixed effects. We understand that this historical level depends on other factors such as the productive structure at the local level, the level of education of individuals in the region, among other conditions and economic endowments specific to each region.

Table A5 of Appendix A shows the results of the first stage of the 2SLS regressions for selected percentiles of the regional wage distributions.

In our IV specification, identification in equation 2 for the linear term in the EMW comes entirely from the variation in the statutory national minimum wage, and identification for the quadratic term comes from the inclusion of the square of the log statutory national minimum wage and the interaction term (the term numbered with (iii) above). Taking this into account, the table shows that the instruments have good predictive power with p-values above 1% statistical significance. The directions of the effects are as expected. Also, the Kleinbergen-Paap F-statistics is relatively high and their values are way above the Stock-Yogo weak ID test critical values. These results are reassuring in terms of the use of the empirical strategy followed in this paper.

4 Data

Our main variables of interest are the percentiles of the wage distributions in each region of the six largest economies in Latin America. We define "regions" as agglomerates in Argentina, states in Brazil, administrative areas in Chile, departments for Colombia, districts for Mexico, and departments in Peru. Wage distributions are constructed by pooling all individual responses

[4] Since Latin American countries have national minimum wages but, in contrast to the U.S., no state-level minimum wages, we include as controls in our IV specification state-specific quadratic time trends instead of a set of year dummies to control for time invariant shocks.

using microdata from national household surveys. In particular, we compute percentiles of log real hourly wage, defined as reported monthly monetary income of the main occupation, adjusted by hours worked. The main analysis is carried out for full-employed men and women aged between 18 and 60, living in urban areas and registered in the social security system (formal employees). To reduce the influence of outliers, we winsorized the 3% top and bottom of the wage distribution by assigning the third percentile value to the second and first one; and the ninety-seventh percentiles value to the ninety-eight and ninety-ninth percentiles. Using these individual wage data, we calculate percentiles of regional wage distributions for 2001-2018 (with gaps depending on availability of national household surveys), weighting observations by their sampling weight multiplied by their monthly hours worked.

Regarding the minimum wage data, our main sources of information are ILOSTAT, CEPAL, and data reported by the national statistic offices. We construct hourly minimum wages by dividing monthly minimums by 172.8 hours, considering an average weekly workday of 40 hours.[5]

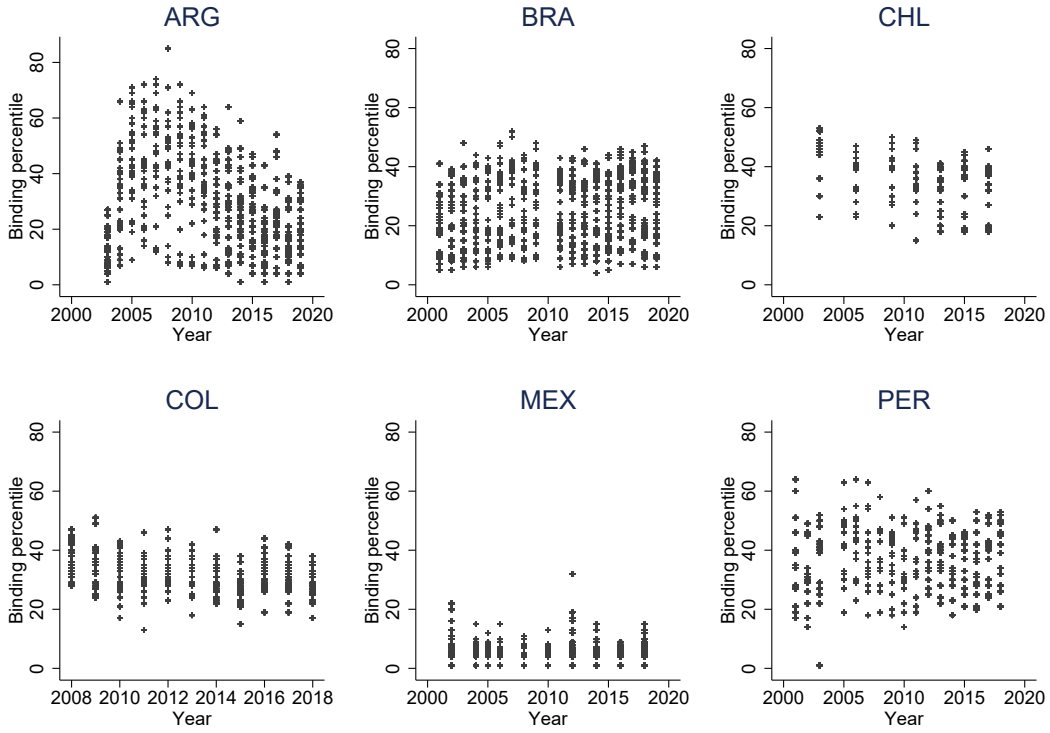
5 Descriptive evidence

Variability in the effectiveness of minimum wage over time and across regions is essential for applying the empirical strategy mentioned above. In this sense, we calculate a "binding percentile" for each region over the period, defined as the income percentile at which workers start to earn wages equal to the national minimum wage. Figure 3 displays this binding percentile for each region over the period, showing that the range over which it varies is relatively large. This evidence supports the identification strategy, as the "bindingness" of minimum wages widely differs across regions.

In addition, Figure 3 shows that minimum wage falls on relatively high wage percentiles. This finding motivates to choose the 75th percentile as the reference percentile since the median seems to be directly affected by the minimum wage level, at least for some regions.

[5] The value of the minimum wage is usually adjusted annually, although changes can occur at different times of the calendar year. We address this point by using an annual average based on monthly minimum wages.

Figure 3: Binding percentiles over countries and regions.

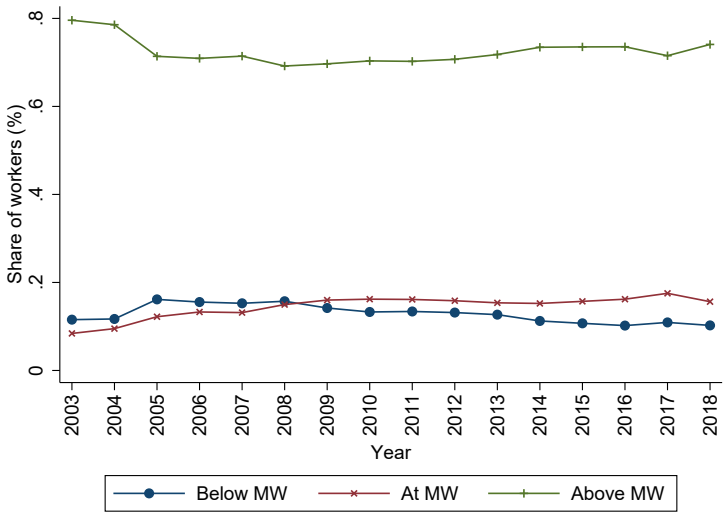


Notes. Each point corresponds to a region and displays the income percentile at which workers earn wages equal to or above the national minimum wage.

Source. Own elaboration based on microdata from SEDLAC (CEDLAS and World Bank).

We also analyze the minimum wage effectiveness by computing the share of workers earning below, at, or above the minimum wage. Since the minimum wage value is set as a gross wage while household surveys earnings are often net wages, we apply a margin of 10% when delimiting whether an individual's income is below, at, or above the minimum wage. Hence, we define a *below* group that includes those individuals who report wages up to 90% of the minimum wage level; an *at* group that comprises individuals who declare wages between 90% and 110% of the minimum wage value, and finally, an *above* group which includes those individuals who reported wages higher than the 110% of the minimum wage. Results in Figure 4 show that most formal workers in Latin America earn more than the minimum wage, although the share earning below is not negligible. Enforcement problems or potential measurement errors (due to differences between gross and net wages) could explain formal workers earning below the minimum wage.

Figure 4: Share of workers earning below, at, and above the minimum wage.



Notes. Unweighted average of national shares. Due to national households surveys availability, Latin American averages were computed for 2003-2018.
Source: Own elaboration based on microdata from SEDLAC (CEDLAS and World Bank).

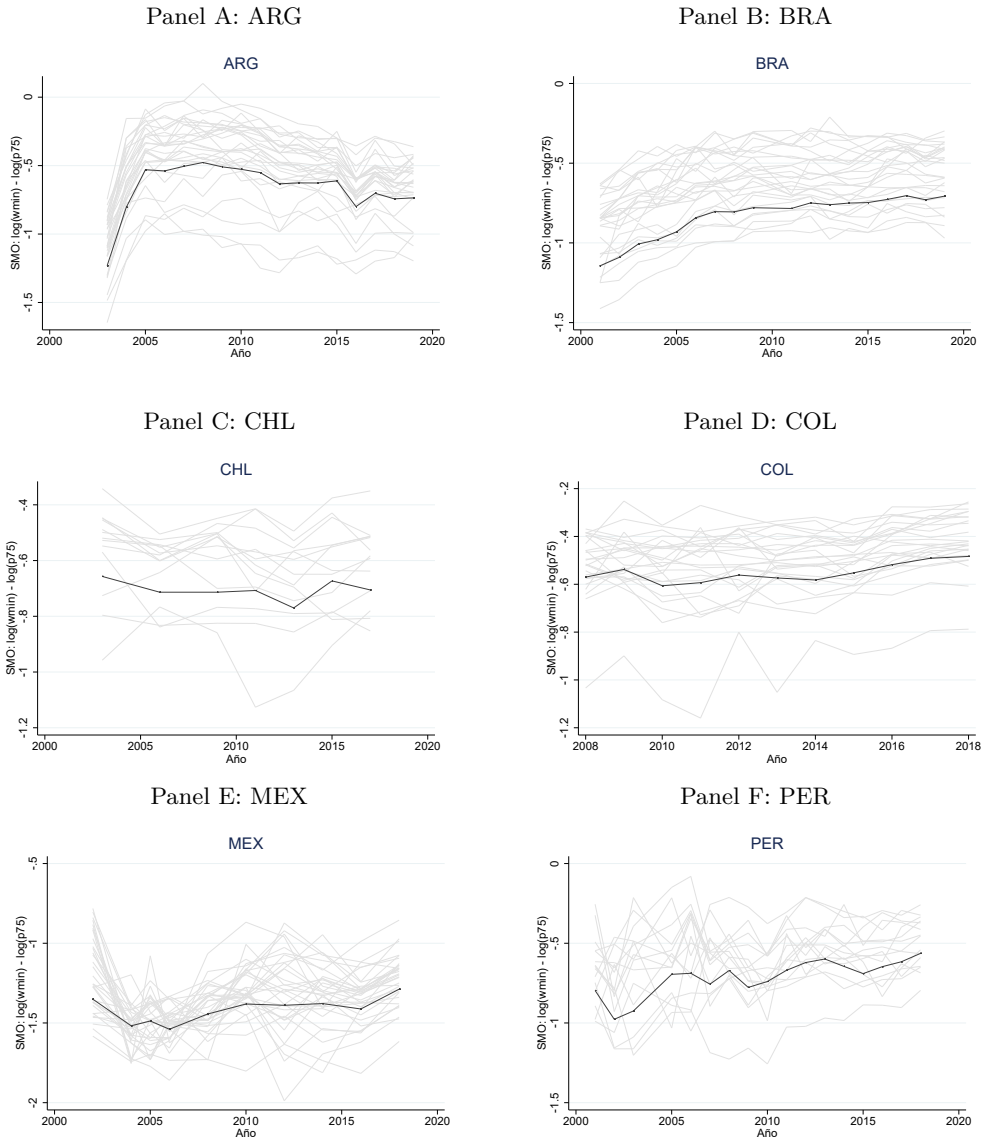
The share of workers earning below the minimum remained somewhat stable, ranging between 10% and 15% over the period. The share of workers earning at the minimum wage increased from 8% in 2003 to around 16% in 2018. Most of the increase took place in the early 2000s. The flip side was a decrease in the proportion of workers earning above the MW. These changes imply an increase in the bite of the MW over the period.[6]

Tables A2, A3 and A4 in Appendix A show gender, education, and age distributions for workers earning at, below,and above the minimum wage. The profiles for workers earning below the minimum is similar to workers earning at the minimum wage. There has been a particularly marked increase in the share of mid and high skilled, and older workers in those groups.

Lastly, Figure 5 shows the evolution of EMW ($wmin - w(p75)$) across regions and over time, where each grey line represents a region and the dark lines represents the national trend. For most countries, we observe an increase in EMW at a national level with remarkable differences across regions, which supports our identification strategy.

[6] Table A1 displays below, at, and above minimum wage groups for each country. Most Mexican workers earn above the minimum throughout the entire period, while Chile had a significant reduction in workers earning below. In addition, Argentina showed a sharp increase in the low group in 2004 and 2005, possibly related to a considerable increase in the minimum in 2003. These differences among countries may explain heterogeneous impacts, since minimum wage can affect inequality by changing wages levels and modifying the compliance of these policies.

Figure 5: Evolution of EMW across countries and regions



Notes. Each line represents a regional EMW, defined as $log(minwage) - log(p75)$. $Log(minwage)$ is the (log) national minimum wage; and $log(p75)$ is computed at a regional level.
Source. Own elaboration based on microdata from SEDLAC (CEDLAS and World Bank).

6 Results

6.1 Distributive effects of the minimum wage in Latin America

Table 1 presents the marginal effects of changes in the ratio $log(minwage) - log(p75)$ (the effective minimum wage, EMW) on the ratio $log(p) - log(p75)$ for selected percentiles, evaluated at its hours-weighted average across regions and years for our sample of formal employees. Additionally, in the last row we report the marginal effects of the EMW for the Gini of the regional wage distributions. We start by presenting OLS estimates in columns (1) and (2). Column 1 shows the estimates of a specification that includes region and year fixed effects; while the specification in Column 2 adds linear regional trends. As mentioned in Section 3, if the minimum wage compresses the wage distribution, it is expected to find positive coefficients for wage gaps below the reference percentile (a less negative $w(p) - w(p75)$); and negative coefficients above the reference percentile (a less positive $w(p) - w(p75)$). Results of Column 2 (our preferred specification for OLS) show that an increase of 10 log points in the effective minimum implies an increase of 4.2 log points in the ratio $log(p10) - log(p75)$ (first row). Similarly, the second row depicts that an analogous increase in the EMW narrows the gap between the first and third quartiles of the wage distribution by 3.9 log points.

Columns (3) and (4) present 2SLS estimates, both including region fixed effects. While the third column also adds quadratic regional time trends, the last specification considers linear country time trends. Results of column 3 (our preferred IV specification) show that an increase of 10 log points in the EMW lowers 2 log points the ratio $log(p10) - log(p75)$ (first row).[7] Additionally, the effective minimum seems to reduce wage inequality as measured by the Gini index, as seen in all specifications.

[7] We also experimented including country fixed effects and linear trends interacted with country dummies. This has virtually no impact on the results of our estimations.

Table 1: OLS & 2SLS relationship between $log(p) - log(p75)$ and $log(minwage) - log(p75)$ for selected percentiles of formal workers' wage distribution

	OLS		2SLS	
	(1)	(2)	(3)	(4)
$p(10)$	0.421***	0.424***	0.200***	0.191***
	(0.040)	(0.040)	(0.037)	(0.037)
$p(25)$	0.367***	0.391***	0.153***	0.147***
	(0.026)	(0.026)	(0.023)	(0.024)
$p(50)$	0.236***	0.263***	0.075***	0.074***
	(0.021)	(0.022)	(0.016)	(0.016)
$p(80)$	-0.016*	-0.023**	-0.025***	-0.025***
	(0.008)	(0.009)	(0.007)	(0.007)
$p(90)$	-0.058**	-0.077***	-0.083***	-0.084***
	(0.025)	(0.027)	(0.020)	(0.019)
Gini	-0.101***	-0.108***	-0.062***	-0.061***
	(0.012)	(0.012)	(0.009)	(0.009)
Observations	1,909	1,909	1,909	1,909
F-stat			28.25	29.89
Region FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	No	No
Region trends	No	Linear	Quadratic	No
Country trend	No	No	No	Linear

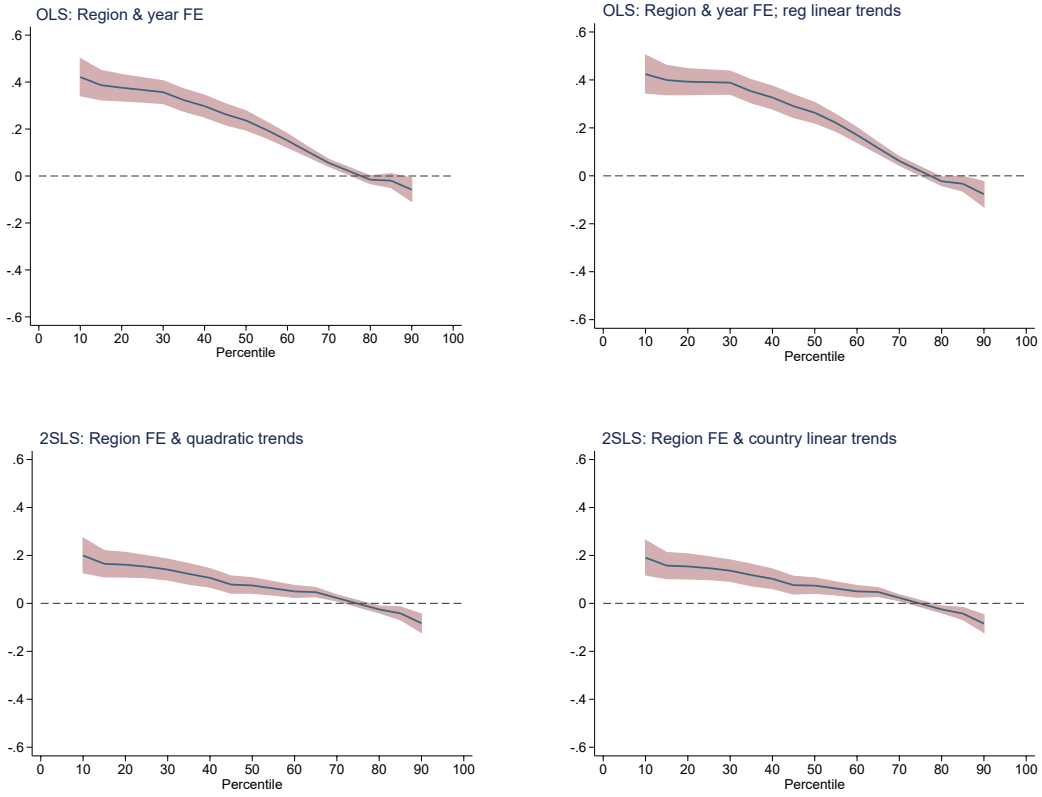
Notes. We consider formal workers in the period 2001-2018 (with gaps depending on availability of national household surveys). All regressions are unweighted and for all of them, except the one in the last row, the dependent variable is $log(p) - log(p75)$ where p is the wage of the indicated percentile. For the last row, the dependent variable is the Gini of the wage distribution at regional level. Estimates are the marginal effects of $log(minwage) - log(p75)$, evaluated at its hours-weighted average across regions and years. For 2SLS specifications, the effective minimum and its square are instrumented by the log of the minimum, the square of the log minimum, and the log minimum interacted with the average real log median for the state over the sample. Standard errors clustered at the region level in parentheses. Kleibergen-Paap rk Wald F-statistics are shown. $***p < 0.01$; $**p < 0.05$; $*p < 0.1$.

Source. Own elaboration based on data from SEDLAC.

As mentioned in the empirical strategy, estimations were carried out for each wage distribu-

tion percentile by changing the $log(p) - log(p75)$ ratio iteratively. Figure 6 complements Table 1, by showing estimated marginal effects for all percentiles. On the one hand, the positive coefficients found in the lower tail of the wage distribution indicate that the gap between the wages of those percentiles and the wages of the 75th percentile becomes less negative. On the other hand, the negative coefficients observed for the upper tail of the distribution imply a reduction of the initial positive gap between the top wages and the reference percentile.[8] This narrowing in the gap both in the lower and upper end of the wage distribution implies a compression in the wage distribution: the minimum wage appears to have had an equalizing impact in Latin America.[9]

Figure 6: 2SLS relationship between $log(p) - log(p75)$ and $log(minwage) - log(p75)$ for selected percentiles of formal workers' wage distribution



[8] Although this effect is not typical of developed economies (Autor et al., 2016; Lee, 1999) where, for example, the minimum wage is binding only at the lower end of the wage distribution, evidence in favor of such an effect has been found in some developing countries (Engbom and Moser, 2021; Bosch and Manacorda, 2010).

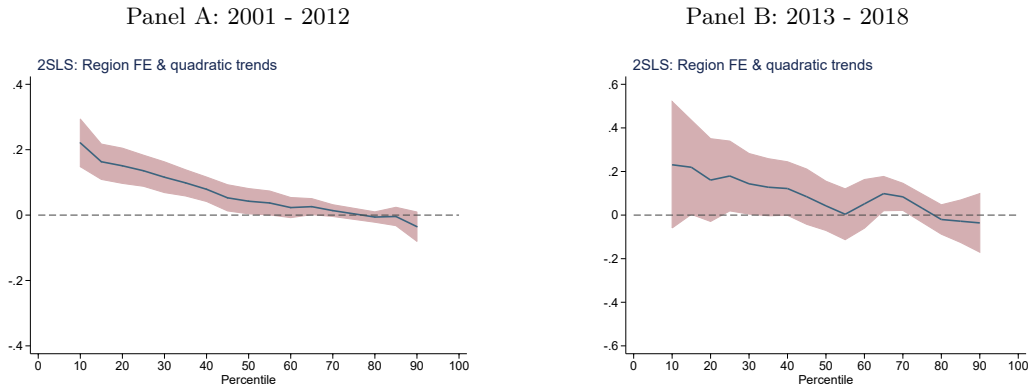
[9] Figure A1 in Appendix A shows the variability in the effect of the EMW for each of the countries analyzed. Despite the differences in the precision of the estimates, we observe a common pattern across countries similar to the average effect found for Latin America.

6.2 Heterogeneous distributive effects of the minimum wage in Latin America in 2001-2012 and 2013-2018

The period analyzed in Latin America can be subdivided into two parts. The first period between 2001 and 2012 witnessed remarkable growth rates in the region, along with a reduction in inequality in almost all countries. This was followed by a second period between 2013 and 2018, where the favorable macroeconomic context changed, bringing a slowdown (or even stagnation) in growth and inequality reduction (Acosta et al., 2019; Gasparini, 2019). The different macroeconomic scenarios could have implied differences in the impact of the minimum wage.

In Figure 7 we present the effects of the EMW on wage gaps for the two periods. The negative effects found in Table 1 were particularly clear in the booming 2000s. During this decade, our IV estimates show an equalizing impact of the minimum wage stemming from the left tail of the wage distribution; while in the second period the effect of the EMW seems to be smaller and rather noisier.

Figure 7: 2SLS relationship between $log(p) - log(p75)$ and $log(minwage) - log(p75)$ for selected periods



Notes. All regressions are unweighted and for all of them the dependent variable is $log(p) - log(p75)$ where p is the wage of the indicated percentile. We consider formal workers in the period 2001-2012 (Panel A), and the period 2013-2018 (Panel B). Years might have gaps depending on availability of national household surveys. The red shaded areas represent 95 percent confidence intervals.
Source. Own elaboration based on data from SEDLAC.

6.3 Heterogeneous distributive effects of the minimum wage in Latin America by wage distributions of skills, age and gender

The results may vary according to workers characteristics, as gender, age or education, among other factors. To explore this possibility, we construct multiple sub-samples (according to different characteristics) and compute minimum wage effects on percentiles of sample-specific wage distributions. Table 2 presents marginal effects estimated considering each one of the following

sub-groups: (i) men and women; (ii) low, medium and high skilled and; (iii) workers between 18 and 24 years old and workers between 25 and 64 years old.

According to gender, the effects are concentrated in male workers; while when considering different sub-samples according to education, those workers with medium qualification seem to be the ones more affected. When carrying out the analysis according to age, there seem not to be clear differences between both subgroups, which differs from the US literature that finds larger effects for young workers.

Table 2: 2SLS relationship between $log(p) - log(p75)$ and $log(minwage) - log(p75)$ for selected percentiles of formal workers' Wage Distribution by socio-demographic characteristics

	Gender		Education			Age	
	Men	Women	Low-skilled	Med-skilled	High-skilled	Young	25-60 years old
$p(10)$	0.228***	0.093	0.277*	0.122*	0.004	0.605**	0.205***
	(0.040)	(0.101)	(0.166)	(0.068)	(0.090)	(0.248)	(0.042)
$p(25)$	0.164***	0.042	0.070	0.123***	-0.079	0.123*	0.139***
	(0.028)	(0.046)	(0.048)	(0.033)	(0.069)	(0.071)	(0.025)
$p(50)$	0.070***	0.051*	0.050	0.076***	-0.107**	0.056	0.072***
	(0.018)	(0.030)	(0.032)	(0.021)	(0.046)	(0.050)	(0.016)
$p(80)$	-0.024***	-0.002	0.023*	-0.016*	0.033**	0.030*	-0.014
	(0.009)	(0.012)	(0.014)	(0.009)	(0.015)	(0.018)	(0.010)
$p(90)$	-0.059***	-0.024	0.022	-0.059***	0.074*	0.088***	-0.055**
	(0.021)	(0.026)	(0.029)	(0.016)	(0.039)	(0.033)	(0.022)
Observations	1,653	1,652	1,649	1,654	1,648	1,648	1,654
F-stat	30.15	8.40	15.85	54.58	18.84	15.08	26.75

Notes. Sample period is 2001-2018 with gaps depending on availability of national household surveys and consists only of formal employees. Columns 1 and 2 present estimates for the wage distribution of registered workers considering only men and women, respectively. Columns 3 to 5 also consider sub-samples of formal workers, respectively: individuals with less than completed high school, with completed high school, and with tertiary education or more. Finally, columns 6 and 7 consider formal workers by age sub-samples, columns names are self-explanatory. For all regressions the dependent variable is $log(p) - log(p75)$ where p is the wage of the indicated percentile. Estimates are the marginal effects of $log(minwage) - log(p75)$, evaluated at its hours-weighted average across regions and years. Standard errors clustered at the region level in parentheses. Regressions are unweighted, otherwise they would give disproportionate importance to only Brazil and Mexico. For 2SLS specifications, the effective minimum and its square are instrumented by the log of the minimum, the square of the log minimum, and the log minimum interacted with the average real log median for the state over the sample. All regressions include region FE and quadratic regional time trends. $***p < 0.01$; $**p < 0.05$; $*p < 0.1$.

Source. Own elaboration based on data from SEDLAC.

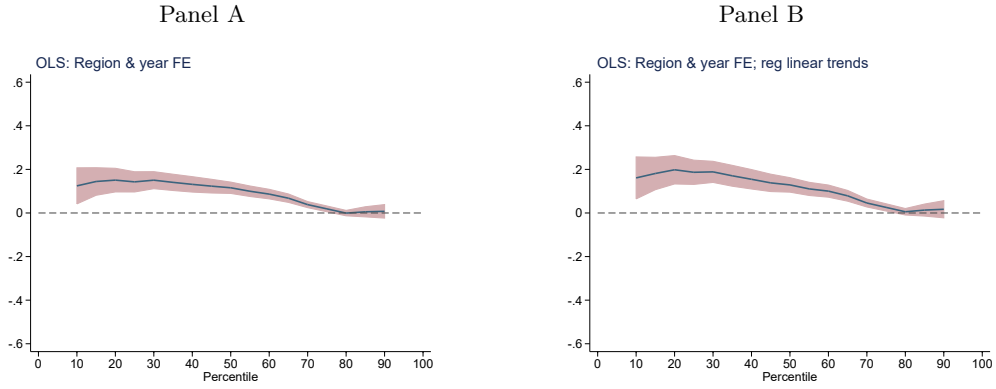
6.4 Lighthouse effect

A large number of Latin Americans work informally. According to our sample countries, the urban employed population working without social security contributions (our definition of informality) was, on average, 43.5% in 2018. In this context of informality, it is relevant to study whether a labor institution such as the minimum wage, which is binding for formal workers,

affects informal ones.

Figure 8 shows OLS estimates of the effect of the EMW on wage gaps for informal workers' wage distribution. We show OLS estimates because the instrument we use is constructed to predict the effect of the minimum wage among formal workers. The relationship between the historical regional wage level and the bite of the minimum wage among informal workers is not clear. In fact, the correlation between our IV and the effectiveness of the minimum wage for this sample is low. Panel (a) of the figure shows estimates that consider annual and regional fixed effects, while Panel (b) adds linear regional time trends. As can be seen in both figures, the effective minimum wage would appear to have an equalizing impact on the left tail of the informal workers' wage distribution. In other words, the minimum wage would be reducing the existing gap between the informal workers who earn the least and those in the 75th percentile of the wage distribution.

Figure 8: OLS relationship between $log(p) - log(p75)$ and $log(minwage) - log(p75)$ for informal workers



Notes. All regressions are unweighted and for all of them the dependent variable is $log(p) - log(p75)$ where p is the wage of the indicated percentile. We consider informal workers in the period 2001-2018 (with gaps depending on availability of national household surveys). The red shaded areas represent 95 percent confidence intervals.
Source. Own elaboration based on data from SEDLAC.

These wage increases in the informal sector are consistent with the existence of a lighthouse effect. Although the minimum wage is only binding among formal workers, it would appear to act as a reference price in the informal sector for wage bargaining.

6.5 Robustness checks

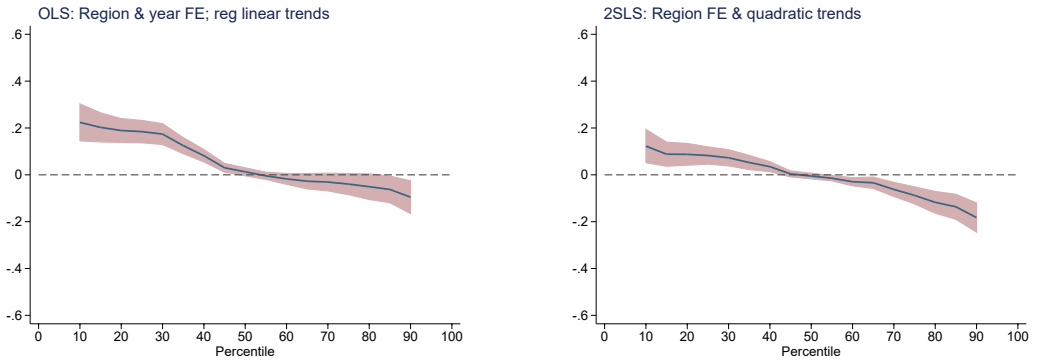
In this section, we perform several robustness exercises to provide further evidence of the effects found in this paper and more confidence about the empirical strategy implemented.

First, we re-estimate our main results by changing the reference wage percentile chosen to

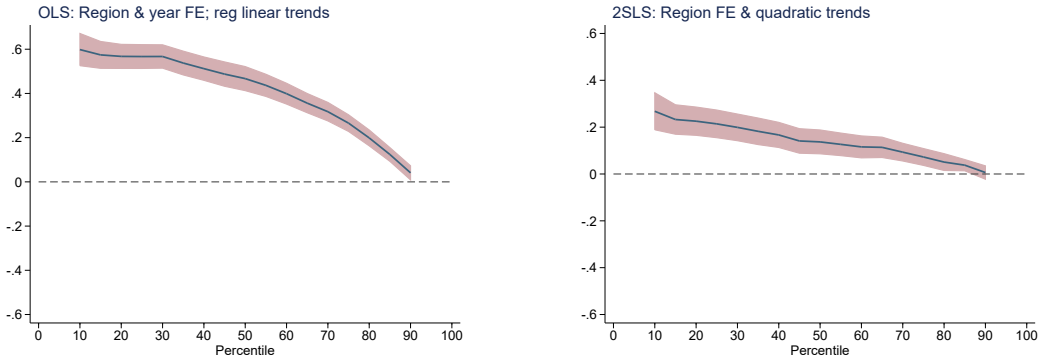
calculate the minimum wage bite. As shown in Figure 9, the EMW has an equalizing effect throughout the whole wage distribution when using the median and $p(90)$ as reference percentiles.[10] As can be seen, our results are robust to the use of these other reference percentiles typically used in the literature.

Figure 9: OLS & 2SLS relationship between $log(p) - log(ref)$ and $log(minwage) - log(ref)$ for $ref = 50$ and $ref = 90$ of formal workers' wage distribution

Panel A - Relative to $p50$



Panel B - Relative to $p90$



Additionally, we carried out several specifications in our OLS and 2SLS estimates, and conclusions about the marginal effect of minimum wage throughout wage distribution are essentially unchanged.

7 Concluding remarks

The minimum wage is at the core of the debate on labor policies. How effective is this instrument to increase real wages at the bottom, and hence reducing wage inequality? Does the impact

[10] Tables A6 and A7 in Appendix A complement Figure 9.

depend on the phase of the business cycle? Are there spillovers to informal workers? This paper contributes to the rich literature on these issues by exploring the effect of the MW on the wage distributions of the six largest economies in Latin America (Argentina, Brazil, Chile, Colombia, Mexico and Peru) over the last two decades. To that aim we exploit the heterogeneity in the bite of the nationally-set minimum wage across local labor markets and over time.

Our results suggest that the MW has been effective in the 2000s, a decade of sustained growth and strong labor markets. The positive impact of the MW on wages of formal workers decreases over the percentiles of the wage distribution. We also find some evidence that the equalizing effect spills over the informal sector of the economy: wages in the bottom of the distribution of informal workers are also lifted by this policy. Interestingly, the effects of the minimum wage on formal and informal workers seem to be smaller in the 2010s, a decade of much weaker labor markets.

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Appendix A

Table A1: Workers earning below, at and above the minimum wage across countries

	ARG			BRA			CHL			COL			MEX			PER		
	Below	At	Above	Below	At	Above	Below	At	Above	Below	At	Above	Below	At	Above	Below	At	Above
2003	4%	4%	92%	7%	12%	81%	28%	13%	59%	n/d	n/d	n/d	1%	2%	96%	18%	11%	70%
2004	13%	10%	77%	7%	12%	82%	25%	15%	60%	n/d	n/d	n/d	1%	2%	96%	n/d	n/d	n/d
2005	25%	16%	59%	7%	13%	80%	23%	16%	61%	n/d	n/d	n/d	1%	2%	97%	25%	15%	59%
2006	24%	16%	60%	8%	16%	75%	21%	17%	62%	n/d	n/d	n/d	0%	2%	97%	24%	15%	60%
2007	25%	17%	58%	9%	17%	75%	20%	17%	62%	n/d	n/d	n/d	1%	2%	97%	21%	13%	65%
2008	26%	16%	57%	8%	16%	76%	20%	18%	63%	16%	24%	60%	1%	2%	97%	24%	14%	62%
2009	23%	17%	60%	8%	20%	72%	19%	18%	63%	15%	26%	60%	1%	2%	97%	19%	14%	67%
2010	24%	16%	60%	8%	19%	74%	16%	21%	63%	13%	24%	63%	1%	2%	96%	18%	15%	66%
2011	22%	14%	64%	7%	17%	75%	13%	25%	62%	13%	24%	63%	1%	2%	96%	24%	15%	61%
2012	17%	13%	70%	8%	18%	74%	14%	22%	65%	14%	25%	61%	2%	2%	95%	25%	16%	59%
2013	16%	13%	71%	7%	19%	74%	14%	18%	68%	14%	24%	62%	1%	2%	96%	24%	16%	60%
2014	16%	12%	72%	6%	17%	77%	13%	20%	67%	12%	25%	63%	1%	3%	96%	19%	15%	66%
2015	16%	11%	73%	6%	19%	75%	12%	22%	66%	11%	24%	64%	1%	2%	97%	18%	15%	66%
2016	9%	9%	82%	7%	21%	72%	12%	22%	66%	12%	28%	60%	1%	2%	97%	20%	15%	65%
2017	13%	11%	76%	6%	24%	70%	11%	23%	66%	12%	30%	59%	1%	3%	96%	23%	15%	62%
2018	10%	9%	82%	6%	21%	74%	n/d	n/d	n/d	12%	31%	57%	2%	3%	95%	23%	15%	62%

Notes. *Notes*. Due to households surveys availability, Latin American averages were computed for 2003-2018.
Source. Own elaboration based on microdata from SEDLAC (CEDLAS and World Bank).

Table A2: Summary statistics for workers earning at the minimum wage

	Gender		Education			Age	
	Men	Women	Low-skilled	Med-skilled	High-skilled	Young	25-60 years old
2003	66.5%	33.5%	38.1%	52.5%	9.4%	24.8%	75.2%
2004	65.2%	34.8%	37.9%	51.6%	10.5%	22.7%	77.3%
2005	62.8%	37.2%	31.6%	57.2%	11.2%	22.4%	77.6%
2006	63.9%	36.1%	32.7%	53.6%	13.7%	19.4%	80.6%
2007	62.8%	37.2%	29.4%	56.4%	14.2%	21.6%	78.4%
2008	60.9%	39.1%	27.6%	59.7%	12.7%	22.3%	77.7%
2009	61.8%	38.2%	27.9%	60.4%	11.8%	22.5%	77.5%
2010	61.0%	39.0%	28.5%	58.3%	13.2%	22.1%	77.9%
2011	60.6%	39.4%	26.3%	60.6%	13.1%	20.5%	79.5%
2012	61.2%	38.8%	24.0%	63.0%	13.0%	19.4%	80.6%
2013	59.1%	40.9%	23.3%	62.7%	14.0%	19.8%	80.2%
2014	56.6%	43.4%	24.1%	62.7%	13.2%	21.7%	78.3%
2015	56.7%	43.3%	23.2%	63.6%	13.2%	20.8%	79.2%
2016	56.7%	43.3%	22.1%	63.1%	14.8%	19.5%	80.5%
2017	56.9%	43.1%	21.2%	63.8%	15.0%	19.8%	80.2%
2018	57.0%	43.0%	20.8%	64.2%	15.0%	20.4%	79.6%

Notes. Notes. All columns refers to unweighted average of national shares. Due to households surveys availability, Latin American averages were computed for 2003-2018.

Source. Own elaboration based on microdata from SEDLAC (CEDLAS and World Bank).

Table A3: Summary statistics for workers earning below the minimum wage

	Gender		Education			Age	
	Men	Women	Low-skilled	Med-skilled	High-skilled	Young	25-60 years old
2003	63.2%	36.8%	39.5%	52.4%	8.1%	23.6%	76.4%
2004	62.5%	37.5%	38.8%	52.8%	8.4%	24.1%	75.9%
2005	63.9%	36.1%	40.0%	50.8%	9.1%	26.5%	73.5%
2006	65.6%	34.4%	33.2%	57.7%	9.1%	23.6%	76.4%
2007	63.3%	36.7%	33.0%	57.3%	9.7%	21.5%	78.5%
2008	62.1%	37.9%	32.2%	56.9%	10.9%	21.5%	78.5%
2009	62.7%	37.3%	33.4%	56.8%	9.9%	21.2%	78.8%
2010	62.9%	37.1%	33.4%	57.2%	9.4%	21.4%	78.6%
2011	59.5%	40.5%	34.2%	55.5%	10.2%	21.5%	78.5%
2012	57.9%	42.1%	33.6%	55.8%	10.6%	19.6%	80.4%
2013	58.8%	41.2%	31.3%	58.1%	10.6%	20.9%	79.1%
2014	57.8%	42.2%	29.5%	60.5%	10.0%	22.4%	77.6%
2015	59.4%	40.6%	27.9%	60.4%	11.7%	20.5%	79.5%
2016	60.6%	39.4%	25.5%	60.9%	13.6%	19.0%	81.0%
2017	59.3%	40.7%	24.1%	63.1%	12.9%	18.8%	81.2%
2018	58.6%	41.4%	23.8%	64.0%	12.2%	19.6%	80.4%

Notes. Notes. All columns refers to the unweighted average of national shares. Due to households surveys availability, Latin American averages were computed for 2003-2018.

Source. Own elaboration based on microdata from SEDLAC (CEDLAS and World Bank).

Table A4: Summary statistics for workers earning above the minimum wage

	Gender		Education			Age	
	Men	Women	Low-skilled	Med-skilled	High-skilled	Young	25-60 years old
2003	69.6%	30.4%	21.6%	47.2%	31.2%	13.9%	86.1%
2004	69.5%	30.5%	20.7%	47.3%	32.0%	12.9%	87.1%
2005	70.2%	29.8%	19.3%	48.2%	32.5%	12.5%	87.5%
2006	69.3%	30.7%	17.9%	48.6%	33.5%	12.6%	87.4%
2007	69.8%	30.2%	17.7%	49.1%	33.1%	13.2%	86.8%
2008	68.0%	32.0%	16.5%	47.9%	35.6%	13.2%	86.8%
2009	67.4%	32.6%	15.5%	48.7%	35.9%	12.8%	87.2%
2010	67.7%	32.3%	15.2%	49.5%	35.3%	12.1%	87.9%
2011	67.1%	32.9%	14.4%	49.9%	35.7%	12.8%	87.2%
2012	67.1%	32.9%	14.7%	49.4%	35.9%	12.8%	87.2%
2013	66.4%	33.6%	13.7%	49.6%	36.8%	12.6%	87.4%
2014	66.5%	33.5%	13.6%	50.0%	36.3%	12.3%	87.7%
2015	65.9%	34.1%	13.1%	50.8%	36.2%	11.4%	88.6%
2016	65.1%	34.9%	12.1%	49.4%	38.5%	10.9%	89.1%
2017	64.9%	35.1%	11.4%	48.9%	39.8%	10.5%	89.5%
2018	62.5%	37.5%	13.3%	54.5%	32.3%	13.2%	86.8%

Notes. Notes. All columns refers to the unweighted average of national shares. Due to households surveys availability, Latin American averages were computed for 2003-2018.

Source. Own elaboration based on microdata from SEDLAC (CEDLAS and World Bank).

Table A5: First stage correlations for selected percentiles of regional wage distributions

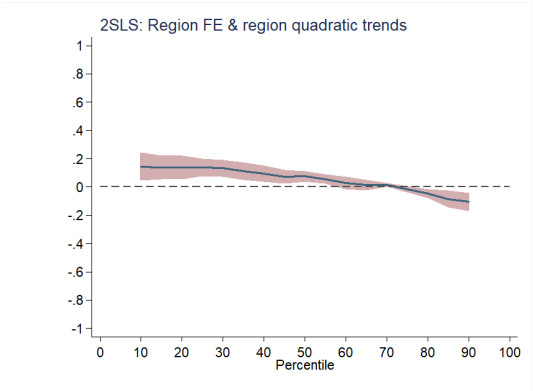
	EMW	EMW^2	EMW	EMW^2
***p*(25)**				
National MW	0.949***	-0.652**	0.900***	-0.739***
	(0.194)	(0.327)	(0.159)	(0.274)
Square national MW	-0.197***	0.692***	-0.213***	0.667***
	(0.041)	(0.077)	(0.038)	(0.073)
Interaction term	0.077	-1.071***	0.133	-0.978***
	(0.157)	(0.293)	(0.124)	(0.239)
***p*(50)**				
National MW	0.949***	-0.652**	0.900***	-0.739***
	(0.194)	(0.327)	(0.159)	(0.274)
Square national MW	-0.197***	0.692***	-0.213***	0.667***
	(0.041)	(0.077)	(0.038)	(0.073)
Interaction term	0.077	-1.071***	0.133	-0.978***
	(0.157)	(0.293)	(0.124)	(0.239)
***p*(70)**				
National MW	0.949***	-0.652**	0.900***	-0.739***
	(0.194)	(0.327)	(0.159)	(0.274)
Square national MW	-0.197***	0.692***	-0.213***	0.667***
	(0.041)	(0.077)	(0.038)	(0.073)
Interaction term	0.077	-1.071***	0.133	-0.978***
	(0.157)	(0.293)	(0.124)	(0.239)
***p*(90)**				
National MW	0.949***	-0.652**	0.900***	-0.739***
	(0.194)	(0.327)	(0.159)	(0.274)
Square national MW	-0.197***	0.692***	-0.213***	0.667***
	(0.041)	(0.077)	(0.038)	(0.073)
Interaction term	0.077	-1.071***	0.133	-0.978***
	(0.157)	(0.293)	(0.124)	(0.239)
Observations	1,909	1,909	1,909	1,909
F-stat	30.68	30.68	32.26	32.26
Region FE	Yes	Yes	Yes	Yes
Year FE	No	No	No	No
Region trends	Quadratic	Quadratic	No	No
Country trend	No	No	Linear	Linear

Notes. Coeficients are first stage estimates of 2SLS regressions in which the second stage dependent variable is $log(p) - log(p75)$ where p is the wage of the indicated percentile. We consider formal workers in the period 2001-2018 (with gaps depending on availability of national household surveys). All regressions are unweighted. In the first stage, the effective minimum and its square are instrumented by the log of the natinal minimum wage, its square, and the log minimum interacted with the average real log median for the state over the sample ("interaction term"). Standard errors clustered at the region level in parentheses. Kleibergen-Paap rk Wald F-statistics are shown. $***p < 0.01$; $**p < 0.05$; $*p < 0.1$.

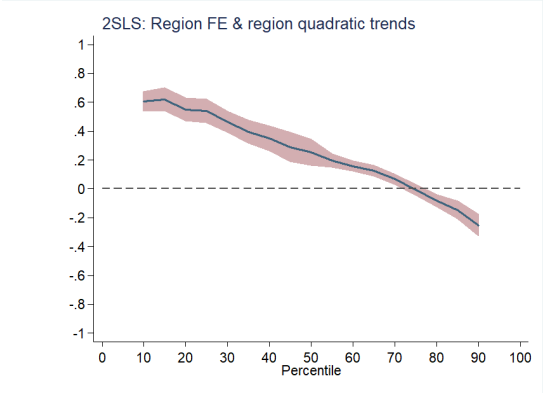
Source. Own elaboration based on data from SEDLAC.

Figure A1: 2SLS relationship between $log(p) - log(p75)$ and $log(minwage) - log(p75)$ for selected percentiles of registered workers' wage distribution

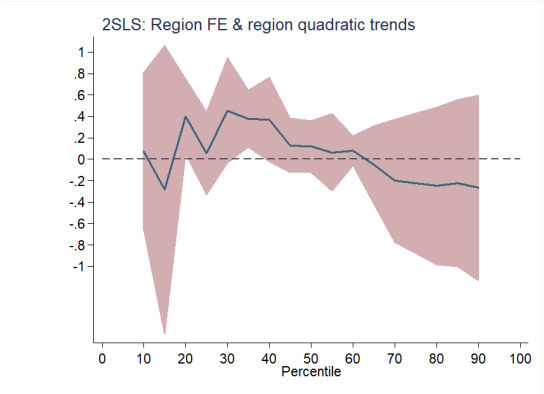
ARG



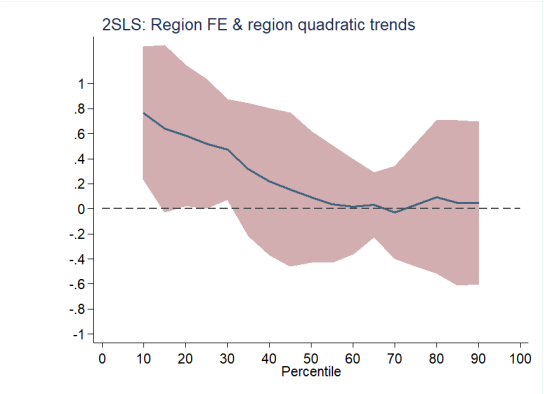
BRA



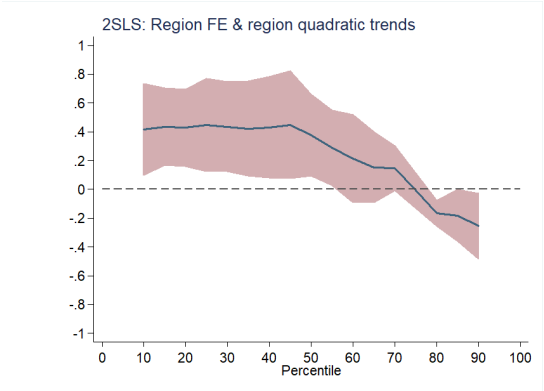
CHL



COL



MEX



PER

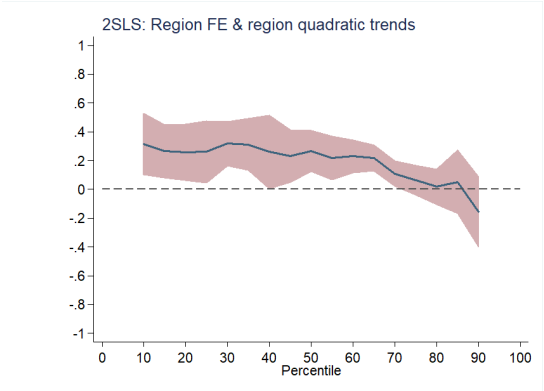


Table A6: OLS relationship between $log(p) - log(p_{ref})$ and $log(min.wage) - log(p_{ref})$ for selected percentiles of Formals' Wage Distribution

	Panel A - reference $p(50)$		Panel B - reference $p(90)$	
	(1)	(2)	(3)	(4)
$p(10)$	0.221***	0.224***	0.602***	0.598***
	(0.037)	(0.040)	(0.043)	(0.037)
$p(25)$	0.167***	0.184***	0.554***	0.567***
	(0.021)	(0.024)	(0.033)	(0.027)
$p(40)$	0.069***	0.082***	0.496***	0.512***
	(0.010)	(0.013)	(0.033)	(0.027)
$p(75)$	-0.024	-0.040*	0.254***	0.266***
	(0.018)	(0.023)	(0.022)	(0.019)
$p(80)$	-0.022	-0.051*	0.191***	0.199***
	(0.020)	(0.028)	(0.019)	(0.018)
$p(95)$	-0.056	-0.137***	-0.046***	-0.042**
	(0.042)	(0.049)	(0.015)	(0.016)
Observations	1,909	1,909	1,909	1,909
Region FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Region trends	No	Linear	No	Linear
Country trend	No	No	No	No

Notes. We consider formal workers in the period 2001-2018 (with gaps depending on availability of national household surveys). All regressions are unweighted. In regressions of Columns (1) and (2) the dependent variable is $log(p) - log(p50)$ where p is the wage of the indicated percentile. Estimates are the marginal effects of $log(minwage) - log(p50)$, evaluated at its hours-weighted average across regions and years.In regressions of Columns (3) and (4) the dependent variable is $log(p) - log(p90)$ where p is the wage of the indicated percentile. Estimates are the marginal effects of $log(minwage) - log(p90)$, evaluated at its hours-weighted average across regions and years. $***p < 0.01$; $**p < 0.05$; $*p < 0.1$.

Source. Own elaboration based on data from SEDLAC.

Table A7: 2SLS relationship between $log(p) - log(p_{ref})$ and $log(min.wage) - log(p_{ref})$ for select percentiles of Formals' Wage Distribution

	Panel A - reference $p(50)$		Panel B - reference $p(90)$	
	(1)	(2)	(3)	(4)
$p(10)$	0.123***	0.122***	0.268***	0.252***
	(0.036)	(0.036)	(0.040)	(0.040)
$p(25)$	0.082***	0.082***	0.214***	0.205***
	(0.019)	(0.019)	(0.030)	(0.029)
$p(40)$	0.035***	0.035***	0.167***	0.163***
	(0.011)	(0.012)	(0.027)	(0.027)
$p(75)$	-0.088***	-0.087***	0.073***	0.076***
	(0.019)	(0.019)	(0.018)	(0.017)
$p(80)$	-0.117***	-0.117***	0.051***	0.054***
	(0.024)	(0.025)	(0.018)	(0.017)
$p(95)$	-0.219***	-0.218***	-0.025	-0.030*
	(0.041)	(0.040)	(0.017)	(0.016)
Observations	1,909	1,909	1,909	1,909
F-stat	49.01	34.27	24.72	25.05
Region FE	Yes	Yes	Yes	Yes
Year FE	No	No	No	No
Region trends	Quadratic	No	Quadratic	No
Country trend	No	Linear	No	Linear

Notes. We consider formal workers in the period 2001-2018 (with gaps depending on availability of national household surveys). All regressions are unweighted. In regressions of Columns (1) and (2) the dependent variable is $log(p) - log(p50)$ where p is the wage of the indicated percentile. Estimates are the marginal effects of $log(minwage) - log(p50)$, evaluated at its hours-weighted average across regions and years.In regressions of Columns (3) and (4) the dependent variable is $log(p) - log(p90)$ where p is the wage of the indicated percentile. Estimates are the marginal effects of $log(minwage) - log(p90)$, evaluated at its hours-weighted average across regions and years. For 2SLS specifications, the effective minimum and its square are instrumented by the log of the minimum, the square of the log minimum, and the log minimum interacted with the average real log median for the state over the sample. Standard errors clustered at the region level in parentheses. Kleibergen-Paap rk Wald F-statistics are shown. $***p < 0.01$; $**p < 0.05$; $*p < 0.1$.

Source. Own elaboration based on data from SEDLAC.