Minimum Wages and Firm-Level Employment in a Developing Country

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Fredrik Sjöholm*

Department of Economics, Lund University.

The Research Institute of Industrial Economics, Stockholm.

Email: fredrik.sjoholm@nek.lu.se

Abstract

The effect of minimum wages on employment is a matter of debate, and the existing empirical literature contains mixed results. One reason for this is the methodological difficulties involved where changes in minimum wages are endogenous to other important economic changes. To overcome this problem, we examine exogenous changes to local minimum wages in Indonesia between 1989 and 1994. Our natural experiment results from a national policy change: from minimum wages being determined by local guidelines and criteria to minimum wages being harmonized and set according to nationwide criteria. We examine how these changes in minimum wages affect employment, considering the effect both on employment within plants and on exit of plants. Our results show no evidence of an effect of minimum wages on employment in Indonesian plants. One explanation found in the data is that higher minimum wages force plants to increase productivity, which in turn enables them to retain their labor force, despite higher wage costs.

Keywords: Minimum wages; Employment; Plants; Indonesia

JEL Codes: J21; J23; J38

1. Introduction

Minimum wages are increasing across the world (Mayneris, Poncet, and Zhang 2018, 1). This has sparked research interest in how employment will be affected; however, the existing theoretical and empirical literature is inconclusive. This paper examines the effect of minimum wages on employment in a developing country, by exploiting an exogenous change in minimum wages. It will thereby contribute to the understanding of a debated policy—one of particular importance in developing countries, where formal-sector employment can be relatively scarce.

On the one hand, increased minimum wages might facilitate wealth redistribution and improve living standards for the poorest workers. On the other hand, increased minimum wages might lead to a decrease in the number of people employed in the formal sector, and put downward pressure on wages in the rural and informal sectors (Bell 1997, 103). Since the poorest people tend to be engaged in the rural and informal sectors, this can have a negative effect on welfare and increase poverty. The World Bank leans towards this position and has recently advised developing countries to abandon minimum wages (World Bank 2018, 115-119).

Economic theory does not give any clear guidance on the general effect of minimum wages on employment. Minimum wages set above the market clearing wage will, in perfectly competitive markets, lower employment, increase worker surplus and lower firm surplus. However, competitive labor markets tend to be a poor approximation of the situation in developing countries, where search and matching problems, asymmetric information, adjustment costs and nominal rigidities are common. Firms with high bargaining power, which could be caused by such features, will appropriate a relatively large share of surpluses (e.g., Manning 2003; Robinson 1933; Stigler 1946). The introduction of minimum wages may, then, lower firms' profits while leaving employment unchanged.

Nor are the findings of empirical studies consistent, partly because of the methodological difficulties involved. The first generation of empirical papers correlated regional levels of employment with regional minimum wages. A number of such studies have been conducted for Indonesia, the country that is the focus of this paper; most find a negative correlation between province-level minimum wages and formal urban employment (Rama 2001; SMERU 2001; Suryahadi et al. 2003).

A methodological problem is that minimum wages are likely to be affected by economic shocks that also affect employment (Allegretto, Dube, and Reich 2011; Dube, Lester, and Reich 2010; Neumark 2017). Specifically, minimum wages are more likely to be raised in good times and in tight labor markets than in times of high unemployment (Aaronson et al. 2018, 5). Hence, simply correlating minimum wages and employment will lead to biased estimates, because of the endogeneity of the minimum wage variable.

A new generation of papers tries to overcome endogeneity problems by utilizing natural experiments. These papers primarily examine developed countries (in particular, the US) and generally find small or no effects of minimum wages on employment. For overviews of this literature, see Belman and Wolfson (2014), Doucouliagos and Stanley (2009), and Schmitt (2015).

One way to control for the endogenous change of minimum wages is to compare growth in employment in firms within the same market, i.e., firms located geographically close to each other, but subject to different minimum wages. For instance, Card and Krueger (1994) examine employment in fast-food establishments within the same market but on opposite sides of the New Jersey–Pennsylvania state border, and therefore affected by different minimum wages. They find that minimum wage has no impact on employment. Their results have been questioned on the basis of the data used (Neumark and Wascher 2000) and based on the

assumption of common employment trends before the change in minimum wages (Deere and Welch 1995); however, the paper remains highly influential and many studies have followed its approach, although few have focused on developing countries. One exception is Alatas and Cameron (2008), who examine employment in four industries in Indonesia's capital, Jakarta, and in three districts around the city. They find that high minimum wages have a negative impact on employment in small firms, but not in larger firms.

One drawback of the Card and Krueger approach is the difficulty in generalizing from a single case study (Bertrand, Duflo, and Mullainathan 2004; Donald and Lang 2007). In other words, the effect of minimum wages in the examined cases might differ from a general effect (Schmitt 2015, 556).[1]

We will follow an alternative strategy to identify the effect of minimum wages on employment, utilizing exogenous changes taking place in Indonesian districts. In 1989, it was decided that the decentralized, haphazard Indonesian system of minimum wages would be replaced with a national, uniform method for minimum wage setting. As a result, plants present before the policy change experienced varying and exogenous changes in minimum wages. The growth in minimum wage between 1988 and 1994 varied from 3 to 215 percent, with a median growth of 95 percent. We will make use of this policy reform to examine the impact of changes in minimum wages on both growth in employment for different types of workers (production, non-production) and on exit rates of Indonesian plants. This paper relates to a growing literature on firm-level effects of minimum wages in developing countries. Much of this literature studies the effect of changes in regional minimum wages in China (e.g., Fan, Lin, and Tang 2018; Gan, Hernandez, and Ma 2016; Long and Yang 2016). In particular, Mayneris, Poncet, and Zhang

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[1] Several papers have used the Card and Krueger approach, but expanded the examined cases to make the studies nationally representative (Addison, Blackburn, and Cotti 2009; 2012; Dube, Lester, and Reich 2010). Minimum wages seem to affect wages but not employment.

(2018) make an important contribution to the literature by using a 2004 reform of minimum wages in China to set up a difference-in-differences estimation. Treated firms paid relatively low wages before the reform and are therefore argued to be relatively more affected by minimum wages; control firms paid relatively high wages. Mayneris, Poncet, and Zhang (2018) find no effect of increased minimum wages on employment in their sample of large Chinese firms. Their paper is complemented by this study, which takes a different approach and utilizes a different type of reform. Most importantly, in China, minimum wages are set at the discretion of regional authorities and are therefore not exogenous to local conditions. In the words of Mayneris, Poncet, and Zhang (2018, 26), "Each province, municipality, autonomous region, and even district can set its own minimum wage according to local conditions and based on national guidelines." Such "local conditions" include, for instance, local unemployment, productivity and economic development.[2] Another difference in this paper is that we will utilize all available information on minimum wage changes and how they impact employment, rather than using a dummy variable and comparing employment growth before and after a reform. Finally, this study includes all plants with more than 20 employees; this is an important difference from studies on large Chinese firms, since the effect of minimum wages might differ between size classes of firms (Gindling and Terell 2009; Mayneris, Poncet, and Zhang 2018, 4).

We find increased minimum wages to increase average wages. However, we find no effect of minimum wages on employment in Indonesian plants, either for the number of employees in surviving plants or for the exit rates of plants. The results are the same for small and large plants, for plants paying high and low wages, and for both production and non-production workers. We continue by examining possible reasons for why the substantial increase in

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[2] Papers on minimum wages and firm-level effects in other countries that face a similar problem include Del Carpio et al. (2015); Gindling and Terell (2009); Ham (2018).

minimum wages, and its demonstrated effect on average wages in firms, does not have more of an effect on employment. The explanation does not seem to be that plants compensate for the increased wage costs by increasing output prices, by reducing profits, by changing the composition of the labor force, or by replacing labor with capital. However, our results suggest that increased minimum wages increase productivity (perhaps through higher work efforts), which in turn enables firms to keep workforce numbers unchanged.

The rest of the paper is organized as follows: Section 2 discusses minimum wages in Indonesia, Section 3 shows the empirical setup, Section 4 gives the results, Section 5 examines possible explanations for those results and Section 6 concludes the paper.

2. Minimum wages in Indonesia

Minimum wages were highly decentralized in Indonesia in the 1970s and 1980s (SMERU 2001). Different provinces and districts used different criteria to set minimum wages, with the result that the spread in minimum wages was very large—for example, in 1988 the minimum wage in Batam was 350 percent higher than that in Yogyakarta and Central Sulawesi.

In the 1980s, there was domestic and foreign pressure on Indonesia to reform minimum wages. Parts of the population argued that their incomes did not benefit from Indonesia's high growth in GDP, a view picked up by the independent trade unions that emerged (SMERU 2001, 17). Foreign pressure arose as a consequence of an anti-sweatshop campaign involving protests against low wages in the affiliates of multinational firms in developing countries, including Indonesia (Harrison and Scorse 2010).

It was decided in 1989 that minimum wages in Indonesia should be reformed and harmonized to make them comparable across the country. The aim was to set the minimum wage sufficiently

high to sustain an adequate standard of living for a single worker. The benchmark was the cost of living, measured by the cost of a bundle of goods consisting mainly of food and basic staples (Rama 2001, 865). The new minimum wages were to be implemented during a transition period that ended in 1994. Minimum wages increased throughout Indonesia, but they increased at different rates, both because the original levels differed and because of differences in living costs across provinces.
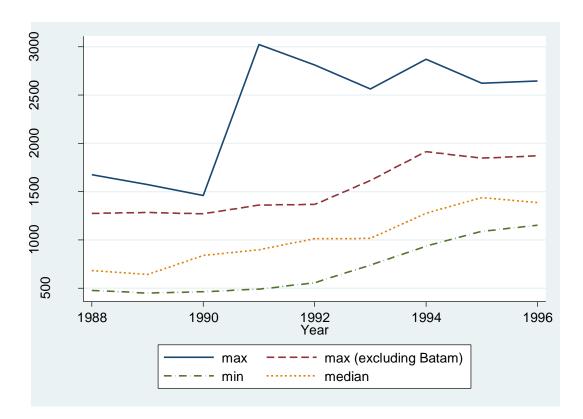
Figure 1. Minimum wages in Indonesia, 1988–1996.

Note: The graph refers to real minimum wages in Indonesian provinces and districts, measured in 1996 Indonesian Rupiah.

The spread and growth of real minimum wages are seen in Figure 1. The high minimum wage in Batam is something of an outlier, and we show the maximum value both with and without

this district.[3] Several conclusions can be drawn. First, there is a strong growth in real minimum wages over the period, and the median minimum wage increased by approximately 103 percent. Moreover, there is a convergence in minimum wages across Indonesia: the ratio of the highest minimum wage to the median declined: from 245 percent to 191 percent if the outlier is included, and from 187 percent to 135 percent if is excluded. The ratio of the lowest minimum wage to the median increased from 70 to 83 percent.

After the reform, minimum wages were updated annually, according to a decree issued by the Minister of Manpower (Del Carpio et al. 2015).[4] A survey of living costs at the provincial level was the base for the changes in minimum wages, and the process was handled by local councils (Rama 2001, 866). Local employees of the Ministry of Manpower dominated the councils, but the central government monitored the implementation. Firms apparently adhered to the new minimum wages (Manning 1998, 117; Wolf 1992, 116), and compliance increased over time (SMERU 2001). Alatas and Cameron (2008, 206–207) argue that the main enforcement mechanism was that firms failing to comply were, in addition to being fined, blacklisted by the Ministry of Manpower; the names of those firms were published in a list of non-compliers. However, compliance was never universal. Rama (2001) finds that in 1993, 15 percent of all urban employees earned less than the minimum wage.

The growth in minimum wages was substantial—for example, higher than the growth in average wages or in GDP (SMERU 2001, 40). Moreover, the increase in minimum wages made them converge towards average wages. Figure 2 shows that the average wage for production workers (the group with the lowest wages and therefore most likely to be affected by minimum

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[3] Batam is an export-processing zone with a strong foreign multinational presence.
[4] The system changed again in the early 2000s as a result of extensive Indonesian decentralization, with the responsibility of setting minimum wages transferred to local governments (SMERU 2001, 1).

wages) went from being around twice as high as the minimum wage in 1988–1989, to 60 percent

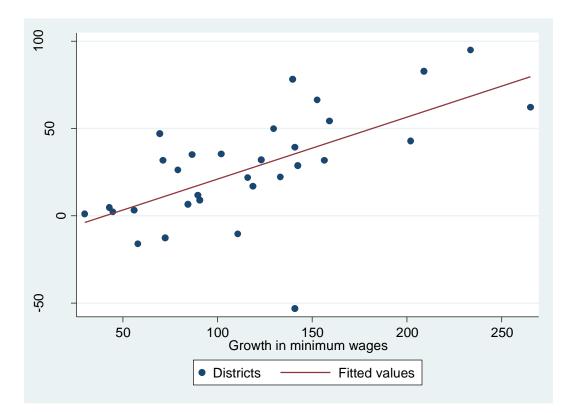higher in 1990, declining further to 11 percent higher in 1996.

Figure 2. The ratio of average production-worker wages and minimum wages, 1988–1996.

An important question is whether the increase in minimum wages has any effect on firms'

behavior—more explicitly, on their wage-setting behavior. As noted above, there is a relatively

large number of firms that pay below the official minimum wage. Such behavior is not

inconsistent with minimum wages having an impact on wage setting, but a more formal analysis

is warranted. One way to go about this is to examine the relationship between minimum wages

and firms' wages. For instance, we would expect high wage growth in districts with high

minimum-wage growth if the minimum wage is taken into account in firms' wage setting. This

is what is observed in Figure 3, where each district's growth in average production-worker

wages is plotted against that district's growth in minimum wages. Generally, districts with high growth in minimum wages have also seen high growth in average wages, but there are exceptions. Note that average wages in Figure 3 are affected not only by changes in existing plants, but also by the entry/exit of plants and by the growth and decline of low- and high-wage industries.[5]

Figure 3. Percentage growth in minimum wages and average production-worker wages by district, 1988–1996.

As an alternative illustration of how minimum wages impact average wages, we have also carried out a simple regression at the plant level between 1988 and 1996, with average

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[5] The obvious outlier in Figure 2 is Central Sulawesi, with a large decline in average wages (caused by growth of the low-wage wood, bamboo and rattan products industry).

production-worker wage as the dependent variable. The results are seen in Table 1. Column 1 shows that a 10 percent higher minimum wage increases average production-worker wage by approximately 6 percent. However, controlling for firm fixed effects (Column 2) and other control variables (Column 3) reduces the coefficient substantially, suggesting that the average production-worker wage increases by about 1.6 to 1.8 percent. As previously mentioned, minimum wages roughly doubled between 1988 and 1994, which corresponds to an increase in average wages of close to 20 percent.

Table 1. The effect of minimum wages on firm-average production-worker wages, 1988–1996.

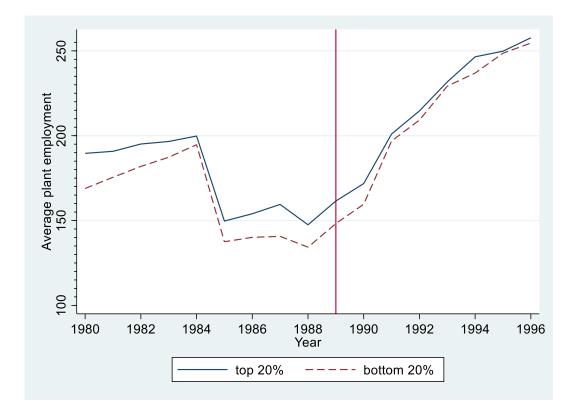|	(1)	(2)	(3)
Minimum wage	0.644***	0.181***	0.164***
	(0.005)	(0.040)	(0.032)
Firm fixed effect	No	Yes	Yes
Year fixed effect	No	Yes	Yes
Control variables	No	No	Yes
No. of observations	127,935	127,935	126,062
R-squared	0.099	0.067	0.113

Note: Minimum wages and firm characteristics are in log forms. See Section 3.1 and Table A1 in the appendix for descriptions of the control variables. Standard deviations are clustered at the province level and shown in parentheses.

*** = statistical significance at the 1-percent level.

Figure 4 gives a first glimpse of the effect of minimum wages on employment within plants. The graph shows average employment in plants located in the quintile of districts with the highest growth in minimum wages (top 20 percent), and in plants in the quintile of districts with the lowest growth in minimum wages (bottom 20 percent). Only plants present in 1988 (i.e., before the reform of minimum wages in 1989) are included, to avoid any effect of entry of new plants that might be affected by the reform. A number of conclusions can be drawn. First, there is no clear difference between the average employment trends in the two groups of districts before the 1989 reform; this is important for avoiding bias in later estimations. Second, the post-

reform growth in employment has been relatively higher for plants in districts with low minimum-wage growth: in 1988 the plant-average number of employees was 134 in districts with low minimum-wage growth and 148 in districts with high minimum-wage growth. Average employment converged until 1996, when it amounted to 255 in districts with low minimum-wage growth and 258 in districts with high minimum-wage growth: growth in employment of 90.3% and 74.3%, respectively.
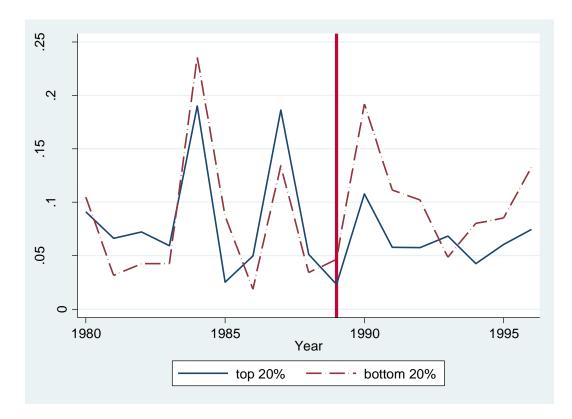
Figure 4. Average plant employment in districts with high and low minimum-wage growth, 1980–1996.

Source: See Section 3.2.

Note: The sample includes only plants that were present in 1988.

Figure 5. Exit rates of Indonesian plants in districts with high and low minimum-wage growth, 1980–1996.

Source: See Section 3.2.

Note: Exit rates are calculated as the number of plants exiting in year *t+1* as a share of total plants in year *t*.

We continue in Figure 5, looking at exit rates of Indonesian plants in districts with high and low changes in minimum wages.[6] Exit rates tend to be high, but vary substantially from year to year. There are no clear differences between exit rates in the two groups of districts before 1989. After 1989, exit rates tend to be lower in districts with high minimum-wage growth. Hence, the results contrast with the tendency to high employment growth in districts with low minimum-wage growth, seen in Figure 4. The next section will examine whether the difference in

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[6] Note that a plant can exit the data if its size falls below 20 employees.

employment growth and exit rates in figures 2 and 3 remains in more rigorous econometric estimations.

1.   Empirical setup

2.1. The sample of firms

As described above, the reform of minimum wages in Indonesia led to very different changes in different districts. The reform took place in 1989; changes in minimum wages are therefore exogenous to plants that had established themselves in the district before 1989, i.e., before the reform. As mentioned above, we will examine the effect of minimum wages on a set of Indonesian plants that were present in 1988, one year before the reform was initiated. We will not include plants that entered after 1988, since entry might be endogenous to minimum wages. Moreover, as it has been argued that changes in minimum wages affect employment with a time lag (Baker, Benjamin, and Stanger 1999), we will examine employment growth and exit rates until 1996, i.e., two years after the reform was scheduled to have been fully implemented.

We will start by examining the effect of minimum wages on employment within plants. Estimations will be carried out on a balanced sample of plants present throughout the period 1988 to 1996. We will then continue to examine the effect of minimum wages on the exit of plants. These estimations will be conducted on an unbalanced sample of all plants present in 1988.[7]

Hence, our framework offers a quasi-experimental way to examine the effect of minimum wages. Moreover, we are examining employment within plants and thereby, unlike some

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[7] To test for robustness, we will also run estimations on different samples of plants.

studies looking at total employment in a district or province, avoiding a possible bias from common labor markets stretching across provincial borders.

2.2. Data

This analysis is based on Indonesian manufacturing data supplied by the Indonesian Central Statistical Office. All plants in the manufacturing sector with more than 20 employees are included in the census. Econometric estimations will employ data from between 1988 and 1996. The number of plants rose from 11,766 in 1988 to 17,836 in 1996. A plant identification code enables us to construct a panel and follow individual plants over time. Information is available for each plant on a range of characteristics, including geographic location (by province and district), wages and employment of production and non-production workers.

Minimum wages at the province and district levels are obtained from Harrison and Scorse (2010). There were 27 provinces in Indonesia between 1988 and 1996. Most provinces had a single minimum wage, but three had different minimum wages in different districts: there were two different minimum wages in Riau, four in West Java and four in East Java. For West Nusa Tenggara and East Nusa Tenggara, minimum wage information is only available from 1990; these two provinces are therefore excluded, as information on minimum wages before the reform is a requirement of the study; moreover, no minimum wage information is available for East Timor, now an independent country but at the time an Indonesian province. These three provinces account for less than one percent of the firm-year observations; excluding them should, therefore, not have any major impact on our ability to draw general conclusions from the results. Accounting for all of the above, we arrive at 31 province-/district-level minimum wages.

3.3 Estimations

The starting point for the estimations is the following expression:

$$y_{ijt} = \beta_0 + \beta_1 MW_{jt} + \beta_2 X_{ijt} + \lambda_i + \lambda_t + \varepsilon_{ijt}, \tag{1}$$

where y_{ijt} is the outcome variable in firm i in district j at time t. We will examine two different outcomes: employment growth and exit. These outcomes are a function of the district minimum wage (MW_{jt}), plant-specific characteristics (X_{ijt}), and firm- and time-specific fixed effects (λ_i, λ_t). Firm characteristics include size (number of employees), capital (measured by capital investments), intermediate goods and foreign ownership. A description of the variables is included in Table A1 in the appendix. The residuals, ε_{ijt}, are clustered at the province level.

3. Results

The effect of minimum wages on growth in employment is shown in Table 2. Three different employment measures are used: total employment (columns 1 and 2); non-production workers (Column 3); and production workers (Column 4). We expect minimum wages to have most effect on employment of production workers, since production-worker wages are lower than non-production-worker wages.

However, minimum wages do not affect employment. The coefficients are positive, suggesting a positive employment effect, but the standard deviations are very large and none of the coefficients on minimum wages are close to being statistically significant. Looking at the control variables, establishments with large amounts of capital and usage of input goods show high employment growth. Foreign ownership is seen to have a positive effect on the number of production workers.

We look next at the effect of minimum wages on exit. The dependent variable takes the value 1 if the plant exits. Hence, a positive coefficient on any of the control variables means that the likelihood of exit increases. The model is estimated as a linear probability model with inclusion of firm and year fixed effects.

Minimum wages have no statistically significant effect on exit rate, as seen in columns 5 and 6. Moreover, the control variables show that large establishments with high amounts of capital and intermediate products are less likely to exit. Foreign ownership has no significant effect.

Table 2. Minimum wages and employment growth in Indonesian plants, 1988–1996.

	Growth in employment				Exit	
	(1)	(2)	(3)	(4)	(5)	(6)
	Total employment	Total employment	Non-production workers	Production workers	Exit	Exit
Minimum wage	0.104	0.083	0.053	0.093	-0.045	-0.037
	(0.074)	(0.059)	(0.037)	(0.066)	(0.030)	(0.025)
Size	--	--	--	--	--	-0.049
						(0.011)***
Capital	--	0.069***	0.067***	0.067***	--	-0.007
		(0.005)	(0.004)	(0.006)		(0.002)***
Inputs of materials	--	0.137***	0.110***	0.143***	--	-0.025
		(0.008)	(0.006)	(0.009)		(0.003)***
Foreign direct investment (FDI)	--	0.042	0.024	0.072*	--	0.031
		(0.027)	(0.070)	(0.037)		(0.018)
Constant	2.960***	-0.192	-1.257***	-0.596	0.831	1.187
	(0.928)	(0.789)	(0.414)	(0.866)	(0.437)	(0.344)***
Firm fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	29,925	29,554	26,086	29,554	61,712	60,099
R-squared	0.123	0.275	0.104	0.226	0.131	0.137

Note: Minimum wages and firm characteristics are in log forms. Standard deviations are clustered at the province level and shown in parentheses.

* = statistical significance at the 10-percent level; ** = statistical significance at the 5-percent level; *** = statistical significance at the 1-percent level.

In addition to the results shown in Table 2, lags of the minimum wage variable were also explored, to allow for time lags between changes in minimum wages and labor force adjustments. No effect of changes in minimum wages on employment or exit could be found.

The estimations above suggest that there is no general effect of minimum wages on employment. However, there could be an effect on some plants, e.g., on relatively weak plants paying relatively low wages; this is examined in Table 3.

Columns 1 and 3 of Table 3 examine the effect of minimum wages on plants that paid relatively low wages in 1988, i.e., plants from the lowest quartile of average production-worker wages. Minimum wages differ between regions, and this is taken into account in columns 2 and 4, where the average production-worker wage in 1988 is related to the 1996 minimum wage within the district. Again, plants in the lowest quartile of average wages are included in the estimations. The results are similar between the two measures and across the four estimations. Minimum wages have no effect, either on the level of employment in surviving plants, or on exit rates.

Table 3. The effect of minimum wages on employment growth and exit in plants with low wages, and in plants with low wages as a share of minimum wages in 1996.

	Growth in employment		Exit	
	Low wage plants (1)	Low wage-ratio plants (2)	Low wage plants (3)	Low wage-ratio plants (4)
Minimum wage	0.016	0.083	-0.002	-0.048
	(0.054)	(0.064)	(0.027)	(0.041)
Control variables	Yes	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
No. of observations	7,349	7,384	13,837	13,967
R-squared	0.223	0.243	0.172	0.169

Note: Minimum wages and firm characteristics are in log forms. See Table 2 for the included control variables. Low wage plants are in the lower quartile of average production-worker wages in 1988. Low wage-ratio plants are in the lower quartile in terms of wages in 1988 as a share of the district minimum wage in 1996. Standard deviations are clustered at the province level and shown in parentheses.

* = statistical significance at the 10-percent level.

In addition to the estimations shown in Table 3, we also followed the related approach of Harrison and Scorse (2010) and constructed a measure of whether the minimum wage is binding to the plant: a minimum wage is defined as binding where the minimum wage in 1996 is higher than the average production-worker wage in 1988. According to this definition, binding minimum wages apply in around 75 percent of the plants. The coefficients were similar to the ones obtained in columns 2 and 4 of Table 3: increased minimum wages do not lead to lower employment or increased exit rates.

Another supplementary investigation concerned the effect of minimum wages on plants of different sizes. On the one hand, smaller plants may fly under the radar of the authorities and be less likely to adhere to official minimum wages (Gindling and Terell 2009); on the other hand, small—relatively weak—plants might be forced to cut workforce numbers when wage costs increase. We therefore examined the effect of minimum wages in small and large plants. Increased minimum wages were found to have no effect on employment and exit rates in any size class of plants.

The above estimations on employment relate to a balanced panel of plants present from 1988 to 1996, with the aim of distinguishing between effects on employment and effects on exit rates. However, it can be argued that having a balanced panel of plants might bias the estimates, as this panel includes only those plants strong enough to survive. Columns 1 and 2 of Table 4, therefore, employ an unbalanced panel of plants. All plants present in 1988 are included. The number of observations increases substantially; however, the effect of minimum wages on employment remains unchanged: minimum wages have no statistically significant effect on employment within plants. In addition to the results shown, an estimation in which the restriction of being present in 1988 was relaxed (i.e., to allow for firms entering during the period) was undertaken; despite the potential endogeneity problem, this did not affect the results.

Although the new rules for setting minimum wages were to be fully implemented by 1994 at the latest, we have included observations until 1996, as it might take time for the new minimum wages to affect employment. However, as this might bias the results (considering that minimum wages in 1995 and 1996 were calculated in the same way across Indonesia), in columns 3 to 6 of Table 4 we confine our sample to the years until 1994. Again, minimum wages have no effect on employment, either on the level of employment within plants (columns 3 and 4), or on exit rates (columns 5 and 6).

Finally, minimum wages in Batam are, as previously stated, much higher than in other parts of Indonesia. Additional estimations excluding Batam were carried out, to see whether this outlier is important for the results. It is not: results from estimations with and without Batam do not differ in any important respect.

Table 4. The effect of minimum wages on employment growth and exit in an unbalanced sample, and with time period shortened until 1994.

	Growth in employment				Exit	
	(1) Unbalanced panel	(2) Unbalanced panel	(3) Until 1994	(4) Until 1994	(5) Until 1994	(6) Until 1994
Minimum wage	0.073 (0.074)	0.057 (0.060)	0.061 (0.071)	0.045 (0.058)	-0.030 (0.031)	-0.030 (0.026)
Control variables	No	Yes	No	Yes	No	Yes
Firm fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	70,232	68,500	32,732	32,195	50,244	48,624
R-squared	0.048	0.169	0.075	0.194	0.119	0.120

Note: Minimum wages and firm characteristics are in log forms. See Table 2 for the included control variables. Standard deviations are clustered at the province level and shown in parentheses.

5. In search of an explanation

To summarize the above estimations—increased minimum wages increase average wages; increased wages do not seem to be associated with any negative effect on employment. One reason why we do not find more of an effect on employment could be that plants are able to balance increased wage costs (i.e., minimum wages) with increased prices on their produced goods. This hypothesis is examined in columns 1 and 2 of Table 5. Our measure of prices is very crude: prices are measured at the five-digit level of the International Standard Industry Classification (ISIC), and therefore do not vary over districts; however, since industries tend to be geographically concentrated, it is still possible that such a price index could be affected by firms' responses to changes in regional minimum wages. Bearing in mind the major constraints of this data, we can see that minimum wages do not seem to affect output prices: the coefficient is negative rather than positive, but only (marginally) statistically significant in one of the two estimations.

Another possibility is that plants lower their profits as a result of increased minimum wages, as found by Draca, Machin, and Van Reenen (2011) in a study on British firms. This hypothesis is rejected in columns 3 and 4 of Table 5, where the firm-level profit margin is measured as value added minus wages, as a share of value added. In fact, profits seem to increase with increased minimum wages: a 10 percent increase in minimum wages increases profits by between 0.7 and 1 percent. One possible explanation is that plants react to increased costs by changing their production processes, which increases productivity. Plants might keep their labor force, despite increased labor costs, if output per worker also increases. Mayneris, Poncet, and Zhang (2018) found minimum wages to increase productivity in Chinese firms, whereas Álvarez and Fuentes (2018) found that increased minimum wages led to lower firm productivity in Chile. We examine the effect on productivity in columns 5 and 6 of Table 5, where labor productivity (measured as value added per employee) is the dependent variable, and we control

for inputs of materials and capital (Column 6). Increased minimum wages increase labor productivity: a 10 percent increase in minimum wages increases productivity by between 1.6 and 1.8 percent. Our result is, hence, similar to findings from China (Mayneris, Poncet, and Zhang 2018).

Yet another possible reason why increased wages are not associated with any general negative effect on employment is that plants facing increased minimum wages will use relatively more capital and relatively less labor. In other words, the relative amount of capital (capital intensity) might change, even if the above estimations on employment show that the absolute amount of labor is unaffected. This is examined in columns 7 and 8 of Table 5, where capital intensity is the dependent variable; increased minimum wages have no effect on capital intensity.

Another possibility is that plants will use less unskilled labor (the type of labor most affected by increases in minimum wages) and more skilled labor. Unfortunately, the only information we have on the skill level of employees concerns numbers of production and non-production workers;[8] this information is used to examine whether minimum wages have an effect on workforce composition, i.e., relative numbers of production and non-production workers (columns 9 and 10 in Table 5). The dependent variable is the share of total employment consisting of non-production workers. Again, we find no effect of increased minimum wages: the coefficients are small and statistically insignificant.

The insignificant effects of minimum wages on capital intensity (columns 7 and 8) and on the relative numbers of production and non-production workers (columns 9 and 10) suggest that the increased productivity (columns 5 and 6) is accomplished without any major changes in technology, but by improving efficiency within existing production. The literature offers

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[8] Data on the shares of employees with different levels of educational are available, but only for later years (Lipsey and Sjöholm 2004).

different explanations for why increased wages might increase labor productivity, and even increase labor productivity more than proportionally. This literature, often categorized as theories on "efficiency wages," shows that worker productivity depends (positively) on wages. These theories can be distinguished as related either to the ability of workers to put in more effort, or to the desire of workers to do so.

Good nutrition and health increase ability to work. Hence, well fed and healthy workers are more productive than hungry and unhealthy workers. This is an issue of potentially large relevance in poor/developing countries, a category to which Indonesia belonged during the studied period. Nutrition and health are, in turn, dependent on income. Increased minimum wages can therefore improve the nutrition and health of workers, and, consequently, labor productivity (Leibenstein 1957).

Increased minimum wages also make it relatively more costly for workers to shirk and run the risk of losing employment (Shapiro and Stiglitz 1984). Alternative occupations in developing countries are often in the informal or rural sectors, which are characterized by low wages. As a result, increased minimum wages will reduce shirking and increase work efforts, thereby increasing labor productivity.

Table 5. The effect of minimum wages on price, profit, productivity, capital intensity, and non-production workers as a share of total employment, 1988–1996.

	Output price		Profit margin		Productivity		Capital intensity		Non-production workers (share)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Minimum wage	-0.025	-0.027*	0.073**	0.095***	0.163***	0.177***	-0.032	-0.039	-0.005	-0.006
	(0.016)	(0.016)	(0.031)	(0.030)	(0.043)	(0.042)	(0.036)	(0.036)	(0.008)	(0.008)
Control variables	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Firm fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	26,818	26,648	29,362	28,994	29,925	29,554	29,554	29,554	29,925	29,554
R-squared	0.354	0,355	0.013	0.390	0.0362	0.456	0.914	0.917	0.01	0.02

Note: Minimum wages and firm characteristics are in log forms. The included control variables are: in columns 2, 4 and 10, foreign direct investment (FDI), capital and inputs of materials; in column 6, FDI, capital intensity (capital over employment) and material intensity (inputs of materials over employment); in Column 8, FDI and material intensity. Standard deviations are clustered at the province level and shown in parentheses.

* = statistical significance at the 10-percent level; ** = statistical significance at the 5-percent level; *** = statistical significance at the 1-percent level.

4. Concluding remarks

The effect of minimum wages on employment has received considerable attention from academics and policy makers. The issue is of particular importance in low-income countries, where expanding employment in the modern sector is key to economic development. The importance of the issue demands empirical evidence. However, methodological difficulties have caused many previous papers to experience a potential endogeneity problem, i.e., increased minimum wages result from changes in for instance employment or economic growth.

We have examined the effect of minimum wages on employment in a developing country and by using exogenous changes in minimum wages. We find no effects of minimum wages on employment, either on the level of employment in surviving firms, or on the exit rates of plants. Our results are robust to changes in specifications and samples. Our results contrast with those of most previous studies on developing countries, but are in line with recent studies on developed countries, where the endogeneity problem has been solved. Moreover, our results are similar to those of Mayneris, Poncet, and Zhang (2018) on China, despite the differences between countries being studied, methodological approaches and samples of firms.

One possible explanation for our findings is that plants seem to respond to increased minimum wages by increasing productivity. In other words, an increased labor cost is balanced by increased output per worker, allowing firms to retain their workforce.

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Appendix

Table A1. Descriptive statistics, 1988–1996.

Variable	Description	Mean	Standard deviation	Minimum	Maximum
Minimum wages	Minimum wage (in Rupiah) at the province/district level.	1075431	400375.9	449539.1	3021576
Exit	Takes the value 1 if the firm exits.	.0917825	.2887207	0	1
Employment total	The total number of workers.	187.8763	527.673	9	23516
Employment: production workers	The number of production workers.	153.8479	419.9852	1	21912
Employment: non-production workers	The number of non-production workers.	34.02844	160.589	0	11045
Non-production workers (share)	Non-production workers as a share of total employment.	.1576251	.1502936	0	.9285714
Wage (production workers)	Average production-worker wage (in Rupiah).	1440154	1639573	3213.638	1.25e+08
Foreign direct investment (FDI)	Foreign-owned firms (above 0% foreign ownership).	.3573823	.479231	0	1
Capital	Value of capital investments (in Rupiah).	4.83e+08	5.14e+09	0	4.62e+11
Materials	Value of inputs (in Rupiah).	1.95e+09	1.22e+10	11276.44	1.10e+12
Capital intensity	Capital investments (in Rupiah per worker).	1501401	5467043	0	3.02e+08
Material intensity	Inputs of materials (in Rupiah per worker).	8225575	2.90e+07	461.249	1.83e+09
Output price	The output price (index) at an industry level.	190.6702	58.57417	76.15001	792.8702
Profit margin	Value added minus wages as a share of value added.	.3560539	.1868802	.0003209	.997202
Productivity	Value added per worker (in Rupiah).	3917911	1.28e+07	606.9065	8.28e+08