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# Does the Minimum Wage Affect Employment?

## Evidence from the Manufacturing Sector in Indonesia

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## Abstract

Using survey data from the Indonesian manufacturing industry, this paper investigates the impact of minimum wage on employment and wages offered by Indonesian manufacturing firms from 1993 to 2006. It shows that the estimated effects of minimum wage on employment are positive within a province (i.e., with province fixed effects), but negative within a firm (i.e., with firm fixed effects), indicating the importance of using firm panel data to reduce the endogeneity bias in estimates. It finds significant heterogeneous effects of minimum-wage changes on employment. The employment effects of minimum wages are significant and negative among small firms and less educated workers, but not among large firms and workers with high school education and above. The negative employment impact is more severe for non-production workers than for production workers. The analysis also shows that the minimum wage disproportionally affects women: most of the non-production job losses are experienced by female workers. Lastly, the paper finds that the minimum wage is more correlated with the average wage of small firms than that of large firms, suggesting that minimum wages are more binding in small firms.


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Produced by the Research Support Team

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## *Evidence from the Manufacturing Sector in Indonesia*

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JEL: J08, J16, J20, J31, L60
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## I. Introduction

Most countries around the world have some form of minimum wage. Policymakers have often argued that rises in the minimum wage increase the earnings of low-income workers, and therefore can be used as a tool to reduce poverty and inequality. In some situations (e.g. with monopsonistic firms), a moderate rise in the minimum wage can increase the earnings of low-income workers without causing job losses. Some also argue that wage increases can improve workers' productivity (Levine, 1992; Raff and Summers, 1987) because they lead to increases in work effort, reductions in job turnover and more on-the-job training (Katz, 1987). However, some empirical findings have shown that higher minimum wages lead to lower employment.

Theoretically, whether changes in the minimum wage lead to higher employment or job losses depends on where existing wages are set relative to workers' marginal product of labor (MPL). If existing wages are set much below the MPL, as in the case of a monopsonistic firm, a moderate increase in minimum wages can benefit workers without leading to job losses, because the firm still profits from hiring workers, even at a higher wage rate (Rebitzer and Taylor, 1995). On the other hand, in the case of a competitive labor market where equilibrium wages equal the MPL, a minimum wage increase will lead to job losses.

Past literature on minimum wage tends to focus on youth workers and the fast-food industry in developed countries, where minimum wages matter most. As many developing countries are considering adopting minimum wage laws or reforming their existing minimum wage systems, it is important to investigate whether minimum wage changes affect employment in a developing country context. The labor market conditions in developing countries are fairly different to those in developed countries. They are typically more segmented, filled with less educated labor, characterized by a high ratio of male-to-female workers, and dominated by small and informal firms. Changes in minimum wages in a developing country can potentially lead to significant heterogeneous effects on a large fraction of the labor force.

This paper uses firm-level data from the Indonesia industry survey (SI) to investigate the impact of minimum wages on employment and wages in the manufacturing sector, differentiating between the effects on workers by production[2] and non-production type, education level, and gender. One may expect the presence of differential wage and employment

[2] Production workers, defined by Indonesia industry survey, as "workers who work directly in the production process, or activities connected with the production process, from the time materials enter the factory until the final products are sent out of the factory, for example, foreman supervising the production process, driver of a forklift in the factory, workers of working in the processing of goods etc"

effects on different types of firms and workers. Yet, there is limited evidence of whether differential effects are present in the manufacturing sector, which typically takes a large share of formal sector employment among poorer countries. Understanding how minimum wage changes affect different types of workers not only informs policymakers regarding the extent of market power that firms may have and the potential social cost of minimum wage laws, it also provides policymakers information on whether additional policy options are needed to assist specific groups when a uniform minimum wage is introduced.

The Indonesian data are particularly appropriate for the study of the impacts of minimum wage changes on wages and employment in manufacturing by types of workers and firms, as Indonesia has a long history of minimum wage law and has substantial variations of minimum wage changes over time and across provinces. Furthermore, Indonesia's manufacturing census data have broad coverage, tracked firms over time and contain a wide range of detailed information. This data advantage permits us to perform firm fixed effects regressions to estimate the impacts of minimum wage changes. The use of firm fixed effects regressions is superior to the use of province fixed effects regressions, as the Indonesian central and provincial governments set provincial minimum wage changes taking into consideration the labor market conditions of provinces and estimates based on province fixed effects regressions may suffer from a greater degree of endogeneity bias. The use of firm-level fixed effects potentially removes unobserved factors that jointly influence employment in the province and the level of the minimum wage and exploits only variation in employment within firms.

We find that minimum wage changes had significant negative effects on employment. Our estimates show that regressions including only province and year fixed effects suffer from significant upward bias, resulting in positive correlation between minimum wage changes and employment. In contrast, regressions that include firm and year fixed effects show a negative relationship between minimum wage changes and employment. The results highlight the importance of using firm panel data to reduce the endogeneity bias in estimates. We also show heterogeneous effects of minimum wage changes on employment. In particular, the employment effects of minimum wages are significant and negative in small firms and among less educated workers, but not in large firms and among workers with high school education and above. These findings are consistent with the theoretical predictions that small firms and less educated workers have little market power and are more responsive to minimum wage changes. We also find that when minimum wages are raised, job losses are more severe for non-

production workers. Non-production employment is more adversely affected by increases in minimum wages perhaps because wages for non-production workers are closer to their MPL. It might be the case because firms tend have less market power in competing for low-skilled non-production workers, who can work in most industries. The analysis also yields clear gender differentiated effects of the minimum wage: most of the non-production job losses are experienced by female workers. Lastly, the paper also finds that minimum wages are more correlated with average wages in small firms than in large firms. This indicates that wages in small firms are more binding, and an increase in minimum wage helps to increase the average wage in small firms.

## II. Literature Review

There is an extensive literature on the impact of minimum wages on employment.[3] Earlier studies in the United States provide evidence on positive or no effect of minimum wage increases on employment. For example, Katz and Krueger (1992) find that employment in Texas fast food industry increased following the Federal minimum wage hike in 1991 and argue that the result is consistent with fast food restaurants having monopsonistic power. Card and Krueger (1994) exploit a differences-in-differences approach to examine the effect of the minimum wage increase in 1992 on employment in fast food restaurants in the state of New Jersey relatively to those in the neighboring state of Pennsylvania and find no effect of the minimum wage hike on employment. As the restaurants surveyed are near the state border and facing similar economic conditions, except the change in minimum wage, unobserved economic conditions affecting both employment and minimum wage laws are differenced out from the estimated effect.

More recent US evidence indicates a small negative effect of minimum wage changes on employment. Neumark and Wascher (2000) reanalyze Card and Krueger's (1994) seminal work using payroll data and show a small decrease in employment in New Jersey relative to Pennsylvania after the 1992 minimum wage increase. Similarly, the study by Burkhauser, Couch and Wittenburg (2000) reassess the sensitivity of US studies on the effects of minimum wage on employment that rely on state-level panel data and show significant and modest negative effects of minimum wages on teenage employment. In particular, they demonstrate that past findings on the insignificant effect of minimum wage on employment are sensitive to the inclusion of

[3] See Neumark and Wascher (2008) for a comprehensive overview.

year fixed effects, which captures the variation in federal minimum wage and eliminates virtually all of the variation in the minimum wage changes. Past US studies highlight the importance to control for unobserved economic conditions affecting both employment and minimum wage changes, to find variation in minimum wage changes at the sub-national level, and to use relatively high quality data to minimize measurement errors.

There is a growing volume of empirical studies examining the impacts of minimum wages on employment in developing countries. The evidence tends to indicate negative effects of minimum wage hikes on employment, especially in Latin American countries where the minimum wage level is high relative to the overall wage distribution (Kristensen and Cunningham, 2006). Bell (1997) finds negative impacts of minimum wage rises in Colombia, where the minimum wage was close to the average wage, and no impacts in Mexico, where the minimum wage was way below the market clearing. Maloney and Nunez (2004) find a negative employment effect in both formal and self-employed sectors in Colombia. Ginding and Terrell (2007) also report a negative impact on employment in the formal sector in Costa Rica. Similarly, Nguyen (2011) finds that minimum wage increases led to a decrease in formal employment among low-wage formal sector workers in Vietnam.

The issue of minimum wage in Indonesia has also received considerable attention. Rama (2001) uses repeated cross-section of labor force surveys (*Sakernas*) to create province-level panel data and assess the impact of minimum wages on employment. He finds a negative employment effect for small firms (those with less than 20 workers) but a positive effect for medium-sized and large ones. Islam and Nazara (2000), Suryahadi et al (2003), and Pratomo (2011) also use *Sakernas* to generate province-level panel data and find negative effects of minimum wages on employment. For instance, using 1988-1999 data, Suryahadi et al. (2003) estimated the elasticity of employment to minimum wage to be roughly -0.11. However, since central and provincial governments set minimum wages taken into consideration the labor market conditions of provinces, estimates based on province-level panel data are likely to suffer from the endogeneity bias discussed above.[4] More recently, Magruder (2011) use district-level panel data to implement a difference in spatial differences estimation strategy to address the potential endogeneity bias of district fixed effects analysis and show positive effects of the rise

[4] An exception is Indonesia Jobs Report (2010) where they analyze employment using individual level data, rather than provincial aggregates in province fixed effects regressions. They also find that minimum wages tend to decrease industrial and formal sector employment.

in minimum wages on employment in some sectors—though not in tradable manufacturing—in Indonesia in the early 1990s.

Several studies also use firm data to study the relationship between wages and employment in Indonesia. Alatas and Cameron (2008) adopt Card and Kruger's (1994) differences-in-differences approach to study the effects of minimum wage changes between 1990 and 1996 on the employment of production workers in clothing, textiles, footwear and leather firms in greater Jakarta, potentially addresses the problems associated with the use of province fixed effects regressions. They find a negative employment impact of minimum wages on production workers in small firms, with an elasticity estimate in the range of -0.31 to -0.54, but not in large firms. Harrison and Scorse (2010) examine the impact of anti-sweatshop campaigns on real wage increases in foreign-owned, exporting firms in textiles, footwear and apparel sectors and find that a 10% increase in real minimum wages reduces production worker employment by 1.2%, on average. They also find reduced investment, falling profits, and increased probability of going out of business (at least in the formal sector) for smaller firms, but not for large firms. Hallward-Driemeier et al (2010) use both firm level and labor force data to show that minimum wage increases reduce gender wage gaps for workers who completed junior high school, but that the gap worsens for workers who did not complete primary school.

This paper extends existing literature on the effects of minimum wage changes on employment in several ways. First, the paper shows that firm fixed effects regressions significantly reduce the extent of endogenous bias that province fixed effects regressions suffer from. Second, by focusing on both production workers and non-production workers, this paper sheds light on issues of policy significance. There is a perception that non-production workers are unaffected by minimum wage changes because they are typically highly-skilled and highly paid workers, such as managers and researchers, whose wages are significantly above the minimum wage. In fact, a significant portion of non-production workers in the manufacturing sector actually have low education and perform mainly basic tasks. Moreover, although non-production workers account for a smaller fraction of the manufacturing labor force, they do account for a much larger fraction in the service sector (and hence in the entire economy), thus making the findings from this paper relevant to the economy as a whole. Third, the analysis on employment of workers by educational attainment and gender informs policymakers who set minimum wage levels with the objective to benefit poorer, often low skilled workers.

One caveat worth highlighting is that by looking at manufacturing firms, this paper focuses on formal manufacturing employment, and not on employment in the informal sector, which accounts for approximately 63% of the employed workforce in Indonesia (Indonesia Job Reports, 2010). Previous studies show that indeed, workers who lose their formal employment do not necessarily become unemployed but rather they are likely to go into the informal sector (either in self-employment or working in an informal firm) (Loayza, Oviedo, Serven, 2005; Perry et. al, 2007; Nguyen, 2011). In Indonesia, there are potentially labor movements and other types of interactions between formal and informal sectors. For instance, using district-level data, Comola and de Mello (2011) find that an increase in minimum wages is associated with job losses in the formal sector and job gains in the informal sector[5]. A second caveat is that the analysis does not take into account firms that exit (for any reason, including higher minimum wages) thus potentially underestimating the negative impact of minimum wages. Similarly, we do not take into account new or entering firms, and hence the results do not fully reflect any "multiplier" effects that minimum wage increases can generate in the labor market. The multiplier effect refers to the possibility that with higher wages brought about by the minimum wage rise will translate into higher income and higher purchasing power for workers benefited. Thus, the increase can generate higher demand for other goods and services (Magruder, 2011). However, because the added employment of new firms is not captured in the panel regression framework, the multiplier effect cannot be entirely captured in this analysis.

## III. Context and the Minimum Wage Institution

Indonesia is the world's fourth most populous country with a population of 238 million. It is also the largest economy in South East Asia, the world's 18th largest by nominal gross domestic product (GDP), and a member of G-20 major economies. Despite its on-going economic growth, Indonesia is still considered a lower middle income country, according to the World Bank classification, and has nominal GDP per capita of US$ 2945 in 2010.

Men are largely overrepresented in the Indonesian labor force. Female labor participation in 2009 is 52%, and women are disproportionately represented amongst the lowest paid in Indonesia (Cuevas et.al. 2009). The Indonesian workforce is increasingly becoming more educated, but is still relatively less so compared to neighboring countries (World Bank, 2010). For example, Indonesia's overall net secondary enrollment rate was 59 percent in 2006,

[5] Similar evidence is also found for Indonesia, see Indonesia Jobs report, by the World Bank 2010.

compared to 61 percent in Vietnam in 2000, 69 percent in Malaysia in 2005, and 71 percent in Thailand in 2006. Similarly, its tertiary enrollment rate is also low by regional standards. In the manufacturing sector, the focus of this paper, the vast majority of the workforce only has at most senior high school education (Indonesia Industry Survey).

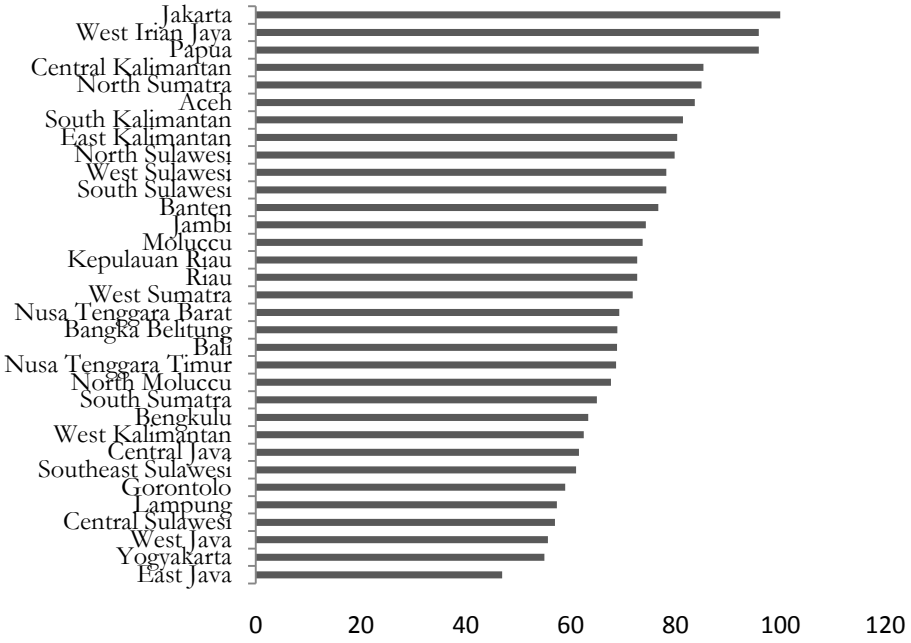
The minimum wage legislation in Indonesia was first introduced in the early 1970s for those working in mainly urban areas. According to the 2003 Law on Manpower Affairs regulation, minimum wages were established solely to meet the adequate living standard needs of a single worker, and the adequate living standard should be derived from a yearly survey conducted at a provincial level.[6] The law also establishes, in general terms, that when defining the minimum wage, consideration should be given to productivity and economic growth, as well as to the condition of the labor market, the level of economic development, income per capita, and the capacity to pay and sustainability of employers.

Different minimum wages are set for different provinces to take into account their differences in living costs. Most provinces had just one level of minimum wage, with a few exceptions. Some provinces have different minimum wages set for different districts, or different sectors of the economy. Until the end of 2000, provincial minimum wages were established centrally by a decree issued by the Minister of Manpower. To determine minimum wage levels, the minister received recommendations from provincial governors, who in turn took advice from provincial councils, made up of representatives of employees, employers and the government. In practice, employee and employer representatives were usually government appointees (Suryahadi, 2003). Since 2001, the setting of minimum wage levels was transferred to governors and some cases mayors, who also receive recommendations from councils in their respective areas.

There is substantial variation in minimum wage levels across provinces and over time. For example, Figure 1 shows normalized real minimum wages across 33 Indonesia's provinces in 2006. Note that the real minimum wages are calculated as the nominal wages divided by *provincial* CPI, hence they already reflect provinces' different living costs. Nevertheless, the differences between the real minimum wages across provinces remain large; for instance, the level in Jakarta, the capital and largest economic center, is twice as high as the level in East Java.

[6] Law on Manpower Affairs 2003 articles 88 and 89. *Regulation regarding implementation and component of achievement scale on adequate living needs (ALN) articles1 and 3*. cited in ILO (2011a).

***Figure 1: Normalized real minimum wages across Indonesian provinces in 2006***




Source: Indonesia Statistical Agency (BPS)
Note: Real minimum wage in Jakarta normalized to 100

Minimum wages in Indonesia also vary markedly over time. Figure 1 shows the evolution of nominal and real minimum wages in Jakarta from 1993 to 2006. The interest in using minimum wage as an instrument to affect workers welfare grew over time, and in late 1980s, after pressure from international groups about low wages, workers exploitation and labor standards in Indonesia, minimum wage levels began to rise. As reported by Sutyahadi et al. (2001), in the first half of the 1990s minimum wages tripled in nominal terms and more than doubled in real terms in a period of five years. During the second half of the 1990s, nominal minimum wages continued to increase but not in real terms due to high levels of inflation. In 1998, the real minimum wage declined as much as 30% due to the financial crisis, although the nominal wage steadily climbed (see Figure 2). After the crisis, minimum wages re-emerged as a key element of economic and social policies, with sharp increases in nominal minimum wages. By 2001, the real wage was back at the pre-crisis level, but since then has remained flat.

***Figure 2: Normalized nominal and real minimum wages in Jakarta, 1993-2006***




Source: Indonesia Statistical Agency (BPS)
Note: Nominal and real minimum wages in Jakarta in 1993 are normalized to 100

Compared to other growing economies in East Asia, the monthly minimum wage relative to the countries' GDP per capita is higher in Indonesia than in Thailand or China[7], two competing economies. Both Vietnam and the Philippines have higher ratios, while Malaysia still has no statutory minimum wage.

## IV. Data and Descriptive Analysis

The main data source used in the analysis is the annual manufacturing census survey of Indonesia (*Survei Industri* or SI). It was collected and compiled by the Indonesian government's statistical agency (*Badan Pusat Statistik* or BPS). The survey includes all manufacturing firms that have more than 20 employees, and the multi-modular survey captures detailed questions about the firm and its operation, including output, intermediate inputs, employment, capital, ownership and balance sheet.[8] The data used in this paper range (inclusively) from 1993 to 2006. The number of observations varies from about 18,000 firms in 1993 to about 29,000 firms in 2006.[9] In terms of employment, the survey divides a firm's employment into those of production and of non-production workers, along with the total wage bill for each category, from which it is easy to calculate average wages for production workers and non production workers. For four years 1995, 1996, 1997 and 2006, the survey also has information about the

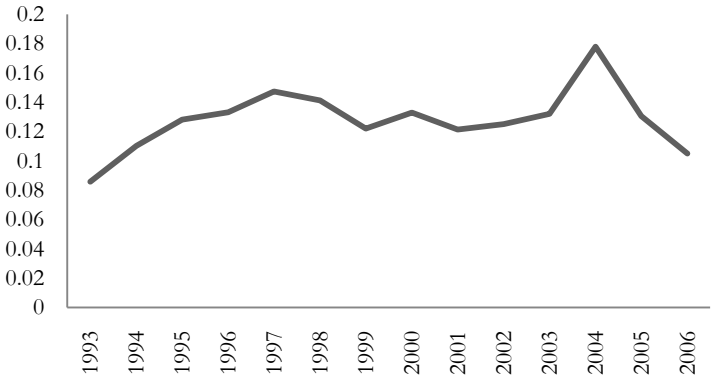
[7] It is worth noting that the minimum wage in China has been increasing rapidly in recent years and the ratio may be the same or higher than Indonesia in 2012.
[8] The SI data track establishments, rather than firms. A recent PBS study has suggested that less than 5% of establishments in the Manufacturing Census are owned by a multi-establishment firm (see Hallward-Driemeier et al, 2010 for a discussion). For this reason, we will use the terms "firms" and "plants" interchangeably throughout the paper.
[9] Since we utilize panel data with firm fixed effects, we drop firms that appear only once during the sampled period.

exact educational compositions of its workforce, allowing us to perform analysis on the effects of minimum wage changes on the educational composition of the workforce. Minimum wage data are obtained from BPS. A summary table of variables used in the paper is in the Appendix.

The paper also uses, albeit selectively, data derived from the National Socio-Economic Survey (*Susenas*). The *Susenas* is an annual multi-purpose household level survey that collects individual and household level information, including wages as well as various socio-economic, demographic, and labor characteristics of individuals and households. Comparable waves of this survey are available; however, given that the analysis presented in this paper focuses on firms, the data from *Susenas* is only used to better understand the results and contextualize the discussion.

The analysis starts by looking at how high minimum wage is relative to workers' wage rates. In order to do so, ideally one would like to have detailed wage distributions within a firm. However, since the data only provides the numbers of production and non-production workers and their respective wage bills, the calculation focuses on within firm average wages. Here minimum wages are compared to the average wage ratio across firms. Figure 3 shows the country average of the minimum wage- firm average wage ratio. It fluctuates from about 0.085 in 1993 to about 0.177 in 2006.

***Figure 3: Minimum wages relative to within firm average wages, 1993-2006***

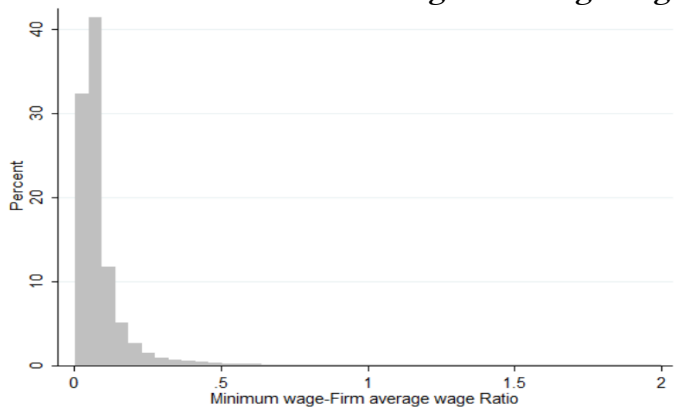



Source: Indonesia Industry Survey (SI)

An in-depth look at minimum wage to firm average wage ratio across firms in 2006 reveals that for the majority of firms, the ratio is at the low end (Figure 4). About 76% of all firms have a ratio less than 0.1 (i.e. the minimum wage is less than 10% of the firm's average

wage). For less than 1% of them, the minimum wage is larger than the firm's average wage and compliance with minimum wage law might be an issue.

***Figure 4: Firm distribution of minimum wage to average wage ratio, 2006***




Source: Indonesia Industry Survey (SI)

This paper focuses on the asymmetric impacts of minimum wages on small firms and large firms. Following Alatas and Cameron (2008), small firms are defined as firms that always have 150 workers or less, and large firms are those that always have more than 150 workers. In the data, there are about 27,000 small firms and about 4,500 large firms that appear in the time period evaluated (1993-2006). Small firms and large firms in Indonesia have fundamentally different characteristics. Small firms are overwhelmingly domestic[10], have lower productivity levels, lower wages, and are slightly more concentrated in labor-intensive manufacturing[11] (see Table 1).

***Table 1: Firm characteristics in 2006***

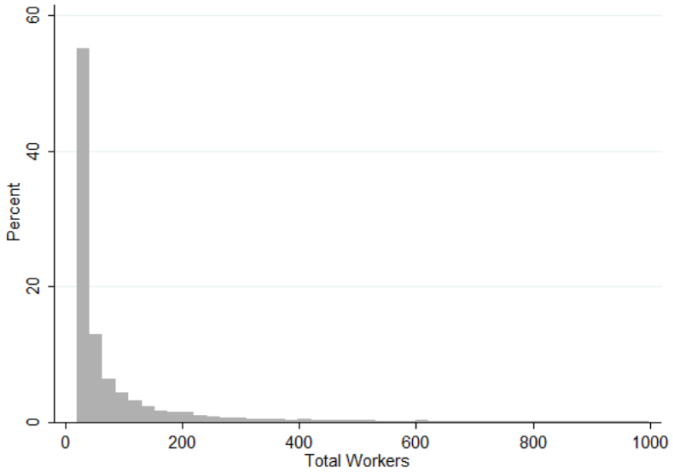
| | Number of firms | Foreign firms (%) | Real value-added per worker (normalized) | Real wage per worker (normalized) | Labor-intensive manufacturing (%) |
|---|---|---|---|---|---|
| Small firms | 24079 | 3.71% | 50.09 | 67.6 | 73 |
| Large firms | 5302 | 23.35% | 100 | 100 | 64 |

Source: Indonesia Industry Survey (SI)

[10] Domestic firms are defined as those that have 10% or less owned by foreigners.
[11] Labor-intensive manufacturing firms are defined as firms in textiles, leather, footwear, wood products and furniture.

Figure 5 reveals that the distribution of firm size in Indonesia is skewed to the right: a vast majority of firms are small. In 2006, about 50% of firms have only 20-40 workers. Out of 29,000 firms, there are only 802 firms with more than 1,000 workers and 38 firms with more than 5,000 workers.

***Figure 5: Distribution of firm size, 2006***




Source: Indonesia Industry Survey (SI)
Note: Only firms with fewer than 1,000 workers are included.

## V. Empirical Strategy

The analysis focuses on four outcome variables of interest: employment of production workers, employment of non-production workers, changes in workers' educational composition, and real average wages. We exploit the firm panel data to estimate a set of province fixed effects and firm fixed effects regressions. In addition to province fixed effects or firm fixed effects, all regression specifications include year effects to capture time varying national macroeconomic factors, such as changes in interest rates, exchange rates, and financial crisis, which influence the economic environment in which all firms operate.

The province fixed effects regressions take the following form:

$$\log(Y_{ijt}) = \alpha_j + \alpha_t + \beta \log(MinWage_{jt}) + \beta'_X X_{ijt} + \varepsilon_{ijt} \quad (1)$$

$\text{Log}(Y_{ijt})$ is the natural log of the outcome of interest of firm $i$ in province $j$ in year $t$. $\text{Log}(\text{MinWage}_{jt})$ is the log of real minimum wage in province $j$ in year $t$. The coefficient $\beta$ measures the elasticity of the outcome of interest with respect real minimum wage. $X_{ijt}$ is a set of time-varying firm specific control variables. $a_j$ is a set of province fixed effects, while $a_t$ is a

set of year fixed effects.[12] With the set of province fixed effects included, regression equation (1) implies that we are using the variation of minimum wages within provinces to identify $\beta$.

The firm fixed effects regressions take the following form:

$$\log(Y_{ijt}) = \alpha_i + \alpha_t + \beta \log(MinWage_{jt}) + \beta'_X X_{ijt} + \varepsilon_{ijt} \quad (2)$$

The difference between regression specification (1) and regression specification (2) is that the latter includes a set of firm fixed effects $a_i$, rather than province fixed effects.

The firm fixed effects specification assumes that a province's minimum wage does not respond to changes in employment and wage payment of a particular firm, and the firm can only vary its employment behavior in response to changes in the minimum wage in the province. This assumption is more likely to hold with firm level fixed effects. This is so because of the large heterogeneity among firms, and the near impossibility for one or even a few minimum wage levels to be set in response to every single firm's employment behavior. Thus one can safely assume that the deviation of an average firm's employment behavior at a particular time is unlikely to affect the deviation of the provincial minimum wage level.

The endogeneity bias is likely more severe when only province fixed effects are included. The deviation of the overall employment within a province from its time average is highly likely to influence the deviation of the provincial minimum wage from its time average. In other words, the provincial government is much more likely to takes the province-aggregate labor market condition into account when setting the minimum wage level. For example, the provincial government might raise the province's minimum wage when it observes a higher employment level in the province. Thus, province fixed effects estimates are more likely to suffer from endogeneity bias and biased upward.

## VI. Results and Discussion

Four major groups of regression estimates are shown in this section. The first group focuses on the impact on production worker employment. The second group focuses on the impact on non-production worker employment. The third group focuses on the impact by educational category of workers, and the last group focuses on the impact on real wage firms have to pay their workers. The analysis in the paper and the discussion is based on data from 1993 through

[12] Some provinces were split during the sample period. We treated the split provinces as one province in the fixed effect throughout the sample period, but allow minimum wages to differ across the split provinces. As a result, we have 26 province fixed effects, and 33 province real minimum wages.

2006. To make sure the results are not driven by any critical economic events, and to make sure the results are robust, we exclude the crisis years of 1997 and 1998. As expected, the results remain unchanged and hence not reported here.

### *a. Employment of Production Workers and Non-production Workers*

Table 2A reports estimates for all firms based on regression specifications (1) and (2) with the log of paid production worker employment as the dependent variable (we focus on paid workers only). Furthermore, log of firm's age (*Firm age*), percentage owned by foreigners (*Foreign*), percentage of output exported (*Export*), and percentage owned by local and central government (*Government*), are included as additional regressors in some specifications. We also separately report estimates for small firms in Table 2B and for large firms in Table 2C.

According to the simple OLS regression in column (1) of Table 2A, as minimum wage rises by 10%, employment of paid production workers is expected to increase by 3.3% on average. Column (2) shows that as minimum wage rises by 10%, employment of production workers within provinces is expected to increase by 1.8% on average. Clearly, the inclusion of province fixed effects significantly reduces the extent of endogeneity bias. Column (3) shows that the estimated effect of minimum wage changes on employment of production workers turns from positive into negative when a set of firm fixed effects is included. For every 10% increase in minimum wage, employment of production workers is expected to fall by 0.5% on average. Column (4) shows the elasticity of production employment to minimum wage become -0.27 and statistically insignificant when we include a set of additional regressors.[13] The current estimate is much smaller than previous estimates. For example, Alatas and Cameron (2008) estimated that employment of production workers would fall by 5% and Harrison and Scorse (2010) estimated that employment of production workers would fall by 1.2%, for every 10% increase in minimum wage. This can partly be explained by the fact that all three studies use different samples and evaluate the impact on different time periods.

[13] The sample size is smaller when additional regressors are added as these variables have missing values for several years. The drop in significance is not due to the smaller sample size but the additional regressors as the effect of minimum wage changes is significant according to the specification reported in column (3) but using the sample in column (4).

***Table 2A: Employment Effects of Minimum Wages on Production Workers – All Firms***

| | Dependent variable: Log (Number of paid production workers) | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Log (Min. Wage) | 0.3290*** | 0.1838*** | -0.0473*** | -0.0233 |
| | (0.0350) | (0.0302) | (0.0168) | (0.0183) |
| Log (Firm Age) | | | | 0.2131*** |
| | | | | (0.0075) |
| Foreign Share | | | | 0.0017*** |
| | | | | (0.0002) |
| Export Share | | | | 0.0007*** |
| | | | | (0.0001) |
| Govt. Share | | | | 0.00004 |
| | | | | (0.0002) |
| Fixed Effects | No | Province | Firm | Firm |
| Year Effects | Yes | Yes | Yes | Yes |
| Observations | 233,512 | 233,512 | 233,512 | 160,013 |
| Number of Firms | 32,390 | 32,390 | 32,390 | 30,945 |
| R-squared | 0.0041 | 0.0342 | 0.9179 | 0.9214 |

Notes: The sample includes only firms with non-zero production and non-production workers, firms that continuously observed from year to year, and firms observed more than once during the sample period (1993-2006). Column (4) has fewer observations than other columns because the additional regressors have missing values in 2001, 2002, 2003, and 2005. Robust standard errors clustered by firm are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 2B examines the effects of minimum wage changes on employment of paid production workers among small firms (i.e., firms with 150 or fewer workers during the sample period). The results for small firms are similar to the results for all firms. The inclusion of firm fixed effects changes the estimated effect of minimum wage changes on employment of production workers from significantly positive to insignificantly negative. The results suggest that minimum wage changes have little effect on employment of production workers of small firms.

Table 2C reports estimates for firms that always employed more than 150 workers during the sample period. The effect of minimum wages on employment of production workers is statistically insignificant in all specifications. The coefficient estimates are smaller in magnitudes while standard errors are similar compared to those for small firms, suggesting that employment of production workers in large firms are not responsive to minimum wage changes.

***Table 2B: Employment Effects of Minimum Wages on Production Workers - Small Firms***

| | Dependent variable: Log (Number of paid production workers) | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Log (Min. Wage) | 0.0818*** | 0.0939*** | -0.0213 | -0.0071 |
| | (0.0176) | (0.0192) | (0.0155) | (0.0172) |
| Log (Firm Age) | | | | 0.1155*** |
| | | | | (0.0067) |
| Foreign Share | | | | 0.0006** |
| | | | | (0.0003) |
| Export Share | | | | 0.0005*** |
| | | | | (0.0001) |
| Govt. Share | | | | -0.0002 |
| | | | | (0.0001) |
| Fixed Effects | No | Province | Firm | Firm |
| Year Effects | Yes | Yes | Yes | Yes |
| Observations | 170,717 | 170,717 | 170,717 | 115,605 |
| Number of Firms | 27,856 | 27,856 | 27,856 | 26,272 |
| R-squared | 0.0017 | 0.0215 | 0.8121 | 0.8208 |

Notes: The sample includes only small firms with non-zero production and non-production workers, small firms that continuously observed from year to year, and small firms observed more than once during the sample period (1993-2006). Small firms are firms which always have 150 or fewer workers. Column (4) has fewer observations than other columns because the additional regressors have missing values in 2001, 2002, 2003, and 2005. Robust standard errors clustered by firm are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1

***Table 2C: Employment Effects of Minimum Wages on Production Workers - Large Firms***

| | Dependent variable: Log (Number of paid production workers) | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Log (Min. Wage) | 0.0045 | -0.0323 | -0.0227 | 0.0090 |
| | (0.0469) | (0.0430) | (0.0271) | (0.0317) |
| Log (Firm Age) | | | | 0.2337*** |
| | | | | (0.0139) |
| Foreign Share | | | | 0.0012*** |
| | | | | (0.0002) |
| Export Share | | | | 0.0003*** |
| | | | | (0.0001) |
| Govt. Share | | | | 0.00003 |
| | | | | (0.0003) |
| Fixed Effects | No | Province | Firm | Firm |
| Year Effects | Yes | Yes | Yes | Yes |
| Observations | 62,795 | 62,795 | 62,795 | 44,408 |
| Number of Firms | 8,586 | 8,586 | 8,586 | 8,296 |
| R-squared | 0.0007 | 0.0179 | 0.8502 | 0.8565 |

Notes: The sample includes only large firms with non-zero production and non-production workers, large firms that continuously observed from year to year, and large firms observed more than once during the sample period (1993-2006). Large firms are firms which always have more than 150 workers. Column (4) has fewer observations than other columns because the additional regressors have missing values in 2001, 2002, 2003, and 2005. Robust standard errors clustered by firm are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1

In the second group of regressions, the focus is on employment of non-production workers. As mentioned above, past studies tend not to focus on non-production workers, as non-production workers constitute a smaller fraction of the labor force in manufacturing.

Although the total number of non-production workers is about one-fifth of production workers' in the data and the number is stable for the entire sample period, household data from *Susenas* show that the estimated share of non-production workers (ages 15-65) in the manufacturing sector in 2006 is non-trivial, about 47%. Tables 3A, 3B, and 3C summarize the results using the log of paid non-production worker employment as the dependent variable for all firms, small firms, and large firms, respectively.

***Table 3A: Employment Effects of Min. Wages on Non- Prod. Workers - All Firms***

| | Dependent variable: Log (Number of paid non-production workers) | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Log (Min. Wage) | 0.5997*** | 0.3341*** | -0.0585*** | -0.0542** |
| | (0.0402) | (0.0357) | (0.0211) | (0.0255) |
| Log (Firm Age) | | | | 0.1969*** |
| | | | | (0.0101) |
| Foreign Share | | | | 0.0012*** |
| | | | | (0.0003) |
| Export Share | | | | 0.0007*** |
| | | | | (0.0001) |
| Govt. Share | | | | 0.0007*** |
| | | | | (0.0003) |
| Fixed Effects | No | Province | Firm | Firm |
| Year Effects | Yes | Yes | Yes | Yes |
| Observations | 233,512 | 233,512 | 233,512 | 160,013 |
| Number of firms | 32,390 | 32,390 | 32,390 | 30,945 |
| R-squared | 0.0093 | 0.0377 | 0.8733 | 0.8771 |

Notes: The sample includes only firms with non-zero production and non-production workers, firms that continuously observed from year to year, and firms observed more than once during the sample period (1993-2006). Column (4) has fewer observations than other columns because the additional regressors have missing values in 2001, 2002, 2003, and 2005. Robust standard errors clustered by firm are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 3A indicates that the effect of minimum wage on employment is more pronounced and significant for non-production workers than for production workers. Column (3) shows that the inclusion of firm fixed effects significantly changes the estimated effect of minimum wage on employment of non-production workers based on the OLS and province fixed effects regressions reported in column (1) and column (2), respectively. Column (4) shows that including additional regressors does not alter the estimated employment effect of minimum wage much. A 10% increase in real minimum wages will lead to a 0.54% decline in employment of non-production workers, on average. The negative impact of minimum wages on employment of non-production workers is more significant than that on production workers.

***Table 3B: Employment Effects of Min. Wages on Non- Prod. Workers - Small Firms***

| | Dependent variable: Log (Number of paid non-production workers) | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Log (Min. Wage) | 0.3578*** | 0.2719*** | -0.0667*** | -0.0813*** |
| | (0.0289) | (0.0313) | (0.0219) | (0.0269) |
| Log (Firm Age) | | | | 0.0974*** |
| | | | | (0.0102) |
| Foreign Share | | | | 0.0020*** |
| | | | | (0.0004) |
| Export Share | | | | 0.0006*** |
| | | | | (0.0001) |
| Govt. Share | | | | 0.0007*** |
| | | | | (0.0002) |
| Fixed Effects | No | Province | Firm | Firm |
| Year Effects | Yes | Yes | Yes | Yes |
| Observations | 170,717 | 170,717 | 170,717 | 115,605 |
| Number of Firms | 27,856 | 27,856 | 27,856 | 26,272 |
| R-squared | 0.0085 | 0.0323 | 0.8152 | 0.8231 |

Notes: The sample includes only small firms with non-zero production and non-production workers, small firms that continuously observed from year to year, and small firms observed more than once during the sample period (1993-2006). Small firms are firms which always have 150 or fewer workers. Column (4) has fewer observations than other columns because the additional regressors have missing values in 2001, 2002, 2003, and 2005. Robust standard errors clustered by firm are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1

***Table 3C: Employment Effects of Min. Wages on Non- Prod. Workers - Large Firms***

| | Dependent variable: Log (Number of paid non-production workers) | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Log (Min. Wage) | 0.0045 | 0.0630 | 0.0123 | 0.0655 |
| | (0.0469) | (0.0550) | (0.0414) | (0.0498) |
| Log (Firm Age) | | | | 0.2462*** |
| | | | | (0.0212) |
| Log (Foreign Share) | | | | -0.0000 |
| | | | | (0.0004) |
| Log (Export Share) | | | | 0.0003* |
| | | | | (0.0001) |
| Log (Govt. Share) | | | | 0.0004 |
| | | | | (0.0004) |
| Fixed Effects | No | Province | Firm | Firm |
| Year Effects | Yes | Yes | Yes | Yes |
| Observations | 62,795 | 62,795 | 62,795 | 44,408 |
| Number of Firms | 8,586 | 8,586 | 8,586 | 8,296 |
| R-squared | 0.0007 | 0.0175 | 0.7605 | 0.7731 |

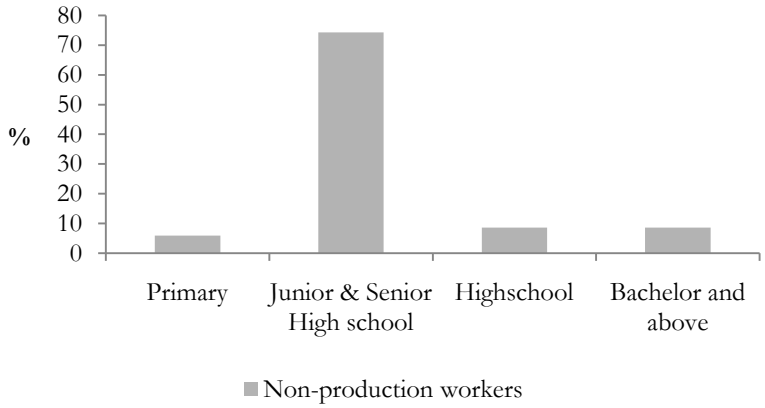
Notes: The sample includes only large firms with non-zero production and non-production workers, large firms that continuously observed from year to year, and large firms observed more than once during the sample period (1993-2006). Large firms are firms which always have more than 150 workers. Column (4) has fewer observations than other columns because the additional regressors have missing values in 2001, 2002, 2003, and 2005. Robust standard errors clustered by firm are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 3B shows that the negative effect of minimum wage on employment of non-production workers is pronounced among small firms. Similar to previous results, adding firm fixed effects switches the estimated sign of the employment effect of minimum wage. The estimates suggest that for every 10% increase in the real minimum wage, employment of non-

production workers among small firms is expected to fall between 0.7% and 0.8%. On the other hand, Table 3C shows that minimum wage changes have no negative effect on the employment of non-production workers in large firms. The estimates are positive and insignificant for all specifications.

The negative effect of minimum wage changes on employment of non-production workers is several times larger than that of production workers. This is initially surprising because non-production workers are generally thought as more educated than production workers, and therefore should be less vulnerable to changes in minimum wages. While non-production workers are indeed generally more educated than production workers, a large fraction of them still has low levels of education. As we can see in Figure 6, close to 80% of non-production workers in manufacturing have less than high school education. The heterogeneity of non-production jobs, and that low end non-production workers receive low wages might explain the negative impact of minimum wages on non-production workers.

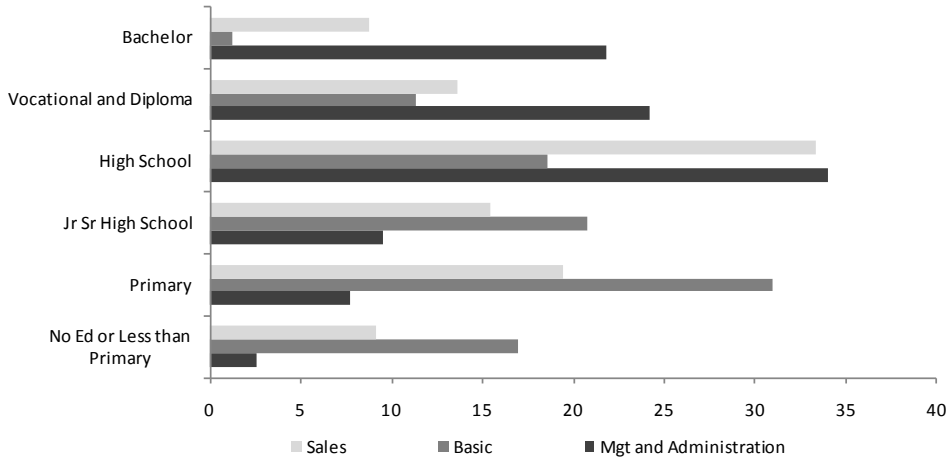
***Figure 6: Education composition of non-production workers, 2006***




Source: Indonesia Industry Survey (SI)

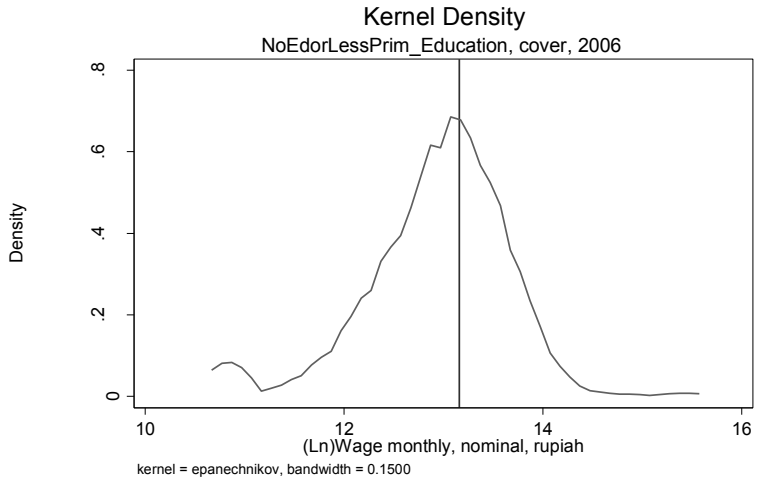
Household data also confirms these points. There are at least three distinct occupation categories among non-production workers in manufacturing: management and administrative staff, sales people, and workers performing menial tasks. As expected, workers in the management and administrative category have higher levels of education, where at least 80% of them have high school completed. On the other hand, about 40% of sales people and 70% of workers performing basic tasks have not completed high school (Figure 7).

***Figure 7: Education levels of distinct types of non-production workers in the manufacturing sector, 2006***




Source: Susenas 2006

***Figure 8: Wages for non-production "Basic" workers with low education levels in the manufacturing sector, 2006***




Source: Susenas, 2006

Figure 8 shows that over half of all non-production workers with less than primary school education earn at or below the national minimum wage, suggesting that they account for the majority of job losses.[14]. These workers earn low wages, are more likely low skilled (primary education or less) and tend to perform non-essential tasks in the factories, thus making them

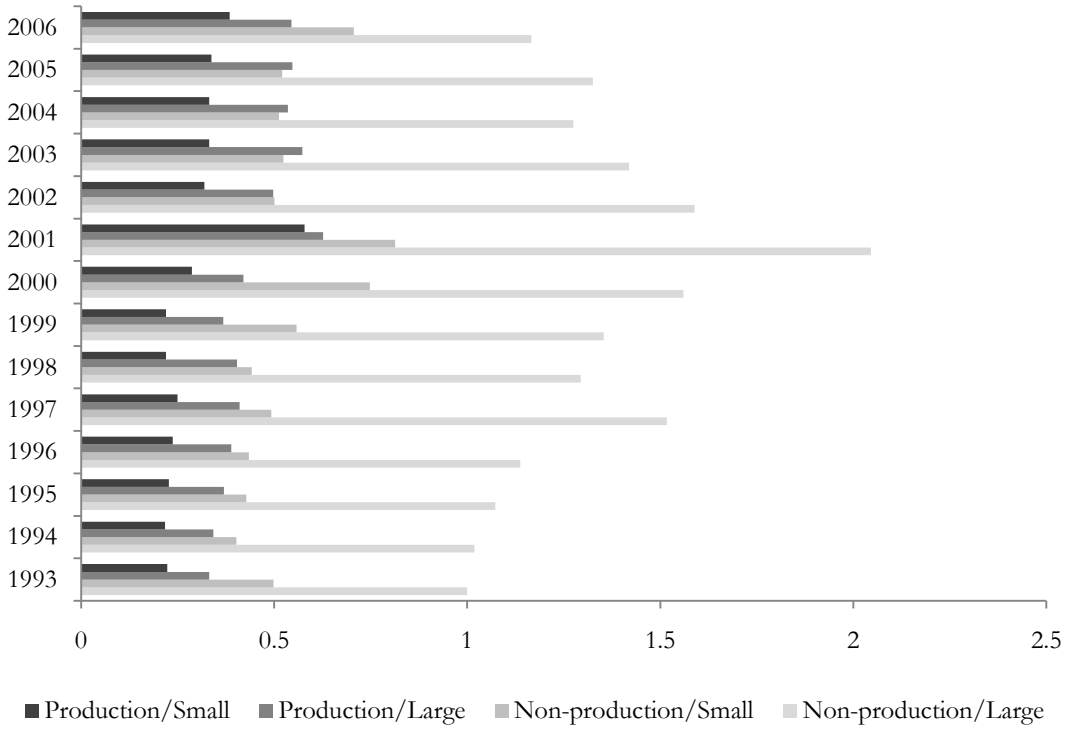
[14] Figure 8 is estimated using a kernel density method on a weighted sample. The vertical line represents an average of all sub-national minimum wage lines (logged) in the country. There are about 28 different lines, and these range from as low as 12.87 in East Java to as high as 13.62 in West Irian Jaya, Aceh and Jakarta.

extremely vulnerable to wage hikes. In part (c) the discussion delves deeper into different education categories of production and non-production workers.

### *b. Asymmetric Impacts of Minimum Wages on Large Firms and Small Firms*

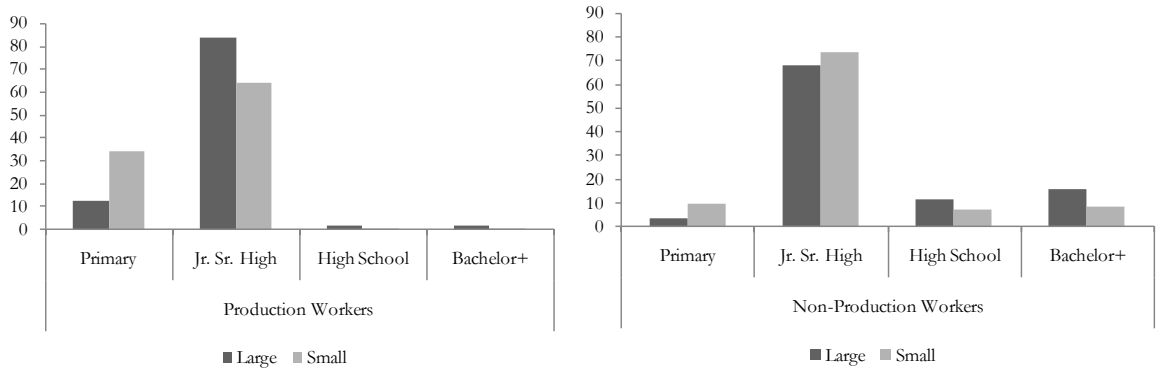
It is critical to understand why minimum wages hurt employment of non-production workers in small firms but not in large firms. Perhaps small firms tend to pay their workers lower wages on average, and thus must cut employment aggressively in response to a higher minimum wage. In contrast, large firms are less responsive to minimum wage changes, as they may not only have monopsony power in the labor market, but also pay higher wages on average due to higher labor productivity and the extensive use of capital. Data confirm that the average wages of workers in small firms are significantly lower than average wages of workers in large firms (see Table 1 and Figure 9). The difference is much more pronounced among non-production workers: average non-production wages in large firms are at least twice as high as wages in small firms.

***Figure 9: Normalized firm-average real wage of production workers and non-production workers in small firms and large firms***




Source: Indonesia Industry Survey (SI)
Note: Firm average real wage of non-production workers in large firms in 1993 is normalized to 1

***Figure 10: Educational composition of workers in large firms and small firms, 2006***




Source: Indonesia Industry Survey (SI)

It is then important to understand why large firms pay workers higher salaries. One reason could be related to different skill levels (proxied by their educational attainment). Among non-production workers, the percentage of workers with at least bachelor education is twice as high in large firms as in small firms (16.1% compared to 8.7%, in 2006) (Figure 10). This probably accounts for a part of the wage discrepancy between non-production wages in large firms and small firms. On the other hand, the differences between production workers with at least a high school diploma and those without are similar between large firms and small firms.

Another potential reason is that large firms might have a higher degree of mechanization, which explains why the value added per worker in large firms is higher and workers in large firms are better paid (see Table 1). The data seem to confirm this conjecture: the estimated value of machine capital per worker is much larger in large firms. For the years where the estimated values of machine capital are available, the estimate for firms in Jakarta area shows that the estimated value of machine capital per worker of large firms is 1.4 to 16 times larger than that of small firms.

Figure 9 also reveals that on average, non-production workers receive higher wages than production workers. The fact that non-production workers are more vulnerable to rises in minimum wage could indicate several things. First, there may be a large dispersion in wages (or wage inequality) among non-production workers within a firm; unfortunately, the data does not allow us to confirm this point. Second, and related to the first point, the large dispersion of wages within the group likely hide the fact that a subset of nonproduction workers earns very

little (for instance, janitors and cleaners), while a subset earn very high wages (for instance, managers).

### *c. Educational Compositions of Production and Non-production Workers*

The third group of regressions helps look at employment changes by education in response to minimum wage. There are several questions of interest here. First, which groups of workers are most hurt by minimum wage changes? Second, do firms substitute low-skilled workers for higher skilled workers in response to minimum wage increases? Since detailed skill portfolios of workers are not available, we use education as a proxy for skill to examine these questions.

The focus of this part of the analysis is on small firms because they are where the majority of the workforce is, and where there are interesting dynamics. Employment of production and non-production workers is analyzed separately. For each group of workers, the analysis measures percentage changes of the following education categories: at most primary education (*primary*); junior high and incomplete senior high (*juniorseniorhigh*); high school diploma (*highschool*); university and above (*bachelor*).[15] Note that data are only available for 1995, 1996, 1997, and 2006.

***Table 4: Employment Effects of Minimum Wages on Production Workers in Small Firms by Educational Category***

| | Dependent variable: Log (Employment of production workers) | | | |
|---|---|---|---|---|
| | Primary | Jr. Sr. High | High School | Bachelor |
| Log (Min. Wage) | -0.0855 | -0.1957*** | 0.0233 | 0.0891 |
| | (0.0723) | (0.0552) | (0.2155) | (0.1978) |
| Log (Firm Age) | 0.0940*** | 0.0691*** | -0.2686*** | -0.2768*** |
| | (0.0272) | (0.0202) | (0.0688) | (0.0779) |
| Foreign Share | -0.0008 | 0.0002 | 0.0032* | 0.0012 |
| | (0.0010) | (0.0006) | (0.0017) | (0.0015) |
| Export Share | 0.0003 | 0.0007*** | -0.0001 | 0.0009 |
| | (0.0003) | (0.0002) | (0.0008) | (0.0007) |
| Govt. Share | 0.0006 | 0.0013*** | 0.0001 | -0.0004 |
| | (0.0006) | (0.0005) | (0.0014) | (0.0013) |
| Firm Fixed Effects | Yes | Yes | Yes | Yes |
| Year Effects | Yes | Yes | Yes | Yes |
| Number of Firms | 16,360 | 19,036 | 3,592 | 3,087 |
| Observations | 35,634 | 40,865 | 5,159 | 4,502 |
| R-squared | 0.8622 | 0.8645 | 0.8953 | 0.9104 |

Notes: The sample includes only small firms with non-zero production and non-production workers, small firms that continuously observed from year to year, and small firms observed more than once during the sample period. Small firms are firms which always have 150 or fewer workers. Data of workers' educational composition are available in 1995, 1996, 1997, and 2006. Robust standard errors clustered by firm are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1

[15] Data on education of the workforce is available only in four years: 1995, 1996, 1997, 2006.

***Table 5: Employment Effects of Minimum Wages on Non-Production Workers in Small Firms by Educational Category***

| | Dependent variable: Log (Employment of non-production workers) | | | |
|---|---|---|---|---|
| | Primary | Jr. Sr. High | High School | Bachelor |
| Log (Min. Wage) | -0.2915* | -0.1553*** | -0.0751 | -0.0490 |
| | (0.1660) | (0.0497) | (0.1114) | (0.1026) |
| Log (Firm Age) | 0.0483 | 0.1104*** | -0.1204*** | -0.1803*** |
| | (0.0531) | (0.0191) | (0.0400) | (0.0349) |
| Foreign Share | -0.0027* | 0.0021*** | 0.0008 | -0.0006 |
| | (0.0016) | (0.0006) | (0.0011) | (0.0009) |
| Export Share | -0.0008 | 0.0001 | 0.0006 | 0.00003 |
| | (0.0005) | (0.0003) | (0.0005) | (0.0004) |
| Govt. Share | 0.0010 | 0.00004 | -0.0016 | -0.0017* |
| | (0.0011) | (0.0005) | (0.0010) | (0.0009) |
| Firm Fixed Effects | Yes | Yes | Yes | Yes |
| Year Effects | Yes | Yes | Yes | Yes |
| Number of Firms | 7,707 | 19,126 | 7,234 | 7,208 |
| Observations | 13,571 | 41,823 | 11,982 | 12,523 |
| R-squared | 0.8888 | 0.8596 | 0.8431 | 0.8239 |

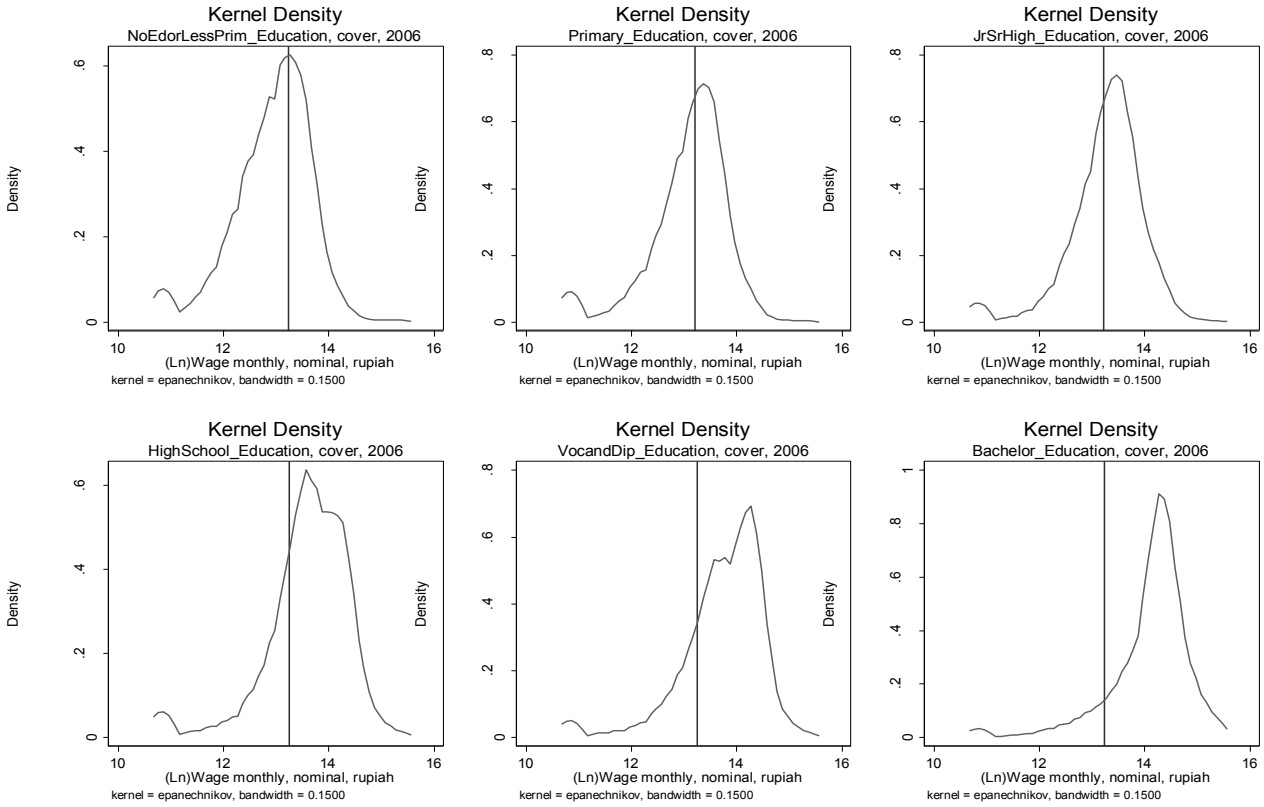
Notes: The sample includes only small firms with non-zero production and non-production workers, small firms that continuously observed from year to year, and small firms observed more than once during the sample period. Small firms are firms which always have 150 or fewer workers. Data of workers' educational composition are available in 1995, 1996, 1997, and 2006. Robust standard errors clustered by firm are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 4 reports the estimates for employment of production workers by educational category. Results shows that production workers with lower levels of education (senior high and below) are negatively affected by an increase in minimum wage. In particular, the effect on production workers with junior and senior high school education is significant. *Within a firm,* a 10% increase in minimum wage is expected to decrease the number of workers with junior high or senior high school education by 2% on average. On the other hand, the effects on production workers with high school degree and above are positive and insignificant.

Table 5 summarizes the results from the analysis of employment of non-production workers by educational category. The negative effects of minimum wage changes are significant for non-production workers without high school diploma but insignificant for those with at least a high school diploma. A 10% increase in minimum wage causes employment of non-production with no more than a primary education to fall by 2.9%. This effect is several times larger than the average decline. Moreover, there is no evidence of substitution from less educated workers to more educated workers; instead, only less educated workers are let go. As mentioned above, non-production jobs, particularly those performed by low-educated workers, are not management or research related, but mostly menial jobs. Figure 11 shows the wage distribution of non-production workers by education level for all sectors of the economy and further illustrates the tendency of less educated non-production workers to earn low wages and

be more vulnerable to minimum wage changes. The first three diagrams in the first row show the wage distributions of non-production workers with no or less than primary education, with primary education and with junior and senior high school education. Almost half of them receive lower wages than the (national average) minimum wage—shown as the vertical lines in the diagrams.

***Figure 11: Wage density curves for non-production workers by education level across all economic sectors, 2006***




Source: Susenas, 2006

### *d. Employment of Male and Female Workers*

The fourth group of regressions focuses on the minimum wage effect on employment by gender. The question of interest is whether a rise in minimum wages attracts broader female participation to the formal labor force in the manufacturing sector or leads to greater job losses among women workers. As shown before, of all working-age women only 52% of them were actively working or looking for work in 2006; this is low compared to male participation in the country (86%). Time-use surveys from around the world reveal that women are largely

responsible for housework and raising children (Miranda, 2011). As a result of the double burden some studies conclude that women's reservation wage in many cases is higher than what the market is willing to pay them, keeping them out of the labor force. Recent evidence on the other hand shows that many women, especially among lower economic quintiles, lower their reservation wage and enter the labor force to finance basic expenditures of having children (Priebe, 2010). Thus, one can argue that a rise in the minimum wage could potentially attract women to the labor market. On the other hand, women are usually less educated and less well-paid than men in developing countries. Women may also suffer from gender discrimination in the labor market, as women earn between 70 to 80 percent the wages of men for similar work in many countries (Haussman et al, 2010).[16] Women workers, especially less educated ones, may be the first laid off when firms are compelled to pay higher minimum wages.

***Table 6: Employment Effects of Minimum Wages on Male and Female Workers in Small Firms***

| | Dependent variable: | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Log of Employment of Production Workers | | | | Log of Employment of Non-Production Workers | | | |
| | ------ Male ------- | | ------ Female ------ | | ------ Male ------- | | ------ Female ------ | |
| Log (Min. Wage) | -0.0258 | -0.0208 | -0.058** | -0.0430 | -0.0365 | -0.0290 | -0.061*** | -0.0692** |
| | (0.0174) | (0.0210) | (0.0245) | (0.0309) | (0.0236) | (0.0289) | (0.0227) | (0.0287) |
| Log (Firm Age) | | 0.1202*** | | 0.0964*** | | 0.1003*** | | 0.0802*** |
| | | (0.0081) | | (0.0122) | | (0.0110) | | (0.0108) |
| Foreign Share | | 0.0007** | | 0.0001 | | 0.0019*** | | 0.0013*** |
| | | (0.0003) | | (0.0006) | | (0.0005) | | (0.0004) |
| Export Share | | 0.0003*** | | 0.0007*** | | 0.0004** | | 0.0005*** |
| | | (0.0001) | | (0.0001) | | (0.0001) | | (0.0001) |
| Govt. Share | | 0.0001 | | -0.0005** | | 0.0009*** | | -0.0000 |
| | | (0.0002) | | (0.0003) | | (0.0003) | | (0.0002) |
| Firm Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 167,873 | 113,780 | 126,026 | 83,780 | 159,346 | 106,834 | 129,736 | 85,473 |
| Number of Firms | 27,500 | 25,894 | 23,351 | 21,616 | 27,122 | 25,282 | 23,897 | 21,890 |
| R-squared | 0.8450 | 0.8498 | 0.8522 | 0.8591 | 0.8086 | 0.8104 | 0.7678 | 0.7708 |

Notes: The sample includes only small firms with non-zero production and non-production workers, small firms that continuously observed from year to year, and small firms observed more than once during the sample period. Small firms are firms which always have 150 or fewer workers. Both paid and unpaid workers are included as data since 2001 do not permit separation of paid and unpaid workers by gender. The additional regressors have missing values in 2001, 2002, 2003, and 2005. Robust standard errors clustered by firm are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 6 shows the detailed analysis. Four items are measured here: employment of male production workers, of female production workers, of male non-production workers, and of female non-production workers. The dependent variables are log of employment of the four

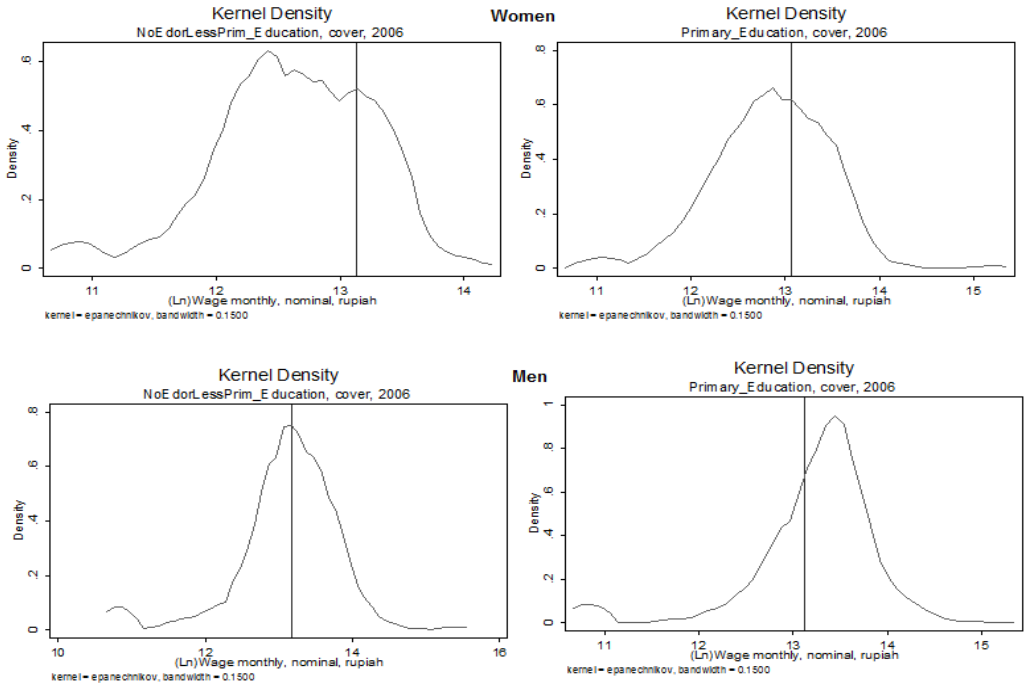
[16] Evidence from around the world shows that firms factor in costs associated with benefits they provide women (e.g. maternity and family leave, maternity insurance coverage). They also factor costs for replacing women during longer work absences (Ruhm, 1998).

categories; and as in previous sections the same control variables and firms fixed effects are included.

The results show that a rise in minimum wage disproportionately hurts female workers, especially those performing non-production jobs. They bear most of the burden of job losses. The negative impact on female non-production workers is large, statistically significant and robust. A 10% increase in minimum wage leads to 0.6% – 0.7% decline in female non-production employment in small firms. The impact of minimum wage on male workers is negative, with a smaller coefficient and not statistically significant.

The firm survey does not have detailed information on education of non-production workers by gender and it is not possible to disentangle the gender effects by education. We use household survey in 2006 to examine the wage distribution of non-production workers with primary education or less by gender (Figure 12) to provide further analysis. Note that the vertical line indicates the value of a hypothetical national minimum wage in 2006. The figures show that the wage densities for women are concentrated to the left of the line, but not for men with similarly low levels of education. Thus, the results are consistent with the view that non-production female workers are more likely laid off because they are less well paid than men.

***Figure 12: Wage distribution of low skilled non-production workers in 2006, by gender***




Source: Susenas, 2006

### *e. Wage Rates of Production Workers and Non-production Workers*

This section examines if changes in minimum wages have impacts on firms' average wage rates. The relevant question is whether firms adjust their wages in response to minimum wages. One cannot fully rule out the issue of reverse causality because it is plausible that the government sets minimum wages to take into account the aggregate wage growth. In other words, higher minimum wages are because the aggregate wage is higher. Therefore, the estimates for the impact of minimum wages on the actual wage rates can be biased upward. But as explained before, it is very difficult to expect that all firms are coordinating the way in which they set their wages and one or a few minimum wage levels cannot correspond to all firms' wage setting. Therefore, with firm fixed effects, it is likely that reverse causality is mitigated. Nevertheless, results are interpreted as associations between minimum wages and firms' average wages. As shown previously, the coefficients for small firms and large firms are very different. The two dependent variables of interest are log of real firm-average wages (in cash and in kind) per worker. The results for production workers are presented in table 7, and the results for non-production workers are in table 8. The list of other control variables is similar.

***Table 7: Minimum Wages and Average Wages of Production Workers***

| | Dependent variable: Log(Real average wage of production workers) | | | | | |
|---|---|---|---|---|---|---|
| | All Firms | All Firms | Small Firms | Small Firms | Large Firms | Large Firms |
| Log (Minimum Wage) | 0.1060*** | 0.1537*** | 0.1317*** | 0.1844*** | 0.0607 | 0.0825* |
| | (0.0190) | (0.0226) | (0.0217) | (0.0260) | (0.0391) | (0.0473) |
| Log (Firm Age) | | 0.1001*** | | 0.0960*** | | 0.1322*** |
| | | (0.0090) | | (0.0104) | | (0.0200) |
| Foreign Share | | 0.0008*** | | 0.0013*** | | 0.0002 |
| | | (0.0003) | | (0.0004) | | (0.0004) |
| Export Share | | -0.0000 | | 0.0000 | | 0.0001 |
| | | (0.0001) | | (0.0001) | | (0.0001) |
| Govt. Share | | 0.0010*** | | 0.0015*** | | 0.0003 |
| | | (0.0002) | | (0.0003) | | (0.0004) |
| Firm Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 233,442 | 159,959 | 170,667 | 115,569 | 62,775 | 44,390 |
| Number of Firms | 32,388 | 30,941 | 27,855 | 26,269 | 8,585 | 8,295 |
| R-squared | 0.6221 | 0.6558 | 0.6678 | 0.7044 | 0.5281 | 0.5926 |

Notes: The sample includes only firms with non-zero production and non-production workers, firms that continuously observed from year to year, and firms observed more than once during the sample period. Small firms are firms which always have 150 or fewer workers; large firms are firms which always have more than 150 workers. The additional regressors have missing values in 2001, 2002, 2003, and 2005. Robust standard errors clustered by firm are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Results reveal that in general, the association between minimum wages and firms' actual wages, for both production workers and non-production workers, is robust and significant. For

production workers, a 10% increase in real minimum wages is associated with a 1.8% increase in wages in small firms, but only 0.8 % increase in wages in large firms. For non-production workers, a 10% increase in real minimum wages is associated with a 1.65% increase in wages in small firms, but only 1.2% in larger firms. The association between minimum wages and actual wages is significant, of large magnitude in small firms, but less so in larger firms. This suggests that wages in small firms are more sensitive to changes in minimum wages, which is consistent with the fact that on average, wages in small firms are significantly lower. In other words, small firms are more likely to raise their wages in response to an increase in minimum wages because their wages are more binding.

***Table 8: Minimum Wages and Average Wages of Non-Production Workers***

| | Dependent variable: Log(Real average wage of non-production workers) | | | | | |
|---|---|---|---|---|---|---|
| | All Firms | All Firms | Small Firms | Small Firms | Large Firms | Large Firms |
| Log (Minimum Wage) | 0.0600** | 0.1654*** | 0.0493* | 0.1659*** | 0.0708 | 0.1186* |
| | (0.0254) | (0.0306) | (0.0293) | (0.0355) | (0.0532) | (0.0642) |
| Log (Firm Age) | | 0.1015*** | | 0.0900*** | | 0.1183*** |
| | | (0.0120) | | (0.0137) | | (0.0283) |
| Foreign Share | | 0.0023*** | | 0.0023*** | | 0.0020*** |
| | | (0.0004) | | (0.0006) | | (0.0005) |
| Export Share | | 0.0004*** | | 0.0003 | | 0.0006*** |
| | | (0.0001) | | (0.0002) | | (0.0002) |
| Govt. Share | | 0.0009*** | | 0.0012*** | | 0.0005 |
| | | (0.0003) | | (0.0004) | | (0.0005) |
| Firm Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 226,507 | 158,153 | 163,898 | 113,839 | 62,609 | 44,314 |
| Number of Firms | 31,798 | 30,112 | 27,253 | 25,434 | 8,573 | 8,286 |
| R-squared | 0.6053 | 0.6405 | 0.6281 | 0.6767 | 0.5154 | 0.5571 |

Notes: The sample includes only firms with non-zero production and non-production workers, firms that continuously observed from year to year, and firms observed more than once during the sample period. Small firms are firms which always have 150 or fewer workers; large firms are firms which always have more than 150 workers. The additional regressors have missing values in 2001, 2002, 2003, and 2005. Robust standard errors clustered by firm are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1

## VII. Concluding Remarks

This paper uses firm level data to investigate the employment and wage impacts of minimum wage changes in Indonesia, differentiating the effects on production workers and non-production workers, by educational category, and by gender profile. The use of firm level data allows the inclusion of firm fixed effects, which significantly reduces the extent of endogeneity bias. The analysis focuses on understanding the effects in the manufacturing sector, which constitutes a significant formal component of the Indonesian labor force.

The paper finds that in the manufacturing sector, minimum wages have negative employment effects on small firms but not on large firms. Since there are many more small firms, the aggregate effect of the minimum wages is to have an overall negative effect on formal employment, i.e. they lead to job losses. The negative effects are largely concentrated among labor intensive firms with unskilled or less skilled workers. This finding has implications beyond the manufacturing sector, especially because Indonesia, like many developing economies, has a large concentration of low-skilled workers employed in small firms. Thus, sharp raises of the minimum wage could prevent job creation and retention, and a reduction in formal employment. As shown in other countries, increases in the minimum wage without commensurate raises in worker productivity levels can lead to unemployment or increase informality among low-skill workers. Nonetheless, the negative effects of minimum wage changes on employment are much smaller than previous estimates.

The job losses are primarily driven by those among non-production workers. And the vulnerability is more accentuated for women than men. This result has implications for young workers who are likely to be overrepresented among non-production workers performing basic tasks, as well as workers in sectors of the economy where the concentration of non-production workers is higher. Industries such as wholesale and retail and tourism in the services sector for example, have high concentration of (women) non-production workers with low levels of skill.

As mentioned, the importance of skill levels came through very clearly in the analysis, where less educated workers are hit hardest when minimum wage hikes take place. On the other hand, better skilled workers (with a high school education and above) are not affected. The underlying problem is that in the case of low-skilled (or unskilled) workers, higher minimum wage levels likely exceed their level of productivity. Thus, increases in the minimum wage mean that small firms, which are those that employ these workers most often and have low capital intensity, have to lay off non-essential workers. As better educated workers are not added in response to minimum wage increases, there is no evidence of substitutions between less educated and better educated workers. Instead, low skill workers are simply laid off by their employers.

Minimum wages are also found correlated with firms' average wages. They are more correlated with average wages in small firms than in large firms, which suggests that minimum wages are significantly more binding for small firms who on average pay workers less than large firms do.

The fact that this and other studies yield varying results regarding the effects of minimum wages on employment should not come as a surprise given that there are structural differences between countries and there is wide variation in the way minimum wage policy is designed and implemented. Thus, results from this and other analysis undertaken in other developing contexts should not be interpreted to indicate that minimum wages are bad under all circumstances; instead, the interpretation should be that the effect of a change in minimum wages on employment can be sensitive to the context in which it is implemented.

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## Appendix

***Table A1: Descriptive Statistics***

| Meaning | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Log of total paid employment | 290334 | 4.208 | 1.192 | 0 | 9.5490 |
| Log of total paid production employment | 290248 | 4.020 | 1.191 | 0 | 9.3923 |
| Log of total paid non-production employment | 246081 | 2.279 | 1.455 | 0 | 8.5553 |
| Log of real minimum wage | 290339 | 4.485 | 0.264 | 3.689 | 5.1684 |
| Log of firm age | 289654 | 2.354 | 0.854 | 0 | 4.6052 |
| Log of percentage exported | 207256 | 10.725 | 28.488 | 0 | 100 |
| Percentage owned by foreigners | 290339 | 5.652 | 21.227 | 0 | 100 |
| Percentage owned by government | 290339 | 2.798 | 15.995 | 0 | 100 |
| Log of real value added per worker | 289806 | 8.103 | 1.3196 | -3.9571 | 16.518 |
| Log of real average wage per production worker | 290149 | 7.059 | 0.857 | -2.255 | 15.239 |
| Log of real average wage per non-production worker | 238725 | 7.631 | 1.075 | -6.688 | 16.194 |

## Appendix B: Definitions of variables

*Firm level data:* The explanatory variable of interest is log of real minimum wage (*Minimum wage*). Other control variables are log of firm's age (*Firm age*), percentage owned by foreigners (*Foreign*), percentage of output exported (*Export*), percentage owned by local and central government (*Government*), and log of real value added per worker (*Value Added*).

*Export:* percentage of a firm's output that is exported.

*Foreign:* percentage of firms owned by foreigners.

*Government:* percentage of firms owned by local or central government.

*Value added:* log of real value added per worker. This is calculated by taking value added per worker divided by the provincial CPI obtained from the BPS.

*Minimum wages:* Minimum wages were obtained from BPS as monthly provincial minimum wages (or averages where there is within-province variation across districts) for each year. Real minimum wages are obtained by deflating provincial minimum wages by the provincial CPI. We are grateful to Bob Rijkers and Mary Hallward-Driemeier and David Newhouse for making the data available to us.

*Wages (firm level averages):* following Hallward-Driemeier e. al. (2010), wages are defined as the average wages for production and non-production workers, constructed as the total wage bill for either group divided by the number of workers of either respective group. The total wage bill for production and non-production workers is defined as the sum of cash wages and in-kind benefits.

*Production workers:* Production workers, defined by Indonesia industry survey, as "workers who work directly in the production process, or activities connected with the production process, from the time materials enter the factory until the final products are sent out of the factory, for example, foreman supervising the production process, driver of a forklift in the factory, workers of working in the processing of goods etc".