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Determinants of School Enrolment: Relationship between Minimum Wage and Human Capital Investment

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Abstract: *Most economic research on minimum wage has focused on employment effects. Research analysing the effects of minimum wage on skill acquisition and educational investment is limited, especially in developing countries. To fill the gap in the literature, this paper investigates the relationship of minimum wage and human capital investment using the National Socioeconomic Survey (Susenas). This study is an effort to further analyse whether the minimum wage policy supports or even hinders recent government efforts to keep students in school. The government may be unaware of the possible interaction of different policies, especially in a developing country where inter-sectoral policy coordination is limited. This paper finds that minimum wage legislation has significant negative substitution effect on educational investment, i.e. individuals are more likely to drop out of senior secondary school due to an increase in minimum wage. There is no evidence of gender bias in human capital investment, at least as a response to increasing minimum wage. Even though the response to an increase in minimum wage amongst low-income households is positive, the results of a regression incorporating an interaction term suggest that the substitution effect is the dominant factor. Therefore, the positive result amongst low-income households might be generated by a fall in the probability of obtaining low-skilled employment that offsets the substitution effect.*

Keywords: minimum wage; human capital investment; senior-secondary school enrolment
JEL Classification: I25, I28, J24, J48

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1. Introduction

To improve the living standards of the poor and reduce inequality, minimum wage policy has been proposed and extended not only in developed but also in developing countries in recent years. However, the policy has been politically contentious for policymakers and controversial amongst economists; debate rages fiercely between those who argue that the low-wage labour market is best characterised as competitive (the 'marginalists') and those who argue that it is not (the 'institutionalists') (Neumark and Wascher, 2007). The debate on the implications of wage floors persists but is now accompanied by more sophisticated approaches to identify their impacts. Brown et al. (1982) comprehensively reviewed the research and suggested that, based on time series studies, a 10% increase in minimum wage reduces teenage employment by 1.0%–1.5%. The result, which had been considered a long-standing consensus, was challenged by Card and Krueger (1993), who argued that a moderate increase in minimum wage does not lead to adverse employment outcomes for low-wage workers.

Despite the growing amount of research on the minimum wage, most studies focus predominantly on employment effects. Although lately some attention has been devoted to the analysis of the effects of the minimum wage on skills acquisition and education, results have been contradictory. The limited research that attempts to address the relationship between minimum wage and educational attainment as well as the lack of universal consensus indicates a serious gap in the literature. This paper investigates the relationship between minimum wage and human capital investment, i.e. the choice of whether or not to attend school and, later, the choice of type of school or employment. Those who choose to be at school must enrol at either a general or a vocational school. Those who choose to drop out of school must work either formally or informally (including household work).

This paper hypothesises that the minimum wage has two opposing implications that influence school enrolment choice. First, a higher minimum wage decreases the skill premium of sending a child to school and, therefore, induces a child to drop out of school (substitution effect). Second, the increase in household disposable income leads to an increase in educational investment, making it more likely that a child will enrol at a school (income effect). The effect of the minimum wage on school enrolment

also depends on the structure of the labour market, through its effect on the probability of employment. This effect consists of two conflicting forces, depending on the labour market structure: competitive or monopsonistic. In a competitive labour market, where an increase in minimum wage will lead to displacement of employment, the substitution of low-skilled for high-skilled workers will increase the net benefit of investing in human capital. Thus, a competitive labour market increases student enrolment at school. In a monopsonistic labour market, where an increase in the minimum wage (if not set too high) can lead to an increase in employment, the higher probability of getting a job reduces the incentive to invest further in education. Thus, a monopsonistic labour market induces students to drop out of school.

As the theoretical predictions on the choice of school enrolment are ambiguous, empirical analysis is, therefore, necessary to untangle the complex theoretical relationship between minimum wage and school choice. This paper makes two contributions to the literature. First, it further investigates the indirect implication of minimum wage by introducing household decision in educational investment. Second, by using a rich household survey from the National Socio-Economic Survey (Susenas), this paper captures minimum wage effects at the individual level, which might not be detected by state-level regressions used in most research. This paper analyses whether minimum wage policy supports or hinders efforts of the Government of Indonesia to promote student enrolment through its 12-year compulsory education programme. The government might be unaware of the possible interaction between different policies, especially in a developing country where inter-sectoral policy coordination is limited.

A large-scale annual household survey from Susenas is the primary data source for this paper. Using survey data from 2000 to 2018, a pooled cross-section dataset of individuals was constructed. The sample for this study includes individuals who completed junior secondary education and then chose either to attend senior secondary education or to drop out of school. To capture the possible relationship between minimum wage and choice of school enrolment, a nested logit model is utilised with controls for individual- and household-explanatory variables.

The rest of this paper is structured as follows. Sections 2 and 3 discuss previous studies' findings and the background of Indonesia's labour market and minimum wage policy and education system. Section 4 explains the economic framework underlying

the empirical approach. Section 5 describes the data used in the estimation. Section 6 analyses the effect of an increase in the minimum wage on school enrolment. Section 7 provides conclusions and policy recommendations.

2. Literature Review

2.1. Minimum Wage and Employment

The simple supply–demand model of a competitive labour market predicts that minimum wage regulation – introduced either by the government or by a collective bargaining agreement – pushes the minimum wage above its market-clearing level and leads to displacement of employment. The overall welfare of society decreases as the gains of workers (the additional worker surplus coming from higher wages) are smaller than the losses of the firm (the lower firm surplus due to lower employment). Although at the new minimum wage the model determines an excess supply of labour, Welch (1976) asserted that this excess supply does not correspond to the official measure of unemployment or even to the increase in such unemployment above some frictional level. Contrarily, the conclusion regarding wage floors is different in the monopsony case, where bargaining power is unequal, with the firm having market power in employing factors of production. To maximise profits, the monopsony firm sets the wage at the point where the marginal cost of labour equals the marginal revenue product of labour. However, as the marginal cost of labour rises more steeply than the wage, the monopsony firm will hire fewer workers than the competitive one. Robinson (1933) argued that when a firm has monopsony power, minimum wage can, if not set too high, lead to an increase in employment. Nevertheless, beyond the point at which minimum wage reaches the wage that would be obtained in a competitive labour market, any further increase in minimum wage will reduce employment (Neumark and Wascher, 2008).

Extensive research across different geographic and demographic settings investigates the impact of minimum wage legislation on employment. The most ambitious attempt to examine the employment effect of minimum wage is the comprehensive review of the literature by Brown et al. (1982), which primarily established the consensus view of economics on the employment effects of minimum

wage (Neumark and Wascher, 2008). By conducting a detailed survey on several theoretical models, Brown et al. (1982) noted that time series studies typically find that a 10% increase in the minimum wage reduces teenage employment by 1%–3%. The consensus was challenged by Card and Krueger (1993), who found an increase in employment in a state where the minimum wage increased. Despite the prominence that this study has received, Neumark and Wascher (2000) offered a careful re-evaluation of its results by presenting new evidence based on administrative payroll records from a sample of fast-food restaurants, instead of employment data derived from telephone surveys used in Card and Krueger (1994). By using payroll data, a simple replication of difference-in-difference estimation indicates that the increase in the New Jersey minimum wage led to a 3.9%–4.0% decrease in fast-food employment. In response, Card and Krueger (2000) attempted to reconcile the conflicting findings by analysing administrative employment data from a new representative sample of fast-food employers in New Jersey and Pennsylvania. They concluded that the increase in the New Jersey minimum wage had little or no systematic effect on total fast-food employment in the state, although there might have been heterogeneous effects across individual restaurants in which employment rose or fell as a response to higher minimum wage.

The contradictory results in recent research on the employment effect of minimum wage suggest the need for more detailed analysis of the mechanism within the labour market that might have driven this effect. At the labour market level, a firm's monopsony power – in the sense of the supply of labour to an individual firm not being infinitely elastic – implies that an employer that cuts wages does not immediately lose all its workers (Manning, 2003). Similarly, when firms pay workers an 'efficiency wage' to induce good behaviour, particularly when they are unable to observe workers' on-the-job effort costlessly, this principal–agent incentive problem results in an equilibrium that entails quantity constraints (job rationing) (Shapiro and Stiglitz, 1984). In both cases, workers are limited in their ability to find alternative employment, and thus must accept the wage offers they receive. To deal with this unequal bargaining power, the government can introduce minimum wage legislation and ensure that workers receive fair compensation. As the minimum wage raises the average wage – and the free market wage is too low – an appropriately chosen minimum wage can

restore efficiency (Manning, 2001). In the extreme scenario of a monopsony labour market, minimum wage can even increase employment. At the firm level, the minimum wage mostly increases the salary of less-skilled workers while leaving the wage of skilled workers largely unaffected. Therefore, the firm does not have to increase the wage of a worker whose productivity is below the minimum wage if the firm provides training to this worker (Acemoglu and Pischke, 2001). Because firms will benefit from the increase in productivity, minimum wage encourages them to invest in general training, which serves as firms' non-layoff adjustment dynamics, which alleviate the possible adverse employment effect of minimum wage.

2.2. Minimum Wage and Human Capital Investment

Apart from the analysis based on the firm and labour market, the household should be considered an important channel for explaining the effect of a minimum wage policy, as household behavioural adjustment (e.g. spending pattern and entry into labour market) can generate substantial changes in the economy. Because households supply labour, a household decision on educational investment – affecting human capital and thus the quality of labour supplied – is another essential channel. Neumark and Wascher (1994) found that the effect of minimum wage on employment is sensitive to the introduction of schooling control, highlighting the importance of examining the linkage between minimum wage, employment, and enrolment.

Although research is still insufficient, recent studies on the minimum wage have devoted some attention to investigating the effects of minimum wage on skill acquisition and human capital investment. For instance, using United States (US) state–year observations in 1977–1989, Neumark and Wascher (1994) identified a negative influence of minimum wage on school enrolment and a positive effect on the proportion of teenagers neither employed nor in school. This adverse effect of minimum wage on schooling is confirmed by a series of studies from Chaplin et al. (2001) for the US, Landon (1997) for Canada, Pacheco (2007) for New Zealand, and Rice (2010) for the United Kingdom. In the context of developing countries, Shah and Steinberg (2015) reported that India's National Rural Employment Guarantee Scheme decreases school enrolment by 2 percentage points amongst children aged 13–16. Based on provincial data in Indonesia, Colombé (2016) found that in 1990–2000, a significant increase in the real wage floors reduced the proportion of teenagers enrolled

in senior secondary education. In contrast, Mattila (1978), using time-series data based on the US Current Population Survey, found that the minimum wage induces enrolment rates. Similarly, Ehrenberg and Marcus (1982) suggested that educational attainment of white teens from higher-income families increases as a response to minimum wage legislation in the US. Cahuc and Michel (1996) showed that minimum wage can have a positive impact on growth by inducing more human capital accumulation, reducing unemployment caused by low demand for unskilled workers.

Earlier research had some limitations, including the lack of variation in minimum wage and potential endogeneity bias due to the inability to control for some explanatory variables. Although later research took advantage of state-level variation in minimum wage, only a handful of studies used individual or household data to examine the effect of minimum wage on school enrolment. To contribute to the current literature, this paper investigates the relationship between minimum wage and human capital investment at the individual level, and thus attempts to reveal some individual heterogeneity of the effect of minimum wage, which might not be detectable in previous state-level regressions. The use of household survey data makes it possible to control for some important explanatory variables, such as household income, parents' educational attainment, and the number of children in the household. Most studies were conducted in developed countries, and I know of no study investigating the impact of minimum wage legislation on the choice of senior secondary school type, particularly in developing countries.

3. Indonesian Context: Labour Market and Minimum Wage Laws

According to data from the National Labour Force Survey (Sakernas), the unemployment rate in 2018 fell to 5.34% from 11.20% in 2005. Challenges in the labour market persist, however, including major deficits in employment outcomes by productivity, quality of work, and gender, and disparities across provinces. The unemployment rate amongst the youth (15–24) is still exceedingly high (19.4%), 1.6 percentage points higher than in the previous year. The share of unemployed youth in total unemployment is substantial at 57.9%, which is considerably above the global average of 30.0%. The number of young people who are neither employed nor in

education is high (23.2%) and is one of the highest rates in Asia (ILO, 2017). According to data from the Ministry of Manpower, Indonesia's current workforce, based on educational background, is 60% elementary and junior secondary school graduates, 25% high school and vocational school graduates, and 15% tertiary education graduates.

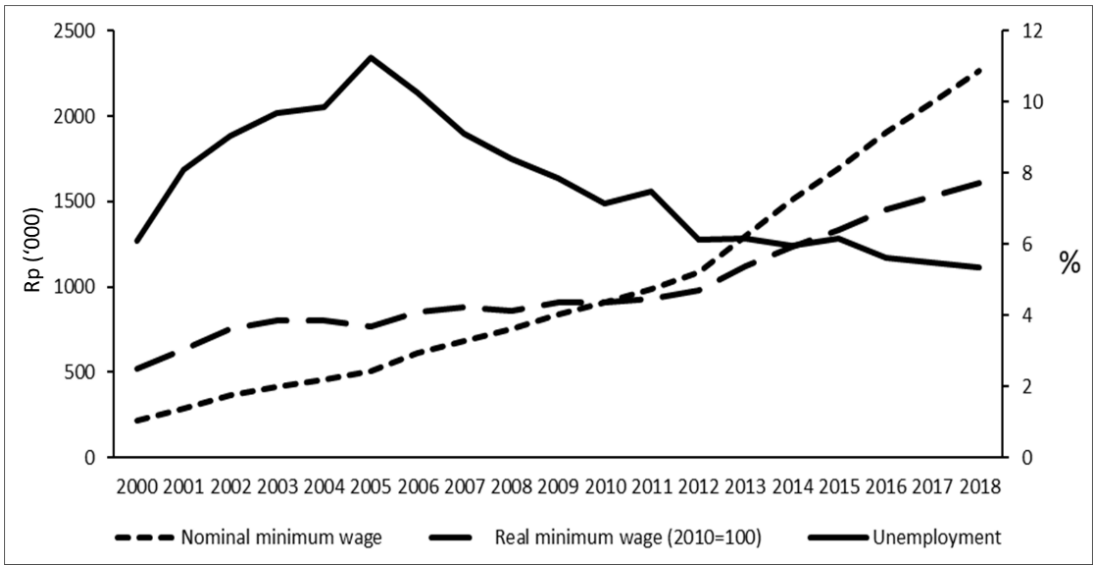
Indonesia is an intriguing case study for analysing the effects of minimum wage. First, although the first minimum wage legislation, introduced in the early 1970s, was neither binding nor enforced, the government implemented new minimum wage legislation in 1989 and started to aggressively promote minimum wage policies as an important labour policy (Hohberg and Lay, 2015). Second, the responsibility for minimum wage setting is delegated to each of the 34 provincial governments, which revise their own minimum wage annually. This reform, which occurred in 2001, has provided substantial variation to investigate the impact of minimum wage policies. Finally, the political process, which has been more decentralised for the past few years, is expected to yield greater variation in regional policies, including those related to the minimum wage (Chun and Khor, 2010).

Based on the Regulation of the Minister of Manpower and Transmigration Number 7 of 2013, the determination of the minimum wage is based on Kebutuhan Hidup Layak (Decent Living Standard), the cost of consumption bundles to sustain a decent living standard, which is adjusted in accordance to productivity and economic growth. A decent living standard is defined as a standard of need that must be fulfilled by a single worker to be able to live a decent life physically, non-physically, and socially for 1 month. The value of a decent living standard is obtained from a price survey of 60 goods and services, with a minimum daily caloric intake of 3,000 kilocalories per day for a single worker. Other factors are also considered in determining the minimum wage, including productivity, economic growth, labour market conditions, and the number of marginal businesses in a particular province for a certain period.

Figure 1 depicts the annual nominal and real minimum wage averaged across 33 provinces in 2000–2018. The nominal minimum wage steadily increased and multiplied almost 10-fold in 2000–2018. The real value of the minimum wage (deflated by the gross domestic product [GDP] deflator) rose by more than 200% in

2000–2018; even so, the value dropped by 12.4% from 2006 to 2008 due to high inflation caused by the 2008 financial crisis. During 2000–2018, the average annual rate of increase in real minimum wage was 6.7%, more than 1.5 times higher than annual real GDP per capita growth rate of 4.3%. Despite minimum wage expansion, the unemployment rate exhibited a downward trend in 2005–2016, which departs from the theoretical model's prediction of a competitive labour market. This simple correlation of minimum wage and unemployment rate is, however, in accordance with the empirical study by Rama (2001), which found that – despite a substantial decrease in employment for small firms – some large firms experienced a hike in their employment. Magruder (2012) supported this, showing that smaller firms operate in a competitive labour market whereas larger firms are monopsonistic employers. This finding is in line with research by Hohberg and Lay (2015), which reported that there is a statistically significant small positive effect of minimum wage on formal employment in Indonesia. This result suggests that (i) employers might adjust to the possible adverse effect of the minimum wage through other channels than employment, and (ii) effects such as a demand stimulus at the local level offset the possible adverse effect on employment. Finding employment in the informal sector, where minimum wage legislation is not binding, might be a way of adjusting to the adverse employment effect (Brown, 1999).

Figure 1: Minimum Wage and Unemployment Rate, 2000–2018

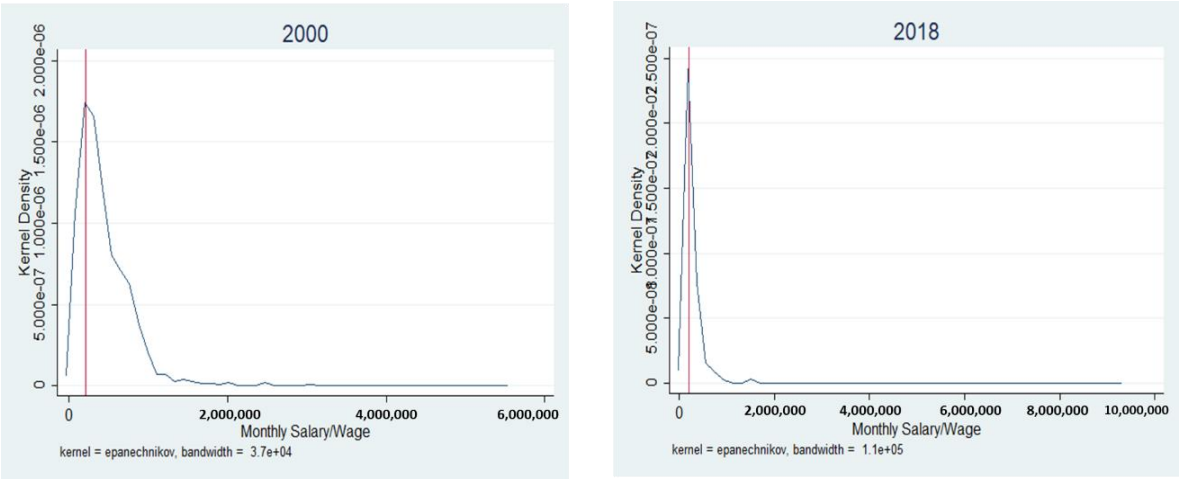


Source: Indonesian Bureau of Statistics.

The effect of minimum wage legislation on either employment or human capital investment relies on the level of firms' compliance. The government makes efforts to ensure that minimum wage laws are binding. Under Law No. 13 of 2003 on manpower, violating the minimum wage provision is a criminal offense and employers could face 1–4 years of imprisonment and/or a fine of Rp100 million–Rp400 million (about US$6,800–US$27,000). Indonesia also has Government Regulation (Peraturan Pemerintah/PP) No. 78 of 2015 on wages and remuneration, Regulation of Minister of Manpower (Permenaker) No. 1 of 2017 on wage structure and scale, and Permenaker No. 15 of 2018 on minimum wage. However, in practice, the major motivation for companies to comply with minimum wage legislation is the possibility of labour strikes, which could disrupt production, and of consumers boycotting the companies, which could affect companies' sales and revenue.

To ascertain that the government's minimum wage regulation is binding, this study examines the distribution of workers' wages, and how they interact with the level of minimum wage. Figure 2 displays the kernel density of salary distribution as reported by Sakernas in 2000 and 2018, since the survey data used for this paper are from 2000 to 2018. The national average of nominal minimum wage is depicted by the red vertical line. In this case, an evident spike in salary distribution around nominal minimum wage is observed in each year, indicating that minimum wage legislation has, to a certain extent, affected salary distribution. Of formal workers, 91% received more than minimum wage in 2000, but only 63% did so in 2018 as it significantly increased. Despite firms' imperfect compliance with minimum wage legislation, the evidence in Figure 2 is sufficient to allow the analysis using minimum wage.

Figure 2: Kernel Density of Monthly Salary or Wage Distribution, 2000 and 2018 (Rp)



Source: National Labour Force Survey (Sakernas), 2000 and 2018.

4. Economic Framework: Simple Two-period Model of Schooling Investments

A simple two-period model of human capital investment is utilised to formalise the relationship between minimum wage and choice of school enrolment. This model is developed based on Acemoglu and Autor (2000) and Acemoglu and Pischke (2001), who were inspired by the theoretical models of investment in human capital of Becker (1964) and Becker and Tomes (1986).

Consider a household that consists of one adult and one child. In period one, an adult, who lives for just one period, works and earns income y_i (either high-skilled or minimum wage), consumes c_i^1, and decides whether to invest in the child's education e_i. The total cost – including the opportunity cost – of sending a child to a school is θ_i, which varies with i as there is heterogeneity amongst children. In period two, the child becomes an adult, has a child on his or her own, consumes c_i^2 and earns the wage of a low-skilled worker (minimum wage) if he or she did not attend school, w_l, or the wage of a high-skilled worker if he or she enrolled in school, w_h.

According to the above two-period model, the utility of household i is given as

$$U = lnc_i^1 + \beta lnc_i^2 \qquad (1)$$

where β is a parameter that measures how important future (child's) consumption is to current consumption. In accordance to the 'separation theorem' for human capital investment, the decision on school enrolment will be made simply to maximise the budget set of the household; hence, e_i does not appear in the objective function. In the case of perfect capital market in which the adult can borrow for his or her child with interest rate r, the decision problem of the adult is, therefore, to maximise household utility subject to the household budget constraint, which is given as

$$c_i^1 + \frac{c_i^2}{(1+r)} \leq y_i - e_i\theta_i + \frac{w_l}{(1+r)} + e_i\frac{w_h - w_l}{(1+r)} \qquad (2)$$

For an adult to send his or her child to a school and to invest in his or her education, the following equation must be satisfied:

$$\theta_i \leq \frac{w_h - w_l}{(1+r)} \qquad (3)$$

which asserts that the cost of schooling θ_i must be less than or equal to the net present value of the skill premium $w_h - w_l$ obtained from enrolling at school.

For this solution to hold, strong assumptions, including a fully altruistic parent (willing to borrow to finance the child's education or β = 1) and the absence of credit market problems (such as informational and/or contractual problems) are required. However, in practice, credit market problems are prevalent, especially in developing countries. In Indonesia, Johnston and Morduch (2008) found that out of 40% of creditworthy poor households only 10% had recently borrowed from a formal bank, suggesting a large gap between financial use and creditworthiness. In that case, credit market problems must be considered in the model setup. In this scenario, the adult is assumed to be either unable or unwilling to borrow, and thus saving cannot be negative or, to simplify, saving is zero in both periods. This modifies the budget set as follows:

$$c_i^1 = y_i - e_i\theta_i \qquad (4a)$$

$$c_i^2 = w_l + e_i(w_h - w_l) \qquad (4b)$$

The utilities from sending and not sending the child to a school are given, respectively, by

$$U(e_i = 1|y_i, \theta_i) = \ln(y_i - \theta_i) + lnw_h \quad (5a)$$

$$U(e_i = 0|y_i, \theta_i) = \ln y_i + lnw_l \quad (5b)$$

Hence, an adult will send his or her child to a school if the condition below is satisfied:

$$\ln(y_i - \theta_i) + lnw_h \geq \ln y_i + lnw_l \quad (6)$$

$$y_i \frac{w_h - w_l}{w_h} \geq \theta_i \quad (7)$$

Besides the household's optimality specified in equation (7), another constraint on school enrolment decision is that household income in each period cannot be less than the minimum subsistence level (Wongsangaroonsri, 2016). The arbitrary minimum basket of consumption for a household is $\bar{c}_i$, which varies across households to consider household-specific consumption preference. It is assumed that $w_l \geq \bar{c}_i$ and, without access to the credit market, the household that earns the minimum wage is bound by this additional constraint:

$$\bar{c}_i + \theta_i \geq w_l \quad (8)$$

As a response to an increase in minimum wage, conditions (7) and (8) generate two opposing impacts on the choice of senior secondary school type. According to (7), higher minimum wage decreases the skill premium because it increases the wage of the low-skilled worker. As a result, minimum wage legislation reduces the net benefit of sending a child to school and induces a child to drop out of school (substitution effect). An increase in minimum wage, however, causes income constraint in condition (8) to become less binding; hence, the child will be more likely to enrol at school (income effect). In addition to the direct impact of minimum wage on wage, the school choice decision is also influenced by the indirect impact of minimum wage on the probability of employment. This impact consists of two conflicting forces, depending on labour market structure. In a competitive labour market, the substitution of low-

skilled for high-skilled workers – due to an increase in minimum wage – will increase the net benefit of investing in human capital and thus give rise to student enrolment at school. In a monopsonistic labour market, the higher probability of getting a job reduces the incentive to invest further in education and thus induces the student to drop out of school.

Therefore, the total effect of an increase in minimum wage will depend on the combination of its impact on wage and employment probability. For example, if the substitution effect of minimum wage is offset by a fall in the probability of obtaining low-skilled employment, the child will be more likely to enrol at school. Conversely, if the adverse effect on employment is small or the probability of employment increases, the increase in minimum wage will raise the opportunity cost of going to school and the child will be more likely to drop out of school.

5. Data Characteristics

A large-scale annual household survey from Susenas serves as the primary data source for this paper, covering about 300,000 households in the country's 34 provinces. The core questionnaire consists of a household roster listing the sex, age, marital status, and educational attainment of all household members. The survey is supplemented by modules covering additional information such as health care and nutrition, household income and expenditure, and labour force experience. The macroeconomic variables, including provincial nominal minimum wage, GDP price deflator, and poverty line, are obtained from the Indonesian Bureau of Statistics. The provincial real minimum wage variable is created by dividing the provincial nominal minimum wage with the provincial GDP price deflator in each year to index the variable in terms of 2010 rupiah. Household expenditure is adjusted spatially and temporally by multiplying nominal household expenditure by the average national poverty line in the base year, and then dividing the result by the provincial poverty line.

Using survey data from 2000 to 2018, a pooled cross-section dataset of individuals was constructed. The sample for this study includes individuals who completed junior secondary education and then chose either to attend senior secondary education or to drop out of school. Starting from 2015, the government increased

compulsory education from 9 to 12 years. However, the take up of this programme is still exceedingly low; the drop-out rate at junior secondary school is still the highest amongst education levels (51,200 students dropped out in 2017–2018). Therefore, it is assumed that the schooling choice is made when students complete junior secondary school. The sample chosen for this study consists of individuals who were 15–19 years old during the survey year, the ages when students are enrolled in senior secondary school. The choice of the age cut-off is also in line with the definition of working-age population – those aged 15 to 64. To avoid endogeneity, individuals who migrated across provinces are not included in the analysis as the migration might be motivated by incentives to pursue a higher minimum wage.

The dependent variable of this study is the choice of human capital investment after completing junior secondary school, which is categorised into two choice types: attend senior secondary school or drop out of school. Under the subset of 'attending senior secondary school', there are two choices: attending general or vocational senior secondary school. Individuals attending general senior secondary schools are those enrolled in *sekolah menengah atas* (general senior secondary school) and *madrasah aliyah* (Islamic general senior secondary school). Individuals attending vocational senior secondary schools are those enrolled in *sekolah menengah kejuruan* (vocational senior secondary school) and *madrasah aliyah kejuruan* (Islamic vocational senior secondary school). *Madrasah aliyah* is equivalent to general and/or vocational senior secondary school but under the management of the Ministry of Religion. Within the subset of 'dropping out of school' are two alternatives: working in the formal or the informal sector. Individuals categorised as formally employed are those self-employed with unpaid family or temporary workers in non-agriculture industry, those self-employed with permanent workers, and government and private sector workers. Individuals categorised as non-formally employed are those working in the informal sector (the self-employed, unpaid family workers, the self-employed with unpaid or temporary workers in agriculture industry, and casual workers); taking care of the household; and doing other activities besides personal routines.

The variable of interest is the log value of real minimum wage, which is set at the provincial level yearly. Some control variables included in the analysis are gender, age, marital status, and urban residency dummy. Household control variables in the

analysis are highest education attainment of the mother and father, household size, number of children under 15 in the household, and the log value of real monthly household expenditure disaggregated into food and non-food expenditures. To ensure the comparability of real monthly household expenditure variable across different family sizes, the value is divided by $\sqrt{n}$ in a sense that the marginal cost of living is decreasing as the number of household members is increasing. These control variables at the individual and household levels are the case-specific variables for the first decision level in the nested logit model use in this study. Equally important, the share of each alternative at district level poses as the alternative-specific variable, which varies amongst the bottom-level alternatives, the four choices that one could make after completing junior secondary school.

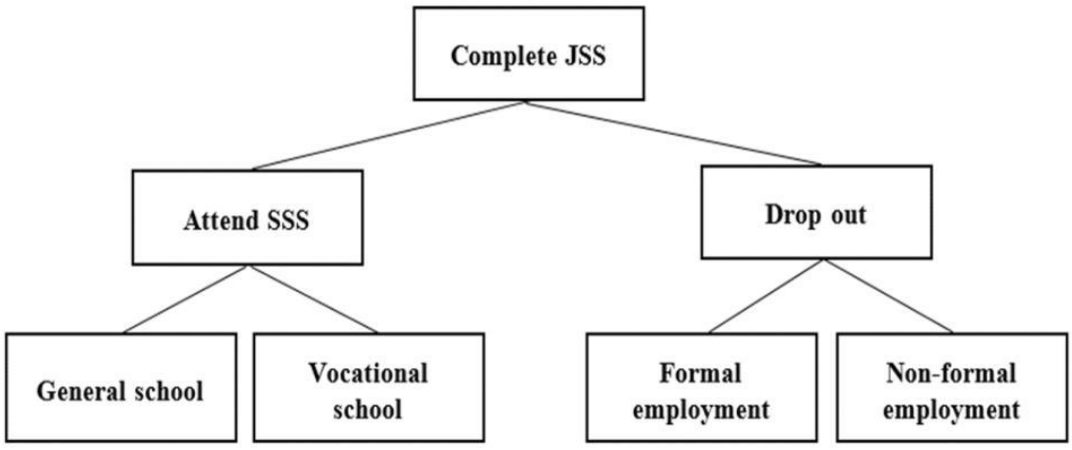
As information about senior secondary school choice is observed only once during someone's lifetime (unless the student has to repeat a grade and transfer to another school), a panel dataset cannot be constructed and a fixed effects model at the individual level cannot be used. Besides, to the best of the author's knowledge, a plausible instrument for minimum wage is not available. Therefore, to limit potential sources of endogeneity in the regression due to omitted variables, it is crucial to control for as many predetermined or exogenous characteristics as possible. Despite the limitations, compared with pure cross-sectional and time series data, the independently pooled cross-section data offer some advantage, including more precise estimators due to the availability of more observations and the ability to trace the evolution of the dependent variable over time after controlling for confounders. As the data are collected independently of each other across clusters, serial correlation of residuals is not an issue when regression analysis is applied.

6. Minimum Wage Effect on Choice of Senior Secondary School Type

6.1. Empirical Approach

To capture the possible relationship between minimum wage and choice of school enrolment, a nested logit model is utilised with controls for individual- and household-explanatory variables. This nested logit model allows for non-zero correlation between unobserved components of choices within a nest and maintains zero correlation across nests (Heiss, 2002). Hence, this model relaxes the assumption of independently distributed errors and the independence of irrelevant alternatives (IIA), which implies proportional substitution across alternatives, inherent in conditional and multinomial logit models by clustering similar alternatives into nests (Train, 2009). In this paper, individuals' choices after completing junior secondary school (JSS) are under (i) 'Attend senior secondary school (SSS)' or (ii) 'Drop out' (Figure 3). The tree diagram below consists of two branches and each contains two twigs for the two alternatives within the subset. Substitution is proportional across twigs within a branch but not across branches.

Figure 3: Tree Diagram for Choices after Completing Junior Secondary School



JSS = junior secondary school, SSS = senior secondary school.
Source: Author.

The nested logit model is estimated according to the following specification:

$$schl\_choice_{i,t} = \pi_0 + \pi_1 lnMW_{j,t} + X'_{i,t}\gamma_1 + X'_{h,t}\gamma_1 + \varepsilon_{i,t} \quad (9)$$
$$schl\_choice_{i,t} \in 0,1$$

The dependent variable $schl\_choice_{i,t}$ is a dummy variable, which takes the value of 0 if an individual i drops out of school and 1 if an individual i enrols at senior secondary school. The independent variable is $lnMW_{j,t}$ where $MW_{j,t}$ is real minimum wage of province j at time t. $X_{i,t}$, $X_{h,t}$ are each vector of individual- and household-specific control variables. The parameters of the nested logit model are estimated by simultaneous maximum likelihood technique, which, under general conditions, generates consistent and efficient value of the parameters (Brownstone and Small, 1989). The positive value of parameter π_1 indicates that an increase in minimum wage is associated with an increase in the likelihood of senior secondary school enrolment. The negative value of parameter π_1 suggests that a hike in minimum wage is linked to a drop in the probability of enrolling at senior secondary school, i.e. the individual is more likely to drop out of school. The nested logit model in this study has two decision levels. In the first level, a type of choice is selected – to enrol at senior secondary school or to drop out; in the second level, a specific alternative is chosen.

The nested logit model is a generalisation of the multinomial logit model, allowing groups of alternatives to be similar in an unobserved way (Heiss, 2002). In the case of two-level nested logit, as in this paper, it is assumed that there are J choices of alternatives $\{0,1,2,\dots,J\}$ nested into S sets $\{B_1, B_2, \dots, B_s\}$. The conditional probability of choice j given the choice in the set B_s becomes

$$\Pr\left(Y_i = j \mid X_i, Y_{,} \in B_s\right) = \frac{exp\,(\rho_s^{-1} X'_{ij}\beta)}{\Sigma_{l \epsilon B_s} exp\,(\rho_s^{-1} X'_{il}\beta)} \quad (10)$$

for $j \in B_s$, and zero otherwise. In addition, the marginal probability of a choice in the set B_s is as follows:

$$\Pr(Y_i \in B_s \mid X_i) = \frac{(\Sigma_{l \epsilon B_s} exp\ (\rho_s^{-1} X_{il}' \beta))^{\rho_s}}{\Sigma_{t=1}^{S} (\Sigma_{l \epsilon B_t} exp\ (\rho_s^{-1} X_{il}' \beta))^{\rho_s}} \qquad (11)$$

If $\rho s = 1$ for all s, then

$$\Pr(Y_i = j \mid X_i) = \frac{exp\ (X_{ij}' \beta + Z_s' \alpha)}{\Sigma_{t=1}^{S} (\Sigma_{l \epsilon B_t} exp\ (X_{ij}' \beta + Z_s' \alpha))} \qquad (12)$$

Thus, the implied joint distribution function of the $\varepsilon_{i,j}$ is

$$F\left(\in_{i,0}, \dots, \in_{i,J}\right) = (-\sum_{s=1}^{S} (\sum_{j \epsilon B_s} exp\ (-\rho^{-1} \varepsilon_{i,j}))^{\rho_s}) \qquad (13)$$

ρ_s indicates the degree of independence of alternatives within the nest, and $1 - \rho_s$ is a measure of correlation within the nest. Between the sets, the $\varepsilon_{i,j}$ are independent, in which $\rho_s = 1$. When all correlations are zero, the nested logit model becomes a standard logit model.

In a nested logit model, IIA holds within each nest. For example, the probabilities for attending general and vocational senior secondary schools rise by the same proportion whenever one of the other alternatives is removed, and similarly for the probabilities for formal employment and non-formal employment. Therefore, these alternatives satisfy IIA and can be put into nests called 'Attend SSS' and 'Drop out'. However, IIA does not hold for alternatives in different nests. For instance, when the formal employment alternative is removed, the probability of non-formal employment rises proportionately more than the probability of attending general and vocational secondary schools. Although the decision tree is often interpreted as implying that the highest-level decisions are made first, followed by decisions at lower levels, no such temporal ordering is necessarily implied (Henscher et al., 2005).

6.2. Estimation Results

Table 1 presents the effect of minimum wage legislation on the choice of human capital investment, estimated using equation (9). Column (1) contains the estimate for the full sample, columns (2) and (3) show the estimation results when the sample is disaggregated by gender, and columns (4) and (5) display the estimation results when the sample is subdivided based on household income.

Table 1: The Effect of Minimum Wage on the Choice of Human Capital Investment

Dependent variable is the choice of human capital investment (0 = Drop out of school; 1 = Enrol at senior secondary school)					
	(1) Baseline	(2) Male	(3) Female	(4) Low Income	(5) High Income
Log (minimum wage)	–.304**	–.453**	–.331**	.203***	–.202
	(.128)	(.220)	(.151)	(.064)	(.193)
Odds ratio	.738	.636	.718	1.225	.817
Wald χ^2	568.11	534.74	413.85	2415.59	391.08
Log likelihood	–1083.09	–810.79	–764.89	–10146.30	–744.91
Observations	29,495	15,674	14,271	9,304	20,191

Note: All estimations include all the control variables described in section 5 as well as year and province fixed effects. Standard errors are reported in parentheses below coefficient estimates. Significance at the 1%, 5%, and 10% levels is denoted respectively by ***, **, and *.
Source: Author.

Based on the estimation using the nested logit model, for the full sample regression, the estimated effect of minimum wage is negative and statistically significant at 5% significance level. The coefficient of a nested logit estimation is in terms of log odds. When the outcome is converted to odds ratio by taking the exponent, the odds can be inferred as 0.738 to 1 (26% decrease in the odds) that parents will invest in their children's education with e (or about 2.718) times increase in minimum wage (the odds ratio is associated with a b-fold increase in the predictor, where b is the base of the logarithm used when log-transforming the predictor). This result suggests that an increase in the minimum wage is associated with lower odds to enrol at senior secondary school. The finding of this negative effect is in accordance to the previous studies conducted by Neumark and Wascher (1994), Landon (1997), Pacheco (2007), and Rice (2010).

To capture gender difference in the effect of minimum wage, the sample is disaggregated into male and female. For the male sample regression, the negative coefficient on log minimum wage indicates that a higher minimum wage is linked to the likelihood of dropping out of school. The odds are 0.636 to 1 (36% decrease in the odds) that parents will invest in their male children's education with e times increase in the minimum wage. The same regression carried out using the female sample

signifies a negative significant effect of minimum wage on educational investment. The odds are 0.718 to 1 (28% decrease in the odds) that parents will invest in their female children's education with *e* times increase in minimum wage.

Two explanations are possible for this negative result. First, the substitution effect could be dominant, as shown in equation (7). Thus, a child will have a higher probability of dropping out of senior secondary school as minimum wage legislation reduces the skill premium and the net benefit of sending a child to a school. Second, the income effect could be larger than the substitution effect, but then it is offset by a rise in the probability of obtaining low-skilled employment. Hence, an increase in minimum wage is accompanied with higher odds of a child dropping out of senior secondary school.

Statistically, at 5% significance level, the disaggregation reveals that the odds ratio amongst female children is 11% higher than that of male children to enrol at senior secondary school due to minimum wage increase. This indicates that male children are more likely to drop out of school and start working, either in the formal or informal sector, as minimum wage increases. A worse effect amongst males is found in a study by Cunningham (1981), which reported that a minimum wage increase reduces enrolment of white males as it encourages firms to shift from part-time to full-time (higher-productivity) workers. Although, many studies (Dreze and Sen, 1995; Davies and Zhang, 1995; Chen et al., 2011) suggested that educational investment in developing countries is likely to be biased towards males, the results of this paper indicate no evidence of such bias, at least as a response to the increase in minimum wage legislation.

The sample is subdivided by household income proxied using household expenditure data, which were timely and spatially standardised, to generate comparable figures across time and province. This disaggregation is crucial to analyse possible differences in the effect of the minimum wage between low-income and high-income households in the sample. The intuition is that the effect of the positive income shock would be more likely to affect households with an income below minimum wage. Conversely, households with income well above minimum wage should experience no or smaller effect on their income. For this purpose, a low-income household is defined as a household that receives real monthly income less than the equivalent value of Rp 800,000 in 2010, whilst any household with income above this threshold is defined as

a high-income household. This subdivision threshold is consistent with the average of the real minimum wage in 2010 – Rp845,707. The regression is run separately based on household income status and the results are presented in columns (4) and (5). The estimate of the minimum wage effect is negative for individuals in high-income households and positive for those in low-income households.

According to the estimation using the nested logit model, for the low-income sample regression, the estimated effect of minimum wage is positive and statistically significant at 1% significance level. The odds are 1.225 to 1 (22% increase in the odds) that parents will invest in their children's education with *e* times increase in minimum wage. When the same regression is carried out using the high-income sample, the minimum wage has no significant effect on educational investment. The significant positive effect of minimum wage legislation amongst low-income households indicates that an increase in minimum wage is associated with a higher probability of enrolling at senior secondary school. This result is in accordance with the model prediction that the budget constraint in condition (8) is more likely to be binding for low-income households; hence, a positive income shock will make it less binding, resulting in a higher probability of investing in senior secondary education. The result is also consistent with the intuition that an individual in a household at the lower end of income distribution is more sensitive to an increase in minimum wage.

Amongst low-income households, however, the income effect cannot be concluded to be the dominant factor (relative to the substitution effect) as this positive result may be generated by a fall in the probability of obtaining low-skilled employment that offsets the substitution effect. In other words, if the labour market is assumed to be competitive, as suggested by Suryahadi et al. (2003), and that firms substituted low-skilled workers for high-skilled workers, the dominant substitution effect (i.e. drop out of school) may be superseded by the lower probability employment due to higher minimum wage. As a result, the probability of enrolling in senior secondary school is higher. In this regard, Cameron and Alatas (2003), using census data from all medium-sized and large Indonesian firms, found evidence of a negative employment impact for small domestic firms but no employment impact for large firms – foreign or domestic – which could indicate that smaller firms operate in a competitive labour market.

Although minimum wage may not directly affect low-income households since a great portion of them are engaged in the informal sector,[3] empirical studies reveal that minimum wage plays a significant role. A study by Khamis (2008) found that, in Argentina, the rise in minimum wage has had only minor effect on the formal sector but has improved wages in the informal sector. This result indicates that the common practice of non-compliance with labour laws and standards in the informal economy does not necessarily imply that minimum wage has no effect. The rationale for the influence of minimum wage on wages received by informal workers has been the 'lighthouse effect' – i.e. a signal given by minimum wage legislation to workers and employers in the informal economy regarding socially acceptable minimum levels of pay (Souza and Baltar, 1979; Bell, 1997). A field investigation in Indonesia conducted by Widarti (2006) observed that the wage system in the informal sector uses wage references in similar businesses in the regions; therefore, wages for most workers in the informal sector are clustered around provincial minimum wage standards.

Separating the Substitution and Income Effects

Determining the magnitude of substitution and income effect is also of interest in analysing the effect of the minimum wage on educational investment. Several additional assumptions underlie this identification. First, the magnitude of the substitution effect is symmetric across low-income and high-income households. Second, as the effect of the positive income shock is more likely to affect households with income below minimum wage, the income effect is assumed to affect only low-income households. Third, the labour market is competitive so that an increase in minimum wage is followed by an adverse effect in employment. To determine the size of substitution and income effect, the regression is estimated according to the following specification:

$$choice_{i,t} = \pi_0 + \pi_1 lnMW_{j,t} + \pi_2 Low\ Income_{i,t} + \pi_3\big(Low\ Income_{i,t} * lnMW_{j,t}\big) + X'_{i,t}\gamma_1 + X'_{h,t}\gamma_2 + \varepsilon_{i,t} \quad (14)$$

$$schl\_choice_{i,t} \in 0,1$$

$Low\ Income_{i,t}$ is a dummy variable taking the value of 1 if the household is classified

[3] More than 55% of workers in Indonesia are employed in the informal sector, and about 65% of workers with income in the bottom 20% work in the informal sector (Sakernas, 2019).

as low income (receiving real monthly income less or equal to the equivalent value of Rp800,000 in 2010) and 0 if otherwise. According to equation (14), π_1 will capture the common effect of minimum wage across all households. π_3, the coefficient of the interaction term, will capture the additional effect of minimum wage specific to low-income households. Given the aforementioned assumptions, π_1 will capture the substitution effect for low- and high-income households, and thus the sign is expected to be negative, whereas π_3 will capture the income effect for low-income households, and the sign should be positive.

Table 2: Alternative Specification with Interaction Term

Dependent variable is the choice of human capital investment (0 = Drop out of school; 1 = Enrol at senior secondary school)				
	Coefficient	Standard Error	z	$P > \|z\|$
Log (minimum wage)	–0.126	0.026	–4.91	0.000
Low income	2.538	5.968	0.43	0.671
Low income* Log (minimum wage)	–0.202	0.416	–0.49	0.627

Note: The regression uses the full sample and includes all the control variables described in section 5 as well as year and province fixed effects. Standard errors are reported in parentheses below coefficient estimates. Significance at the 1%, 5%, and 10% levels is denoted respectively by ***, **, and *.
Source: Author.

Based on the regression specified in equation (14), Table 2 shows that the coefficient of log real minimum wage is negative, but the coefficient of the interaction term is insignificant. From the results generated, it can be inferred that substitution effect is dominant for low- and high-income households, whereas income effect is non-existent for low-income households. Hence, the positive and significant result of an increase in minimum wage amongst low-income households, presented in column (4) of Table 1, is more likely to be associated with a fall in the probability of obtaining low-skilled employment that offsets the substitution effect, rather than with the income effect on its own.

6.3. Robustness Checks

6.3.1. Standard Logit or Nested Logit Model

According to Train (2009), the nested logit model is appropriate when the choice set can be subdivided into subsets or nests in such a way that the following properties hold:

1. For any two alternatives in the same nest, the ratio of probabilities is independent of the attributes or existence of all other alternatives in the nest. In other words, IIA, which implies proportional substitution across alternatives, holds within each nest.
2. For any two alternatives in different nests, the ratio of probabilities can depend on the attributes of other alternatives in the two nests. In other words, IIA does not hold in general for alternatives in different nests.

To check whether a nested logit model provides an accurate representation of the substitution pattern, hypothesis tests on the correlations within a nested logit model can be used (Train, 2009). When all correlations are zero, the generalised extreme value distribution becomes the product of independent extreme value distributions and the nested logit model becomes a standard logit model. If there are correlations over alternatives, the nested logit model is the appropriate model.

Table 3: Dissimilarity Parameters, Likelihood-Ratio Test, and Hausman Test for Independence of Irrelevant Alternatives

Dependent variable is the choice of human capital investment (0 = Drop out of school; 1= Enrol at senior secondary school)					
	(1) Baseline	(2) Male	(3) Female	(4) Low Income	(5) High Income
$\rho_{Senior\ Secondary\ School}$	.968	1.099	.963	1.019	1.046
$\rho_{Drop\ Out}$	.295	.320	.212	.412	.330
LR test for IIA (H_0: $\rho_s = 1\ \forall\ s$)	26.55***	36.72***	61.59***	509.62***	26.93***
Hausman test for IIA (H_0: $\rho_s = 1\ \forall\ s$)	42.38***	44.88***	94.37***	468.14***	33.00***

IIA = independence of irrelevant alternatives, LR = likelihood ratio.
Note: All regressions include all the control variables described in section 5 as well as year and province fixed effects. Standard errors are reported in parentheses below coefficient estimates. Significance at the 1%, 5%, and 10% levels is denoted respectively by ***, **, and *.
Source: Author.

The coefficient on the inclusive value (ρ_s), sometimes called the log-sum coefficient or the dissimilarity parameter, reflects the degree of independence amongst the unobserved portions of utility for the alternatives in each nest. A high value of ρ_s means greater independence and less correlation, i.e. the alternatives in the nest are less similar for unobserved reasons. For a nested logit model to be consistent with utility-maximising behaviour, it must be the case that $0 < \rho_s < 1$ for all s. A negative value of ρ_s is inconsistent with utility maximisation since it implies that improving the attributes of an alternative decreases the probability that it will be chosen. In general, the estimated log-sum coefficient that is outside the (0,1] bound suggests a misspecification problem with the model, in which either the systematic component, the grouping, or both could be incorrectly specified. Table 3 exhibits that the log-sum coefficients in all nested logit model specifications satisfy $0 < \rho_s < 1$ for all s. Thus, it can be inferred that there is no misspecification problem with the model.

To check whether the model has complete independence and the nested logit reduces to a standard logit model, a likelihood ratio (LR) test is conducted with the null being that $\rho_s = 1$ for all s. The LR test in Table 3 shows that the null that all of the dissimilarity parameters are 1 can be rejected at 1% significance level for all nested logit model specifications in this paper. This indicates that a nested logit model is more appropriate to estimate the effect of minimum wage on educational investment than a standard logit model, especially when one must choose either the type of senior secondary school or type of employment. The joint test that $\rho_s = 1$ for all s can be seen as a test of the IIA assumption. If $\rho_s = 1$ for all s, then the IIA holds and it is appropriate to use the standard logit model. Nevertheless, the result from the LR test should be used with caution as it will depend on exactly how the decision tree is specified. Different specifications of the decision tree can lead to conflicting results. Therefore, Hausman's (1978) specification test can be used to test for IIA, and this test will not be sensitive to the tree structure specified in the nested logit model. Table 3 reports the results of Hausman's specification test, indicates that IIA does not hold, and shows that it is appropriate to use a nested logit model.

6.3.2. Disaggregation into High- and Low-income Household

The regressions for low- and high-income households presented in Table 1 use the sample disaggregated according to the equivalent value of Rp800,000 in 2010, an arbitrary threshold set to examine the heterogeneity of minimum wage effect based on household income. To check for robustness, this section will repeat the regression done in columns (4) and (5) of Table 1 using different sample subdivision. Table 4 presents the estimation of minimum wage effect on educational investment when the sample is disaggregated into three groups based on household income distribution.

Table 4: Estimation of Minimum Wage's Effect on Educational Investment Based on the Household Income Distribution

	Dependent variable is the choice of human capital investment (0 = Drop out of school; 1 = Enrol at senior secondary school)			
	(1) HH income ≤ 5th percentile	(2) HH income ≤ 25th percentile	(3) 25th percentile > HH income ≤ 50th percentile	(4) HH income > 50th percentile
Log (minimum wage)	.225***	–.045	.020	–.057
	(.070)	(.082)	(.116)	(.321)
Odds ratio	1.252	.956	1.020	.566
Wald χ^2	1919.74	1185.77	1324.83	334.71
Log likelihood	–8025.89	–3867.75	–4150.84	–691.93

HH = household.
Note: All regressions include all the control variables described in section 5 as well as year and province fixed effects. Standard errors are reported in parentheses below coefficient estimates. Significance at the 1%, 5%, and 10% levels is denoted respectively by ***, **, and *.
Source: Author.

The threshold for the 5th percentile of household income distribution is the equivalent value of Rp817,165 in 2010, whereas the 25th and 50th percentiles of the distribution lie at the equivalent value of Rp1,287,747 and Rp1,796,012 in 2010, respectively. Column (1) shows that minimum wage legislation has a significant positive effect on educational investment. In other words, an increase in minimum wage induces enrolment in senior secondary school amongst individuals in low-income households, particularly those with income below 5% of the distribution. The odds are 1.252 to 1 that parents will invest in their children's education with *e* times

increase in the minimum wage. Conversely, columns (2), (3), and (4) show that there is no significant effect of minimum wage on educational investment. These results are consistent with the regression estimated for low- and high-income households in Table 1, and indicate that the significant positive effect amongst low-income households is mostly driven by individuals whose household incomes are at the 5th percentile of the distribution, which is equal to the average value of real minimum wage in 2010.

6.3.3. Construction of Provincial Real Minimum Wage Variable

In adjusting nominal values to real values, one could use a consumer price index (CPI) or GDP deflator. Although at first glance both seem to measure the same thing, there are a few key differences. The first is that the GDP deflator includes only domestic goods and not anything that is imported, whilst the CPI includes anything bought by consumers, including foreign goods. The second difference is that the GDP deflator is a measure of the prices of all goods and services, whilst the CPI is a measure of only goods bought by consumers. Therefore, this section will present a robustness check on the construction of the provincial real minimum wage variable using CPI rather than GDP as a deflating measurement.

The national CPI data are constructed based on available city or district CPI data representing all provinces. The number of cities used to survey the cost of living has increased through the years. In 2000, CPI was based on surveys in 44 cities, then 45 in 2004, 66 in 2008, and 82 in 2014. Although there are no provincial CPI data, the author attempts to construct provincial CPI using city and district data by weighting cities that represent the province based on their GDP relative to provincial GDP. Table 5 presents the estimation of the minimum wage effect on educational investment, where the provincial real minimum wage variable is formulated by dividing the provincial nominal minimum wage with the value of provincial CPI in each year to index the variable in terms of 2010 rupiah.

Table 5: The Effect of Minimum Wage on the Choice of Human Capital Investment

Dependent variable is the choice of human capital investment (0 = Drop out of school; 1= Enrol at senior secondary school)					
	(1) Baseline	(2) Male	(3) Female	(4) Low Income	(5) High Income
Log (minimum wage)	–0.316**	–0.264	–0.351**	0.255***	–0.172
	(0.131)	(0.162)	(0.155)	(0.0783)	(0.238)
Odds ratio	0.730	0.768	0.704	1.289	0.842
Wald χ^2	565.23	360.29	412.32	1830.89	248.87
Log likelihood	–1075.72	–790.08	–761.76	–7560.25	451.26
Observations	29,495	15,674	14,271	9,304	20,191

Note: All estimations include all the control variables described in section 5 as well as year and province fixed effects. Standard errors are reported in parentheses below coefficient estimates. Significance at the 1%, 5%, and 10% levels is denoted respectively by ***, **, and *.
Source: Author.

Based on the estimation using the nested logit model, for the full sample regression the estimated effect of the minimum wage is negative and statistically significant at 5% significance level. It can be inferred that the odds are 0.730 to 1 (27% decrease in the odds) that parents will invest in their children's education with *e* times increase in the minimum wage. When the sample is disaggregated according to gender, the male sample regression does not show any significant effect of the minimum wage on educational investment. However, amongst the female sample, there is evidence that a higher minimum wage is linked to the likelihood of dropping out of school, significant at 5% significance level. The odds are 0.704 to 1 (29% decrease in the odds) that parents will invest in their female children's education with *e* (or about 2.718) times increase in minimum wage.

According to the household income disaggregation, the estimated effect of minimum wage is found to be positive and statistically significant at 1% significance level amongst low-income households. The odds are 1.289 to 1 (29% increase in the odds) that parents will invest in their children's education with *e* times increase in minimum wage. When the same regression is carried out using the high-income sample, there is no significant effect of minimum wage on educational investment. The significant positive effect of minimum wage legislation amongst low-income

households indicates that an increase in minimum wage is associated with a higher probability of enrolment at senior secondary school.

As explained in the Data Characteristics section, the provincial real minimum wage variable is created by dividing the provincial nominal minimum wage with provincial GDP price deflator in each year to index the variable in terms of 2010 rupiah. However, the results of the robustness-check regression show no significant difference between using the provincial GDP deflator or CPI value as the deflating measurement. Both find significant positive effects of minimum wage increase on the odds of senior secondary school enrolment amongst low-income households, and significant negative effects for the full sample. The size of the odds ratio between the two types of regressions denotes no significant dissimilarity.

6.4. Discussion and Limitations

In a pooled cross-section data setting, one is unable to fully control for time-invariant unobservable characteristics as in a panel data setting. As a result, both the time-variant and time-invariant unobservable characteristics that affect school choice will lead to endogeneity bias if they are correlated with the independent variables and are not directly controlled. Therefore, in this paper, whenever possible, both the time-variant and time-invariant factors that have the potential to cause endogeneity bias are controlled. Data on some important control variables are unavailable, however, including data on the direct cost of senior secondary education and a proxy for the quality of education, such as salaries of teachers or the student–teacher ratio. The minimum wage variable might be correlated with these unobservable factors, which would then determine the educational investment and lead to possible endogeneity bias. For instance, if the direct cost of senior secondary education is positively correlated with the minimum wage, as this cost is part of the decent living standard consumption bundle determining the minimum wage, the coefficient of the minimum wage variable will be biased upwards. Given the availability of data, these control variables could provide a way to improve this paper.

In this paper, the parameters of the nested logit model are estimated simultaneously using standard maximum likelihood technique. Although maximisation using maximum likelihood is sometimes challenging because the log-likelihood functions are not globally concave, and even in concave areas are not close

to a quadratic, the parameters of the nested logit model results are consistent (Brownstone and Small, 1989). With simultaneous estimation, the parameters of the nested logit model are efficient since all information is utilised in the estimation of each parameter, and parameters that are common across components are necessarily constrained to be equal (Train, 2009). In some cases, however, if problems arise in simultaneous estimation, nested logit models can be estimated in a bottom-up sequential manner. However, conforming to Train (2009), sequential estimation of nested logit models, whilst consistent, is not as efficient as simultaneous estimation by maximum likelihood. In the case of the nested logit model in this paper, there is no problem in simultaneous estimation and the log-likelihood has a unique global maximum. Therefore, there is little reason to estimate the nested logit model sequentially.

7. Conclusion and Policy Implications

Based on the full sample regression, minimum wage legislation has significant negative effect on educational investment, i.e. individuals are more likely to drop out of senior secondary school due to an increase in minimum wage. The male and female sample regression show significant negative response as a result of an increase in minimum wage. There is no evidence of gender bias in human capital investment, at least as a response to the increasing minimum wage. After disaggregating the sample by household income, this paper finds that the minimum wage increase has no effect on education investment for individuals in high-income households but has a positive effect for those in low-income households. Using these income division results alone, it cannot be concluded that the income effect is the dominant factor amongst low-income households since this positive result might be generated by a fall in the probability of obtaining low-skilled employment that offsets the substitution effect. Therefore, to separate the substitution and income effects, a regression incorporating an interaction term is estimated. The results suggest that the substitution effect is the dominant factor in explaining the effect of minimum wage legislation on human capital investment for low- and high-income households. This dominant negative substitution effect was discovered in most studies analysing the impact of minimum wage on human capital investment, such as Neumark and Wascher (1994), Landon (1997), Pacheco (2007), and Rice (2010).

The results of this empirical investigation suggest that an increase in the minimum wage hinders recent government efforts to promote student enrolment in senior secondary school. Consequently, the impact on human capital investment decision of individuals should be considered when introducing or raising minimum wage. Policy interventions might be crucial to encourage students to complete senior secondary school, particularly to counteract the negative impact of minimum wage legislation on educational investment and to avert the negative consequences of the low level of human capital in the labour force. The results indicate that the success of a government programme will depend at least in part on other programmes. Therefore, inter-sectoral policy coordination should be improved to enable synergy or at least prevent overlapping and conflict of sector policies as policy issues become more numerous and complex. The government needs to identify and mitigate divergences between sector priorities and policies and promote mutually supporting actions across sectors and institutions.

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Appendix

Table A.1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
General SSS	29,495	0.569	0.495	0.000	1.000
Vocational SSS	29,495	0.189	0.391	0.000	1.000
Formal employment	29,495	0.052	0.222	0.000	1.000
Non-formal employment	29,495	0.190	0.392	0.000	1.000
Log (minimum wage)	29,495	13.746	0.379	12.675	14.698
Log (minimum wage)*	29,495	13.721	0.360	12.978	14.729
Rural	29,495	0.529	0.499	0.000	1.000
Female	29,495	0.491	0.500	0.000	1.000
Married	29,495	0.038	0.190	0.000	1.000
HH size	29,495	5.145	1.809	1.000	30.000
Mother educ level	29,495	1.896	1.316	0.000	12.000
Father educ level	29,495	2.125	1.474	0.000	12.000
Log (food expenditure)	29,495	13.892	0.495	9.170	18.994
Log (non-food expenditure)	29,495	13.483	0.796	9.170	18.925

educ = education, HH = household, max = maximum, min = minimum, obs = number of observations, std. dev. = standard deviation.
(*) The provincial real minimum wage variable is formulated by dividing the provincial nominal minimum wage with the value of provincial consumer price index (CPI).
Source: Author.

Table A.2: The Effect of Minimum Wage on the Choice of Human Capital Investment

	(1) Baseline	(2) Male	(3) Female	(4) Low Income	(5) High Income
Alternative					
(general SSS, vocational SSS, formal employment, non-formal employment)					
Proportion at district level	3.345***	3.310***	3.207***	3.691***	3.799***
	(0.422)	(0.323)	(0.149)	(0.136)	(0.428)
Choice type					
(0 = Drop out; 1 = Attend senior secondary school)					
Log (minimum wage)	–0.304**	–0.453**	–0.331**	.203***	–.202
	(0.128)	(0.220)	(0.151)	(.064)	(.193)
Rural	–0.0321	–0.0110	–0.485	–0.108*	–0.0347
	(0.243)	(0.290)	(0.297)	(0.0568)	(0.278)
Married	–4.068***	–3.082***	–3.867***	–4.290***	–3.867***
	(0.362)	(0.677)	(0.326)	(0.146)	(0.441)
HH size	0.126	0.138	0.166	–0.0584***	0.385
	(0.103)	(0.141)	(0.164)	(0.0202)	(0.527)
Mother educ level	0.204*	0.463***	0.291**	0.438***	0.100
	(0.114)	(0.153)	(0.137)	(0.0459)	(0.129)
Father educ level	0.401***	0.370***	0.205**	0.347***	0.463***
	(0.0937)	(0.113)	(0.0962)	(0.0378)	(0.117)
Log (food expenditure)	–0.323	–0.482*	–0.322	–0.988***	–0.375
	(0.201)	(0.254)	(0.231)	(0.0669)	(0.271)
Log (non-food expenditure)	0.599***	0.703***	0.673***	0.656***	0.511**
	(0.162)	(0.202)	(0.205)	(0.0553)	(0.200)

school_tau	0.959***	1.845***	0.964***	1.039***	1.159***
_cons	(0.102)	(0.592)	(0.131)	(0.0471)	(0.143)
dropout_tau	0.264***	0.416	0.212***	0.415***	0.341***
_cons	(0.0448)	(0.668)	(0.0430)	(0.0191)	(0.0711)
Observations	29,495	15,674	14,271	9,304	20,191

educ = education, HH = household, SSS = senior secondary school.
All estimations include all the control variables described in section 5 as well as year and province fixed effects. Standard errors are reported in parentheses below coefficient estimates. Significance at the 1%, 5%, and 10% levels is denoted respectively by ***, **, and *.
Source: Author.

Table A.3: The Effect of Minimum Wage on the Choice of Human Capital Investment

	(1) Baseline	(2) Male	(3) Female	(4) Low Income	(5) High Income
Alternative (general SSS, vocational SSS, formal employment, non-formal employment)					
Proportion at district level	3.357***	3.365***	3.423***	3.600***	3.628***
	(0.330)	(0.408)	(0.435)	(0.158)	(0.497)
Choice type (0 = Drop out; 1 = Attend senior secondary school)					
Log (minimum wage)*	–0.316**	–0.264	–0.351**	0.255***	–0.172
	(0.131)	(0.162)	(0.155)	(0.0783)	(0.238)
Rural	–0.00232	0.0300	–0.444	–0.162**	0.182
	(0.243)	(0.291)	(0.297)	(0.0665)	(0.359)
Married	–4.037***	–3.059***	–3.840***	–4.101***	–4.740***
	(0.363)	(0.677)	(0.326)	(0.158)	(0.774)
HH size	0.131	0.140	0.172	–0.0552**	0.0963
	(0.103)	(0.138)	(0.163)	(0.0232)	(0.671)
Mother educ level	0.197*	0.449***	0.284**	0.482***	0.105
	(0.113)	(0.154)	(0.137)	(0.0533)	(0.163)
Father educ level	0.392***	0.369***	0.196**	0.319***	0.398***
	(0.0938)	(0.113)	(0.0963)	(0.0423)	(0.143)
Log (food expenditure)	–0.288	–0.450*	–0.283	–0.999***	–0.620*
	(0.204)	(0.253)	(0.234)	(0.0795)	(0.332)
Log (non-food expenditure)	0.573***	0.627***	0.648***	0.617***	0.717***
	(0.162)	(0.197)	(0.206)	(0.0643)	(0.244)

school_tau	0.974***	1.097***	0.990***	1.008***	1.046***
_cons	(0.105)	(0.145)	(0.135)	(0.0539)	(0.158)
dropout_tau	0.270***	0.321***	0.219***	0.406***	0.330***
_cons	(0.0461)	(0.0697)	(0.0447)	(0.0220)	(0.0801)
Observations	29,495	15,674	14,271	9,304	20,191

educ = education, HH = household, SSS = senior secondary school.
Note: All estimations include all the control variables described in section 5 as well as year and province fixed effects. Standard errors are reported in parentheses below coefficient estimates. Significance at the 1%, 5%, and 10% levels is denoted respectively by ***, **, and *.
(*) The provincial real minimum wage variable is formulated by dividing the provincial nominal minimum wage with the value of provincial consumer price index.
Source: Author.

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