

Article

Informal and Formal Wage Differences Based on Cohorts in Indonesia

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Abstract: Labor market dualism has caused a persistent wage gap between formal and informal workers in Indonesia. This study aimed to decompose the wage difference between formal and informal workers based on cohorts in Indonesia and further analyze the factors that influence this gap. This allowed us to identify the structure of the labor market and whether it tends to be segmented or competitive. By controlling the cohort, the estimation result was compatible with the human capital accumulation argument. The data sourced from the 2010 and 2019 National Labor Surveys comprised 581,312 and 503,313 workers, respectively. This study used the threefold Heckman selection-biased corrected Blinder–Oaxaca decomposition technique. The results showed that the wage gap between formal and informal workers is decreasing, especially among the younger cohort. Among this cohort, the labor market is still segmented, although the degree of segmentation is lower. In contrast, the older cohort labor market is more competitive but at a decreasing rate. A further decomposition showed that education has affected the wage gap between young and old cohorts. However, this effect is diminishing. In addition, differences in institutional labor market settings such as the wage system and occupational health and safety systems have increased the wage gap. The findings imply that equitable access to education for the younger cohort and the improvement of labor market institutions can reduce the gap between formal and informal wages.

Keywords: wage gap; informal and formal worker; cohort; Blinder–Oaxaca decomposition; Heckman selection bias



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1. Introduction

Formal and informal dualism has long characterized the labor market in Indonesia. In 1980, informal employment accounted for around 70% of total employment. In 2020, the proportion of informal employment was still high at about 60% (BPS 2017). The employment shift from the informal to the formal sector has been quite slow. One of the indications of this problem is the persistence of the wage gap between formal and informal workers in Indonesia.

Theoretical approaches to explain the formal–informal wage gap include labor market segmentation, comparative advantage, compensating wage differentials, and labor market heterogeneity. Most empirical studies on differences in wages between formal and informal workers focus on comparing wages based on income quantile. Using conditional quantile regression, Tannuri-Pianto and Pianto (2002) found that wage differentials were wider among workers in the lower quantile. About 30% of the wage difference in the lower quantile could be explained by formal or informal attributes. The results suggested that the market tends to be segmented. However, Perry et al. (2007) warned of the potential for bias from this method. This method assumes that informal workers will remain in a particular segment of the income distribution despite potential changes in individual outcomes. This assumption is contrary to the principle of comparative advantage. A worker will adjust and choose jobs or sectors that will maximize their skills and potential by transitioning to

the formal sector. One of the solutions offered to overcome these weaknesses is the use of unconditional quantile regression by controlling for fixed effects. [Ablaza et al. \(2021\)](#) used this technique to analyze the wage difference between formal and informal workers, especially in the lower-income quintiles in Indonesia. The study confirmed that informal workers in the lower quantile suffer the most significant penalty, but not informal workers in the upper quantile. The wage differential decreased with the quantile of the wage distribution. This wage difference feature among informal workers is consistent with the internal dualism model among informal workers ([Fields 2005](#)).

In the context of Côte d'Ivoire, [Günther and Launov \(2012\)](#) found both segmentation and comparative advantage in the informal labor market. By examining unobserved earnings heterogeneity and self-selection, the study revealed a segmented informal sector. A segment earns quite high wages and levels of return for education and experience, and vice versa. By estimating counterfactual data, this study showed that many informal workers (usually low-paid) could earn higher wages if they were in the formal labor market segment. On the other hand, many informal workers tend to have a comparative advantage; usually, they are informal workers with high wages.

[Bargain and Kwenda \(2014\)](#) also estimated counterfactual data by utilizing the actual wages of workers who have made informal and formal transitions in South Africa, Brazil, and Mexico. By controlling for fixed effects to eliminate characteristics that are neither observable nor change over time, they showed that informal penalties tend to be smaller. Consistent with previous findings, these penalties tend to be significant at the bottom of the income distribution and not visible at the top.

[Pratap and Quintin \(2006\)](#) tested Argentina's labor market segmentation using a semi-parametric technique. The study showed that the formal premium tends to be insignificant after controlling for individual and sectoral characteristics of the company. In other words, the study does not capture the existence of formal and informal labor market segmentation. The young, less skilled workers are willing to queue up, hoping to work in the formal sector even at low wages. Using a different perspective from this study, [El Badaoui et al. \(2010\)](#) indicated a positive and significant formal premium in Ecuador after controlling for firm size. This premium arises because there is a tendency for formal workers, in general, to work for large companies. In contrast, informal workers tend to concentrate on jobs that pay low wages. Thus, the formal premium is only a firm-size premium, so it is not a segmentation of the formal and informal labor market.

In addition to differences in wages based on income quantiles, many other empirical studies have analyzed the differences between formal and informal wages based on gender. The wage gap is higher in the informal sector, especially among female workers ([Tansel and Acar 2016](#); [Nordman et al. 2016](#); [Deininger et al. 2013](#); [El-Mahdi and Amer 2004](#); [Chen 2001](#); [Portes et al. 1986](#)).

Other studies explain wage differences by decomposing wage differences into endowment and coefficient effects ([Dasgupta et al. 2015](#); [Mønsted 2000](#); [Wulandari et al. 2018](#)). An empirical study by [Dasgupta et al. \(2015\)](#) in Thailand showed that most of the wage gap is due to the endowment effect, which suggests a competitive labor market. Systematically, informal workers receive lower incomes across all quantiles, and the difference is more considerable as the quantiles increase. The results in Thailand differ from those of a study conducted in Indonesia by [Wulandari et al. \(2018\)](#). This study explicitly analyzed the skills premium to explain the wage difference between formal and informal workers. The analysis of wage decomposition on skilled workers showed that the difference between formal and informal wages was 39.6%. Individual characteristics only explained about 10.31% of the difference, while unobservable characteristics caused the most. For unskilled workers, formal workers received 28.3% higher wages than informal workers. As much as 46.68% of the wage difference could be explained by differences in individual characteristics, while unobservable characteristics explained the rest. The decomposition results showed that discrimination factors are more dominant in influencing the difference between formal and informal wages for skilled and unskilled workers than are productivity factors. In

other words, these results indicate that the labor market in Indonesia is more segmented, especially for skilled workers.

According to [Mønsted \(2000\)](#), in 1985, the difference in worker characteristics only contributed 27% to the difference in formal and informal wages in Bolivia, while the difference in returns contributed 49%. Differences in both returns and characteristics were explained primarily by educational, and experience returns. The role of differences in characteristics grew in 1995 to 54%, while the difference in returns was only able to explain 29% of the difference in wages. This study's results indicated an increasingly competitive labor market structure in Bolivia.

Meanwhile, [Gong and Van Soest \(2002\)](#) investigated the segmentation of the urban labor market in Mexico. Using a dynamic multinomial logit model and random effects, the wages of both sectors increased along with education, especially for workers in the formal sector. In addition, the study also found a vast difference in wages between formal and informal workers in higher education, while for workers with secondary or low education, the difference was slight or even negative.

[Skoufias and Suryahadi \(2002\)](#) examined the effect of economic growth and contraction from 1986 to 1998 on the median and distribution of wages in Indonesia. Economic growth was enjoyed mainly by a young cohort of workers in the formal sector. The development of the wage sector had absorbed many new entrants into the labor market. This increase in median wages increased wage differentials, especially in the younger cohort of women. However, the wage decline since the 1997 monetary crisis was evenly distributed between age and sex cohorts.

The wage differences in Indonesia are also a consequence of the labor market transformation favoring formal workers over informal workers ([Pratomo and Manning 2019](#)). However, it is not easy for informal workers in the agricultural sector to find formal work in the non-agricultural sector. The informal workers who are young and have better education will tend to switch to jobs in the formal sector rather than informal ones. In terms of wages, the transformation of the labor market provides the most significant benefits to formal workers, who earn significantly higher wages than newcomers and informal workers. The wages of workers who previously worked in the informal sector with those of newcomers are relatively not different. This condition shows a scarring effect, although it is not very strong.

The minimum wage policy in Indonesia may cause a persistent wage gap between formal and informal wages. Using individual data, [Rama \(2001\)](#) showed that the minimum wage increases the average wage by approximately 15%. However, this increase was mainly enjoyed by low-skilled workers in the formal sector. This finding is in line with [Hohberg and Lay \(2015\)](#), which used Indonesia Family Life Survey (IFLS) data and concluded that minimum wages positively affect increases in formal sector wages. Unfortunately, the minimum wage policy had no spillover effect on the informal sector.

Meanwhile, [Chun \(2008\)](#) also stated that the minimum wage is the primary determinant of the increase in the monthly wage for workers whose income is below the minimum wage. However, this increase in minimum wage does not affect those who work in the informal sector, whose wages are still below the minimum. [Dewi \(2018\)](#) used a quantile approach to analyze the wage gap caused by the minimum wage. The results implied that the minimum wage's direct effect on the formal sector is more dominant than the indirect effect on the informal sector. The effect of the minimum wage policy was more even across all quintiles of the formal sector.

Unlike the studies above, which explain the positive effect of minimum wage on formal sector workers, [Yan \(2016\)](#) found a mixed effect of minimum wage on the informal sector. This occurred due to dualism in the informal sector, where the upper tier is more competitive, while the lower tier is inferior. This study used the standard Welch–Gramlich–Mincer dual-sector labor market model on data from the 2007 and 2010 Indonesia Labor Survey (SAKERNAS).

The Indonesian labor market's demographic composition may also affect the persistence of the formal and informal wage gap. Education level significantly influences the transition toward higher wages in the formal sector. [Taufiq and Dartanto \(2020\)](#) used the National Panel Socio-Economic Survey (2011–2013) to reveal that workers with better education tend to leave the informal sector. This turnover process plays a role in reducing the poverty rate in Indonesia. This research is also in line with [Xiao Chen \(2017\)](#), who reported that the higher the education level, the higher the probability of a transition to the formal sector. In addition, a better education also prolongs a worker's stay in the formal sector. On the other hand, [Naidoo et al. \(2015\)](#) reported that the longer a worker is in the informal sector, the more disadvantaged they are in terms of income compared to workers with the same qualifications but working in the formal sector.

Aside from having a better education, those transitioning from informal to formal are young workers and newcomers to the labor market. They generally work in the industrial and urban service sectors. Indonesia Family Life Survey (IFLS) data show that only about one-fourth of new arrivals come from the agricultural sector in rural areas ([Suryahadi et al. 2018](#)). In addition, technological progress that requires more educated and skilled workers increase the formal premium, which raises the gap between formal and informal wages in Indonesia. The increasing demand for skilled labor has increased inequality since the 2000s due to technological diffusion from imports and foreign direct investment ([Lee and Wie 2015](#)).

The findings in the literature suggest that specific controls over individual characteristics, sector and company size, income segment, and fixed effects significantly affect wage differences for formal and informal workers. Thus, conclusions about what type of theory or model explains wage differences will vary depending on the control variables. This study offers a different point of view on wage difference by specifically controlling for cohort effect. By controlling for the cohort effect, the estimation result was comparable to the human capital accumulation argument. First, human capital accumulation between young and old cohort is different. In the standard theory of income ([Mincer 1974](#)), age determines experience and tenure, affecting the income difference between young and old workers. The age-earning profile explains that older workers earn more because they accumulate returns from previous human capital investments, even at a diminished rate. Thus, comparing the wages of young workers with old ones becomes less relevant. Second, [BPS \(2019\)](#) reveals that, on average, young workers in Indonesia only receive 67% of the wages of older workers (Table 1). Third, disaggregation into age cohorts also provides other benefits. Cohort studies allow for comparing the income profile of a particular cohort or generation over time.

Table 1. Wage by Age Groups (Indonesia Rupiah).

Age Group	2016	2017	2018	2019
15–19	1,361,099	1,563,174	1,587,250	1,684,545
20–24	1,819,594	2,094,129	2,108,362	2,236,560
25–29	2,172,390	2,399,056	2,489,229	2,617,012
30–34	2,451,806	2,650,159	2,780,282	2,880,453
35–39	2,748,140	2,910,602	2,982,764	3,122,455
40–44	2,921,924	3,078,404	3,110,507	3,305,665
45–49	3,378,014	3,334,748	3,449,582	3,430,826
50–54	3,626,983	3,703,469	3,793,509	3,772,288
55–59	3,533,016	3,781,950	4,083,219	3,930,529
60+	2,044,160	2,045,848	2,234,565	2,280,785
Average	2,552,962	2,742,621	2,829,130	2,913,897
Average of 15–34	1,951,222	2,176,630	2,241,281	2,354,642
Average of 35–60+	3,042,040	3,142,504	3,275,691	3,307,091

Source: Indonesian Statistics.

2. Methodology

2.1. Data

The classification of formal and informal workers refers to Proxy 2 of the Indonesia Statistics (Table 2). The proxy combines the employment status with the employment type. The cross-sectional data sources from the 2010 and 2019 Indonesia National Labor Survey comprised samples of 581,312 and 503,313 workers, respectively.

Table 2. The Classification of Formal and Informal Workers.

Employment Type	Employment Status						
	1	2	3	4	5	6	7
1	F	F	F	F	F	F	I
2	F	F	F	F	F	F	I
3	F	F	F	F	F	F	I
4	I	F	F	F	I	I	I
5	I	F	F	F	I	I	I
6	I	I	F	F	I	I	I
7	I	F	F	F	I	I	I
8	I	F	F	F	I	I	I
9	I	F	F	F	I	I	I
10	I	F	F	F	I	I	I

F: formal worker, I: informal worker; employment types: (1) Professional, technical, and other related workers; (2) Administrative and managerial workers, (3) Clerical and related workers; (4) Sales workers; (5) Service sector workers; (6) Agriculture, animal husbandry, forestry, fishers, and hunters; (7) Production and related workers; (8) Transport equipment operators; (9) Laborer, and (10) Others. Employment status: (1) Own-account worker; (2) Employer assisted by temporary workers/unpaid workers; (3) Employer assisted by permanent workers/paid workers; (4) Employee; (5) Casual employee in agriculture; (6) Casual employee not in agriculture, and (7) Family/unpaid worker. Source: Indonesian Statistics.

2.2. The Estimation Model

The model uses a threefold Heckman selection-biased corrected Blinder–Oaxaca decomposition technique (Jann 2008). This model is a development of seminal papers by Blinder (1973) and Oaxaca (1973) or Blinder–Oaxaca (BO). The BO method decomposes the difference in average log wages by estimating its counterfactual.

$$R = \{E(X_F) - E(X_I)\}'\beta_F + E(X_I)'(\beta_F - \beta_I) + \{E(X_F) - E(X_I)\}'(\beta_F - \beta_I) \quad (1)$$

$$R = E + C + I,$$

The first component in (1) is the endowment effect (E). This effect arises because of the different predictors in each group. Group I (informal) is the reference group where the difference in predictors between the two is weighted by the coefficient of group I . This effect measures the expected change in the average wage of group I if group I has characteristics like group F (formal). The second component, the coefficient effect (C), measures the contribution of coefficient differences. The predictor of group I weights the coefficient difference. In other words, this effect estimates the expected change in group I 's average wage if the group I has a group F coefficient. The last component, the interaction effect (I), is used to accommodate the simultaneous differences in endowment and coefficients between the two groups. Using this decomposition technique, we could identify the wage structure of each cohort. If the coefficient effect is more dominant than the endowment effect, then the wage structure tends to be segmented. Meanwhile, the wage structure tends to be competitive if the endowment effect is more dominant than the coefficient effect.

Estimation of wage models typically has a selection bias problem (Heckman 1979). An approach to deal with the selection bias in the decomposition calculation is to first address the selection effect on the difference in total wages and then apply the standard decomposition method (Neuman and Oaxaca 2004). This study uses the two-step Heckman model to overcome the problem. According to this model, there are two equations: the

outcome equation and the selection equation. The outcome equation is a mechanism to determine the outcome variable. This equation uses the Mincer equation, as Equation (2):

$$\ln(Y_\ell^*) = \mathbf{X}'_\ell \alpha + \varepsilon_\ell, \varepsilon_\ell \sim N(0, \sigma_\varepsilon^2), \quad (2)$$

and

$$\ln(Y_\ell) = \begin{cases} \ln(Y_\ell^*) & \text{if } \ln(Y_\ell^*) > 0 \\ - & \text{if } \ln(Y_\ell^*) \leq 0' \end{cases}$$

The selection equation is the sample portion whose results can be observed and is a mechanism for determining the selection process (3). In this study, the latent variable is work participation.

$$h_\ell^* = \mathbf{Z}'_\ell \gamma + u_\ell, u_\ell \sim N(0, 1) \quad (3)$$

and

$$h_\ell = \begin{cases} 1 & \text{if } h_\ell^* > 0 \\ 0 & \text{if } h_\ell^* \leq 0' \end{cases}$$

Thus, $h_\ell > 0$ only if the latent variable is $h_\ell^* > 0$, but if $h_\ell^* \leq 0$, then $h_\ell = 0$. The magnitude of h_ℓ^* is irrelevant, but only the sign. Thus, $\ln(y_\ell)$ is observable only if $h_\ell^* > 0$.

In this study, the selection equation includes several variables: age, age squared, marital status, and the number of household members. These variables affect the selection process for work participation but do not affect wages. Therefore, wages can be observed if $h_\ell > 0$.

Equation (1) can be estimated directly to obtain $\hat{\beta}_F$ and $\hat{\beta}_I$ as predictions of the parameters β_F and β_I . Meanwhile, \bar{X}_F and \bar{X}_I are the average predictors of groups F and I as predictions for $E(X_F)$ and $E(X_I)$. Thus, (1) can be estimated by

$$R = \bar{Y}_F - \bar{Y}_I = (\bar{X}_F - \bar{X}_I)' \hat{\beta}_I + \bar{X}'_I (\hat{\beta}_F - \hat{\beta}_I) + (\bar{X}_F - \bar{X}_I)' (\hat{\beta}_F - \hat{\beta}_I), \quad (4)$$

Procedure (4) was performed separately for each old and young cohort. The $\hat{\beta}$ coefficients in each group, formal and informal (ℓ), as well as the young and old cohorts (c), were obtained by partial estimation on the two-step Heckman model as follows:

$$Y_{\ell c} = \alpha_{\ell c} + \mathbf{X}'_{\ell c} \beta + \delta \lambda(\mathbf{Z}_{\ell c}, \delta) + \mu_{\ell c}, \quad (5)$$

The dependent variable is wages at 2010 constant prices. The unit measurement of wages is rupiah per month. The explanatory variables are education, experience, gender, region, certified training, regional income per capita, and distance and duration of traveling from home to the workplace. Specific to the 2019 data, we benefited from the availability of additional labor-market institutional variables such as disabilities, wage system, contract system, employment social security, insurance, and labor unions.

In addition to the problems related to the selection bias above, one of the weaknesses of the Blinder–Oaxaca decomposition model is that the model does not apply to the non-linear model, non-mean distribution, or continuum group comparison (Fortin et al. 2010). Therefore, the model in this study is linear, uses distribution of the mean, and has discrete formal and informal data. All models were estimated using STATA/MP 14.0 software (StataCorp, College Station, TX, USA).

A robustness check tested whether the estimated coefficients were sensitive to the addition of these additional variables. The latent variable used in the model was work participation, which is a function of age, marital status, and the number of family members.

3. Results

Table 3 presents the total decomposition of the wage difference between formal and informal workers. Among young cohorts, the wage difference fell sharply to 31%. Conversely, the wage difference between the old cohort decreased slightly by about 14%. The coefficient effect was more dominant in explaining the wage gap among the young cohort

than the endowment effect. However, in 2019, the coefficient effect dropped sharply to 0.0971, while the endowment effect dropped to 0.0152. The decrease in these two effects was compensated by an increase in the interaction effect. Conversely, the endowment effect was more dominant than the coefficient effect among the old cohort in 2010 and 2019.

Table 3. The Total Decomposition of Wage Difference.

Total Decomposition	2010		2019	
	Young	Old	Young	Old
formal wage	13.64 ***	14.07 ***	13.88 ***	14.19 ***
informal wage	13.12 ***	13.36 ***	13.53 ***	13.57 ***
wage difference	0.515 ***	0.718 ***	0.357 ***	0.618 ***
endowment effect	0.0713 ***	0.220 ***	0.0152	0.146 *
coefficient effect	0.378 ***	0.148 ***	0.0971 ***	0.0374
interaction	0.0661 ***	0.350 ***	0.245 **	0.435 ***
N	119,975	157,619	91,613	130,053
municipal/city dummy	yes	yes	yes	yes
sectoral dummy	yes	yes	yes	yes

Note: the signs *, **, and *** indicate significance at 5%, 1%, and 0.1% levels, respectively.

Table 4 present the further decomposition of each effect. The endowment effect decomposition shows that education explains wage differences of 11% among the young cohort in 2010. In 2019, education was still a factor contributing to the wage gap, even though the effect had decreased to 7%. In addition to education, experience depreciation, the wage system, and occupational health and safety system also affected wage differences. For the old cohort, education increased wage differences by about 9% in 2010, but its effect had decreased to 6% by 2019. Other factors increasing the wage differentials among the old cohort were certified training, depreciation of experience, gender, urban/rural area, distance, and regional per capita income. The occupational health and safety system, wage systems, and all types of disability also increased the differences in wages for formal and informal workers.

Based on the decomposition of the coefficient effect, educational attainment was also a dominant factor in increasing the wage difference of the young cohort in 2010. This factor increased the difference in wages by up to 25%. Education still contributed to the wage difference in 2019, even though the effect had decreased to 10%. Occupational health and safety had a considerable effect, up to 35%.¹ For the old cohort, education remained very influential on the wage difference, accounting for 39% in 2010 and falling to 18% by 2019. Experience also affects the wage difference, by up to 408%. (See note 1).

The simultaneous interaction between the endowment and coefficient effect statistically affected wage difference for formal and informal workers. Among the young cohort, this factor accounted for only 13% of the difference in 2010. However, in 2019, its influence increased sharply to 69%. Meanwhile, among the older cohort, the interaction factors had a significant effect. In 2010 the interaction coefficient was 49%, and in 2019 it increased to 70%.

Differences in education affected the wage difference of the young cohort in 2010 by about 11%. Meanwhile, by 2019, the effect of education on interaction had decreased to 5%. In addition, the increase in wage differences was also influenced by the occupational health and safety system, gender, experience, urban/rural areas, and certified training. Among the old cohort, education influenced the wage difference between formal and informal workers in 2010 by 44%. By 2019, education still affected the wage gap by 19%. The occupational health and safety system, experience depreciation, trade unions, certified training, gender, and urban/rural areas also affected the increase in wage differences.

Table 4. The Effect Decompositions of Wage Difference.

Decomposition	Endowment Effect				Coefficient Effect				Interaction Effect			
	2010		2019		2010		2019		2010		2019	
	Young	Old	Young	Old	Young	Old	Young	Old	Young	Old	Young	Old
education	0.111 ***	0.0919 ***	0.0696 ***	0.0553 ***	0.249 ***	0.393 ***	0.100 ***	0.180 ***	0.105 ***	0.365 ***	0.0491 ***	0.170 ***
experience	−0.117 ***	−0.101 ***	−0.154 ***	−0.0869 ***	0.129	1.626 ***	−0.216 ***	0.608 ***	−0.0383	−0.350 ***	0.0654 ***	−0.130 ***
experience, squared	0.0430	0.130 ***	0.0898 ***	0.0863 ***	0.00680	−0.685 ***	0.133 ***	−0.274 ***	−0.00303	0.263 ***	−0.062 ***	0.102 ***
1 if female	−0.0648 ***	0.0135 ***	−0.128 ***	−0.0309 ***	0.0684 ***	0.089 ***	0.0427 ***	0.072 ***	0.0362 ***	−0.006 ***	0.0699 ***	0.014 ***
1 if urban	0.0109	0.0123 ***	−0.00274	0.00253	0.0218 *	0.0091 **	0.0307 ***	0.016 ***	0.0152 *	0.0052 **	0.0295 ***	0.011 ***
1 if part. in training	0.00671	0.0185 ***	−0.00397	0.000198	0.00216	0.002 ***	0.0038 ***	0.003 ***	0.00529	0.013 ***	0.0169 ***	0.028 ***
regional per-capita income	0.0508	0.0257 ***	0.00937	0.0319	0.669	0.454 *	0.400	−0.145	−0.0375	−0.0192 *	−0.0271	0.0100
distance to the workplace	0.00694	0.0108 **	0.01000 ***	0.00998 ***	0.00243	0.000317	−0.00207	−0.0158	0.00387	0.000916	−0.000227	−0.00137
duration of travelling	0.00565	0.00596	0.00601 ***	0.00164	−0.00140	−0.00018	−0.0289	0.00463	−0.00222	−0.00049	−0.00189	0.000232
visually impaired			−0.000412	0.00135 ***			0.158	0.0121			0.000474	−0.00029
hearing issue			0.000102	0.00115 **			0.0190	−0.0156			−0.000076	0.000272
mobility issue			−0.000077	0.000628 *			−0.265	−0.0246			0.000074	0.000200
dissolvent			0.000077	0.00015			0.379	0.0664			−0.000065	−0.00015
communication issue			0.000574	0.000570 **			0.0451	0.115 *			−0.00022	−0.0005 *
other disability			0.000610	0.00103 ***			0.00028	0.0604			−0.00000	−0.00044
wage system			0.0614 ***	0.0495 ***			0.0227	0.0141			−0.0121	−0.00701
contract system			0.0600	0.0390			0.0273	−0.0949			−0.00812	0.0323
1 if health insurance covered			0.00125	−0.000097			0.255	−0.0155			−0.00194	0.000015
1 if access OHS			0.0611 **	0.0781 ***			0.298 ***	0.426 ***			0.0893 ***	0.182 ***
1 if life insurance covered			−0.00584	0.00187			0.392	−0.574			0.00413	−0.00300
1 if union member			0.00117	−0.00952			−0.133	−0.372 ***			0.00498	0.039 ***
constant					−0.383	−1.543***	−0.659	0.510				
N	119,975	157,619	91,613	130,053	119,975	157,619	91,613	130,053	119,975	157,619	91,613	130,053
municipal dummy	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
sectoral dummy	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

Note: the signs *, **, and *** indicate significance at 5%, 1%, and 0.1% levels, respectively.

4. Discussion

Overall, the decomposition of wage difference yielded a slight decrease in the wage gap between formal and informal workers. The persistence of the wage gap between formal and informal wages may be due to changes in the economic structure that favored the development of the formal sector. Although there was some labor mobility from the informal to the formal sector, it appears to be difficult for individuals who previously worked in the informal sector to move to the formal sector even though they have the same characteristics as the formal workers. Not only is it difficult for the informal worker to find a formal job, but the earnings among those who initially started in the informal sector were also less than their counterparts (Pratomo and Manning 2019). This fact may also indicate the existence of the insider–outsider problem in Indonesian labor markets. However, this indication is still premature and must be formally explored and tested to determine whether there is a form of insider pressure on wage levels.

In addition, in the last few decades, Indonesia has experienced impressive growth. This growth has shifted the structure of the Indonesian economy from the agricultural sector to the industrial sector. The role of the agricultural sector fell from 45% in the 1970s to only 14% in 2014. This transformation led to urbanization and informalization processes in the early stages, especially in urban areas (Rothenberg et al. 2016). However, the consistent growth of the industrial and service sectors drove the transition toward the formal sector. The proportion of the formal workforce grew to 44.9% in 1997, before the economic crisis (Newhouse and Alatas 2010).

However, there has been a substantial decrease among the younger cohort. The increasing educational attainment of the young cohort, especially women, might be responsible for this decreasing gap. The reversed educational gender gap (OECD 2018) can explain this phenomenon. In addition, a shift in the type of women's work towards non-traditional work also supports this trend (Goldin 2004, 2006). The declining role of the agriculture sector has caused a significant decrease in the workforce, because the workforce primarily consists of informal workers in rural areas.

Meanwhile, the decomposition also shows that the wage structure among young cohorts still tends to be segmented, even though the degree of segmentation has decreased. The dominance of the coefficient effect over the endowment effect indicates this segmentation. Even though the degree of segmentation is decreasing, the wage structure does not show that it is increasingly competitive. On the other hand, the wage structure of the older cohort tends to be competitive, but the level of competition is decreasing. The dominance of the endowment effect over the coefficient effect indicates this competitive wage structure. These results indicate that the labor market structure in Indonesia is more heterogeneous, in that one segment of the young cohort tends to be less segmented, while the old segment is competitive. Although different techniques and approaches were used here, this heterogeneity of the labor market confirms the previous research by Ablaza et al. (2021) in Indonesia, Günther and Launov (2012) in Côte d'Ivoire, and Tannuri-Pianto and Pianto (2002) in Brazil. In contrast, these results contradict the study of Dasgupta et al. (2015) in Thailand and Mønsted (2000) in Bolivia, which showed more competitive labor markets.

Further decomposition confirmed that differences in educational attainment are one of the factors that consistently lead to differences in wages for formal and informal workers for all cohorts. However, the effect is decreasing, especially among the younger cohort. This may indicate that the accessibility of education for the younger generation in Indonesia is more evenly distributed than in the past. The effect of differences in education on the income gap between formal and informal workers confirms empirical studies conducted in Indonesia (Ablaza et al. 2021; Prabowo 2021; Wicaksono et al. 2017; World Bank 2016). In addition to education, occupational health and safety and wage systems also increase the wage gap between formal and informal. Since the observations in this study are at the aggregate national level, the policy formulation proposed is still general. Further studies can correct this weakness by utilizing the rich SAKERNAS data at disaggregate levels, such

as provinces or districts. Taking into account the heterogeneity of the labor market in each region will result in more specific policy formulations.

Robustness Check

Since the 2019 estimation model is different from the 2010 model in terms of the number of explanatory variables, it was necessary to do a robustness check. This check ensured that adding variables for 2019 would not affect the stability of the results. Table 5 shows that the wage difference between formal and informal workers remained significant. The wage gap among the older cohort was larger than that of the younger cohort. However, the wage gap in each cohort decreased, especially among the younger cohort. For this cohort, the coefficient effect was more dominant than the endowment effect; conversely, among the older cohort, the endowment effect was more dominant than the coefficient effect. The wage structure tends to be segmented for the younger cohort and at a decreasing rate. Meanwhile, the wage structure of the old cohort is still competitive, albeit at a diminishing rate.

Table 5. The Robustness Check for Total Decomposition of Wage Difference.

Total Decomposition	2010		2019	
	Young	Old	Young	Old
formal wage	13.64 ***	14.07 ***	13.88 ***	14.18 ***
informal wage	13.12 ***	13.36 ***	13.66 ***	13.71 ***
wage difference	0.515 ***	0.718 ***	0.223 ***	0.472 ***
endowment effect	0.0713 ***	0.220 ***	0.028 ***	0.144 **
coefficient effect	0.378 ***	0.148 ***	0.167 ***	0.0677 *
interaction	0.0661 ***	0.350 ***	0.028 ***	0.260 **
N	119,975	157,619	114,516	210,404
municipal/city dummy	yes	yes	yes	yes
sectoral dummy	yes	yes	yes	yes

Note: the signs *, **, and *** indicate significance at 5%, 1%, and 0.1% levels, respectively.

5. Conclusions

The dualism of the formal and informal labor markets in Indonesia has existed for a long time. This dualism causes the persistence of the wage gap between formal and informal workers. This study aimed to decompose the factors influencing wage differences by controlling for the cohort. This study uses the threefold Blinder–Oaxaca decomposition technique with Heckman selection bias correction. This study contributes to the empirical literature on alternative measurements of the formal and informal wage gap by specifically controlling for cohort aspects. The study results were comparable to the human capital accumulation argument by controlling for the cohort effect. Based on this argument, the earnings of the young and old cohorts are basically different due to different human capital accumulation. The age-earning profile shows that the older earn more because they accumulate returns from previous human capital investments.

Average wages for informal and formal workers differed significantly among both the young and old cohorts. However, the difference was more significant among the older cohort. The wage difference among the young cohort tended to decrease sharply over time, while among the older cohort, it decreased only slightly. Among the young cohort, the wage structure tended to be segmented, even though the degree of segmentation decreased over time. On the other hand, the older cohort is more competitive. This finding suggest that Indonesia has a heterogenous labor market.

Educational differences were persistently a determinant of increasing wage gaps in all cohorts. Nonetheless, the effect of education is diminishing, particularly among the younger cohort. In addition, differences in institutional labor market settings, such as the wage and occupational health and safety system, also increase inequality. These findings imply that the policy of equitable access to education for the younger generation

is essential in reducing the wage gap. Institutional improvements in Indonesia's labor market, especially in the informal sector, and those related to occupational health and safety, health insurance systems, and a competitive and fair wage system can reduce the gap between formal and informal wages. In the case of a very heterogeneous labor market like Indonesia, a further study based on sub-group analysis by province or region will provide more advantages for policy formulation purposes.

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Notes

¹ The interpretation of the dummy coefficient in the log-linear model is $(e^{\hat{\beta}} - 1) \times 100\%$.

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