

Yusuf, Arief Anshory; Siyaranamual, Martin D.; Sumner, Andrew

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# Education expansion, the Kuznetsian tension, and inequality

The case of Indonesia

Arief Anshory Yusuf,<sup>1</sup> Martin D. Siyaranamual,<sup>1</sup> and Andy Sumner<sup>2</sup>

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**Abstract:** This paper explores the impact of education expansion on structural transformation and income inequality in Indonesia, contextualized within the Kuznetsian framework of economic development. Using a natural policy experiment from the 1978–1979 extension of the school year, we apply a regression discontinuity design (RDD) to establish the causal relationship between increased education and labour shifts from agriculture to non-agricultural sectors. Additionally, we employ the recentred influence function (RIF) Oaxaca-Blinder decomposition and the Atkinson inequality decomposition to assess how education expansion contributes to both within-sector and between-sector income inequality. Our findings suggest that while education expansion facilitates structural transformation, it also has complex implications for inequality, particularly within modern sectors.

**Key words:** Kuznets, structural transformation, inequality, Indonesia

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<sup>1</sup> Padjadjaran University, Bandung, Indonesia, corresponding author: [arief.yusuf@unpad.ac.id](mailto:arief.yusuf@unpad.ac.id); <sup>2</sup> King's College London, UK

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# 1 Introduction

The transition to modern economic growth, as articulated by Kuznets (1973), involves a significant structural transformation (ST) where labour shifts from agriculture to manufacturing and eventually to services. This transformation often leads to increased income inequality, a phenomenon known as the Kuznets tension. In developing countries like Indonesia, this process is complicated by the persistence of large productivity gaps between sectors and the slow pace of labour movement out of agriculture.

A common policy response to these challenges is to expand education, with the expectation that it will equip the workforce with the skills needed for higher-productivity jobs, thereby facilitating structural transformation. However, the relationship between education expansion and inequality, particularly in the context of structural transformation, remains underexplored.

One of the significant challenges in achieving structural transformation in developing economies like Indonesia is the persistence of large labour-productivity gaps across sectors. This issue has been well-documented, notably by McMillan and Rodrik (2011), who found substantial differences in productivity between the most and least productive sectors, particularly in developing countries.

In Indonesia and many other developing countries, the agricultural sector continues to employ a large portion of the labour force, despite being significantly less productive compared to the non-agricultural sectors. The productivity gap between agriculture and other sectors can be as much as fivefold (McMillan and Rodrik 2011), indicating severe inefficiencies in how labour is allocated across the economy. This gap is especially pronounced in the poorest regions, where agriculture remains a dominant source of employment but contributes minimally to economic growth due to its low productivity.

Even after adjustments for various factors, these productivity gaps persist, suggesting that labour market frictions, such as geographical constraints, monopsony power, and the informality of the labour market, play a critical role in slowing down the reallocation of labour from agriculture to more productive sectors. The continued employment of a significant share of the labour force in agriculture, despite its lower productivity, underscores the need for policies that not only expand education but also address these frictions to facilitate a more efficient labour reallocation.

Investing human capital facilitates or may even cause (Porzio et al 2022) structural transformation (i.e., labour movement out of agriculture sector) because modern sector typically skill-intensive sectors. This is often called skill-biased structural change (see Buera et al. 2020). Yet, despite the long history of study of ST since Kuznets (1955), the role of human capital (and thus education) in structural transformation was studied only recently such as by Caselli and Coleman II (2001) in the US context.

Recent studies, such as those by Caselli and Coleman II (2001) and Porzio et al. (2022), have begun to explore the role of human capital in structural transformation. These studies suggest that as education expands, it drives labour from low-productivity agricultural sectors to higher-productivity non-agricultural sectors, thus facilitating structural transformation. However, this shift may also exacerbate income inequality within modern sectors, as these sectors often exhibit wider income disparities.

They argued that structural transformation occurs as education expands over time, driven by declining education and training costs, leading more workers to transition from the unskilled agricultural sector to the skilled non-agricultural sector.

Based on this, and on Acemoglu and Guerrieri (2008), Porzio et al. (2022) contribute to this body of work by isolating empirically the effects of human capital growth across cohorts on the supply of agricultural workers and the reallocation of labour out of agriculture. Using a model of frictional labour reallocation, Porzio et al. (2022) conclude that the increase in human capital significantly reduced the agricultural labour supply, accounting for 40% of the decrease in agricultural employment at fixed prices.

The paper aims to explore the impact of education expansion on structural transformation and income inequality in Indonesia, within the framework of the Kuznetsian structural transformation. The core objective is to understand how expanding access to education influences the movement of labour from agriculture to more productive non-agricultural sectors, and whether this shift contributes to rising income inequality.

To address these questions, the paper employs a regression discontinuity design (RDD) using data from the 1978-1979 school length extension in Indonesia. This method helps assess the causal effect of education on labour reallocation. Additionally, the paper examines the relationship between education expansion and income inequality using a within and between sector inequality decomposition (Atkinson) and a recentred influence function (RIF) Oaxaca-Blinder inequality (Gini) decomposition. These methods allow for a detailed analysis of how education affects inequality within and across different economic sectors.

This paper offers a nuanced examination of the relationship between education expansion, structural transformation, and income inequality in Indonesia, using causal inference methods. While the connection between education and labour mobility, including the movement between sectors, has been widely studied, few analyses have applied rigorous causal inference techniques. Notable studies by Duflo (2001) and Porzio et al. (2022) have explored similar themes, yet the specific role of education expansion in the context of the Kuznetsian tension between economic growth and inequality has not been thoroughly investigated.

By utilizing a rare natural policy experiment—the 1978-1979 extension of the school year in Indonesia—this paper employs a regression discontinuity design (RDD) to examine the causal relationship between education and structural transformation. This approach provides a more detailed understanding of how education influences the shift of labour from agriculture to more productive sectors.

Additionally, the paper applies recentred influence function (RIF) regressions to investigate how education expansion affects income inequality, particularly within modern sectors that often experience greater income disparities. While the study aims to contribute to the existing literature, it does so with a focus on deepening the understanding of these complex relationships, offering insights that may be useful for policymakers interested in promoting more equitable economic development.

## 2 Methodology

### 2.1 Conceptual framework

Informally we can explain the conceptual framework of this paper by extending the work of Anand and Kanbur (1993), focusing on the role of education in reducing labour market frictions and facilitating structural transformation. We hypothesize that education expansion can increase labour mobility, thereby reducing the productivity gap between sectors. However, this may also increase within-sector inequality, particularly in the non-agricultural sector.

Structural transformation (ST) occurs when the share of the population working in non-agricultural sectors increases. As this transformation unfolds, within-sector inequality tends to rise, while between-sector inequality initially increases but eventually declines, creating the characteristic inverted U-shape of the Kuznets curve. However, this process can be hindered by factors such as labour market frictions, leading to a slowdown or even a stalling of structural transformation.

Evidence suggests that stagnation is often due to the persistence of productivity gaps between sectors. In theory, education expansion could help alleviate this bottleneck, enabling the economy to progress to a point where structural transformation is more robust and inequality begins to decline. In this paper, we will attempt to confirm this movement as caused by education expansion using causal inference techniques for the case of Indonesia.

As education expands, its impact on inequality can manifest in different ways. Within the Kuznets framework, this effect may operate through two primary channels: the influence on between-sector inequality and the influence on within-sector inequality. The direction of this change is not definitive, as the literature suggests that education could either reduce or increase inequality depending on various factors. Exploring these potential outcomes and their implications forms the focus of the second part of this paper.

### 2.2 Regression discontinuity design and school length term extension

We use a natural experiment from the 1978–1979 extension of the school year in Indonesia, which shifted the academic calendar and extended the school year by six months. This reform serves as the basis for our RDD analysis, allowing us to estimate the causal impact of increased education on labour movement from agriculture to non-agriculture. The analysis uses data from the Indonesian Family Life Survey (IFLS) for the years 2000, 2007, and 2014.

In 1978, Indonesia undertook a significant reform of its education system by shifting the start of the academic year from January to July to align with the government's budget year. This adjustment extended the school year by six months, resulting in the 1978 academic year stretching until June 1979. Notably, this extension did not introduce new instructional materials; instead, teachers were directed to review and reinforce existing content. The reform was uniformly applied across the country, providing all students in 1978 with additional instructional time.

This reform serves as a natural experiment for the current study, which seeks to assess the impact of increased education on structural transformation using a fuzzy regression discontinuity design (FRDD). The identification strategy hinges on the fact that individuals born in 1972 or earlier were exposed to the extended school year, while those born in 1973 or later were not, due to the typical age of school enrolment in Indonesia. Children generally start first grade at age seven, so those born in 1972 would have been in school during the reform, whereas those born later would not have experienced the additional instruction time.

The study leverages this variation in exposure, treating it as if it were random, to examine the causal effects of education expansion. The additional instruction time could potentially increase the total years of education completed by those exposed to it, providing a unique opportunity to study the broader impacts of education on outcomes such as structural transformation and inequality.

While the 1978 reform is the focal point of this study, it is important to note that other significant reforms also shaped the Indonesian education system in the 20th century. The SD Inpres school construction program, launched in 1971, aimed to increase school enrolment by expanding access to elementary education, leading to the construction of approximately 61,000 new schools. However, this program was independent of the 1978 reform. Additionally, the nine-year compulsory education program introduced in 1994, which mandated education through junior high school, does not confound the current study's identification strategy, as the youngest students affected by the 1978 reform would have completed senior high school by 1990, well before the compulsory education policy was implemented.

RDD using the same natural experiment has previously been applied in the context of health (Parinduri 2017), political participation (Parinduri 2019) or religiosity (Masuda and Yudisthira 2020), among others.

To estimate the effect of education expansion on ST, we estimate the following regression model.

$$\Pr(y_i = 1) = F(\alpha_0 + \alpha_1 E_i + \alpha_2 X_i + f(yob_i)) \quad (1)$$

$\Pr(y_i = 1)$  is the probability that worker  $i$  moves from traditional to modern sector. We define four kinds of mobility.:

1. Mobility of workers from rural to urban area
2. Mobility of workers from agriculture sector to (broad) non-agricultural sectors
3. Mobility of workers from agriculture sector to high productivity (formal) non-agricultural sectors
4. Mobility of workers from agriculture sector to low-productivity (informal) non-agricultural sectors.

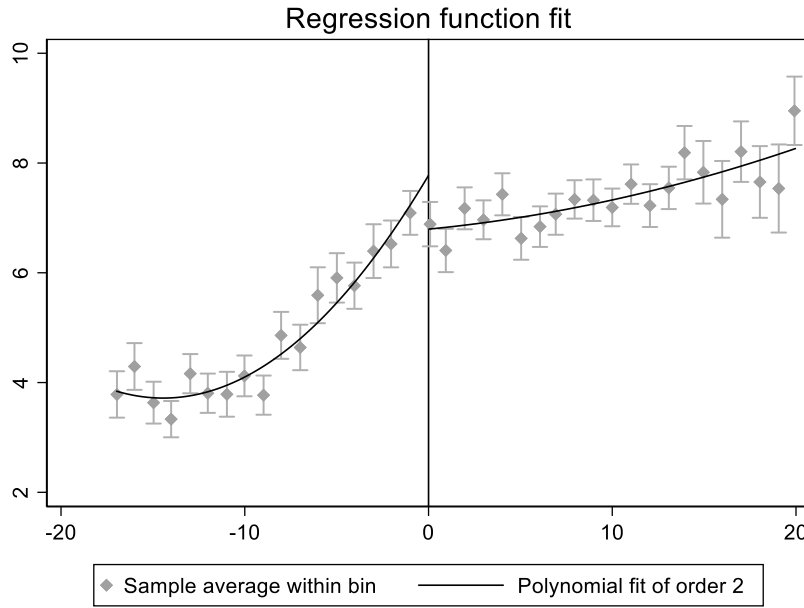
$E_i$  is the key independent variable. It is the years of education of worker  $i$ .  $X_i$  is the control variables which include socio-demographic (age, sex and marital status) and regions (island of where the worker lives).  $f(yob_i)$  is the quadratic function of the worker's year of birth. Whereas  $F(\cdot)$  is cumulative standardized normal distribution.

Before estimating equation (1) we estimate in the first stage regression the following model.

$$E_i = \beta_0 + \beta_1 D_i^{1972} + \beta_2 X_i + f(yob_i) + \varepsilon_i \quad (2)$$

$D_i^{1972}$  is the year of birth dummy that equals 1 if worker was born in 1972 or before and 0 otherwise, and  $\varepsilon_i$  is error term. Figure 1 below shows a quadratic function fitted to birth year data, revealing a noticeable discontinuity in educational attainment around the 1972 cohorts. This initial evidence indicates that the extended school year reform led to an increase in the educational attainment of individuals who were exposed to the reform (left part of 1972 cohort) compared to those who were not (right part of the 1972 cohort).

**Figure 1: Schooling years discontinuity**



Source: authors' illustration.

## Data

Our main data source was the Indonesian Family Life Survey (IFLS), a comprehensive longitudinal socio-economic and health survey that covers approximately 83% of the Indonesian population, including over 30,000 individuals across 13 of the 34 Indonesian provinces (Figure 1). Few large-scale longitudinal surveys exist for developing countries, particularly those that include data on various aspects of religious intolerance, making the IFLS both unique and exceptional in this regard. For this study, we used data from IFLS-2 (2000), IFLS-4 (2007/2008) and IFLS-5 (2014) to construct variables related to workers sector-mobility, and other socio-demographic variables.

## 2.3 Atkinson inequality decomposition

To assess the impact of education on inequality, we use the Atkinson index to decompose overall inequality into within-sector and between-sector components. This helps us understand how much of the inequality is driven by differences within sectors versus differences between agriculture and non-agriculture sectors.



To do this we make use of the Atkinson index of inequality because of its decomposability into between and within inequality. We look at the difference between worker's sector of employment (agriculture and non-agriculture) using The Atkinson index of inequality, as proposed by Atkinson (1970). To calculate the inequality index<sup>1</sup>, let's define a population of household  $i = 1, 2, \dots, N$  with income  $y_i$ . Atkinson (1970) define  $y^{EDE}$ , the equally-distributed-equivalent income, which can be calculated from the data as:

$$y^{EDE} = \begin{cases} \left( \frac{1}{N} \sum_{i=1}^N y_i^{1-\varepsilon} \right)^{\frac{1}{1-\varepsilon}} & \text{for } 0 < \varepsilon \neq 1 \\ (\prod_{i=1}^N y_i)^{\frac{1}{N}} & \text{for } \varepsilon = 1 \end{cases} \quad (3)$$

Then the Atkinson index is defined as:

$$A(\varepsilon) = 1 - \frac{y^{EDE}}{\mu} \quad (4)$$

Where  $\mu$  is the arithmetic mean of  $y_i$ ,  $\varepsilon$  is a parameter for the degree of inequality aversion. The well-known property of the Atkinson index of inequality is that it is decomposable by between-group and within-group components. Therefore, we can estimate the contribution of within- and between-group inequality to overall inequality. The Atkinson Index can be decomposed into Within-group inequality  $I_W$  and Between-group inequality  $I_B$ ,<sup>2</sup> where:

$$I_W = 1 - \frac{1}{\mu} \sum_{k=1}^K \frac{N_k}{N} y_k^{EDE} \quad (5)$$

and,

$$I_B = 1 - \frac{y^{EDE}}{\sum_{k=1}^K \frac{N_k}{N} y_k^{EDE}} \quad (6)$$

Where  $k = 1, \dots, K$  is the sub-group  $k$  of the population,  $N_k$  is the share of population in group  $K$ , and  $y_k^{EDE}$  is equally-distributed-equivalent income of group  $k$ . A decomposition analysis will be used to estimate the contribution of within-sector and between-sector inequality to overall inequality and also how the proportion of each contribution changes over time.

## Data

We utilize the National Labour Force Survey (Survey Angkatan Kerja Nasional, SAKERNAS), a nationally representative survey of the labour force in Indonesia. Conducted by Statistics Indonesia (Badan Pusat Statistik, BPS) since 1976, the survey was initially conducted quarterly, became annual in 1994, and transitioned to a semi-annual format in 2006 (Dong 2016). The sample size of SAKERNAS has varied over the years, with recent rounds being the largest. The primary goal of SAKERNAS is to gather detailed information on Indonesia's workforce and to monitor changes in its

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<sup>1</sup> This formulation of Atkinson index is based on the explanation in the manual of the STATA software, of which its routine *ineqdeco* is used to practically implement the decomposition written by Jenkins (2006). The *ineqdeco* command from STATA is used to do the decomposition.

<sup>2</sup> Note that the index is decomposable but not additively decomposable.

structure. The survey covers all Indonesian provinces, though some remote provinces may be excluded in certain years. In recent surveys, the sample size is representative at the district level, while older surveys are representative at the provincial level. SAKERNAS selects enumeration areas from the census sampling frame, chooses segment groups within these areas, and interviews all households in the selected segments. Typically, the household head responds to questions on behalf of household members aged 10 years and older. At the individual level, SAKERNAS collects data on the highest level of education completed, employment status, sector and industry of employment, occupation, working hours, and earnings for wage earners. Notably, until 2014, earnings data were collected only for salaried workers; since then, earnings data for self-employed workers have also been included. For this paper, we use SAKERNAS data for the year 2015 and 2018.

## 2.4 RIF Oaxaca-Blinder decomposition

We extend our analysis using the recentred influence function (RIF) Oaxaca-Blinder decomposition, which allows us to examine how education expansion affects inequality at different points in the income distribution. This method distinguishes between the composition effect (differences in characteristics) and the earning structure effect (differences in returns to characteristics) of workers across sectors.

The RIF methodology is particularly suitable for the paper's objective, which is to examine the differences in earning inequality (specifically the Gini coefficient) between two sectors of employment—agriculture and non-agriculture. This is because RIF allows for the decomposition of the Gini index as well as other distributional measures like the median and variance.

This method employs RIF regressions, introduced by Firpo et al. (2009). Influence functions (IF), which originate from the robust statistics literature (Hampel 1974), are used to assess how individual data points influence a specific characteristic or summary statistic of a distribution, such as a particular quantile (like the median) or an inequality measure (such as the Gini coefficient).

Consider a statistic  $v$  that describes a particular aspect of the earnings distribution ( $Y$ ) such as the mean, a specific quantile, or the Gini coefficient. The influence function corresponding to this statistic, typically represented as  $IF(Y;v)$ : for each  $v$ , it is a function of  $Y$ . The IF is constructed to have mean zero. Recentring it,  $RIF(Y;v) = v + IF(Y,v)$ , ensure that the mean of the RIF equal the distributional feature of interest.

The RIF Oaxaca-Blinder decomposition, as developed by Firpo et al. (2009, 2018), allows for the extension of traditional mean-difference decomposition (1st moment) to the decomposition of inequality differences (2nd moment). This provides a deeper understanding of how education expansion contributes to differences in inequality within sectors, specifically between the agricultural and non-agricultural sectors.

By applying this decomposition, we can identify the degree to which education expansion affects within-sector inequality across these two sectors. Furthermore, the RIF Oaxaca-Blinder approach enables us to distinguish between two key effects of education expansion: (1) the composition effect, which relates to how changes in the distribution of education levels influence inequality, and (2) the earning structure effect, which pertains to how the returns to education differ within each sector. This

analysis offers valuable insights into the mechanisms through which education expansion impacts economic inequality in different sectors.

Similar to Atkinson inequality decomposition analysis, this decomposition will use SAKERNAS data for 2015 and 2018.

## 3 Results

### 3.1 Effect of education expansion on structural transformation

Table 1 presents the results of the first-stage regression in the regression discontinuity design (RDD) analysis. The validity of the RDD is usually assessed by examining the impact of the treatment on the key variables of interest (in this case, schooling) as well as on the running variables (year of birth) and their interactions. The results from the first-stage regression indicate that the treatment dummy variables are generally positive and statistically significant, as are the year of birth and their interactions. This suggests that the treatment is having the expected effect on the variables under study, supporting the validity of the RDD approach used in the analysis.

**Table 1: Effect of schooling years on ST**

	[1] Rural  Urban	[2] Agriculture  Non-agriculture	[3] Agriculture Formal non- agriculture	[4] Agriculture Informal non- agriculture
<b>2nd stage regression (of ST)</b>				
Schooling years	0.187*** (0.0349)	0.0509 (0.0381)	0.0964* (0.0509)	0.0215 (0.0416)
<i>Control variable</i>	YES	YES	YES	YES
Constant	-2.032*** (0.188)	-1.122*** (0.197)	-2.134*** (0.227)	-1.174*** (0.219)
<b>1st stage regression (of schooling years)</b>				
Treatment	0.632*** (0.143)	0.406** (0.185)	0.473** (0.200)	0.529*** (0.191)
Yob (year of birth)	0.166*** (0.0251)	0.0524* (0.0308)	0.0448 (0.0341)	0.0578* (0.0317)
Squared of yob	-0.00288** (0.00122)	0.00154 (0.00147)	0.00192 (0.00162)	0.00165 (0.00152)
treatment×yob	0.395*** (0.0462)	0.468*** (0.0472)	0.479*** (0.0511)	0.478*** (0.0480)
treatment×yob <sup>2</sup>	0.0205*** (0.00219)	0.0171*** (0.00264)	0.0164*** (0.00284)	0.0182*** (0.00269)
Constant	6.767*** (0.196)	5.290*** (0.255)	5.097*** (0.275)	5.145*** (0.262)
<i>Control variable</i>	YES	YES	YES	YES
Observations	32,573	13,011	11,138	12,094

Note: robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Examining the results of the second-stage regression, we observe that schooling has a substantial and statistically significant effect on the probability of workers migrating from rural to urban areas,

indicating a strong impact on migration or urbanization (Model 1). However, when mobility is measured in terms of inter-sectoral movement—specifically, the transition from the agricultural sector to the broadly defined non-agricultural sector—schooling appears to have no significant effect. This suggests that while education facilitates geographic mobility, its influence on sectoral shifts within the labour market is less pronounced.

Recognizing that the non-agricultural sector may be too broadly defined, Model 3 refines the analysis by specifying mobility as the movement from the agricultural sector to the formal non-agricultural sector—where jobs are likely to be more productive and better-paying compared to those in the informal non-agricultural sector. The results are notably different: schooling now shows a positive and statistically significant effect on this type of mobility (with a p-value of 0.058). To further validate these findings, Model 4 examines mobility from the agricultural sector to the informal non-agricultural sector and finds that schooling has no significant effect on this type of movement. This distinction highlights the critical role of education in facilitating transitions to more formal, higher-quality employment opportunities.

Our RDD analysis confirms a causal relationship between education expansion and structural transformation. Specifically, increased schooling significantly raises the probability of labour moving from rural to urban areas and from agriculture to non-agriculture sectors. However, the effect is weaker and less significant in the informal sector, indicating that education expansion is more effective in facilitating structural transformation when it leads to formal, higher-productivity jobs.

## **3.2 Atkinson Inequality decomposition**

Table 2 presents the results of the Atkinson inequality decomposition analysis. It reveals that earnings inequality is greater in the non-agricultural sector compared to the agricultural sector. More strikingly, the analysis shows that earnings inequality is highest among workers in the formal non-agricultural sector, regardless of whether the Gini coefficient or the Atkinson index is used as the measure of inequality.

The decomposition analysis suggests that almost all earnings inequality is driven by within-sector inequality. For example, only 4.4% of total inequality is attributed to differences between the agricultural and non-agricultural sectors, while the remaining 95.6% is due to inequality within each sector. When comparing the formal non-agricultural sector with the agricultural sector, the contribution of between-sector inequality is slightly higher, at 6.8%, but it still accounts for a relatively small portion of the overall inequality, with within-sector inequality being the predominant factor.

**Table 2: Atkinson inequality decomposition analysis**

	2015			2018		
	Gini	Atkinson (1)	Percent	Gini	Atkinson (1)	Percent
Agriculture	0.4195	0.27282		0.3964	0.25702	
Non-agriculture	0.4645	0.33732		0.4142	0.2763	
Total	0.4699	0.33328		0.4234	0.28733	
Within group		0.32722	95.6		0.27448	93.9
Between group		0.01500	4.4	0.3964	0.01772	6.1
Agriculture	0.4195	0.27282		0.4045	0.25702	
Formal non-agriculture	0.4763	0.35456		0.4247	0.26356	
Total	0.4864	0.36019			0.28865	
Within group		0.34374	93.2		0.26275	88.2
Between group		0.02507	6.8		0.03513	11.8

The decomposition of the Atkinson index suggests that within-sector inequality contributes more to overall inequality than between-sector inequality. This implies that the prospect for education expansion to increase overall inequality through between-sector disparities is limited.

### 3.3 RIF Oaxaca-Blinder inequality decomposition

Table 3 reports the result of RIF Oaxaca-Blinder inequality decomposition. Our RIF decomposition results show that higher inequality in the non-agricultural sector compared to the agricultural sector is primarily driven by the composition effect of education expansion. While education raises inequality in the non-agricultural sector, the earning structure effect works in the opposite direction, somewhat mitigating the overall impact. Nevertheless, the net effect remains slightly positive, indicating a modest increase in inequality due to education expansion.

**Table 3: RIF Oaxaca-Blinder decomposition**

	Agriculture -> Non-agriculture (2015)		Agriculture -> Formal non-agriculture (2015)			Agriculture -> Non-agriculture (2018)			Agriculture -> Formal non-agriculture (2018)		
	Coef.	s.e.	Coef.	s.e.	P> z	Coef.	s.e.	P> z	Coef.	s.e.	P> z
<b>Distribution</b>											
Final_F	0.4644	0.0021***	0.4763	0.0027***	0.0000	0.4142	0.0015***	0.0000	0.4045	0.0023***	0.0000
Initial_I	0.4195	0.0064***	0.4195	0.0056***	0.0000	0.3964	0.0022***	0.0000	0.3964	0.0020***	0.0000
Total_Change_F-I	0.0449	0.0069***	0.0567	0.0065***	0.0000	0.0178	0.0028***	0.0000	0.0081	0.0029***	0.0050
<b>Reweighting_Decomposition</b>											
Counterfactual_C	0.5524	0.0468***	0.5850	0.0602***	0.0000	0.4117	0.0046***	0.0000	0.4092	0.0059***	0.0000
Total_Composition_C-I	0.1328	0.0418***	0.1655	0.0557***	0.0030	0.0153	0.0039***	0.0000	0.0128	0.0053**	0.0150
Total_Earnings_Structure_F-C	-0.0879	0.0468*	-0.1087	0.0606*	0.0730	0.0025	0.0049	0.6150	-0.0047	0.0067	0.4840
<b>RIF_Composition</b>											
age	-0.0028	0.0008***	-0.0044	0.0015***	0.0030	-0.0047	0.0007***	0.0000	-0.0072	0.0010***	0.0000
sex	0.0043	0.0005***	0.0032	0.0006***	0.0000	0.0061	0.0005***	0.0000	0.0043	0.0006***	0.0000
education	0.1491	0.0590**	0.2359	0.0951**	0.0130	0.0271	0.0039***	0.0000	0.0400	0.0067***	0.0000
island	0.0085	0.0027***	0.0074	0.0025***	0.0030	0.0034	0.0011***	0.0030	0.0027	0.0010***	0.0050
explained	0.1590	0.0608***	0.2420	0.0964***	0.0120	0.0319	0.0042***	0.0000	0.0398	0.0066***	0.0000
<b>RIF_Earnings_Structure</b>											
age	-0.0317	0.0111***	-0.0351	0.0136***	0.0100	0.0193	0.0043***	0.0000	0.0241	0.0047***	0.0000
sex	-0.0174	0.0059***	-0.0298	0.0096***	0.0020	-0.0050	0.0039	0.2010	-0.0125	0.0048***	0.0090
education	-0.1656	0.0405***	-0.2099	0.0449***	0.0000	-0.0249	0.0118**	0.0350	-0.0357	0.0140**	0.0110
island	-0.1152	0.0356***	-0.1219	0.0377***	0.0010	-0.0314	0.0101***	0.0020	-0.0428	0.0116***	0.0000
_cons	0.1803	0.0429***	0.2263	0.0482***	0.0000	0.0168	0.0110	0.1290	0.0294	0.0121**	0.0150
unexplained	-0.1495	0.0523***	-0.1703	0.0657***	0.0100	-0.0252	0.0120**	0.0350	-0.0375	0.0152**	0.0140

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1, Standard errors are estimated with bootstrap with 100 replications.

Our findings suggest that education expansion plays a dual role in structural transformation and inequality. On one hand, it facilitates the movement of labour out of agriculture, thereby supporting economic growth. On the other hand, it can contribute to rising inequality within the non-agricultural sector, particularly when the shift is toward informal, low-productivity jobs.

These results have important policy implications. While expanding access to education is crucial for supporting structural transformation, policymakers must also address the quality and relevance of education to ensure that it leads to high-productivity, formal employment. Additionally, targeted interventions may be needed to mitigate the potential for increased inequality within modern sectors.

## 4 Discussions

This paper set out to examine the role of education expansion in influencing structural transformation and income inequality in Indonesia, within the broader context of Kuznetsian structural transformation theory. The primary goal was to understand how increasing access to education affects the movement of labour from the agricultural sector, characterized by lower productivity, to more productive non-agricultural sectors. Additionally, the paper sought to determine whether this shift exacerbates or mitigates income inequality.

The findings from the regression discontinuity design (RDD) analysis reveal that education expansion plays a significant role in facilitating the shift of labour from agriculture to more productive sectors. This result aligns with the theoretical framework suggesting that reducing labour market frictions through enhanced education can support structural transformation (ST). The positive impact of education on labour reallocation highlights the potential of government policies focused on education to drive economic growth by easing the transition of workers from low-productivity agricultural jobs to higher-productivity roles in modern sectors.

However, the concept of the "modern sector" as proposed in classical theories by Kuznets (1973) and Lewis (1954) must be carefully defined. Simply distinguishing between agriculture and non-agriculture is overly simplistic, as the non-agricultural sector includes both formal and informal segments. The informal non-agricultural sector, which is often associated with lower productivity and precarious employment, does not align with the characteristics of a truly modern, high-productivity sector. This distinction is crucial for accurately assessing the impact of education on structural transformation.

The decomposition analyses conducted in this study provide nuanced insights into the relationship between education expansion and income inequality. The Atkinson inequality decomposition indicates that between-sector inequality contributes only a small portion to overall inequality—approximately 10%. This finding suggests that the potential for education expansion to influence overall inequality through between-sector disparities is limited. Instead, the vast majority of inequality, nearly 90%, is driven by within-sector inequality. This insight implies that while education expansion may help reduce between-sector disparities, its impact on the broader income distribution is more likely to be observed within sectors.

The RIF Oaxaca-Blinder decomposition of the Gini coefficient further underscores the importance of education in explaining within-sector inequality differences between agriculture and non-agriculture. Interestingly, the decomposition reveals a contrasting impact of education on inequality through two distinct channels: the composition effect and the earning structure effect. The composition effect,

which refers to changes in the distribution of education levels across sectors, tends to increase inequality. This could be due to the fact that as education levels rise, the wage distribution within sectors becomes more unequal, with better-educated workers earning significantly more than their less-educated counterparts. On the other hand, the earning structure effect, which reflects changes in the returns to education, tends to reduce inequality. This effect likely arises when increased education leads to more equitable wage distribution within sectors, possibly by enhancing the productivity of a broader segment of the workforce.

## 5 Conclusion

In conclusion, this paper demonstrates that education expansion plays a crucial role in facilitating structural transformation in Indonesia, particularly by enabling labour to move from low-productivity agricultural work to more productive non-agricultural employment. However, the impact of education on income inequality is complex and multi-faceted. While education can help reduce inequality between sectors, its effects within sectors are more pronounced and require careful policy consideration. As Indonesia continues to develop, ensuring that education policies are aligned with the goals of equitable growth and structural transformation will be key to achieving sustained economic development and reducing inequality.

These findings have important policy implications. The positive impact of education on structural transformation suggests that investments in education can be an effective tool for economic development. However, policymakers must be mindful of the complex relationship between education and inequality. While education can facilitate labour reallocation and reduce disparities between sectors, its impact on within-sector inequality needs careful consideration. The dual effect of education on inequality—where it can simultaneously increase and decrease inequality depending on the channel—highlights the need for targeted education policies that address both the composition and earning structure effects.

Moreover, the need to clearly define the sectors impacted by structural transformation is essential. Policies should focus not just on moving labour out of agriculture, but also on ensuring that these workers transition into formal, higher-productivity jobs within the non-agricultural sector. Addressing the challenges associated with the informal sector is critical to ensuring that structural transformation leads to both economic growth and a reduction in income inequality.



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