The Role of Free Education in Narrowing Gender Education Disparity: Evidence from East Java

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Abstract

In June 2019, East Java enacted the Free High School Education Program. To evaluate the program's impact, high school enrollment rates of regencies in East Java and North Maluku are analyzed before and after the program reform. Differences in high school enrollment growth between East Java and North Maluku regencies, where there is no free high school program, offer straightforward assessments of the program's impact. Furthermore, the enrollment changes for women are also analyzed and compared to changes for men to see whether the effect plays a role in narrowing the gender education disparity. The findings do not suggest any evidence that the free high school education program resulted in an increased high school enrollment rate nor played a role in narrowing gender education disparity.

1. Introduction

According to data from the World Bank, the Gender Parity Index (GPI)– a measure for the relative educational attainment of females relative to males, for high school enrollment among 16-18 year-olds in Indonesia has been progressing. In the 1970s, the measure is remarkably low, standing at 0.55. This significant gender disparity is a matter of concern since education plays a pivotal role in a nation's development and future. Education must be accessible to all individuals, regardless of their gender. Various factors contribute to this disparity, including cultural values and inadequate funding. The 2017 National Socio-economic Survey identified insufficient funds as a primary cause of student dropouts. Ihromi (1994) found that limited resources often lead to a higher gender education disparity, as cultural mindsets prioritize boys over girls when faced with limited educational options. This cultural bias is still prevalent in many aspects of Indonesian society, as evidenced by significant wage differences where women earn only 59.27% of what their male counterparts earn, despite having the same level of

education. This further exacerbates parents' challenges in providing equal educational opportunities for their children. However, great progress has been made up until recent times; data reveals an inclining trend in the GPI, reaching a score of 1.03 in favor of girls in 2019. However, it is essential to note that this number is measured on the national level and still varies greatly across provinces and regencies in Indonesia, with more variances among girls enrollment in contrast to boys. The national average score and their variance suggest that certain provinces, likely the larger ones, have successfully made better progress in educating girls while other provinces have yet to.

Understanding the strategies these progressive provinces implement becomes essential to assist and improve the educational standards for girls in the remaining regions. By learning from their success, the government can work towards achieving a more equitable education system nationwide, empowering all students and fostering the development of Indonesia as a whole, with equal opportunity presence on the smaller societal levels instead of only the national level. It is crucial to note that not educating children, particularly girls, can have significant economic consequences for a country, which according to an evaluation from the World Bank (2018), can cost countries trillions of dollars. Recognizing this, Indonesia has implemented free education nationwide for elementary and middle school levels. However, the responsibility of continuing free education for high school levels has been left in the hands of provincial governments. In March 2018, the school participation rate for the high school age group of 16-18 in East Java was 61.5%, a low number compared to the elementary and middle school age groups, with 97.9% and 82%, respectively. Additionally, in 2017 the gender parity in East Java still proves the existence of high school educational disadvantages for girls with a 0.97 score, with girls having more variations than boys in the regency level. Moreover, when analyzed further into each region within the province, variations are high amongst regions. These measures show the extent of children, especially girls, not continuing their academic pursuits after middle school, in contrast to the 12-year compulsory education Indonesia enacted. Albeit knowing the consequences of not educating children; unfortunately, only a few provinces have followed through with the continuation of the free high school policy, leaving many students needing access to education.

In some regions of Indonesia, customary practices specify that women should only occupy domestic spaces, while men are expected to provide for their families and take on leadership

roles. Due to this cultural context, girls may have different educational prospects than boys, especially in impoverished households. In some cases, families may view educated daughters as less valuable since they eventually leave to join their husbands' families after marriage. As a result, some households, particularly those with limited financial resources, may prioritize their sons' education over their daughters'. Fortunately, the province of East Java has taken the initiative to implement a free high school policy, which began in June 2019. Before the policy reform, high school students had to pay Rp150,000-200,000 monthly, which is relatively high compared to the province's minimum monthly wage of Rp1,388,000 in 2017. With the policy reform, the burden of paying for education is abolished and is paid entirely by the government. This is done with the hope of eliminating financial barriers to education. Historically, East Java's high school enrollment does increase, and seeing that the enrollment rate in East Java is increasing, other provinces are also considering implementing this policy. However, no definitive evidence or research has suggested whether such approaches are the cause of the increase in East Java's high school enrollment and reduce gender education disparities or not. The increase in enrollment in East Java might also be driven by some other factors and not be credited to the Free High School Education program.

Therefore, since many provinces are considering taking the same action, it is crucial to investigate whether free education can increase school enrollment by eliminating the financial barrier and leveling the playing field for both genders. This research will provide insights into whether other provinces should adopt similar policies nationwide to ensure all students have equal access to education, regardless of their gender or financial background.

Although research about the effect of the price of education has been done many times (see Glick, 2018; Lincove, 2022), there are not many cases where the cost of education is entirely absent, alas combining the effect of education's direct cost and opportunity cost. This research aims to measure the effect of changes in the direct cost of education, which may be further developed into the existence and role of education opportunity cost for future research. Ultimately, this thesis addresses whether free education increases school enrollment. Furthermore, this thesis will also address whether free education contributes to narrowing the gender education disparity. In answering these questions, I will use an empirical model with repeated cross-section data that is transformed into panel data to measure the role of the free high school education policy in the province of East Java. The analysis will come as a

comparison between provinces based on regency-level data. Data regarding East Java will be compared to data from its counterfactual province, North Maluku. The primary method I will use in this study is the Difference-in-Difference method, with an extension of the policy event study.

The paper elaborates initially on previous literature regarding critical components and concepts relevant to this study, followed by the contextual description of study-specific information, the data, the identification strategy and methods, results and further analysis, and the conclusion.

2. Literature Review

2.1 Secondary Education and Nation's Development

Education is an essential component in the development of a nation, contributing to advancements in economic growth, employment, and quality of life (Faegerlind & Saha, 2016; Griffin et al., 2012). Previous literature has explored the multidimensional aspects of education, including its importance, contributing factors, returns, and consequences of inadequate education. Secondary education is critical, as Konrad (2013) found that there is a fundamental reorganization of the brain in adolescence, where the brain allows environmental influences to exert powerful effects, be it intellectual and emotional development or potentially harmful influences. Furthermore, it indicates that the adolescent years are a pivotal stage for brain development, providing an ideal opportunity to assist young individuals in shaping their intelligence, identity, and personality. A higher quality of human resources this pivotal factor produces would greatly influence a nation's development.

Psacharopoulos (1985) initially confirmed that there is cross-country evidence on returns of education, which are highest for women and developing countries, or those with lower per capita income. Moreover, Sianesi (2002) found that the impact of increased returns at different levels of education appears dependent on the level of a country's development, with tertiary or higher education being the most important for growth in OECD countries. In order to be able to continue a tertiary education, one must complete a senior secondary education, further strengthening the importance of senior high school enrollment. A large amount of literature has investigated these claims with updated data and evidence; Peet (2015) evaluated 61 nationally representative household surveys from 25 developing countries and found that the difference between the returns in developing and developed countries is not as big as it was claimed to be; instead, both are homogeneously beneficial. It also backed the claim regarding gender, confirming that returns are generally higher for women.

2.2 Gender Education Disparity

There have been many claims regarding the fundamentally positive effect educating girls has on a nation (Summers, 1992; Klasen et al., 2002; Jackson, 2009). The studies all led to the same

conclusion, showing the positive impact of girls' education on the growth and development of a nation, which is especially evident in developing countries. Access to fundamental education broadens possibilities and provides tools for self-improvement throughout one's life. As a result, this leads to various advantages on family, household, and national level. Past research suggests that these benefits include increased efficiency in wage labor participation (Heath, 2017; IMF, 2018) and greater flexibility in household economic planning (Eder, 2006). Moreover, education also affects fertility rates, a central problem in developing countries. Educated women possess increased authority and understanding within their households and face more significant trade-offs for their time and effort, impacting fertility rates (Schultz, 1993; Sen, 1999).

In developing nations with significant disparities in education attainment between genders, there are various reasons why investing in girls' education is discouraged. In societies with a patriarchal family structure, parents may have lower expectations of educating their daughters, as the benefits are typically transferred to their daughters' future husbands. In contrast, sons' earnings in the labor market are often the primary source of support for parents in their old age (Boserup, 1995); this is due to fewer or lower-paying job opportunities for educated girls than educated boys. Thus, girls receive lower returns on their investment in education. Additionally, girls' opportunity costs of education are higher when their parents rely on them for domestic labor and childcare for younger siblings (Heward, 1999; McMahon, 1999; Smock, 1983). Moreover, if cultural norms place a low value on women's education or restrict women's participation, parents may also be less inclined to invest in their daughters' schooling (Boserup, 1995; Cleland, 1985). All of these differentiating factors put a limit to what is perceived to be women's potential.

There have been many efforts regarding reducing gender education disparity; Glick (2008) examines the impact of policies on gender disparities in education using a Human Capital Investment framework and presents evidence suggesting that the demand for girls' education is more sensitive to gender-neutral changes in factors such as school proximity, fees, and quality compared to boys. However, when targeted policies are implemented specifically for girls, it has been demonstrated that price incentives for households or schools can effectively reduce gender disparities in education. Kane (2004) also stated that policies that have proven to achieve or are on track for universal primary school completion are policies that focus on poverty as the determining barrier to girls' participation, with a continued emphasis on increasing access while

improving quality and relevance, and focus on the disadvantaged. Thus, policies such as the Free Education policy implemented in East Java fit all the criteria of what is claimed to be a successful policy in diminishing gender education disparity.

2.3 Free Education on School Enrollment

In a comprehensive analysis of the impact of free education on school enrollment, Deininger (2003) conducted tests on Sub-Saharan African countries' policies of providing free primary education. The study revealed that the elimination of primary user fees resulted in an immediate increase in primary school enrollment and a decrease in school dropout rates. Further supporting evidence was found by Al-Samarrai (2007) in the context of Malawi, where the removal of primary school fees led to a significant surge in enrollment rates, particularly among poor individuals.

This notion aligns with empirical evidence on the determinants of school attainment in developing nations. Zhao (2010) discovered that in Gansu, a less-developed province in Northwest China, household income positively affected the number of years of schooling completed. Similarly, Tansel (2002) observed a comparable pattern in Turkey, where the study analyzed educational achievements separately for boys and girls. The findings indicated that an increase in permanent income had a more significant impact on the likelihood of educational attainment for girls than boys.

Therefore, policies promoting free education can serve as a means of addressing relative income disparities and contribute to increased school enrollment. Free education policies prominently benefit economically disadvantaged individuals by removing the constraints associated with determinants such as household income, leading to higher enrollment rates.

3. Context

3.1 Free Education Program

The basis of this study is centered around East Java's Governor Regulation number 33 of 2019, which was officialized on 28 June 2019. This regulation pertains to free-of-cost state high schools (SMAN) and subsidized-pricing private high schools, both of which are a continuation of junior high school, attended typically by students of the age of 15-18 year-olds. For simplicity, we will classify the umbrella term for these types of high schools and classify them as high schools. The East Java state government claims that enhancement in the education sector is a priority aspect in developing human resources, the same way an expansion of opportunities to obtain quality education has to be supported. Thus, considering these two facts, this policy is then enacted. The program was then applied to the province of East Java, providing a free high school policy. This free education policy is financed by the *Anggaran Pendapatan dan Belanja Daerah (APBD)* and *Anggaran Pendapatan dan Belanja Negara (APBN)* and aims to get rid of the burden education cost has on parents or guardians and ensure there are no poverty-stricken students that drop out of school. In this policy, the state government grants funds, called *Bantuan Operasional Sekolah (BOS)*, directly to every state high school in East Java to help meet the needs of school operational costs and other financings to support the learning process. The government measures the cost of each student in a state high school to be Rp3,000,000 yearly. The government has previously subsidized the amount with BOS by Rp1,200,000, making the education fee Rp1,800,000 (or around Rp150,000 monthly) for students or guardians to pay. With the Free Education policy, the same amount of education fee that was previously burdened on guardians is added to the BOS financed by the government, entirely getting rid of the financial burden of the guardians. Thus in return, every high school receiving BOS must carry out the Free Education program, which will be monitored and held accountable every year. The use of Free Education grants includes all activities in the context of admissions of new students, purchase of textbooks and books for library collections, remedial learning activities, enrichment, extracurricular activities, daily operational costs and tests, honorarium for additional teaching hours, teachers financing, purchase of consumable materials, power and service subscription fees, and many other schooling costs. Leaving nothing to be covered by the students or their guardians. The funding of this program is given for every month of each year and distributed periodically every three months, from the January-March period to the October-December

period. This program is deemed valid for this research as the actualization of Free Education is communicated and held accountable by each high school to the state's education office through an annual report.

4. Data

The analysis uses survey data on social demographics (*SUSENAS*) in Indonesia. The survey is of Repeated Cross-Sectional design, meaning that the same information is asked of an independent sample in various waves. The data used for this study comprises six waves, collected annually every March from 2016 to 2021. The survey is conducted through a face-to-face interview between the census taker and the respondent. Data collection is prioritized to be done directly with the intended individuals; however, in some cases, interviews are conducted through a third party such as neighbors, other family members that are not the decision-maker of the family, house taker, et cetera. The scope of this survey covers many aspects of the Indonesian population. It includes the general description of household members, ethnicity, health, education, employment, fertility, technology and information, income, and other socio-economic information. For this study, we will focus on the education aspect of the survey. Since the data is presented as individual-level information by the Central Bureau of Statistics, it is then aggregated by the weights for each observation. The aggregation is done for classification by year, province, regency, and later gender to obtain the necessary data for the study. They are then grouped as treatment and control groups, using province as the variable. The treatment group comprises 38 regencies in East Java, the province implementing the free national high school policy. In comparison, the control group consists of 10 regencies in North Maluku, the province that does not provide free national high schools.

I acquired the data from the University of Indonesia's Computer Lab data bank, where they provided individual-level observations of each section of the survey, in this case, the education section, distributed nationally for each wave. In dealing with the data, I started by keeping the relevant variables and combining each wave into one data set from 2016-2021. I then filter the data to the corresponding profile that matches this study, such as by the high school age range of 15-18, identifying dummy variables of school enrollment, gender, and location status. The data is then collapsed, and several new variables are computed. Using the survey weights, I first measure the high school enrollment at the province level to see the trends. The individual data are grouped by year and province to check for the overall province pre-trends, resulting in yearly provincial high school enrollment (HSE_{pt}). The computation uses the formula $HSE_{pt} = \frac{Population\ aged\ 15{-}18\ enrolled\ in\ school_{pt}}{Population\ aged\ 15{-}18_{pt}}$, where p is the province, and t is the year. Further, into

the process, the data is separated according to gender, producing yearly provincial high school enrollment rate by sex (HSE_{pts}) following the same formula as HSE_{pt}, but this time for each sex, where s is sex classified as female and male. This computation is essential to measure the condition of each gender as it puts the absolute number of enrollment relative to the total population of each gender, giving a more actualized view of the disparity amongst genders. Both province-level data are later used to find and decide the proper counterfactual province with a pre-trend similar to East Java's, explained further in the identification strategy section.

Further, regency-level calculations need to be computed to run the regression analysis to reify the estimates of interest– the Difference-in-Differences (DD) and Difference-in-Difference-in-Differences (DDD). I repeated the same step as the last time in finding the high school enrollment rate and the high school enrollment rate by sex; however, this time, the classification is distinguished by regency. Using the unique regency identifier, producing the yearly regional High School Enrollment (HSE_{rt}), yearly regional High School Enrollment for females (HSE_{rtf}), where r is regency, t is the year, f is female, and yearly regional High School Enrollment for female (HSE_{rtm}), where r is regency, t is the year, and m is male. The calculation follows a similar formula composition but with regency-level classification instead of the province.

Along with the main variables from SUSENAS, control variables at the regency level are also used in this study. The data is obtained through World Bank's "Indonesia Database for Policy and Economic Research." Multiple series are initially obtained for control usage, but only some are complete. Thus the chosen variables that end up being included in the study are the Gini ratio, literacy rate, fiscal expenditure, fiscal revenue, poverty gap, Human Development Index (HDI), number of high schools, and middle school enrollment rate (MSE), all of which are in the regency level. Additionally, the data for 2021 has yet to be available when this paper is written. Thus, data for 2021 is a forecasted value based on 2016 to 2020, with the specification of $forecast = a + bx$, where $a = \underline{y} - b\underline{x}$, $b = \frac{\Sigma(x-\underline{x})(y-\underline{y})}{\Sigma(x-\underline{x})^2}$, and x and y are the sample means of the coefficient of interest and the sample means of years value from 2016 to 2020, respectively. We later tested for multicollinearity for all variables in the regression model, which will be further discussed in the next section.

To continue with the analysis, the data is prepared for regression analyses by identifying crucial dummy variables to use in the method, elaborated in the next section. Computation of the dummy variables includes a treatment dummy valuing 1 if the observation is located in East Java (EJ) and 0 when the observation is in the control province, which is decided in the identification strategy section; an After dummy to distinguish the timing aspect, equaling to 1 if the observation is in the post-policy reform period (after June 2019) and a value of 0 if the observation is in the pre-policy reform period (before June 2019); and a yearly dummy variable for each wave for additional event study purpose.

5. Identification Strategy and Methods

5.1 Identification Strategy

The nature of the program allows for a condition that creates a unique environment where one province, East Java, has a distinction from other provinces in Indonesia in 2019. This allows for a contrast in the education domain that sets East Java's condition apart. Although a few provinces in Indonesia have implemented similar programs, East Java is chosen due to its data completeness and reasonable natural control. In estimating causality, a valid counterfactual is vital (Höfler, 2005). Therefore, the conditions created due to the enactment of the Free High School Education Program by East Java allow for an isolating environment that can lead to causal analysis. Difference-in-Difference (DD) and Difference-in-Difference-in-Differences (DDD) are chosen as the primary methods as both fit the nature of the data and can indicate causality when some assumptions are satisfied.

In finding a counterfactual province to test East Java's policy effect on High School Enrollment, a parallel trend test is used for East Java against every province that does not have a free education policy. Because the treatment is province-wide, data on the province level determine the parallelity of the trend for the period before the policy reform. An overview of the analysis can be found in Appendix 1. From then on, it is found that the province of North Maluku (NM) is the province that does not violate the parallel trend assumption before the policy reform, in a way that East Java and North Maluku follow the same trend for high school enrollment rate at the province level. As a baseline, before the reform, in March 2019, the high school enrollment rate in East Java was 78.6%, while the high school enrollment rate in North Maluku was 81.68%. The changes in both provinces for the previous periods follow the same trend, as seen in Figure 1. This assumption is also supported later by the insignificant interaction coefficients of the periods before the reform in the event study. Thus, other provinces are omitted. The following descriptive statistics summarize all relevant variables, computed using survey weights, that are used for the regency level analysis:

Table 1. Summary Statistics

Statistic	N	Mean	St. Dev.	Min	Max
HSE_{rt}	288	79.972	8.215	47.068	97.942
HSE_{rtf}	288	80.279	10.251	40.819	100
HSE_{rtm}	288	79.701	7.889	53.985	96.331
$Gini_{rt}$	288	0.322	0.045	0.209	0.435
$Literacy_{rt}$	288	93.911	5.514	75.487	103.72
$Revenue_{rt}$ (in billions IDR)	288	2,056.27	1,296.55	555.95	8,765.15
$Expenditure_{rt}$ (in billions IDR)	288	2,040.24	1,303.69	510.212	9,162.66
MSE_{rt}	288	81.343	9.046	59.134	124.046
Poverty Gap_{rt}	288	1.524	0.873	0.22	4.355
HDI_{rt}	288	70.285	5.646	58.66	83.519
Number of $High\ School_{rt}$	288	120.521	87.937	22	363

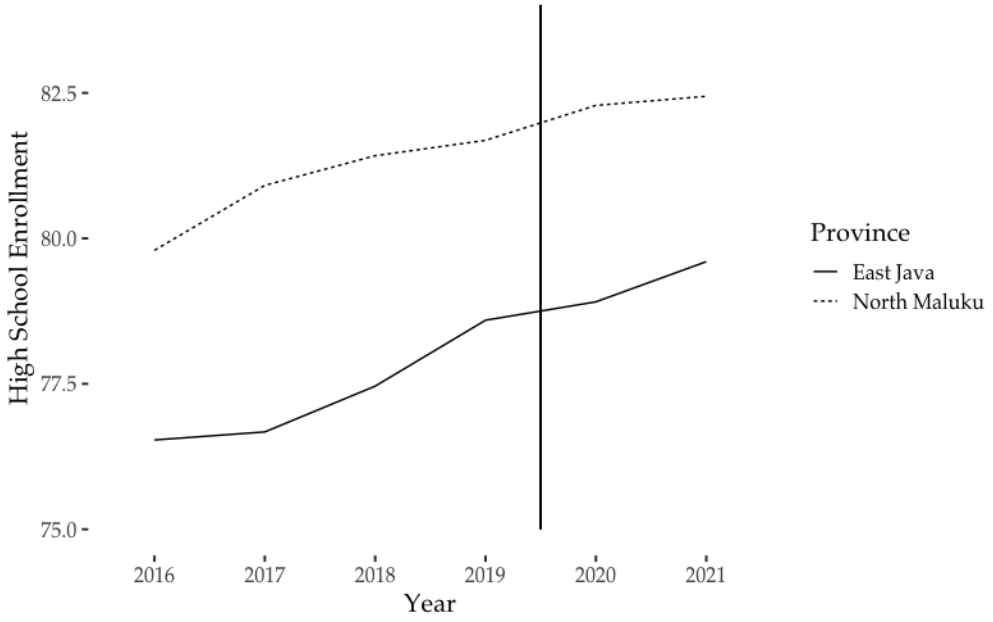
5.2 Difference-in-Differences

Defined by the World Bank, The difference-in-differences method is a quasi-experimental approach that compares the changes in outcomes over time between a population enrolled in a program (the treatment group) and a population that is not (the comparison group). The method requires Stable Unit Treatment Value Assumption (SUTVA) to be satisfied– where the intervention and comparison groups remain stable in their composition over time for repeated cross-sectional design. In this study, we use panel data with stable regency composition that remains the same in each year. Thus, this assumption is satisfied.

Moreover, the critical assumption of this method is the equal trend assumption, in which treatment and control groups have to have parallel pre-trends in their outcome, in this case, the high school enrollment between provinces. The assumption requires that the treatment condition has a similar trend to the control condition in the absence of the treatment. Once the condition is met, it would allow the measurement of causality. A visual approach and statistical test to see whether there is a difference between both groups are common ways to determine the satisfaction of this assumption. From analyzing every province's high school enrollment rate, in its total form and by sex (See Appendix 1) and through statistical tests, which will also be seen in the result section, It is found that the most similar match to East Java's trend is that of North Maluku, hence chosen as the control province. Figure 1 shows the total high school enrollment

rate trend between the treated and control group, East Java and North Maluku, With a cut-off line showing the policy reformation in June 2019.

Figure 1. High School Enrollment Rate, from 2016-2021



Conclusively, the difference in policy presence can be utilized as the treatment in this study; moreover, data before and after the policy can be utilized as a second layer of the difference in differences. Following the classic baseline method of Difference-in-Differences proposed by Card and Krueger (1994). This specification of the difference-in-differences estimator is obtained from the DD regression in the regency level as follows:

$$HSE_{rt} = \alpha + \beta_1 EJ_r + \beta_2 After_t + \beta_3 (EJ_r * After_t) + \varepsilon_{rt} \quad (1)$$

The dependent variable HSE_{rt} is the school enrollment rate for the high school age group of 15-18 years old in regency r in year t. EJ_r is the dummy variable, with a value of 1 if regency r is located in East Java, where free high school policy is enacted, and 0 if the regency r is located in North Maluku, where there is no free high school policy. $After$ is the dummy variable with a value of 0 for all regencies before the intervention period (before June 2019) and 1 for all regencies after the intervention period (after June 2019). $EJ_r * After_t$ is the interaction between the treatment and time variables. The equation also includes the error (ε_{rt}), clustered by regency,

to deal with correlation in the dataset. The coefficient of interest, in this case, lies in β_3, where it measures the difference between the average enrollment change in East Java and the average enrollment change in North Maluku. This baseline model estimates the effect of the policy on the total high school enrollment rate for each regency, which gives an overview of how successful the policy is in increasing the number of students enrolled in high school.

Specifically, the DD estimate has the specification of the following difference-in-differences estimator :

$$DD = \beta_3 = [E(HSE_1(1)|EJ = 1) - E(HSE_0(0)|EJ = 1)] - [E(HSE_0(1)|EJ = 0) - E(HSE_0(0)|EJ = 0)] \quad (2)$$

This specification explicitly shows the importance of the parallel pre-trend assumption. The parallel trends assumption is a counterfactual assumption about $E(HSE_0(0)|EJ = 1)$, the mean potential outcome in the post-period for the EJ province had they received no free high school policy instead, which is unobserved. The parallel trend assumption assumes that $[E(HSE_0(1)|EJ = 1) - E(HSE_0(0)|EJ = 1)] = [E(HSE_0(1)|EJ = 0) - E(HSE_0(0)|EJ = 0)]$. Meaning that the trend in the potential outcomes under control for the treated group is equal to the trend in the potential outcomes under control for the control group. This assumption can be rearranged to find $E(HSE_0(0)|EJ = 1)$. This enables the measurement of the contrast for interest in DD, which is $E(HSE_1(1)|EJ = 1) - E(HSE_0(1)|EJ = 1)$, resulting in equation (3). Thus, the coefficient we obtain from regression (1), which is specified in equation (2), shows the isolated differences of the treatment when the parallel trend assumption is satisfied. Hence, the equations can be utilized to isolate the effect of the treatment, which is the free high school policy effect on the regency's total high school enrollment rate.

Additionally, to extend the model further, control variables are introduced to create a more precise and isolating environment to analyze the treatment effect.

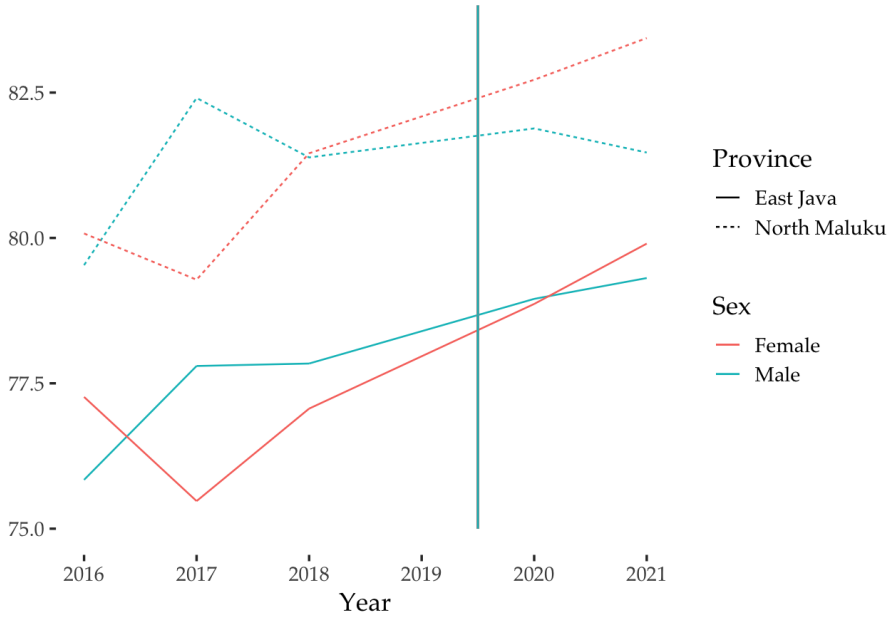
$$HSE_{rt} = \alpha + \beta_1 EJ_r + \beta_2 After_t + \beta_3 (EJ_r * After_t) + Z_{rt} + \varepsilon_{rt} \quad (3)$$

Z_{rt} is the vector of control variables in regency r in year t, consisting of regional characteristics that could affect the outcome variable, such as the number of high schools, middle school enrollment rate, and poverty rate, amongst other variables mentioned in the data section of this study.

5.3 Difference-in-Difference-in-Differences

In answering the research question of whether such policy plays a role in narrowing gender education disparity, The policy is analyzed further using gender identifiers, thus utilizing the gendered high school enrollment rate variable as the dependent variable, where HSE_{rtf} is stacked with HSE_{rtm} in a variable called HSE_{rts} (High School Enrollment by Sex), this will then be the dependent variable. Consequently, a gender female dummy is added, valuing 1 if the observation indicates female data and 0 when indicating male. In doing so, a triple difference specification is then utilized. This evaluation extends the difference-in-differences explained in equation (1), where the triple difference estimator is computed as the difference between two difference-in-difference estimators. Which measures the difference between the regency average high school enrollment change for girls (relative to boys) in East Java (relative to North Maluku) after the policy reform (relative to the before period). The DDD similarly requires a parallel trend amidst control and treated groups. Figure 2 indicates that the required assumption of a relative parallel trend is not violated between East Java and North Maluku. The event study will also show statistical tests of the insignificance of the before-period coefficients. Thus, with the parallel pre-trend assumption satisfied, we can analyze using this method and see the policy effect.

Figure 2. High School Enrollment Rate by Sex, from 2016-2021



Moreover, by adding another difference of gender, we can measure the triple difference estimator for the effect of the treatment for females from the DDD regression as follows:

$$HSE_{rts} = \alpha + \beta_1 EJ_r + \beta_2 After_t + \beta_3 (EJ_r * After_t) + \beta_4 Female_s + \beta_5 (EJ_r * Female_s) + \beta_6 (After_t * Female_s) + \beta_7 (EJ_r * After_t * Female_s) + \varepsilon_{rts} \quad (4)$$

The dependent variable HSE_{rts} is the school enrollment rate for the high school age group of 15-18 years old in Regency r in year t and sex s. Most variables are the same as equation (1) with an additional gender variable. $Female_s$ is a sex dummy variable with a value of 1 if the observation is female and 0 if the observation is male. The equation also includes the clustered error (ε_{rts}) by regency. Additionally, the interaction effects of each intended variable are analyzed, along with the interaction of all variables of interest. Represented in $EJ_r * After_t * Female_s$ is the interaction between the treatment and time and gender variables, making β_7 the main coefficient of interest, also known as the DDD with the specification of:

$$DDD = \beta_7 = [(E[HSE|EJ = 1, F = 1, After = 1] - E[HSE|EJ = 1, F = 1, After = 0]) -$$
$$(E[HSE|EJ = 1, F = 0, After = 1] - E[HSE|EJ = 1, F = 0, After = 0])] -$$
$$[(E[HSE|EJ = 0, F = 1, After = 1] - E[HSE|EJ = 0, F = 1, After = 0]) -$$
$$(E[HSE|EJ = 0, F = 0, After = 1] - E[HSE|EJ = 0, F = 0, After = 0])] \quad (5)$$

Furthermore, analysis with the same control variables as in equation (3) is also conducted, with a regression equation below:

$$HSE_{rts} = \alpha + \beta_1 EJ_r + \beta_2 After_t + \beta_3 (EJ_r * After_t) + \beta_4 Female_s + \beta_5 (EJ_r * Female_s)$$
$$+ \beta_6 (After_t * Female_s) + \beta_7 (EJ_r * After_t * Female_s) + Z_{rt} + \varepsilon_{rts} \quad (6)$$

Lastly, multicollinearity checks are conducted for regressions with control variables to ensure the regression's validity and avoid variables with strong correlations between one another. To do so, I use the Variance Inflation Factors (VIF) and select variables with scores of less than 5. A VIF score of 1 indicates that the independent variables are not related to any other independent variable in the model, while a value of 1 to 5 shows a moderate correlation, however not severe enough that it needs corrective measures. Thus, the control variables included later in the regression will be tested and ensured to have a VIF score of less than 5.

5.4 Event Study

Event study measures the impact of a specific event on an environment, such as a company or market. In this study, the regency-level analysis will be done. Moreover, the method will compare the periods before and periods after the free high school policy reform to assess its impact. This analysis enables us to estimate the timing of the responses and gain insights into whether there is a time lag for the impact of the policy. The event study done is as follows:

$$HSE_{rt} = \alpha + \sum_{t=2016}^{2021} \beta_t Year_t \times 1(EJ_r = 1) + \gamma_r + \mu_t + \varepsilon_{rt} \quad (7)$$

The equation follows the same subscripts as the equations before. However, the event study demonstrates the reactions in which $Year_t$ is a dummy variable for year t in the analysis, γ_r is the regency r fixed effect presented in dummy forms, and μ_t is the time t fixed effect. The β_t coefficients represent the program's effect in year t compared to the reference year. In this instance, 2019 is the year of reference, with the data occurring prior to the implementation of the policy in June 2019, 2019 is then omitted from the model. Using 2019 as the reference year allows us to compare the changes in the outcome variable before and after the policy implementation and estimate the treatment effect of the policy. This event study will be calculated using weights concerning each corresponding regency size. As a robustness measure, control variables are added to a comparison model:

$$HSE_{rt} = \alpha + \sum_{t=2016}^{2021} \beta_t Year_t \times 1(EJ_r = 1) + \gamma_r + \mu_t + Z_{rt} + \varepsilon_{rt} \quad (8)$$

Z_{rt} is the control variables for regency r in year t, consisting of the Gini index, poverty gap, middle school enrollment rate, Human Development Index, and number of high schools. Additionally, analysis based on gender is also done, with similar classifications of:

$$HSE_{rts} = \alpha + \sum_{t=2016}^{2021} \beta_t Year_t \times 1(EJ_r = 1) \times Female_s + \gamma_r + \mu_t + \varepsilon_{rts} \quad (9)$$

$$HSE_{rts} = \alpha + \sum_{t=2016}^{2021} \beta_t Year_t \times 1(EJ_r = 1) \times Female_s + \gamma_r + \mu_t + Z_{rt} + \varepsilon_{rts} \quad 10)$$

The classifications follow the same subscript as the equations in this section, with a difference in the outcome variable, separating the boys' and girls' high school enrollment rates by regency r, year t, and gender s.

6. Results & Further Analysis

6.1 Difference-in-Differences Effect

The following results are found when estimating the effect of the Free Education Program in East Java. Table 2 summarizes the levels and changes in average high school enrollment per regency. I present the data by the treatment in columns (i) and (ii) and include the differences in average high school enrollment between the treatments of when the regency is located in East Java and when the regency is located in North Maluku in column (iii). The estimate of interest, in this case, is located in row 3, which presents the changes in average high school enrollment between the program before and after. This row shows the difference between the averages of the two periods, meaning the value in row 2 minus the value in row 1. As the previous section shows, East Java regencies have an initially lower average high school enrollment rate than North Maluku regencies. However, the high school enrollment rate grew relatively more than the regencies in North Maluku. The policy reform enacted in East Java increased its regencies' high school enrollment rate by 0.7. This result matches those in Table 3, column (1), where the DD (East Java:After) coefficient is also 0.7. This gain, however, is not statistically significant, with a t stat of 1.1. There needs to be more evidence to show that the program effectively increases the high school enrollment rate, at least in the case of regencies in East Java.

Table 2. High School Enrollment Rate Before and After Policy Reform

	Regencies by Treatment		
	NM	EJ	Difference, EJ-NM
Variables	(i)	(ii)	(iii)
HS Enrollment before, all available observations	80.475	79.164	-1.311
HS Enrollment after, all available observations	81.526	80.915	-0.611
Change in Mean HS Enrollment	1.051	1.751	**0.700**

To analyze this even further, control variables are introduced. Table 3 summarizes the analysis of the effect of the free education program in East Java on the regency's high school enrollment rates with different classifications and models. Specifically, Table 3 presents other models as a robustness test to see the consistency between outcomes and ensure a more precise estimate. Column (2) presents the model's outcome stated in equation (3), which introduces the control variables. Various control variables are tested and selected to be included in the model, albeit the ones that made it into the model are the regional-level Gini index, Poverty Gap Rate, Middle School Net Enrollment Rate, Human Development Index, and the number of high schools. These control variables are tested for multicollinearity with VIF and have passed the test with VIF scores lower than 5. At the same time, regional revenue, expenditure, and literacy rate are omitted from the model due to multicollinearity. The result of this model is consistent with the baseline model without controls, leading to statistically insignificant results, with a coefficient that the policy reform enacted in East Java increased its regencies' high school enrollment rate by 0.713.

6.2 Difference-in-Difference-in Differences Effect

Figure 2 notes that in East Java, prior to the policy reform, women were at a disadvantage regarding high school enrollment. To answer whether the program plays a role in narrowing the gender education disparity, we can see whether the policy reform affects girls more than it affects boys in narrowing the gender education disparity in the case of East Java. The difference-in-difference-in-differences method is used by adding the difference of gender. Similarly to the DD method, estimates can be obtained by creating an interaction variable in a regression model with all three differences, as specified in equation (5). For this gender analysis, I start with a baseline model without any control variables, following equation (4). The result of this model is summarized in column (3) of Table 3; it proceeds to produce a consistent result as the first two models for the treatment and time interaction that is positive but insignificant. However, the coefficient of interest from this model is the DDD estimate, indicated by the EastJava:After:Female variable. This interaction estimate captures the differences-in-difference-in-differences and suggests that the change in regencies' high school enrollment rate for women (relative to men) in East Java (relative to North Maluku) in the post-program reform period (relative to pre-program reform) is -1.883. Even so, the estimate

remains insignificant. Thus, there is not enough evidence to prove that the free education program in East Java is effective in narrowing the gender education gap.

Table 3. Regression Models for Free High School Reform Effect on High School Enrollment

	Dependent variable:			
	HSE_{rt}		HSE_{rts}	
	(1)	(2)	(3)	(4)
East Java	-1.311	-2.681	-2.291	-3.671
	(1.936)	(2.720)	(1.731)	(2.651)
After	1.051**	-1.090	0.408	-1.740
	(0.479)	(0.788)	(0.946)	(1.188)
Female			-0.957	-0.957
			(0.908)	(0.912)
East Java:After	0.700	0.713	1.557	1.580
	(0.630)	(0.948)	(1.130)	(1.437)
East Java:Female			2.001	2.001
			(1.358)	(1.364)
After:Female			1.343	1.343
			(1.180)	(1.185)
East Java:After:Female			-1.883	-1.883
			(1.488)	(1.494)
Constant	80.475***	19.735	80.968***	19.926
	(1.296)	(15.230)	(1.207)	(15.146)
Control Variables	No	Yes	No	Yes
Observations	288	288	576	576
R^2	0.012	0.537	0.011	0.437
Adjusted R^2	0.001	0.523	-0.001	0.425
Residual Std. Error	8.210 (df = 284)	5.671 (df = 279)	9.147 (df = 568)	6.931 (df = 563)
F Statistic	1.114 (df = 3; 284)	40.400*** (df = 8; 279)	0.933 (df = 7; 568)	36.457*** (df = 12; 563)
Note:				*p<0.1; **p<0.05; ***p<0.01

Additionally, another model is analyzed; Table 3 column (4) presents the outcome of the regression line in equation (6). For this model, control variables are introduced to the gender model. The control variables included are the same as the ones in column (2) and are checked for multicollinearity. The results of this model stay consistent with the other models, with positive yet insignificant coefficients for the treatment and time interaction. The value of the

DDD estimate in this model suggests the same conclusion as in column (3), with the same relative loss for women in East Java after the program to the baseline model. The result shows a -1.883 relative loss in regencies' high school enrollment rate for women (relative to men) in East Java (relative to North Maluku) in the post-program reform period (relative to pre-program reform). This estimate is still statistically insignificant, despite having better power. Thus showing consistency in the model.

6.3 Event Study

An event study is conducted to see what happens each year as a complement to the DD and DDD analysis. This regression analysis aims to demonstrate the coefficients for each period before and after treatment and show that the periods before the treatment are statistically insignificant. I start with an event study baseline model of equation (7), with an outcome variable of HSE_{rt}. The result is summarized in Table 4 column (1), which suggests that the free education program in East Java has no significant effect on the regency high school enrollment rate compared to North Maluku. The specification already includes regency and time-fixed effects; however, as a robustness check, controls are also added to the specification, summarized in column (2) under the equation (8) specification. The finding is the same for both models in which the changes in regency high school enrollment rates in East Java are not significantly different from the changes in North Maluku following the policy reform. Moreover, the insignificant interaction coefficients in years before the policy reform support DD estimation's parallel trends assumption. Interestingly, although the treatment is insignificant, the coefficient shows a diminishing decline from 2017-2021 in the regency total high school enrollment rate compared to the reference year when the policy was enacted in 2019. This analysis further proves the program's absence of a significant direct effect in 2020 and 2021. Other estimates from this analysis are also consistent with the results discussed before.

Moreover, The insignificance of the program applies to both the total and gender-based rates. The same analysis is done for the regency high school enrollment rate outcome based on gender. The baseline model with fixed effects, specified in equation (9), and the robustness check with added control variables under equation (10) are presented in Table 4, columns (3), and (4), respectively. The findings are consistent with the previous result. The change in regency high school enrollment is not statistically different between genders in East Java and North Maluku

following the policy reform. It is found that the average change for women relative to men in regencies located in East Java relative to regencies located in North Maluku in 2020 and 2021 relative to 2019, as the reference year shows a negative value rather than a positive one. Alas, these differences are still not proven to be significant. Similarly to the analysis of the total high school enrollment, The insignificant interaction coefficients in years before the policy reform supports the parallel trends assumption in DDD estimation.

Table 4. Event Study Models for Free High School Reform Effect on High School Enrollment

	Dependent variable:			
	HSE_{rt}		HSE_{rts}	
	(1)	(2)	(3)	(4)
EastJava:y2016	-1.030	-0.869	-1.930	-1.842
	(1.436)	(1.497)	(2.525)	(2.581)
EastJava:y2017	-1.888	-1.831	-2.970	-2.915
	(1.436)	(1.459)	(2.525)	(2.548)
EastJava:y2018	-0.672	-0.636	-1.384	-1.324
	(1.436)	(1.447)	(2.525)	(2.537)
EastJava:y2020	-0.454	-0.539	-0.466	-0.572
	(1.436)	(1.446)	(2.525)	(2.536)
EastJava:y2021	0.058	-0.083	0.439	0.315
	(1.436)	(1.455)	(2.525)	(2.544)
EastJava:y2016:female			1.636	1.636
			(3.570)	(3.579)
EastJava:y2017:female			1.807	1.807
			(3.570)	(3.579)
EastJava:y2018:female			1.243	1.243
			(3.570)	(3.579)
EastJava:y2020:female			-0.428	-0.428
			(3.570)	(3.579)
EastJava:y2021:female			-0.996	-0.996
			(3.570)	(3.579)
Regency and Time Fixed Effects	Yes	Yes	Yes	Yes
Control Variables	No	Yes	No	Yes
Observations	288	288	576	576
R^2	0.903	0.904	0.734	0.735
Adjusted R^2	0.879	0.878	0.698	0.697
Residual Std. Error	2.857 (df = 230)	2.866 (df = 226)	5.023 (df = 506)	5.036 (df = 502)
F Statistic	37.608^{***} (df = 57; 230)	34.958^{***} (df = 61; 226)	20.280^{***} (df = 69; 506)	19.088^{***} (df = 73; 502)
Note:				*p<0.1; **p<0.05; ***p<0.01

7. Discussions & Conclusion

Based on all the analyses done for this study, we find no indication that the free high school policy reform in East Java increased East Java's regency high school enrollment. Moreover, the findings also suggest that the program does not significantly play a role in narrowing gender education disparity. Many reasons can cause such findings, including the lack of adaptation to the program. When analyzed further, it is found that the provincial government of East Java struggled with the Free Education Program socialization and in dealing with the school hierarchy, making the adoption of the policy not fully implemented. Moreover, another reason why the result is not enough to claim the program's effectiveness can be due to the time lag the program effect might have. Due to restrictive data availability, analyses can only be done up to two years after its reform, leading to a low number of observations, thus, a lack of power. Additionally, as this study covers the direct cost of education, its insignificance may suggest the presence of indirect costs of education, such as the opportunity cost. Therefore, further studies regarding this topic should be done in the future.

Although the program's significant success can not be found in the findings of this paper, results show a positive relationship between the program and the enrollment rate and a negative relationship between the effectiveness of women. Historically, East Java has been experiencing a consistent increase in the total high school enrollment rate; thus, policymakers should consider this policy as a tool to promote a surge in high school enrollment. The program could increase the Regency total high school enrollment rate with proper implementation. However, since the program also aims to give equal educational opportunities to every student-aged population, the evidence found in this study does not indicate its role in narrowing gender education disparity. Thus, policymakers should consider a more gender-targeted approach that is set in accordance to favor the disadvantaged groups of each region.

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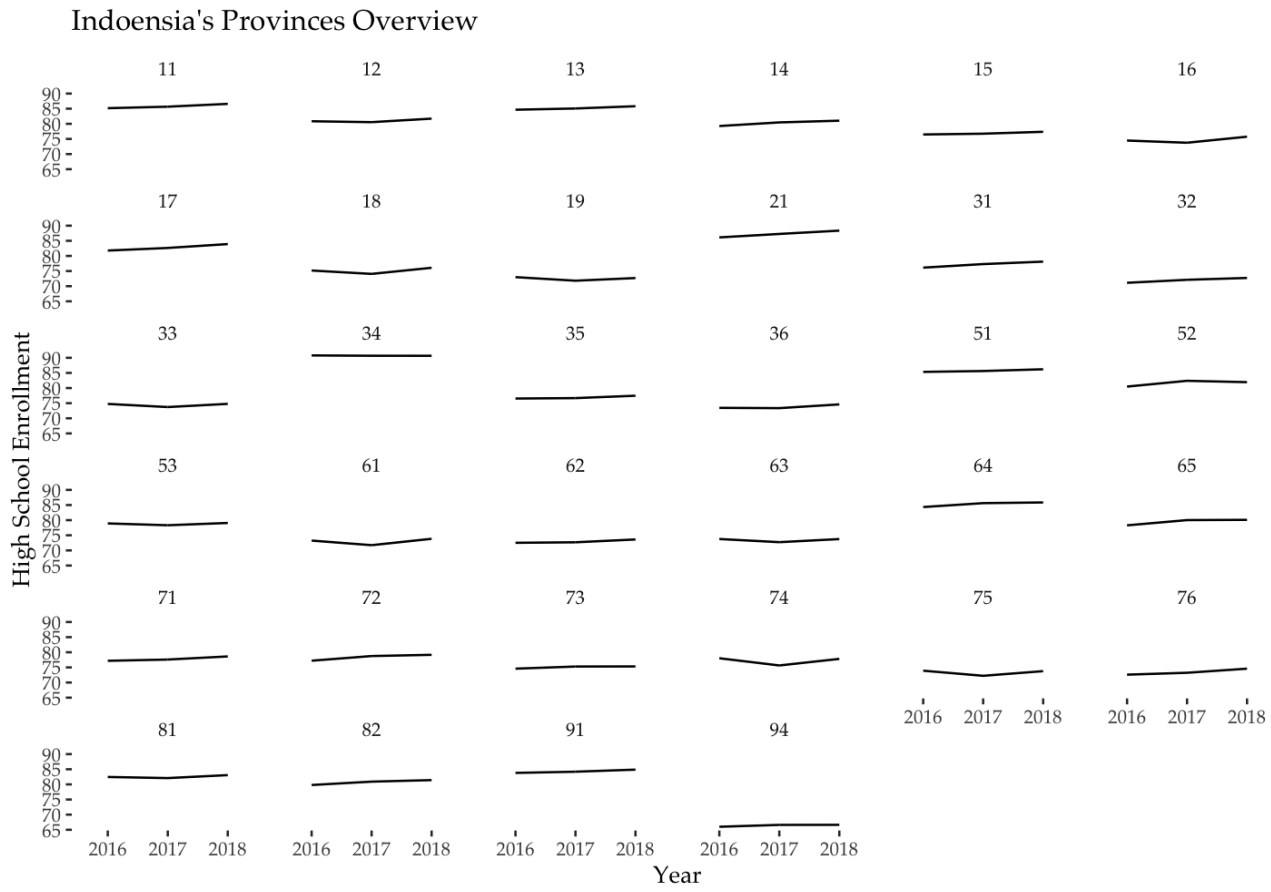
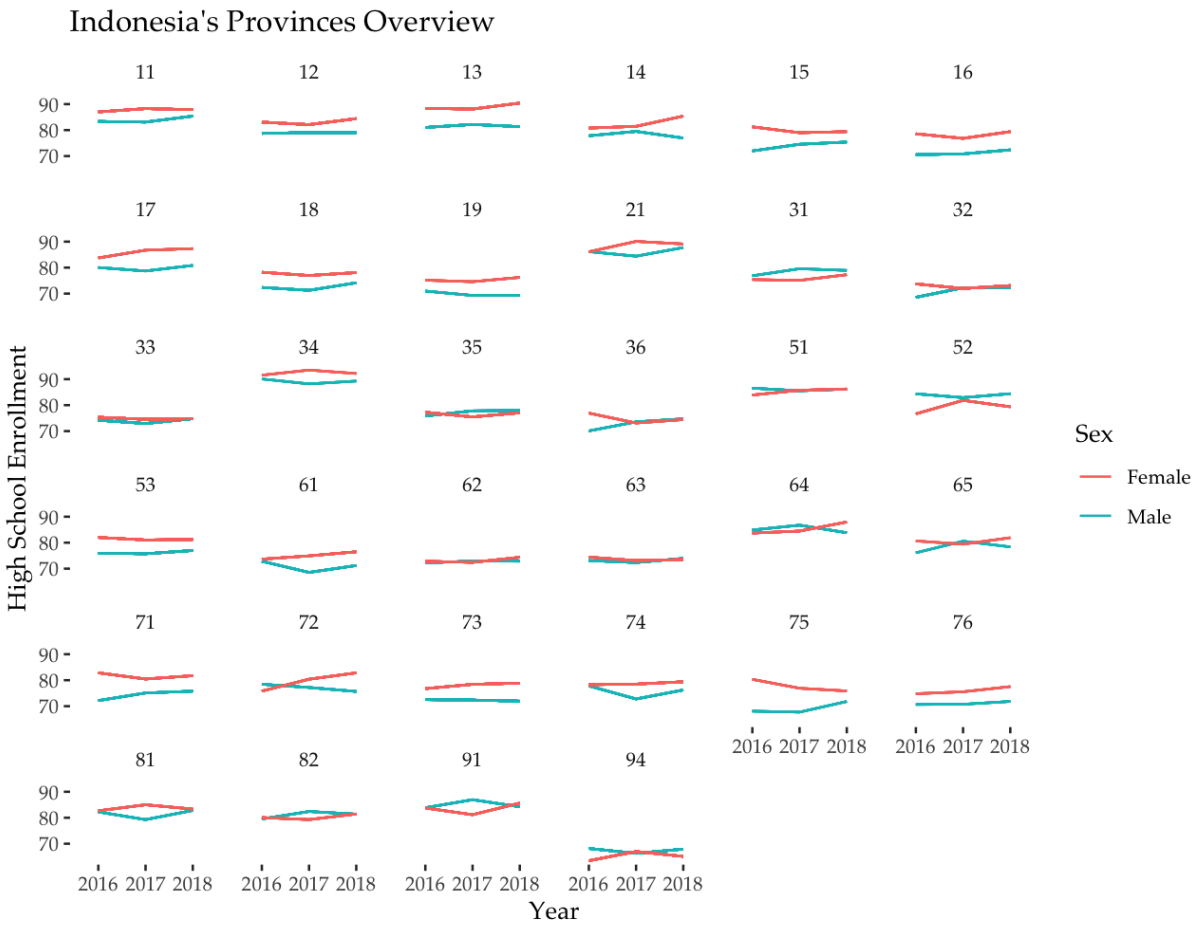
Appendix

Appendix 1. Total High School Enrollment Rate & Gender High School Enrollment Rate for All Provinces in Indonesia from 2016-2018 (Pre-Trend)





Directory:

No	BPS Statistics	
-	**Province Name**	**Province Code**
1	Aceh	11
2	North Sumatera	12
3	West Sumatera	13
4	Riau	14
5	Jambi	15
6	South Sumatera	16
7	Bengkulu	17

8	Lampung	18
9	Bangka Belitung Islands	19
10	Riau Islands	21
11	DKI Jakarta	31
12	West Java	32
13	Central Java	33
14	DI Yogyakarta	34
15	East Java	35
16	Banten	36
17	Bali	51
18	West Nusa Tenggara	52
19	East Nusa Tenggara	53
20	West Kalimantan	61
21	Central Kalimantan	62
22	South Kalimantan	63
23	East Kalimantan	64
24	North Kalimantan	65
25	North Sulawesi	71
26	Central Sulawesi	72
27	South Sulawesi	73
28	Southeast Sulawesi	74
29	Gorontalo	75
30	West Sulawesi	76
31	Maluku	81
32	North Maluku	82
33	West Papua	91
34	Papua	94