Opportunities in Education: Are Factors Outside Individual Responsibility Really Persistent? Evidence from Indonesia 1997-2007

Maria C. Lo Bue (University of Göttingen, Germany, and University of Verona, Italy) and Rajius Idzalika (University of Göttingen, Germany)

Paper prepared for the 34th IARIW General Conference

Dresden, Germany, August 21-27, 2016

PS1.3: Education/Public Broadcasting

Time: Monday, August 22, 2016 [Late Afternoon]

Opportunities in Education: Are Factors Outside Individual Responsibility Really Persistent? Evidence from Indonesia 1997-2007*

Rajius Idzalika† Maria C. Lo Bue‡

June 29, 2016

Abstract

Education is a strong predictor of economic performance. Educational inequality in opportunity could thus make a significant contribution to earning disparities. Following Ferrerira and Gignoux (2014) parametric method, we construct aggregate indices of inequality in educational opportunities for thirteen Indonesian provinces in the years 1997, 2000 and 2007. The contribution of this paper is to define individual indices of the power of circumstances, which measure the effect that the accumulation of factors, outside individual control, has on individual educational achievements and earnings in the short and long run. We find that-for the period considered- there has been a declining trend in inequality of educational opportunities, albeit not in all provinces. Our findings also suggest that parental educational background is the most significant factor for school survival. Additionally, the effect that circumstances exert on future individual educational achievements and early earnings perspectives tends to persist over time, but only to a very small extent. Our causal model, which relates educational budget policy to equality of opportunity, shows that the educational budget has a negative impact on the youngest cohorts, thus causing us to question the effectiveness of the allocation of resources to primary and intermediate schools.

*We would like to thank Francisco Ferreira, Inma Martinez-Zarzoso, Martin Ravaillon, Paolo Brunori, Alain Trannoy, Vito Peragine, Stephan Klasen and participants of the 10th Winter School on Inequality and Social Welfare Theory 2014 for their helpful comments and suggestions. Rajius Idzalika acknowledges the nancial support from the European Commission. This publication re ects the views of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

†Email: ridzali@uni-goettingen.de

‡Email: mariacarmela.lobue@univr.it

1 Introduction

It has been well recognized that a person's educational achievement is not only a key dimension of her human development in its own right, but also represents a fundamental input for the realization of other human development goals, such as wealth, health, employment and political participation. More recently, a number of studies has also shown that both within and across countries, inequalities in education are likely to be reflected in disparities in other dimensions. The existence of such correlations has raised political and academic interest in the inequality of education and, in particular, two questions have emerged: which factors are driving these inequalities? Are they all "unfair"?

The theory of inequality of opportunity can provide an answer to these questions as it finds its main rationale in the idea that inequality itself can have different sources, but not all of these can be equally objectionable. As theoretically conceptualized by Roemer (1998), differences on certain socio-economic outcomes may be partly attributed to individual choices, innate ability, talents and *efforts* and partly to factors or *circumstances* which are economically exogenous to the person, such as gender and socio-economic background.

While inequalities in education that are due to personal responsibility are fair and do not necessarily need to be suppressed, disparities in educational achievements, which result from factors beyond an individual's control are, without doubt, inequitable, and should be amenable to equal-opportunity policy interventions that, as suggested by Roemer, will equalize advantages for each centiles of the efforts distribution, across groups of people, which share the set of circumstances.

Empirical evidence regarding this issue is still less explored. However, OECD (2012) suggests the positive relationship between educational opportunities and labour income. Therefore, educational policies with strong attention on equity could be used as a strategic tool to improve economic performance in a long term.

Equality of opportunity could only be achieved when pre-determined *circumstances* have no correlation with success in life (de Barros et al., 2008). In the case of education, pre-determined *circumstances* should not affect the chance of children going to school or achieving identical educational performance.

Among developing countries, evidence using PISA scores 2006 placed Indonesia in the lower half of cross-country distribution of inequality in educational opportunity (Ferrerira and Gignoux, 2014). Contrarily, the Indonesian GINI index shows an increasing trend from 31.3 in 1996 to 33 in 2004 and

38.1 in 2011 World Bank (2014), which indicates that educational policies might not have accurately targeted equity.

In this paper, we therefore focus on country level evidence using household data from the Indonesian Family Life Survey (IFLS), in order to quantify the role that the accumulation of pre-determined *circumstances* play in influencing future socio-economic outcomes and generating inequality in educational opportunities among the Indonesian population over the period 1997-2007.

We contribute to previous literature by devising an individual index of the power of *circumstances*, which explains the influence that the accumulation of pre-determined *circumstances* has on individual educational achievements. This allows us to see how persistent these *circumstances* can be over the individual life's course and, thus, how sticky current levels of inequality of opportunities can be.

Next, by evaluating the association between our power of *circumstances* index and educational budgeting at the provincial level, we seek to understand if the educational budgeting policy had any influence (and in which direction) on inequality of opportunity in education.

The remainder of this paper is organized as follows. Section 2 is devoted to providing a review of the literature in this field and Section 3 discusses methodological issues involved in measuring inequality of educational opportunity and the specific choices we have made. In Section 4 we report descriptive statistics and discuss our empirical findings in Section 5. Section 6 concludes.

2 Inequality of opportunity: conceptual underpinnings and empirical applications

The concept of inequality in educational opportunity finds its roots in the mid-60s when the Coleman Report (Coleman et al., 1966) started the debate on what is meant by equality of opportunity and how to achieve it. This report questioned the effectiveness (in terms of a fairer distribution of outputs or educational achievements) of policies aimed at equalizing benefits between students or granting full access to education and argued that socio-economic conditions and family background are important factors that drive most of the variation in students' achievements.

The debate on the meaning of equality of opportunity in various income and wealth related outcomes was enriched by the contributions of important philosophers and economists (such as Rawls 1971; Nozick 1974; Sen 1980, 1985; Dworkin 1981a,b) posited the importance of compensating individuals" different situations, especially in cases outside of an individual's personal responsibility. It

was only at the end of the nineties that this concept was explicitly addressed, described and translated into a mathematical formulation in John Roemer's seminal book on equality of opportunity (1998). The main argument of Roemer was based on the distinction between unchosen and pre-determined *circumstances* and individual *efforts*. While the latter are attributed to the personal responsibility of the individual, the former are inherited by the individual and are beyond his or her control. Differences in individual outcomes which are attributable to *circumstances* are hence not only morally objectionable but can also lead to an inefficient allocation of resources (Ferrerira and Gignoux, 2014; Fernández and Galí, 1999) and should thus be compensated by public policies. On the other hand, outcome differences that are due to individual choices and personal responsibility can be ethically accepted because they represent the natural reward of individual *effort* (see Fleurbaey 2008).

Measuring inequality of opportunity requires two fundamental preliminary steps: first, the search of a set of factors which can accurately represent those *circumstances* and second, the partition of a society into groups (or *types*) of individuals sharing the same set of circumstances and into groups (or *tranches*) of individuals characterized by the same degree of *effort* (Checchi and Peragine, 2010).

Two methodological approaches have been suggested in order to quantify the extent to which a given society is unequal. Either one can adopt an utilitarian "ex-ante" perspective (van der Gaer, 1993) by considering outcome differences *between types*- prior to the realization of their *effort* level, or one can follow an "ex-post" approach by looking at the opportunity set granted to individuals who exert the same degree of *effort* (Roemer, 1998; Checchi and Peragine, 2010). While in the first approach equality of opportunity is achieved when opportunities are equalized *between types* (Ferrerira and Gignoux, 2011, 2014), in the ex-post approach outcomes should be equalized *within tranches* or groups of people who, independently of their inherited *circumstances*, are featured by the same degree of *effort* (Checchi and Peragine, 2010). As noted in Fleurbaey (2008) and Checchi and Peragine (2010) these two approaches do not necessarily generate same rankings of distributions, as compensation mechanisms within types will only affect opportunity inequality when adopting the ex-post approach (Checchi and Peragine, 2010). On the other hand, the ex-ante approach can generate a distribution that fully satisfies the utilitarian or reward principle according to which inequality of a given outcome within groups of individuals sharing the same *circumstances* can be fair, as long as these individuals are rewarded according to the amount of *effort* exerted in order to achieve a certain outcome (Donni and Pignataro, 2014).

The vast majority of the applied studies on the measurement of inequality of opportunity has fo-

cused on the opportunities for the acquisition of income (see, among others, Peragine 2002, 2004a,b; Bourguignon et al. 2007; Peragine and Serlenga 2008; Lefranc et al. 2008, 2009; Aaberge et al. 2011; Björklund et al. 2012; Andreoli et al. 2014) whereas relatively fewer empirical studies appear in the domain of education. In this field, three main strands of research have emerged so far: the first strand of the empirical literature has applied the "education production function" framework to directly estimate the effect of specific socio-economic variables on educational outcomes (Fertig 2000; Hanushek 1979; Wößmann 2003; Filmer and Pritchett 1998) and to directly as well as indirectly consider intergenerational mobility in educational achievements outcomes (Behrman et al., 2001; Dahan and Gaviria, 2001; Lam and Schoeni, 1993).

The second, more recent strand of the literature has addressed the Roemer's theory more explicitly and attempted to operationalize the concept of inequality of opportunity theory in the domain of education. Some notable contributions include the study by Ferrerira and Gignoux (2014) who propose and compute an ex-ante, parametric measure of inequality of educational opportunity for PISA scores in 57 countries; the article by Asadullah and Yalonetzky (2012) who construct several indices of inequality in educational opportunity across Indian states and the analysis conducted by Gamboa and Waltenberg (2012) who, following an ex-ante non-parametric approach, considers inequality of educational opportunity in PISA scores for Latin American students.

Lastly, the third strand of the literature (Mongan et al., 2011; Waltenberg and Vandenberghe, 2007; Iatarola and Stiefel, 2003) has instead focused more on policy-oriented research objectives and has evaluated the opportunity-equalizing effects of education policies.

This paper connects these three strands by considering the distribution of educational opportunities across provinces and over time, assessing the role that both *circumstances* and individual responsibility plays in education levels and earning outcomes in the short and long run, and evaluating the effect of educational budgeting policies on inequality of opportunity.

3 Methods

3.1 Measuring inequality of opportunity in education

To measure the educational inequality of opportunity, we seek to build upon Roemer's utilitarian principle, according to which inequality between individuals determined by different degrees of *effort*

is fair (Donni and Pignataro, 2014). We thus pursue the ex-ante approach that considers inequality of opportunity as a *between-type* inequality[1]. For the main educational outcome variable we focus on educational attainment, which is completed years of schooling defined by the last grade the individual achieved in order to avoid measurement error (i.e. the same real year of schooling could reflect different educational levels).

Following Bourguignon et al. (2007) and Ferrerira and Gignoux (2014), we apply a parametric methodology to construct our aggregate indices of the inequality of opportunity in education (measured by the educational attainment):

$$\hat{\theta}_{IoP} = \frac{Var\left(C_i, \hat{\beta}\right)}{Var\left(Y_i\right)} \tag{1}$$

which is simply the R-squared of an Ordinary Least Squares (OLS) regression of the individual's educational achievement (y) on a vector C of individual *circumstances*.

As argued in Dardanoni et al. (2005), the exact content of these *circumstances* is a contentious issue which is largely related to the outcome the research is focused on. For example, one can reasonably assume to have one set of *circumstances* defining *types* when examining inequality of opportunity for educational attainments (where parental wealth and education may play a central role) and another set when the outcome variable is represented by earnings or other labor market achievements (where gender becomes a key variable).

Among the pre-determined *circumstances* available, we therefore stick to variables that were also proposed in the precedent literature, ones that are truly "pre-determined" and exogenous and have a small rate of missing values to keep the attrition rate low. Those are parental education, represented by mother and father educational attainments, sex, rural or urban residence and dummies of household wealth such as ownership of the house, other buildings, farm land, livestock, vehicles, household appliances, savings, receivables, jewelry, furniture, electricity, television and other assets. Contrary to Ferrerira and Gignoux (2014), we do not include access to books as this variable might actually be endogenous, i.e. parents observing efforts and school achievements of their kids might motivate them to buy more books and learning tools to satisfy the increasing needs of their keenest children.

It is important to note that since all the variables included in this analysis are not all of the possible pre-determined *circumstances*, the R-squared should be interpreted as the lower bound of educa-

[1] The ex-ante approach is well represented in the related empirical literature and has been adopted by Bourguignon et al. (2007); Checchi and Peragine (2010); Ferreira and Gignoux (2011, 2014), Li Donni et al. (2014).

tional inequality of opportunity[2].

Further, we do not include age as one of the explanatory variables of educational attainments. We argue that regardless of whether age is truly exogenous and pre-determined, it makes very little sense to consider it as a *circumstance* that may drive inequality of opportunity[3]. In our approach we thus consider the adjusted educational attainment as the main dependent variable which results from the residual obtained from two sets of zero-truncated Poisson regressions of educational attainment against age, runned separately for two cohorts of individuals. By doing this, we make sure that the effect of age is somewhat controlled for and avoid the risk of obtaining a blurred measure of inequality of opportunity.

Excluding the constant, equation 2 proceeds the extraction of educational attainment from age that yields the residual part Y as the age-adjusted educational attainment for each cohort, where subscriptions index i and t represent individual and time consecutively[4].

$$Educational\ attainment_{it} = Age_{it} + Y_{it} \tag{2}$$

Primary education in Indonesia normally starts at the age of 6 and the adequate supply of primary schools implies that 6-10 years old have a similar level of opportunity in education. Consequently, we define our youngest cohort as 11-14 years old and the next cohort as 15-18 years old[5].

After having obtained our aggregate indices of inequality of opportunity for all the Indonesian provinces sampled in IFLS for the three different time periods (i.e. 1997, 2000 and 2007), we are able to analyze time trends and differences among provinces in inequality of opportunity of education.

Lastly, by applying the Shapley value method (Shorrock, 1999, 2013), we can decompose our index of educational inequality of opportunity and find the contribution of each of the *circumstances*[6].

[2] A formal proof is provided in Ferreira and Gignoux (2011). In practise, it is also crucial to check the adjusted R-squared when selecting the circumstances. The arbitrarily large disparity between R-squared and adjusted R-squared indicates that some of the explanatory variables do not significantly explain the outcomes.

[3] and when the outcome is educational attainment, the inclusion of age as one of the regressors in OLS will considerably inflate the R-squared.

[4] We argue that while the residuals are indeed generated from a Poisson model, it is sensible to flexibly make a further assumption in the second stage regression that age-adjusted educational attainment is normally distributed as the residuals from the first stage regression have no longer count nature as well as they could possess negative values.

[5] Basic descriptive statistics are reported in Table A1 in the Appendix.

[6] In the Shapley decomposition, the contribution of each factor is determined as average marginal contribution taken over all possible ways in which factors may be removed in sequence.

3.2 Measuring the effect of individual circumstances

While the R-squared is able to measure the extent to which educational opportunities are distributed among a given groups at the aggregate level, there is one important question left. To what extent do we, as the researchers, use this measure Ferrerira and Gignoux (2014) have shown that the R-squared of pre-determined *circumstances* explaining PISA score in each country is significantly associated with two educational policy variables. While the approach is definitely promising, it has the drawback that this aggregate measure cannot explain the effect of inequality of opportunity on the individual level. Instead, it might be of crucial importance to explain if and how the "burden" of unequal opportunities in education carried by each person will affect her future life achievements, such as the educational attainment, wage, occupation, income, productivity or non-cognitive ability to name a few. We therefore rely on the longitudinal dimension of the dataset and find an alternative measure that is able to capture the inequality of opportunity in that sense.

We focus our attention on the fitted values of a regression model that are comparable to the R-squared to grasp the idea of the inequality of opportunity at the individual level. In a simple linear regression setting where the dependent variable is the adjusted years of education observed for individual i at time t in each cohort and a vector of circumstances X such as[7]:

$$Y_{it} = \alpha + \beta X_{itc} + \delta_2 Z_2 + ... + \delta_n Z_n + \gamma_t + \mu_{it} \tag{3}$$

and $E(\mu_{it}) = 0$, the fitted values of each individual $i, i = 1, ..., n$ at time $t, t = 1, ..., T$ for each cohort *c* excluding the common constant and time effect as well as individual effects are simply given by:

$$\hat{Y}_{it} = \hat{\beta} X_{it} \tag{4}$$

The R-squared of this model informs us of the extent to which the variation of X explains the variation in Y for all individuals i over time. The fitted value $\hat{Y}_{it}$ explains, alternatively, the predicted value for response variable Y of individual i at time t that is specifically influenced by the X circumstances experienced by individual i at time t, with $\hat{\beta}$ governing the average magnitude of the relationship over

[7] For clarification, Y_{it} in eq. 3 is an estimated Y_{it} in Eq. 2

time and across individuals.

The interpretation of this measure is quite straightforward. Fitted values are the part of individual educational attainment that is explained by individual pre-determined circumstances. Fitted values also contain constant and the estimated parameter. But they are fixed terms so the distance between two observations remains proportional and the distribution rank of the fitted values does not change.

The higher value of pre-determined *circumstances* in the model, hence the higher the fitted values $\hat{Y}$, the stronger the effect of pre-determined *circumstances* as the source of inequality of opportunity at the individual level, contributes to the years of education. This one-to-one relationship is more understandable when the fitted values are tailored to the standardized range [0,100]. Standardized fitted values zero represent the individuals with the lowest effect of pre-determined *circumstances*, while the largest values map the ones with the highest effect of pre-determined *circumstances*[8].

Furthermore, equation 3 can be seen as a two-way fixed-effects regression by replacing individual dummies Z with individual time invariant effect ε_i for a more compact estimation procedure, such that

$$Y_{it} = \alpha + \beta X_{itc} + \gamma_t + \varepsilon_i + \mu_{it} \tag{5}$$

The two-way fixed-effect estimator of equation 5 is defined based on

$$(Y_{it} - \bar{Y}_i) = \beta(X_{it} - \bar{X}_i) + (\gamma_t - \bar{\gamma}) + (\mu_{it} - \bar{\mu}_i) \tag{6}$$

that removes time invariant variables[9]. The coefficient estimates and standard errors of equation

[8]Concerning the importance of explanatory variables, it is crucial to note that unlike R-squared, fitted values cannot be adjusted. Instead, it purely relies on the coefficients of pre-determined *circumstances*. If $\hat{\beta}$ is large, fitted values will be large too. If $\hat{\beta}$ is close to zero or practically insignificant, it translates into the fitted values as a very small number. This measure will potentially suffer from imprecision if $\hat{\beta}$ is large but the standard error is also large that makes it statistically insignificant. Therefore, we need to keep an eye on the statistical assessment of individual coefficients such as t-test and VIF before making decision to move forward using fitted values, or even to refine the model until the empirical assessments are more convincing. Another issue with fitted values is related to the modelling strategy. Ordinary least square that implicitly assumes normal distribution naturally produces unrestricted fitted values. However, in many cases educational outcomes are bounded and particularly for educational attainment it should have the lowest value zero. Negative fitted values, when this is the case, will violate the nature of of schooling. Therefore, generally speaking it is very important to investigate if the fitted values go beyond their innate boundaries and when it is there, one may have to look at various strategies to overcome this issue prior further analysis.

[9]Some source of complete derivation is i.e. by Allison (2009).

3 and equation 5 (as well as equation 6) are identical[10]. Nevertheless, in equation 5 and 6 the estimates have a stronger causal interpretation, such that for each individual i, the predicted values are translated as the joint influence of pre-determined *circumstances* deviation at time point t from its mean on the deviation of educational attainment at time point t from its mean[11]. This interpretation employs within variation to solidify the effect of *circumstances* in time t relative to the ones at every time point via an averaging procedure. This method privilege is not found for models with cross-sectional information or longitudinal data sets with pooled approaches.

As for the term time dimension deviation from its mean $(\gamma_t - \bar{\gamma})$ in equation 5, it exists for each predicted value. Therefore, this does not affect the within variation attached to index of *circumstances* deviation[12].

Moreover, we exploit the assumption that in the individual fixed effect model, as specified in equation 5, ε_i is the zero-mean time-invariant part of the error term. We interpret this part as an upper-bound estimate of the fixed element of *unobserved effort* or innate ability . The possibility that *effort* or innate ability varies over time so that it has a time-variant element is an interesting case, yet beyond the scope of the study. We encourage the readers to peruse this topic.

3.3 Assessing the long-term effect of the circumstances

Once equation 5 is estimated to extract the individual indexes of the effect of *circumstances* deviation for each time point t $\left(\hat{\triangle Y_t}\right)$ –also referred to as the individual index of effect of *circumstances* - and of innate ability ($\hat{\varepsilon}_i$), we turn to the third-stage of our analysis. This stage will focus on the cohorts of students who stopped school by the time the last survey was taken (i.e. 2007) and use these measures to explain long-term educational and earning outcomes. The purpose of this stage is mainly to assess whether and to what extent the educational gains obtained during school-age through the beneficial effect of circumstances persist over time and contribute to long term achievements such as educational attainment at the last survey period in 2007, enrolment in tertiary education and wage earned as young adults.

[10] Clustered standard errors.

[11] The deviation implies the magnitude of pre-determined *circumstances* affecting the outcomes, i.e. the small deviation of X from its mean at time t leads to a small impact on the deviation of Y from its mean at time t. In addition, deviation has two directions, negative and positive. Pursuing pre-determined circumstances that affect the outcomes direction might utilize this approach.

[12] It is important to notice, however, that STATA routine for estimating the fixed-effect through xtreg,fe command has a bit different method to produce the predicted values in order to introduce back the constant. Under the constraint that $\bar{\varepsilon} = 0$, the fixed-effects model reformulation from Gould (2013) is modified into two-way fixed-effect version so that for each cohort $(Y_{it} - \bar{Y}_i - \bar{\bar{Y}}) = \alpha + \beta(X_{it} - \bar{X}_i - \bar{\bar{X}}) + \gamma_t + (\mu_{it} - \bar{\mu}_i - \bar{\bar{\mu}})$. The reformulation does not affect the within variation of index of *circumstances* since the additional terms do not contain individual subscript *i*.

These long term effects for each cohort are obtained from the following three sets of regressions (we ignore the constant and error terms for simplification):

$$Completed\ years\ of\ education_{i,2007} = \theta^{E}(\widehat{Y_{i,2007} - \bar{Y}_i}) + \tau^{E}\hat{\varepsilon}_i \tag{7}$$

which are estimated with a zero truncated Poisson model by maximum likelihood estimation;

$$Enrollment\ in\ university_{i,2007} = \theta^{U}(\widehat{Y_{i,2007} - \bar{Y}_i}) + \tau^{U}\hat{\varepsilon}_i \tag{8}$$

where the dependent variable is a dummy which equals 1 if the individual is enrolled in university and the effects are estimated with a maximum likelihood probit model;

$$Log\ wage\ per\ day_{i,2007} = \theta^{W}(\widehat{Y_{i,2007} - \bar{Y}_i}) + \tau^{W}\hat{\varepsilon}_i \tag{9}$$

that is estimated with a Heckman selection model where selection is predicted by using age, years of education, and dummies for female gender, being married, and for enrolment in university.

Equation 7, 8 and 9 work with two different sets of sample, observation in 1997 and observation in 2000. Hence, the average outcome over time $\bar{Y}_i$ depends on when the observation entered the survey. More specifically, for $t = 1997$ the outcome average $\bar{Y}_i$ is estimated over the time period 1997, 2000 and 2007. While for $t = 2000$, $\bar{Y}_i$ is from the time period 2000 and 2007.

We lastly consider the relationship between inequality of opportunity and educational budgeting policy. In doing so, we aim to see whether allocating more resources to the education sector had any effect on the equalization of opportunities among students and thus therefore mitigated the influence of circumstances on individual educational achievements.

We therefore model our indexes of the effect of circumstances as a function of lagged educational budget spending and the lagged values of the dependent variable. Our regression of interest for each cohort takes the following form:

$$\triangle\hat{Y}_{i,p,t} = \varphi + \theta\triangle\hat{Y_{i,p,t-s}} + \delta budget_{p,t-x} + \gamma_t + \upsilon_{i,p,t} \tag{10}$$

where $\hat{\triangle Y_{i,p,t}}$ is the individual index of the effect of circumstances measured in time t for individual i, living in province p; $\hat{\triangle Y_{i,p,t-s}}$ is the lagged value of the index as measured in the previous survey available, $budget_{p,t-x}$ is the share of the budget devoted to education in province p at time t-x, where x is two, three or five years depending on whether the dependent variable is observed in 1997, 2000 or 2007 and γ_t are the time fixed effects, $\upsilon_{i,p,t}$ is the idiosyncratic error term with zero expectation.

There is a concern that the standard errors in equation 7, 8, 9 and 10 are downward biased. In the second stage analysis, the age adjusted attainment is an estimated variable from the first stage analysis and the estimation excludes this kind of uncertainty. The complication of parametric inference consequently gets bigger in the third stage analysis. We thus rely on bootstrapping to estimate the final standard errors. In this fashion, the implicit assumption is that the sets of observations are independently and identically distributed. We expect that this assumption holds true, as we have included the sampling weights in the first stage analysis to correct for the probability of being selected into the survey.

4 Data and Descriptive Analysis

4.1 Data

Our main data comes from the 1997, 2000 and 2007 waves of the Indonesia Family Life Survey (IFLS) which is a longitudinal individual and household survey data conducted in 13 Indonesian provinces spread out in the islands of Sumatra, Java, Kalimantan, Sulawesi, Bali and West Nusa Tenggara.

There are interesting features in the IFLS which make this data particularly suited to our research needs. First, the data featuresis featured by high recontact rates (Frankenberg and Thomas 2000) that contribute significantly to data quality by lowering the bias due to non-random attrition. Second, in addition to the information on theto basic demographic and socio-economic characteristics of all the household's members, the IFLS collected detailed information on various educational aspects (e.g., current schooling grade; age at which the child first enrolled at school; number of correct answers given in a cognitive test) as well as on earnings which are necessary to analyze inequality of opportunity in educational outcomes and intergenerational mobility.

To scrutinize the educational budget policy, we extracted lagged annual provincial revenue data ("Anggaran Pendapatan dan Belanja Daerah"-APBD) from The Indonesian Ministry of Finance of Finance Government of Indonesia (1997-2007, 2007)[13]. The data are available for public, but the formats are different. Data for 1994/1995 and 1996/1997 combine the budget of education, youth, sport and faith under the same umbrella, while data in 2002 has specific section for educational budget. Even though the correlation established for 2007 and other waves are not head-to-head comparable, they still give some benefits regarding the general description of the relationship between educational policies and educational inequality of opportunity.

4.2 Levels and trends of inequality of opportunity in education in Indonesia

Table 1 shows our estimates of the inequality of educational opportunity, measured as the R-squared of a set of several regressions run separately for each province, year and cohort.

On average these figures suggests that pre-determined *circumstances* account for a relatively low portion of the total variance of attainment, yet but there are remarkable differences among provinces as well as, between cohorts and over time.

We see that –in most of the cases- the inequality of opportunity measure seems to be relatively higher for the oldest cohorts, a finding, this one, which goes against our initial expectations. This is due to the fact that one would reasonably assume that while young kids are very much dependent on their family choices, as a person gets older, his achievements and choices tend to be less "dependent" on her parents' choices.

It can also be observed, however, that inequality of opportunity has decreased in almost all the Indonesian provinces analyzed in this paper. Some notable exceptions are South Sumatra, where the portion of overall inequality in educational attainments, accounted for by inherited *circumstances*, grew for the older cohort from 27% in 1997 to 44% in 2007 or in South Kalimantan, where, for the youngest cohort it shows an increase of almost 50 percentage points.

In Table 2 we report the decomposition of inequality of opportunity into partial shares by individual *circumstances*. These estimates, which are based on the cross sectional dataset from 1997, suggest that mother's and father's education are associated with the largest share of inequality in educational achievements. In some provinces, however, the relative contribution of inherited wealth

[13]The provincial revenue in our model is not the budget dedicated for province administration. Instead, we use the sum of district revenues in each province, as the development budget is concentrated at the district level, particularly after decentralization.

status measured by ownership of the house and of several assets is particularly prominent. This is for the example the case of Central Java, where ownership of the house and TV counts relatively much more than parental education, as together they account for almost 40 percentage points of the overall share of explained inequality of opportunity in the oldest cohort. Another interesting example is Lampung, where ownership of farm land accounts for about 21 percentage points of overall inequality in the cohort 11-14 years.

4.3 Educational mobility and the role of pre-determined circumstances in driving educational achievements

This section aims at examining the influence of pre-determined *circumstances* in the educational attainments of the two cohorts of Indonesian students analyzed here. In this section we get a first glimpse at the extent to which the effect of these circumstances is sticky across generations of the same household.

As a first explorative step we cover adults or individuals who graduated or dropped out since the first period of observation and apply a sequential response model (Maddala, 1983; Mare, 1981) in order to assess the association of pre-determined circumstances with the decision of an individual to continue or to exit school at each level.

More specifically, we use a sequential logit model that considers the sequence of the binary response variable. It allows the explanatory variables to unequally influence the probability of staying in one level or moving on to the next level. Moreover, the probability of being in one level takes into account the probability of being in the previous level. Educational levels fit into this modeling strategy as, in order to graduate from primary school, one needs to be enrolled in primary school. Then the decision to be made is either to stay in that level and never graduate (i.e. drop out/exit) or complete primary school (graduate)[14].

We therefore exploit the longitudinal dimension of our data by following individuals who either left of graduated from each school level by the last wave of the survey in order to assess the extent to which pre-determined, inherited *circumstances* (such as the socio-economic status of the family observed in the first wave) affect individual probability to proceed towards further levels of schooling.

[14] See Figure A1 reported in the Appendix.

Table 1: Aggregate index of inequality of educational opportunities

	1997				2000				2007			
	Cohort 11-14		Cohort 15-18		Cohort 11-14		Cohort 15-18		Cohort 11-14		Cohort 15-18	
	Obs.	R^2	Obs.	R^2	Obs.	R^2	Obs.	R^2	Obs.	R^2	Obs.	R^2
North Sumatera	172	0.237	102	0.171	180	0.279	102	0.244	156	0.218	90	0.205
West Sumatera	120	0.451	75	0.418	117	0.343	77	0.464	65	0.301	50	0.332
South Sumatera	116	0.246	45	0.277	139	0.405	54	0.455	47	0.487	38	0.444
Lampung	99	0.377	36	0.513	108	0.249	45	0.495	76	0.433	40	0.285
DKI Jakarta	179	0.236	130	0.291	137	0.333	127	0.191	88	0.293	48	0.365
West Java	263	0.319	128	0.343	283	0.227	142	0.319	201	0.236	129	0.124
Central Java	230	0.234	122	0.235	221	0.185	121	0.215	147	0.232	113	0.120
DI Yogyakarta	77	0.320	62	0.356	82	0.141	60	0.358	54	0.268	58	0.296
East Java	243	0.151	114	0.268	219	0.314	162	0.255	168	0.247	128	0.223
Bali	100	0.372	53	0.541	94	0.289	58	0.319	79	0.298	64	0.249
West Nusa Tanggara	140	0.241	47	0.436	156	0.213	71	0.358	112	0.297	98	0.123
South Kalimantan	74	0.177	31	0.374	73	0.444	29	0.629	63	0.650	34	0.533
South Sulawesi	104	0.382	39	0.443	98	0.266	46	0.453	90	0.263	58	0.384

We code the sequential steps from entering primary school to entering higher education as an ordinal variable which ranges from 1 (lowest level) to 7 (highest level)[15] and run separate sets of regressions for the two five-years cohorts of individuals sampled. Results are reported in Tables 3 and 4.

[15] See Table A2 reported in the Appendix.

Table 2: Decomposing inequality of educational opportunity into individual circumstances share

PANEL A: Cohort 11-14	Total	Gender	Mother's Education	Father's Education	Rural	TV	House	Farm Land	Household Appliances	Electricity
North Sumatra	0.150	0.002	0.053	0.042	0.007	0.007	0.008	0.016	0.014	0.002
West Sumatra	0.379	0.049	0.072	0.019	0.025	0.054	0.004	0.032	0.066	0.034
South Sumatra	0.202	0.004	0.043	0.087	0.013	0.009	0.013	0.017	0.014	0.008
Lampung	0.330	0.011	0.044	0.038	0.103	0.006	0.017	0.067	0.019	0.022
Jakarta	0.157	0.003	0.064	0.061	-	0.008	0.011	0.002	0.003	0.004
West Java	0.284	0.003	0.057	0.117	0.052	0.022	0.001	0.011	0.022	0.001
Central Java	0.239	0.025	0.054	0.063	0.022	0.032	0.008	0.002	0.031	0.003
Yogyakarta	0.275	0.037	0.075	0.102	0.001	0.046	0.004	0.003	0.005	0.026
East Java	0.146	0.023	0.027	0.029	0.011	0.019	0.001	0.001	0.002	0.035
Bali	0.315	0.012	0.091	0.073	0.003	0.081	0.007	0.009	0.012	0.016
W. Nusa Tenggara	0.189	0.007	0.057	0.050	0.001	-0.023	0.008	0.001	0.015	0.028
South Kalimantan	0.072	0.002	0.005	0.024	0.002	0.015	0.001	0.007	0.006	0.002
South Sulawesi	0.315	0.043	0.051	0.117	0.003	0.016	0.005	0.010	0.061	0.010
PANEL B: Cohort 15-18										
North Sumatra	0.102	0.000	0.038	0.024	0.001	0.002	0.001	0.005	0.017	0.012
West Sumatra	0.279	0.030	0.091	0.012	0.046	0.009	0.004	0.008	0.032	0.024
South Sumatra	0.250	0.030	0.121	0.032	0.013	0.024	0.002	0.005	0.011	0.006
Lampung	0.449	0.004	0.229	0.031	0.057	0.047	-	0.027	0.013	0.026
Jakarta	0.236	0.038	0.054	0.080	-	0.011	0.050	0.002	-	-
West Java	0.240	0.006	0.084	0.082	0.022	0.011	0.001	0.009	0.006	0.014
Central Java	0.130	0.019	0.011	0.005	0.017	0.035	0.017	0.001	0.003	0.009
Yogyakarta	0.228	0.004	0.018	0.063	0.003	0.001	0.033	0.001	0.004	0.040
East Java	0.300	0.021	0.044	0.044	0.021	0.101	0.001	0.010	0.020	0.029
Bali	0.360	0.018	0.119	0.062	0.059	0.041	0.011	0.001	0.047	-
W. Nusa Tenggara	0.280	0.009	0.011	0.027	0.019	0.011	0.033	0.052	0.006	0.106
South Kalimantan	0.306	0.017	0.021	0.003	0.107	0.016	0.003	0.005	0.008	0.028
South Sulawesi	0.332	0.043	0.030	0.048	0.016	0.077	0.027	0.022	0.008	0.004

Note: Based on cross-sectional data from IFLS 1997.

Table 3: Sequential Logit model for educational levels. Results for cohort 11-14

	1 vs 2-7	2 vs 3-7	3 vs 4-7	4 vs 5-7	5 vs 6-7	6 vs 7
Father's Educ.	0.248	0.097	0.155	0.126	-0.111	0.187
	(3.13)	(2.14)	(1.59)	(3.25)	(1.13)	(3.00)
Mother's Educ.	0.061	0.180	0.018	0.162	0.185	0.141
	(0.74)	(3.53)	(0.16)	(3.49)	(2.00)	(2.32)
Female	-0.212	-0.039	1.088	-0.223	-0.108	0.456
	(0.59)	(0.15)	(2.25)	(0.95)	(0.22)	(1.61)
Rural	0.174	-0.021	0.127	-0.949	0.799	-0.316
	(0.36)	(0.07)	(0.25)	(3.41)	(1.22)	(0.88)
TV	0.311	0.486	0.206	0.679	1.260	-0.766
	(0.65)	(1.51)	(0.39)	(2.29)	(1.80)	(1.44)
House	1.032	-0.153	1.562	-0.066	-0.263	0.967
	(1.81)	(0.28)	(2.31)	(0.15)	(0.35)	(2.29)
Other buildings	0.936	0.466	2.045	0.687	1.545	0.368
	(1.13)	(0.75)	(1.97)	(1.61)	(1.34)	(0.94)
Farm Land	0.180	0.709	0.031	-0.125	0.190	0.687
	(0.49)	(2.42)	(0.07)	(0.51)	(0.29)	(2.29)
Livestock	0.445	-0.563	-0.440	-0.113	-0.033	-0.846
	(1.19)	(2.21)	(0.90)	(0.47)	(0.05)	(2.49)
Vehicles	1.057	0.781	0.584	0.023	0.293	0.120
	(2.80)	(3.02)	(1.35)	(0.10)	(0.49)	(0.35)
HH Appliances	0.112	0.980	0.103	-0.344	-2.720	1.020
	(0.24)	(2.77)	(0.15)	(0.87)	(2.37)	(1.32)
Receivables	-0.003	-0.545	0.962	0.007	1.352	-0.701
	(0.01)	(1.33)	(1.15)	(0.02)	(1.09)	(1.44)
Jewelry	0.541	0.080	-0.386	0.576	1.376	0.188
	(1.45)	(0.30)	(0.86)	(2.38)	(2.45)	(0.61)
Electricity	0.493	-0.110	1.072	-0.038	0.253	0.912
	(1.17)	(0.32)	(1.75)	(0.10)	(0.24)	(1.04)
Age	0.134	-0.126	0.280	-0.126	-0.032	0.451
	(1.28)	(1.38)	(1.51)	(1.50)	(0.17)	(4.07)
Constant	-3.991	2.310	-6.938	2.655	4.016	-16.441
	(1.69)	(1.11)	(1.62)	(1.42)	(0.97)	(5.82)
Observations			812			

Note: Sample is delimited to individuals who stopped schooling by 2007 or graduated from senior high school by 2007. Robust standard errors are in parentheses. The estimation includes age as the control variable and sampling weight. Education levels are enter Primary School (1), graduate Primary School (2), enter Junior High School (3), graduate Junior High School (4), enter Senior High School (5), graduate Senior High School (6), enter higher education (7). Stata module for sequential logit model is seqlogit (Buis, 2007).

Our findings show that parental education positively influences school survival across most of the levels of education. Among both cohorts of students, we observe that maternal education positively affects the probability of being enrolled in senior high school and, for the oldest cohort, it is also significantly associated (and with a relatively larger coefficient) with higher odds of proceeding towards higher levels of education after graduation from high school.

Father's education instead seems to positively affect the probability of both generations graduating from primary school. It can be observed that the magnitude of these probabilities is always larger for the youngest generations, which may imply that the importance of such a *circumstance* in driving

educational choices has grown over time.

Table 4: Sequential Logit model for educational levels. Results for cohort 15-18

	1 vs 2-7	2 vs 3-7	3 vs 4-7	4 vs 5-7	5 vs 6-7	6 vs 7
Father's Educ.	-0.009	0.179	-0.129	0.125	-0.128	0.114
	(0.12)	(3.03)	(0.72)	(2.40)	(1.23)	(2.06)
Mother's Educ.	0.286	0.137	0.273	0.163	0.032	0.186
	(3.12)	(2.13)	(1.35)	(2.58)	(0.30)	(3.39)
Female	-0.203	0.134	0.461	0.307	1.814	0.587
	(0.47)	(0.43)	(0.53)	(0.97)	(1.65)	(1.93)
Rural	0.290	0.020	-1.914	-0.706	-0.314	0.469
	(0.50)	(0.05)	(2.44)	(1.93)	(0.42)	(1.33)
TV	0.328	0.615	0.308	1.396	2.325	0.288
	(0.65)	(1.70)	(0.38)	(3.73)	(3.32)	(0.58)
Farm Land	0.632	0.103	1.224	0.410	0.391	-0.003
	(1.30)	(0.29)	(1.36)	(1.07)	(0.39)	(0.01)
Livestock	-0.524	-0.024	-0.565	-0.679	0.252	-1.226
	(1.05)	(0.08)	(0.64)	(1.94)	(0.27)	(3.58)
Vehicles	-0.016	0.755	0.341	-0.473	0.492	0.853
	(0.03)	(2.55)	(0.43)	(1.30)	(0.61)	(2.24)
HH Appliances	0.893	0.236	-1.269	0.267	-0.134	0.885
	(1.81)	(0.58)	(0.99)	(0.58)	(0.11)	(0.83)
Jewelry	0.751	0.118	2.440	0.497	-2.036	-0.371
	(1.71)	(0.38)	(2.47)	(1.52)	(1.72)	(1.01)
Age	-0.165	-0.208	-0.260	0.036	0.016	0.290
	(1.18)	(2.30)	(0.87)	(0.30)	(0.06)	(2.43)
Constant	4.985	4.705	11.217	-1.919	3.053	-12.006
	(1.26)	(1.95)	(1.36)	(0.61)	(0.43)	(3.66)
Observations			512			

Note: Sample is delimited to individuals who stopped schooling by 2007 or graduated from senior high school by 2007. Robust standard errors are in parentheses. The estimation includes age as the control variable and sampling weight. Education levels are enter Primary School (1), graduate Primary School (2), enter Junior High School (3), graduate Junior High School (4), enter Senior High School (5), graduate Senior High School (6), enter higher education (7). Stata module for sequential logit model is seqlogit (Buis, 2007).

Moreover, we can observe the presence of a gender gap (in favour of girls) in higher education levels. However, it also seems that the gap has been closing for the youngest generation, as the difference has lost statistical significance and in the case of the probability of enrolling in tertiary education, its magnitude has shrunk.

5 Findings

5.1 Persistence of unequal educational opportunities

We now turn to the inferential part of our analysis. It aims at unravelling the consequences of unequal opportunities in education because of exogenous pre-determined circumstances has on a person's future life outcomes.

Considering the distribution of young students' rewards according to *efforts* and *circumstances* is a very meaningful exercise in that it can tell how large a role pre-determined *circumstances* play in influencing schooling opportunities (given the limited responsibility of children that might have been tolerated in the past) that persist over the individual life's course.

By doing this, we can also get a clearer picture of the persistence or "stickiness" of the effects of inherited *circumstances* and therefore their repercussions for intergenerational mobility. In particular, we look at the effects in terms of future education achievement and of earnings on four different cohorts of students ranging from the oldest ones, aged 15-18 in 1997 and aged 15-18 in 2000, to the youngest ones, aged 11-14 in 1997 and aged 11-14 in 2000.

Panel A in Table 5 shows the results for the effects that inequality of educational opportunity experienced in the past has on future school achievements (i.e. on the highest grade completed in 2007).

As discussed in Section 3, we measure the deviation of pre-determined circumstances in 2007 from its average over the periods of observation by the fitted values of the educational achievement equation and, for the sake of interpretation, we normalize these fitted values in order to get an index which goes from 0 to 100. The larger the value of this index, the stronger effect from the latest circumstances on educational achievement relatively compared to those from the previous circumstances, within each individual.

Table 5: Persistence in inequality of opportunity and future educational achievements

Panel A	(1)	(2)	(3)	(4)
Dep. Var.:	Cohort 11-14	Cohort 11-14	Cohort 15-18	Cohort 15-18
Final Years of Education	2000	1997	2000	1997
Effect of Circumstances	0.014	0.006	0.002	0.002
	(49.09)	(32.97)	(14.35)	(11.06)
Innate Ability	0.022	0.018	0.008	0.013
	(50.48)	(44.64)	(21.47)	(26.84)
Panel B				
Dep. Var.:				
Tertiary Education				
Effect of Circumstances	0.044	0.030	0.002	0.005
	(2.38)	(4.34)	(0.37)	(1.06)
Innate Ability	0.065	0.008	0.038	0.048
	(2.18)	(4.52)	(3.18)	(2.49)

Note: T ratios in parentheses. Circumstances and Innate Ability are measured respectively by the normalized fitted values and the time-invariant residual obtained from panel, fixed effects estimation.
Col 1 and 3: Samples are students from cohorts 11-14 and 15-18 years old in 2000 who stopped schooling by 2007. Panel A: Obs.: 1188 (cohort 11-14). Obs.: 600 (cohort 15-18). Panel B: Obs.: 394 (cohort 11-14). Obs.: 312 (cohort 15-18).
Col 2 and 4: Samples are students from cohorts 11-14 and 15-18 years old in 1997 who stopped schooling by 2007. Panel A: Obs.: 986 (cohort 11-14). Obs.: 408 (cohort 15-18). Panel B: Obs.: 367 (cohort 11-14). Obs.: 193 (cohort 15-18).

As these results suggest a significant cumulated and persistent effect of pre-determined *circumstances* seems to exist. The more educational opportunities that are granted to a person based on her inherited *circumstances*, the larger her educational reward in the near future will be.

The coefficient on the effect of *circumstances* index indicates the difference between observation with the lowest support of pre-determined *circumstances* during the last period compared to those of the earlier periods (the standardized index of fitted values is 0) and the observations with the highest ones (the standardized index of fitted values is 100) ranges from around 1.4 years for youngest cohort aged 11-14 in 2000 to around 0.2 years for the oldest cohort (aged 15-18 in 1997).

One possible interpretation of the difference in the magnitude of the effect between the youngest

cohorts 11-14 and the oldest cohort15-18 is related to the fact that, due to their young age and therefore lower maturity, young adolescents depend much more on the choices made by their parents. Nevertheless, when comparing the coefficients for the youngest cohort measured in 2000 and the one in the same age-range measured in 1997, our results also show that the current influence of *circumstances* is stronger for the youngest generations, possibly implying that the distribution of educational opportunities have become more concentrated over time.

On the other hand, for each of the cohorts under investigations the role of innate ability is relatively larger than the power of *circumstances* and -when comparing the effect of the two youngest cohorts- it has also grown over time.

Moreover, when considering the results in Panel B on the probability of enrolling in tertiary education, we see that the indirect effect of current *circumstances* via education achievements is not at all statistically significant for the two oldest cohorts. Conversely, among the youngest generations we observe a positive and significant independent effect. Nevertheless, the effect of innate ability is not only larger, but –as implied by the difference in the coefficients- has also grown relatively faster than the effect of *circumstances*.

When looking at the results obtained from a simple Heckman model estimating the association between earnings and the effect of *circumstances* index (see Table 6), one can also see that there is a close and positive relationship between the role that latest *circumstances* played in the allocation of educational rewards during adolescence and future earnings perspectives.

Table 6: Persistence in inequality of opportunity. Wage equations.

	(1)	(2)	(3)	(4)
	Cohort 11-14	Cohort 11-14	Cohort 15-18	Cohort 15-18
	2000	1997	2000	1997
Effect of Circumstances	0.004	0.011	0.007	0.004
	(0.23)	(2.07)	(1.45)	(1.19)
Innate Ability	0.013	0.023	0.017	0.037
	(0.60)	(2.06)	(1.54)	(2.32)

Note: T ratios in parentheses. MLE estimation with bootstrapped standard errors. Dep. Var. is log wage per day in 2007. Variables included: years of education in 2007, age in 2007, sex, married, tertiary education, wealth index.
Circumstances and Innate Ability are measured respectively by the normalized fitted values and the time-invariant residual obtained from panel, fixed effects estimation.
Col 1 and 3: Samples are students from cohorts 11-14 and 15-18 years old in 1997 who stopped schooling by 2007. Obs.: 639. Cens. Obs.: 329 (cohort 11-14). Obs.: 245. Cens. Obs.: 101 (cohort 15-18).
Col 2 and 4: Samples are students from cohorts 11-14 and 15-18 years old in 2000 who stopped schooling by 2007. Obs.: 684. Cens. Obs.: 404 (cohort 11-14). Obs: 377. Cens.Obs: 168 (cohort 15-18).

However, we see that in most of the cases the effect of current *circumstances* is not statistically different from zero and relatively small in magnitude if compared to the effect of innate ability.

These results –that echo back to our previous results on tertiary education as well as our aggregate figures on inequality of opportunity- imply that in our sample any “unfair” reward mechanisms at school did not tend to persist and were not reflected in future earning perspectives.

5.2 Educational inequality of opportunity and public policy

Our next research question is whether educational budgeting policy has played a role in evening the allocation of opportunities among the Indonesian students. We have observed that equality of opportunity in education (as measured by the aggregate index at the province level as well as proxied by the individual index of effect of the *circumstances*) has tended to improve slightly over time. Was this improvement associated with an increase in the budget devoted to education?

In order to answer this question, we exploit the panel dimension of our data and estimate a fixed-effects model relating the between-provinces variation in the budget share devoted to the education sector to the between-province variation in inequality of opportunity, as measured by our effect of

circumstances indices obtained for the cohorts 11-14 and 15-18.

The results, which are reported in Table 7, show that while one of the oldest cohorts has experienced better pro equality policies, there is a more stable, positive and significant relationship between inequality of opportunity and spending in education when considering the results obtained for the youngest cohort.

These findings may be interpreted as such despite the differences in the way financial resources have been spent over time.

The oldest cohort of students, aged 15-18 in 2000, seems to have benefited extensively from various supply side interventions, targeting especially secondary school (such as the realignment of the education system and the creation of new vocational schools) that were realized in the aftermath of the 1997 crisis. By simply increasing and diversifying the supply of education, these policies created more opportunities for secondary school students to achieve higher education levels. At the same time, the campaign concerning the benefits of studying at vocational schools to increase the demand side has also been actively taking place. Students or households that have no intention of obtaining tertiary education were advised to attend vocational schools, since this schooling type has a lower opportunity cost as the skillful fresh graduates are more ready to enter the job market than the traditional high school graduates.

On the other hand, the effectiveness of the allocation of provincial budgets to primary and junior high schools has been more ambiguous: more resources were devoted to hire a greater number of teachers, assigning each teacher to teach one subject and therefore decreasing the students/teachers ratios. Yet –as remarked in various reports (Suryadarma and Jones, 2013; OECD and Asian Development Bank, 2015) - this mechanism has been highly inefficient, especially for small schools that are mostly located in remote and disadvantaged areas where problems related to teachers' lack of motivation and absenteeism were more frequently observed.

Table 7: Inequality of opportunity in education and public policy

Dep. Var.: Effect of Circumstances Index	(1) Cohort 11-14 2000	(2) Cohort 11-14 1997	(3) Cohort 15-18 2000	(4) Cohort 15-18 1997
Lag Educational Budget Share	1.33	1.28	-3.35	0.24
	(11.49)	(5.23)	(5.47)	(0.39)
Lag Effect of Circumstances Index	-0.36	-0.12	-0.48	-0.14
	(3.26)	(2.24)	(3.83)	(2.13)
Time Fixed Effects	yes	yes	yes	yes
Observations	2584	2561	1465	1129
Sample observed in:	2000-2007	1997-2000-2007	2000-2007	1997-2000-2007

Note: The lags for the educational budget share are of two, three and five years depending on whether the dependent variable is observed in 1997, 2000 or 2007. T ratios in parentheses.

6 Concluding remarks

Educational outcomes are important for achieving a wide array of important personal goals. Having the opportunity of being well educated also has its own intrinsic value, regardless of the effect education can have on other, contemporaneous or future, outcomes. Every person should be able to exert her fundamental right of being educated, but -of course- this does not necessarily imply that everybody should achieve the same level of education. However, according to both ethical and efficiency-related arguments, the only source of inequality in educational achievements should be related to the heterogeneity in effort committed to studying, and not on inherited factors which are simply outside the scope of individual responsibility.

This simple consideration has motivated the present study which contributes to previous literature by, firstly, accruing current knowledge on inequality of educational opportunities in Indonesia, which has experienced remarkably high rates of economic growth as well as reductions in economic poverty. The country stands out when considering average national figures on education by benefiting from massive supply side interventions which boosted school enrolment rates (Duflo, 2001). Yet, despite these gains, there are still two important challenges that the country needs to face: the first one is

the increasing trend of income inequality and inequality of opportunity in the health dimension World Bank (2014)and the other one related to large disparities within and between provinces and regions in many quantitative and qualitative indicators of school achievement (World Bank, 2011; OECD and Asian Development Bank, 2015).

Second, we identified the factors (or "*circumstances*") that account most for overall inequality of educational opportunity and found that parental educational background is one of the most important pre-determined *circumstances* that affect educational inequality of opportunity.

We contribute to previous literature on this field by devising an "individual" index of the effect of *circumstances*, which is given by the fitted values representing the importance that, for each individual, the deviation of current *circumstances* from its average have on her educational achievement. By using this index we were able to show how persistent these *circumstances* are over the individual life's course and thus how relentless current levels of inequality of opportunities are.

We also observe for the youngest cohorts a positive trend between inequality indices and educational budget share. This evidence may suggest that the increase in the educational budget share has not been efficient and has led to an increase in inequality.

Bibliography

Aaberge, R.Mogstad, M., and Peragine, V. (2011). Measuring long-term inequality of opportunity. *Journal of Public Economics*, 3-4(95): 193–204.

Allison, P. D. (2009). *Fixed effects regression models*. New York: AGE Publications.

Andreoli, F.Havnes, T., and Lefranc, A. (2014). Equalization of opportunity: definitions, implementable conditions and application to early-childhood policy evaluation. In *33rd IARIW Conference*. Rotterdam, The Netherlands.

Asadullah, M. N.Yalonetzky, G. (2012). Inequality of educational opportunity in India: Changes over time and across states. *World Development*, 40(6): 1151–1163.

Behrman, J. R.Gaviria, A., and Székely, M. (2001). Intergenerational Mobility in Latin America. *Economia*, 2(1): 1–31.

Björklund, A.Jäntti, M., and Roemer, J. (2012). Equality of Opportunity and the distribution of Long-Run Income in Sweden. *Social Choice and Welfare*, 39(2-3): 675–695.

Bourguignon, F.Ferreira, F., and Walton, M. (2007). Equity, efficiency and inequality traps: a research agenda. *Journal of Economic Inequality*, 5(2): 235–256.

Buis, M. L. (2007). SEQLOGIT: Stata module to fit a sequential logit model, Statistical Software Components S456843, Boston College Department of Economics. Revised 25 Oct 2013.

Checchi, D.Peragine, V. (2010). Inequality of opportunity in Italy. *Journal of Economic Inequality*, 8(4): 429–450.

Coleman, J.Campbell, E., and Hobson, C., and Macpartland, Y. (1966). Equality of educational opportunity. Discussion paper, US Government Printing Office, Washington DC.

Dahan, M.Gaviria, A. (2001). Sibling correlations and social mobility in Latin America. *Economic Development and Cultural Chan*, 49(3): 537–554.

Dardanoni, V.Fields, G., and Puerta, J. R. R. S. (2005). How demanding should equality of opportunity be, and how much have we achieved? In S. L. Morgan, D. Grusky, and G. Fields (Eds.), *Mobility and Inequality: Frontiers of research in Sociology and Economics*. Stanford: Stanford University Press.

de Barros, R. P.Ferreira., F., and Vega, J. R. M., and Chanduvi, J. S. (2008). *Measuring Inequality of Opportunities in Latin America and the Caribbean*. 2580. The World Bank.

Donni, P. L.Pignataro, V. P. P. (2014). Ex-ante and ex-post measurement of equality of opportunity in health: a normative decomposition. *Health economics*, 53(1): 69–105.

Duflo, E. (2001). Schooling and labor market consequences of school construction in Indonesia: evidence from an unusual policy experiment. *American Economic Review*, 91(4): 795–813.

Dworkin, R. (1981a). What is equality? Part 1. Equality of welfare. *Philosophy and Public Affairs*, 10(3): 185–246.

Dworkin, R. (1981b). What is equality? Part 2. Equality of resources. *Philosophy and Public Affairs*, 10(4): 283–346.

Fernández, R.Galí, J. (1999). To Each According to . . . ? Markets, Tournaments, and the Matching Problem with Borrowing Constraints. *Review of Economic Studies*, 66: 799–824.

Ferrerira, F.Gignoux, J. (2011). The measurement of inequality of opportunity: theory and an application to Latin America. *Review of Income Wealth*, 57(4): 622–657.

Ferrerira, F.Gignoux, J. (2014). The measurement of educational inequality: Achievement and opportunity. *The World Bank Economic Review*, 28(2): 210–246.

Fertig, M. (2000). Who's to blame? The determinants of German students' achievement in the PISA 2000 study. *Institute for the Study of Labor Discussion Paper*, (739).

Filmer, D.Pritchett, L. (1998). The Effects of Household Wealth on Educational Attainment around the World: Demographic and Health Survey Evidence. *The World Bank Policy Research Working Paper Series*, (1980).

Fleurbaey, M. (2008). *Fairness, Responsibility, and Welfare*. Oxford University Press, London.

Frankenberg, E.Thomas, D. (2000). The Indonesia Family Life Survey (IFLS): study design and results from waves 1 and 2. Technical report dru, RAND, Santa Monica, CA.

Gamboa, L. S.Waltenberg, F. (2012). Inequality of Opoortunity for educational achievement: Evidence from PISA 2006-2009. *Economics of Education Review*, 31(5): 694–708.

Hanushek, E. (1979). Conceptual and empirical issues in the estimation of education production functions. *Journal of Human Resources*, 14(3): 351–388.

Iatarola, P.Stiefel, L. (2003). Intradistrict equity of public education resources and performance. *Economics of Education Review*, 22(1): 69–78.

Lam, D.Schoeni, R. F. (1993). Effects of Family Background on Earnings and Returns to Schooling: Evidence from Brazil. *Journal of Political Economy*, 101(4): 710–740.

Lefranc, A.Pistolesi, N., and Trannoy, A. (2008). Inequality of opportunities vs. inequality of outcomes: are western societies all alike? *Review of Income and Wealth*, 54(4): 513–546.

Lefranc, A.Pistolesi, N., and Trannoy, A. (2009). Equality of opportunity and luck: definitions and testable conditions, with an application to income in France. *Journal of Public Economics*, 93(11): 1189–1207.

Maddala, G. S. (1983). *Limited Dependent and Qualitative Variables in Econometric*. Cambridge: Cambridge University Press.

Mare, R. D. (1981). Change and Stability in educational Stratification. *American Sociological Review*, 46(1): 72–87.

Mongan, J. C.Santin, D., and Valiño, A. (2011). Towards the equality of educational opportunity in the province of Buenos Aires. *Journal of Policy Modelling*, 33(4): 583–596.

Nozick, R. (1974). *Anarchy, state, and utopia*. Basil Blackwell.

OECD (2012). Inequality in labour income: What are its drivers and how can it be reduced?

OECDAsian Development Bank (2015). Education in Indonesia: Rising to the Challenge. Discussion paper, OECD Publishing, Paris.

of Finance Government of Indonesia, M. (1997-2007). Anggaran Pendapatan Belanja Negara. URL http://www.djpk.ke-menkeu.go.id/data-series/data-keuangan-daerah.

of Finance Government of Indonesia, M. (2007). Anggaran Pendapatan Belanja Negara. URL http://www.djpk.ke-menkeu.go.id/data-series/data-keuangan-daerah/setelah-ta-2006.

Peragine, V. (2002). Opportunity egalitarianism and income inequality. *Mathematical Social Sciences*, 44(1): 45–64.

Peragine, V. (2004a). Measuring and implementing equality of opportunity for income. *Social Choice and Welfare*, 22(1): 1–24.

Peragine, V. (2004b). Ranking income distributions according to equality of opportunity. *Journal of Economic Inequality*, 2(1): 11–31.

Peragine, V.Serlenga, L. (2008). Higher education and equality of opportunity in Italy. *Research in Economic Inequality*, 16: 67–97.

Rawls, J. (1971). *A theory of justice*. Cambridge: Harvard University Press.

Roemer, J. (1998). *Equality of opportunity*. Cambridge: Harvard University Press.

Sen, A. (1980). Equality of what? In S. McMurrin (Ed.), *The Tanner Lectures on Human Values*. Sla Lake City: University of Utah Press, 1 edition.

Sen, A. (1985). *Commodities and capabilities*. Amsterdam: North- Holland.

Shorrock, A. F. (1999). Decomposition Procedures for Distributional Analysis: a Unified Framework Based on the Shapley Value.

Shorrock, A. F. (2013). Decomposition procedures for distributional analysis: A unified framework based on the Shapley value. *Journal of Economic Inequality*, 11(1): 99–126.

Suryadarma, D.Jones, G. W. (Eds.) (2013). *Education in Indonesia*. Institute of Southeast Asian Studies.

van der Gaer, D. (1993). *Equality of Opportunity and Investment in Human Capital*. Ph.D. thesis, Catholic University of Leuven.

Waltenberg, F. W.Vandenberghe, V. (2007). What does it take to achieve equality of opportunity in education? An empirical investigation based on Brazilian data. *Economics of Education Review*, 26(6): 709–723.

World Bank (2011). Gender Equality. Kesetaraan Gender.

World Bank (2014). Indonesia: avoiding the trap.

Wößmann, L. (2003). Schooling resources, educational institutions and student performance: The international evidence. *Oxford Bulletin of Economics and Statistics*, 65(65): 117–170.

Appendix

Table A1: Descriptive Statistics

Panel A: 1997	**Cohort 11-14**		**Cohort 15-18**	
Variable	Obs	Mean/proportion	Obs	Mean/proportion
Attainment	2341	5,575	2145	8,288
Father's attainement	2171	5,886	1938	6,056
Mother's attainement	2281	4,864	2086	4,821
Residence (rural dummy)	2339	0,545	2145	0,501
Age	2341	12,586	2145	16,456
Panel B: 2000	**Cohort 11-14**		**Cohort 15-18**	
Variable	Obs	Mean/proportion	Obs	Mean/proportion
Attainement	2619	5,715	2690	8,589
Father's attainement	2401	6,142	2395	6,195
Mother's attainement	2544	5,222	2594	5,053
Residence (rural dummy)	2619	0,576	2690	0,494
Age	2619	12,539	2690	16,482

Source: own elaboration on IFLS data

Figure A1: Educational transition

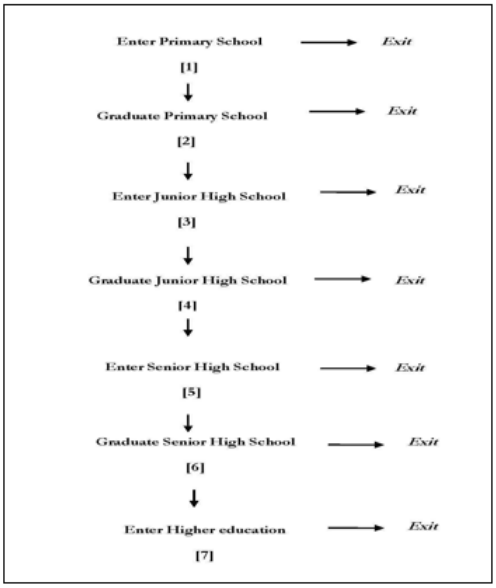

Table A2: Coding educational steps

Level	Value
Enter Primary School	1
Graduate Primary School	2
Enter Junior High School	3
Graduate Junior High School	4
Enter Senior High School	5
Graduate Senior High School	6
Enter Higher Education	7