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Master Thesis International Economics

**The Allocation of Foreign aid to education, Human Capital
and Economic growth**

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Abstract

The effectiveness of foreign aid in developing countries has been intensively investigated. This paper attempts to test the link between aid and education. For that, the extensive database on aid disbursements provided by the OECD Credit Reporting System Aid Activity is used to examine the effect of foreign aid allocated to the sector of education on educational variables. The empirical findings of this study show a positive effect on the variables completion rate in the primary and secondary level of education, pupil to teacher ratio in the tertiary level and share of trained teachers in both primary and secondary levels. Furthermore, contrary to the existent literature, this study shows no significant impact on primary enrollment. Additionally, in order to assess the prevalence of gender inequality in the education sector, the data was disaggregated per gender groups. Having as starting point the consensual importance of human capital investment for the economy, the second part of the analysis focuses on the relation between education and growth. In addition, the research on the different outcomes from male and female education also provides insightful conclusions. The results show a strong effect on the growth rate of GDP per capita from female primary enrollment rate and male secondary completion rate.

Key words: Foreign aid effectiveness, Educational outcomes, Economic growth

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1. Introduction

The intervention in developing countries to promote the economic development has been rising over the years. According to the Organization for Economic Cooperation and Development (2022), the total value of Official Development Assistance (ODA) amounted to USD 178,9 billions, in 2021. OECD has defined foreign aid as “*government aid designed to promote the economic development and welfare of developing countries*”¹.

Early 1960s, education was incorporated as a component of foreign aid (Heyneman & Lee, 2016) and has become a priority sector. Several studies focus on the relationship between human capital investment and economic development. For example, Castelló-Climent and Hidalgo-Cabrillana (2012) analysed the importance of the qualitative aspects of schooling and its contribution to growth. In this study, the value added of education has been shown to be significantly large. Paraschiv (2017) mentions how investment in human capital can be an important factor for poverty alleviation and significant improvement in individuals’ well-being. Using a sample of OECD countries, this study proves that education at a macro level and the income of families are extremely correlated, as well as educational indicators may affect poverty level.

In the recent years, substantial efforts to promote and boost education were made. In 2020, the total value of gross disbursements to the education sector was 2 630,732 million US dollars in low income countries and 6 072,740 million US dollars in lower-middle income countries, according to the OECD (2022). Additionally, in this context, the post-2015 agenda draws 17 Sustainable Development Goals, being the number 4, the insurance of “*inclusive and equitable quality education*” and promotion of “*lifelong learning opportunities for all*” (United Nations, 2015). Despite the progress made, the current paradigm shows that there is still action to be undertaken to achieve the full potential of education. According to the World Bank, in 2019, the total primary completion rate was 72,6% and the total lower secondary completion rate was 47,3% in the least developed countries (UN classification).

¹ *Official Development Assistance (ODA) - net oda - OECD data*. The OECD. (n.d.). Retrieved October 5, 2022, from <https://data.oecd.org/oda/net-oda.htm>

The effectiveness of ODA on poverty reduction, economic development and other outcomes has been an ongoing discussion among several researchers, as it is undoubtedly a relevant topic on the global agenda. Burnside and Dollar (2000) showed the existence of the potential positive effects of aid on economic development under the prevalence of good governance. Nevertheless, in general, empirical studies on the effectiveness of foreign aid had shown inconclusive results. Due to the complexity of evaluating the effect of aid at a macroeconomic level, recent studies have addressed disaggregated sectors and their respective data, on education, health, to mention some. For these specific sectors researchers have found to be possible to significantly estimate the effects. In fact, authors as Michaelowa and Weber (2007) and Birchler and Michaelowa (2016), have found a positive effect of aid disbursement on primary education indicators.

The present study provides an extension of the literature by estimating the effect of foreign aid to the education sector. It elaborates an analysis on two main questions: *Is there significant effect of foreign aid on educational outcomes?* And *what is the impact of human capital investment on economic growth?* For that, this study uses a sample constituted by low and lower-middle income countries between the years 2002 and 2020 and data on aid disbursements allocated to the education sector. For the first research question, the outcomes in the sector of education are measured by four different indicators, per level of education and gender groups in order to expand the coverage of the analysis. The results show that foreign aid can have an impact on educational variables. The largest effect is observed for the secondary level, specifically for the variable completion rate. Nevertheless, the estimates obtained are relatively small. The second research question focuses on the link between education and economic growth. For this analysis, a distinction between the effect of male and female human capital investment is made. The results show a positive effect of education on economic growth, specifically of total secondary completion rate. Moreover, the results suggest that the impact of male secondary education, measured by completion rate, is larger than the female's and female primary education, measured by the enrollment rate, has a higher impact on economic growth than the male education.

The remainder of the present paper is organized as follows. The next section discusses the past literature found on the topic of foreign aid. Section 3 and 4 present the hypothesis of this paper and provides information on the data selection, respectively. Section 5 introduces the

methodology adopted and section 6 focuses on the results obtained and the robustness checks executed. Finally, the last sections provide a discussion and the main take-aways of the paper.

2. Literature Review

The impact of foreign aid in developing countries has been widely investigated. The existent literature follows two main approaches. The first one refers to the study of the effect at a macroeconomic level, focusing on aspects such as economic growth and poverty reduction. The second aims at measuring the effect at a microeconomic level, by assessing aid allocated to specific sectors.

2.1. The link between aid and growth

According to conventional growth theories, the relevance of aid transfer can be explained by the fact that poor countries lack the necessary capital boost that would allow economic growth. This means that foreign flows would contribute to capital formation and development, in cases where poverty traps arise (Nurske, 1953).

The analysis of the effects on economic development started in the mid 1980s and has led to more inconclusive results. One of the most influential studies was developed by Burnside and Dollar (2000). The authors find that aid can generate a positive impact on growth, being more effective in environments where good macroeconomic policies are put in practice. In other words, the authors conclude that aid can be effective, conditional on political and institutional characteristics. This implies that donor countries are required to evaluate the recipient countries' institutional context.

However, other studies find no proof of systematic relationship between aid and economic growth. Inclusive, some show no evidence that favourable policies and geographical environment can increase the efficiency of aid allocation (Rajan & Subramanian, 2008). Additionally, Djankov et al. (2008) compares the effect of aid with the effect of oil rents and demonstrates that aid causes more harm, which is measured by the quality of the democratic system and the political institutions.

More recently, a study by Kamguia et al. (2022) uses a sample of 78 developing countries between 1998 and 2017 to evaluate the effect of foreign aid on economic complexity, measuring the sophistication of a country's productive structure. The authors argue that the impact of aid is positive for higher levels of complexity and negative for lower levels.

On a macro level, obtaining robust results has been more challenging. In fact, Harms and Lutz (2005) mention that because official development assistance (ODA) includes several specific components that go from humanitarian to military actions, it is unlikely to obtain significant conclusions. Given this wide allocation of aid, the authors argue that its assessment should be done from a disaggregate perspective.

2.2. The impact of aid to education

The second approach, in which the effect of aid in specific sectors is analysed, has been showing solid results. Focusing on the sector of education, Panel data analysis has been used to observe the long-run impact of aid. Michaelowa and Weber (2007) was a pioneer study of the education sector. It uses data of five-year averages to evaluate long-term improvement in educational indicators (primary school enrollment and completion rates). The results show that aid allocated to education can be effective, even though weakly. Finally, the authors suggest evidence of decreasing returns to aid for primary and secondary education. In contrast, Christensen et al. (2010), which analyse the effect of aid to education on primary school enrollment rate, showed little evidence of a causal relationship and conclude that aid to education has shown to be ineffective.

Regarding the measurement of educational improvement, the majority of the literature focuses on measures of access to education, which include intake rates, enrollment rates and completion rate. Nonetheless, D'Aiglepierre and Wagner (2013) argue that these measures do not explain the improvements in the learning process. Therefore, the authors use three elements of educational achievement, coverage, equality and process. To assess the process, the authors use repetition rate, pupil to teacher ratio and the percentage of trained teachers. The paper findings show that while the pupil to teacher ratio and the share of trained teachers are unchanged, the repetition rate suffers a decrease, translating into positive effects on the educational achievement. Birchler and Michaelowa (2016) develop an extended analysis of the mentioned work by Michaelowa and Weber (2007). The results support the claim that aid,

particularly assistance with facilities and training, can be more effective in increasing the enrollment rates (quantity measure) than students' achievement (quality measure).

The concern of endogeneity is mentioned across different studies. In this context, Michaelowa and Weber (2007) discuss whether aid to health and energy could be used as instrumental variables and conclude that these would not be appropriate, as their relevance is shown to be weak. D'Aiglepiere and Wagner (2013) use cultural proximity between donor countries and recipients as an instrumental variable. This includes characteristics as distance, common language, common religion and common border between the donor and recipient countries. Under this estimation, the results are more positive and robust compared to the panel fixed effects estimation. Alternatively, a system of GMM estimators (elaborated by Blundell and Bond, (1998)) has been used. This consists in instrumenting aid to education with lagged differences and own lag. In addition, it uses the lag of the dependent variable as instrument.

An alternative analysis consists in conducting Randomized Control Trials (RCT) to study the effects of specific programs or intervention. To exemplify, Banerjee et al. (2007) performed a micro study on aid, by comparing the effect of hiring teachers for students lagging behind with the effect of implementing a computer-assisted learning program. The authors concluded there was a positive impact on test scores and suggested that the computer-assisted learning program is more effective, and, in general terms, specific educational interventions could be effective.

2.3. Aid and gender inequality

Another branch of the literature has been observing the effect of aid to education on social outcomes, including gender inequality. Klasen (2002) and Kabeer and Natali (2013) show evidence that reducing gender inequalities in education, which increases the average value of human capital, can be a stronger tool to boost longer term economic growth. Moreover, D'Aiglepiere and Wagner (2013) focus on 3 aspects related to assessing the outcomes in the educational sectors. The variables net enrollment rate (NER) gender parity index (which consists in the ratio between the female and the male's NER) and the percentage of girls in primary education are used to determine changes in the equality parameter. The results show a significant improvement from aid.

In this context, improvements in gender inequality issues are observed from the perspective of the Health and Education sectors. Pickbourn and Ndikumana (2016) determine the effect of aid on indicators such as maternal mortality, gender parity in youth literacy and gender indicator of gender inequality (GII). The results show that foreign aid has been ineffective in realizing gender equality. Other relevant outcomes in focus include adolescent fertility rate and the presence of women in the parliament. Lastly, Bali Swain et al. (2020) observe the impact of both ODA and aid to gender on these variables and conclude that inequalities are unlikely to be fixed by aid transfers.

2.4. Economic growth, education, and gender inequality

The contribution of education to economic growth has been vastly analysed using samples that include both developed countries and developing countries. One very influential study was conducted by Barro (1991). Using a sample of 98 countries, the authors show that human capital, measured by school enrollment rates, positively affects economic growth. The research by Gyimah-Brempong et al. (2006) shows a significant impact of education, across the different levels, on GDP per capita, using as sample African countries between the years of 1960 and 2000. Moreover, Hanushek (2016) focuses on a sample constituted by Sub-Saharan African countries to test the magnitude of effect of education on economic growth. The author concludes the effect is lower for countries in this region compared to other parts of the globe. This highlights the importance of incorporating measures of quality of the educational system in these analyses.

The relation between economic growth and gender inequality has also been studied. Some authors explained the effect of investing in female education on economic growth, compared to males. Research conducted by Klasen (2002) proved low schooling for the female population lowers economic growth per capita for the sample of countries from Sub-Saharan Africa, South Asia, and the Middle East and North Africa. Furthermore, Oztunc et al. (2015) analyse long term GDP growth for a sample of 11 countries in Asia Pacific. This research uses different independent variables, including female literacy rate and female primary and higher education enrollment rate. The results show a positive impact from primary education for girls on income growth. In contrast, because the highest share of women's labour force is allocated to low-skilled jobs, female tertiary education seems to have a negative impact on economic growth. The authors conclude that investing in female human capital is indeed crucial for economic growth.

Similarly, Hassan and Cooray (2015) distinguished the impact of school enrollment rates on economic growth for male and females in Asian countries. The study concludes that the growth effects of school enrollment are higher for male than for the female population across the different levels of education. These results suggest that the differences in education are then translated into a productivity gap, which can only be closed by investing in female human capital. The relevance of female education for economic development seems to be consensual.

2.5. The failure of aid transfers

There are several mechanisms that can justify the failure of aid provision. Some studies have looked at how aid can affect life quality. Specifically, there is evidence that the quality of life can be improved under democratic contexts, whilst under autocratic systems, it may not improve as fast as if aid flows would not have occurred (Kosack, 2003). The skimming by the elite lies on the roots of the ineffectiveness of aid. Bjørnskov (2010) shows that foreign aid under democratic systems can negatively affect the fairness of income distribution. The exploitation argument is also strongly mentioned by the literature. Niyonkuru (2016) explains that foreign aid can cause a source of deterioration of the targeted economy, as they are forced to comply with harmful regulations.

Lastly, some authors aimed at explaining what could contribute to a more efficient aid allocation. Kleemann et al. (2016) analyse whether female leadership in donor countries can be a relevant factor. Using aid granted under female leadership and male leadership in the donor countries as dependent variables, the results show no major differences on aid allocation. However, the authors conclude that aid transfers benefit the countries with higher years of schooling and smaller educational gaps between boys and girls.

Generally, the literature confirms a positive effect of aid allocated to education on educational outcomes. However, the estimates are small, and the impact tends to be weak.

3. Hypothesis Development

Having the described literature as basis for the model of the present paper, the following hypothesis were elaborated. These four hypotheses describe the main research questions which this study aims to investigate.

H1 Foreign aid to the education sector has a positive effect on the educational outcomes in developing countries

As previously discussed, the research conducted by Birchler and Michaelowa (2016) proves that aid can be effective in improving primary education outcomes. Specifically, the results show a positive change on enrollment rates from aid to primary education. Therefore, the primary hypothesis consists of analysing the impact of foreign aid applied to the education sector across the three levels of education: primary, secondary and tertiary, using measures of both quantity and quality education achievement.

H2 Foreign aid to the education sector has a stronger effect on female educational outcomes compared to male outcomes.

D'Aiglepiere and Wagner (2013) use a gender parity index to compare the variation of the male enrollment rate to the female rate. The results show a significant effect of aid on net enrollment rate gender parity index, which means that the proportion of females to males enrolled in primary education has increased. In line with this conclusion, the second hypothesis aims at comparing the effect of foreign aid on education for the male and female groups.

H3 Education has a positive impact on Economic growth

Several authors have supported the claim that education positively contributes to economic growth. The research conducted by Hanushek (2016) questions the magnitude of this effect for low income countries due to differences in quality of the educational system. Taking this into consideration, the third hypothesis aims at testing whether the education indicators, which were used to test the impact of foreign aid, have an impact on the Economy.

H4 The empowerment of female education has a stronger impact on Economic growth, compared to the male education

To test the importance of female education to boost the economy, the research by Klasen (2002) concluded that weak levels of female education have a negative effect on economic growth per capita. This leads to the last hypothesis, which aims at studying whether one gender group has a higher contribution to economic growth than the other.

4. Data

4.1. The Sample

The full sample of the model includes 78 low income (31) and lower-middle income (47) countries over the period 2002 to 2020. Following the criteria of the World Bank Atlas Method, low-income countries are defined by a GNI per capita of \$1,025 or less and lower-middle income countries face a GNI between \$1,026 and \$3,995. Despite the volatility of this classification over time, the followed classification corresponds to the fiscal year of 2020, the last year available for aid to education. The list of the countries is found in the appendix (table 1).

4.2. The Education Equation

The education equation aims at studying how aid to education impacts educational outcomes, per level of education and gender.

4.2.1. The Dependent Variables

The chosen dependent variables comprise measures of educational outcomes. The data is from UNESCO Institute for Statistics and retrieved from the World Bank (the World Development Indicators database). The model uses four dependent variables, which are completion rate, net enrollment rate, pupil-teacher ratio, and share of trained teachers, incorporating both quantity and quality parameters.

Following the definition of the World Bank (2022), completion rate corresponds to the number of new entrants in the last grade of the given level of schooling as a share of the relevant age group. The analysis uses primary completion rate (total, male and female) and lower-secondary education (total, male and female). Net school enrollment rates correspond to the “*ratio of children of official age enrolled in school to the population of the corresponding official school age*” (World Bank, 2022). The present study includes net primary school enrollment (total, male and female) and net secondary school enrollment (total, male and female). Contrary to gross enrollment, net enrollment excludes enrollment due to repetition or late entry and therefore is a better indicator of the real coverage of the educational system.

D'Aiglepierre and Wagner (2013) state that generally quantity variables (enrollment rates, for example) are not reliable in describing the actual learning achievement of the students. Therefore, as additional measures of quality of schools and teaching systems, pupil to teacher ratio and percentage of trained teachers are used as dependent variables. The first one represents the average number of students per teacher for primary, lower secondary, secondary and tertiary education. The second indicator consists in the share of teachers who have received the minimum required teacher training, according to the definition of the World Bank (2022). This is available for primary and secondary (lower and upper) levels of education.

A major limitation faced is the fact that there is missing data for several educational indicators across countries, which are used as dependent variables in the specifications. However, considering that the full sample is constituted by a significant amount of observations, one can still derive insightful results.

4.2.2. The Main Explanatory Variable

The main explanatory variable of the model is aid to education, retrieved from the OECD Credit Reporting System Aid Activity database. This database offers a comprehensive data collection on official development assistance from the Development Assistance Committee (DAC) countries. This database offers a variety of information on the education sector that includes aid targeted to education Policy and administrative management, education facilities and training, specific to the different levels of the educational system and other relevant categories. For the scope of the analysis, the relevant categories are aid to primary education, aid to secondary education and, lastly, aid to higher education.

Following Birchler and Michaelowa (2016), the analysis limits the data to gross disbursements, which consists in the *“placement of resources at the disposal of a recipient or agency”* (World Bank, 2022). This deviates from the other type of flow, Commitments, defined by a written obligation of provision of resources for a recipient country or a multilateral agency, which would not translate in the actual transfer of resources. The variables are recorded in Million US Dollar, in constant prices (2020). For the purpose of the study, aid as a share of the total population is used to balance out the differences in sizes of the national products and economies and needs of resources to boost education (Birchler & Michaelowa, 2016).

4.2.3. The Control Variables

As complement to the main explanatory variable, it is important to include control variables that could also explain variation in the variable of interest. Controlling for the impact of governments' own expenditure on education accounts is relevant for obtaining the causal effect of aid to education (D'Aiglepierre & Wagner, 2013). Therefore, Government Expenditure on education as percentage of government's total expenditure is added as control.

Following Burnside and Dollar (2000), three variables are grouped to construct a policy index which aims at assessing the level of governance of each country and identifying a good and bad environment. For this model, the three indicators included are inflation rate, openness to trade and government debt. Inflation reflects the cost growth of purchasing a basket of goods and services. Openness to trade represents the sum of exports and imports as a percentage of GDP, following the definition by Birchler and Michaelowa (2016). Lastly, Government Budget corresponds to the central Government debt as a percentage of GDP.

To account for the different types of governance and the respective effects on the effectiveness of policy implementation, the Freedom House Index is included as controls. The Freedom House Index, made available by Freedom House, provides information on Political Rights and Civil Liberties, an average of both indexes was computed. This is measured on a scale from one (1) to seven (7), in which 1 represents the highest degree of freedom and 7 the lowest. The choice of these variables is similar to Dreher and Nunnenkamp (2008) and Birchler and Michaelowa (2016), which include measures of government stability and freedom to target structural problems of the country that may affect learning outcomes.

Lastly, similarly to a variety of studies, such as Birchler and Michaelowa (2016), demographic and economic indicators are used in the model. GDP per capita (constant 2015 US\$) is included to control for economic parameters. In addition, the percentage of young (between the ages of 0-14) and urban population, which refers to the percentage of population living in urban areas are used in the model. The latter aims at considering the differences between rural and urban regions.

4.3. The Growth Equation

The growth equation analyses the impact of different educational outcomes on economic growth.

4.3.1. The Dependent Variable

Following the model developed by Burnside and Dollar (2000), the dependent variable of the growth equation is the growth rate of GDP per capita, extracted from the World Bank. This aims to study the impact on economic growth.

4.3.2. The Main Explanatory Variables and the Control Variables

The explanatory variables of this equation correspond to the educational outcomes, which are used as dependent variables in the education equation. These include completion rate and net enrollment rate, for primary and secondary education. The share of trained teachers and the pupil to teacher ratio are not included as these variables are not disaggregated in male and female. Additionally, repetition rate for primary education is included, which consists in the share of students enrolled in the same grade as in the year before. According to D'Aiglepiere and Wagner (2013), this is a better indicator of learning improvements.

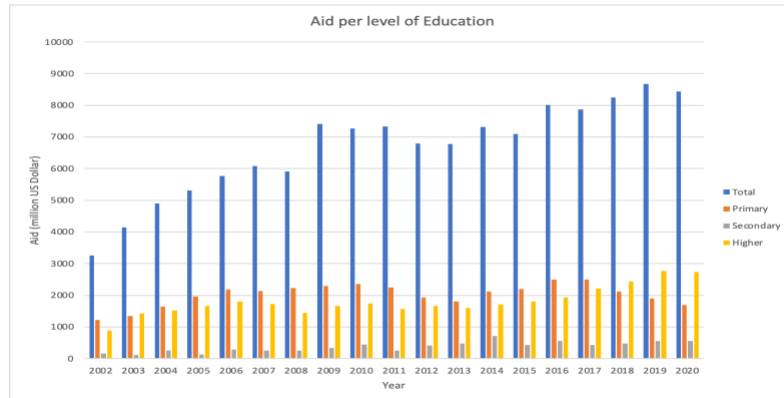
Following previous studies on economic growth, the present model uses the initial income level (initial GDP per capita), Broad Money as percentage of GDP and Control of Corruption as control variables. In addition, the Policy Index, the Freedom Index, Population (total and share of young) and Urbanization rate are included, similarly to the education equation.

4.4. Descriptive Statistics

The present section provides a first glance on the data. To summarize this information, table 2 (appendix) contains general information of the most relevant variables for the complete sample. Figure 1 provides an overview of the aid disbursements (in million US Dollar) allocation per level of education (primary, secondary and higher) for the full sample. Firstly, it is relevant to note that total aid shows an upward trend over time, excluding some years, as 2012 and 2013. It is also possible to observe that primary education receives the highest share of development

aid, which is followed by the share attributed to higher education. In fact, from 2018 onwards the amount of aid to higher education surpasses aid to primary education.

Figure 1: Aid per level of Education



In figures 2 and 3 it is possible to observe the evolution of some educational outcomes in the primary level (averages of net school enrollment rate and completion rate) and aid allocated to primary education. Firstly, it is important to mention that these educational outcomes have been improving, as observed by the positive trend of net enrollment and completion rate. This coincides with a general increase of aid disbursement, excluding the periods 2012-2013 and 2018-2020. Exceptionally, in the last year available the variables face a decrease (net enrollment rates and completion rate decrease in 2019 and 2020, respectively). Regarding differences in outcomes per gender, completion and net enrollment rates have been higher for male compared to female. Nevertheless, these values have been getting closer during the recent years. Furthermore, completion rate for female did surpass the male's in the years of 2019 and 2020. However, these results still show evidence of gender inequality in education.

Figure 2: Outcomes in Primary Education

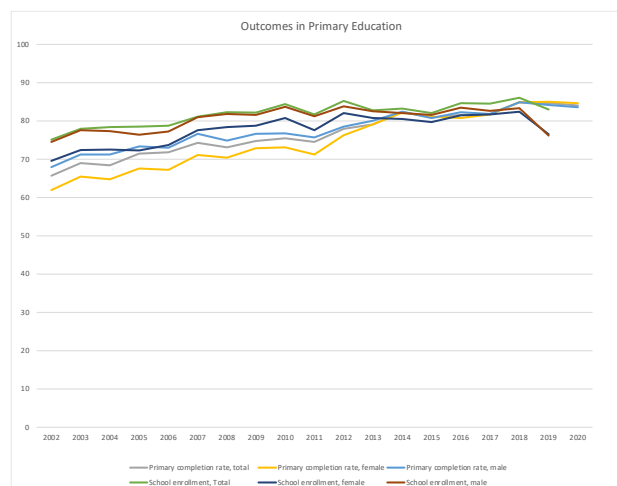
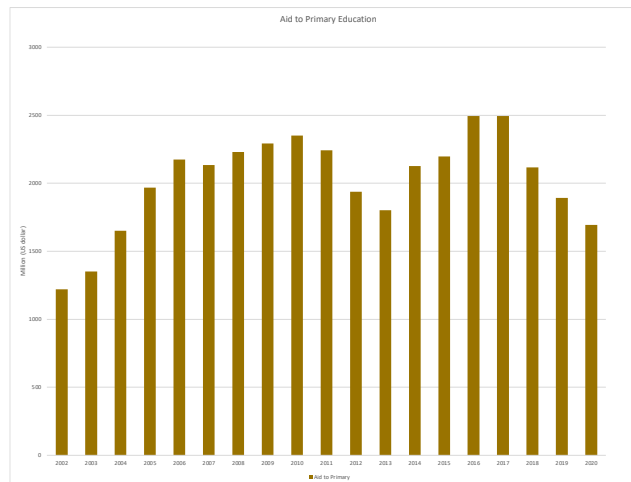


Figure 3: Aid to Primary Education



Figures 4 and 5 display data on the average of GDP per capita and primary educational outcomes for low income countries and lower-middle income countries, respectively. Starting with the low income countries, one can observe that the average GDP per capita increased until 2011 and slightly stabilized afterwards. During the same period, it is possible to verify an improvement in the educational indicators. To exemplify, the total net completion rate for primary education jumps from 63,3% in 2002 to 96,3% in 2019. This means that this progress in the value of human capital has coincide with a boost in economic activity.

For the lower-middle income group, it is clear that GDP per capita has been increasing (excluding the last year, 2020). Similarly, completion rate and percentage of trained teachers present a positive movement. Together with the decreasing pupil to teacher ratio, it is possible to conclude an upward trend of the educational outcomes over time. Nevertheless, these movements are smoother than those of the low income countries, which present lower initial levels for completion rate, enrollment rate and share of trained teachers and higher values for pupil to teacher ratio. Overall, the two figures show clear disparities in the trends of the two country groups, which face different income level and stage of development.

Figure 4: GDP per capita and education outcomes for low income countries

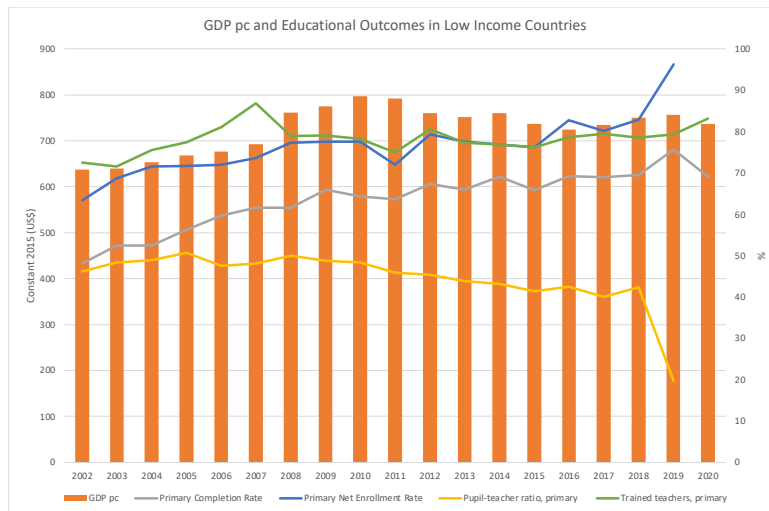
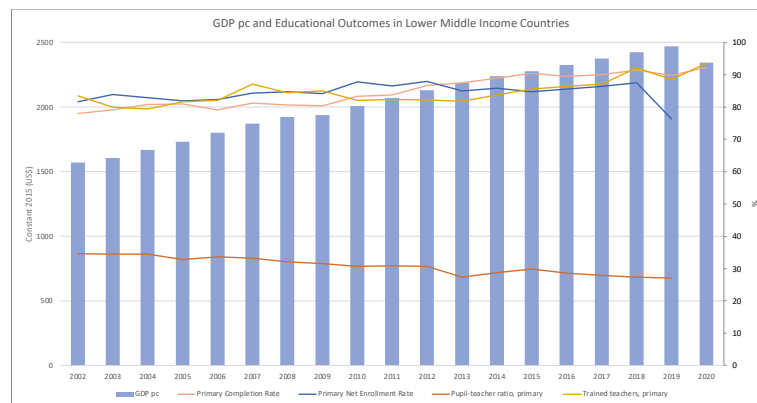


Figure 5: GDP per capita and education outcomes for lower middle income countries



5. Methodology

This present section describes the model adopted to study the impact of aid allocated to the education sector on educational outcomes and the effect of these outcomes on economic growth during the period of 2002-2020. This can be represented by the two baseline specifications, the education equation, and the growth equation. The education equation describes the effect of education to aid on educational outcomes and it is as follows:

$$(1) Educ_{it} = \beta_0 + \beta_1 \ln (Aid)_{it} + \beta_2 \ln (Aid)_{it-1} + \beta_3 Educ_{it-1} + \beta_4 X_{it} + a_i + a_t + \varepsilon_{it}$$

where *Educ* represents the educational outcomes, which can take the form of completion rate, net enrollment rate, pupil to teacher ratio and percentage of trained teachers. *Aid* represents the aid disbursements per capita transferred to the sector of education (primary, secondary and higher education). The model takes the lag value of aid, in order to capture the effect that past

aid disbursements may have on the actual year education outcomes. Additionally, a lag variable of the educational outcome is included. X is a vector of control variables, containing inflation rate, openness to trade and government debt (three variables used as policy measure), government spending on education, the Freedom House Index, share of young population, urban population and GDP per capita (constant 2015 US\$). Finally, a_i and a_t represent country and time fixed effects, respectively, to account for nation and time specific factors that could influence educational outcomes. Lastly, e is the error term.

A fixed effects specification is regressed for each dependent variable, disaggregated in levels of education (primary, secondary and higher education) and gender groups (total, male and female). This aims at evaluating the differences on the impact of aid per level of education and gender.

To calculate the impact of education on economic growth, the growth equation is estimated, and it is as follows:

$$(2) \text{GDPg pc}_{it} = \gamma_0 + \gamma_1 \text{GDP pc}_{it} + \gamma_2 \text{Educ}_{it} + \gamma_3 P_{it} + \gamma_4 X_{it} + g_i + g_t + \varepsilon_{it}$$

where GDPg pc represents the growth rate of the real GDP per capita, GDP pc is the level of GDP per capita (constant 2015 US\$), Educ represents the educational outcomes used in the education equation for primary and secondary education. The equation also includes a vector of policies, P , which may impact growth, used in the education equation (1). X is a vector of the same control variables used in equation (1) and, additional variables as total Population, Control of Corruption, and Broad Money. Finally, g_i and g_t represent country and time fixed effects, respectively. Lastly, e is the error term.

To distinguish the effects of education on economic growth per gender, the fixed effects regression disaggregates the main explanatory variables, educational outcomes, into male and female.

As a starting point for the initial results, the general fixed effects model was regressed, which will be discussed in the next section. Nevertheless, a potential problem that may arise with these fixed effects model may be related with potential endogeneity of some of the variables

of the model. As mentioned by some authors, such as D'Aiglepieire and Wagner (2013), it is intuitive that foreign aid to the education sector is unlikely to be exogenous to education outcomes. For that reason, a variety of potential instruments are discussed across the literature, as energy aid (Michaelowa & Weber, 2007) or cultural proximity between donor countries and recipients (D'Aiglepieire & Wagner, 2013). However, it is extremely challenging to find an appropriate instrument. Birchler and Michaelowa (2016) claim that these instruments would lack the assumption of exogeneity to the dependent variable.

Hence, to solve the identified endogeneity problem, Birchler and Michaelowa (2016) propose a system Generalized Method of Moments (GMM) dynamic panel data model constructed by Blundell and Bond (1998). This consists in instrumenting the differences with the lagged values of the respective variables which may suffer from endogeneity. In this case, the first lag of foreign aid and the educational outcome, which is used as dependent variable. Therefore, a system GMM is used to estimate the education equation.

In the robustness tests section, a fixed effects model was estimated using data aggregated in five-year averages, similarly to Birchler and Michaelowa (2016). This aims at accounting for the fact that these outcomes may require some time to evolve, and changes may not be observable on a yearly basis. Therefore, one will observe the periods of 2002-2006, 2007-2011, 2012-2016, 2017-2020.

6. Results

6.1. Main Results

6.1.1. Educational Outcomes

As a starting point, different general specifications that relate aid to education with educational outcomes for the different levels of schooling and gender were estimated. The results comprise primary and lower secondary completion rate (tables 3, 4, 5 and 6 in the appendix), primary and secondary net enrollment rate (tables 7, 8, 9 and 10), pupil to teacher ratio primary, secondary and higher education (table 11) and primary, and secondary (lower and upper) percentage of trained teachers (table 12). The variables completion rate and net enrollment rate are evaluated in total terms and also, disaggregated in male and female.

Completion Rate

Table 3 reports the results from Fixed Effects (FE) and system of Generalized Method of Moments (GMM) estimations using total primary completion rate as dependent variable. These specifications include aid to primary education per capita, in logarithmic terms, as the main explanatory variable and all the controls mentioned in section (4). The model (1), which controls for country and time fixed effects, results in a positive coefficient but statistically insignificant effect of aid on the educational variable. Column (2) displays the results of using the system GMM model, which uses the lag value of aid to primary education as an instrument. In this setting the effect of aid to education is significant at a 5% confidence level. This implies that 1% increase in aid per capita to primary education increases, on average, total primary completion rate by 0,0074 percentage points, *ceteris paribus*. Furthermore, the lag value of aid is found to be insignificant for both estimations.

Additionally, a closer look is taken at the primary completion rate outcomes for male and female groups. Table 4 reports the results of the Fixed Effects regression and the Generalized Method of Moment one. In models (1) and (2) it is possible to verify that, under the fixed effects conditions, the coefficient for male primary completion rate is slightly larger than female's completion rate, which would mean that the impact of aid to primary education would be greater for male's achievement on primary education. Nevertheless, these results are not statistically significant, and no actual impact of aid can be concluded. Models (3) and (4) display the results of the GMM regression and, contrary to the FE scenario, the female coefficient of primary completion rate is higher than the male coefficient. However, none of these have a significant impact. Additionally, the last specification shows a significant effect of the lag value of aid to primary education on the female primary completion rate, at a 5% level. This means that a 1% increase in aid will lead to a rise in the completion rate for female students by 0,0096 percentage points in the next period, which goes in line with the idea that aid can have a long run effect on education .

Examining the control variables, it is possible to observe that for all models displayed in tables 3 and 4, the dependent variable in the previous period is significant at explaining the values of the current periods. This means that it can be easier to increase educational outcomes in scenarios where those outcomes are already at a high level. Additionally, on average, a country with a higher share of young population performs worse in the total and male primary

completion rate compared to a country with a lower share of young population. This is a significant result that can be verified in specifications (2) of table 3 and (3) of table 4. In these mentioned models, inflation is found to have a negative effect on education outcomes, which is statistically significant, at a 5% level. Lastly, it is possible to observe that the Freedom Index is significant in estimation (3) in table 4. A negative coefficient implies that environments with high degrees of freedom lead to a better performance in primary education, measured by the male completion rate.

In addition to the evaluation of the primary completion rate, the lower secondary completion rate shall be analysed. Table 5 shows the results obtained when estimating the impact of aid to secondary education per capita on the completion rate of the total lower secondary completion rate using Fixed Effects (column 1) and system GMM (column 2) models. Firstly, the coefficient of aid to education is positive and statistically significant at a 5% level using a Fixed Effects model. In this case, a 1% increase in aid to secondary education per capita will increase the lower secondary completion rate by 0,0055 percentage points. However, this result does not hold under a system GMM, as it is possible to observe in specification (2).

Table 6 displays the disaggregated results for male and female. It is relevant to note that the female coefficients are larger than the ones for male. Nevertheless, only in specification (2) it is possible to observe a significant effect of aid to secondary education, in which 1% increase on aid can lead to an increase of the female lower secondary completion rate by 0,007 percentage points. This is only verified when using the Fixed Effects model. Looking at the remaining variables, it is possible to verify that most of the controls are insignificant. Exceptionally, the lag value of the dependent variable for all specifications and inflation for specifications (1) and (2) are found to be statistically relevant.

Enrollment Rate

Another key variable of interest that must be considered is the net enrollment rate. The following tables display the results for primary and secondary education. Table 7 presents the models used for the analysis of total primary enrollment rate. It is possible to verify that the impact estimated of aid to primary education is not significant using both FE and system GMM methods. Similarly, table 8 reveals statistically insignificant results for male and female coefficients. Lastly, it is relevant to mention that for some estimations, (1) in tables 7 and 8, urbanization rate is a statistically significant control variable and reveals that countries with

higher urbanization rate have, on average, a lower primary enrollment rate. This goes against the expected idea that a more urban environment would better stimulate education. Moreover, specification (3) of table 8 shows a positive coefficient for GDP per capita, which means that a higher income level increases, on average, the male primary enrollment rate.

Table 9 and 10 present the estimated impact of aid to secondary education on total, male and female secondary enrollment rate. The results bring to attention that aid is not shown to be significant at impacting overall enrollment rates. Furthermore, specifications (2) of table 9, (3) and (4) of table 10 show that Government Expenditure on education (as percentage of total expenditure) negatively affects this educational outcome. This would imply that countries that spend a higher share of overall spending on education have a worse outcome on secondary enrollment rates, on average. This is an unexpected result, as it would be predictable that government spending in the sector of education would positively contribute to significant improvements in schooling outcomes.

Pupil to teacher ratio

Of strongest interest in table 11 is the variable pupil to teacher ratio for the different levels of education; primary, lower secondary, secondary, and tertiary. First of all, it is relevant to observe that the variable aid to education can only be found significant for the analysis of the tertiary pupil to teacher ratio, at a 5% significance level. In specification (4) it is possible to conclude that, when controlling for time and country fixed effects, a 1% increase in aid to tertiary education decreases the ratio of pupil to teacher by, on average, 0,0096, *ceteris paribus*. This translated into a positive change in the educational system. Specification (8) presents the results of GMM, which uses aid to higher education. For this model, the coefficient for aid to education is greater (in absolute terms) than the one from the FE model, being equal to (-1,015). Additionally, the lag variable of aid to higher education is statistically significant at a 5% level, for the FE model, and at a 1% level, for the GMM model. Examining the higher education specifications, a 1% increase of aid to education would, on average, increase the pupil to teacher ratio by 0,0115 and 0,014 in the next period, *ceteris paribus*.

Trained Teachers

The last dependent variable to be examined is the share of trained Teachers for primary, lower secondary, upper secondary and secondary education, which can be found in table 12. Estimation (1) shows that the effect of aid to education is significant at a 1% level, when

controlling for country and time fixed effects. The coefficient is negative and implies that a 1% increase in aid to education would, on average, decrease the percentage of trained teachers by 0,018 percentage points. In the models (2) and (6), it is possible to verify that aid is not found to be significant at impacting the share of trained teachers in lower secondary education. Furthermore, in the upper secondary education estimation, the lag value of aid is significant at a 5% level. The results translate in the percentage of trained teachers to increase, on average, by 0,0095 percentage points in the next period, given a 1% raise in aid to education. This outcome is verified using the fixed effects model, but not the GMM one. Lastly, estimations (4) and (8) display the results for secondary education. It is possible to observe that, under the FE regression, aid to secondary education is statistically significant at a 5% level and negatively affects the share of trained teachers. Moreover, the lag value of aid is found to be significant for the GMM specification (8) and positively affects the dependent variable in the next year. This last finding goes in line with the hypothesis that these variable may take some time to be positively affected by foreign aid flows.

6.1.2. Economic Growth

The second part of the analysis focuses on estimating the impact of educational outcomes on economic growth. Additionally, this section aims at understanding whether one gender group and the respective outcomes in education have a greater effect on economic growth. Table 13 displays the results on economic growth (growth rate of GDP per capita) explained by total male and female educational outcomes. The estimations displayed control for country and time fixed effects.

In specification (1) in table 13 it is possible to observe that lower secondary completion rate is relevant at explaining economic growth. This analysis shows that a 1% increase in the completion rate leads, on average, to a 0,15% increase in the rate of GDP per capita growth. In models (2) and (3) it is relevant to highlight the following variables; lower secondary completion rate, primary and secondary enrollment rate, which are found to be statistically significant. Lower secondary completion and primary enrollment rates positively impact economic growth. The coefficient of the first one is slightly higher for male which means that the male secondary education has a stronger impact on economic growth than the female one. The coefficient means that a 1% increase in the male secondary completion rate would, on average, increase GDP per capita growth by 0,161%. Female completion rate would contribute

to a 0,157% increase in the growth of GDP per capita, on average. On the other hand, the primary enrollment rate's coefficient is larger for the female group than for the male. On average, a 1% increase in the male's enrollment rate would increase economic growth by 0,108%. For the case of female's enrollment rate, the growth rate of GDP per capita would rise by 0,115%. Lastly, it is relevant to observe that the coefficient of secondary enrollment in both specifications is negative. In this case, a 1% increase in the female secondary enrollment rate would, on average, decrease the growth rate of GDP per capita by 0,188%, *ceteris paribus*. Additionally, the same increase in the male secondary enrollment rate, would lower the growth rate of GDP per capita by 0,168%, on average.

Examining the controls, it is important to note that the actual value of GDP per capita positively contributes to its own growth, at a 1% significance level for all estimations. Moreover, inflation is found to negatively affect economic growth, this coefficient is statistically significant for all regressions. Lastly, the results in the estimations (2) and (3) show that openness to trade positively impacts economic growth.

6.2. Robustness tests

The results of this study differ, in some features, from the existing literature. Therefore, in order to confirm the validity of the models and respective results, three robustness checks are performed. The first one consists in regressing a fixed effects model using five-year averages, in order to take into consideration that the variation of some variables may only be visible in the medium-long run. An additional robustness test consists in estimating exact same specification as the one by Birchler and Michaelowa (2016). The last specification consists in regressing the growth equation using the growth rate of the education variables as explanatory variables, instead of the actual value. The main tests are found in the appendix and the remaining ones are available upon request.

In the first robustness test the observations are grouped in periods of 5 years, such that the new time observations are 2002-2006, 2007-2011, 2012-2016 and 2017-2022. Because the sample is composed of a total of 19 years, the last period consists of 4 years, instead of 5. When taking the averages, the number of observations decreases significantly. For this structural panel, only the fixed effects model is estimated, in which the lag value of foreign aid is not included. This is because the system GMM requires more observations relative to the number of instruments,

as reported by Roodman (2007). When using a structural panel, the majority of the results stays stable. Nevertheless, the following alterations can be found. In table 14 of the appendix, it is possible to observe that the impact of foreign aid on total lower secondary completion is lower and no longer significant. Another relevant change is the fact that the aid coefficient of total primary enrollment becomes significant and negative. Table 15 shows that a 1% increase in aid to primary education leads on average, to a 0,024 percentage points decrease in the primary enrollment rate. Moreover, the outcome displayed in table 16 shows that the impact of aid on the higher pupil to teacher ratio is no longer statistically significant. The last variable to be evaluated is the percentage of trained teachers, for which the results are shown in table 17. First of all, statistically significant aid coefficients can be found for trained teachers in the lower and upper secondary, in contrast with the results initially reported. For lower secondary level, the foreign aid coefficient is positive and equal to 2,9. For the upper secondary level, the impact of aid is found to be negative, with coefficient equal to (-3,5). To finish up, and once again in contrast with the first results, the effect of foreign aid on trained teachers in primary and secondary levels is not found to be significant.

The computation of periods of five-year averages is also executed for the growth equation. The results are displayed in table 18. Specification (1) presents the outcomes using total educational outcomes as explanatory variables. Whereas specifications (2) and (3) show the disaggregated results, using male and female educational outcomes as the many independent variables. The following changes were found. To start with, the variable total secondary completion rate stays significant at a 5% level, but its impact becomes greater. In this case, a 1% increase in total secondary completion rate leads, on average, to an increase of the GDP growth rate by 0,28%. This contrasts with a change of 0,15%, found in the previous section, using annual observations. Additionally, no other main explanatory variables are considered significant. Looking at the disaggregated equations (male and female) it is possible to verify that all educational variables become insignificant. These include lower secondary completion rate, primary enrollment rate and secondary enrollment rate for both male and female, which were significant for the annual observations model. In this case, given a five years panel, it is not possible to conclude that educational indicators have a significant impact on economic growth and there is no statistical difference between male and female education.

The second robustness test consists in deriving an identical regression as Birchler and Michaelowa (2016). The underlying goal of this test is to study the accuracy of the model

chosen for this study. There are four factors that differ these two models. The first one is that the authors' model uses data on aid disbursements only until 2010. The second is the fact that the variable Cash surplus/ deficit, as percentage of GDP, is included as a control. Due to the fact that this variable is not available after 2012, the present study uses Government Debt as a measure of public finance. The third factor is that the authors use the value of aid to education as the main explanatory variable, in contrast with the present study which takes the logarithm of its value. Lastly, the authors' estimation does not include a lag variable of aid to primary education, as explanatory variable. Given these, the results are computed using primary enrollment rate as dependent variable. In table 19 it is possible to confirm that the results are found to be identical to the ones derived by Birchler and Michaelowa (2016). Aid to primary education per capita is statistically significant at having an impact on the primary enrollment rate. This provides a basis for justifying the differences between the results of the present study and the ones suggested by the existing literature, as, in addition to the distinctions mentioned, a larger time span is considered, and additional controls are included.

The economic growth model provided relevant results. The last robustness test consists of estimating the growth equation using, as main explanatory variables, the growth rates of the educational variables. This aims at capturing the impact of the yearly variations of education indicators on the rate of GDP growth. The outcome of this test is presented in table 20. The results of the total growth equation show similar trends as the ones observed in the main results section. In this case, the growth rate of the lower secondary completion rate has a significant impact on economic growth. Specifically, a 1% increase in the growth rate of secondary completion rate leads to an increase in the GDP growth rate of 6,1%, on average. The same is not observed for the male and female specifications, in which the growth rate of the variables primary and secondary enrollment rates are no longer significant. Nevertheless, the growth rate of the secondary completion rate is found to still be significant at a 5% level for both male and female. Results show that a 1% increase in the growth rates of the male and female lower secondary completion rates raise the GDP growth rate by 6,6% and 5,6%, respectively. This goes in line with the outcome displayed in table 13, which shows that the impact on economic growth of the male secondary education, measured by the completion rate, is greater than the female education.

7. Discussion

This section aims at discussing the overall trends on education variables and comparing them with the existing work on the subject. The literature, as Michaelowa and Weber (2007) and Birchler and Michaelowa (2016), gives a greater focus on primary education and uses enrollment rates and completion rates as education measures. The present study differs from others for two reasons. First of all, this analysis is extended to the secondary and higher levels of education. Secondly, the education variables are disaggregated by gender, in order to separately evaluate the impact of aid on male and female education.

Michaelowa and Weber (2007) estimate that an increase of current aid for education of 1% would lead to a rise of net primary enrollment of 0,0125% in their most optimistic scenario. Other studies such as D'Aiglepierre and Wagner (2013) and Birchler and Michaelowa (2016) also show a significant effect of aid for primary education. However, the estimated model finds no significant effect on primary enrollment rate. Moreover, when taking five-year averages, there is a significant effect on primary enrollment rate, which is found to be negative. Furthermore, the present paper finds that aid positively affects total primary completion rates, when estimating a system GMM. Support on this can be found in the work by D'Aiglepierre and Wagner (2013).

The variables share of trained teachers and pupil to teacher ratio are included in the model as measures of the quality of the educational system. The fixed effects estimation on the percentage of trained teachers finds a negative impact of aid on the percentage of trained teachers in the primary level. This differs from D'Aiglepierre and Wagner (2013) that conclude that the share of trained teachers is unchanged and not influenced by foreign aid to education. Finally, this paper finds no evidence that aid has an effect on the pupil to teacher ratio for primary level. This conclusion is supported by the same authors.

Lastly, one of the goals of this research was to compare the results of the two gender groups. As a starting point, for the countries selected, the average of the female primary completion is equal to 74,5%, whereas the male one is 77.5%. Regarding the female lower secondary completion rate, the mean equals to 52,4%, which is slightly lower than the male's (53.7%). Given the mentioned differences, it is worth it to explore the effect of aid on gender equality in education. Even though the results found in this research suggest that no impact is

obtained on male and female enrollment rates, aid is found to be effective when analysing completion rates. In concrete terms, there is a positive effect of foreign aid flows on female primary completion taking place in the next year and on female lower secondary completion rate in the current year. This goes in line with D'Aiglepierre and Wagner (2013), which shows that aid can contribute positively to gender equality in education.

The results also show that the control variables are relevant at explaining the variations in the educational outcomes. In line with Birchler and Michaelowa (2016), variables such as inflation, the freedom index, GDP per capita are significant across different estimations. This supports the importance of the socio-economic environment to the educational system and the learning process of the students.

The second part of this research focuses on how education can contribute to boosting the economy. The work of several researchers has supported that education is relevant for GDP growth. Exemplifying, Barro (1991) finds a positive effect of enrollment rates on economic growth. The results presented support that several education parameters are relevant for GDP growth. Considering the sample with total population, lower secondary completion rate has shown to have a significant and positive impact on economic growth.

In addition, a comparison between the impact of male and female education on the economy was made. Results show that, on the one hand, female primary enrollment rate has a higher effect than male's on GDP per capita growth. This differs from the research conducted by Hassan and Cooray (2015), which suggest that the growth effects of male's school enrollment are higher. On the other hand, secondary completion rate for boys leads to a slightly greater increase in economic growth than for girls. The results show no general conclusion on which gender group has the most substantial impact on the economy, but that investing in human capital can be the crucial factor for improving the economic performance. In fact, female education is shown to be crucial for boosting the economy. Klasen (2002) and Oztunc et al. (2015) support this idea, by proving that there is a positive impact from primary education for girls on income growth. Overall, it becomes evident that the reduction of inequalities in this sector should be targeted such that later productivity gaps are avoided.

8. Conclusion

The present thesis aims at contributing to the discussion on the effectiveness of foreign aid transfers. Despite the numerous attempts of providing concrete and reliable answers to the relationship between foreign aid and measures of economic development, there is no consensus in previous analyses. This paper focuses on two main questions. The first one regards the impact of the allocation of foreign aid to education on human capital and, the second one, to what extent the performance in educational outcomes influences economic growth. Previous studies give a higher focus on primary education, while the present one covers measures of all three levels of education, using both quantity and quality measures.

Given a sample made of 78 countries during the period of 2002 and 2020, the main findings discussed for both Fixed Effects and system GMM models are the following. Foreign aid flows have a positive impact on total and female primary completion rate and lower secondary completion rate. Examining the quality indicators, aid is found to positively contribute to the future value of pupil to teacher in the tertiary level, but to have a negative effect on the present value of the same variable. Lastly, the share of trained teachers in both primary and secondary levels are negatively impacted by aid flows, while aid contributes positively to secondary trained teachers in the next period. In summary, foreign aid on education appears to be more effective for the secondary education level. Nevertheless, the magnitude of the impact mentioned is, overall, rather small. Considering the system GMM as the preferred method for being believed to reduce the bias of the estimates, only the following results are considered significant. Aid to primary education has a positive effect on total primary completion rate and future female completion rate in primary education. Additionally, results show a positive effect on the percentage of trained teachers in secondary education in the next period from aid to secondary. The last relevant aspect to mention is that aid to higher education decreases tertiary pupil to teacher ratio in the current period, but increases it in the following period.

Several robustness checks were conducted. It is relevant to highlight the use of the structural panel, constituted by five-year averages. This leads to various changes on the significance and magnitude of the outcomes of aid flows. Nevertheless, the great majority of the results remain unchanged. The second research question focuses on the impact of the mentioned educational variables on economic growth. The results show that secondary education has the most

significant impact on the overall economic growth. The distinction between the growth for male and female does not provide straightforward results of which group education has the strongest impact on the growth rate of GDP per capita, as it varies across educational variables. Moreover, it is important to address that a major difference is seen in primary education, in which female's enrollment rate has a stronger impact on the economy. The cause for this may lay on the fact that, on average, female enrollment rates are lower than male's.

The methodology followed is similar to the one explored by previous literature. The system GMM is assumed to solve the endogeneity problem, by using the first lag of aid as an instrument. Further research could focus on exploring other strategies to better exploit the causal effect. However, there are some other limitations that can question the empirical value of this analysis. These relate to the fact that there are several missing data for some education variables, specifically for low income countries. Another relevant fact is the absence of data on aid disbursements prior to 2002, which restricts this analysis to a shorter period in time.

Significant amounts of foreign aid are transferred to developing countries, on an annual basis. These are expected to be the solution for structural problems and to boost the economy. However, in many cases no substantial impact is observed and even harm has been reported. For this reason, it is crucial to evaluate the real effectiveness of this intervention. The majority of the research has been attempting to measure it on a macro level, but no conclusive results were obtained, contrary to micro level studies. This paper adds up to the existente literature by providing a new perspective on the effect of the aid allocation to the education sector. This is mainly achieved by disaggregating the analysis for male and female young population. As relevant last remarks, this research contributes to this discussion by connecting different elements, such as gender inequality in education and its consequences on economic growth. For future research, a bigger focus should be given to tertiary education, as in the present thesis, this level of education is evaluated solely by pupil to teacher ratio as dependent variable.

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Appendix

Appendix 1: Country Selection

<i>Country</i>	<i>Classification</i>				
Afghanistan	Low Income	Guinea-Bissau	Low Income	Pakistan	Lower-Middle Income
Angola	Lower-Middle Income	Haiti	Low Income	Papua New Guinea	Lower-Middle Income
Bangladesh	Lower-Middle Income	Honduras	Lower-Middle Income	Philippines	Lower-Middle Income
Benin	Low Income	India	Lower-Middle Income	Rwanda	Low Income
Bhutan	Lower-Middle Income	Indonesia	Lower-Middle Income	Sao Tome and Principe	Lower-Middle Income
Bolivia	Lower-Middle Income	Kenya	Lower-Middle Income	Senegal	Lower-Middle Income
Burkina Faso	Low Income	Kiribati	Lower-Middle Income	Sierra Leone	Low Income
Burundi	Low Income	Korea, Dem. People's R	Low Income	Solomon Islands	Lower-Middle Income
Cabo Verde	Lower-Middle Income	Kyrgyz Republic	Lower-Middle Income	Somalia	Low Income
Cambodia	Lower-Middle Income	Lao PDR	Lower-Middle Income	South Sudan	Low Income
Cameroon	Lower-Middle Income	Lesotho	Lower-Middle Income	Sudan	Lower-Middle Income
Central African Republic	Low Income	Liberia	Low Income	Syrian Arab Republic	Low Income
Chad	Low Income	Madagascar	Low Income	Tajikistan	Low Income
Comoros	Lower-Middle Income	Malawi	Low Income	Tanzania	Low Income
Congo, Dem. Rep.	Low Income	Mali	Low Income	Timor-Leste	Lower-Middle Income
Congo, Rep.	Lower-Middle Income	Mauritania	Lower-Middle Income	Togo	Low Income
Cote d'Ivoire	Lower-Middle Income	Micronesia, Fed. Sts.	Lower-Middle Income	Tunisia	Lower-Middle Income
Djibouti	Lower-Middle Income	Moldova	Lower-Middle Income	Uganda	Low Income
Egypt, Arab Rep.	Lower-Middle Income	Mongolia	Lower-Middle Income	Ukraine	Lower-Middle Income
El Salvador	Lower-Middle Income	Morocco	Lower-Middle Income	Uzbekistan	Lower-Middle Income
Eritrea	Low Income	Mozambique	Low Income	Vanuatu	Lower-Middle Income
Eswatini	Lower-Middle Income	Myanmar	Lower-Middle Income	Vietnam	Lower-Middle Income
Ethiopia	Low Income	Nepal	Low Income	West Bank and Gaza	Lower-Middle Income
Gambia, The	Low Income	Nicaragua	Lower-Middle Income	Yemen, Rep.	Low Income
Ghana	Lower-Middle Income	Niger	Low Income	Zambia	Lower-Middle Income
Guinea	Low Income	Nigeria	Lower-Middle Income	Zimbabwe	Lower-Middle Income
Guinea-Bissau	Low Income				

Appendix 2: Descriptive Statistics

<i>Variable</i>	<i>Observations</i>	<i>Mean</i>	<i>Std. dev.</i>	<i>Min</i>	<i>Max</i>
TotalAid	1470	86.15089	110.262	.523255	781.0176
Aid to Primary Education	1454	26.39211	50.34473	.003158	577.419
Aid to Secondary Education	1482	4.779079	13.75017	-3.274507	314.5243
Aid to Higher Education	1470	23.32652	38.0136	.00482	363.4636
Primary Completion, Total (%)	932	76.28045	20.7313	20.46727	123.066
Primary Completion, Female (%)	913	77.47343	19.21533	24.16941	134.8743
Primary Completion, Male (%)	913	74.51198	23.13808	16.47228	125.6158
NER, primary, Total (%)	789	81.62954	14.80508	31.0222	99.71319
NER, primary, Female (%)	648	77.66733	16.21354	27.11355	99.96022
NER, primary, Male (%)	648	80.61481	13.64714	34.85116	98.98404
NER, secondary, Total (%)	543	46.84984	22.4219	4.13627	91.04401
NER, secondary, Female (%)	541	46.50433	23.73803	3.61007	91.86167
NER, secondary, Male (%)	541	47.12157	21.67773	4.66727	91.34043
Pupil-Teacher ratio, Primary	903	36.75327	13.70593	12.38447	100.2365
Pupil-Teacher ratio, Secondary	610	24.20757	9.291385	5.31356	80.05232
Pupil-Teacher ratio, Tertiary	567	20.78819	10.8506	5.7732	147.56
Trained Teachers, Primary (%)	661	82.55591	19.09127	14.68151	100
Trained Teachers, Secondary (%)	410	78.19001	20.60275	16.5812	100
GDP pc	1419	1551.622	965.5456	258.6288	4394.988
Growth GDP pc (%)	1415	2.043811	4.87639	-47.5906	28.676

Appendix 3: Primary Completion Rate (total)

Dependent Variable	FE: Annual observations	System GMM: annual observations
	(1)	(2)
	P. Total Completion rate (%)	P. Total Completion rate (%)
(log) aid to Primary Education	0.437 (0.41)	0.739* (0.33)
lag Primary Total Completion rate	0.670*** (0.06)	0.751*** (0.05)
(log) lag aid to Primary Education	0.168 (0.37)	0.525 (0.37)
Government Expenditure on Education	0.059 (0.09)	0.146 (0.13)
Young Population (%)	-0.608 (0.51)	-0.456** (0.16)
GDP per capita	-0.003 (0.00)	-0.000 (0.00)
Freedom Index	-0.748 (0.50)	-0.464 (0.53)
Urbanization rate	-0.185 (0.43)	-0.044 (0.07)
Openess to Trade	0.018 (0.02)	0.026 (0.02)
Inflation	0.051 (0.07)	-0.160* (0.08)
Government Debt	-0.075 (0.11)	-0.063 (0.05)
Pupil-teacher ratio, primary	0.152 (0.15)	0.015 (0.11)
Constant	45.031 (24.78)	35.651** (11.38)
Adjusted R-squared	0.767	
AR(2) (Prob > z)		0.321
Sargan (Prob > chi2)		0.000
Observations	387.000	387.000

Notes: Standard errors in parentheses are adjusted for clusters on the country level for FE estimations and estimated robustly for GMM estimations. Aid is measured per capita and in natural logarithms. In the GMM specifications the dependent variable and the explanatory variable aid to Education are considered as endogenous. For aid to Education the first lag is included as instrument. The other variables are considered strictly exogenous.

***, **, and * indicate statistical significance at the 1%, 10%, and 5% level, respectively

Appendix 4: Primary Completion Rate (male and female)

Dependent Variable	FE: Annual observations		System GMM: annual observations	
	(1)	(2)	(3)	(4)
	P. Male Comp. rate (%)	P. Female Comp. rate (%)	P. Male Comp. rate (%)	P. Female Comp. rate (%)
(log) aid to Primary Education	0.466 (0.41)	0.255 (0.46)	0.574 (0.38)	0.789 (0.42)
lag Primary Male Completion rate	0.637*** (0.06)		0.673*** (0.07)	
(log) lag aid to Primary Education	0.165 (0.35)	0.392 (0.41)	0.293 (0.36)	0.964* (0.45)
Government Exp. Education	-0.007 (0.10)	0.115 (0.13)	0.098 (0.12)	0.167 (0.19)
Young Population (%)	-0.702 (0.51)	-0.724 (0.60)	-0.473** (0.17)	-0.327 (0.21)
GDP per capita	-0.002 (0.00)	-0.004 (0.00)	0.000 (0.00)	0.000 (0.00)
Freedom Index	-0.582 (0.54)	-0.793 (0.53)	-1.255* (0.49)	0.045 (0.62)
Urbanization rate	-0.449 (0.45)	-0.140 (0.44)	-0.090 (0.06)	0.031 (0.07)
Openness to Trade	0.006 (0.03)	0.005 (0.03)	0.029 (0.03)	0.022 (0.02)
Inflation	0.060 (0.07)	0.073 (0.07)	-0.176* (0.08)	-0.085 (0.08)
Government Debt	-0.100 (0.09)	-0.036 (0.12)	-0.082 (0.06)	-0.033 (0.05)
Pupil-teacher ratio, primary	0.206 (0.16)	0.134 (0.14)	-0.034 (0.11)	0.060 (0.10)
lag Primary Female Completion rate		0.680*** (0.06)		0.817*** (0.05)
Constant	61.666** (22.88)	46.037 (27.43)	50.430*** (13.38)	16.725 (11.15)
Adjusted R-squared	0.684	0.811		
AR(2) (Prob > z)			0.943	0.609
Sargan (Prob > chi2)			0.000	0.000
Observations	375	375	375	375

Notes: Standard errors in parentheses are adjusted for clusters on the country level for FE estimations and estimated robustly for GMM estimations. Aid is measured per capita and in natural logarithms. In the GMM specifications the dependent variable and the explanatory variable aid to Education are considered as endogenous. For aid to Education the first lag is included as instrument. The other variables are considered strictly exogenous.

***, **, and * indicate statistical significance at the 1%, 10%, and 5% level, respectively

Appendix 5: Lower Secondary Completion Rate (total)

Dependent Variable	FE: Annual observations	System GMM: annual observations
	(1)	(2)
	S. Total Completion rate (%)	S. Total Completion rate (%)
(log) aid to Secondary Education	0.550* (0.26)	0.416 (0.23)
lag L. Secondary Total Completion rate	0.594*** (0.13)	0.982*** (0.06)
(log) lag aid to Secondary Education	0.074 (0.27)	0.246 (0.21)
Government Expenditure on Education	-0.023 (0.13)	-0.182 (0.12)
Young Population (%)	-0.764 (0.44)	-0.230 (0.21)
GDP per capita	-0.001 (0.00)	-0.002 (0.00)
Freedom Index	-0.500 (1.07)	-0.433 (0.36)
Urbanization rate	0.216 (0.41)	-0.014 (0.09)
Openness to Trade	-0.010 (0.04)	0.013 (0.03)
Inflation	0.303*** (0.08)	0.232* (0.11)
Government Debt	-0.007 (0.09)	-0.056 (0.06)
Pupil-teacher ratio, secondary	0.216 (0.12)	-0.010 (0.07)
constant	15.439 (33.28)	19.902* (8.75)
Adjusted R-squared	0.797	
AR(2) (Prob > z)		0.501
Sargan (Prob > chi2)		0.000
Observations	229	229

Notes: Standard errors in parentheses are adjusted for clusters on the country level for FE estimations and estimated robustly for GMM estimations. Aid is measured per capita and in natural logarithms. In the GMM specifications the dependent variable and the explanatory variable aid to Education are considered as endogenous. For aid to Education the first lag is included as instrument. The other variables are considered strictly exogenous. ***, **, and * indicate statistical significance at the 1%, 10%, and 5% level, respectively

Appendix 6: Lower Secondary Completion Rate (male and female)

Dependent Variable	FE: Annual observations		System GMM: annual observations	
	(1)	(2)	(3)	(4)
	S. Male Completion rate (%)	S. Female Completion rate (%)	S. Male Completion rate (%)	S. Female Completion rate (%)
(log) aid to Secondary Education	0.463 (0.25)	0.704* (0.34)	0.281 (0.22)	0.357 (0.28)
lag L. Secondary Male Completion rate	0.507*** (0.13)		0.941*** (0.06)	
(log) lag aid to Secondary Education	0.283 (0.23)	-0.075 (0.30)	0.244 (0.23)	0.217 (0.25)
Government Expenditure on Education	0.056 (0.12)	0.039 (0.13)	-0.184 (0.11)	-0.122 (0.12)
Young Population (%)	-0.340 (0.40)	-0.620 (0.53)	-0.058 (0.26)	-0.262 (0.20)
GDP per capita	-0.000 (0.00)	-0.002 (0.00)	-0.001 (0.00)	-0.001 (0.00)
Freedom Index	-0.787 (1.13)	-0.649 (1.14)	-0.619 (0.43)	-0.893 (0.52)
Urbanization rate	-0.148 (0.47)	0.025 (0.49)	-0.031 (0.11)	-0.066 (0.11)
Openess to Trade	-0.006 (0.04)	-0.001 (0.04)	0.014 (0.03)	0.007 (0.04)
Inflation	0.206* (0.09)	0.320** (0.10)	0.105 (0.11)	0.116 (0.12)
Government Debt	-0.024 (0.10)	-0.069 (0.10)	-0.031 (0.05)	0.015 (0.05)
Pupil-teacher ratio, secondary	0.100 (0.19)	0.060 (0.15)	-0.087 (0.07)	-0.038 (0.07)
lag L. Secondary Female Completion rate		0.616*** (0.13)		0.916*** (0.05)
constant	22.707 (28.18)	14.896 (35.90)	15.751 (10.48)	25.276* (10.31)
Adjusted R-squared	0.694	0.797		
AR(2) (Prob > z)			0.534	0.955
Sargan (Prob > chi2)			0.000	0.000
Observations	225	225	225	225

Notes: Standard errors in parentheses are adjusted for clusters on the country level for FE estimations and estimated robustly for GMM estimations. Aid is measured per capita and in natural logarithms. In the GMM specifications the dependent variable and the explanatory variable aid to Education are considered as endogenous. For aid to Education the first lag is included as instrument. The other variables are considered strictly exogenous. ***, **, and * indicate statistical significance at the 1%, 10%, and 5% level, respectively

Appendix 7: Primary Enrollment Rate (total)

Dependent Variable	FE: Annual observations	System GMM: annual observations
	(1)	(2)
	P. Total Enrollment rate (%)	P. Total Enrollment rate (%)
(log) aid to Primary Education	0.016 (0.24)	-0.168 (0.25)
lag Primary Total Completion rate	0.857*** (0.04)	0.880*** (0.04)
(log) lag aid to Primary Education	-0.230 (0.23)	-0.246 (0.32)
Government Expenditure on Education	-0.081* (0.04)	-0.056 (0.06)
Young Population (%)	-0.019 (0.12)	0.185 (0.10)
GDP per capita	-0.000 (0.00)	0.001 (0.00)
Freedom Index	0.331 (0.26)	-0.349 (0.31)
Urbanization rate	-0.282* (0.14)	-0.031 (0.03)
Openess to Trade	0.013 (0.01)	0.001 (0.01)
Inflation	-0.007 (0.03)	0.011 (0.04)
Government Debt	0.071 (0.04)	0.026 (0.03)
Pupil-teacher ratio, primary	0.086 (0.05)	0.008 (0.04)
constant	20.417* (8.70)	5.650 (6.26)
Adjusted R-squared	0.852	
AR(2) (Prob > z)		0.524
Sargan (Prob > chi2)		0.000
Observations	357	357

Notes: Standard errors in parentheses are adjusted for clusters on the country level for FE estimations and estimated robustly for GMM estimations. Aid is measured per capita and in natural logarithms. In the GMM specifications the dependent variable and the explanatory variable aid to Education are considered as endogenous. For aid to Education the first lag is included as instrument. The other variables are considered strictly exogenous. ***, **, and * indicate statistical significance at the 1%, 10%, and 5% level, respectively

Appendix 8: Primary Enrollment Rate (male and female)

Dependent Variable	FE: Annual observations		System GMM: annual observations	
	(1)	(2)	(3)	(4)
	P. Male Enroll rate (%)	P. Female Enroll rate (%)	P. Male Enroll rate (%)	P. Female Enroll rate (%)
(log) aid to Primary Education	-0.072 (0.27)	0.038 (0.25)	-0.425 (0.31)	-0.232 (0.27)
lag Primary Male Enrollment rate	0.842*** (0.05)		0.843*** (0.04)	
(log) lag aid to Primary Education	-0.170 (0.25)	-0.158 (0.24)	-0.229 (0.31)	-0.336 (0.30)
Government Expenditure on Education	-0.053 (0.05)	-0.074 (0.05)	-0.021 (0.08)	-0.016 (0.09)
Young Population (%)	0.051 (0.20)	0.171 (0.20)	0.154 (0.09)	0.173 (0.09)
GDP per capita	0.000 (0.00)	0.000 (0.00)	0.002* (0.00)	0.001 (0.00)
Freedom Index	0.420 (0.31)	0.278 (0.36)	-0.199 (0.26)	-0.176 (0.33)
Urbanization rate	-0.323* (0.15)	-0.255 (0.15)	-0.074 (0.04)	-0.066 (0.04)
Openess to Trade	0.017 (0.02)	0.012 (0.01)	0.005 (0.01)	0.002 (0.01)
Inflation	-0.020 (0.04)	-0.011 (0.04)	0.018 (0.04)	-0.001 (0.04)
Government Debt	0.067 (0.06)	0.069 (0.06)	0.019 (0.03)	0.019 (0.02)
Pupil-teacher ratio, primary	0.093 (0.07)	0.085 (0.06)	0.031 (0.04)	0.003 (0.04)
lag Primary Female Enrollment rate		0.862*** (0.04)		0.892*** (0.03)
constant	18.056 (12.19)	10.581 (11.40)	8.741 (5.55)	5.286 (6.13)
Adjusted R-squared	0.812	0.891		
AR(2) (Prob > z)			0.511	0.556
Sargan (Prob > chi2)			0.000	0.000
Observations	286	286	286	286

Notes: Standard errors in parentheses are adjusted for clusters on the country level for FE estimations and estimated robustly for GMM estimations. Aid is measured per capita and in natural logarithms. In the GMM specifications the dependent variable and the explanatory variable aid to Education are considered as endogenous. For aid to Education the first lag is included as instrument. The other variables are considered strictly exogenous.

***, **, and * indicate statistical significance at the 1%, 10%, and 5% level, respectively

Appendix 9: Secondary Enrollment Rate (total)

Dependent Variable	FE: Annual observations		System GMM: annual observations	
	(1)	(2)	(1)	(2)
	S. Total Enrollment rate (%)		S. Total Enrollment rate (%)	
(log) aid to Secondary Education	-0.007 (0.08)		0.111 (0.10)	
lag L. Secondary Total Enrollment rate	0.890*** (0.06)		0.966*** (0.03)	
(log) lag aid to Secondary Education	0.143 (0.10)		0.006 (0.09)	
Government Expenditure on Education	0.002 (0.06)		-0.138*** (0.04)	
Young Population (%)	-0.076 (0.24)		0.009 (0.06)	
GDP per capita	0.001 (0.00)		0.001 (0.00)	
Freedom Index	-0.153 (0.41)		-0.238 (0.23)	
Urbanization rate	0.210 (0.23)		-0.052 (0.04)	
Openess to Trade	0.018 (0.02)		0.011 (0.01)	
Inflation	-0.069 (0.08)		0.013 (0.05)	
Government Debt	-0.080 (0.04)		-0.028 (0.02)	
Pupil-teacher ratio, secondary	0.031 (0.10)		0.023 (0.05)	
constant	0.107 (11.10)		5.951 (4.07)	
Adjusted R-squared	0.923			
AR(2) (Prob > z)			0.692	
Sargan (Prob > chi2)			0.011	
Observations	172		172	

Notes: Standard errors in parentheses are adjusted for clusters on the country level for FE estimations and estimated robustly for GMM estimations. Aid is measured per capita and in natural logarithms. In the GMM specifications the dependent variable and the explanatory variable aid to Education are considered as endogenous. For aid to Education the first lag is included as instrument. The other variables are considered strictly exogenous. ***, **, and * indicate statistical significance at the 1%, 10%, and 5% level, respectively

Appendix 10: Secondary Enrollment Rate (male and female)

Dependent Variable	FE: Annual observations		System GMM: annual observations	
	(1)	(2)	(3)	(4)
	S. Male Enroll rate (%)		S. Male Enroll rate (%)	
	S. Female Enroll rate (%)		S. Female Enroll rate (%)	
(log) aid to Secondary Education	-0.040 (0.06)	0.015 (0.11)	0.113 (0.10)	0.105 (0.13)
lag L. Secondary Male Enroll rate	0.845*** (0.06)		0.967*** (0.03)	
(log) lag aid to Secondary Education	0.133 (0.10)	0.164 (0.11)	-0.055 (0.10)	0.075 (0.12)
Government Expenditure on Education	-0.020 (0.07)	0.030 (0.06)	-0.146** (0.04)	-0.145** (0.04)
Young Population (%)	-0.043 (0.23)	-0.103 (0.26)	0.010 (0.06)	0.051 (0.05)
GDP per capita	0.002* (0.00)	0.001 (0.00)	0.001 (0.00)	0.001 (0.00)
Freedom Index	-0.294 (0.46)	-0.019 (0.39)	-0.292 (0.25)	-0.272 (0.25)
Urbanization rate	0.254 (0.23)	0.188 (0.23)	-0.056 (0.04)	-0.069 (0.04)
Openess to Trade	0.015 (0.02)	0.021 (0.02)	0.009 (0.01)	0.013 (0.01)
Inflation	-0.085 (0.07)	-0.051 (0.08)	-0.001 (0.05)	0.013 (0.06)
Government Debt	-0.085 (0.04)	-0.076 (0.05)	-0.031 (0.02)	-0.031 (0.02)
Pupil-teacher ratio, secondary	0.016 (0.09)	0.049 (0.11)	0.015 (0.05)	0.003 (0.0)
lag L. Secondary Female Enroll rate		0.915*** (0.06)		0.975*** (0.03)
constant	-0.014 (11.86)	-0.210 (10.87)	6.386 (4.45)	5.398 (3.97)
Adjusted R-squared	0.894	0.936		
AR(2) (Prob > z)			0.339	0.631
Sargan (Prob > chi2)			0.096	0.001
Observations	171	171	171	171

Notes: Standard errors in parentheses are adjusted for clusters on the country level for FE estimations and estimated robustly for GMM estimations. Aid is measured per capita and in natural logarithms. In the GMM specifications the dependent variable and the explanatory variable aid to Education are considered as endogenous. For aid to Education the first lag is included as instrument. The other variables are considered strictly exogenous. ***, **, and * indicate statistical significance at the 1%, 10%, and 5% level, respectively

Appendix 11: Pupil to teacher ratio

Dependent Variable	FE: Annual observations				System GMM: annual observations			
	(1) Primary PTR	(2) L. Sec PRT	(3) Sec PRT	(4) Tertiary PRT	(5) Primary PTR	(6) L. Sec PRT	(7) Sec PRT	(8) Tertiary PRT
(log) aid to Primary Education	-0.192 (0.23)				-0.004 (0.32)			
lag Primary PTR	0.701*** (0.04)				0.771*** (0.05)			
(log) lag aid to Primary Education	-0.038 (0.19)				-0.230 (0.26)			
Government Expenditure Educ.	-0.087 (0.09)	-0.081 (0.08)	-0.125 (0.07)	0.035 (0.12)	-0.125 (0.13)	-0.137 (0.11)	-0.103 (0.06)	-0.066 (0.11)
Young Population (%)	0.065 (0.16)	0.349 (0.26)	-0.078 (0.20)	0.253 (0.23)	0.209 (0.15)	0.082 (0.08)	0.032 (0.05)	0.011 (0.07)
GDP per capita	0.000 (0.00)	0.001 (0.00)	0.000 (0.00)	0.000 (0.00)	0.000 (0.00)	-0.001 (0.00)	-0.000 (0.00)	-0.001 (0.00)
Freedom Index	-0.320 (0.33)	-0.772 (0.59)	-0.131 (0.25)	0.729 (0.49)	0.201 (0.31)	-0.607 (0.33)	-0.370 (0.19)	0.610 (0.46)
Urbanization rate	-0.232 (0.12)	0.005 (0.19)	0.012 (0.16)	0.449 (0.28)	-0.056 (0.03)	-0.084* (0.04)	-0.042 (0.05)	0.101 (0.05)
Openess to Trade	0.004 (0.01)	0.030 (0.02)	0.019 (0.01)	-0.017 (0.01)	0.022 (0.02)	0.014 (0.02)	0.012 (0.01)	-0.040* (0.02)
Inflation	-0.037 (0.03)	-0.065 (0.08)	-0.105* (0.05)	-0.009 (0.02)	0.008 (0.04)	0.012 (0.09)	-0.055 (0.05)	0.004 (0.03)
Government Debt	0.039 (0.05)	-0.171* (0.06)	0.014 (0.06)	0.081 (0.13)	0.009 (0.06)	-0.093* (0.04)	-0.031 (0.05)	-0.046 (0.09)
(log) aid to L. Sec		0.029 (0.14)				-0.131 (0.18)		
lag L. Sec PTR		0.639*** (0.10)				0.717*** (0.06)		
(log) lag aid to L. Sec		0.105 (0.20)				0.247 (0.18)		
(log) aid to Sec			-0.009 (0.12)				-0.074 (0.11)	
lag Sec PTR			0.650*** (0.06)				0.869*** (0.04)	
(log) lag aid to Sec			0.063 (0.10)				-0.075 (0.12)	
(log) aid to Higher				-0.958* (0.46)				-1.015* (0.45)
lag Tertiary PTR				0.826*** (0.13)				0.835*** (0.08)
(log) lag aid to Higher				1.151* (0.55)				1.401** (0.43)
constant	20.695 (10.57)	-0.428 (11.99)	12.500 (10.65)	-26.565 (14.98)	1.719 (5.69)	12.786* (4.87)	6.540 (3.27)	3.744 (5.24)
Adjusted R-squared	0.662	0.520	0.571	0.683				
AR(2) (Prob > z)					0.511	0.704	0.458	0.444
Sargan (Prob > chi2)					0.000	0.000	0.000	0.036
Observations	461	194	264	275	461	194	264	275

Notes: Standard errors in parentheses are adjusted for clusters on the country level for FE estimations and estimated robustly for GMM estimations. Aid is measured per capita and in natural logarithms. In the GMM specifications the dependent variable and the explanatory variable aid to Education are considered as endogenous. For aid to Education the first lag is included as instrument. The other variables are considered strictly exogenous.

***, **, and * indicate statistical significance at the 1%, 10%, and 5% level, respectively

Appendix 12: Trained teachers (%)

Dependent Variable	FE: Annual observations				System GMM: annual observations			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Primary Teachers	L. Sec Teachers	U. Sec Teachers	Sec Teachers	Primary Teachers	L. Sec Teachers	U. Sec Teachers	Sec Teachers
(log) aid to Primary Education	-1.808*** (0.47)				0.588 (1.96)			
lag P T. Teachers	0.817*** (0.06)				0.642*** (0.13)			
(log) lag aid to Primary Education	1.048 (0.57)				-1.057 (1.34)			
Government Expenditure Educ.	-0.223 (0.14)	-0.019 (0.16)	-0.340 (0.25)	-0.090 (0.13)	0.036 (0.24)	-0.414 (0.45)	-0.167 (0.16)	-0.015 (0.12)
Young Population (%)	0.219 (0.32)	-0.465 (0.97)	1.568 (1.34)	0.090 (0.57)	-0.056 (0.21)	-0.153 (0.26)	0.055 (0.15)	0.017 (0.07)
GDP per capita	-0.005 (0.00)	-0.015 (0.01)	-0.010 (0.02)	0.000 (0.00)	0.003 (0.00)	0.002* (0.00)	0.002 (0.00)	0.000 (0.00)
Freedom Index	-1.034 (1.15)	5.238 (5.59)	-0.552 (7.55)	-4.346 (3.38)	2.014 (1.26)	1.251 (0.70)	-0.062 (0.43)	-0.252 (0.41)
Urbanization rate	0.581 (0.58)	-1.598 (1.29)	1.348 (1.84)	0.954 (0.72)	0.163 (0.20)	0.013 (0.08)	-0.079 (0.10)	-0.042 (0.05)
Openness to Trade	-0.036 (0.02)	0.041 (0.11)	0.245 (0.14)		-0.009 (0.03)	0.027 (0.03)	0.003 (0.02)	
Inflation	0.048 (0.08)	0.214 (0.38)	0.249 (0.26)	0.171 (0.17)	-0.190* (0.08)	0.659 (0.48)	0.327 (0.29)	-0.047 (0.14)
Government Debt	0.275 (0.20)	0.291 (0.53)	0.484 (0.68)	0.216 (0.23)	0.137 (0.22)	0.280 (0.25)	0.094 (0.28)	0.029 (0.08)
PTR, primary	0.035 (0.12)				0.079 (0.19)			
(log) aid to L. Sec		-0.915 (0.73)				-0.219 (0.60)		
lag L. Sec T. Teachers		0.554* (0.25)				0.754*** (0.09)		
(log) lag aid to L. Sec		0.538 (0.84)				0.500 (0.45)		
PTR, 1. secondary		-0.053 (0.19)				-0.023 (0.08)		
(log) aid to U. Sec			-0.176 (0.37)				-0.131 (0.45)	
lag U. Sec T. Teachers			0.397 (0.20)				0.930*** (0.06)	
(log) lag aid to U. Sec			0.953* (0.42)				0.450 (0.43)	
PTR, secondary			0.533 (0.70)	-0.161 (0.15)			0.097 (0.10)	0.050 (0.06)
(log) aid to Sec				-0.800* (0.33)				-0.226 (0.29)
lag Sec T. Teachers				0.754*** (0.08)				0.938*** (0.03)
(log) lag aid to Sec				0.020 (0.37)				0.743* (0.29)
constant	-86.696** (30.13)	46.886 (122.34)	-82.187 (84.55)	-7.983 (51.07)	10.086 (14.95)	14.680 (16.53)	1.639 (5.75)	7.461 (4.56)
Adjusted R-squared	0.834	0.863	0.669	0.705				
AR(2) (Prob > z)					0.496	0.771	0.340	0.643
Sargan (Prob > chi2)					0.000	0.000	0.939	0.340
Observations	274	88	70	113	274	88	70	113

Notes: Standard errors in parentheses are adjusted for clusters on the country level for FE estimations and estimated robustly for GMM estimations. Aid is measured per capita and in natural logarithms. In the GMM specifications the dependent variable and the explanatory variable aid to Education are considered as endogenous. For aid to Education the first lag is included as instrument. The other variables are considered strictly exogenous.

***, **, and * indicate statistical significance at the 1%, 10%, and 5% level, respectively

Appendix 13: GDP growth pc

FE: Annual observations			
Dependent Variable	(1)	(2)	(3)
	GDP pc growth	GDP pc growth	GDP pc growth
Primary Compl.	0.052 (0.06)		
L. sec Compl.	0.148* (0.07)		
Primary Enroll.	0.053 (0.05)		
Sec Enroll.	-0.124 (0.06)		
Primary Repetition	0.129 (0.18)		
GDP per capita	0.010*** (0.00)	0.009*** (0.00)	0.009*** (0.00)
Total Population	0.000 (0.00)	0.000* (0.00)	0.000* (0.00)
Young Population (%)	0.366 (0.27)	0.297 (0.26)	0.186 (0.25)
Freedom Index	0.842 (0.70)	1.506 (0.82)	1.252 (0.78)
Urbanization rate	-0.224 (0.26)	0.017 (0.28)	-0.028 (0.26)
Openess to Trade	0.077* (0.03)	0.082** (0.03)	0.076** (0.02)
Inflation	-0.140** (0.05)	-0.135* (0.05)	-0.134* (0.05)
Government Debt	-0.013 (0.06)	-0.028 (0.05)	-0.005 (0.05)
Broad Money	-0.035 (0.05)	0.002 (0.05)	-0.006 (0.05)
Control of Corruption	-0.100 (1.71)	2.109 (1.57)	1.744 (1.59)
Male Primary Compl.		0.042 (0.06)	
Male L. sec Compl.		0.161* (0.06)	
Male Primary Enroll.		0.108* (0.05)	
Male Sec Enroll.		-0.168* (0.08)	
Male Primary Repetition		0.027 (0.16)	
Female Primary Compl.			0.034 (0.06)
Female L. sec Compl.			0.157** (0.06)
Female Primary Enroll.			0.115* (0.05)
Female Sec Enroll.			-0.188** (0.07)
Female Primary Repetition			0.075 (0.17)
constant	-36.661 (19.20)	-48.035* (20.52)	-39.471* (18.43)
Adjusted R-squared	0.291	0.449	0.448
Observations	274	223	223

Notes: Standard errors in parentheses are adjusted for clusters on the country level for FE. ***, **, and * indicate statistical significance at the 1%, 10%, and 5% level, respectively

Appendix 14: Robustness test (1): Completion rate, Lower Secondary education

Dependent Variable	FE: 5-year averages		
	(1)	(2)	(3)
	S. Total Completion rate (%)	S. Male Completion rate (%)	S. Female Completion rate (%)
(log) aid to Secondary Education	0.350 (0.41)	0.470 (0.62)	0.376 (0.57)
lag L. Secondary Total Completion rate	0.812*** (0.11)		
Government Expenditure on Education	0.031 (0.16)	0.074 (0.19)	0.051 (0.18)
Young Population (%)	0.353 (0.47)	0.234 (0.48)	0.569 (0.52)
GDP per capita	0.006* (0.00)	0.007* (0.00)	0.006 (0.00)
Freedom Index	-1.266 (1.38)	-0.428 (1.41)	-2.263 (1.32)
Urbanization rate	0.290 (0.35)	0.269 (0.37)	0.443 (0.40)
Openess to Trade	0.011 (0.03)	0.014 (0.03)	0.012 (0.04)
Inflation	0.221 (0.13)	0.134 (0.18)	0.335** (0.10)
Government Debt	0.537 (0.31)	0.323 (0.36)	0.643 (0.34)
Pupil-teacher ratio, secondary	0.379* (0.16)	0.328 (0.17)	0.387* (0.18)
lag L. Secondary Male Completion rate		0.867*** (0.11)	
lag L. Secondary Female Completion rate			0.791*** (0.12)
constant	-36.135 (29.92)	-33.203 (29.59)	-48.735 (32.12)
Adjusted R-squared	0.908	0.886	0.917
Observations	99	97	97

Notes: Standard errors in parentheses are adjusted for clusters on the country level for FE. Aid is measured per capita and in natural logarithms
***, **, and * indicate statistical significance at the 1%, 10%, and 5% level, respectively

Appendix 15: Robustness test (1): Enrollment rate, Primary education

Dependent Variable	FE: 5-year averages		
	(1)	(2)	(3)
	P. Total Enrollment rate (%)	P. Male Enrollment rate (%)	P. Female Enrollment rate (%)
(log) aid to Primary Education	-2.362** (0.86)	-0.120 (0.79)	0.567 (0.72)
lag Primary Total Completion rate	0.217 (0.13)		
Government Expenditure on Education	0.130 (0.25)	-0.206 (0.18)	-0.260 (0.14)
Young Population (%)	0.713 (1.03)	-0.100 (0.48)	-0.254 (0.42)
GDP per capita	0.013* (0.00)	0.002 (0.00)	0.000 (0.00)
Freedom Index	-1.534 (1.73)	1.300 (1.09)	1.239 (1.03)
Urbanization rate	1.209 (0.65)	-0.573* (0.24)	-0.385 (0.24)
Openess to Trade	-0.009 (0.05)	-0.009 (0.05)	-0.025 (0.04)
Inflation	0.169 (0.15)	-0.105 (0.12)	-0.072 (0.12)
Government Debt	1.188* (0.53)	-0.061 (0.24)	-0.238 (0.27)
Pupil-teacher ratio, primary	0.069	0.364* (0.14)	0.201
lag Primary Male Completion rate		0.914*** (0.09)	
lag Primary Female Completion rate			1.015*** (0.09)
constant	-75.391 (59.93)	17.436 (21.24)	21.531 (23.56)
Adjusted R-squared	0.922	0.859	0.904
Observations	64	87	87

Notes: Standard errors in parentheses are adjusted for clusters on the country level for FE. Aid is measured per capita and in natural logarithms
***, **, and * indicate statistical significance at the 1%, 10%, and 5% level, respectively

Appendix 16: Robustness test (1): Pupil to Teacher Ratio

Dependent Variable	FE: 5-year averages			
	(1) Primary PTR	(2) L. Sec PRT	(3) Sec PRT	(4) Tertiary PRT
(log) aid to Primary Education	-0.590 (0.52)			
lag Primary PTR	0.845*** (0.11)			
Government Expenditure Educ.	0.039 (0.11)	0.740 (0.41)	-0.090 (0.10)	0.778** (0.25)
Young Population (%)	-0.183 (0.23)	0.020 (0.56)	-0.639 (0.33)	-0.063 (0.59)
GDP per capita	-0.000 (0.00)	-0.003 (0.01)	0.002 (0.00)	0.002 (0.00)
Freedom Index	0.061 (0.52)	-1.322 (1.33)	0.850 (0.81)	-0.430 (1.52)
Urbanization rate	-0.275 (0.20)	0.059 (0.38)	0.017 (0.21)	0.696 (0.35)
Openess to Trade	0.015 (0.01)	0.029 (0.07)	0.003 (0.02)	-0.050* (0.02)
Inflation	0.032 (0.11)	0.474 (0.27)	-0.037 (0.06)	0.361*** (0.07)
Government Debt	0.071 (0.15)	0.151 (0.56)	-0.512* (0.23)	-0.515 (0.41)
(log) aid to L. Sec		0.836 (0.69)		
lag L. Sec PTR		0.763** (0.26)		
(log) aid to Sec			0.252 (0.19)	
lag Sec PTR			1.098*** (0.07)	
(log) aid to Higher				-0.835 (1.98)
lag Tertiary PTR				0.839*** (0.12)
constant	20.215 (10.35)	-5.588 (27.75)	26.203 (15.33)	-24.045 (35.14)
Adjusted R-squared	0.695	0.593	0.884	0.796
Observations	125.000	67.000	92.000	78.000

Notes: Standard errors in parentheses are adjusted for clusters on the country level for FE. Aid is measured per capita and in natural logarithms

***, **, and * indicate statistical significance at the 1%, 10%, and 5% level, respectively

Appendix 17: Robustness test (1): Trained Teacher (%)

Dependent Variable	FE: 5-year averages			
	(1) Primary Teachers	(2) L. Sec Teachers	(3) U. Sec Teachers	(4) Sec Teachers
(log) aid to Primary Education	-0.688 (0.78)			
lag P T. Teachers	0.901*** (0.08)			
Government Expenditure Educ.	-0.303 (0.34)	-2.054*** (0.00)	-1.777*** (0.00)	0.857 (0.59)
Young Population (%)	0.275 (0.37)	1.243*** (0.00)	4.529*** (0.00)	1.175* (0.51)
GDP per capita	-0.001 (0.00)	-0.014*** (0.00)	0.013*** (0.00)	0.020* (0.01)
Freedom Index	-0.584 (2.01)	-9.809*** (0.00)	-12.813*** (0.00)	-10.012* (3.86)
Urbanization rate	0.388 (0.48)	1.503*** (0.00)	3.392*** (0.00)	2.073 (1.10)
Openness to Trade	0.016 (0.04)	-0.094*** (0.00)	-0.166*** (0.00)	-0.028 (0.11)
Inflation	-0.009 (0.18)	1.529*** (0.00)	1.078*** (0.00)	-0.427 (0.55)
Government Debt	0.100 (0.40)	0.765*** (0.00)	0.367*** (0.00)	-0.059 (0.46)
PTR, primary	0.082 (0.22)			
(log) aid to L. Sec		2.910*** (0.00)		
lag L. Sec T. Teachers		0.701*** (0.00)		
PTR, l. secondary		0.000 (.)		
(log) aid to U. Sec			-3.460*** (0.00)	
lag U. Sec T. Teachers			1.077*** (0.00)	
PTR, secondary			-1.185*** (0.00)	0.725 (0.39)
(log) aid to Sec				-1.215 (1.85)
lag Sec T. Teachers				1.562*** (0.28)
constant	-11.187 (34.02)	7.481*** (0.00)	-221.364*** (0.00)	-171.222** (50.02)
Adjusted R-squared	0.799	1.000	1.000	0.857
Observations	109	36	40	63

Notes: Standard errors in parentheses are adjusted for clusters on the country level for FE. Aid is measured per capita and in natural logarithms

***, **, and * indicate statistical significance at the 1%, 10%, and 5% level, respectively

Appendix 18: Robustness test (1): Economic Growth

Dependent Variable	FE: 5-year averages		
	(1) GDP pc growth	(2) GDP pc growth	(3) GDP pc growth
Primary Compl.	-0.146 (0.09)		
L. sec Compl.	0.279* (0.14)		
Primary Enroll.	0.159 (0.11)		
Sec Enroll.	0.001 (0.22)		
Primary Repetition	-0.194 (0.27)		
GDP per capita	-0.001 (0.00)	-0.001 (0.00)	-0.001 (0.00)
Total Population	0.000* (0.00)	0.000 (0.00)	0.000 (0.00)
Young Population (%)	-0.426 (0.36)	-0.407 (0.41)	-0.263 (0.44)
Freedom Index	2.675* (1.13)	2.290 (1.14)	1.956 (1.07)
Urbanization rate	-0.871 (0.46)	-0.667 (0.58)	-0.906 (0.52)
Openess to Trade	0.097* (0.04)	0.097 (0.06)	0.095 (0.06)
Inflation	-0.180 (0.11)	-0.215 (0.11)	-0.231* (0.11)
Government Debt	-0.250** (0.08)	-0.260** (0.09)	-0.219* (0.09)
Broad Money	-0.106 (0.07)	-0.103 (0.09)	-0.116 (0.09)
Control of Corruption	3.303 (3.17)	4.508 (5.86)	1.540 (5.61)
Male Primary Compl.		-0.140 (0.13)	
Male L. sec Compl.		0.267 (0.14)	
Male Primary Enroll.		0.185 (0.14)	
Male Sec Enroll.		-0.109 (0.27)	
Male Primary Repetition		-0.154 (0.28)	
Female Primary Compl.			-0.137 (0.10)
Female L. sec Compl.			0.235 (0.14)
Female Primary Enroll.			0.213 (0.13)
Female Sec Enroll.			0.063 (0.25)
Female Primary Repetition			-0.002 (0.28)
constant	30.124 (25.18)	28.470 (28.76)	22.919 (26.89)
Adjusted R-squared	0.655	0.596	0.627
Observations	117	103	103

Notes: Standard errors in parentheses are adjusted for clusters on the country level for FE.
 ***, **, and * indicate statistical significance at the 1%, 10%, and 5% level, respectively

Appendix 19: Robustness test (2): Enrollment rate by Birchler K., Michaelowa K., (2016)

FE: Annual observations	
(1)	
Dependent Variable	P. Total Enrollment rate (%)
aid to Primary Education	0.095** (0.03)
lag Primary Total Completion rate	0.353 (0.23)
Government Expenditure on Education	-0.363 (0.17)
Young Population (%)	-0.842 (1.58)
GDP per capita	-0.010 (0.01)
Freedom Index	0.701 (1.81)
Openess to Trade	-0.024 (0.02)
Inflation	0.173** (0.05)
Budget	0.029 (0.05)
Pupil-teacher ratio, primary	0.018 (0.14)
constant	85.850 (90.28)
Adjusted R-squared	0.629
Observations	59

Notes: Standard errors in parentheses are adjusted for clusters on the country level for FE. Aid is measured per capita.

***, **, and * indicate statistical significance at the 1%, 10%, and 5% level, respectively

Appendix 20: Robustness test (3): Economic Growth, using the growth rate of the educational variables

FE: Annual observations			
Dependent Variable	(1)	(2)	(3)
	GDP pc growth	GDP pc growth	GDP pc growth
Primary Compl. g.	-6.083 (3.78)		
L. sec Compl. g.	6.109** (2.15)		
Primary Enroll. g.	-3.334 (2.95)		
Sec Enroll. g.	3.161 (3.19)		
Primary Repetition g.	0.904 (1.11)		
GDP per capita	0.012** (0.00)	0.013*** (0.00)	0.013*** (0.00)
Total Population	-0.000 (0.00)	0.000 (0.00)	0.000 (0.00)
Young Population (%)	0.947* (0.43)	1.518** (0.50)	1.466** (0.48)
Freedom Index	0.915 (0.88)	1.172 (0.98)	1.377 (1.06)
Urbanization rate	0.072 (0.44)	0.238 (0.43)	0.179 (0.44)
Openness to Trade	0.046 (0.03)	0.091* (0.04)	0.090 (0.04)
Inflation	-0.130 (0.07)	-0.170* (0.08)	-0.179* (0.08)
Government Debt	-0.041 (0.07)	-0.142 (0.09)	-0.136 (0.10)
Broad Money	0.078 (0.07)	0.148* (0.07)	0.147* (0.06)
Control of Corruption	0.674 (2.49)	4.091 (3.12)	4.093 (3.05)
Male Primary Compl. g.		-4.942 (3.25)	
Male L. sec Compl. g.		6.582** (1.92)	
Male Primary Enroll. g.		-2.967 (11.51)	
Male Sec Enroll. g.		-2.161 (4.46)	
Male Primary Repetition g.		0.390 (1.75)	
Female Primary Compl. g.			-5.470 (3.97)
Female L. sec Compl. g.			5.598* (2.59)
Female Primary Enroll. g.			-0.778 (11.37)
Female Sec Enroll. g.			0.825 (4.51)
Female Primary Repetition g.			0.603 (2.05)
constant	-58.507 (31.30)	-93.840** (31.55)	-89.883** (31.38)
Adjusted R-squared	0.405	0.535	0.530
Observations	187	146	146

Notes: Standard errors in parentheses are adjusted for clusters on the country level for FE. ***, **, and * indicate statistical significance at the 1%, 10%, and 5% level, respectively