EXPORT COMPOSITION AND EDUCATIONAL ATTAINMENT IN INDONESIA

PANEL STUDY ON SECTORAL GROWTH OF VALUE ADDED EXPORTS AS A DRIVER OF INVESTMENTS IN HUMAN CAPITAL

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Abstract

Human capital is one of the most important factors for growth and income, but its drivers are still not well understood. This research describes a potential incentive to invest in human capital from a demand side and is inspired by the article of Blanchard and Olney (2017). They show that growth in exports of less skill-intensive goods lead to a decrease in average educational attainment, while growth in exports of skill-intensive goods lead to an increase in educational attainment. Where Blanchard and Olney (2017) compare 102 countries, this study was based on a panel dataset with 401 Indonesian districts to see if their results also hold for a specific country. Another important unique aspect in this study is the use of value added export data instead of data on gross exports. Using a multivariate regression analysis, the main results show a positive correlation between high skilled exports and lower secondary education. When specifying the results on different age groups, it becomes clear that a basic education is needed in the high skilled export sector, where this is less important within the low skilled export sector. Besides the main results of exports on lower secondary education, the income effect plays a statistically significant role in the decision to invest in tertiary education. The results provide insight in the understanding of investments in human capital for Indonesia and how the sectoral growth of exports affects these decisions the most.

Keywords: Education, Exports, Skill-composition, Trade, Human capital, Indonesia

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1. Introduction

Human capital is one of the most important factors for growth and income, but its drivers are still not well understood. The most important contribution to human capital is education. There is a large amount of literature on education, but the approach of Blanchard and Olney (2017), where they focus on the demand side of education, is still underexposed. Their article shows that growth in exports of less skill-intensive goods lead to a decrease in average educational attainment, while growth in exports of skill-intensive goods lead to an increase in educational attainment. The authors argue that trade liberalization influences wages and job opportunities which will affect household's incentives to invest in human capital. When trade liberalization leads to an increasing demand in the skill-intensive sector this will motivate more education, while increasing job opportunities in the less skill-intensive sector can lead to a higher school attrition rate. This result shed a new light on the drivers of investments in human capital in the long run.

The theory of Blanchard and Olney (2017) is based on the Heckscher-Ohlin (H-O) model to examine the incentives to invest in human capital. In the setting of two countries, one of which has abundance in less skilled labor, and the other has abundance in skilled labor, opening up for trade will increase educational attainment in the skilled labor abundant country, and will decrease educational attainment in the less skilled labor abundant country (Blanchard & Olney, 2017). Because most less-developed countries specialize in less skilled labor intensive goods, this will imply that there are low incentives to invest in human capital. Meanwhile, developed countries will specialize in skilled labor intensive goods which require high levels of education. In this way trade leads to more inequality in educational attainment between countries. Along with this theory, Blanchard and Willmann (2016) find that globalization and openness to trade can lead to a change in the distribution of human capital within and across countries. In their many-good setting they show that as trade can shift the demand for low- and high-skilled workers into the sectors the country has a comparative advantage in, this can lead to bigger polarization of educational attainment and wages. Observed global trends over the last three decades of the previous century support this theory. While the world has become more open to trade, the gaps in terms of secondary and tertiary education have widened between skilled and less skilled labor abundant countries (Wood & Ridao-Cano, 1999).

However, despite the explanation of the H-O model on human capital investments, the education literature find contrasting results with trade liberalization. Where Greenland and Lopresti (2016) and Hickman and Olney (2011) find a positive relationship between globalization and educational attainment in the U.S., Edmonds, Pavcnik and Topalova (2010), and Topalova (2007) both find a relationship between trade liberalization and a relative increase in poverty in both rural and urban areas within India. Sectors that were more exposed to trade liberalization experienced a slower poverty reduction, or even an increase in poverty, and lower school attendance rates. Both studies find that schooling costs are the main reason why children drop out or never attend school, which predict lower returns to education. When parents earn less, because of a tariff change, less investment is made in human capital of their children, due to a change in income.

Also in terms of income, the effects of trade liberalization are unclear and the debate whether trade causes either income convergence or more inequality between countries is still ongoing. Especially because of methodological problems the literature suffers from a lack of robust evidence that shows a causal relation between trade and economic growth (Hallaert, 2006; Rodrik, 2001).

One the one side, according to Bhagwati and Srinivasan (2002) free trade is not only beneficial because of higher relative wages for low-skilled workers in the country that exports low-skilled production goods, as stated by the Samuel-Stolper theorem, but is also beneficial because of the macro-economic stability with low inflation rates. Since the poor are especially vulnerable to inflation, this export-oriented focus will therefore positively assist this group. Besides low inflation rates, trade can also induce the availability of inputs. These inputs could be constrained when the country is under protection and therefore has no scale economies in domestic production. When the country opens up, these inputs are available at a lower price since it has to compete in the world market, thereby reducing the investment rate (Sapsford & Garikipati, 2006).

On the other side, research has shown that inequality increased between and within countries because of trade liberalization and globalization. Bhagwati and Srinivasan (2002) also consider a negative effect of trade on poverty. When taking into account the Lewis model, where free movement of labor is assumed, trade will reduce poverty since workers will move to the urban working areas. However, if free trade is not able to reach the labor market of the very poor, who are not linked to the mainstream or main cities, for example those in remote areas, then growth will pass the poor by. This is in accordance with Topalova (2010) who shows a relationship between trade liberalization and slower poverty reduction in rural districts in India. This effect is most likely because of the inability of labor to reallocate away from sectors that lost trade protection.

With these contrary results in mind, a focus from the demand side of education could potentially offer an explanation to these results. According to Blanchard and Olney (2017) when a developing country opens up for trade, the demand for high skilled labor will go down, as well as the demand for education. The total amount of skilled labor available in the developing country will decrease and this makes it harder to increase economic growth and to catch up in terms of income. Openness to trade will therefore widen the gap in skill endowments between countries and increase income inequality (Blanchard & Olney, 2017). However, this theory is only based on the theory of Blanchard and Olney (2017). When taking other trade theories into account the effect of trade liberalization could have different effects.

An increasing amount of countries rely on trade for their production and total world trade grew rapidly during the last three decades. From 1980 to 2008 the traded share of world output rose from 12% to 19% and most of this increase was due to the rise in trade between skilled labor abundant countries and less skilled labor abundant countries. The cause of this increased trade pattern is due to an increasing amount of countries opening up for trade, especially more less skilled labor abundant countries, which made the characteristics of the open economies less homogeneous (Zymek, 2015).

This shift in trade patterns and the opposed effects of trade on educational attainment makes it interesting to focus on one developing country to see if the results obtained by Blanchard and Olney

(2017) also apply to one specific country. Additionally, with the focus on districts the measurement error is reduced compared to a cross-country analysis. Where data for a cross-country analysis comes from multiple sources, data for one specific country is obtained from the same dataset. Also the amount of observations increase with a focus on districts instead of countries. The importance of using case studies to analyze the relationship between trade and human capital investments is further highlighted in Arora and Vamvakidis (2005) and Kneller, Morgan and Kanchanahatakij (2008). They argue that trade openness can have different outcomes for specific countries and demonstrate a general positive effect of trade liberalization and economic growth, but show either positive, negative and zero effects for individual countries.

In this study the case of Indonesia is examined, since Indonesia is a lower middle-income country with a lot of unskilled workers. Indonesia started liberalizing during the mid-1980s in order to ease import and export procedures, especially to promote non-oil exports (Miranti, 2010). When Indonesia made a commitment on multilateral agreements to the World Trade Organization (WTO) in 1995 both output and input tariffs decreased substantially. Average output tariffs fell from 22 percent to 8 percent and average input tariffs fell from 14 to 6 percent in the period from 1991 to 2000. However, there were large differences between different sectors and industries (Amiti & Cameron, 2012). Another consequence of the liberalization was a changing labor market due to deregulation. The manufacture and construction sector grew rapidly while the agricultural sector was a decreasing supplier of jobs, and real wages were rising (Manning, 2000).

Just before the liberalization period started in the mid-1980s, large investments in the building of schools were made. During this period more than 61,000 primary schools were built which increased the total enrollment rate from 69 percent to 83 percent and led to a substantial increase of the amount of more skilled workers from 10.6 percent in 1986 to 23.7 percent in 1999 (Duflo, 2001; Suryahadi, 2001).

Another important unique aspect in this study will be the use of value added export data instead of data on gross exports. The data on value added exports used in this study are derived from global input-output tables and are calculated as the value the country added to the exported product, instead of the gross value of a product that crosses the border, to overcome double counting. With the use of value added exports, instead of gross exports, the contribution of services as well as the role of intermediate goods can be better highlighted which are especially important in exports in upcoming economies like Indonesia. Value added trade also gives more insight in the effect of trade in intermediate goods on both the income and employment effects of trade (Organization for Economic Cooperation and Development; World Trade Organization, 2013).

From a policy perspective this study is relevant for Indonesia. With more insight in the export composition of the country and the relation to educational attainment, policy makers can respond to the drivers of education and stimulate the development process. From a scientific perspective, this study contributes to the literature by specifically focussing on a large middle-income country and uses value added export data. Since this data is only available since recent years it has not frequently been used yet.

In order to provide insights in the relation between the export composition of Indonesia and educational attainment, the following research question will be answered:
What is the relationship between the composition of value added exports and educational attainment in the case of Indonesia, and how can it be explained?

This question will be answered by using a multivariate regression analysis comparing districts in Indonesia. Where Blanchard and Olney (2017) compare 102 countries, this study will use 401 Indonesian districts. Employment data and data on value added exports will be combined to create measures of both high- and low skill-intensive exports for each district. Following Edmonds et al. (2010) an industry and district specific employment share in an initial year will be used to calculate the district-specific employment weighted sum of industry-specific national exports. Together with the use of a fixed effects model unobserved heterogeneity is eliminated. Data on employment and educational attainment will be obtained from national surveys in Indonesia, and data on value added exports are provided by the World Trade Organization.

The remainder of this research will be structured as follows: In the following section, recent literature is summarized and the theoretical framework is presented. After which, in Section 3, an explanation of the data and the empirical strategy is presented. Thereafter, Section 4 presents the results and Section 5 will discuss the threats and limitations of the research. Finally, Section 6 concludes.

2. Theoretical framework

This section presents different theories on incentives to invest in education. The section first presents the general theory of returns to education, followed by the effect of labor market opportunities and wages on schooling decisions. Related to H-O theory, comparative advantage can be a driving factor behind educational investments and underscores the importance of the composition of exports. However, a change in the export pattern can also have an effect on education via the income effect which will be highlighted in the last part of this section.

2.1 Internal rate of return on schooling

The theory on the rate of return on schooling gives an explanation on how individuals make the decision to invest in human capital. Figure 1 illustrates the private returns on schooling. Two streams of earnings are shown, one for individuals who only complete primary school and one for individuals who complete secondary school. It is assumed that all children go to primary school until age eleven where individuals who follow a secondary education stay in school until the age of eighteen. To keep the model simple it is assumed that individuals in school do not work, and therefore have no earnings while in school. The secondary earnings line in the figure below shows what individuals with a completed secondary education earn beyond what they would earn when they only followed a primary education (Perkins, Radelet, Lindauer, & Block, 2013).

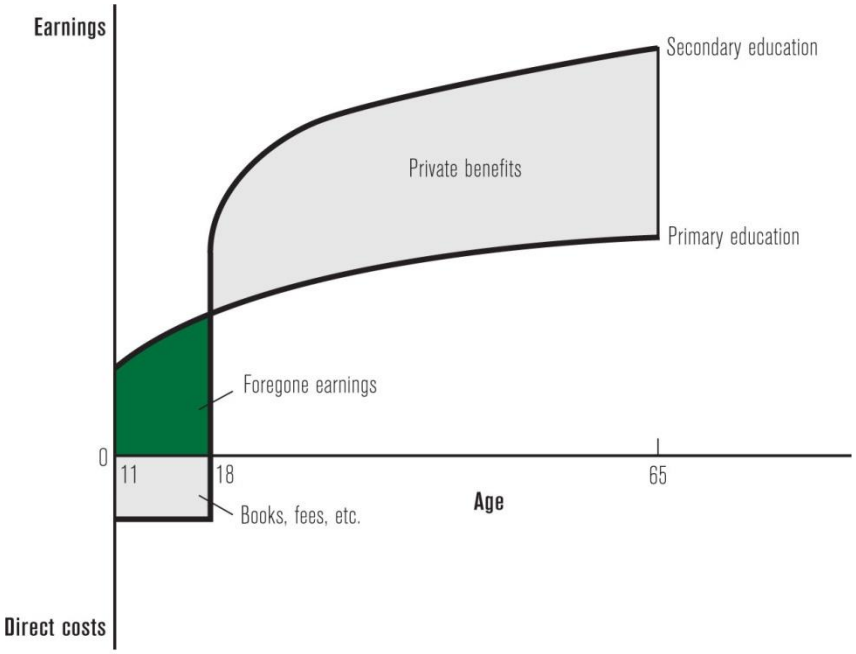


Figure 1 Private returns to schooling (Perkins, Radelet, Lindauer, & Block, 2013)

There are not only benefits of schooling, but also costs involved when individuals stay in school. These include both the direct costs, e.g. school books and uniforms, but also indirect costs of foregone earnings, because an individual in school is not working. The decision to remain in school is therefore a trade-off between the costs and benefits of schooling. Because investments have a discounted value in the future, the present value of the costs and benefits of schooling are the total costs and benefits divided by the interest rate which discounts future costs and benefits. When

comparing the costs with the benefits it is considered if an investment in schooling is worthwhile. The internal rate of return, *r*, can be found such that:

$$\sum_{t=1}^{n}(B_t - C_t)/(1+r)^t = 0$$

which equates the present value of the benefits to the present value of the costs over an individual's *n* years of working. In this equation B_t equals the benefits in year *t*, C_t equals the costs in year *t*, both direct and indirect costs, and *r* is the derived interest rate (Perkins, Radelet, Lindauer, & Block, 2013).

An example of Duflo (2001) shows the relationship between school construction on learning and wages. Based on a natural experiment in Indonesia where an increase in school buildings led to an increase of average years of education on primary school level, this could indicate an increase of the returns to education. The effect also suggested an increase in wages in the long-run as well.

The internal rate of return of schooling corresponds to the theory of Findlay and Kierzkowski (1983), which states that an individual can choose between no education and immediate earn the wage for unskilled labor, or invest in human capital and after a fixed length of time earn the wage for skilled labor. In an economy with two goods, one is always the skill-intensive good and the other the less skill-intensive good. The wage for each produced good is fully determined by the given product price, which is exogenously determined by the world market. For a newborn the present value of education will decide whether this student will acquire an education or will become an unskilled worker.

However, some reservations could be made on this theory. According to Harmon, Oosterbeek and Walker (2003) there can be differences in discount rates between parents. Wealthier parents may have lower discount rates for schooling and their children may 'inherit' some of this. Lower income groups have lower returns to schooling then higher income groups, so this can imply that individuals with higher discount rates are less likely to invest in human capital. Likewise, Becker (1962) shows a positive correlation between ability and investment in education and indicates that the incentive for persons with a higher ability to invest in themselves is higher than for less able persons. This also corresponds with the findings of Priyambada, Suryahadi and Sumarto (2005) which state that higher educated household heads are more likely to send their children to school.

2.2 Labor market opportunities and wages on schooling

Looking at the demand side of education, the benefits of schooling are directly related to the labor opportunities and wages after graduation. When there is high unemployment among graduates, the returns to education are low and this will decrease the incentives to invest in human capital. In this way schooling is not a guarantee for a higher income in the future (Perkins, Radelet, Lindauer, & Block, 2013). Along with labor market opportunities, wages also have a significant effect on the demand for education. According to the empirical analysis of Fredriksson (1997) fluctuations in economic incentives provide an explanation to varying university enrollment rates. This enrollment will decline if there is a reduction in the university wage premium. When wages go up again, enrollment will go up either.

The demand for education can be related to the standard Heckscher-Ohlin (H-O) trade theory, which states that in the presence of trade, countries will specialize in the products in which they have a comparative advantage. This comparative advantage depends on the factor endowments of both trading countries and implies that a country will export goods in which they have a comparative advantage and will import goods that uses the relative scarce factor of the country (Krugman, Obstfeld, & Melitz, 2012). According to Findlay and Kierzkowski (1983) trade affects prices of relative goods, which in turn shapes relative wages via the Stolper-Samuelson theorem and therefore influences schooling decisions. Figure 2 below shows the relationship between goods prices, factor prices and factor proportions. The right panel shows the relationship between relative wages and the amount of skilled and unskilled workers an industry chooses to hire. The left panel shows the Stolper-Samuelson theorem, where an increase of the relative price of a skill-intensitve good (P1) will increase the relative wages of skilled workers. With trade, the relative price and wages of the skill-intensive good will rise in the skilled labor abundant country, increasing the demand for education. The opposite will happen in the less skilled labor abundant country, where the relative wage of skilled workers will decrease, and lower the demand for education.

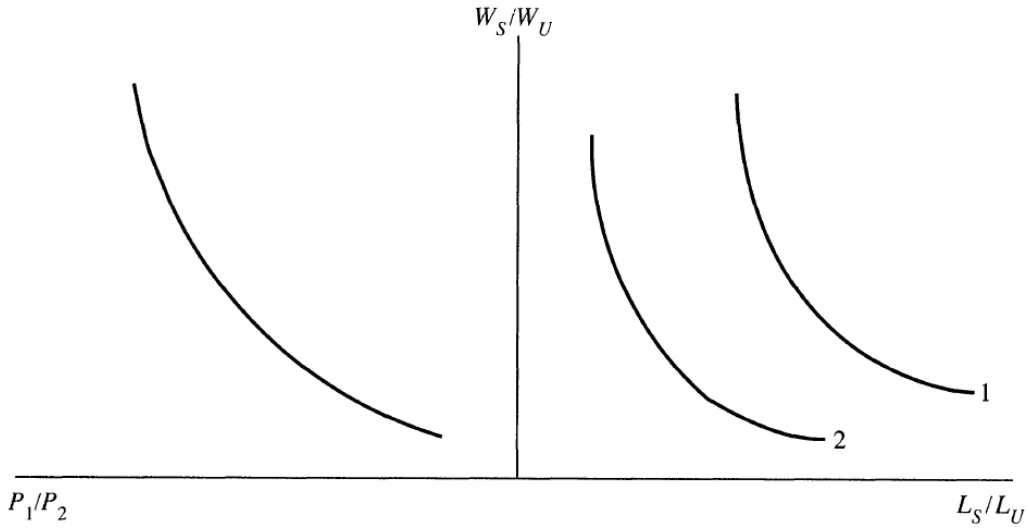


Figure 2 Relationship between goods prices, factor prices and factor proportions

When taking into account trade in intermediates, another relationship between labor demand and wages can be described. This theory, based on Feenstra and Hanson (2001) and Feenstra (2004), looks at trade within industries, rather than between industries. In this case, outsourcing of less skill-intensive activities for intermediates by a skilled labor abundant country to a less skilled labor abundant country affects demand and wages in both countries. The effect of lowering the relative demand for unskilled labor in the skilled labor abundant country increases the relative demand for skilled labor and therefore the relative wages for skilled labor. The same happens in the less skilled labor abundant country, since the activities that are outsourced by the skilled labor abundant country are more skill intensive than any activities previously done in the less skilled labor abundant country. So, this production shift has the effect of higher demand for skilled labor that increases the relative demand and wages for skilled labor. This increase in relative demand for skilled labor in both countries implies an increase of relative wages for skilled workers in both countries. According to this theory the demand for education will go up in both countries since the average skill level increases in

both countries and the higher relative wages of skilled workers affect the incentives to invest in human capital.

Another result of the specialization in less skilled products is found by Galor and Mountford (2008) who conclude that in non-industrial nations the gains from trade are invested in population growth, where in industrial national these gains are invested in education. Because there is more demand for unskilled labor the relative wages of unskilled labor go up and parents have more time and income to raise children. However, no investments have to be made in education since the demand for skilled labor is very low. In more advanced economies, more skilled labor is demanded and parents need to invest more to raise educated children. So, with trade there will be lower population growth in the technology advanced country, and higher population growth in the technology less advanced country, what increases their relative abundance of unskilled labor.

2.3 Income effects on schooling

Besides labor market and wage effects, trade can also generate income effects that can influence schooling decisions. Edmonds et al. (2010) show that a reduction in education caused by a loss of protection due to a tariff decline, seem to be driven by falling incomes of parents. Because of a decrease in income, parents save on schooling costs which results in lower schooling rates. Contrarily, Edmonds and Pavcnik (2005) show that a higher relative price of an export product lead to lower child labor in Vietnam, where income effects play an important role. The latter applies under the assumption that child labor is a bad in parental preferences. Also Kis-Katos and Sparrow (2011) find that trade liberalization in Indonesia led to a decrease in child labor among children between 10-15 years old. The income effects were likely the dominating effects, since the districts that experienced the largest tariff declines also experienced the largest reduction in poverty. This result will have effects in the long run on the investments in human capital. Especially since poorer households are better off with the trade liberalization, due to their higher income, more investments can be made in education for their children.

This is in line with the findings of Glewwe and Jacoby (2004) that state that school enrollment increased more within households that experienced greater wealth increases. As well as with Thomas et al. (2004) who conclude that during the economic crisis in Indonesia between 1997 and 1998, households that faced budget allocation choices, reduced schooling expenses on the younger children within the household, while protecting these expenses on older children. So, this implies that economic growth and human capital accumulation are positively related, where higher economic growth leads to a higher demand for human capital. Since higher exports, regardless of type, could lead to economic growth, this could also generate an income effect by increasing GDP. Blanchard and Olney (2017) control for this effect by including GDP of a country, and conclude that GDP has a significant effect on educational attainment, but it does not significantly alter the low and high skilled coefficients of interest. Since this research only uses one country, instead of multiple as in Blanchard and Olney (2017), an aggregated variable on district level of household expenditures will be used to control for the income effect.

2.4 Hypotheses

Based on the theoretical framework it is expected that an increase of exports of less skilled labor intensive value added products will have a negative influence on educational attainment, where an increase of exports of skilled labor intensive value added products will have a positive influence. However, when taking into account the model of Feenstra and Hanson (2001) and Feenstra (2004) an increase of exports could lead to investments in education in both skilled labor abundant and less skilled labor abundant countries. This also applies to the income effects on schooling, where an increase of exports could lead to higher incomes and more human capital investments.

3. Methodology

This section first presents the study site and data which will be used. Second, the empirical strategy outlines a classification of export products and the baseline specification.

3.1 Study site and data

Data on educational attainment comes from The National Socio-Economic Survey (Susenas) from the years 2006 and 2011. Susenas is a series of large-scale multi-purpose socioeconomic surveys which are fielded every year since 1963. Since 1993 these surveys cover a representative sample of the Indonesian population. The two Susenas surveys used for this study consists both of more than 200.000 households which are stratified and represent more than 400 districts. Questions on rural/urban status, age, gender, educational attainment of the household head, amount of household members and expenditures per capita are used as control variables. Part of the data needed for the PPI index score, used for the robustness check on income, are also from the Susenas dataset.

Following Blanchard and Olney (2017), the analysis focusses on young individuals, aged 10-30 years old, since this demographic group is most sensitive to labor market changes and can more easily make educational decisions. They are more sensitive to economic changes and have a full working career in which they can benefit from the extra schooling which will increase the internal rate of return. It is assumed that educational attainment of an individual over the age of 25 does not change. According to Barro and Lee's (2013) dataset (conducted in Indonesia in 1995 of individuals over 25 years), around 40 percent had no schooling, almost 20 percent had finished primary schooling, 10 percent finished secondary schooling and only 1.6 percent finished tertiary schooling. This led to an average years of total schooling of 4.21 years, compared to an average of 7.26 years of total schooling in 2010. In this year only 9.5 percent had no schooling at all, 30 percent finished primary school, 20 percent finished secondary school and 5 percent completed their tertiary education. Because of a lack of data on years of schooling in the survey, educational attainment will be measured according to whether an individual followed no, primary, lower secondary, higher secondary and tertiary schooling. The standard classification applied by Susenas fits the Indonesian schooling system and implies six years of primary schooling, three years of lower secondary schooling, three years of higher secondary schooling and four years of tertiary schooling as is depicted in Figure 3. Primary and lower secondary schooling are mandatory in Indonesia and will be classified as low education level. Higher secondary and tertiary schooling will be classified as high education level. However, this classification is a bit arbitrary when looking at the results which show an increase in in the attainment of lower secondary schooling when increasing high skilled exports.

Data on employment is from the Inter-Censal Population Survey (Supas) from the year 2005. This survey consists of data on over a million individuals and contains detailed information on the working status of persons older than 10. The question on main industry of work is recoded to match the industries from the value added trade dataset and is used to compute district and industry specific employment weights. These employment weights are determined before the analyzed period and therefore it can be assumed that changes in the employment structure that are the result of a change in value added exports do not affect our measure of changes in low and high skilled exports.

After this measure is computed the districts used from the Supas data are matched with those used in the Susenas.

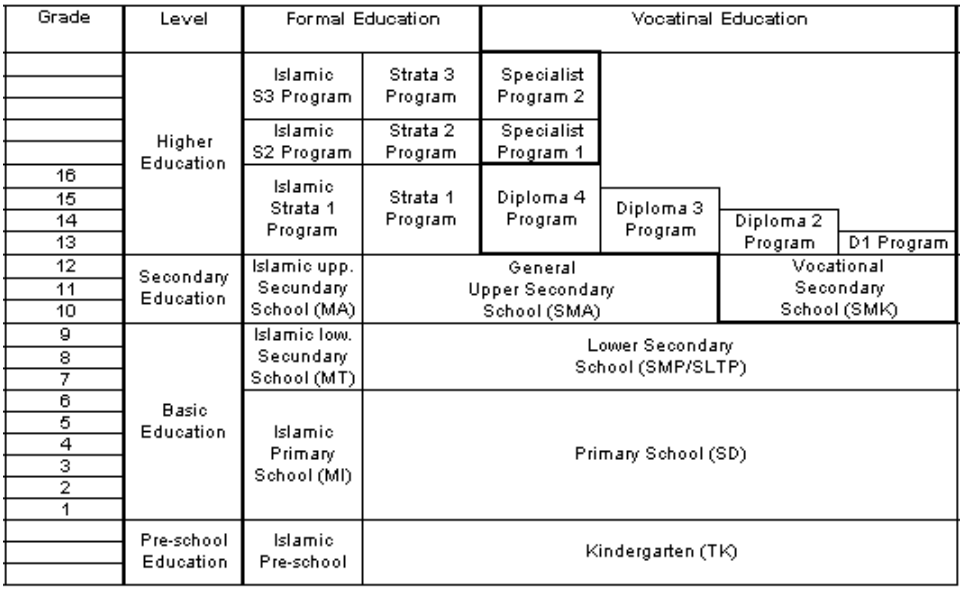


Figure 3 School system in Indonesia

For data on the value added content of exports of Indonesia the OECD-WTO dataset on domestic value added content of gross exports is used. This dataset shows value added exports from Indonesia for different sectors within the economy. There are 33 sectors, of which one sector in agriculture, seventeen sectors are in manufacturing and fifteen sectors are in services. The value added exports consist of any value added in the domestic economy, not just by the exporting industry. Since value added trade data is only available for recent years and to match with the other dataset the study will cover the years 2006 and 2011.

3.2 Empirical strategy

3.2.1 Classification of skilled and unskilled labor intensive export products

For this study the same classification system is used as in Blanchard and Olney (2017). UNCTAD uses the Standard International Trade Classification (SITC) Revision 3 to classify export products as low skill- or high skill-intensive products. SITC codes 0, 1, 2 and 4 are classified as primary commodities and SITC codes 5 to 8 are classified as manufactured goods[1]. In order to classify products into different categories based on the skill-, technology-, and capital-intensities, UNCTAD developed six different product groups. These six different levels consists of: Non-fuel primary commodities (A); Labor-intensive and resource-intensive manufactures (B); Low skill- and technology-intensive manufactures (C); Medium skill- and technology-intensive manufactures (D); High skill- and technology-intensive manufactures (E); and Unclassified products (F) (United Nations, 2002)[2]. As stated in Appendix A of Blanchard and Olney (2017), all agricultural products are classified by

[1] See Appendix 1 for an overview of the general SITC classification.
[2] See Appendix 2 for an overview of the UNCTAD classification of product groups B,C,D and E

UNCTAD as non-fuel primary commodities and therefore the products belonging to SITC codes 0, 1, 2 and 4 are treated as homogeneous and all belong to group A. Manufactured products can be classified as low skill-intensive and high skill-intensive using the levels mentioned above and these do not correspond to a general SITC code. Using 3-digit SITC codes, low skill-intensive products primarily consist of 'non-fuel primary commodities', 'resource-intensive manufactures' and 'mineral fuels', and high skill-intensive products primarily consist of 'technology-intensive manufacturing' as also stated in the appendix of Blanchard and Olney (2017). So, in this research the levels A, B and C will be classified as low skill-intensive export goods, and the levels D and E will be classified as high skill-intensive export goods.

For the classification of the services sector the BPM6 classification is used, which defines trade in services into 12 sectors (United Nations, 2011)[3]. According to Loungani et al. (2017) and Seyoum (2007) traditional services sectors still need physical presence where modern services do not. Therefore, sector 1 to 5 are classified as low skill-intensive exports and sector 6 to 12 are classified as high skill-intensive exports.

The final division of the 33 value added export sectors into low and high skill-intensive sectors is shown in Appendix 4.

3.2.2 Measuring exports at the local level

To measure the effect of high and low skill-intensive exports on educational attainment a measure needs to be constructed of the degree of high and low skill-intensive exports at the regency level. Following Edmonds et al. (2010) the export composition of a district is measured as the interaction between the share of a district's population employed by various industries in some initial year and total Indonesian exports in these industries. For each industry *i* in district *d* an employment share is measured using Indonesian employment data of 2005 to create industry employment weights. The district export composition at time *t* is the district-specific employment weighted sum of industry-specific national exports:

$$lnexports_{d,t} = ln(\sum_{i}^{1,\dots N} \frac{emp_{i,d}^{2005}}{emp_{d}^{2005}} \times exports_{i,t}) \quad (1)$$

In order to measure high and low skill-intensive exports the classification of export products outlined above is used. Every export product is assigned to one of the categories and the export composition measure in (1) can be divided in high and low skill-intensive exports:

$$lnexports_{d,t}^{LS} = ln(\sum_{i}^{1,\dots N_{LS}} \frac{emp_{i,d}^{2005}}{emp_{d}^{2005}} \times exports_{i,t}) \quad (2)$$

$$lnexports_{d,t}^{HS} = \ln(\sum_{i}^{1,\dots N_{HS}} \frac{emp_{i,d}^{2005}}{emp_{d}^{2005}} \times exports_{i,t}) \quad (3)$$

[3] See Appendix 3 for an overview of the BPM6 classification of services

3.2.3 Baseline specification

The outcome variable will be measured at district level at two points in time. $y_{d,t}$ is an indicator for educational attainment (no formal, primary, lower secondary, higher secondary and tertiary schooling) in district *d* at time *t*. The impact of the independent variables will be assessed on followed no formal, primary, lower and higher secondary and tertiary schooling. To test if the composition of exports affects educational attainment the following base specification is used:

$$y_{d,t} = \alpha_d + \beta_1 lnexports_{d,t}^{LS} + \beta_2 lnexports_{d,t}^{HS} + \gamma X_{d,t} + \delta_d + \tau_t + \varepsilon_{d,t} \quad (4)$$

$\beta_1$and $\beta_2$are the main coefficients of interest and capture the correlation between low and high skill-intensive exports and educational attainment. The vector $X_{d,t}$ contains control variables for rural/urban status, age, gender, educational attainment of the household head, household size and expenditures as a proxy for income. These control variables are based on the model of Kobiane, et al. (2004), which provides a framework for analysing education data from household surveys and censuses, and are all averaged at district level using individual and household specific weights. Adding district fixed effects (δ_d) controls for time-invariant heterogeneity at the district level, while time, τ_t, fixed effects control for all trends in education that affect Indonesia as a whole. $\varepsilon_{d,t}$ is the error term with $\varepsilon \sim N(0, \sigma)$. The standard errors are clustered at district level to control for the effect that the standard errors are not fully independent, since the same districts are used in both years.

At first, the analysis will be done with the two main variables of interest, where after the control variables will be included. Then the analysis will be repeated for different age groups in order to assess the correlations in more detail. Considering underlying trends that influence both educational attainment and the amount of low and high skilled exports, initial conditions on the share of workers in high and low skilled sectors are taken into account besides all other control variables. After which, the age groups are combined with the initial conditions. Finally, robustness checks are done on income and with a changed classification of exports. Since measuring income is hard, and can cause endogeneity problems with trade, a robustness check is done on income, where the PPI index is included instead of the expenditures variable. The robustness check on the classification of exports is done to check if the results are sensitive for the classification of high and low skilled exports.

According to the baseline specification, the main hypotheses are that β_1 is negatively correlated with the outcome variable on followed tertiary and higher secondary schooling, $\beta_1 < 0$, but can be positively correlated with followed no formal, primary and lower secondary schooling, $\beta_1 > 0$. Contrarily, β_2 is positively correlated with the outcome variable on followed tertiary and higher secondary schooling, $\beta_2 > 0$, but negatively related with followed no formal, primary and lower secondary schooling, $\beta_2 < 0$. However, when there is a positive income effect of trade on the demand for education, both coefficients will be larger than zero, $\beta_1, \beta_2 > 0$ for the outcome variable on followed tertiary and higher secondary schooling, and lower for followed no formal, primary and lower secondary schooling, $\beta_1, \beta_2 < 0$.

4. Empirical results

This section first presents descriptive and summary statistics to show the correlation between the variables. In the following sub-section the main findings of the relationship between export composition and educational attainment are demonstrated first, followed up by more extensive analysis with initial conditions and specialized on certain age groups. The subsequent sub-section pursues robustness checks to verify the results.

4.1 Descriptive statistics

Figure 4 shows the growth of the total amount of exports and the change in the share of exports per industry over the years 2006-2011. The size of each circle depicts the weighted amount of total export and only the sectors that had the biggest or lowest growth are highlighted. The biggest export sector is mining which contained around 25% of the total export share in 2006 and around 30% in 2011. The second biggest export sector is retail, with a share of 14% in both years respectively. On the third place come food products, with a share growth of 48% increased exports from 7 to 10% in 2011. All other industries had a share lower than 10% of total exports in both years and, as can be seen from the figure, a lot of these industries did not have as high as an influence on total exports as the sectors mentioned above. Where more than half of the industries had a negative share growth of total exports, only the export of wood experienced a fall in total amount exported. The figure also shows that industries with a higher total amount of exports also experienced the highest total growth and increase in share of exports. The three biggest exports sectors (mining, retail and food products), are all classified as low skilled export products.

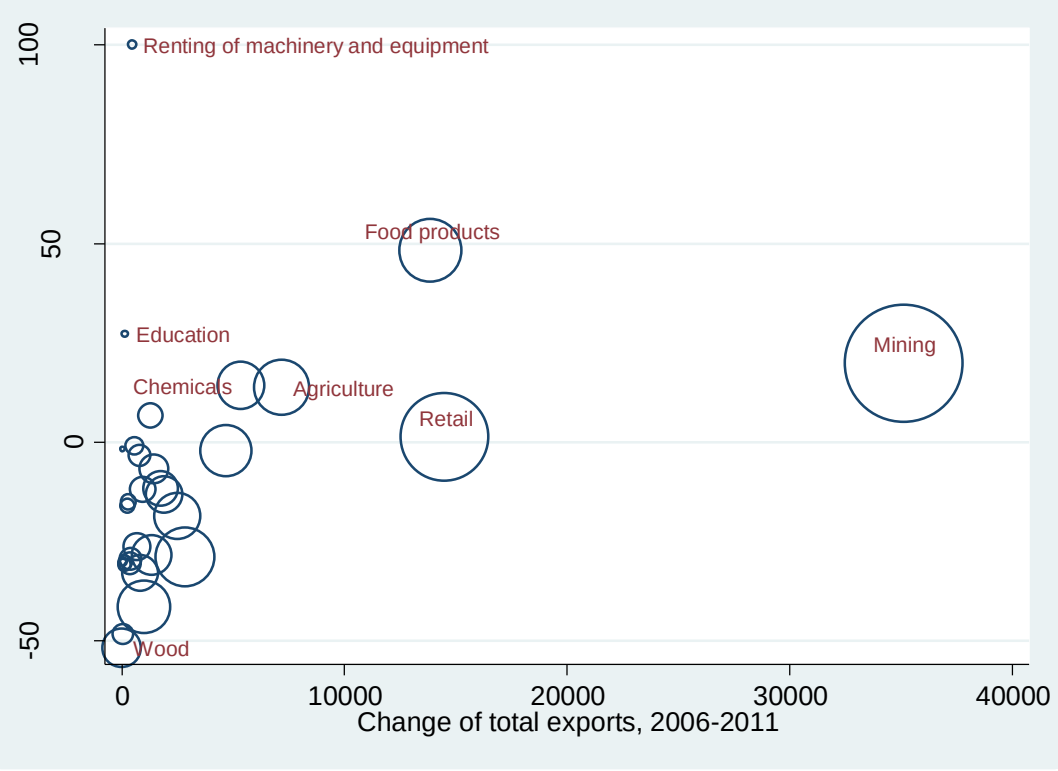


Figure 4 Change of total and share of exports

Panel A in Table 1 reports descriptive statistics for the highest followed education level and the low and high skilled exports variables for the years 2006 and 2011. Besides the mean value of each variable, the number of observations, standard deviation and minimum and maximum values are also shown. From the table it becomes clear that the share of 10-30-year-olds with no followed formal education decreased a little bit to 2 percent of the total population. However, this share ranged from zero percent to almost 75 percent between the districts in 2006, and from zero to 65 percent in 2011. Also, for followed primary education there is a small decrease to 34 percent of the population between 10 and 30 years old, but also this share has a big range between districts in both years. The share of lower secondary education increased slightly, and both higher secondary and tertiary education increased over the years. For tertiary education the minimum value stayed zero for both years, so there were still districts in which no 10-30-year-olds followed tertiary education. However, this is not very surprising, since this study only covers five years. In opposition, the maximum value did increase for tertiary education, what either indicates a rise of 10-30-year-olds who followed tertiary education, or a migration shift of 10-30-year-olds with tertiary education. Also the minimum values for the share of persons who followed lower and higher secondary education increased, and this share decreased for primary education. These results indicate that 10-30-year-olds became a little bit more educated over the years 2006-2011. This can also be concluded by the lower share of no formal and primary education which can be an indication for higher enrollment rates for lower and higher secondary and tertiary education. Both the amount of low and high skilled exports increased. However, there is a big difference between the amount of low and high skilled exports, where low skilled exports take care of the biggest part of total exports.

Table 1 Summary statistics for 2006 and 2011

Panel A: Summary statistics education level and low- and high skilled exports

Variable	Obs	Mean	Std. Dev.	Min	Max
2006					
Share of education level					
No formal education	439	.024	.067	0	.745
Primary education	439	.384	.119	.125	.752
Lower secondary education	439	.276	.052	.047	.430
Higher secondary education	439	.261	.097	.021	.543
Tertiary education	439	.056	.050	0	.365
Amount of exports (ln)					
Low skilled exports	415	39.429	8.867	8.561	58.820
High skilled exports	415	4.148	5.993	-6.365	26.901
2011					
Share of education level:					
No formal education	439	.020	.067	0	.651
Primary education	439	.344	.103	.117	.670
Lower secondary education	439	.280	.053	.081	.441
Higher secondary education	439	.273	.080	.047	.509
Tertiary education	439	.084	.061	0	.411

Amount of exports (ln)					
Low skilled exports	415	45.460	10.256	9.412	67.969
High skilled exports	415	8.318	7.429	-2.093	35.433

Panel B: Summary statistics on differences in education level and low- and high skilled exports

Variable	Obs	Mean	Std. Dev.	Min	Max
Share of education level					
Δ No formal education	439	-.004	.025	-.231	.232
Δ Primary education	439	-.040	.052	-.249	.140
Δ Lower secondary education	439	.004	.036	-.115	.133
Δ Higher secondary education	439	.012	.044	-.152	.221
Δ Tertiary education	439	.028	.029	-.173	.158
Amount of exports (ln)					
Δ Low skilled exports	415	6.030	1.537	.851	9.150
Δ High skilled exports	415	4.169	1.858	0	8.894

Panel B in Table 1 shows the percent changes of the outcome variables and the coefficients of interest over the years 2006-2011. As already mentioned above, the total share of 10-30-year-olds who followed no formal or only primary education has both decreased with 0.004 and 0.040 percentage points, where the share of lower and higher secondary and tertiary education have increased. Both low and high skilled value added exports have increased, where the growth in low skilled exports exceeded the growth in high skilled exports.

To see where the changes within Indonesia in followed education level are highest, five maps of each education level are shown below. From Table 1 it became clear that there is an average decrease of followed no formal and primary education over the years 2006-2011. From Figure 5 and Figure 6 it can be seen that no specific region has outstanding high or low changes in the share of 10-30 year olds that either followed no formal or only primary education. The four biggest islands (almost) all have a moderate positive or negative growth for both no formal and primary education, and only the most eastern island shows a few districts that have a more than average growth and decline rate. However, this is only the case for followed no formal education. For followed primary education there are more districts that show negative growth compared to followed no formal education. This is in accordance with the results in Table 1, since followed primary education shows a bigger decline over the years.

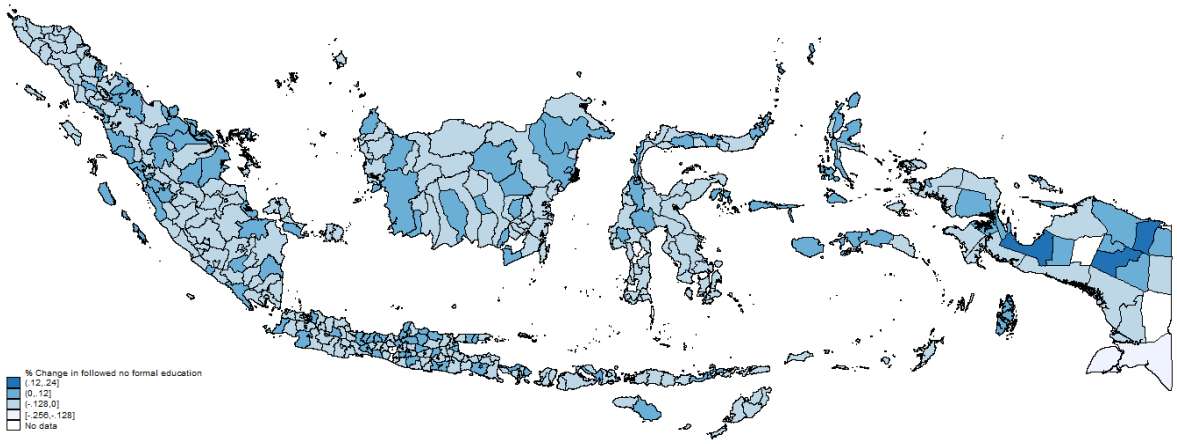


Figure 5 % Change in followed no formal education per district 2006-2011

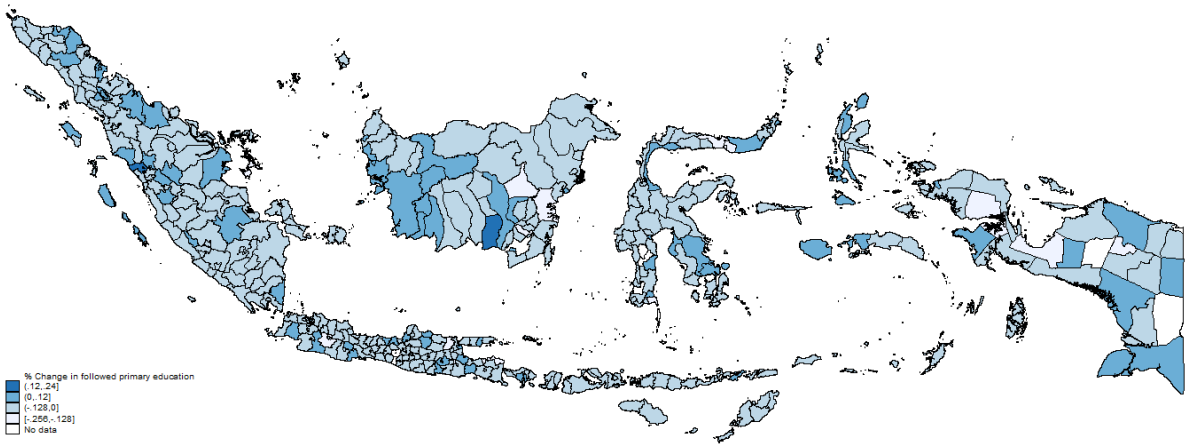


Figure 6 % Change in followed primary education per dsitrict 2006-2011

For lower and higher secondary schooling, the results are quite similar to these of no formal and primary education. According to Figure 7 around half of the districts shows an average negative change. The other half shows an average positive change. Compared to Figure 8 the islands of Sumatra and Kalimantan are interesting to look at. Most districts on these islands that show a negative change of lower secondary education in Figure 7 show a positive change of higher secondary education in Figure 8 and the other way around. This suggest that more 10-30-year-olds decide to follow higher secondary education. Figure 9 shows that almost all districts had an average positive change in the share of 10-30-year-olds that followed tertiary education. This is in accordance with panel B of Table 1, which showed the highest increase of the share of 10-30-year-olds in this education level.

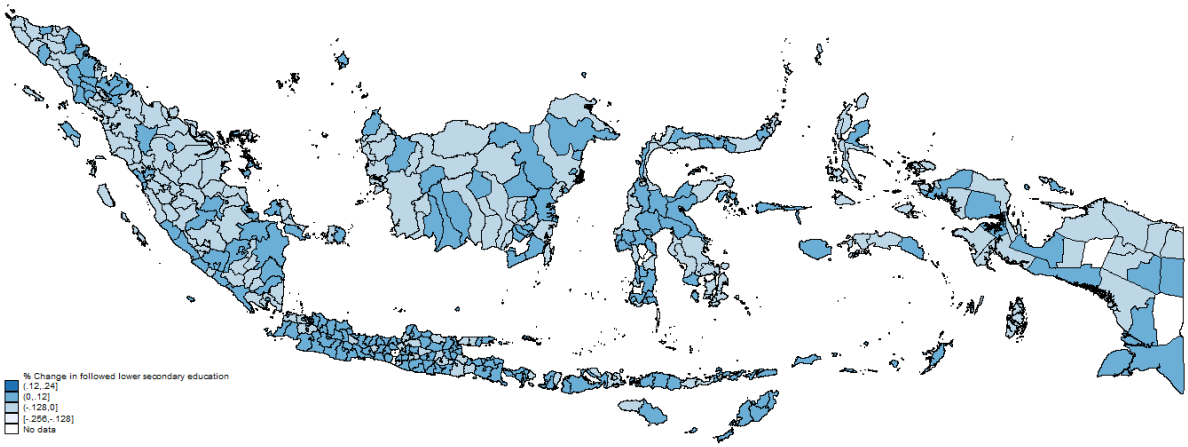


Figure 7 % Change in followed lower secondary education per district 2006-2011

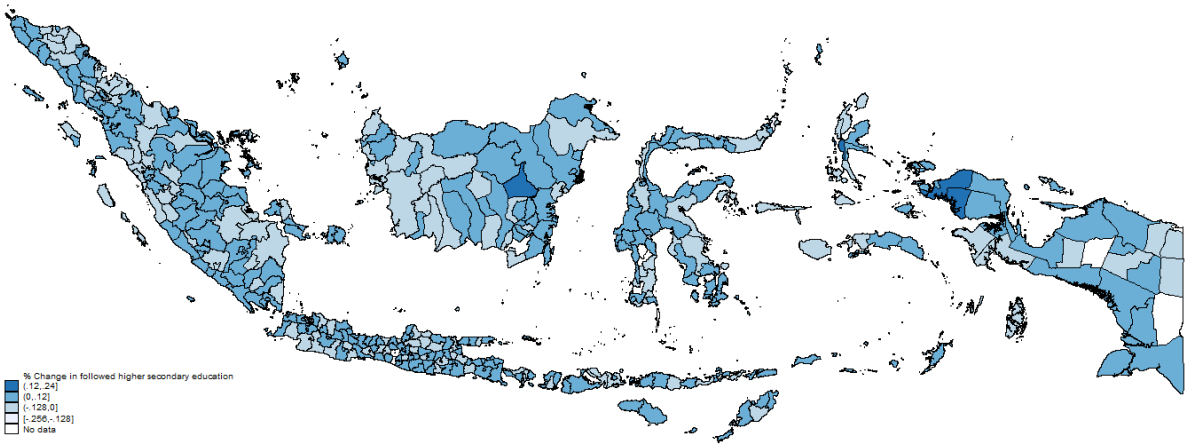


Figure 8 % Change in followed higher secondary education per district 2006-2011

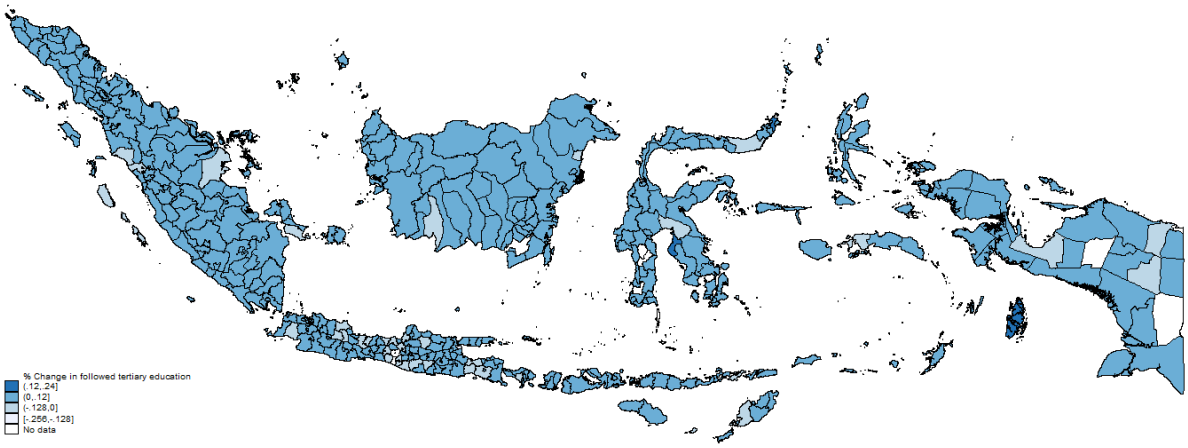
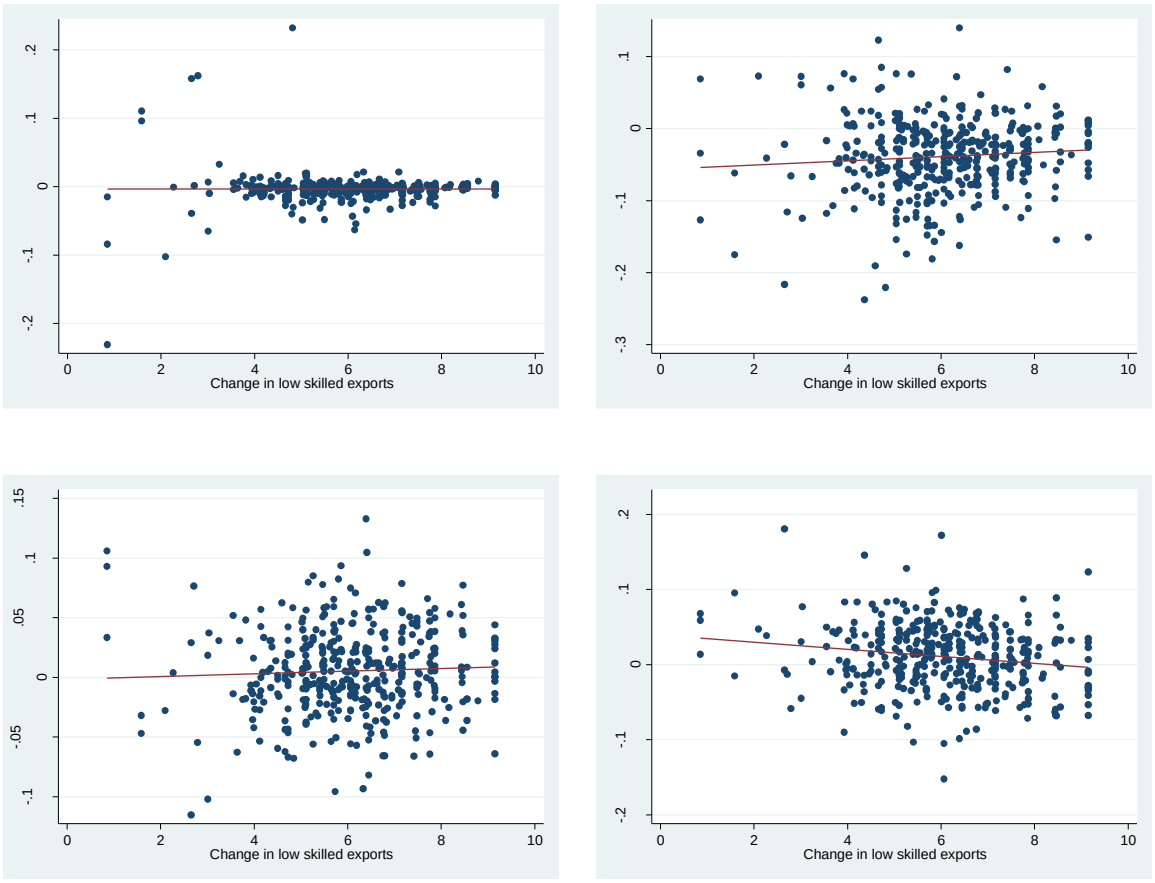


Figure 9 % Change in followed tertiary education per district 2006-2011

In order to see if there is a relationship between education level and exports, Figure 10 and Figure 11 each plot change in education level against the change of low and high skilled exports. When using this differenced data, the importance of a panel setting is taken into account, since higher developed districts can have a higher education level. In the upper left panel of Figure 10 no relationship can be

seen between a change in low skilled exports and the change in no formal education. The panel to the right shows a small positive correlation between low skilled exports and followed primary education. However, the correlation indicates that for a higher change in low skilled exports, the less negative is the change in followed primary education. So, when low skilled exports increase with a higher amount, the smaller the decrease of 10-30-year-olds who only followed primary education. This is in accordance with the theoretical predictions. In the lower left panel the relationship between lower secondary education and low skilled exports is not very clear, but this is different in the lower right panel, where a negative relationship between higher secondary education and low skilled exports is revealed. However, also this correlation shows negative growth for higher increases in low skilled exports. Districts with a higher increase in low skilled exports experience a larger decrease in the share of 10-30-year-olds who followed higher secondary education, what is also in line with the predictions from theory. The lowest panel in the middle shows the correlation between low skilled exports and followed tertiary education. Again, this correlation is not very clear, but can be interpreted as a small positive correlation. If this is indeed the case, this correlation is the only one which is not consistent with the theoretical prediction.

Education and low skill exports differences over years



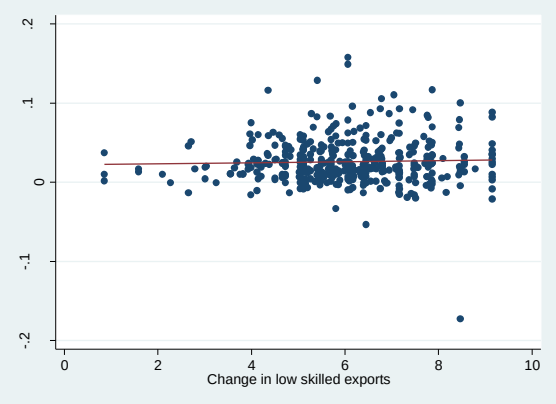
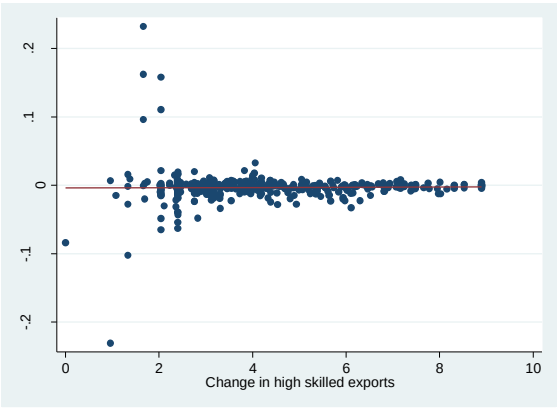
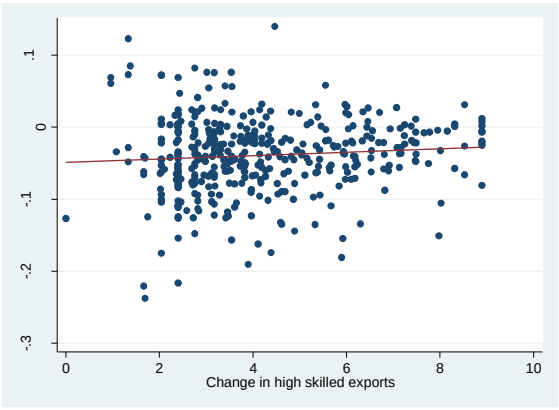


Figure 10 Education and low skill exports differences over years
Every panel plots the change in education level agianst the change in low skilled exports over the years 2006-2011.

Exactly the same happens with all correlations in Figure 11. The upper left panel shows no correlation between high skilled exports and no formal education. The upper right panel again shows a small positive correlation between high skilled exports and followed primary education. However, also this correlation is getting less negative when high skilled exports increase. The correlation between high skilled exports and lower secondary education is not very clear and this changes to a negative correlation for higher secondary education. Also for this correlation, higher increases in high skilled exports lead to higher negative growth rates for followed higher secondary education of 10-30-year-olds. The lowest panel in the middle is not very clear, but can be interpreted as a small positive correlation between high skilled exports and followed tertiary education. Where this correlation was the only one that was not in accordance with the theoretical predictions with low skilled exports, in the case of high skilled exports this is the only correlation that is in line with the theoretical prediction.

Education and high skill exports differences over years





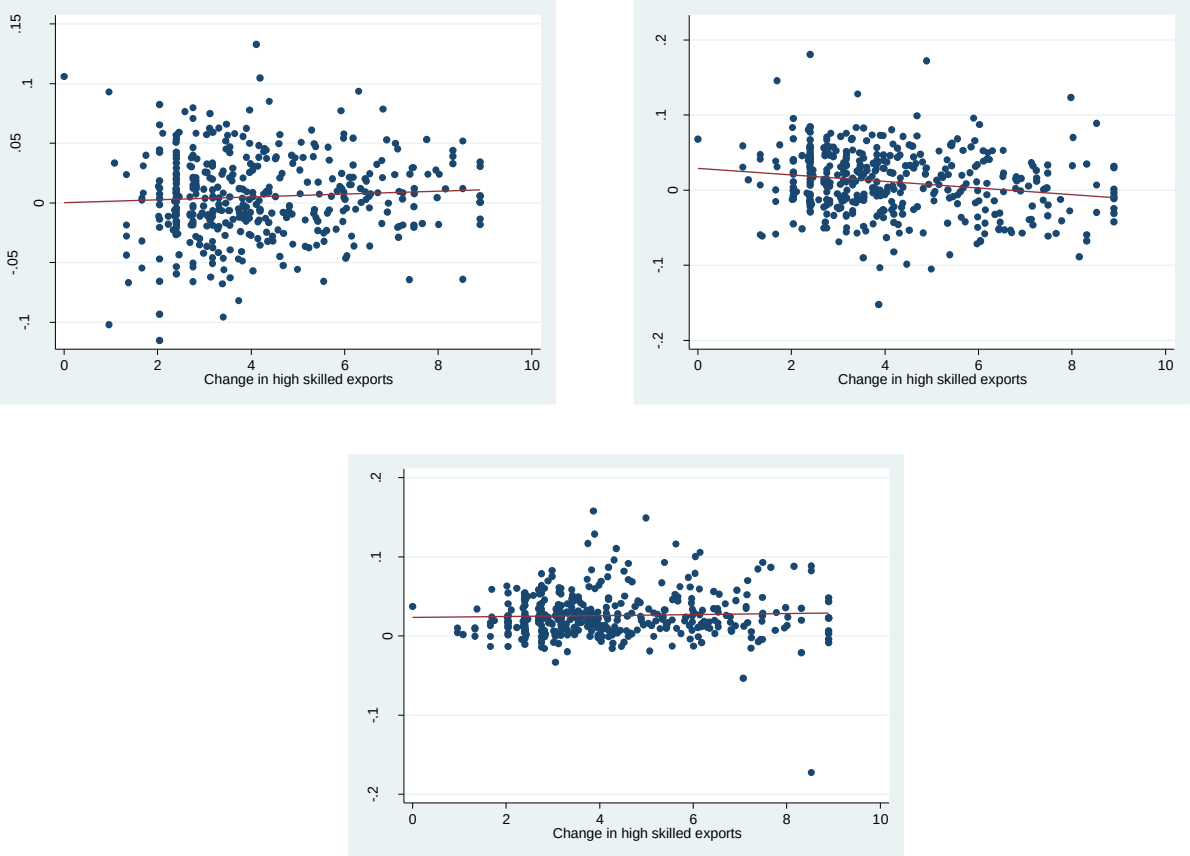


Figure 11 Education and high skill exports differences over years
Every panel plots the change in education level agianst the change in high skilled exports over the years 2006-2011.

Table 2 shows summary statistics for the control variables mentioned in Section 3.2.3 for both years. Besides the mean value of each variable, the number of observations, standard deviation and minimum and maximum values are shown as well. For the rural/urban control variable, 0 stands for rural and 1 for urban. In order to not use the same persons twice in the analysis, the control variable for educational attainment for the household head only covers household heads over the age of 30 years old.

Table 2 Summary statistics for control variables 2006 and 2011

Variable	Obs	Mean	Std. Dev.	Min	Max
2006					
Share of males					
Age 0-9	439	.201	.037	.105	.322
Age 10-19	439	.209	.031	.137	.324
Age 20-29	439	.165	.025	.107	.259
Age 30-39	439	.153	.021	.095	.252
Age 40-49	439	.125	.018	.078	.188
Age 50-59	439	.080	.018	.033	.140

Share of females					
Age 0-9	439	.192	.036	.111	.334
Age 10-19	439	.196	.027	.121	.288
Age 20-29	439	.178	.029	.098	.288
Age 30-39	439	.161	.020	.095	.228
Age 40-49	439	.126	.019	.081	.217
Age 50-59	439	.074	.020	.016	.128
Age 60+	439	.073	.035	0	.188
Rural/urban	439	.351	.319	0	1
Educational attainment head of household	439	2.586	.896	.223	5.511
Household members	439	4.029	.375	2.951	5.822
Log expenditures per capita	439	12.448	.301	11.630	13.428
PPI index	401	34.648	5.810	16.442	51.370
2011					
Share of males					
Age 0-9	439	.214	.033	.140	.304
Age 10-19	439	.194	.022	.131	.274
Age 20-29	439	.167	.024	.101	.244
Age 30-39	439	.159	.018	.097	.224
Age 40-49	439	.122	.016	.075	.174
Age 50-59	439	.080	.018	.032	.143
Age 60+	439	.065	.024	.003	.153
Share of females					
Age 0-9	439	.203	.035	.106	.351
Age 10-19	439	.183	.021	.119	.238
Age 20-29	439	.180	.028	.104	.313
Age 30-39	439	.160	.018	.112	.242
Age 40-49	439	.123	.018	.062	.169
Age 50-59	439	.078	.020	.014	.130
Age 60+	439	.074	.032	.002	.177
Rural/urban	439	.398	.315	0	1
Educational attainment head of household	439	2.900	.902	.794	5.634
Household members	439	4.010	.386	2.865	5.809
Log expenditures per capita	439	13.113	.310	12.414	14.037
PPI index	439	40.710	6.149	22.393	57.414

4.2 Main findings

Table 3 reports the results of the fixed effect regression of equation (4) to show the relationship between export composition and educational attainment. Each regression uses a level of education as outcome variable, with five levels ranging from no formal education to tertiary education. Every level is included twice in the table, first with only the independent variables of interest, low and high skilled exports, and afterwards also with the income control variable included to see if this variable alters the results. All regressions include district and year fixed effects and standard errors are clustered at the district level and are reported in brackets.

Table 3 only shows a statistically significant negative relationship between a change in high skilled exports and higher secondary education. This indicates that an increase in high skilled exports will lead to a decrease of the share of 10-30-year-olds who followed higher secondary education. This is not in line with the theoretical prediction. The signs of the other coefficients of interest also show opposite results of what is expected.

The income variable is statistically significantly different from zero in almost all education levels, except for no formal and lower secondary education. This variable does not change the coefficient of interest for either low and high skilled exports, so there could be no income effect on education. To control for this effect more carefully also other control variables are included, which are discussed in Section 3.2.3, in Table 4.

Table 3 Impact of exports on highest followed education level

	Δ No formal education	Δ No formal education	Δ Primary education	Δ Primary education	Δ Lower secondary education	Δ Lower secondary education	Δ Higher secondary education	Δ Higher secondary education	Δ Tertiary education	Δ Tertiary education
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Δ Low skilled exports	-0.000	-0.001	0.002	0.001	0.000	-0.000	-0.002	-0.001	0.000	0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
Δ High skilled exports	0.000	0.000	0.001	0.001	0.001	0.001	-0.003**	-0.003*	0.001	0.001
	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)
Δ Log expenditures per capita		-0.016		-0.051**		-0.013		0.031*		0.050***
		(0.019)		(0.023)		(0.013)		(0.017)		(0.011)
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
District FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	401	401	401	401	401	401	401	401	401	401
R-squared	0.000	0.008	0.008	0.027	0.004	0.007	0.036	0.046	0.002	0.057

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4 first shows the outcomes per education level with all other control variables besides income, followed by the results where the income control variable is also included. With all control variables included, both with and without the income control variable, no coefficient of interest turns out to be statistically significant in Table 4.

Compared to Table 3 the income control variable now only shows a significantly different effect from zero for tertiary education. Education until lower secondary school is considered normal in Indonesia, and almost all children do stay in school until this education level. Therefore, income would not play a significant role for the decision to invest in human capital and other demographic variables become more important in this decision. For the tertiary education level, the income variable does alter the results for both low skilled and high skilled exports, assuming that for this education level income still does play a significant role for the human capital decision. The sign for the income control variable is only positive for this education level, assuming that higher income would lead to higher investments in tertiary education. Since all other coefficients for the income control variables show a negative effect on the other education levels, there could be an income effect to invest more in tertiary education.

The education level of the household head appears an important control variable, except for the regression on lower secondary schooling. The control variable for the share of females in the age of 0-9 years present in the district also turns out statistically significant in two regressions. The other age and gender groups turn out to be not very important control variables. The control variable on the amount of household members turns out statistically significant at the 1% level for only the higher secondary school level and shows a positive effect.

Table 4 Impact of exports on highest followed education level with control variables

	Δ No formal education	Δ No formal education	Δ Primary education	Δ Primary education	Δ Lower secondary education	Δ Lower secondary education	Δ Higher secondary education	Δ Higher secondary education	Δ Tertiary education	Δ Tertiary education
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Δ Low skilled exports	-0.002	-0.002	0.000	0.000	-0.001	-0.001	0.002	0.002	0.000	0.001
	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
Δ High skilled exports	0.001	0.001	0.001	0.000	0.002	0.002	-0.002	-0.002	-0.001	-0.000
	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)
Δ Rural/urban	0.002	0.002	0.007	0.007	0.022	0.022	-0.082**	-0.082**	0.051*	0.050*
	(0.015)	(0.015)	(0.038)	(0.038)	(0.026)	(0.026)	(0.041)	(0.041)	(0.031)	(0.029)
Δ Males 0-9 years	0.032	0.031	0.230	0.216	0.242	0.232	-0.382	-0.399*	-0.122	-0.080
	(0.112)	(0.117)	(0.324)	(0.325)	(0.230)	(0.232)	(0.233)	(0.233)	(0.168)	(0.164)
Δ Males 10-19 years	-0.120	-0.121	0.101	0.087	0.410*	0.400*	-0.228	-0.245	-0.163	-0.121
	(0.102)	(0.105)	(0.345)	(0.344)	(0.225)	(0.226)	(0.257)	(0.256)	(0.181)	(0.176)
Δ Males 20-29 years	-0.118	-0.117	-0.123	-0.115	0.248	0.254	0.098	0.107	-0.106	-0.128
	(0.148)	(0.143)	(0.342)	(0.342)	(0.225)	(0.225)	(0.249)	(0.249)	(0.181)	(0.180)
Δ Males 30-39 years	-0.181	-0.182	-0.098	-0.110	0.435*	0.426	0.111	0.097	-0.267	-0.232
	(0.178)	(0.188)	(0.383)	(0.383)	(0.259)	(0.259)	(0.275)	(0.275)	(0.233)	(0.228)
Δ Males 40-49 years	0.194	0.193	-0.491	-0.503	0.585**	0.576**	0.031	0.017	-0.319	-0.283
	(0.229)	(0.235)	(0.353)	(0.352)	(0.251)	(0.253)	(0.266)	(0.267)	(0.195)	(0.191)
Δ Males 50-59 years	0.043	0.043	-0.218	-0.216	0.389	0.391	0.093	0.096	-0.306	-0.313
	(0.110)	(0.110)	(0.358)	(0.358)	(0.250)	(0.249)	(0.295)	(0.295)	(0.215)	(0.211)
Δ Females 0-9 years	0.275**	0.274**	0.264	0.251	0.073	0.063	-0.464**	-0.479**	-0.148	-0.110
	(0.122)	(0.117)	(0.290)	(0.293)	(0.212)	(0.212)	(0.205)	(0.206)	(0.158)	(0.157)
Δ Females 10-19 years	0.084	0.083	0.162	0.151	0.192	0.184	-0.331	-0.344	-0.106	-0.075
	(0.135)	(0.128)	(0.290)	(0.289)	(0.207)	(0.206)	(0.220)	(0.221)	(0.155)	(0.153)
Δ Females 20-29 years	0.142	0.141	-0.184	-0.193	0.189	0.182	0.204	0.194	-0.351*	-0.325*
	(0.112)	(0.108)	(0.295)	(0.295)	(0.199)	(0.199)	(0.227)	(0.228)	(0.186)	(0.184)
Δ Females 30-39 years	0.000	0.000	0.184	0.181	0.085	0.083	-0.075	-0.078	-0.194	-0.186
	(0.166)	(0.164)	(0.340)	(0.340)	(0.229)	(0.230)	(0.238)	(0.238)	(0.179)	(0.179)
Δ Females 40-49 years	0.270	0.270	0.219	0.217	-0.095	-0.097	-0.429*	-0.433*	0.035	0.044
	(0.236)	(0.239)	(0.333)	(0.334)	(0.249)	(0.249)	(0.254)	(0.254)	(0.184)	(0.182)
Δ Females 50-59 years	0.141	0.140	0.040	0.021	0.014	-0.001	-0.159	-0.182	-0.036	0.022
	(0.109)	(0.119)	(0.292)	(0.301)	(0.230)	(0.232)	(0.254)	(0.252)	(0.189)	(0.186)
Δ Education attainment household head	-0.019**	-0.019**	-0.050***	-0.047***	-0.004	-0.003	0.046***	0.048***	0.027***	0.021***
	(0.009)	(0.009)	(0.012)	(0.013)	(0.008)	(0.008)	(0.009)	(0.009)	(0.006)	(0.006)

Δ Amount of household members	-0.001 (0.010)	-0.001 (0.010)	-0.021 (0.018)	-0.021 (0.018)	-0.005 (0.011)	-0.005 (0.011)	0.043*** (0.014)	0.043*** (0.014)	-0.016 (0.011)	-0.015 (0.011)
Δ Log expenditures per capita		-0.001 (0.017)		-0.013 (0.024)		-0.010 (0.014)		-0.016 (0.016)		0.039*** (0.011)
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
District FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	401	401	401	401	401	401	401	401	401	401
R-squared	0.107	0.107	0.128	0.129	0.054	0.055	0.244	0.246	0.110	0.138

Standard errors are clustered at the district level and are in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Since the younger cohort within the 10-30-year-olds age group are more sensitive to changes in exports on their education level, the same analysis is done on different age groups. Considering that older persons already made their educational decisions, and therefore are less sensitive to changing export- and labor market conditions, the 21-30-year-olds are taken as one group, and the 10-15-year-olds and 16-20-year-olds as the two other groups.

Table 5 Impact of exports on highest followed education level for 10-15-year-olds

	Δ No formal education	Δ Primary education	Δ Lower secondary education	Δ Higher secondary education
	(1)	(2)	(3)	(4)
Δ Low skilled exports	-0.006	0.007**	-0.001	-0.000
	(0.004)	(0.004)	(0.003)	(0.001)
Δ High skilled exports	0.002	-0.002	-0.001	0.001
	(0.001)	(0.002)	(0.002)	(0.001)
Controls	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
District FE	YES	YES	YES	YES
Observations	401	401	401	401
R-squared	0.105	0.070	0.072	0.129

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Control variables are not shown

Table 5 shows the impact of exports on the highest followed education level for 10-15-year-olds. Since the official age for primary schooling is until twelve and for lower secondary education until fifteen, it is most interesting to look at these two education levels. Since (almost) no individual of this age is enrolled in tertiary schooling at this age, this education level is not included in this test. The results only show a statistically significant result for a change in low skilled exports on primary education. The effect is positive, which indicates that more children in this age group followed

primary education. This is in line with the theory of Blanchard and Olney (2017). At the same time, the coefficient for no formal education shows a negative effect of almost the same size as primary education, what could indicate that more children in this age level went to primary school instead of following no schooling at all. This could imply that even some education is needed for low skilled work and when demand for labor is this sector goes up this incentivize children in this age group to follow primary education. Also the coefficients for lower and higher secondary school are negative, what is in line with the predictions from theory. For high skilled exports the coefficients for primary education and lower secondary education show a decrease in the share of 10-15-year-olds who followed these education levels, and an increase in the share that followed no formal education and higher secondary education.

Also Table 6 shows interesting results for the impact of exports on highest followed education level for 16-20-year-olds. For this age group the results for higher secondary and tertiary education are most interesting. However, what stands out are the results for low and high skilled exports on lower secondary education. They both show a statistically significant effect (at the 1% and 5 % level), which is interesting since the examined age group is (officially) not in this education level anymore. The effect of high skilled exports on lower secondary education shows a positive effect. A probable explanation could be a higher level of education needed to work in the high skilled export sector causing more 16-20-year-olds who finish their lower secondary education. These results indicate that more persons in this age group finish their basic education and start working in the high skilled export sector. Contradictory, the negative effect of low skilled exports on lower secondary education could imply a dropout of 16-20-year-olds who do not finish their lower secondary education and start working without finishing their basic education.

Table 6 Impact of exports on highest followed education level for 16-20-year-olds

	Δ No formal education	Δ Primary education	Δ Lower secondary education	Δ Higher secondary education	Δ Tertiary education
	(1)	(2)	(3)	(4)	(5)
Δ Low skilled exports	-0.000	-0.001	-0.007**	0.005	0.003
	(0.002)	(0.004)	(0.003)	(0.004)	(0.002)
Δ High skilled exports	0.000	0.003	0.007***	-0.011***	0.001
	(0.001)	(0.003)	(0.002)	(0.003)	(0.002)
Controls	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
District FE	YES	YES	YES	YES	YES
Observations	401	401	401	401	401
R-squared	0.114	0.109	0.091	0.220	0.186

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Control variables are not shown

Finally, the effect of exports on highest followed education level for 21-30-year-olds is examined in Table 7 below. For this age group effects are expected for tertiary education. However, no

statistically significant correlations are found. As stated before, it is assumed that educational decisions do not change anymore after the age of 25. Since the official age to finish higher secondary school, and then make the decision to follow tertiary education, is at the age of 18, it is not surprising that this age group finds no significant results.

Table 7 Impact of exports on highest followed education level for 21-30-year-olds

	Δ No formal education	Δ Primary education	Δ Lower secondary education	Δ Higher secondary education	Δ Tertiary education
	(1)	(2)	(3)	(4)	(5)
Δ Low skilled exports	0.002	-0.003	0.002	-0.001	-0.000
	(0.002)	(0.004)	(0.003)	(0.003)	(0.002)
Δ High skilled exports	-0.001	0.001	-0.000	0.000	-0.000
	(0.001)	(0.003)	(0.002)	(0.002)	(0.002)
Controls	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
District FE	YES	YES	YES	YES	YES
Observations	401	401	401	401	401
R-squared	0.162	0.133	0.087	0.199	0.126

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Control variables are not shown

All the results above raise the question whether the statistically significant control variables simply reflect the demographic differences of the districts. Because industries are often located at a certain district, the results may capture regional growth trends that may or may not have to do with trade. Considering underlying trends that influence both educational attainment and the amount of low and high skilled exports, more control variables are included in the regression. The presence of confounding trends can undermine identification when a drop or increase of education level is incorrectly attributed to a change in exports, when in reality this effect comes from an underlying trend. It can be that districts with a larger share of high skilled workers are increasing the educational attainment of 10-30-year-olds with a faster rate than districts with a larger share of low skilled workers. This can also be related to the income effect, where districts with a higher income invest more in education of 10-30-year-olds than poorer districts. So, if educational attainment is dependent on the employment structure across districts this lead to a confounding employment structure effect that both influences the total value added exports as well as the incentive to invest in education. If this is the case then the coefficient of high skilled exports will be biased upwards and the coefficient of low skilled exports will be biased downwards. According to McCaig (2011), in order to control for the unobserved trends at the district level that are correlated with the change in high and low skilled exports, initial conditions on the share of workers in both high and low skilled sectors are added, which control for the differences in educational attainment across districts before the analyzed period.

In Table 8 initial conditions on the share of workers in high and low skilled sectors are taken into account besides all other control variables. This specification shows a significantly different from zero relationship between high skilled exports and lower secondary and tertiary education for both with and without control variables. The effect on lower secondary schooling is positive where the effect for tertiary education is negative. This is surprising, according to the theory of Blanchard and Olney (2017), since it is expected that this effect would be the other way around for high skilled exports. The statistically insignificant coefficients for primary and higher secondary education are in line with the predicted theory. For low skilled exports, all coefficients of interest are statistically insignificant. The control variables alter the results more for these effects, since the signs of the coefficients all change when the control variables are included.

As the initial conditions show statistically significant impacts on lower secondary and tertiary education for both employment shares, these conditions are important to take into account when looking at the changes in educational attainment. For these education levels that what matters for educational attainment is not only the composition of exports, but also the share of workers employed in both high and low skilled sectors. The coefficients of the initial conditions show positive values for lower secondary education, implying that an increase of the shares in both sectors lead to a higher share of 10-30-year-olds who follow lower secondary education. This is the other way around for tertiary education, given the negative values for both sector shares. This negative value is in line with the theory of Blanchard and Olney (2017) for low skilled exports, but is remarkable for high skilled exports. Considering these results, initial conditions cannot be excluded from the analysis in explaining educational attainment of 10-30-year-olds. Focusing on column 6 and 10, doubling the high skilled exports is associated with an increase of the share of 10-30-year-olds who followed lower secondary education of 0.4 percent. For tertiary education this would be a decrease of 0.5 percent. It should be noted that the results are small and only a subsample of the working population works in the export-oriented sector.

Table 8 Impact of exports on highest followed education level with initial conditions

	Δ No formal education (1)	Δ No formal education (2)	Δ Primary education (3)	Δ Primary education (4)	Δ Lower secondary education (5)	Δ Lower secondary education (6)	Δ Higher secondary education (7)	Δ Higher secondary education (8)	Δ Tertiary education (9)	Δ Tertiary education (10)
Δ Low skilled exports	-0.000	-0.001	0.001	-0.000	0.001	-0.001	-0.001	0.002	-0.001	0.000
	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
Δ High skilled exports	0.000	0.001	-0.002	-0.002	0.004**	0.004**	0.002	0.002	-0.005***	-0.005***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
Total low skilled employment share	0.146	0.120	-0.050	-0.239	1.357***	1.245**	0.227	0.407	-1.680***	-1.533***
	(0.235)	(0.296)	(0.777)	(0.710)	(0.491)	(0.539)	(0.755)	(0.666)	(0.492)	(0.473)
Total high skilled employment share	0.145	0.113	0.061	-0.115	1.289***	1.184**	0.025	0.198	-1.520***	-1.381***
	(0.240)	(0.297)	(0.796)	(0.718)	(0.495)	(0.542)	(0.774)	(0.679)	(0.502)	(0.482)
Controls	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
District FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	401	401	401	401	401	401	401	401	401	401
R-squared	0.000	0.108	0.031	0.153	0.043	0.081	0.145	0.341	0.216	0.290

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Control variables are not shown

Now that initial conditions turn out to be an important factor for lower secondary and tertiary education, the analysis for the age groups is repeated with these control variables included. The results for the 10-15-year-olds in Table 9 show the same effect for a change in low skilled exports on all education levels as in Table 5, which indicated that more children in this age group followed primary education. The effect sizes for a change in high skilled exports on lower and higher secondary education do change when the initial conditions are included, but there still is no statistically significant effect. This could be expected for both lower and higher secondary schooling, since this age group is not old enough for higher secondary education and they are obliged to follow lower secondary education by national law. This makes that almost all children already attend lower secondary education in this age group. These arguments could also explain why the initial conditions turn out not to be important for educational decisions for this age group. Again, tertiary education is not included in this test since (almost) no individual of this age is enrolled in tertiary schooling at this age.

Table 9 Impact of exports on highest followed education level for 10-15-year-olds with initial conditions

	Δ No formal education	Δ Primary education	Δ Lower secondary education	Δ Higher secondary education
	(1)	(2)	(3)	(4)
Δ Low skilled exports	-0.006	0.007**	-0.001	-0.001
	(0.004)	(0.004)	(0.003)	(0.001)
Δ High skilled exports	0.002*	-0.002	0.000	-0.000
	(0.001)	(0.002)	(0.002)	(0.001)
Total low skilled employment share	-0.164	1.037	-0.800	-0.072
	(0.433)	(0.925)	(0.932)	(0.546)
Total high skilled employment share	-0.184	1.086	-0.880	-0.022
	(0.443)	(0.934)	(0.945)	(0.554)
Controls	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
District FE	YES	YES	YES	YES
Observations	401	401	401	401
R-squared	0.106	0.074	0.080	0.141

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Control variables are not shown

When the analysis is repeated for 16-20-year-olds the results stay the same for a change in low skilled exports, but do show differences for a change in high skilled exports compared to Table 6. Again the positive effect for a change in high skilled exports on lower secondary education could imply that more 16-20-year-olds finish their basic education before they start working. Also both initial conditions are an important factor for the change in lower secondary schooling.

Table 10 Impact of exports on highest followed education level for 16-20-year-olds with initial conditions

	Δ No formal education	Δ Primary education	Δ Lower secondary education	Δ Higher secondary education	Δ Tertiary education
	(1)	(2)	(3)	(4)	(5)
Δ Low skilled exports	-0.000	-0.001	-0.007**	0.006	0.002
	(0.002)	(0.004)	(0.003)	(0.004)	(0.002)
Δ High skilled exports	0.000	0.000	0.006**	-0.001	-0.005***
	(0.001)	(0.003)	(0.002)	(0.003)	(0.002)
Total low skilled employment share	0.357	-1.112	1.685*	0.406	-1.337
	(0.298)	(1.053)	(0.924)	(1.749)	(0.976)
Total high skilled employment share	0.357	-1.022	1.764*	-0.013	-1.085
	(0.301)	(1.065)	(0.933)	(1.776)	(0.991)

Controls	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
District FE	YES	YES	YES	YES	YES
Observations	401	401	401	401	401
R-squared	0.116	0.118	0.102	0.305	0.328

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Control variables are not shown

For the 21-30-year-olds the results show big differences in a change of high skilled exports compared with Table 7, where the results for low skilled exports are the same. The effects on lower and higher secondary and tertiary education are now statistically significant when high skilled exports change. Especially higher secondary and tertiary education show high significance levels and display an increase in attendance rate for higher secondary education when high skilled exports rise, where attended tertiary education decreases. The initial conditions for lower secondary and tertiary education are statistically significant and have the same sign as in Table 8 for the same education levels. These results together strengthens the assumption that for the high skilled export sector a basic education is needed to find work in this sector, and this is less important for the low skilled export sector. However, tertiary education is not very important to find work and shows a decrease in attendance rate. This suggest that the country's export sector is developing, because higher education levels are needed, but can still grow since the high skilled export sector is not a driver to follow tertiary education yet.

Table 11 Impact of exports on highest followed education level for 21-30-year-olds with initial conditions

	Δ No formal education	Δ Primary education	Δ Lower secondary education	Δ Higher secondary education	Δ Tertiary education
	(1)	(2)	(3)	(4)	(5)
Δ Low skilled exports	0.002	-0.004	0.003	0.000	-0.002
	(0.002)	(0.004)	(0.003)	(0.003)	(0.002)
Δ High skilled exports	-0.001	-0.004	0.004*	0.007***	-0.006***
	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
Total low skilled employment share	0.253	-1.041	2.623***	0.791	-2.626***
	(0.378)	(0.919)	(0.747)	(0.999)	(0.769)
Total high skilled employment share	0.252	-0.862	2.481***	0.533	-2.405***
	(0.379)	(0.927)	(0.750)	(1.021)	(0.784)
Controls	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
District FE	YES	YES	YES	YES	YES
Observations	401	401	401	401	401
R-squared	0.162	0.164	0.144	0.268	0.246

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Control variables are not shown

4.3 Robustness checks

To check if the results are sensitive for the classification of high and low skilled exports, three sectors are changed. It could be doubted if these sectors belong to the assigned sector, since the product category exists of more products, of which some are in the high skilled sector and some are in the low skilled sector. The sectors which changed are: (1) the fabricated metal products, which is changed from low skill to high skill sector, (2) the manufacturing nec; recycling, which is changed from high skill to low skill sector, and (3) wholesale and retail trade; repairs sector, which is changed from a low skilled sector to a high skilled sector. The first two sectors mentioned above only account for a very small part of total value added exports. However, the wholesale and retail trade sector is the second biggest value added export sector, so this change could have an impact on the results.

As can be seen in Table 12 no coefficient of interest turns out to be statistically significant, what is in accordance with the results in Table 4, where the same specification is used but with the classification of exports as is explained in Section 3.2.1. Also in this specification with the new classification, all coefficients of interest show the opposite effect that would be expected for all education levels. Likewise, the control variables show the same results as well. The three control variables that show the most interesting results are highlighted in Table 12, and these variables all show the same coefficients and significance levels as in Table 4. This robustness check indicates that the classification of exports does not have an effect on the results, even when a big sector is changed from the assigned group.

Table 12 Impact of exports on highest followed education level with changed classification of exports

	Δ No formal education (1)	Δ Primary education (2)	Δ Lower secondary education (3)	Δ Higher secondary education (4)	Δ Tertiary education (5)
Δ Low skilled exports	-0.003	-0.001	0.000	0.002	0.001
	(0.002)	(0.003)	(0.002)	(0.002)	(0.001)
Δ High skilled exports	0.001	0.001	0.000	-0.002	-0.000
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)
Δ Rural/urban	0.003	0.007	0.022	-0.082**	0.050*
	(0.015)	(0.039)	(0.026)	(0.041)	(0.029)
Δ Education attainment household head	-0.019**	-0.048***	-0.002	0.048***	0.021***
	(0.009)	(0.013)	(0.008)	(0.009)	(0.006)
Δ Log expenditures per capita	-0.001	-0.013	-0.010	-0.016	0.039***
	(0.017)	(0.024)	(0.014)	(0.016)	(0.011)
Controls	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
District FE	YES	YES	YES	YES	YES
Observations	401	401	401	401	401
R-squared	0.112	0.130	0.053	0.246	0.138

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Not all control variables are shown

Additionally, a robustness check for income is done. The Poverty Probability Index (PPI) variable is another way to measure income and is included in the analysis instead of the expenditures variable. This index variable is a tool to measure poverty and consists of ten questions about a household's characteristics and asset ownership. These outcomes are scored between zero and hundred, where a higher score implies a wealthier household, and indicate the likelihood that a household has expenditures below a certain poverty line[4].

First the effects of the specification with only the PPI index as control variable is compared to the results of the fixed effects regression in Table 4, columns 2, 4, 6, 8 and 10, where the expenditure control variable is included as only control variable. The results in Table 13 give the same results for the coefficients of interest as in Table 3, and the PPI variable does not alter the results. The coefficients for low skilled exports change a little bit in their effect size, but are still comparable in size. However, there is a difference in outcomes between the two control variables that measure income. Where expenditures per capita shows a statistically significant relationship with the primary, higher secondary and tertiary education level, the PPI index also shows a statistically significant relationship with no formal education, when no other control variables are included. Where the levels of significance are comparable between the two control variables, there are differences between the effect sizes. This is not surprising, given the different measurement methods for both variables. When looking at the income control variable for tertiary education, doubling log expenditures per capita would increase the share of 10-30-year-olds who followed tertiary education with 5 percent. For the PPI index, an increase of one point within this index indicates an increase of 0.2 percent for this education level.

Second, the effects of the specification with all other control variables included in Table 13 are compared to the results in Table 4, column 2, 4, 6, 8 and 10. Also for this analysis the results of the coefficients of interest are the same for the two income control variables. There are, again, a few changes in effect sizes, which are too small to affect the results. The other included control variables show the same significance levels and effect sizes in both specifications. The only difference between the two income control variables is the fact that the PPI index shows statistically significant results for primary and tertiary education, where for the expenditure per capita variable this is only for tertiary education. As mentioned above, the effect sizes for the two income control variables differ, but the signs are equal. These results show that income does not alter the results, but is an important factor to take into account, especially for the decision to follow tertiary education.

[4] See Appendix 5 for the PPI Scorecard for Indonesia

Table 13 Impact of exports on highest followed education level with PPI index

	Δ No formal education (1)	Δ No formal education (2)	Δ Primary education (3)	Δ Primary education (4)	Δ Lower secondary education (5)	Δ Lower secondary education (6)	Δ Higher secondary education (7)	Δ Higher secondary education (8)	Δ Tertiary education (9)	Δ Tertiary education (10)
Δ Low skilled exports	-0.000	-0.002	0.002	0.001	-0.000	-0.001	-0.002	0.002	-0.000	0.000
	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
Δ High skilled exports	0.000	0.001	0.001	0.000	0.001	0.002	-0.003*	-0.002	0.001	-0.001
	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)
Δ Rural/ urban		0.002		0.019		0.018		-0.084**		0.045
		(0.016)		(0.038)		(0.026)		(0.042)		(0.032)
Δ Males 0-9 years		0.035		0.138		0.273		-0.371		-0.075
		(0.112)		(0.322)		(0.233)		(0.229)		(0.161)
Δ Males 10-19 years		-0.118		0.030		0.434*		-0.220		-0.126
		(0.101)		(0.341)		(0.226)		(0.254)		(0.175)
Δ Males 20-29 years		-0.118		-0.113		0.245		0.096		-0.111
		(0.149)		(0.344)		(0.225)		(0.250)		(0.178)
Δ Males 30-39 years		-0.180		-0.116		0.441*		0.113		-0.258
		(0.176)		(0.380)		(0.258)		(0.275)		(0.230)
Δ Males 40-49 years		0.195		-0.539		0.601**		0.036		-0.294
		(0.229)		(0.352)		(0.251)		(0.265)		(0.192)
Δ Males 50-59 years		0.045		-0.285		0.411		0.101		-0.271
		(0.109)		(0.357)		(0.250)		(0.295)		(0.209)
Δ Females 0-9 years		0.277**		0.193		0.096		-0.455**		-0.111
		(0.131)		(0.287)		(0.215)		(0.209)		(0.160)
Δ Females 10-19 years		0.086		0.100		0.213		-0.324		-0.075
		(0.143)		(0.288)		(0.209)		(0.222)		(0.156)
Δ Females 20-29 years		0.144		-0.255		0.212		0.213		-0.314*
		(0.118)		(0.290)		(0.200)		(0.233)		(0.190)
Δ Females 30-39 years		-0.001		0.217		0.074		-0.079		-0.211
		(0.165)		(0.336)		(0.230)		(0.237)		(0.178)
Δ Females 40-49 years		0.271		0.200		-0.089		-0.427*		0.045
		(0.235)		(0.334)		(0.248)		(0.255)		(0.187)
Δ Females 50-59 years		0.142		0.015		0.022		-0.156		-0.023
		(0.109)		(0.290)		(0.231)		(0.256)		(0.191)
Δ Education attainment h.h		-0.019*		-0.043***		-0.007		0.045***		0.024***
		(0.010)		(0.012)		(0.008)		(0.009)		(0.006)
Δ Household members		-0.001		-0.033*		-0.001		0.045***		-0.010
		(0.009)		(0.019)		(0.012)		(0.015)		(0.011)

Δ Poverty probability index	-0.001* (0.000)	0.000 (0.001)	-0.004*** (0.001)	-0.003** (0.001)	0.001 (0.001)	0.001 (0.001)	0.002* (0.001)	0.000 (0.001)	0.002*** (0.001)	0.002*** (0.001)
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
District FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	401	401	401	401	401	401	401	401	401	401
R-squared	0.005	0.107	0.040	0.143	0.006	0.057	0.045	0.245	0.036	0.122

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

This outcome shows that income is important to include in the analysis, but it is hard to find a good measurement for income. Both control variables show a statistically significant relationship between educational attainment and income, what could indicate a confounding income effect. According to Feyrer (2009) it is difficult to find a robust causal relationship between trade and income, since it is difficult to know the direction of causality. However, using different estimation strategies, they find a positive association between trade and income per capita. This could indicate endogeneity problems with this measure since higher income could also be an effect of higher education levels. According to Blanchard and Olney (2017) the used control variables and fixed effects do alleviate some of the concerns about reverse causality and omitted variable bias, but they cannot completely eliminate endogeneity. Since the differenced regressions suffer from this endogeneity problem an IV approach can be used to identify a causal relationship between educational attainment and the composition of exports as is also done in Blanchard and Olney (2017). This is, however, not in the scope of this study and will not be discussed here.

5. Robustness and limitations

This section discusses the main threats and limitations of this research. There is elaborated on five main limitations that could explain the results founded.

5.1 Endogeneity

The endogeneity concerns are limited by using only within-district variation for identification, which control for all time-invariant country characteristics that causes omitted variables concerns, like technological change and local policy reforms. Also the employment weights are time-invariant and set before the measured time period. Likewise, the year fixed effects capture trends in education as well as structural changes. The risk of endogeneity resulting from reverse causality between the independent and dependent variables is not very high, since educational attainment is measured on district level, and exports are based on national level exports. A change in the educational attainment in one district does therefore probably have no influence on national exports.

However, as is mentioned in Section 4.3, there could be a confounding income effect that both influences the total value added exports, as well as the incentive to invest in education. The used control variables and fixed effects do alleviate some of the concerns of omitted variable bias and reverse causality, but they cannot completely eliminate these endogeneity concerns. Since no IV method is used in this study, the estimates could be biased and wrong assumptions could be made about the effect export composition has on educational attainment. Both Blanchard and Olney (2017), Feyrer (2009) and Frankel and Romer (1999) find larger IV estimates than the parallel OLS results and therefore find stronger estimated causal effects. Since reverse causality and omitted variable bias push the OLS estimates away from zero relative to IV, the higher IV estimates indicate a greater magnitude of this approach compared to OLS. Robustness checks showed that the results tend to change resulting from small changes in the set of variables, which indicated the uncertainty on the coefficients. When, for example, a control variable was excluded from the analysis or when the income variable was changed into a logarithmic variable, this significantly altered the results of the coefficients of interest.

An extensive analysis for this research could include an IV approach to measure the confounding income effect. However, since good instruments are hard to find this approach will not be the overall solution to overcome the problems of making causal inferences (Khandker, Koolwal, & Samad, 2009).

5.2 Heterogeneity

There is a risk of heterogeneity in the sample, since characteristics can vary between respondents. This risk does not immediately lead to a bias of the results, but can cause noise in the standard errors. The incentive effects of a change in exports may have different effects across different individuals. An increase in the high skill export sector has more implications for tertiary schooling level, while an increase in the low skill export sector can have more effects on lower education levels. With the measurement of educational attainment in no, primary, lower and higher secondary and tertiary schooling part of the heterogeneity problem is solved. Also the random selection of participants, which were not selected on a set of observed characteristics, reduced the heterogeneity bias. Further, because the differenced method assumes the unobserved heterogeneity is time

invariant, these effects are canceled out with differencing and no heterogeneity problem is expected (Khandker, Koolwal, & Samad, 2009).

5.3 Data availability and data quality

Another limitation of the research is the availability of the data. Because of a lack of data on average years of schooling attended, only educational attainment on primary, secondary and tertiary schooling could be measured. It is not clear if data on average schooling years would give better or different results, but since this data was unavailable, no comparison could be made between the two measurement methods. Additionally, the availability of suitable control variables was limited due to the already existing dataset.

There was some missing data, because the districts in the Susenas and Supas dataset did not fully overlap. Also within these datasets there was some missing data on certain persons or households, which were dropped from the analysis. However, the two Susenas datasets both have a sample size of over a million individuals. Also the dataset used for the calculation of the employment weights, Supas, has a sample size of this amount. When these individuals are averaged on district level around 400 districts are matched out of 439 districts in the SUSENAS dataset and 415 districts in the SUPAS dataset. Because of this large sample size, the missing values did not influence the power of the research.

According to Sianesi and Van Reenen (2003) the results on educational attainment are only based on formal educational attainment. Wider definitions of accumulating human capital are not taken into account, as this could also be gained by, for example, on the job training or experience in the work field. Additionally, schooling quality is not discussed when interpreting the results on education, while the schooling quality does matter for the direct impact on economic growth. Data on school participation includes both private and public schools, which differ in educational quality. Where public schools have to follow the national curriculum, private schools have more possibilities to deviate from this compulsory program and can add more additional courses. Therefore the results should be interpreted with this difference of quality in mind.

To validate the quality of the data it is important to address the validity of this research. Internal validity was ensured in two ways. First, the questionnaires over the two analyzed years were largely the same. Where questions did differ in their outcomes, they were generated in such a way that they corresponded with the outcomes of the comparing questionnaire. All datasets used for this research were designed according to international standards. Second, the full analysis strategy is stored in a do-file, so that the results can easily be replicated.

The external validity was ensured as well. Since participating individuals were randomly selected from the Indonesian population, and then merged on district level, the results can be generalized for the whole of Indonesia. Generalization to other, similar cases, can be done to a limited extent. The capacity to generalize is increased by using a theoretical model, since the thesis looks at factors predetermined in the model. Since context always plays a role, and since some cultural, historical and contextual factors are specific to Indonesian districts, testing the model in other similar cases of exporting districts is recommended to improve the external validity of this research.

5.4 Time span of the study

The short time span of this study is one of the most important limitations of this study. Since education changes take a long time, it is hard to find a big difference in educational attainment within the analyzed period. According to Blanchard and Olney (2017) it takes five years for economic factors to affect average years of schooling, and since this research only covers five years it could be expected that no robust result is found. However, this research could give an indication for how there could be a relationship between the composition of exports and educational attainment.

5.5 Composition of variables

It is assumed that the variables that are composed in this research are the best measure for the variables they represent. However, in absence of other alternative variables their robustness could not be confirmed. So, it could be discussed if the variables used are the best measures for the effects they are supposed to measure.

One example concerns the constructed district specific employment weights. Taking the logarithm of the employment weight times the total exports yielded different results on the variable of interest then calculating the logarithm of the total exports before multiplying it to the employment weight. This indicates that the final results are sensitive to the decision of the researcher on the way of computing this variable, and that the results could be altered considerably by changing the composition of the variables.

6. Conclusion and recommendations

The aim of this research was describing a potential incentive to invest in human capital from the demand side. This research was inspired by the article of Blanchard and Olney (2017), who show that growth in exports of less skill-intensive goods lead to a decrease of average educational attainment, while growth in exports of skill-intensive goods lead to an increase in educational attainment. Based on standard H-O trade theory, opening up for trade will show an increase in educational attainment in the skilled labor abundant country and a decrease in the less skilled labor abundant country. Where Blanchard and Olney (2017) compare 102 countries, this study was based on a panel dataset with 401 Indonesian districts.

The demand side of education is driven by three factors, which were described in the theoretical framework. First, the internal rate of return to education explains the incentives on how individuals make the decision to invest in education, based on a cost-benefit analysis. Second, drivers for education are directly linked to the labor market and wages. When there is high unemployment among graduates the returns to education are low and this will decrease the incentives to invest in human capital. Finally, trade can also generate income effects that could influence schooling decisions, where higher economic growth leads to higher demand for human capital. Therefore, this is an important variable to control for in the analysis.

The research was conducted using a classification of export products. Every industry, out of a total of 33, was assigned to either a low skilled or high skilled sector and a share of the total population employed in this sector per district was calculated. Based on this share, the export composition of a district is measured as the interaction between the share of a district's population employed by various industries in some initial year and total Indonesian exports in these industries.

According to the base specification it was expected to find a positive effect for no formal, primary and lower secondary schooling and low skilled exports, and a negative effect for higher secondary and tertiary schooling. Contrarily, for high skilled exports a negative effect was expected for no formal, primary and lower secondary education, and a positive effect for higher secondary and tertiary education.

The first analysis with the two main variables of interest only showed a statistically significant negative relationship between a change in high skilled exports and higher secondary education. The effect of including the income control variable did not alter the results, so other control variables were included. With all control variables included, both with and without the income control variable, no coefficient of interest turned out to be statistically significant and the income control variable only altered the result for tertiary education.

When the results on different age groups were examined, it became clear that the effects are mainly concentrated among the age groups of 10-15 and 16-20-year-olds. For the youngest age group, an increase in primary schooling was found with an increase in low skilled exports, which was mainly due to a decrease in no formal education and could imply that even some education is needed for low skilled work. For the 16-20-year-olds the results on lower secondary education stood out the most. Both export sectors showed a statistically significant effect, where this effect was negative for low skilled exports and positive for high skilled exports. A probable explanation could be a higher

level of education needed to work in the high skilled export sector and a dropout of 16-20-year-olds in the low skilled export sector who do not finish their lower secondary education and start working without finishing their basic education.

Considering underlying trends that influence both educational attainment and the amount of low and high skilled exports, initial conditions on the share of workers in both high and low skilled sectors were added to control for confounding trends. When these initial conditions were added, significantly different from zero results were found for high skilled exports and lower secondary and tertiary education for both with and without control variables. For the statistically significant results on high skilled exports also the initial conditions turned out to be significant. For these education levels that what matters for educational attainment is not only the composition of exports, but also the share of workers employed in both high and low skilled sectors. The coefficients of the initial conditions show positive values for lower secondary education, implying that an increase of the shares in both sectors lead to a higher share of 10-30-year-olds who follow lower secondary education. This is the other way around for tertiary education, given the negative values for both sector shares.

Combining the analysis with initial conditions with the different age groups did not change the results in a big way for the 10-15 and 16-20-year-olds. However, the 21-30-year-old age group showed big differences with the initial conditions included in the analysis. Especially higher secondary and tertiary education showed statistically significant results and indicated an increase in attendance rate for higher secondary education when high skilled exports rise, where attended tertiary education decreased. Together with the statistically significant results for the initial conditions on these education levels, these results strengthens the assumption that basic education is needed to find work in the high skilled export sector, where this is less important for the low skilled export sector.

The robustness checks showed that the classification of exports did not have a large impact on the results. For the income variable, the coefficients of interest were comparable between the analyses with different income control variables, but the outcomes for the two income control variables differed slightly. The effect sizes for the two income control variables were different, but the signs were equal, and they both turned out to be a statistically significant factor for the decision to follow tertiary education.

Summarized, this research showed the relationship between the division of exports on investments in human capital in Indonesian districts. The main results turned out to be not statistically significant and interesting results were found in the signs of the effects. Where statistically significant effects were found, most were of such a small value that they could be considered trivial. This is not surprising given the short time span of this study, and considering the time it takes for education decisions to change. Another explanation of these results could be the composition of labor within industries. The industries are identified to be either a low or high skilled sector, but within the industry a division could be made as well. Therefore, an industry that is considered a high skill export sector does not automatically need only high skilled labor. More results were found within the different age groups. Especially with the inclusion of the initial conditions it turned out that a basic education is needed in the high skilled export sector, where this is less important within the low

skilled export sector. However, tertiary education is still not demanded from the high skilled export sector and therefore the income effect plays a bigger role for this education level.

So, the results also demonstrate that not only the division of exports is important, but also specific control variables and income are important factors in determining when parents invest in human capital of their children. Especially the income effect for tertiary education, both with the expenditures and PPI control variable, stood out which could indicate that there is an income effect for tertiary education. Since education until lower secondary school is considered normal in Indonesia this is a plausible explanation. These results improve the understanding of investments in education and are therefore valuable for policymakers. The results also add to academic literature, since this is a case study specific study. However, some processes and relations are still unknown, for which reason further research is recommended.

The most important suggestion for further research is the use of a longer time span. Since educational attainment takes some years to change, a longer time span would allow for increased capacity to detect the actual effect and make the results more reliable. In this case a lagged variable of five years could be used to account for the time it takes for economic factors to affect average years of schooling. Furthermore, a follow-up study using the same survey and study sample would allow for a more extensive comparison over years between districts. In order to completely rule out the presence of any major differences in behavior between the moment the data were collected and now, a repetition of the survey is required, so that within-district changes over time can be assessed. The use of an IV approach could be used to check for endogeneity concerns, but this is challenging since no perfect instrument exists. Additional research could be done on differences in gender or to change the dependent variable into average years of schooling, as is done in Blanchard and Olney (2017).

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Appendix 1: SITC Revision 3

0	Food and live animals
1	Beverages and tobacco
2	Crude materials, inedible, except fuels
3	Mineral fuels, lubricants and related materials
4	Animal and vegetable oils, fats and waxes
5	Chemicals and related products, n.e.s.
6	Manufactured goods
7	Machinery and transport equipment
8	Miscellaneous manufactured articles
9	Commodities and transactions not classified elsewhere in SITC

Note. From UNCTADSTAT, 2017

Appendix 2: Manufactured goods by degree of manufacturing groups

B. Labor-intensive and resource-intensive manufactures	
611	Leather
612	Manufactures of leather, n.e.s.; saddlery & harness
613	Furskins, tanned or dressed, excluding those of 8483
633	Cork manufactures
634	Veneers, plywood, and other wood, worked, n.e.s.
635	Wood manufacture, n.e.s.
641	Paper and paperboard
642	Paper & paperboard, cut to shape or size, articles
651	Textile yarn
652	Cotton fabrics, woven
653	Fabrics, woven, of man-made fabrics
654	Other textile fabrics, woven
655	Knitted or crocheted fabrics, n.e.s.
656	Tulles, trimmings, lace, ribbons & other small wares
657	Special yarn, special textile fabrics & related
658	Made-up articles, of textile materials, n.e.s.
659	Floor coverings, etc.
661	Lime, cement, fabrica. constr. mat. (excluding glass, clay)
662	Clay construction, refracto. construction materials
663	Mineral manufactures, n.e.s.
664	Glass
665	Glassware
666	Pottery
821	Furniture & parts
831	Travel goods, handbags & similar containers
841	Men's clothing of textile fabrics, not knitted
842	Women's clothing, of textile fabrics
843	Men's or boy's clothing, of textile, knitted, croche.
844	Women's clothing, of textile, knitted or crocheted
845	Articles of apparel, of textile fabrics, n.e.s.
846	Clothing accessories, of textile fabrics
848	Articles of apparel, clothing access., excluding textile
851	Footwear
C. Low skill- and technology-intensive manufactures	
671	Pig iron & spiegeleisen, sponge iron, powder & granu
672	Ingots, primary forms, of iron or steel; semi-finis.
673	Flat-rolled prod., iron, non-alloy steel, not coated
674	Flat-rolled prod., iron, non-alloy steel, coated, clad
675	Flat-rolled products of alloy steel
676	Iron & steel bars, rods, angles, shapes & sections
677	Rails & railway track construction mat., iron, steel
678	Wire of iron or steel
679	Tubes, pipes & hollow profiles, fittings, iron, steel
691	Structures & parts, n.e.s., of iron, steel, aluminium
692	Metal containers for storage or transport

693	Wire products (excluding electrical) and fencing grills
694	Nails, screws, nuts, bolts, rivets & the like, of metal
695	Tools for use in the hand or in machine
696	Cutlery
697	Household equipment of base metal, n.e.s.
699	Manufactures of base metal, n.e.s.
785	Motorcycles & cycles
786	Trailers & semi-trailers
791	Railway vehicles & associated equipment
793	Ships, boats & floating structures
895	Office & stationery supplies, n.e.s.
899	Miscellaneous manufactured articles, n.e.s.
D. Medium skill- and technology-intensive manufactures	
775	Household type equipment, electrical or not, n.e.s.
772	Apparatus for electrical circuits; board, panels
621	Materials of rubber (pastes, plates, sheets, etc.)
625	Rubber tyres, tyre treads or flaps & inner tubes
629	Articles of rubber, n.e.s.
711	Vapour generating boilers, auxiliary plant; parts
712	Steam turbines & other vapour turbin., parts, n.e.s.
713	Internal combustion piston engines, parts, n.e.s.
714	Engines & motors, non-electric; parts, n.e.s.
716	Rotating electric plant & parts thereof, n.e.s.
718	Other power generating machinery & parts, n.e.s.
721	Agricultural machinery (excluding tractors) & parts
722	Tractors (excluding those of 71414 & 74415)
723	Civil engineering & contractors' plant & equipment
724	Textile & leather machinery, & parts thereof, n.e.s.
725	Paper mill, pulp mill machinery; paper articles man.
726	Printing & bookbinding machinery, & parts thereof
727	Food-processing machines (excluding domestic)
728	Other machinery for particular industries, n.e.s.
731	Machine-tools working by removing material
733	Mach.-tools for working metal, excluding removing mate.
735	Parts, n.e.s., & accessories for machines of 731, 733
737	Metalworking machinery (excluding machine-tools) & parts
741	Heating & cooling equipment & parts thereof, n.e.s.
742	Pumps for liquids
743	Pumps (excluding liquid), gas compressors & fans; centr.
744	Mechanical handling equipment, & parts, n.e.s.
745	Other non-electr. machinery, tools & mechan. appar.
746	Ball or roller bearings
747	Appliances for pipes, boiler shells, tanks, vats, etc.
748	Transmis. shafts
749	Non-electric parts & accessor. of machinery, n.e.s.
771	Electric power machinery, and parts thereof
773	Equipment for distributing electricity, n.e.s.
774	Electro-diagnostic appa. for medical sciences, etc.

778	Electrical machinery & apparatus, n.e.s.
781	Motor vehicles for the transport of persons
782	Motor vehic. for transport of goods, special purpo.
783	Road motor vehicles, n.e.s.
784	Parts & accessories of vehicles of 722, 781, 782, 783
811	Prefabricated buildings
812	Sanitary, plumbing, heating fixtures, fittings, n.e.s.
813	Lighting fixtures & fittings, n.e.s.
893	Articles, n.e.s., of plastics
894	Baby carriages, toys, games & sporting goods
E. High skill- and technology-intensive manufactures	
751	Office machines
752	Automatic data processing machines, n.e.s.
761	Television receivers, whether or not combined
762	Radio-broadcast receivers, whether or not combined
763	Sound recorders or reproducers
759	Parts, accessories for machines of groups 751, 752
764	Telecommunication equipment, n.e.s.; & parts, n.e.s.
776	Cathode valves & tubes
511	Hydrocarbons, n.e.s., & halogenated, nitr. derivative
512	Alcohols, phenols, halogenat., sulfonat., nitrat. der.
513	Carboxylic acids, anhydrides, halides, per.; derivati.
514	Nitrogen-function compounds
515	Organo-inorganic, heterocycl. compounds, nucl. acids
516	Other organic chemicals
522	Inorganic chemical elements, oxides & halogen salts
523	Metallic salts & peroxysalts, of inorganic acids
524	Other inorganic chemicals
525	Radio-actives and associated materials
531	Synth. organic colouring matter & colouring lakes
532	Dyeing & tanning extracts, synth. tanning materials
533	Pigments, paints, varnishes and related materials
541	Medicinal and pharmaceutical products, excluding 542
542	Medicaments (incl. veterinary medicaments)
551	Essential oils, perfume & flavour materials
553	Perfumery, cosmetics or toilet prepar. (excluding soaps)
554	Soaps, cleansing and polishing preparations
562	Fertilizers (other than those of group 272)
571	Polymers of ethylene, in primary forms
572	Polymers of styrene, in primary forms
573	Polymers of vinyl chloride or halogenated olefins
574	Polyethers, epoxide resins; polycarbonat., polyesters
575	Other plastics, in primary forms
579	Waste, parings and scrap, of plastics
581	Tubes, pipes and hoses of plastics
582	Plates, sheets, films, foil & strip, of plastics
583	Monofilaments, of plastics, cross-section > 1mm
591	Insectides & similar products, for retail sale

592	Starche, wheat gluten; albuminoidal substances; glues
593	Explosives and pyrotechnic products
597	Prepared addit. for miner. oils; lubricat., de-icing
598	Miscellaneous chemical products, n.e.s.
792	Aircraft & associated equipment; spacecraft, etc.
871	Optical instruments & apparatus, n.e.s.
872	Instruments & appliances, n.e.s., for medical, etc.
873	Meters & counters, n.e.s.
874	Measuring, analysing & controlling apparatus, n.e.s.
881	Photographic apparatus & equipment, n.e.s.
882	Cinematographic & photographic supplies
883	Cinematograph films, exposed & developed
884	Optical goods, n.e.s.
885	Watches & clocks
891	Arms & ammunition
892	Printed matter
896	Works of art, collectors' pieces & antiques
897	Jewellery & articles of precious materia., n.e.s.
898	Musical instruments, parts; records, tapes & similar

Note. From UNCTADSTAT, 2017

Appendix 3: BPM6 classification of services

1	Manufacturing services on physical inputs owned by others
2	Maintenance and repair services, n.i.e.
3	Transport
4	Travel
5	Construction
6	Insurance and pension services
7	Financial services
8	Charges for the use of intellectual property n.i.e.
9	Telecommunications, computer, and information services
10	Other business services
11	Personal, cultural, and recreational services
12	Government goods and services n.i.e.

Note. From Loungani et al., 2017

Appendix 4: List of industries

Industry	Low or High skilled classified
Agriculture, hunting, forestry and fishing	LS
Mining and quarrying	LS
Food products, beverages and tobacco	LS
Textiles, textile products, leather and footwear	LS
Wood and products of wood and cork	LS
Pulp, paper, paper products, printing and publishing	LS
Coke, refined petroleum products and nuclear fuel	HS
Chemicals and chemical products	HS
Rubber and plastics products	HS
Other non-metallic mineral products	LS
Basic metals	LS
Fabricated metal products	LS
Machinery and equipment, nec	HS
Computer, electronic and optical equipment	HS
Electrical machinery and apparatus, nec	HS
Motor vehicles, trailers and semi-trailers	LS
Other transport equipment	LS
Manufacturing nec; recycling	HS
Public administration and defence; compulsory social security	HS
Education	HS
Health and social work	HS
Other community, social and personal services	HS
Private households with employed persons	LS
Wholesale and retail trade; repairs	LS
Hotels and restaurants	LS
Transport and storage	LS
Post and telecommunications	LS
Financial intermediation	HS
Real estate activities	HS
Renting of machinery and equipment	HS
Computer and related activities	HS
R&D and other business activities	HS
Construction	LS

Appendix 5: PPI Scorecard for Indonesia[5]

Indicator	Response	Points
1. How many household members are there?	A. Six or more	0
	B. Five	5
	C. Four	11
	D. Three	18
	E. Two	24
	F. One	37
2. Do all household members ages 6 to 18 go to school?	A. No members ages 6 to 18	0
	B. No	0
	C. Yes	2
3. What is the highest level of education that the female head/spouse has completed?	A. None	0
	B. Grade school (incl. disabled, Islamic, or non-formal)	3
	C. Junior-high school (incl. disabled, Islamic, or non-formal)	4
	D. No female head/spouse	4
	E. Vocational school (high-school level)	4
	F. High school (incl. disabled, Islamic, or non-formal)	6
	G. Diploma (one-year or higher), or higher	18
4. What was the employment status of the male head/spouse in the past week in his main job?	A. No male head/spouse	0
	B. Not working, or unpaid worker	0
	C. Self-employed	1
	D. Business owner with only temporary or unpaid workers	3
	E. Wage or salary employee	3
	F. Business owner with some permanent or paid workers	6
5. What is the main material of the floor?	A. Earth or bamboo	0
	B. Others	5
6. What type of toilet arrangement does the household have?	A. None, or latrine	0
	B. Non-flush to a septic tank	1
	C. Flush	4
7. What is the main cooking fuel?	A. Firewood, charcoal, or coal	0
	B. Gas/LPG, kerosene, electricity, others, or does not cook	5
8. Does the household have a gas cylinder of 12kg or more?	A. No	0
	B. Yes	6
9. Does the household have a refrigerator or freezer?	A. No	0
	B. Yes	8
10. Does the household have a motorcycle, scooter, or motorized boat?	A. No	0
	B. Yes	9

Note. From IPA, 2012

[5] Because question 8,9 & 10 were not available in Susenas 2006 for the PPI index score, data for question 9 and 10 are used from Supas 2005. Question 8 is transformed into the question: Does the household have a phone?