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The effect of globalization on educational attainment

By

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A Thesis Submitted to
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Abstract

This paper studies the effect of globalization on educational attainment. Using exports as percentage of GDP and globalization index to measure globalization, I use a series of panel regression models that includes agricultural exports, skilled manufactured exported and low-skilled manufactured exported as explanatory variables of schooling. Using a panel of 63 countries, 47 years (from 1970-2016) and OLS model, my results suggest that reduction in tariff or increasing in exports lead to increase in years of schooling. Moreover, WTO member does not play roles in education achievement. Educational attainment decreases with agriculture exports, low-skill-intensive manufactured exports and skilled manufactured exports.

1 Introduction

Technology and fall of trade barriers resulting in the integration of countries. The transformation of the world economy has happened recently. In United States the proportion of workers in blue-collar reduced from 56 percent to 39 percent between 1969 and 1999; during the same time the proportion of jobs that are technical and professional increased from 23 percent to 33 percent (Levy and Murnane, 2004). The economy has become more global and at the same time transformation is taking place in education. The rise of Asia in the late 20th also shows that globalization leads to both economic and education changes. China's GDP tripled from 1980 to 2003. In the Cultural Revolution of the 1960s in China, almost no students went to school. However, today in China, nine years of basic education are universal in most areas in China Stewart (2012). It is thus interesting to study how does globalization affects education in developing and developed countries. Liu (2017) finds that China's accession to WTO reduced high school educational attainment by 3.5% since 2001. When I study the effect of globalization on education, it is also interesting to consider whether there is a difference between WTO members and non WTO members.

Recent studies suggests that globalization has positive influence on education attainment especially in developing countries (Atkin, 2012; Chuang, 2000; Stokey, 1996). The evolution of technology boost the relationship between higher education and economic development. Highly educated and high-skilled people become an important factor of economic growth. The demand for skilled workers of these countries changes due to trade liberalization. Thus it is important to study the influence of globalization or tariff changes on educational attainments of people.

To examine the relationship between trade liberalization and educational attainment, I study exports and tariff as factors of years of schooling. The first panel regression measures years of schooling with GDP per capita, average tariff, exports of agricultural product as percentage of total exports, exports of low-skill intensive manufacture as percentage of total exports, exports of skill intensive manufacture as percentage of total exports and total

exports as percentage of GDP and globalization index as explanatory variables. My results show that When MFN weighted average tariff decreases by 1 %, which means the country is more globalized, average years of schooling will increase by 0.00894 years. Moreover, the results indicate that decreasing in GDP per capita, government spending on education, agriculture exports, low-skill-intensive manufactured exports and skilled manufactured exports and tariff will lead to an increase in years of schooling. While education attainment is increasing with globalization index moreover, globalization has different effects on different stages of education level.

Globalization can impact educational attainment through different channels. First, globalization stimulates people to obtain higher education or increase years of schooling Stokey (1996). High-skill jobs mean higher income, so trade changes returns to education. Moreover, globalization influences the affordability of education and peoples attitude towards education Edmonds et al. (2010). Globalization leads to labor market internationalization. In order to adapt to global economy, labor markets need more high skilled workers. Trade promotes economic growth and bring more opportunities thus a country has more financial resource to support educational attainment Dollar and Kraay (2002).

This paper contributes to the literature by comparing WTO members and non WTO members responds to education. Also, this paper focuses on the countries with different trade structure and different stages of education level. Globalization influences the government install policies related to education and trade, which provides the people with more skills and technology improvements. The government benefits from the economic growth resulting from trade liberalization and technology upgrading.

The rest of the paper is organized as follows. Section 2 discuss related literature about relationship among trade, education and income. Section 3 discusses methodology and specification of the model; Section 4 discusses the data used in my empirical analysis; Section 5 includes my empirical results and how they compare to previous findings and limitations. Section 6 discusses globalization and policy implication; Section 7 concludes and provides

suggestions for future research.

2 Literature Review

Many papers have studied the relationship between education and trade. I hypothesize that trade liberalization has significantly positive effects in both developing and developed countries, especially with larger effects on developing countries after joining the WTO. I divide the literature review into five sections: Heckscher-Ohlin model, trade and demand for education, trade and supply for education, global value chain and trade, and wage inequality and education inequality.

2.1 Heckscher-Ohlin Model

In real world, trade is explained only partly by differences in labor productivity and it reflects differences in countries' resources. However, Heckscher-Ohlin Model assumes two countries are identical and emphasizes resource differences as the only source of trade. Also Heckscher-Ohlin Model shows that comparative advantage is influenced by factor abundance and factor intensity. In the model a labor-abundant country will export labor-intensive goods, while a capital-abundant country will export capital-intensive goods. This implies that the relative abundance in labor will cause the labor-abundant country to produce labor-intensive goods cheaper than the capital-abundant country (Krugman, 2008).

Many previous studies focus on Heckscher-Ohlin Model to understand the effects of international trade on endogenous education in developed and developing countries. Findlay and Kierzkowski (1983) expand the Heckscher-Ohlin model of trade with endogenous acquisition of skill. Their work suggests a theoretical basis that connects a country's exports to endogenous investment in human capital. It shows that trade impacts relative commodity prices, thus affecting relative wages, which in turn promotes the returns to education and thus impacts peoples choice of schools. For example, the relative price of skill-intensive goods

will increase if a country with a comparative advantage in high-skill intensive goods opens to trade. The increase in the relative price of skill-intensive goods will then increase relative demand for higher skilled workers, and also increase the skilled wage premium. The rise in the return to education then will attract more people to invest in schooling (Blanchard and Olney, 2017).

Also, the Heckscher-Ohlin Model shows the important role of comparative advantage. In a two-country setting, it is clear that trade liberalization will have a positive effect on education in the more skill-abundant country and have a negative effect on education in the less skill-abundant country. In general, this model shows that skill-composition of its exports is the most important determinant in the impact of trade on education (Blanchard and Olney, 2017). This outlines the theoretical basis for our empirical approach. The pattern of a country's exports drives local investment in human capital and finally influences education. Moreover, exports can generate income effects that may influence schooling. Also, trade liberalization can stimulate skill upgrading, this lead me to investigate if there are different effects of trade liberalization at different stages of education level.

2.2 Trade and demand for education

Imports and exports may lead to changes in the education system. The relationship between trade openness and the demand for skilled labor have been studied by lots of people. An increase in the number of skilled workers is happening in many developing and developed countries in recent years because of trade openness and technological progress. Demand for skilled workers is increasing because of increased trade liberalization and skilled workers wages is then increasing because of demand. For workers, higher education means higher returns to education. These higher returns to education lead companies and countries to have incentives to invest in human capital (Velde, 2005).

Some studies relate trade openness to labor market and investment on education and skill training. Chuang (2000) argues that there is a positive bidirectional relationship between

trade and human capital accumulation. Human capital accumulation stimulates exports and exports improve economic growth in the long run if the process of human capital accumulation is accelerating. Also, Chuang argues that trade liberalization brings more opportunities thus the rate of return on human capital investment increases. Export growth advances learning and the spread of technological knowledge (Chuang, 2000). For developing countries, although their exported products are low-skilled intensive goods, international trade can initiate technology transfer from developed to developing countries due to the skill-biased technology differences between them (Eli and Machin, 2000).

In addition, Stokey (1996) shows that free trade leads to an increase in wage rates for both skilled and unskilled labor and therefore human capital accumulation increases comparing to closed economy. Hanson and Harrison (1995) show that the quality of workers increases because of accumulation of human capital and thus a country with abundant skilled labor has a comparative advantage.

Galhardi (1999) argues that international trade and technological improvement affect the structure of production. The paper focuses on the Republic of Korea and Brazil. In the Republic of Korea, the structure of trade by sectors has changed from food and textile to machinery and electronics, meaning from labor intensive to skill intensive industries. The paper also mentions that the employment growth pattern is similar to the structure of trade: exporting heavy industries increase their employment share, especially skill intensive industries have an important influence on increasing employment. Moreover, Galhardi (1999) suggests that productivity changes due to open to trade. Skill upgrading from manual assembly to machine production in the manufacturing sector has advantages on the supply of workers in general because the skill level of workers has increased due to a better educational attainment of workers in the labor market in total.

Ridao-Cano and Wood (1999) show different theories on the impact of trade on skill inequality. One trade theory suggests that openness to trade give developing countries the opportunity to become developed countries. Other theories suggest that based on the differ-

ence between trade structures, industries with low skilled workers are replaced by industries with greater productivity growth potential and high skill workers. The paper also provides another explanation based on Heckscher-Ohlin Model. The results in the paper show that trade liberalization has influences on international differences in skill supplies. In developing countries, the greater openness to trade will lead to the increase in relative wage of skilled workers. Then the gap in skill endowments among countries widens. Thus, inequality in education will increase because secondary and tertiary enrollment rates increases more in high-skilled and high income countries than in other countries. This implies that income per capita increased by trade liberalization is greater in developing countries (Ridao-Cano and Wood, 1999).

Free trade influences the relative demand for factors of production, and shifts the wages to skilled and unskilled workers consequently. Increases (decreases) in wages of high-skilled workers translate directly into increases (decreases) in returns to education. Moreover, trade leads to technological advancement and in turn affects returns to education. Globalization has fastened the speed of obtaining technological upgrade in developing countries (Pavcnik, 2003). As a result, the increased wage gap between skilled and unskilled labors in developing countries has also been attributed to trade-induced technological improvement (Liu, 2017). Liu (2017) uses a panel regression with tariff rates abroad on unskilled and skilled labor intensive products, import tariff rates on capital goods, and import tariff rates for unskilled and skilled goods as a measure of globalization. She uses panel data from 1990 to 2005 across 324 Chinese prefectures and temporal variation across 15 age cohorts. She concludes that falling tariff on foreign technology increases the completion of high school education in China. However, her data is only from 1990 and 2005 and in China there are lots changes in economics and policys after 2005. Thus the results cannot give significant supports for people who want to know relationship between education and globalization in recent years. Loosened trade policy will expand export opportunities in unskilled sectors thus increasing the opportunity cost of schooling and decreasing high school education completion. She also

finds that trade policy changes have no effect on college education, and increasing schooling premium and local government's provision of public education will increase education attainment.

Some papers study endogenous skill acquisition in response to trade reform. Trade reform can change education attainment through different ways. First, trade shocks can change people's incentive to gain tertiary education and also change returns to education. Previous studies state that when trade brings new exporting opportunities, the years of schooling will increase. Atkin (2012), however, finds a different result that the opportunity cost of schooling potentially increases because of new low-skill exports jobs and school dropout rates will increase if the increase in opportunity cost of education prevail over other increases in returns to education. Also, the paper studies education in response to different industry of new job arrivals from 1986 to 2000. Atkin chooses this period because Mexico joined General Agreement on Tariffs and Trade (GATT) in 1968 and the North American Free Trade Agreement (NAFTA) in 1994, lots of factories opened in this period and brought new jobs with them. He focuses on expansion of labor forces in export-oriented industries. Atkin (2012) concludes that if factories were located near rich and educated areas in Mexico, there would be a positive correlation between education attainment and employment, but this correlation would be negative if factories were located near poor areas. He also finds that for jobs that require more educated and skilled workers, export manufacturing expansion does not have same negative impact on education attainment.

The literature discussed in this section supports my hypothesis that international trade has positive influences on educational attainment through returns to education and opportunity cost of schooling. Moreover, international trade changes people's attitude towards education and people from developed and developing countries give different responses towards globalization.

2.3 Trade and supply for education

If the country focuses on more skill-intensive industries, then trade gives opportunities to countries to increase the supply of skilled labors. The effect on the supply of education through two channels. The first is that trade promote economic growth then country have more financial resources for the supply of education (Velde, 2005).

Dollar and Kraay (2002) find a positive relationship between trade openness, growth and incomes of the poorest one-fifth of the income distribution. They include domestic variables such as government consumption, inflation, primary education and the rule of law, and trade outcomes such as export and imports as percent of GDP. Their studies do not show the direction of causality because their studies is not clearly stated determinant of exports or imports. However, their results show that trade liberalization benefits economic growth.

A second channel is that countries have ability to finance education if economy expands due to trade and then trade taxation is one the sources of fiscal revenues. Lots of countries depend on trade taxes (e.g. import duties, quote or tariff) for their fiscal revenues, and during trade openness, tariff decreases and then fiscal revenues decrease. Therefore this lower the amount of resources available for the provision of education (Velde, 2005).

Moreover, globalization leading foreign firms to invest in developing countries can bring latest technology which requires skilled and educated workers. Moreover, workers get education through voluntary investment and scholarships (Velde, 2005). Multinational enterprises (MNEs) provide more training than their local counterparts. Batra and Tan (1995) use a sample of firms in Colombia, Mexico, Indonesia, Malaysia and Taiwan, ranging from 500 to 56,000 more firms in single years in the early 90s, and find that firms are more likely to offer worker training when they are large, employ a highly educated workforce (except Indonesia), invest in R&D (except Indonesia), are export oriented (except Malaysia) and use quality control. Thus trade liberalization may lead countries or companies have ability to finance education and training. While it remains unclear why they chose to examine the countries they did, as these countries appear to be randomly selected.

Barro (2000) focuses on human capital as a determinant of economic growth. The analysis stresses the distinction between the quantity of education measured by years of attainment at various levels and the quality of education measured by scores on internationally comparable examinations. Growth is positively related to the starting level of average years of school attainment of adult males at the secondary and higher levels. Growth is insignificantly related to years of school attainment of females at the secondary and higher levels. The study applied to roughly 100 countries observed from 1960 to 1990. This result suggests that highly educated women are not well utilized in the labor markets of many countries. Data on students scores on internationally comparable examinations in science, mathematics, and reading were used to measure the quality of schooling. Scores on science tests have a particularly strong positive relation with economic growth. Therefore, if a country maintains strong today, then it is likely also to maintain strong in the long run (Barro, 2000).

Greenland and Lopresti (2016) show the effect of trade-induced changes in labor market conditions on human capital accumulation in the U.S. from 1990 to 2007 by exploiting change in exposure to Chinese import competition. The paper measures changes in import penetration per worker and uses trade data at the six-digit HS product level and years of schooling. The paper finds that increases in imports per worker increase high school graduation rates in the U.S. The paper also shows that an average increase in the graduation rate of 3.64 percentage points result from a shift from 25th to the 75th percentile in Chinese import exposure. Then they conclude that the rise of Chinese import competition in the U.S. lead to a decline in labor market opportunities for individuals without a high school degree.

The literature discussed in supply for education supports my hypothesis that international trade promote economic growth in a country thus a country has more financial resource to support educational attainment. The literature offers multiple issues associated with globalization such as trade competition responses to education, and human capital responses to trade.

2.4 Global value chain

In addition, trade and education effects at the micro level appear in two aspects. First, returns to education are usually highest for the skilled labors in the export firms/sectors. Secondly, international trade (imports as well as exports) forces companies to become more productive and competitive, by pushing them to hire more skilled labors and providing more educational support (Velde, 2005).

Moran (1998) and Chuang (2000) find that exposure to foreign competition is important for skill upgrading. As part of the global competitive network, companies that force them to remain competitive seem to have more incentives to spend more money on training and education and will hire more skilled workers, and are also more likely to invent the latest technology for further training. As a result, workers need to have continuous skill improvement in order to participate in the international market continuously.

The impact of global value chains on upgrading of suppliers in developing countries is drawing more interests from scholars to study. Value chain governance affects the upgrading of the suppliers production capacity. Value chain analysis considers four types of upgrading (Kaplinsky et al., 2003). Process upgrading is connected to the increase in the productivity of production processes within or between stages of the value chain. When the technology is upgraded, innovation promotes the product upgrading. Functional promotion changes the combination of activities and functions conducted inside the value chain or company (for example, improving marketing and design, improving transactions, and optimal redistribution of resources). Finally, chain upgrading leads to moving to a new value chain. As mentioned before, upgrading needs human capabilities.

In a captive value chain (when purchaser-driven system locks producers) as one example, suppliers are facing both opportunities and obstacles to gain success in such chains. Gereffi (1999) shows a classic example is the textile and clothing value chain in some Asian countries where upgrading helped to improve the human abilities of suppliers. East Asian countries improved production processes and functions from simple assembly to more skilled department

such as marketing and design; buyers from developed country place orders with East Asian countries. Therefore developed countries became successful entrepreneurs and outsourced parts of the production to less developed countries such as China, Indonesia, Vietnam. East Asian countries are now more participating in design and other functions further down the value chain. However, other developed countries are locked into the upstream part of the value chain with few incentives to upgrade.

Kaplinsky et al. (2003) examine the global value chain of wooden furniture in South Africa where pine furniture has confronted intense price competition exerting pressures on export prices. Products are also considered to be low in quality and poor in delivery reliability. In this captive value chain, the global buyer did not think about improving the efficiency of this production stage instead of turning to more competitive East Asian suppliers, while South Africa had to upgrade to use environmentally friendly wood and focus on a different value chain. Therefore, the ability of people is improved in such an example participate in global value chains.

The literature discussed in global value chains shows that international trade influence different production stages within the value chains. Moreover, industrial structures in different countries are different which lead to different responses to trade reform. This allows me to consider trade has different influence on different industries.

2.5 Trade, education inequality and wage inequality

Globalization can generate income effects that may influence people's years of schooling. As families become richer, they will send their children to school longer even if the opportunity cost of education is increasing. However, if the households are poor, the educational investment will reduce even if the opportunity cost of schooling is also decreasing. At the national level, a country with higher GDP could in turn induce greater educational attainment. Conversely, a country with lower GDP will have less educational attainment (Blanchard and Olney, 2017). Blanchard and Olney (2017) use agriculture export, unskill-intensive manu-

factured exports, skill-intensive manufactured exports, total exports and GDP as a measure of average years of schooling. They use panel data from 1965 to 2010 with 102 countries. They conclude that decreasing in agriculture exports, low-skill-intensive manufactured exports will lead to increasing in years of schooling, however, increasing in skilled manufactured exports and GDP will lead to increasing in years of schooling. Thus I hypothesize that GDP and skilled manufactured exports are increasing with educational attainment; agriculture exports, low-skill-intensive manufactured exports are negative relate to schooling. However, in his study, he only uses quantity based measures of educational achievement; the quality-base measures of educational achievement (test scores) seems to be more powerful predictor of economics growth than quantity-base measurements.

The combined effect of the skill premium and income effect changes on education depends on whether income effect dominates (Liu, 2017). A decrease in import tariffs on unskilled labor generative goods lowers unskilled workers wages. This could result in an increase in the returns to education, and then an increase in the years of schooling. Existing studies that examine aggregate educational outcomes have found different results in developing countries. For example, both countries facing increased skill premium due to globalization, Hickman and Olney (2011) find that unskilled labors responded by upgrading their skills, while in India unskilled labors responded by reduce spending on their children's education in the U.S. (Edmonds et al., 2010). Therefore trade lead to education inequality problem.

Inequality in some developing countries has not decreased with trade. Zhu and Trefler (2005) focus on Southern exports to Northern countries (Northern countries are major OECD countries and Southern countries are countries whose 1980 real GDP per capita is below \$14000) and find that Southern catch-up changes export shares towards the Souths most skill-intensive products. Then the resulting change in export shares increases the level of wage inequality. Thus the South is only indirectly raising wage inequality by raising the export shares of the most skill-intensive products in the Southern. Blanchard and Olney (2017) give a potential explanation on inequality. Trade leads to a change in educational

attainment that can resist the rising pressure on low-skilled wages. An increase in less-skill-intensive exports decreases primary schooling on some degree, in developing countries supply of less-skilled workers will increase due to this influence, and thus may alleviate the decline in inequality.

Also, trade exposure has strong effect on labor market. David et al. (2013) study the impact of international trade on U.S. wage inequality. The paper connects changes in labor market situation from 1990 to 2007 in U.S. to changes in Chinese import competition. He studies manufacturing and nonmanufacturing employment, earnings and transfer payments across U.S. in response to Chinas import. David et al. (2013) find that China's conversion to a market oriented economy lead to increase in low income country exports from 1990 to 2007. The results show that labor markets that are exposed to rising low income country exports face increased unemployment because of Chinas increasing competitiveness. Import shocks lead to a decrease in wages and a decline in both employment and wage, which causes decrease in average earnings of households. These changes finally lead to rising transfer payments through many state programs.

Goldberg and Pavcnik (2007) study how globalization impact the income inequality in developing countries. The paper uses narrowly defined globalization: trade liberalization, outsourcing, capital flows, foreign direct investment and exchange rate. They show different approaches to study how trade polity influence wage inequality. The paper is a general equilibrium approach, in this approach, the model combined with predictions about the changes of traded good prices and estimates wage-price elasticities. The main advantage of this method is that it shows how trade policy changes impact welfare distribution. However, this model depend on estimation of wage-price elasticities, which is difficult to measure. Alternative approach mentions in the paper is differential exposure approach (Goldberg and Pavcnik, 2007). This approach emphasizes on cross-sectional variation in difference in trade protection. Such studies review more-exposed industries or regions have smaller or bigger changes in wage inequality than less-exposed within a country. The main advantage of this

approach is that the model can show different time changes in trade liberalization. The limitation in this model is that this approach only can reflect industry or regions response to trade liberalization. Goldberg and Pavcnik (2007) conclude that before trade liberalization in developing countries, unskilled-labor-intensive sectors were more protected by government. Thus globalization often has negative impact on unskilled workers in developing countries. Their results show that trade liberalization does not mitigate wage inequality in some developing countries and this conclusion is different from Stolper-Samuelson prediction which predicts that an increase in exports of skill intensive goods will increase the relative income of skilled labors and therefore will increase the skill premium so inequality in developed countries have a comparative advantage in skill intensive good.

There is another paper shows endogenous human capital responses to trade. Blanchard and Willmann (2016) explore how workers responses to technology upgrading and globalization. From previous studies, workers respond to openness to trade by improving their education ladder or other workers self-select to find low-skill intensive jobs. Blanchard and Willmann (2016) explain this polarization of educational attainment in their model. Their model is different from other studies that have models with endogenous human capital choice to two-good setting, this paper has many-good setting that allows comparative advantages in multiple goods. Their model emphasis on individuals educational decisions are determined by both trade and educational institutions. Blanchard and Willmann (2016) conclude that trade openness can lead to polarization of both employment and educational attainment.

Jaumotte et al. (2013) examine the relationship between trade and financial globalization and the rise in inequality in most countries in recent decades. They find that technological skill upgrading have a greater influence than globalization on inequality. Globalization impact on educational attainment reflect two tendencies. Trade globalization is linked to a decreasing in inequality and financial globalization is increasing with foreign direct investment. An important finding is that globalization increases returns on human capital and for both developed and developing countries, emphasizing the significant of education and training

to help mitigate inequality problem.

2.6 Contributions

My study is related to the reviewed literature by adapting Blanchard's and Olney's (2017) and Liu's (2017) model and incorporating many of the variables used by the discussed studies. My main contributions include comparing the effect of exports and imports on different country's educational attainment under a different time period, incorporating globalization index and industry characteristics into Blanchard's and Olney's (2017) and Liu's (2017) model, and focusing on countries with different development degrees and from different continents. Because in the previous reviewed literature, some researchers only focus on one country such that Atkin (2012) shows that globalization reduced educational attainment in Mexico, but Hickman and Olney (2011) find that globalization increases years of schooling in the U.S. so with larger sample of countries from different locations and with different economics backgrounds, I can draw a broader conclusion on education response on openness to trade.

3 Methodology

My empirical methods are based on Blanchard and Oley's (2017) and Liu's (2017) methodology. Similar to Blanchard and Olney, I implement GDP per capita, average tariff, exports of agricultural product as percentage of total exports, exports of low-skill intensive manufacture as percentage of total exports, exports of skill intensive manufacture as percentage of total exports and total exports as percentage of GDP as explanatory variables of educational attainment. However, I define exports of agricultural product as percentage of total exports, exports of low-skill intensive manufacture as percentage of total exports and exports of skill intensive manufacture as percentage of total exports differently from Blanchard and Oley because I use different dataset to collect data. Blanchard and Olney

use UNCTAD dataset and they define agricultural exports as the sum of exports in SITC industries 0,1,2 and 4, also manufactured exports are the sum of exports in SITC industries 6,7 and 8. I use WITS dataset and define agriculture exports as the sum of exports in animal, vegetable and food product. Also, I define low-skill intensive manufacture as the sum of exports in stone & glass, metals, textiles & clothing. Moreover, I define skill intensive manufacture as the sum of exports in chemical, transportation and electrical machinery. I add new variable globalization index in my model.

Most of the reviewed literature implements OLS or IV models to study trade liberalization and education. I use a panel regression and incorporate fixed effects into regressions to control for cross-country heterogeneity. I also run regression on different groups that I define. Then I compare the group regressions with my main model regression to see whether some independent variables had significant influence on trade and education.

3.1 Specification

The models that I generate is:

$$avesch_{it} = \beta_0 + \beta_1 govedu_{it} + \beta_2 exGDP_{it} + \beta_3 agrEXP_{it} + \beta_4 lowskmanEXP_{it} + \beta_5 skmanEXP_{it} + \beta_6 avetariff_{it} + \beta_7 gloidz_{it} + \beta_8 GDP_{it} + \beta_9 DWTO_{it} + \phi_i + \gamma_t + \epsilon_{it} \quad (1)$$

where Equation 1 examines my regression model. The dependent variable $avesch_{it}$ is average years of schooling in country i in year t ; $govedu_{it}$ represents government spending on education as percent of GDP in country i in year t ; $exGDP_{it}$ represents total exports as % of GDP in country i in year t ; $agrEXP_{it}$ represents exports of agricultural product as % of total exports in country i in year t ; $lowskmanEXP_{it}$ represents exports of low-skill intensive manufacture as % of total exports in country i in year t ; $skmanEXP_{it}$ represents exports of skill intensive manufacture as % of total exports in country i in year t ; $avetariff_{it}$ MFN weighted ave tariff in country i in year t ; $gloidz_{it}$ globalization index of country i in year t ;

GDP_{it} represents GDP per capita (thousands) in country i in year t ; $DWTO_{it}$ represents dummy variable, $DWTO_{it} = 1$ if the country i is a member of WTO, $DWTO_{it} = 0$, otherwise; ϕ_i captures country fixed effects, γ_t captures time fixed effects, and ϵ_{it} is a stochastic error term capturing other factors that influence educational attainment. I hypothesize that government spending on education as percent of GDP, total exports as percent of GDP, exports of skill intensive manufacture as percent of total exports, globalization index and GDP per capita will have a positive effect on years of schooling while exports of agricultural product as % of total exports, low-skill intensive manufacture as percent of total exports and tariff will have negative effect on years of schooling. These hypotheses are supported by the reviewed literature, specifically Blanchard and Olney (2017), Liu (2017) and Velde (2005). I run the first regression based on the model I generate. Then I run different group regressions to examine: how globalization affects education differently in WTO members and non-WTO members; how globalization affects primary, secondary and tertiary schooling; how globalization affects education differently in developed countries and developing countries; moreover, how globalization affects countries with different types of exports. I use a panel regression for the specification, similarly to Blanchard and Olney (2017).

4 Data

I combine multiple datasets from World Bank, KOF Swiss Economic Institute and WITS (World Integrated Trade Solutions) to create the dataset that includes all the variables in the model. I use annual panel data from 1970-2016, yielding 2961 observations. Average years of schooling and different education level data are from Barro and Lee (2013). This data is reported from individuals who are 15 years or older. I choose this data is because they span over one hundred countries at five year intervals starting from 1950, and are collected in several important dimensions like average years of schooling and completion rates at the primary, secondary, and tertiary levels, which I exploit in my analysis on how trade influences

education levels. GDP per capita is collected by the World Bank. Globalization index is from KOF Swiss Economic Institute. MFN average tariff, total exports as a percentage of GDP, exports of agricultural product as a percentage of total exports, exports of low-skill intensive manufacture as a percentage of total exports and exports of skill intensive manufacture as a percentage of total exports come from the WITS datasets. Government spending on education is collected from UNESCO Institute of Statistics. Some of the variables do not have data in some year range such as tariff data is from 1996 to 2016, so I do not have complete data for some variables from 1970 to 2016. I choose 63 countries based on Blanchard and Olney (2017). Table 1 shows summary statistics for all the variables. From the statistics, I can see that on average GDP per capita is 9750.684 thousand dollars. Also, average years of schooling for the 63 countries are 6.81 years, which is approximately the time to only finish primary level education. The maximum exports as percentage of GDP is 99.49% while the minimum is only 3.286%, meaning major exporter and major importer countries exist. The mean of low-skill manufactured exports as a percentage of total exports is 21.38%, but the maximum is as high as 92.51%, meaning that there is at least one country still mainly relying on low skilled manufactured exports. The same situation is observed in agricultural exports as a percentage of total exports as well.

5 Results

5.1 Main model

Table 2 reports results from estimating regression equation using OLS. The regression in the table uses average years of schooling as the dependent variable, and includes year-fixed effects and country-fixed effects. When running the regression with fixed effects, the estimated coefficients for the government spending on education, and total exports as a percentage of GDP are negative and statistically insignificant at the 5% level. As the government spending on education as a percentage of GDP increases by 1%, average years of schooling will

Table 1: Summary Statistics

VARIABLES	Obs	Mean	Std.Dev.	Min	Max
year	2,961	1993	13.56695	1970	2016
avesch	2,961	6.812817	3.081099	0.06	13.18
govedu(%)	1,568	4.348337	1.531365	0.70414	9.66163
exGDP(%)	1,766	34.38449	26.9636	3.286459	99.4998
agrEXP(%)	1,433	17.95403	17.48617	0	93.8419
lowskmanEXP(%)	1,433	21.38117	17.75197	0	92.5138
skmanEXP(%)	1,433	28.7879	21.87946	0	79.3219
avetariff(%)	931	8.942383	5.78753	0	56.3585
gloidz	2,818	56.62117	16.74696	17.99077	89.74767
GDP (\$ thousands)	2,759	9750.684	14706.4	60.47565	103059.2
WTO	1,378	0.9085631	0.288334	0	1

decrease by 0.0309 years. When total exports as a percentage of GDP increases by 1%, average years of schooling will decrease by 0.005 years. It shows that if a country is a large exporter, this country is more open to trade, but the average years of schooling will decrease due to trade liberalization. This result does not support my hypothesis that when a country is more globalized, the country has higher schooling in total.

The estimated coefficients for exports of agricultural product as a percentage of total exports, exports of low-skill intensive manufacture as a percentage of total exports, and exports of skill intensive manufacture as a percentage of total exports are negative and statistically insignificant at the 5% level. As the exports of agricultural product as percentage of total exports increases by 1%, the average years of schooling will decrease by 0.00127 years. It shows that if a country's structure of trade focuses more on agriculture, the country is less developed because agriculture is less skill-intensive. Also, the increase in exports of agricultural product as a percentage of total exports means that more unskilled labors are in the agriculture industries in the country, thus average years of schooling decreases due to trade openness on agriculture.

As exports of low-skill intensive manufacture as a percentage of total exports increases by

1%, the average years of schooling will decrease by 0.0072 years. It means that if a country's trade structure focuses more on low skilled manufacture industries, the low skilled intensive manufacture requires low-skilled labor. Thus, countries that are low skilled manufacture oriented will have a decreased average years of schooling when open to trade.

When exports of skill intensive manufacture as a percentage of total exports increases by 1%, average years of schooling will decrease by 0.00194 years. It shows that if a country's trade structure focuses more on skilled intensive manufacture and skilled intensive manufacture requires more skilled labor, average years of schooling in this country decreases slightly. This contradicts with what was concluded by Blanchard and Olney, who find that growth in skill-intensive manufactured exports increases average years of schooling. One possible explanation may be during trade liberalization, countries that are oriented in skilled intensive manufacture give more opportunities to foreign people with sufficient skills, thus the demand for high-skilled workers inside the countries actually does not increase, resulting in the insignificant, very small negative coefficient in this regression model.

The estimated coefficient for MFN weighted average tariff is negative and statistically insignificant at the 5% level. When MFN weighted average tariff decreases by 1%, average years of schooling will increase by 0.00894 years. My interpretation is that when the tariff of a country decreases, this country would more globalized thus the average years of schooling in this countries would increase. This result supports my hypothesis that openness to trade increases schooling.

The estimated coefficient for globalization index is positive and statistically significant at the 5% level. As a country's globalization index increases by one unit, the average years of schooling increase by 0.0282 years. A country with high globalization index means that the country is more globalized; the country with high globalization level will increase its average years of schooling when facing trade liberalization. This result supports my hypothesis that when a country is more globalized, the country has higher educational attainment in total.

The estimated coefficient for GDP is negative and statistically significant at the 5%

level. When a country's GDP per capita increases, the average years of schooling decreases. This result is different from my hypothesis that when a country has higher GDP, trade liberalization has a positive effect on education.

5.2 WTO membership

My second regression uses different interaction terms to find how globalization affect educational attainment differently between WTO and non WTO members. Table 3 shows the coefficient and the standard error in parentheses for each variable, with asterisks indicating significance level. When controlling for time fixed effect, the estimated coefficients for all the interaction terms are statistically insignificant at the 5% level and 10% level. This shows that whether a country is a WTO member does not correlate with education attainment. This result is different from my hypothesis that WTO members have higher educational attainment. The difference is because of my sample, there are only three non WTO countries and sixty WTO countries.

5.3 Educational Ladder

Besides focusing only on average years of schooling, I also study the effects of globalization on different levels of schooling. The previous results show overall average years of schooling are affected by globalization. However is this driven by changes in primary, secondary or tertiary education? In literature review, Blanchard and Olney (2017) suggest that exports of agriculture may decrease achievement at the primary or secondary level while skilled intensive manufactured export products may be likely to increase secondary or tertiary education.

Table 4 explores how globalization affect primary, secondary and tertiary schooling. I redefine the dependent variable to be the percent of the young population (15-29) with at least completed primary schooling, at least completed secondary schooling and at least completed tertiary from the Batto and Lee (2013) data. In my country sample, I rank the countries based on primary, secondary and tertiary school completed rate from 1970-2016

Table 2: Results for globalization on average years of schooling

VARIABLES	(1) avesch	VARIABLES	(2) avesch
govedu	-0.0309 (0.0308)	2002.year	0.392*** (0.124)
exGDP	-0.00512 (0.00441)	2003.year	0.376*** (0.127)
agrEXP	-0.00127 (0.00298)	2004.year	0.360*** (0.130)
lowskmanEXP	-0.00720 (0.00446)	2005.year	0.938*** (0.135)
skmanEXP	-0.00194 (0.00380)	2006.year	0.903*** (0.141)
avetariff	-0.00894 (0.00723)	2007.year	0.936*** (0.149)
gloidz	0.0282*** (0.00962)	2008.year	0.902*** (0.151)
GDP	-8.32e-06*** (3.00e-06)	2009.year	0.896*** (0.156)
DWTO	-0.0344 (0.196)	2010.year	1.300*** (0.157)
1996.year	0.314** (0.130)	2011.year	1.310*** (0.163)
1997.year	0.0932 (0.159)	2012.year	1.323*** (0.167)
1998.year	0.128 (0.122)	2013.year	1.316*** (0.167)
1999.year	0.122 (0.119)	2014.year	1.236*** (0.175)
2000.year	0.394*** (0.118)	2015.year	1.177*** (0.186)
2001.year	0.369*** (0.125)	Constant	6.384*** (0.612)
Observations	507		
Number of newcountry	46		
R-squared	0.707		

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3: Results for WTO group and average years of schooling

VARIABLES	(1) avesch
govedu	-0.469 (0.482)
exGDP	-0.0188 (0.0809)
agrEXP	-0.00562 (0.0578)
lowskmanEXP	-0.00660 (0.0330)
skmanEXP	0.0319 (0.0791)
avetariff	0.0304 (0.0928)
gloidz	0.0660 (0.0633)
GDP	-1.21e-05 (6.14e-05)
DWTO	0.717 (6.329)
wtotarif	-0.0400 (0.0929)
wtogovedu	0.443 (0.484)
wtoexGDP	0.0136 (0.0811)
wtoagrEXP	0.00427 (0.0579)
wtolsmaEXP	-0.000951 (0.0328)
wtoskmaEXP	-0.0342 (0.0792)
wtoglo	-0.0376 (0.0633)
wtogdp	4.11e-06 (6.14e-05)
Constant	5.632 (6.293)
Observations	507
Number of newcountry	46
R-squared	0.709

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

respectively. I define countries that listed every year in the top 20 primary school completion rate to be high primary schooling and define countries that listed every year in the bottom 20 primary/secondary/tertiary school completed rate to be low primary/secondary/tertiary schooling. This specification provides further insight into how trade liberalization affect the distribution of education.

For countries with high primary school completion rate, the results show that the estimated coefficients for government spending on education as percent of GDP, exports of agricultural product as percentage of total exports, exports of low-skill intensive manufacture exports as percentage of total exports, and GDP per capital are positive and statistically insignificant at the 5% level. Globalization index is insignificant, however the coefficient is negative. The estimated coefficients for total exports as percentage of GDP, exports of skill intensive manufacture as percentage of total exports and average average tariff are statistically significant. When total exports as percentage of GDP increases by 1%, the average years of schooling for these countries increase by 0.02 years. When skill intensive manufacture as percentage of total exports increases by 1%, the average years of schooling for these countries increase by 0.06 years. When tariff decreases by 0.1%, which means countries are more globalized, the average years of schooling for these countries increase by 0.1 years. However, for countries with low primary school completion rate, the results show that the estimated coefficients for government spending on education as percent of GDP, skill intensive manufacture as percentage of total exports and GDP per capita are positive and statistically insignificant at 5% level. Total exports as percentage of GDP, exports of agricultural product as percentage of total exports and average tariff are negative and insignificant. The estimated coefficients for globalization index and low skill intensive manufacture as percentage of total exports are statistically significant. When low skill intensive manufacture as percentage of total exports increases by 1%, the average years of schooling decrease by 0.025 years. When the globalization index increases by 1 unit, the average years of schooling for a country increases by 0.102 years.

For countries with high tertiary school completion rate, the results show that the estimated coefficients for total exports as percent of GDP, exports of agricultural product as percentage of total exports are negative and statistically insignificant at the 5% level. The estimated coefficients for government spending on education as percent of GDP, exports of low-skill intensive manufacture as percentage of total exports, exports of skill intensive manufacture as percentage of total exports, average average tariff, globalization index and GDP per capita are statistically significant. When government spending on education as percent of GDP increases by 1%, the average years of schooling for these countries decrease by 0.17 years. When low-skill intensive manufacture as percentage of total exports increases by 1%, the average years of schooling for these countries increase by 0.025 years. When skill intensive manufacture as percentage of total exports increases by 1%, the average years of schooling for these countries increase by 0.0157 years. When tariff decreases by 0.1%, which means countries are more globalized, the average years of schooling for these countries decrease by 0.0378 years. When the globalization index increases by 1 unit, the average years of schooling will increase by 0.0939 years. When GDP per capita increase by \$1000, the average years of schooling will increase. However, for countries with low tertiary school completion rate, the results show that the estimated skill intensive manufacture as percentage of total exports and tariff are positive and statistically insignificant at 5% level. Exports of agricultural product as percentage of total exports is negative and statistically insignificant. However, government spending as percentage of GDP, total exports as percentage of GDP, exports of low-skill intensive manufacture as percentage of total exports, globalization index and GDP are significant. When government spending as percentage of GDP increases by 1%, the average years of schooling decrease by 0.205 years. When total exports as percentage of GDP increase by 1%, the average years of schooling for a country decrease by 0.0363 years. When exports of low-skill intensive manufacture as percentage of total exports increase by 1%, the average years of schooling decreases by 0.0213 years. When globalization index increase by 1 unit, the average years of increase by 0.0649 years. When GDP per capita

increase by one thousand dollars, the average years of schooling will increase.

For countries with high secondary school completion rate, the results show that the estimated coefficients for total exports as percent of GDP is positive and statistically insignificant at the 5% level. The estimated coefficients for government spending on education as percent of GDP is negative and statistically insignificant at the 5% level. However, exports of agricultural product as percentage of total exports, low-skill intensive manufacture as percentage of total exports, skill intensive manufacture as percentage of total exports, tariff, globalization index and GDP are statistically significant. When exports of agricultural product as percentage of total exports increase by 1 %, the average years of schooling for these countries increase by 0.0360 years. When exports of low-skill intensive manufacture as percentage of total exports increase by 1 %, the average years of schooling for these countries increases by 0.0284 years. If exports of skill intensive manufacture as percentage of total exports increase by 1 %, the average years of schooling for these countries increase by 0.0224 years. When tariff decreases by 0.1% which means countries are more globalized, the average years of schooling for these countries decrease by 0.0266 years. When the globalization index increase by 1 unit which means the country is more globalized, the average years of schooling will increase by 0.0804 years. If GDP per capita increases by \$1000, the average years of schooling also increases. However, for countries with low secondary school completion rate, the results show that the estimated government spending on education as percent of GDP, exports of agricultural product as percentage of total exports and skill intensive manufacture as percentage of total exports are negative and statistically insignificant. The estimated coefficient for tariff is positive and statistically insignificant. However total exports as percentage of GDP, exports of low-skill intensive manufacture as percentage of total exports, globalization index and GDP are significant. When total exports as percentage of GDP increase by 1%, the average years of schooling for a country decrease by 0.0133 years. When exports of low-skill intensive manufacture as percentage of total exports increases by 1%, the average years of schooling decrease by 0.0145 years. When globalization index increase by 1 unit, the

average years of increase by 0.101 years. When GDP per capita increase by one thousand dollars, the average years of schooling will increase.

The results do not offer a clear trend about how trade liberalization influence on different stages of education level. The results suggest that globalization has different effect on different stages of education level. These results opposes that findings of Blanchard and Olney (2017). Blanchard and Olney find that less-skill-intensive exports reduce schooling most sharply at the primary school level, while positive effect of skill-intensive exports on schooling manifests at higher educational level.

Table 4: Results for countries with different education level

VARIABLES	high primary avesch	low primary avesch	high tertiary avesch	low tertiary avesch	high secondary avesch	low secondary avesch
govedu	0.0366 (0.0881)	0.127 (0.104)	-0.173** (0.0678)	0.205*** (0.0595)	-0.0544 (0.0506)	-0.0489 (0.0544)
exGDP	0.0201* (0.0109)	-0.0221 (0.0208)	-0.00308 (0.0101)	-0.0363*** (0.0116)	0.00556 (0.00725)	-0.0133* (0.00755)
agrEXP	0.0102 (0.00627)	-0.0175 (0.0288)	-0.00714 (0.0118)	-0.00765 (0.00558)	0.0360*** (0.0107)	-0.00648 (0.00431)
lowskmanEXP	0.0664 (0.0440)	-0.0251** (0.0101)	0.0255* (0.0144)	-0.0213*** (0.00697)	0.0284*** (0.00977)	-0.0145** (0.00627)
skmanEXP	0.0648** (0.0242)	0.00748 (0.0141)	0.0157* (0.00824)	0.0156 (0.0110)	0.0224*** (0.00649)	-0.00861 (0.00857)
avetariff	-0.105** (0.0479)	-0.0311 (0.0356)	0.0378* (0.0222)	0.0154 (0.0153)	0.0266* (0.0154)	0.00917 (0.00705)
gloidz	-0.00155 (0.0231)	0.102*** (0.0242)	0.0939*** (0.0115)	0.0649*** (0.0127)	0.0804*** (0.00770)	0.101*** (0.0139)
GDP	1.36e-05 (2.55e-05)	9.02e-06 (3.43e-05)	1.77e-05*** (5.23e-06)	0.000401*** (4.69e-05)	2.46e-05*** (5.09e-06)	0.000508*** (6.19e-05)
Constant	7.099*** (1.677)	1.054 (1.446)	3.380*** (1.078)	2.188*** (0.798)	2.336*** (0.734)	0.130 (0.773)
Year FE	Y	Y	Y	Y	Y	Y
Observations	31	23	115	114	95	83
R-squared	0.868	0.914	0.694	0.816	0.864	0.890
Number of newcountry	3	3	8	12	7	8

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

column (1) shows countries with high primary school completion rate; column (2) shows countries with low primary school completion rate; column (3) shows countries with high tertiary school completion rate; column (4) shows countries with low tertiary school completion rate; column (5) shows countries with high secondary school completion rate; column (6) shows countries with low secondary school completion rate

5.4 Level of Development

I divide the data differently to examine whether there are differences in how trade liberalization affect years of schooling in developed and developing countries. The results of this extension are reported in Table 5, where developed countries are defined as those designated as "high GDP per capita" that listed in the top 20 high GDP per capita countries every year and developing countries are defined as those designated as "low GDP per capita" that listed in the top 20 low GDP per capita countries every year based on my dataset.

When running the regression, for developed countries, the estimated coefficient for government spending on education as percent of GDP is negative and statistically significant; exports of agricultural product as percent of total exports, globalization index and GDP per capita are positive and statistically significant. While the coefficients for exports as percent of GDP, low-skill intensive manufacture as percent of total exports, skill intensive manufacture as percent of total exports and average tariff are statistically insignificant. Table 5 shows the coefficient and the standard error in parentheses for each variables, with asterisks indicating significance level. As government spending on education as percent of GDP increases by 1%, years of schooling will decrease by 0.206 years for developed countries. This result is consistent with my results in the main model that government spending and education attainment have negative relationship. As agricultural product as percent of total exports increase by 1%, years of schooling for developed countries will increase by 0.0613 years. This results is different from my results in the main model that agriculture exports and education achievement have negative relationship. As globalization index increases by 1 unit, it means the country is more globalized, years of schooling for developed countries will increase by 0.0881 years. This result is consistent with my results in the main model that globalization index and education attainment have positive relationship. For developed countries, if GDP per capita increase by one thousand dollars, years of schooling will increase.

For developing countries, the estimated coefficient for government spending on education as percent of GDP, globalization index and GDP are positive and statistically significant;

coefficient for low-skill intensive manufacture as percent of total exports and skill intensive manufacture as percent of total exports are negative and statistically significant. While other coefficient for other variables are statistically insignificant. As government spending on education as percent of GDP increases by 1%, years of schooling will increase by 0.103 years for developing countries. This results is different from my results in the main model that government spending and education attainment have negative relationship. As low-skill intensive manufacture as percent of total exports increase by 1%, years of schooling for developed countries will decrease by 0.0142 years. This results is consistent with my results in the main model that low-skill manufactured exports and education achievement have negative relationship. As skill intensive manufacture as percent of total exports increase by 1%, years of schooling for developing countries will decrease by 0.0182 years. This results is consistent with my results in the main model that skill manufactured exports and education achievement have negative relationship. As globalization index increases by 1 unit, it means that the country is more globalized, years of schooling for developing countries will increase by 0.0942 years. This results is consistent with my results in the main model and results for developing countries that globalization index and education attainment have positive relationship. For developing countries, if GDP per capita increase by one thousand dollars, years of schooling will increase. Also, comparing results for developing countries and developed countries, I find many coefficient for variables have opposite sign. Such as government spending on education has negative impact on schooling for developed countries and positive impact on schooling for developing countries. Moreover, comparing this with my main model results I find that developed countries' government spending has larger negative impact on schooling while developing countries' government spending has smaller positive impact on education. Thus developed countries have dominant position, so in the main model, decreasing government spending will lead to increase in schooling. There are also other variables have similar behaviors such as total exports as percent of GDP, skill manufactured exports and globalization index.

Overall, I see that export composition is associated with educational decisions in both developed and developing countries. There are some differences; agriculture exports as a percentage of total exports exhibit a positive effect on years of schooling in developed countries, but I find no such evidence when only pay attention to developing countries. This finding is consistent with Blanchard's and Olney's (2017) finding that increasing in agriculture exports lead to increasing schooling in developed countries and decreasing schooling in developing countries.

I find that skill-intensively manufactured exports have roughly equivalent effects on educational attainment in both developed and developing countries. Also, the low skill intensive manufactured exports have opposite effects on educational attainment in both developed and developing countries. The results here is different from Blanchard's and Olney's results that they find increasing skilled manufactured exports lead to increasing in years of schooling in both developed and developing countries and increasing unskilled manufactured exports lead to decreasing in years of schooling. The difference is due to the fact that I define skilled and unskilled manufactured exports differently.

5.5 Export Composition

Moreover, I am also interested in whether there are differences in how globalization affects years of schooling in countries with different export categories. The results of this extension are reported in Table 6, where agriculture countries are defined as those countries listed in the top 20 based on agriculture exports as percent of export every year, unskilled manufacturing countries are defined as those countries listed in the top 20 high listed in the top 20 based on their unskilled manufactured exports as percent of export every year and skilled manufacturing countries are defined as those countries listed in the top 20 high listed in the top 20 based on their skilled manufactured exports as percent of export every year using my data.

For agriculture countries, the estimated coefficient for low-skill intensive manufacture as

Table 5: Impact of globalization on schooling by level of development

VARIABLES	developed avesch	developing avesch
govedu	-0.206*** (0.0702)	0.103** (0.0449)
exGDP	-0.0194 (0.0118)	0.000271 (0.00888)
agrEXP	0.0613** (0.0252)	-0.00709 (0.00598)
lowskmanEXP	0.0220 (0.0179)	-0.0142** (0.00634)
skmanEXP	-0.00698 (0.0100)	-0.0182** (0.00915)
avetariff	0.00762 (0.0222)	0.00894 (0.00792)
gloidz	0.0881*** (0.0144)	0.0942*** (0.0115)
GDP	1.66e-05*** (2.46e-06)	0.000603*** (6.90e-05)
Constant	4.885*** (1.468)	0.146 (0.780)
Year FE	Y	Y
Observations	92	122
R-squared	0.771	0.859
Number of newcountry	7	13

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

column (1) shows high GDP countries; column (2) shows low GDP countries;

percent of total exports is negative and statistically significant and globalization index is positive and statistically significant, while other variables are insignificant.

For unskilled manufacturing countries, the estimated coefficient for government spending on education as percent of GDP, total exports as percent of GDP, skill intensive manufacture as percent of total exports, globalization index and GDP per capita are positive and statistically significant.

For skilled manufacturing countries, the estimated coefficient for total exports as percent of GDP and average tariff are negative and statistically significant; coefficient for globalization index and GDP per capita is positive and statistically significant.

Overall, the results did not show an interesting pattern except the coefficient for globalization index for all agriculture countries, unskilled manufacturing countries and skilled manufacturing countries are significant and globalization index increase schooling most sharply in skilled manufacturing countries.

5.6 Limitations

As discussed above, there are only three non WTO countries and sixty countries in my sample. Because of this, results about how trade liberalization influence on educational attainment differently on WTO and non-WTO members will be influenced.

The second limitation to this study is that data about educational attainment data from Barro and Lee (2013). They do not give annual data, but they span one hundred countries in five year intervals. Thus, I use the same data among five years. For example, from 1970 to 1974 I use the same 1970 data. Also, I use quantity-based measures of educational attainment (years of schooling); researchers could use both quantity-based and quality-based (test scores) measures of educational achievement. Another limitation is that my variables' data have different year ranges. For example, my education data is from 1970 to 2016 and my tariff data is from 1996 to 2016.

6 Policy implications

In general, my results show that globalization leads to higher education. This result has some policy implications. In my paper the result shows that whether a country is a WTO member does not influence its average years of schooling. But when China joined WTO in 2001, completion of high school education has increased in China since early 1990s (Liu, 2017). In addition, trade policy can change educational attainment through these three ways: return to education, opportunity cost of schooling and supply of education resources (Liu, 2017). Moreover, as globalization continues to expand, more and more countries are already integrated into world markets, my study will give support for the question about what types of exports are most beneficial for human capital accumulation. This is very important for different countries with different trade structure. Because countries' trade structure is more focused on skill-intensive goods and countries' trade structure is more focused on low-skill-intensive goods have different effect on education. Human capital is a key factor of economic growth, thus countries need to rethink the relevant policy that how best to engage in trade with the rest of the world (Blanchard and Olney, 2017).

7 Conclusion

In this paper, I demonstrate that educational attainment responds to changes in globalization, especially reduction in tariff and increasing total exports, and thus offer insight into how investment in human capital responds to changing patterns of trade structure and how globalization responds to different education level. I construct a panel data set that spans 63 countries and 47 years and adopt OLS model. My results show that MFN weighted average tariff decreases by 1 %, which means the country is more globalized, average years of schooling will increase by 0.00894 years. Also, my results indicate that educational attainment decreases with agriculture exports, low-skill-intensive manufactured exports and skilled manufactured exports. Moreover, globalization has different effect on different stages of edu-

cation level. Moreover, whether a country is a WTO member does not influence educational attainment.

There are some suggestions for future studies. First, in my paper I use quantity-based measures of educational attainment (years of schooling); researchers could use both quantity-based and quality-based (test scores) measures of educational achievement. Another suggestion is to use different measures of globalization. In my paper, I use total exports and average tariff. There are different measurements such as migration and private cross-border investment. Moreover, When facing trade liberalization, countries seem to increase average years of schooling and then people's income will also increase due to increasing in educational attainment. In Card and Krueger's (1992) paper, they find that quality of schooling influences income. More specifically, people who were educated with higher-quality schools have a higher return to additional years of schooling and also rates of return are also higher for individuals from states with better educated teachers. Thus future research can find how does globalization affect income and how education affect income when facing trade liberalizaion.

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Table 6: Impact of globalization on schooling by countries with different exports structure

VARIABLES	agriculture avesch	unskilled manufacturing avesch	skilled manufacturing avesch
govedu	0.0815 (0.0540)	0.173* (0.0951)	0.0790 (0.0699)
exGDP	0.00271 (0.01000)	0.0303* (0.0158)	-0.0168* (0.00893)
agrEXP	0.00366 (0.00476)	0.00874 (0.0174)	0.0251 (0.0333)
lowskmanEXP	-0.0235* (0.0119)	-0.00960 (0.00935)	0.0301 (0.0218)
skmanEXP	0.00261 (0.00800)	0.0222** (0.0109)	-0.0105 (0.0125)
avetariff	-0.0222 (0.0149)	-0.0196 (0.0133)	-0.0465*** (0.0109)
gloidz	0.0646*** (0.0132)	0.0344** (0.0153)	0.119*** (0.0131)
GDP	-1.32e-05 (9.17e-06)	4.45e-05*** (1.50e-05)	2.29e-05* (1.28e-05)
Constant	4.271*** (0.902)	4.081*** (0.975)	1.969 (1.469)
Year FE	Y	Y	Y
Observations	138	120	98
R-squared	0.493	0.674	0.846
Number of newcountry	11	10	7

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

column (1) shows high agriculture exports countries; column (2) shows high low skill manufacture exports countries; column (3) shows high skill manufacture exports countries;