An empirical study on the relationship between trade impediments and economic growth

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In this thesis there has been looked at the relationship of different trade impediments with economic growth per capita. A general equilibrium model shows that retaliation by the trade partner is the best-response on an import tariff of the domestic country. Utility levels would however be higher for both countries in a situation with free trade. To check the relationship of other trade impediments with economic growth per capita, a fixed effects panel data regression analysis has been made, which shows that countries in a higher income-category have lower or more negative correlations. Next to that are technical barriers to trade and sanitary and phytosanitary measures associated with a small, but positive economic growth per capita. Anti-dumping measures and safeguards are expected to be harmful for economic growth, while countervailing duties have a positive correlation with economic growth per capita for countries with a GNI below $12.375 and a negative one for richer countries. There has also been looked at whether these results were different for differently sized countries, but there were ambiguous results.

Summary

In this master thesis there has been looked at the relationship between different trade impediments and the economic growth per capita. This has been done because of the recent trade war between Trumps United States of America and China. At first a mathematical model of the world has been created to show the effects of import tariffs and retaliation for different sized countries with different endowments and transport costs via a mathematical general equilibrium model in GAMS. Thereafter there has been looked at other trade impediments, since they are increasing in quantity in recent years. This has been done via a fixed effects panel data analysis with data from the WTO, IMF and the World Bank. The regressions are based on Robert Solow's model of economic growth (1956). This is the reason why the variables population change and change of capital accumulation are added in the regression. Human capital is often seen as another important factor of economic growth and education is seen as a way to reflect this in the data. That is why the fifth lag of the secondary school enrollment rate and five lags of the government expenditures on education as a percentage of GDP are added as well. Next to that, has the first lag of the economic growth per capita and the first difference of the total trade as a percentage of GDP been added to the regression.

The hypotheses stated that import tariffs, technical barriers to trade, sanitary and phytosanitary measures and safeguards were expected to have negative effects on the economic growth per capita, while anti-dumping measures and countervailing duties were expected to be beneficial. Another hypothesis was that richer countries were hurt more or benefited less from the trade impediments. The mathematical analysis of the effects of import tariffs showed that without retaliation import tariffs would always be beneficial, but that the benefits are higher if the import tariff is set on the good which foreign producers initially produced more. Benefits are also higher if the foreign country is relatively bigger in size and if transport costs are lower. In all situations the best response of the foreign country would be to retaliate and put an import tariff on the good which they import the most. If both countries place an import tariff on the good which they import the most, then the utility levels would be below the levels of the situation with free trade. The best option would thus be to talk and try to get rid of the import tariff of the trade partner. In the model a small country could benefit from a retaliated import tariff, while this is not in line with economic theory. The likely problem is that due to the model only containing two countries, the small country could still influence the world price which would be unrealistic in the real world.

The regression analysis shows that the first and second hypotheses could be rejected, since the coefficients, although not statistically significant, are positive for the technical barriers to trade and the sanitary and phytosanitary measures. The results of the safeguards and countervailing duties were in line with its hypotheses, while the anti-dumping measures did have negative coefficients, where positive ones were expected. This could be explained by the fact that dumping is in the short term beneficial for domestic consumers and that anti-dumping measures, although protecting domestic producers, does harm to the economy. All in all, could technical barriers to trade, sanitary and phytosanitary measures and countervailing duties be expected to be beneficial to the economic growth per capita. However, the expected effects differ per income category and per country size quartile. For all trade impediments is the expected benefit (harm) lower (higher) for countries in a higher income group. This led to the association of an extra countervailing duty with economic growth per capita to be negative. Safeguards are expected to be the most harmful trade impediment since the foreign country should be compensated for the harm of the safeguard. Countries belonging to a higher country size quartile had higher/less negative coefficients for technical barriers to trade, sanitary and phytosanitary measures and safeguards. The coefficients of anti-dumping measures and countervailing duties were however smaller/more negative for bigger countries.

Another regression analysis has been made to make a comparison between the trade impediments. This is done with a sample with only the eleven countries which have data for all the variables. Trade impediments could not be used in all situations. Technical barriers to trade and safeguards could however be implemented in almost all situations. Sanitary and phytosanitary measures on the other hand, could only be used for imports of food, plants and animals. When the trade partner subsidizes their exports, then this could be retaliated with a countervailing duty, technical barrier to trade or a safeguard, and if the import is a food, plant or animal then a sanitary and phytosanitary measure could also be used. A countervailing duty is expected to be the most beneficial for the lower middle-income countries Indonesia and the Philippines and the upper middle-income countries: Argentina, Brazil, Colombia, Malaysia, South Africa, Thailand and Turkey. For the high-income countries Hungary and South Korea, a technical barrier to trade is the trade impediment with the highest expected benefit. If the subsidization leads to dumping, then an anti-dumping measure could also be used. A countervailing duty would still be the better option for all countries expect for Hungary and South Korea. For those countries an anti-dumping measure would now be the trade impediment associated with the highest level of economic growth per capita.

If the foreign country does not subsidize their exporters or dumps their products, then only technical barriers to trade and safeguards could be used and sanitary and phytosanitary measures if the product is a food, plant or animal. Safeguards have high coefficients for low-income and lower middle-income countries, but these results are not in line with the expectations and the other regression. This could be because of the low amount of observations. If there is assumed that these coefficients are wrongly positive, then a sanitary and phytosanitary measure would be the most beneficial for all countries expect Hungary and South Korea. If the import is not a food, plant or animal, then the best option for Indonesia and the Philippines is to do nothing. For the upper middle-income and the high-income countries, a technical barrier to trade would be expected to be the best for the economic growth per capita. However, there should be taken into account that those expected numbers are based on historical data. Next to a high variety due to the statistical insignificancy and possible omitted variables, could this mean that those trade impediments could be retaliated more than previously was done, which lowers the benefits or could even make it harmful.

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Introduction

Due to the trade war between the United States of America and China, I got interested in the effects of import tariffs and other trade impediments on economic growth. The trade war had harmed the Chinese economy, and its economic growth had slowed down in the third quarter of 2018 to its lowest point in ten years. The consumer confidence was also very low, which also lowered the expectations of economic growth in the Chinese economy. Louis Kuijs, the head of Asia economics at Oxford Economics, wrote in an article in the South China Morning Post (2018b) about his growth forecasts of China being 6 percent for 2019 and 5.7 percent for 2020. These numbers could have been respectively, 0.6 and 0.8 percentage point higher if the trade war was not there anymore. These numbers are also expected by the Chinese government, according to Wang Yang – member of the elite Politburo Standing Committee. He said that the Chinese government expected the gross domestic product (GDP) growth to be one percentage point lower than expected in the worst-case scenario of the trade war (South China Morning Post, 2018a).

The US economy had been doing well in the early months of 2019 - unemployment in the US was extremely low, the S&P 500 reached an all-time high in April, and GDP kept growing strong with for example 3.2% in the first quarter of 2019 (Zandi, 2019). However, this could be partly explained by the expansionary policies of president Trump (Wolfers, 2019) and the trade war has been a burden on the US economy according to economists. In a May Bloomberg News survey, economists did predict that the US economic growth would fall from 2.6% to 2% and 2.1% for the second quarter of 2019 and the second-half of 2019 respectively (Dmitrieva, 2019), due to Trumps announcement of imposing new tariffs on Chinese goods after the failed trade negotiations.

While a lot of economists criticize Trumps trade policies and predict lower economic growth for the major players affected by the trade war. Still all countries, except Singapore and the independent regions of Hong Kong and Macao have import tariffs (World Trade Organization, 2017). Next to tariffs do countries nowadays focus on technical regulation and standards in the international trading system (Maskus & Wilson, 2001). In this thesis, there will be looked at the relationship between openness to trade and economic growth. The central question will therefore be:

What is the relation between trade impediments and economic growth?

Answering this question is relevant because economic growth is a goal all countries pursue – assuming that there are no problems with externalities or high distribution costs combined with inequality. Economic growth is also a solution to many humane problems around the globe. So, could economic development close the gap in income per capita and living standards between rich and poor countries. Like we saw in the second part of the 20th century in Asian countries like South Korea, Japan and Singapore and last decades in China (Acemoglu, 2012). This thesis will give new insights to the free trade – economic growth relationship and could be of help in trade policies on whether to apply trade impediments and which one to apply.

As said, most economists believe that trade barriers have a negative effect on economic growth. However, when looking at the literature about this topic, there is no clear number for the effect of a trade impediment on economic growth. Not for a certain earlier trade war, nor an overall effect. The existing literature about trade liberalization often uses the level of trade as an indicator of how open the country is – like in the papers of Michaely (1977) and Balassa (1978 and 1982). They do this to deal with the "measurement problem of trade orientation". This problem was there because of the difficulty to find good measurements of trade orientation, which fitted in time series and cross-country analyses (Edwards, 1992). Because of the databases of organizations like the World Trade Organization (WTO), International Monetary Fund (IMF) and the Organisation for Economic Co-operation and Development (OECD) this issue has become less of a problem. Although a lot of countries still lack data, there should be sufficient data to get significant results from a panel-data regression analysis.

But before the empirical results are shown, there will first be a theoretical framework, some theory and a data and methodology part. The theoretical framework contains some explanations of the different trade impediments and of a mathematical method used later in this thesis. After that, some theory will be discussed via a mathematical two-country general equilibrium model in GAMS. This model will show the effects of import tariffs on the economy. There will be some variation in the types of countries. So, will there be differences in sizes, technologies and factor endowments between the two countries. When this has been treated the data and methodology part will be discussed. In that section, the sub-questions and hypothesis will be given and there will be explained which data has been used to make the regressions and the reason behind choosing the variables. After this, the empirical results will be reviewed. At last, there will be a conclusion and a small discussion.

Theoretical framework

Technical barriers to trade

With a technical barrier to trade an exporter must meet certain technical regulations, standards or procedures before the products can be sold in the foreign country. This way the importing country can protect human, animal or plant life or health (World Trade Organization, n.d.-d). When countries deviate from international standards and set their own technical barriers to trade this could be seen as a way of protectionism. Since these technical barriers to trade add additional exporting costs for foreign competition, they weaken foreign competition and thus protect domestic suppliers.

Sanitary and phytosanitary measures

Sanitary and phytosanitary measures are all measures to protect both human and animal life from harmful substances in food, to protect humans from diseases transmitted by plants and animals, to protect plants and animals from diseases and to prevent other damages which could be caused by the imports (World Trade Organization, n.d.-b). Countries can set standards they find appropriate to maintain the safety, as long as it is based on science and there is no discrimination between countries. This also means that domestic producers should meet those standards. Due to its technical complexity a sanitary and phytosanitary measure could be a barrier which is hard to challenge and could therefore be used for protectionist reasons (World Trade Organization, n.d.-b).

Anti-dumping final measures

Anti-dumping final measures are in place to stop foreign countries from dumping – selling at a discount in another geographical market. In the European Union the European Commission investigates claims of dumping and how to respond. This investigation checks whether the claim of dumping is real, whether there is 'material injury' for the European industry, whether the injury is due to the dumping and whether anti-dumping measures are not against the interest of the European Union (European Commission, n.d.-a). If all conditions are met, the European Commission can implement anti-dumping measures on the imported products that are dumped. The most common anti-dumping measure is an 'ad valorem' duty, but there could also be chosen for a fixed import duty or a minimum import price (European Commission, n.d.-a). Anti-dumping measures are in place for five years but can be reviewed if the circumstances of the exporters have changed or if there is a new exporting firm that requests the calculation of

its own dumping margin. After five years the measures normally end unless the European Commission thinks it is necessary to keep it in place (European Commission, n.d.-a).

Countervailing duties

When a foreign country subsidizes their exports, the country that imports those products could do two things to counter the subsidy. They could either try to get a subsidy withdrawal via the WTO's dispute settlement procedure or they could start their own investigation on whether the subsidy gives foreign exporters an unfair advantage over domestic producers. If this is found to be so the country can charge countervailing duties on the imported products which are subsidizes (World Trade Organization, n.d.-c).

Safeguards

Safeguards can be used in situations where imports cause or threaten serious injury to a domestic industry. In contrast to the previous two impediments could these be implemented directly without any investigation. To stop it from being used purely for protectionist reasons, the safeguards must be temporary and there should be compensation to the exporting countries. Next to that, must the safeguards be applied non-selectively, which means that there could be no distinction between which exporting countries have to face the safeguard (World Trade Organization, n.d.-a). Safeguards could take the form of quantitative import restrictions or of an import duty and after one year it should start to regularly liberalize it. The maximum length of a safeguard is four years (World Trade Organization, n.d.-a).

The delta method

The delta method is used to calculate the aggregate correlation effect after multiple years between two variables. The delta method says that the long-run effect of the independent variable on the dependent variable is given by the sum of the coefficients of the independent variable and its lags, divided by 1 minus the coefficient of the dependent variable. Mathematical this looks like $\frac{dE(Y_t)}{dE(X_t)} = \frac{\beta_2+\gamma_1+\cdots+\gamma_q}{1-\rho}$ in an ADL(1,q) model with $\gamma_t = \beta_1 + \beta_2 X_t + \rho\gamma_{t-1} + \gamma_1 X_{t-1} + \cdots + \gamma_q X_{t-q} + \varepsilon_t$ with $t = 1, \dots, T$.

The delta method can be useful to give the aggregate effect of percentage change in government expenditures on education on economic growth per capita and the aggregate effect of the trade barriers on economic growth per capita. The delta method can however not be used in all situations. The regressions, with one lag of the dependent variable and 2 or 5 lags of the independent variable, can be described as an ADL(1,q) model. With q equal to 2 for the trade

barriers and equal to 5 for the government expenditures on education. For the delta method to be used, these models should be stationary. Since there is a lag of the dependent variable, the stability conditions from an AR(1) model are necessary for the ADL(1,q) model to be stationarity, which is the case if $|\rho| < 1$.

Theory

The "New" New Trade model with Heckscher-Ohlin trade

When looking at the theory behind trade policies, the "New" New Trade Theory is the most recent major contribution to trade theory. The "New" New Trade Theory expands the New Trade Theory with firm heterogeneity, which explains why only a small percentage of the total number of firms are exporting their goods and why some firms benefit from trade liberalization and some do not (Melitz, 2003). Especially the latter is useful, since it highlighted a new source for gains from trade. When trade is liberalized – for example due to lower trade barriers – productive firms will export (more) and will gain from the trade liberalization, while the other effect of trade liberalization is an increase in competition from foreign producers, which will lead to the least productive firms exiting the market (Clerides et al., 1998). The overall effect of this is that the industry's productivity increases (Bernard and Jensen, 1999), (Pavcnik, 2002).

Bernard, Redding and Schott (2007) extended Melitz (2003) by allowing for relative factor endowment differences between countries and by allowing for two sectors and two factors of production. The "New" New Trade Theory can be combined with the already existing Heckscher-Ohlin model – a general equilibrium model of international trade, based on comparative advantages of countries. A general equilibrium model gives the parameters which must hold for all equations in the model. Therefore, the effects on all variables of a single change can be seen in the model. In this model there will be played with the labor endowments and import tariffs of both countries to show the effects of import tariffs in different situations. Like when one country is bigger, has a comparative advantage in the production of one good and whether the foreign country retaliates or not.

To do this, a GAMS file with a "New" New Trade Model with Heckscher-Ohlin trade from the Erasmus University Rotterdam Master course 'Advanced International Trade' is used as a standard general equilibrium model with the right assumptions. This model contains 36 variables and 36 equations. They can be found in tables 3 and 4 in the appendix respectively, but the most important assumptions are:

- Just like in Bernard et al (2007) there are two countries, two goods and two input factors, namely skilled and unskilled labor.
- There are Dixit-Stiglitz preferences (Dixit & Stiglitz, 1977), which means that there is a love of variety. In other words, there is a preference to consume both goods instead of consuming the same amount but of only one good.
- Households maximize their utility, firms their profits. And there is a parameter for the elasticity of substitution between the two goods. A higher elasticity means that the goods are less unique, and firms are therefore less monopolistic.
- There are increasing returns to scale in the production process. Production of good 1 is more skilled-labor intensive than that of good 2.
- Unlimited firms can enter and exit the markets, but there are fixed market entry costs. These are paid before they know their randomly selected and uniformly distributed productivity. This way firms will keep entering the market until the expected profits of market entry are equal to the fixed (sunk) market entry costs.
- To balance the number of firms, there are individual negative shocks, which lead to the firm exiting the market.
- There are costs for exporting. A fixed cost each period and a variable transport cost per unit exported.

Open economy equilibria without transport costs

In table 5 in the appendix all the parameters are shown. Keeping the parameters as in the first column and thus, having two identical countries and no costs for exporting, gives a situation in which both countries produce 50.200 units of both goods for their domestic market and 50.200 units of both goods for exports to the other country. In the second column it can be seen that a change in the labor endowments changes the production process so that the home country with relatively more skilled-labor produces more of the skilled-labor intensive variety 1, while the foreign country with more low-skilled labor produces more of variety 2. The exponents of the consumption of both varieties in the utility function are equal, and the labor endowments and the exponents of skilled labor for the varieties are exact opposites of each other between the two countries. Therefore, a change in the endowments only affects who produces it, and the utility of both countries remains the same. If one country has higher labor endowments, but the total skilled labor for the two countries equals the total unskilled labor, like in column 4 then

the production is again divided like exact opposites of each other, but due to the higher total endowments have both countries higher utility levels. If productions are not exact opposites, then the prices will not only differ between the two countries, but also between the two goods as can be seen in columns 3 and 5. Next to that, the wage for the labor with the highest total endowment decreases. These changes are beneficial for the country with relatively more of the scarce labor source and will increase the country's utility, while the other country's utility decreases. This can be seen from the comparison between the utility levels of column 3 and 5.

Open economy equilibria with transport costs

By allowing for iceberg transport cost of 10% - like in columns 6 till 10 - the model becomes more realistic. Iceberg transport cost means that the costs of transportation are deducted from the value of the exports. Two equal countries will now produce more of both goods than in the same situation without transport costs, since value is lost during transportation. The utility levels are still equal between the two countries but are lower due to the transport costs – see column 6. With transport costs, a difference in endowments does not only affect who produces which good, but also lowers the utilities of both countries. This is because the countries have the same preferences, but different labor endowments. Therefore, they are more obligated to trade to get the product which is labor intensive in the labor that they are relatively scarce in. Which leads to higher transport costs and thus lower utilities, as can be seen in column 7.

The situation where one country is bigger than the other does also change with the addition of transport costs. Again, the total production is increased, due to the lost value during transportation if the endowments are changed with the same amounts but in the opposite directions like in column 10, compared to column 9 from the table. Here, the transport costs also negatively affect the utility of both countries. The utility of the foreign country only slightly decreases, since they have higher endowments and are therefore more self-sufficient. The home country is more dependent on their trade partner and that is why their utility has decreased more, in both relative as absolute terms.

If the endowments in this situation are changed, so that the total skilled labor does not equal the total unskilled labor, like in column 8. Then the benefits for the relatively skilled-abundant home country become smaller due to the transport costs, while the utility of the foreign country decreases more than in the change without transport costs (column 9-8 vs column 4-3).

General equilibrium with transport costs and import tariff

An add-valorem import tariff of 10% on sector 1 imports of the home country is added to the GAMS model. This decreases the competition which sector 1 producers face in the home country. Therefore, it becomes more profitable to enter the market and as a result, the number of sector 1 firms increased – see column 11. As, did the average production increase for both the domestic use as the exports of sector 1 goods. The increased profitability of sector 1 goods in the home country, makes for a decrease in the sector 2 producers in the home country, while the number of producers in the foreign country takes opposite shifts. All in all, the import tariff distorts the markets. Since the import tariff protects the domestic producers, the average productivity of the domestic sector 1 producers decreases. On the contrary does the average productivity of domestic sector 1 exporters increase, due to the higher production in combination with the assumption of increasing returns to scale. The foreign country shifts to producing more of sector 2 goods and becomes on average more productive, but the average productivity of the sector 2 exporters decreases in the foreign country. This can be explained by the sharp increase in exports from 31.811 to 39.582, of which a part is now produced by new exporters with a lower productivity than the original exporters. The effects of sector 2 average productivity in the domestic country and of sector 1 average productivity in the foreign country are in line with the reasoning above but have the opposing effects. All this together decreases the utility levels of both countries. However, the utility of the home country does increase due to the revenue from the import tariffs. Making the import tariffs beneficial for the home country – as can be seen in column 11 of table 5 in the appendix.

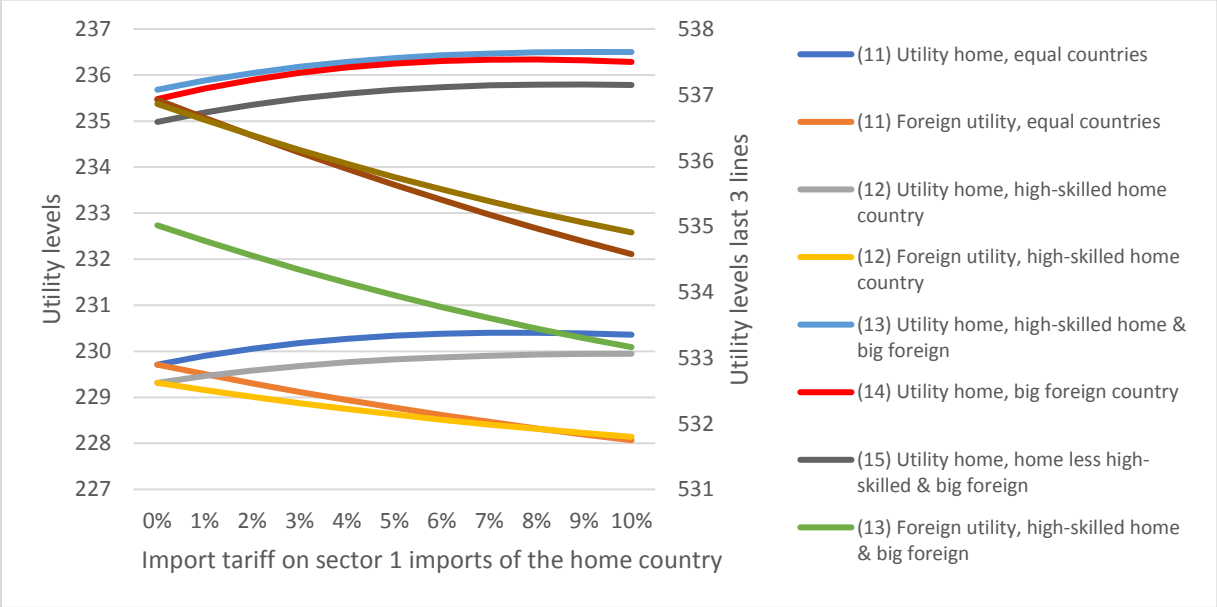
If the home country is more high skilled labor intensive and the foreign country more low skilled labor intensive – like in column 12 of table 5, than an import tariff on the home country's sector 1 imports still decreases the utility level of the foreign country. The utility level of the home country would also have decreased if it was not for the profits of the import tariff. The changes in the utility levels compared to the situation with two equal countries like in column 11 of table 5 are smaller. This can be explained by the fact that due to the endowments the home country was already producing more of sector 1 goods and the foreign country more of sector 2 goods. Therefore, the distortion of the import tariff is smaller and the import tariff revenue for the home country is smaller, since the imports are smaller.

In a situation where the tariff paying country is bigger - like in columns 13 till 15 -, the effects of an import tariff will also be bigger. The tariff raising small country will benefit more, because the foreign sector 1 producers now export a quantity of 21.880 instead of 14.245. The foreign

country loses more, since they were producing greater quantities of sector 1 goods for the export to the home country and are therefore hit harder than in the situation with two countries of the same size. The home country being more high-skilled labor intensive and the other more low-skilled labor intensive has the same effect if the countries are not the same size like in column 15, as in column 12 where both countries have the same total endowment. Namely, that the effects of the import tariff are smaller due to the home country already producing relatively more of the first good and the foreign country relatively more of the second good.

Until now in all situations the home country benefitted from a higher import tariff – at least until a tariff of 10% - and it was disadvantageous for the foreign country. In the situation where the home country is relatively high skilled labor intensive, the bigger foreign country is more low skilled labor intensive and there is in total a higher endowment of low skilled labor than of high skilled labor. Then an increase of the import tariff on sector 1 imports of the home country is still disadvantageous for the foreign country, but only beneficial for the home country till a tariff of 9%, as can be seen in column 13 in table 6 in the appendix and the flattening of the lines in figure 1 below. Tariffs from 10% and higher only lower the utility level of the home country compared to a tariff of 9%, except for situation (12). This could be because of the extra distortions, which are there since the utility level of the foreign country is still decreasing. But it could also be partly explained by the slightly lower price and lower volume of the sector 1 exports of the foreign country, which decreases the import tariff revenue for the home country. Although the utility level of the home country decreases after a tariff of 9%, the level is still higher than in the situation with different sized countries but equal total endowments between high - and low skilled labor. This is due to high skilled labor being scarcer and the home country being relatively more high skilled labor intensive.

Figure 1: Utility levels with different import tariffs



A tariff on sector 2 imports of the home country

A country could obviously also put an import tariff on the other good. A 10 percent import tariff on sector 2 goods that the foreign country exports gives the same utility levels as a 10 percent import tariff on sector 1 goods if both countries have the same labor endowments – like in column 16. In the situation where the home country has relatively more high skilled labor and the foreign country more low skilled labor – like in column 17, then there is a difference between an import tariff on the different goods. A tariff on the second good protects the domestic producers of the good in which the country has a smaller endowment of. Instead of protecting the market in which they could benefit from their higher endowment and make use of the increasing returns to scale. The home country could better put an import tariff on the first good, as could be seen from the utility levels in columns 12 and 16 in table 5. A tariff on the second good increases the home country's utility less than a tariff on the first good, while the foreign country's utility still decreases compared to no import tariff, but the decrease is significantly less than that with a tariff on the first good.

If the foreign country is bigger in size and thus has higher endowments, then a tariff on sector 2 goods has the same implications as a tariff on goods of the first sector, but just like in the paragraph above are the changes smaller if the home country is relatively more high skilled labor intensive.

Home country is bigger than the foreign country

Another situation which will be discussed is the situation in which the import raising home country is bigger than the foreign country. Previous results already showed that the home country could better put an import tariff on the good of which they are relatively abundant in. Therefore, the situation in which the home country is bigger will only be discussed with an import tariff on the first good. Column 21 in table 5 shows the situation without an import tariff. This is basically the same as column 9 but the values have been swapped between the countries.

From column 23 it can be seen that a big home country benefits from the import tariff, but the percentual gains from an import tariff are higher for a small country and lower for a big country. This is because the import tariff gives the home country a comparative advantage in the first good and this leads to them specializing in this product and exporting it to the foreign market. Bigger countries cannot rely as easily on imports to fill their demands and must produce at least a part of the demand domestically. Specialization in combination with the increasing returns to scale will therefore be more beneficial for small countries. However, if a country is so small

that they cannot influence the world price. Then their terms-of-trade are zero. Assuming that there is perfect competition in the market and industry profits – which are zero - will therefore not change due to a tariff. Then an import tariff will only distort the market which goes together with efficiency costs.

Retaliation

Losing countries often fight back when their trade partner imposes an import tariff. At first, they often try to talk to get rid of the tariff, but if that does not work, then protecting their own producers via import tariffs is a common counter measure. This is also the case in the recent trade war between the United States of America and China. Import tariffs are implemented to protect the domestic producers, but political reasons do also play a role. So, did China, which was a major importer of U.S. agricultural products, place import tariffs on U.S. agricultural products, because farmers were a big supporter of Donald Trump during the U.S. elections.

The exponents for skilled labor in sector 1 and sector 2 have been equalized to a half to make the two countries in the model even more equal. In column 25 – where there are no import tariffs - and column 26 – where both countries set the same import tariffs - the utility levels are equal between the countries. It can also be seen that both countries implementing an import tariff of 10% on their imports of good 1 decreases the utility levels of both countries. If the home country is more high skilled labor intensive and the foreign one more low skilled labor intensive, then this means that the home country will partly specialize in the production of the first good and the foreign country in the production of the second good. Because both countries implemented an import tariff on imports of the first good, it is the foreign country who benefits the most. They gain a lot of revenues from it and gain in utility, while the home country's utility level has decreased, as shown in column 27 of the table.

Just like in the situation where there was no retaliation, the gain in utility is bigger for small countries. This can be seen in column 29 versus column 28 where the home country gains, and the foreign country loses from the trade war. This is again mostly because of the home country's import revenues and the foreign country paying for it. If the foreign country is bigger in size, but is relatively more low skilled labor abundant, like in column 30. Then this will lead to the prices, wages and the level of trade to drastically fall. Due to the lower trade, the foreign country is hit less hard with the import tariff of the home country and foreign utility will increase and come close to the level of the situation without tariffs, but still be lower. The home country is now not benefitting that much from the import tariff, due to the lower imports and their utility has decreased below the level without tariffs.

All together does the model show that unilateral import tariffs could benefit the implementing country. However, when there is retaliation or it even evolves into a trade war, then in most situations does it harm to both countries. There are however situations where a small country can implement an import tariff and benefit from it. These results are mostly in line with other papers about tariffs and trade wars. So simulated Li, He & Lin (2018) the China-United States trade war and found that a trade war would hurt both countries and the world economy. According to economic theory a small country should however always have a deadweight loss from implementing a tariff, which would thus decrease its welfare. The likely problem in the model is probably that the small country could still influence the world price, due to the model only containing two countries and the small country still having a significant share in the world production.

Data and methodology

Sub-questions and hypotheses

The GAMS model showed that import tariffs, when retaliated, did damage to the utility levels of both countries. In recent years did other trade impediments became more popular as an alternative to import tariffs. That is why multiple fixed effects panel-data regressions have been made in Stata to see whether the relationships with economic growth per capita are in line with the results of the GAMS model or not. These regressions will answer the sub-questions, which are in place to give structure and help answering the central question. The first sub-question is: '*What is the relationship between an extra technical barrier to trade measure implemented by a country and its economic growth per capita?'*. Next to the GAMS model has there also been looked at economic literature to set up a hypothesis for this sub-question. However, there were no studies specifically on impact of individual trade impediments on economic growth per capita. There were some claims from economists that technical barriers to trade restrict trade due to the extra costs, but other economists say that the technical regulations and standards increases the consumer confidence in the safety and quality of the products and therefore increases trade (Maskus & Wilson, 2001). These views are contradicting each other, but from the attempts of the Word Trade Organization to reduce the number of standards and technical barriers it is plausible to assume that more international standards and less technical barriers are better for the world economy. It could however also be assumed that a well-implemented standard or non-tariff barrier could be beneficial for the domestic economy of the implementing country, just like an import tariff could be before it is retaliated. However, it could be expected

that trade partners will try to retaliate technical barriers to trade just like they do for import tariffs. Lawrence & Weinstein (2001) did also conclude from their study on East-Asia that trade liberalization is beneficial for a country's economy. Therefore, is the hypothesis of the first sub-question as follows: '*There is a negative relationship between an extra Technical barrier to trade measure implemented by a country and its economic growth per capita'.*

The second sub-question is: 'What i*s the relationship between an extra Sanitary and Phytosanitary measure implemented by a country and its economic growth per capita?*'. Sanitary and phytosanitary measures are similar to technical barriers to trade, but can only be implemented on food, plants and animals. That is why the hypothesis is almost the same, namely: '*There is a negative relationship between an extra Sanitary and Phytosanitary measure implemented by a country and its economic growth per capita'*.

The third and fourth sub-questions are: '*What is the relationship between an extra anti-dumping Measure implemented by a country and its economic growth per capita?*' and '*What is the relationship between an extra countervailing duty implemented by a country and its economic growth per capita?*'. Anti-dumping measures and countervailing duties can only be implemented after specific actions of the trade partner. In the GAMS model retaliation was always the best-response of the trade partner. This is also what Johnson (1953) found. He wrote that a trading partner which has been affected by an optimum import tariff or quota could set an optimum import tariff or quota as a form of retaliation. That is why the hypotheses of the third and fourth sub-question are '*There is a positive relationship between an extra anti-dumping measure implemented by a country and its economic growth per capita'* and '*There is a positive relationship between an extra implemented countervailing duty by a country and its economic growth per capita'*.

Safeguards are the fifth trade impediment which had been looked at. The sub-question related to this is 'What is the *relationship between an extra safeguard measure implemented by a country and its economic growth per capita?*'. The hypothesis is again based on Lawrence & Weinstein (2001) and is: '*There is a negative relationship between an extra safeguard measure implemented by a country and its economic growth per capita'*.

According to data on tariff rates (World Bank, n.d.) low-income countries have on average higher import tariffs (weighted mean applied on all products) than developed countries. In 2017 the average import tariff for low-income countries was 9.8%, while this was only 2.0% for high income countries. Since the countries in the regression should be representative of the world this should also be the case for the chosen countries. The question is whether this difference is

there because of different effects on economic growth or because of other reasons. To test this there has been looked at the interaction effects between the trade impediments and the income category in which they are allocated to by the World Bank based on their gross national income per capita. The sub-question reads: 'How do the *relationships between the trade impediments and economic growth per capita differ between developed and developing countries?*'. Yanikkaya (2003) found the correlation between tariffs and growth to be higher for developing countries than for developed countries. Although she also found positive results for developed countries, which is in contradiction with most of the earlier hypotheses, is the finding of a more positive/less negative correlation for developing countries assumed to be reasonable. The hypothesis of the sixth sub-question therefore is: 'E*xtra trade impediments are more beneficial/less harmful for developing countries*'.

Since the GAMS model showed that relatively small countries could benefit more from import tariffs, has there also been looked at country sizes in the regression analysis. The sub-question reads: '*How do the relationships between the trade impediments and economic growth per capita differ between small and big countries?*'. Based on the results of the GAMS model will the hypothesis for this question be: '*Extra trade impediments are more beneficial/less harmful for smaller countries*'.

Why those variables?

The sub-questions are answered via the results of fixed effects panel-data regressions in Stata. These regressions are based on Robert Solow's model of economic growth (1956), commonly known as the Solow model. Solow made some modifications to the Harrod-Domar model of economic growth (1946) because he did not agree with the conclusion that changes of the savings ratio, the rate with which the labor force increases, and the capital-output ratio from their equilibria would merely lead to either higher unemployment or higher inflation. Solow therefore changed the assumption of production taking place under fixed proportions with the assumption of production taking place via a production function, where labor and capital can be substituted by each other. In this model economic growth is explained by capital accumulation, increasing population and technological progress (Solow, 1956).

Since then the Solow model has been the main model of economic growth and its key characteristics have been used in a lot of augmentations of the Solow growth model. This is the reason that the variables population and capital accumulation have also been used in the regressions in this thesis. Technological progress can be widely interpreted as everything that

increases production efficiency. Schultz (1972), Rosen (1989) and many more, named human capital as an important part of this technological progress. Human capital is often associated with education (Becker, 2009) and therefore there has also been looked at variables related to education as an indicator of human capital. These are the total enrollment to secondary education as a percentage of the number of children secondary schooling aged and the government expenditures on education as a percentage of GDP.

Another addition to the augmentations of the Solow model are lags of the economic growth. Just like in Bräuninger & Pannenberg (2002), a lag has been added to the model. This is done, because of the cyclical course of economic growth. Of course, there are moments where a market crashes or suddenly plummets, but overall should economic growth in the preceding period give a good indication of current economic growth.

A country's openness to trade is in the literature another important variable for economic growth. Positive relations have been found by Dollar (1992), Sachs & Warner (1995) and Frankel & Romer (1999), but opposite relations have also been found (e.g., Rodríguez & Rodrik, 2001). Next to the trade impediments, has a country's total imports and exports as a percentage of GDP also been added to the regression. Because the number of trade impediments alone does not give the full picture of how open a country is. A country could have no to little trade impediments, but this does not have to mean that they are open. So could their imports and exports be very small relative to their GDP.

The interaction effects are added to show whether trade impediments have different effects for developed and developing countries and for small and big countries. The country size variable has been divided in four groups based on which quartile their GDP as a percentage of world GDP belonged to. This interaction effect had been added because of the results of the GAMS model. The interaction effects with the income groups have been added because of different views in last century. During the 1950s till the 1970s a protectionist view predominated under development economists and protectionism was widely used in developing countries, especially in Latin-America (Edwards, 1993). However, since the 1980s there came more voices for trade liberalization, and this has been the popular policy ever since. But there are still arguments in favor of protectionism. So is protectionism in most developed countries used to protect certain groups, often for political reasons. Farmers for example are protected in the European Union to ensure an affordable and stable supply of food in the European Union, while also safeguarding the farmers to make a reasonable living (European Commission, n.d.-c). In developing countries another argument for protectionism is often used, namely that protection can help new domestic

firms survive and grow in their first years to be able to compete with foreign competition after their initial years. This kind of protection is in recent years often seen in China.

The regressions

As said, are the sub-questions answered via the results of fixed effects panel-data regressions in Stata. There is chosen to use a fixed effects model, because variables which are fixed over time do not have to be taken into account. A Hausman test has been taken to check whether a fixed effects model is rightly used. According to this test do the random effects assumptions of the country-specific effects not being correlated with the independent variables, not hold and therefore could the null-hypothesis, that a random effect model is used appropriately, be rejected. A fixed effects model is thus more appropriate to use than a random effects model.

In those regressions, economic growth, displayed by the first difference of GDP, is the dependent variable. The independent variables are the first difference of the gross capital formation as a percentage of GDP, the fifth lag of the difference school enrollment rate, up to five lags of the first difference of the government expenses on education as a percentage of GDP, the first difference of the openness to trade given by the total exports and imports as a percentage of GDP, the percentage change of the labor force, the first difference of the given trade impediment and two lags of it, and finally the interaction effect between the dummy variable ‘income group’ and the trade impediment and its lags. The interaction effect between the dummy variable ‘country size’ and the trade impediment and its lags have been added to the independent variables in another regression.

There is chosen to only use one lag of economic growth per capita. This is based on the lower values of the Akaike’s Information Criteria (AIC) and the Bayesian Information Criteria (BIC) in tables 8 and 9 in the appendix. Those criteria are also used to choose the number of lags of the first differences of the trade impediments. Due to the BICs nature to penalize additional parameters, the values of the BIC were decreasing in absolute value in the number of lags. The values of the AIC therefore say more about the optimal number of lags. The optimal number of lags differs for every variable according to the AIC, but to be able to make good comparisons between the effects of the different trade impediment, the number of lags should be equal between them. Therefore, there is chosen to use two lags for all variables, since it had the lowest or second lowest value of the AIC for four of the six variables, see table 9 in the appendix.

The data

The regressions are made with data from the World Trade Organization (WTO), International Monetary Fund (IMF) and the World Bank. The WTO is an international organization which functions as a forum for negotiating trade agreements and monitors whether trade goes according to the rules (World Trade Organization, n.d.-e). From the WTO database the data about the different trade barriers and the variable about trade openness, given by the total imports and exports of a country as a percentage of its GDP, are used. The data about GDP growth is from the IMF database, a United Nations (UN) organization of 189 countries and focuses on stabilizing the international monetary system (International Monetary Fund, n.d.). The World Bank is also an organization of the UN that focuses on fighting poverty and inequality by lending to developing countries and giving advice in policymaking. From their database the gross capital formation as a percentage of GDP, labor force, government expenditures on education as a percentage of GDP, the GDP as a percentage of world GDP and the school enrollment rate are used. The World Bank is also used to divide the countries in four groups based on how rich they are. This division is based on a country's gross national income (GNI) per capita. Countries with a GNI lower than $1025 are specified as low-income countries. A GNI between $1025 and $3995 belongs to lower-middle-income countries and upper-middle-income countries have a GNI between $3995 and $12375. High income countries have GNI's above $12375.

Although those organizations frequently update their databases, there are still a lot of countries which lack data for at least one of the variables. In the world there are 195 official countries, but due to missing data the regressions contain between 24 and 83 countries. With yearly data for the period 1995-2017 this makes for the observations of the regressions to be between 189 and 632. In the table on the next page some summary statistics are shown of the variables used in the regressions. The average economic growth per capita is 5.9171%. According to data from the World Bank was the annual percentage GDP growth of the world on average 2.99% in the period 1995-2017. The higher percentage in the data could have two causes. Either the 83 countries in this regression had above average growth rates and/or the population of these countries were decreasing. Of the 83 countries, 10 of them are low income countries, 17 lower middle-income countries, 22 upper middle-income countries and 34 high income countries. Thus, the biggest group is the one of the high-income countries. Overall have developed countries an economic growth target between 2% and 3% and thus seems the latter explanation more reasonable. The world population has been growing with 1,511% in 1995 and the growth

has been decreasing to 1.109% in 2017. Developed countries have overall lower population growth rates than developing countries. Some even have negative population growth, which leads to the percentual GDP per capita growth to be higher than the percentual GDP growth. The table on the next page does also show the means and standard deviations of the trade impediments. Technical barriers to trade and sanitary and phytosanitary measures can be seen to be used much more often than anti-dumping measures, countervailing duties and safeguards. The medians showed that for at least half the data there were no changes in the number of trade impediments. This means that when trade impediments are implemented, they often come in larger groups of multiple trade impediments.

Table 1: Summary statistics

Variable	Observations	Mean	Median	Standard deviation	Minimum	Maximum
Percentual economic growth per capita	3082	5.9171	5.1925	13.6268	-64.0315	295.0221
Δ Gross capital formation as a percentage of GDP	2739	0.0927	0,1243	3.3664	-25.3518	27.6570
Δ 5th lag of the secondary school enrollment rate	1536	0.8689	0.8679	3.0775	-33.7326	20.3887
Δ 1st lag of the government expenditure on education as a percentage of GDP	1442	0.0413	0.0041	0.5037	-3.0505	3.9042
Δ Total trade as a percentage of GDP	2924	0.2874	0.3756	8.3600	-74.7134	71.4575
Δ number of technical barriers to trade	2948	6.6815	0	36.5413	-614	614
Δ number of sanitary and phytosanitary measures	2596	5.5747	0	23.9896	-213	338
Δ number of anti-dumping measures	1804	0.7001	0	3.4404	-10	38
Δ number of countervailing duties	726	0.1653	0	1.1966	-3	10
Δ number of safeguards	748	0.0428	0	0.8005	-5	7

Empirical analysis

When looking at the standard regression in table 2 on the next page – the one without any trade impediments or its lags – it can be seen that there is an economic growth per capita trend of 4,53%. This is above the world annual economic growth of 2.99%. As discussed in the part about the summary statistics could this be due to the developed countries which are more represented in the data than developing countries. Next to an economic trend does this regression show that economic growth per capita depends partly on the previous period's growth. There is thus some cyclical course which makes that on average 19.58% of previous period's economic growth per capita can be seen back in the current economic growth. This is not a causality, but the average relation based on the historic data from 1995 till 2017. With this relationship – which is statistically significant at a 1% level - it can be said with a certainty of 95% that 12.10% till 27.05% of a period's economic growth per capita comes back in the next period's growth.

The first difference of the gross capital formation as a percentage of GDP is also statistically significant at a 1% level. Gross capital formation and economic growth per capita are correlated in a way that if the gross capital formation increases with 1 percent, it could be expected that economic growth has increased with 1.1625 percentage points in the same period. This positive relation was also expected from the Solow model, since more investments in capital goods leads to more efficiency in the production process, which leads to higher economic growth.

As discussed in the data and methodology, is education an important indicator of human capital in augmentations of the Solow model. The fifth lag of the first difference of the secondary school enrollment rate does, as expected, have a positive correlation coefficient. When the secondary school enrollment rate increased 5 years ago with 1 percent, current GDP per capita can be expected to be grown by 0.3276 percentage points. The other variable related to human capital, the variable of the government expenditures on education as a percentage of GDP contains 5 lags. To calculate the aggregate coefficient after 5 years, the delta method is used. The conditions described in the data and methodology part hold when $|\rho| < 1$.

Table 2:Regressions with individual sample sizes

Percentual economic growth per capita	(1) Standard	(2) Technical barriers to trade	(3) Sanitary and phytosanitary measures	(4) Anti-dumping measures	(5) Countervailing duties	(6) Safeguards
First lag	0.1958*** (0.000)	0.1936*** (0.000)	0.1897*** (0.000)	0.2487*** (0.000)	0.2214*** (0.001)	0.1805*** (0.007)
Δ Gross capital formation as a percentage of GDP	1.1625*** (0.000)	1.1410*** (0.000)	1.1757*** (0.000)	1.1810*** (0.000)	1.9765*** (0.000)	1.7332*** (0.000)
Δ 5th lag of the secondary school enrollment rate	0.3276** (0.030)	0.3490** (0.021)	0.2554 (0.168)	0.3058* (0.052)	0.1247 (0.606)	0.6535* (0.061)
Δ 1st lag of the government expenditure on education as a percentage of GDP	0.5621 (0.576)	0.6704 (0.507)	0.9240 (0.392)	1.3280 (0.245)	0.7695 (0.706)	1.2975 (0.508)
Δ 2nd lag	2.8181*** (0.007)	2.7724*** (0.008)	3.0874*** (0.006)	2.0233* (0.003)	-5.410 (0.801)	2.9340 (0.167)
Δ 3th lag	-1.8900* (0.089)	-1.8861** (0.090)	-1.6389 (0.169)	-1.5570 (0.227)	-1.2935 (0.5290	-2.1420 (0.322)
Δ 4th lag	0.8435 (0.437)	0.7576 (0.487)	1.0955 (0.346)	1.5298 (0.238)	0.7353 (0.714)	0.0372 (0.986)
Δ 5th lag	0.9339 (0.415)	1.1346 (0.323)	1.1905 (0.338)	1.2891 (0.336)	1.8855 (0.371)	1.2326 (0.576)
Δ Total trade as a percentage of GDP	0.1267** (0.040)	0.1363** (0.028)	0.1203* (0.069)	0.1737*** (0.010)	0.2469 (0.122)	0.1277 (0.325)
%Δ labor force	-0.0000 (0.410)	-0.0000 (0.356)	-0.0000 (0.409)	-0.0000 (0.166)	-0.0000* (0.072)	-0.0000** (0.014)
Δ number of the 'chosen' trade impediment		0.1672* (0.060)	-0.0103 (0.952)	0.7685 (0.676)	-5.0603 (0.594)	0.9096 (0.828)
1st lag		0.0285 (0.791)	0.2139 (0.268)	1.1379 (0.495)	7.6786 (0.390)	-4.0844 (0.292)
2nd lag		0.0686 (0.484)	0.2203 (0.232)	-2.8043* (0.095)	4.9214 (0.552)	-2.6700 (0.388)
Interaction effect with income group		-0.0387* (0.091)	-0.0012 (0.981)	-0.5046 (0.343)	1.3453 (0.606)	-1.2482 (0.399)
1st lag		-0.0039 (0.890)	-0.0636 (0.271)	-0.3353 (0.496)	-2.6485 (0.279)	0.4187 (0.737)
2nd lag		-0.0168 (0.506)	-0.0741 (0.191)	0.7771 (0.118)	-1.9816 (0.390)	0.3458 (0.734)
Constant term	4.5302*** (0.000)	4.0964*** (0.000)	4.6560*** (0.000)	4.3846*** (0.000)	3.9035*** (0.001)	7.1533*** (0.000)
Observations	632	632	557	503	219	189
Groups	83	83	75	58	24	24
F-test	13.09	8.57	7.04	9.08	3.21	6.61
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000
R^2 ***within***	0.1954	0.2045	0.1947	0.2530	0.2230	0.4152
R^2 **between**	0.3648	0.1998	0.3624	0.3658	0.1200	0.0410

*** p < 0.10, ** p < 0.05, *** p < 0.01 p-value between brackets**

In table 2, ρ -the coefficient of the lag of economic growth per capita - equals 0.1958 and thus satisfies this condition. The aggregate correlation effect of an increase in government expenditures on education as a percentage of GDP after 5 years is thus equal to $\frac{0.005621+0.0281809-0.0188997+0.0084351+0.0093389}{1-0.1957726}=4.0631$ Although not all coefficients are statistically significant, it can be said that when the government expenditures as a percentage of GDP had increased with 1%, that economic growth per capita had increased, on average, with an aggregate of 4.0631 percentage points after five years. When the expenditures on education are increased with one percent for a single year, then this means that a year later the change in government expenditures is negative. This means that after five years there is an expected increase of the GDP per capita of 4.0631 percentage points due to the increase 5 years before, but there is also a negative expectation of 2.9018 due to the decrease in government expenditures on education four years ago. This means that after 5 years the economy is expected to be grown with 1.1613 percentage points. A year later the expected growth is however -1.1613 due to the fifth lag of the one-percentage point decrease of the government expenditures on education five years ago. Of course, there are other variables which influence the economic growth, which could make the aggregate effects of a single-year increase in government expenditures on education non-zero. But ceteris paribus a single year increasement is not expected to have long-term effects on the GDP. It could however be used to get higher economic growth in the short-term at the expense of economic growth in the years thereafter. Due to the expected economic growth being positive in the first year, but also because of the growth trend is the GDP expected to be higher in the year after the one-time increase in government expenditures. This means that an increase of the government expenditures on education with X million euros is as a percentage of GDP higher than a decrease with X million euros in the next year. Depending on the economic growth a single year increasement of the government expenditures on education could thus have a positive effect on the economic growth. Next to that are there other positive externalities from investments in education. So will the youth become better educated, which has all kind of positive effects on society. So is a higher education level associated with better health later in life. Cutler & Lleras-Muney (2010) for example found that higher educated people are less likely to have a kind of obese, to smoke or be a heavy drinker and are more likely to live in a safe house, drive safe and use preventive care. Next to these examples, there are also positive externalities for future generations. Next to the education system being improved due to the current investments are children of the higher educated healthier, and healthier children are expected to do better in school and the labor

market (Currie, 2009). Government expenditures on public education could also help the poor to escape the poverty trap and public education a great way to redistribute income in a country (Saint-Paul & Verdier, 1993).

The coefficient of the openness to trade is statistically significant at a 5%-level and says that if the volume of imports plus exports as a percentage of GDP had increased with 1%, the economic growth per capita had on average increased with 0.1267 percentage points. The average change in the total trade as a percentage of GDP is 0.38% and half of the observations – the ones between the first and the third quartile – are between -2.7352% and 3.7781%. The expected percentual change of the economic growth per capita would then be 0.0485 percentage points, but due to variety in the total trade difference could it be expected that with a 95% certainty it lays between -0.3490 and 0.4821 percentage points.

Finally, the percentage change of the labor force has a statistical insignificant negative coefficient. The coefficient is however very small. So small that the values in the 95% confidence interval are all rounded to 0.0000. This is also what was expected, because the dependent variable is already the growth per capita.

Technical barriers to trade

When the number of technical barriers to trade and two lags of it are added in this regression, the other variables coefficients do not change much. The coefficient of the labor force stayed almost equal to zero, and the coefficients of the secondary school enrollment rate and the trade as a percentage of GDP changed slightly from 0.3276 to 0.3490 and from 0.1267 to 0.1363 respectively. Next to the slight changes did they also become slightly more statistically significant. The first lag of the dependent variable had a small change of 0.0022 and the gross capital accumulation rate as a percentage of GDP decreased with 0.0215 to 1.1410. The aggregate coefficient of the government expenditures on education did change slightly more. From 4.0631 to 4.2769.

The aggregate coefficient of the technical trade barriers, which is calculated via the delta method is 0.3278. Although this is statistically not a significant result, this means that on average economic growth per capita has grown with 0.3278 percentage points in the two years after an extra technical trade barrier was implemented. These effects differ however for the different income groups. According to the data does the correlation decrease on average with 0.0737 per higher income category. This means that the correlation of 0.3278 only holds for the low-income countries. Thus, countries with a gross national income (GNI) per capita lower than

$1025 a year. The lower middle-income countries GDP increased on average with 0.2541 percentage points in the two years, after an extra technical trade barrier was implemented. For upper-middle income countries the correlation is 0.1804, which means that per extra technical trade barrier the GDP per capita is expected to increase with 0.1804 percentage points in two years. For the high-income countries this expected growth has decreased to 0.1068 percentage points per extra implemented technical trade barrier. On average did the technical trade barriers in a random country from the regressions increase with 6.5 a year, which goes along with expected changes in the economic growth per capita of 0.6940 till 2.1304 percentage points depending on the income class. There are however also countries which have years with a high number of implementations, repealed or expired technical trade barriers. For those countries the expectations from the correlation do not go along with the real economic growth per capita.

According to those regressions, although there cannot be spoken about a causality, it seems like extra trade barriers are beneficial for all countries. The expected economic growth is however smaller for countries in a higher income class. Next to that are technical trade barriers likely to decrease the total trade of a country, which is expected to decrease the economic growth of a country with 0.1363 percentage points per lower percentage point total trade as a percentage of GDP. Against the expectations did bigger countries have higher coefficients. Per higher quartile were the coefficients 0.0468 percentage points bigger.

Sanitary and phytosanitary measures

In the regression where the technical trade barriers are replaced by the sanitary and phytosanitary measures there are again some small changes in the other correlation results. So did the coefficient of the first lag of the dependent variable change with 0.0039 to 0.1897. The coefficient of the capital accumulation is now equal to 1.1757 and stayed statistically significant. This was not the case for the secondary school enrollment rate and the trade openness variable insignificant, whose coefficients of 0.2554 and 0.1203 respectively, became statistically insignificant at a 5% level. The aggregate coefficient of the government expenditures on education as a percentage of GDP and the coefficient of the constant term increased with 1.6860 and 0.5596 respectively, and the coefficient of the labor force stayed almost equal to zero.

The aggregate two-years correlation between the sanitary and phytosanitary measures with the economic growth per capita is 0.5231 for low-income countries. Per higher income category this correlation is expected to decrease with 0.1714. This means that an extra sanitary and

phytosanitary measure is associated with an economic growth of 0.3517 percentage points for lower-middle income countries and of 0.1804 percentage points for upper-middle income countries. The correlation between extra sanitary and phytosanitary measures and economic growth is still positive for high-income countries, but with a correlation of 0.0089 it is close to zero. Taking the average change in sanitary and phytosanitary measures of 5.2 a year, this means that the associated economic growth is 0.0462 percentage points for high income countries. For low income countries this average change in sanitary and phytosanitary measures is expected to go along with a much higher 2.7203 percentage points increase in the economic growth. Just like for the technical trade barriers there were some countries with much bigger changes in the number of sanitary and phytosanitary measures. The biggest increasement was in 2016 when China implemented 338 new sanitary and phytosanitary measures. Since China is an upper middle-income country this increase can be associated with an economic growth of 64.99 percentage points in the period between 2016 and 2018. This seems to be too high if you put it against the real economic growth per capita in China in 2018. The coefficients of the sanitary and phytosanitary measures were thus higher than expected. This was also the case for the interaction effect with the country size groups. Per higher quartile did the aggregate coefficient of an extra sanitary and phytosanitary measure on economic growth per capita increase with 0.1792 percentage points.

Anti-dumping measures

In the regression with anti-dumping measures the aggregate correlation for low-income countries between the number of extra anti-dumping measures implemented in a year and the aggregate economic growth per capita in the next two years is -1.1951. The results are not comparable with the results of the previous regressions due to the different samples, but in this regression the income category variable has a more negative coefficient with -2.1442 than the previous ones had with -0.0737 and -0.1714 for the technical trade barrier and sanitary and phytosanitary regressions respectively. In combination with the negative aggregate correlation between anti-dumping measures and economic growth this leads to negative associations for all income groups. So are lower-middle income countries expected to have a lower economic growth per capita of 3.3393 percentage points in the two years after an implemented extra anti-dumping measure. For upper-middle income countries this is -5.4834 percentage points and for high-income countries even -7.6276 percentage points. The changes in the technical trade barriers and the sanitary and phytosanitary measures were much bigger than those of the anti-dumping measures. So was the average change in the number of anti-dumping measures only

0.7 and were the maximum and minimum change 38 and -10, while those were in the hundreds for the previous regressions. The other variable related to trade, the total imports and exports as a percentage of GDP, did have a significant positive correlation effect of 0.1737. Anti-dumping measures seem to be harmful for the economy for the countries in this sample.

The other variables in the regression did have some slight changes compared to the standard regression. So was the constant term 0.1456 percentage points lower, while the lag of the dependent variable was 0.0529 percentage points higher. Both with the statistical significance unchanged. Almost the same holds for the gross capital formation as a percentage of GDP. Its coefficient was 0.0185 higher than the one in the standard regression, but the p-value of the significance stayed equal to zero. A variable which had a significant coefficient in the standard regression but not in the one with anti-dumping measures is the school enrollment rate, although the coefficient only changed with -0.0218. The other education related variable, the government expenditures on education and 5 of its lags had a coefficient of 6.1403, meaning that an increase of the variable with one percentage point is associated with an economic growth per capita of 6.1403 percentage points in the next five years. Again, is the labor force expected to have no impact on the economic growth per capita with a variable almost equal to zero. The interaction effect with the country size groups does have impact. Table 14 in the appendix shows that per higher quartile the aggregate effect of an extra anti-dumping measure on economic growth per capita is 1.9385 percentage points lower.

Countervailing duties

The fourth trade barrier which has been used is the countervailing duty. Again, there are some changes in the coefficients compared to the standard regression. So, can it be seen from table 2 on page 25, that 22.14% of last periods economic growth per capita comes back in current periods economic growth and that an increase of one percentage point in the gross capital formation as a percentage of GDP is associated with an economic growth per capita of 1.9765 percentage points. The education related variables have lower coefficients than in the standard regression. So is the secondary school rate correlated with economic growth per capita with a coefficient of 0.1247 and is a one percentage point increase of government expenditures on education as a percentage of GDP associated with an economic growth per capita of -4.2553 percentage points in five years.

Just like in the previous regressions is more trade as a percentage of GDP associated with economic growth per capita. In table 2 on page 25 it can be seen that this correlation has a

positive coefficient of 0.2469. The countervailing duties and its lags did on aggregate also have a positive correlation. An extra duty would be associated with an increase of the GDP per capita of 9.6837 percentage points. The income interaction effect is also quite big. Per higher income group is the correlated effect of an extra countervailing duty decreased with 4.2189 percentage points. This means that an extra countervailing duty in a lower middle-income country is associated with an economic growth of 5.4648 percentage points and in upper middle-income countries this is only 1.2460 percentage points. The aggregate correlation between a single extra countervailing duty and the total trade as a percentage of GDP is only -0.1369. Multiplied by the correlation coefficient of the total trade with economic growth this shows that economic growth is expected to decrease with 0.0338 percentage points in two years due to fewer trade because of an extra countervailing duty. This means that extra countervailing duties are expected to only be harmful for high-income countries with a correlation of -2.9729.

The countervailing duties have much higher correlation coefficients than those of the previous regressions. The correlation between an extra countervailing duty and economic growth per capita is with 9.6837, more than eight times bigger in absolute value than the second highest coefficient of the previously discussed trade barriers. However, the interaction effect with the income groups is with an aggregate coefficient of -4.2189 also much bigger than those of the previous regressions, which has led to big differences between the income groups.

The interaction effect with the country size groups were also bigger than those of the others. A country belonging to a higher quartile in terms of country size, were expected to have a lower aggregate coefficient of 3.6954 percentage points for an extra countervailing duty on economic growth per capita.

Like for the sanitary and phytosanitary measures is China the country with the most implementations in a single year. A big difference however is that in this case there were only 10 new countervailing duties compared to the 338 sanitary and phytosanitary measures. Overall there are fewer countervailing duties than the previous trade barriers. This can be seen back in the average countervailing duties per country of only 0.17.

Safeguards

The last trade variable which has been looked to is the number of safeguards. With 24 groups and 189 observations this is the variable with the least available data. Despite this, the coefficient of the first lag of economic growth per capita is still statistically significant. The coefficient of 0.1805 tells that 18.05% of last years economic growth per capita can be expected

to come back in the country's current economic growth per capita. The coefficients of the gross capital formation as a percentage of GDP, the labor force and the constant term were also statistically significant with coefficients of 1.7332, 0.0000 and 7.1533 respectively. The secondary school enrollment rate is, in contrast to its coefficients in the standard regression, not significant at a 5% confidence level. However, it could still be expected that on average an increase in the secondary school enrollment rate with one percentage point goes along with an increase of economic growth per capita five years later of 0.6535 percentage points. The aggregate coefficient of the other education related variable has again been calculated via the delta method. The result is an expected aggregate economic growth per capita of 4.0992 percentage points in the five years after an increase in government expenditures on education as a percentage of GDP with one percentage point. Table 2 on page 25 shows that the trade related variables speak for a more open trade policy. So is the total imports and exports as a percentage of GDP associated with an economic growth per capita of 0.1277 percentage points and is the aggregate economic growth per capita two years after an extra implemented safeguard expected to be -7.1322 for low-income countries. Per higher income category this correlation decreases with 0.5902 percentage points. Lower middle-income countries thus have a correlation between extra safeguards and economic growth per capita of -7.7224 and for upper middle-income countries this is -8.3126. An extra implemented safeguard in a high-income country means that in the two years after the implementation the economy can be expected to be decreased with 8.9029 percentage points. Quite big number, however, safeguards are not implemented in vast quantities. On average did the number of safeguards increase with 0.04 per year. An increase like this, which could be seen as an extra safeguard once every 25 years, in a low-income country would thus be associated with a lower economic growth of 0.0029 percentage points after two years. There has also been looked at the differences of these relations between different sized countries. Table 14 in the appendix shows that per higher quartile an extra safeguard is on aggregate expected to be less harmful on economic growth per capita with 3.2421 percentage points.

Comparisons

Due to all regressions having different sample sizes, the trade barrier coefficients could not be compared to each other. So did the standard regression in table 2 on page 25, and the regression with technical trade barriers have data for 83 countries, while the regression with safeguards only had data for 24 countries. Of the 131 countries which had been looked at, there were only eleven countries with data for all variables. Those eleven countries have been used in multiple

regressions with the individual trade barriers to be able to make a comparison. Due to there only being 82 observations most of the coefficients were statistically less significant than in the regressions previously discussed. In the regression without trade barriers, the constant term, the gross capital formation as a percentage of GDP and the labor force had coefficients which were significant at a 5%-level. The coefficient of the constant term is with a value of 8.1728 higher than the constant terms in the previous regressions. The other standard regression and the average of all the six previous regressions were 4.5302 and 4.7873 respectively. Like discussed previously was the average annual GDP growth of the world 2.99% in the period 1995-2017 and could the higher coefficient be explained by above average growth and/or decreasing population in the countries of the regression. The eleven countries in the regression are the lower middle-income countries Indonesia and the Philippines, the upper middle-income countries: Argentina, Brazil, Colombia, Malaysia, South Africa, Thailand and Turkey and the high-income countries Hungary and South Korea. The average economic growth for those countries together is above world average, but not that high. There was on average an economic growth of 3.72% from 1995 till 2017. The population did however also decrease on average for those countries and therefore the average economic growth per capita equaled 6.79%. Still not equal to the 8.1728% from the regression, but also not far away. Although the lag of the dependent variable is with a p-value of 0.052 just not statistically significant it can be expected that 21.91% of last years economic growth comes back in the current economic growth. From table 2 on page 25, it could also be seen that an increase in the gross capital formation as a percentage of GDP is associated with an economic growth in the same period of 2.9605 percentage points. The education related variables have coefficients of 0.0973 and -4.8557 for the secondary school enrollment rate and the aggregate government expenditures on education as a percentage of GDP, respectively. Like in the previous regressions does the labor force almost have no effect on economic growth per capita. The most important variables are however the trade related variables. In the standard regression the total imports and exports had a negative correlation effect of 0.0656, which means that a one percentage point increase in the trade as a percentage of GDP is associated with an economic decrease of GDP per capita of 0.0656 percentage points.

In table 10 in the appendix the technical barriers to trade are added to the regression and the coefficient of the total trade as a percentage of GDP is now positive with a value of 0.1571. The coefficient has a slightly lower p-value than in the standard regression but is still highly insignificant. The number of technical barriers to trade and its lags had also insignificant

coefficients, but on average can it be expected that an extra trade barrier goes along with a decrease of the GDP per capita of 0.6159 percentage points for low-income countries. In table 10 the coefficients for lower middle-income countries and upper middle-income countries can be seen to be -0.2065 and 0.2029, respectively. The benefits of an extra trade barrier for high-income countries are therefore the highest with an expected economic growth per capita of 0.6123 percentage points. In the hypotheses it was stated that the opposite was expected. That trade barriers were harmful to countries economic growth and especially for more rich countries. Those opposing results could however also be because of the high statistical insignificancy.

The regression with sanitary and phytosanitary measures in table 10 shows positive correlation effects between an extra sanitary and phytosanitary measure and economic growth per capita. The benefits do in contrast to the previous regression decrease as countries are in a higher income category. Where low-income countries had a correlation coefficient of 3.8551, is this expected to be 1.1739 lower per higher income category. Lower middle-income countries have thus a correlation coefficient of 2.6812 and an extra sanitary and phytosanitary measure is associated with an economic growth per capita of 1.5074 and 0.3335 percentage points for upper middle-income and high-income countries respectively. Although the coefficients are again statistically not significant, this again suggest that the results do not match the hypothesis. An alternative hypothesis was that extra sanitary and phytosanitary measures increases the trust in the safety of foreign food products and other products on which the sanitary and phytosanitary measures are applied and that this leads to more trade and thereby a higher economic growth. This view also seems also be reasonable for the lower growth for countries with a higher income, since the safety of food is generally better in more developed countries. In addition to this is the product range generally wider in developed countries, giving customers more choice, which decreases the need for sanitary and phytosanitary measures.

The aggregate coefficients in the regression in table 10 with the anti-dumping measures are similar to those of the sanitary and phytosanitary measures. The aggregate coefficient of the trade barrier is positive and the interaction effect with the income group is negative. There is however one big difference and that is the size of the coefficients. Low income countries are expected to have an aggregate economic growth of 14.0673 percentage points in the two years after an extra implemented anti-dumping measure. A correlation more than 3,5 times bigger than the same correlation for sanitary and phytosanitary measures. The interaction effect was with a coefficient of -4.1247 also much higher. It was again slightly more than 3,5 times bigger

and thus relatively almost equal to the one in the sanitary and phytosanitary measures regression. Although the high negative income interaction effect are all the correlation coefficients between anti-dumping measures and economic growth per capita positive. Lower middle-income countries are expected to have an economic growth per capita of 9.9426 percentage points in the two years after an extra anti-dumping measure has been implemented. In lower middle-income and upper middle-income countries an extra anti-dumping measure is associated with an aggregate economic growth of 5.8178 and 1.6931 percentage points.

In table 10 the aggregate correlation effects of an extra countervailing duty with economic growth per capita are given. For low-income countries the correlation is with a value of 26.2129 even bigger than the one of the anti-dumping measures. Although the interaction effect with the income group is with -8.8126 twice as big as the one in the regression with anti-dumping measures, are the coefficients of the lower middle-income and upper middle-income countries still higher than those in the previous regression. Lower middle-income countries are expected to have an economic growth of 17.4003 percentage points in the two years after an extra countervailing duty is implemented. For upper middle-income countries this is expected to be 8.5876 percentage points. For high-income countries this expected correlation effect between an extra countervailing duty and economic growth per capita is with -0.2250 percentage points negative.

A possible explanation for why the high-income countries have a negative correlation coefficient in the countervailing duties regression could be that the export subsidies of the foreign countries are bad for domestic producers which are competing in the same market. The government then protects their domestic producers by implementing countervailing duties, which takes away the foreign producers benefit of the export subsidies, but also, in the case of an import tariff, generates income to the public treasury. In richer countries producers are generally more competitive and therefore they can survive extra foreign competition without the help of their own government. If the government does intervene this decreases the competitiveness of the domestic producers which makes them less innovative. One might ask why more competition leads to more innovation in developed countries, but not in developing countries. This is because there is an inverted U-relationship between product market competition and innovation (Aghion et al, 2005). This means that the smaller more laggard firms in the developing countries innovate less if competition becomes fiercer, while the bigger neck-and-neck firms in the developed countries innovate more to become better than the competition.

The last trade barrier in this comparison is the safeguard. Low-income countries are expected to have an economic growth per capita of 17.2908 percentage points in the two years after an extra safeguard is implemented. The interaction effect with the income group is with -9.4730 the biggest interaction effect of them all. Because of this the aggregate correlation effect in high-income countries between an extra safeguard and economic growth per capita is the lowest of all regressions with a coefficient of -11.1283. Lower middle-income and upper middle-income countries are expected to have an economic growth per capita of 7.8178 and -1.6553 percentage points in the two years after an extra safeguard was implemented. The results of the upper middle-income and high-income countries are in line with the hypothesis of sub-question 6 but opposing results can be seen for less developed countries. This could be because safeguards are used to protect the domestic market from imports. A similar story to the reasoning why countervailing duties were harmful for high-income countries but beneficial for lower income countries could be given for the opposing effects of the countervailing duties. When implementing a safeguard, the foreign country should be compensated for the damage of the safeguard. This could be the reason why the correlation effects are smaller for the safeguards than for the countervailing duties. Because of the lower correlation effects are safeguards harmful for upper middle-income countries, while countervailing duties are not.

In table 10 all the correlations of the five trade barriers are given. From this it can be seen that the correlations have quite some different effects. According to the results are technical barriers to trade the only trade barrier which are harmful for low-income and lower middle-income countries. The low-income countries are according to the results best of by implementing a countervailing duty. An extra safeguard or anti-dumping measure is also expected to be quite beneficial for low-income countries with an expected aggregate economic growth per capita of around 15 percentage points, while an extra sanitary and phytosanitary measure has an expected positive effect of 3.8551 percentage points. Technical barriers to trade and sanitary and phytosanitary measures (restricted to food, animals and plants) could be quite easily implemented in comparison to the other chosen trade barriers. Safeguards are also quite easy to implement in cases where the domestic industry is hurt by a sudden increase in imports, since there is no need to prove ‘unfair’ trade (European commission, n.d.-b). Anti-dumping measures and countervailing duties can only be implemented after specific moves of a foreign country. Since all coefficients except the one of the technical trade barriers are positive it should be beneficial for low-income country to implement a sanitary and phytosanitary measure, anti-dumping measure, countervailing duty or safeguard if possible. These measures will likely

decrease the total imports and exports which has a negative expected effect on the GDP per capita, but the total trade as a percentage of GDP is not likely to decrease so much due to a single extra trade barrier that the total expected effect is negative. Another issue for the implementing country is retaliation of the exporting countries. Due to the results being based on historical data it could be expected that a form of retaliation is already taken into account in these results. But when the trade barriers are excessively used, more retaliation could be expected which would decrease the total trade even more but could also hurt the domestic economy in other ways.

Lower middle-income countries did have similar results. However, with an average coefficient of 7.4477 were the coefficients lower. The coefficient of the technical trade barriers was again the only negative coefficient and the countervailing duties had again the highest coefficient. The anti-dumping measures and safeguards had coefficients half the size of the coefficient of countervailing duties, but now the anti-dumping coefficient is higher than the coefficient of the safeguards. Sanitary and phytosanitary did again have an expected positive relationship of a couple percentage points. Like discussed are extra trade barriers likely to decrease the total trade, which has a negative correlation effect in all regressions except the one with technical trade barriers. Just like for low-income countries should it thus be expected that implementing any trade barrier except a technical trade barrier should be beneficial for the economic growth per capita of the country. Again, there is the side note that extra trade barriers could be retaliated which could have extra negative effects on economic growth.

When looking at the upper middle-income countries the coefficients are lower for all variables except for the technical barriers to trade. This is due to the interaction effects with the income groups being negative for all except the latter. The technical trade barrier does now even have a positive coefficient for upper middle-income countries. The coefficient of the safeguards however has become negative. Upper middle-income countries are thus expected to benefit from all extra trade barriers except safeguards. As said are most of the coefficients lower than those of the lower-income countries. An extra countervailing duty is with an aggregate expected economic growth per capita of 8.5876 percentage points the trade barrier with the highest coefficient. The negative correlation effect of the total trade as a percentage of GDP is not that big that it makes the total effects of an extra trade barrier - other than a safeguard – negative. Again, there is only accounted for that much retaliation as in the historical data. More retaliation or other effects not in this regression could make the average effect become negative.

High-income countries are expected to benefit from extra technical trade barriers, sanitary and phytosanitary - and anti-dumping measures. The first two have expected economic growths of 0.6123 and 0.3335 percentage points respectively. Although these numbers are quite small, does the expected lower trade not make it negative. The correlation with the total trade is namely -0.3508 and -0.1836 respectively, see table 13 in the appendix. This means that a single extra technical barrier to trade is expected to be associated with a lower percentage total trade as a percentage of GDP of 0.3508 percentage points and an extra anti-dumping measure is associated with a lower total trade of 0.1836 percentage points. In combination with the coefficients of the total trade of 0.1571 and -0.0736 in the regression with technical trade barriers and sanitary and phytosanitary measures respectively, are those two trade barriers still expected to have a positive association with economic growth per capita. The other trade impediments have smaller correlation coefficients with the total trade variable and in combination with the bigger aggregate effects of extra of those trade impediments will they have no effect on the sign of those coefficients. The expected effects of extra technical trade barriers and sanitary and phytosanitary measures on economic growth per capita are thus positive, but again could extra trade impediments also be retaliated which is expected to hurt the economy. Due to the higher coefficient of anti-dumping measures is retaliation less likely to change the sign and make an extra anti-dumping measure hurt the domestic economic growth. Next to that are anti-dumping measures already a retaliation of the foreign country's actions. Retaliation of the foreign country is then less likely to happen. About the implementation of countervailing duties or safeguards could be said that they are expected to hurt the domestic economy since their coefficients are already negative.

Overall the pattern is that some extra trade barriers could be beneficial to the economic growth in a country, but these effects decrease as countries belong to higher income groups and do even become negative for some variables. Since the coefficients are statistically not significant and there cannot be spoken about causalities, it should be taken into account that these coefficients are averages of historical data and that there could be a big variety in the effects of a single extra trade barrier. Next to that could there also be other effects correlated with extra trade barriers. So could trade barriers be retaliated by foreign countries which could hurt the economy. Especially with the low values for some upper middle-income and high-income countries variable coefficients could it therefore be irrational to implement extra trade barriers.

Conclusion

In this master thesis the central question was whether there is a relation between trade impediments and economic growth per capita. To give structure in answering this question, some sub-questions had been added. To write the related hypotheses for those questions, there has been looked at economic literature and the results of the GAMS model. The GAMS model showed that import tariffs could be beneficial for the implementing country. Those benefits are higher when the trade partner is bigger or (partly) specialized in the production of the good which now faces an import tariff. However, when retaliation takes place, all utility levels decrease to levels lower than in a situation of free trade. The results did show that there are situations where a small country could benefit from a retaliated import tariff. This is not in line with economic literature and could be the problem of the small country still being able to influence world prices.

The hypothesis of the first sub-question was: '*There is a negative relationship between an extra technical barrier to trade measure implemented by a country and its economic growth per capita'*. This could be rejected, since the results of the regression analysis show positive correlations for all countries. The results are more in line with Yanikkaya, H. (2003) who also found a positive association between trade barriers and growth, especially for developing countries. However, the results are not that big, especially for high-income countries and thus would it be irrational to implement extra technical barriers to trade with the sole purpose of economic growth. Especially, since there is only accounted for the levels of retaliation based on the historical data. Exploiting technical barriers to trade could be expected to come with higher levels of retaliation. Next to that are trade impediments bad for the political relations with other countries.

This story does also hold for sanitary and phytosanitary measures. The hypothesis: '*There is a negative relationship between an extra Sanitary and Phytosanitary measure implemented by a country and its economic growth per capita'* could also be rejected since the results show small, but positive coefficients.

'*There is a positive relationship between an extra anti-dumping measure implemented by a country and its economic growth per capita'* was the hypothesis of the third sub-question. The results did however show negative coefficients. These could be explained by the fact that the dumping hurts domestic producers of that good but is beneficial for domestic consumers. Dumping is not necessarily harmful for the economy but the ones whom are hurt bear all costs.

Anti-dumping measures could protect domestic producers, which could be beneficial for the future, but in the short term, it is expected to lower the economic growth.

For countervailing duties are the results partly in line with the hypothesis: *'there is a negative relationship between an extra safeguard measure implemented by a country and its economic growth per capita'*. Countries with a GNI per capita less than $12376, are expected to benefit from an extra countervailing measure. This is probably because it is a reaction on an export subsidy of a trade partner, which both protects domestic producers while also generating income for the public treasury. In high-income countries an extra countervailing duty is however expected to come along with a negative growth. This could possibly be explained by the fact that there is an inverted U-relationship between product market competition and innovation (Aghion et al, 2005). Producers in high-income countries are generally bigger firms whom will try to beat the foreign competition by being innovative, which is beneficial for the future economy. Countervailing duties would protect those firms from foreign competition and thus discourage them from innovating, which is harmful for future economic growth.

Safeguards were the least implemented trade impediment of the ones discussed. The big negative expected relationship with economic growth per capita could be an explanation for this. The relationship is expected to be so negative, because with the implementation of safeguards, the trade partner should be compensated for the harm they received. The results are thus in line with the hypothesis: '*there is a negative relationship between an extra safeguard measure implemented by a country and its economic growth per capita'*. An advantage of safeguards is that they could be implemented in all situations without any investigation. Therefore, could safeguards be seen as a last resort to protect a domestic industry.

The sixth sub-question was: 'How do the *relationships between the trade impediments and economic growth per capita differ between developed and developing countries?*'. As discussed in the part about the data, has the sample been divided in four groups based on their GNI per capita. Table 12 in the appendix shows that the expected relationships between the trade impediment and economic growth per capita are for all trade impediments lower/more negative for countries from a higher income-group. This is in line with the hypothesis: '*Extra trade impediments are more beneficial/less harmful for developing countries*'.

The last sub-question was: '*How do the relationships between the trade impediments and economic growth per capita differ between small and big countries?*'. Table 14 in the appendix shows that bigger countries have higher/less negative coefficients of the technical barriers to

trade, sanitary and phytosanitary measures and the safeguards, while smaller countries had higher/less negative coefficients for anti-dumping measures and countervailing duties. The hypothesis: '*Extra trade impediments are more beneficial/less harmful for smaller countries*' is only partly correct and should therefore be rejected.

To be able to compare the trade impediments with each other, there has also been made a regression analysis with equal samples. Only 11 countries had data for all variables, which made most coefficients even less significant, see table 10 in the appendix. Especially the aggregate coefficients of the trade impediments and the interaction effects with the income group have now much higher coefficients. This has also led to the technical barriers to trade being expected to be harmful for low-income and lower middle-income countries. Apart from the size have the sanitary and phytosanitary measures and the countervailing duties similar coefficients as in the other regression. This could however not be said about the anti-dumping measures. Where the coefficients were negative in the previous regression, are they now positive for all income-groups. This is in line with the hypothesis, but in the other anti-dumping regression a possible explanation was given for the negative coefficients. It seems more reasonable to reject the initial hypothesis and take the positive results as an implication of the small amount of observations than to ignore that dumping could be beneficial to consumers. Safeguards do also have other signs for some income groups in the smaller regression. So is an extra safeguard expected from this regression to be beneficial for low-income and lower middle-income countries. Since trade partners should be compensated for the harm of safeguards it seems unlikely that next to protecting the domestic producers it also is beneficial for the economy.

Not every trade impediment could be implemented at all moments. So, could sanitary and phytosanitary only be implemented on foods, plants and animals, while anti-dumping measures and countervailing duties could only be used as a reaction on the trade partner. Technical barriers to trade and safeguards could however be implemented quite easily. Still, some trade impediments could be compared with each other. So could a countervailing duty, technical barrier to trade or a safeguard be implemented in a situation where the trade partner subsidizes their exports. A countervailing duty would be expected to be the best response for the lower middle-income countries Indonesia and the Philippines and the upper middle-income countries: Argentina, Brazil, Colombia, Malaysia, South Africa, Thailand and Turkey. For the high-income countries Hungary and South Korea, a technical barrier to trade is the only trade impediment which could be used in this situation with positive expected effect. If the subsidy

leads to the foreign producers dumping their products in the domestic country, then an anti-dumping measure could also be implemented. A countervailing duty would still be the best response for the low-income, lower middle-income and upper middle-income countries, but for Hungary and South Korea an anti-dumping measure would be expected to be more beneficial.

When the trade partner does not subsidize their exports or dumps their products, then of the five trade impediments discussed only a technical barrier to trade or a safeguard could be implemented. If the imported good is food, a plant or an animal, then a sanitary and phytosanitary measure could also be used as a form of retaliation. According to the numbers in table 13 are safeguards the best option for Indonesia and the Philippines, but as said before are those positive coefficients probably the result of a low number of observations. Sanitary and phytosanitary measures seem more likely to be beneficial for the economy, since those results could also be seen in the regression in table 10 in the appendix. For the upper middle-income countries Argentina, Brazil, Colombia, Malaysia, South Africa, Thailand and Turkey is a sanitary and phytosanitary the best option, while Hungary and South Korea would be expected to be best of by implementing a technical barrier to trade. If a sanitary and phytosanitary measure could not be implemented and the coefficients of the safeguards are assumed to be wrongly positive, then low-income and lower middle-income countries are best of by doing nothing. For the upper middle-income and high-income countries in this sample a technical barrier to trade seems to be beneficial, but one should again take into account that these numbers are based on historical data and new implementations could have other effects and there could be other effects, like more retaliation which is not (fully) taken into account yet.

The central question in this thesis was: '*What is the relation between trade impediments and economic growth?*'. The answers on the sub-questions showed that this depends on which type of trade impediment is implemented, but the regression analysis also showed that richer countries, based on their GNI per capita, had lower/more negative relationships between the trade impediments and economic growth per capita. There was also a difference in those relationships between small and big countries, based on their GDP as a percentage of world GDP, but these differences did not have a single-sided effect on the relationships.

Discussion

The topic of economic growth will remain an interesting topic for research, since economists and organizations like the WTO vow for free trade, while trade impediments – and especially the non-tariff ones – are increasing in numbers. Previous papers did also have ambiguous results for the relation between trade impediments and economic growth. This thesis showed that technical barriers to trade, sanitary and phytosanitary measures and countervailing duties – with the exception of high-income countries - are expected to have positive effects on economic growth per capita, while anti-dumping measures and safeguards are expected to have negative effects. These coefficients were however statistically not significant. As said has there been a "measurement problem of trade orientation", which means that it is difficult to find good measurements of trade orientation, which fits in time series and cross-country analyses (Edwards, 1992). Although the WTO, IMF and the OECD are keeping up a database on the most important variables related to this topic, are there still only 11 countries which had data for all the variables used in the regression analysis of this thesis. With an expansion of the data over time would this problem become less of an issue and could a regression analysis give more significant results. This would also fix the problem of bad comparison which could be made. Due to the low number of observations and the statistical insignificancy of the coefficients could the trade impediments not be compared optimally.

Another thing which could be done differently in further research is the mathematical representation of the world in the GAMS model. The results were as expected from economic theory, for the exception of a small country which would be able to benefit from a retaliated import tariff. As said is this due to the country unrealistically being able to influence the world price. In further research this could be fixed by making the country relatively even smaller.

References

Acemoglu, D. (2012). Introduction to economic growth. *Journal of economic theory*, *147*(2), 545-550.

Aghion, P., Bloom, N., Blundell, R., Griffith, R., & Howitt, P. (2005). Competition and innovation: An inverted-U relationship. *The quarterly journal of economics*, *120*(2), 701-728.

Bernard, A. B., Redding, S. J., & Schott, P. K. (2007). Comparative advantage and heterogeneous firms. *The Review of Economic Studies*, *74*(1), 31-66.

Bernard, A. B., & Jensen, J. B. (1999). Exceptional exporter performance: cause, effect, or both?. *Journal of international economics*, *47*(1), 1-25.

Bernard, A. B., Jensen, J. B., Redding, S. J., & Schott, P. K. (2007). Firms in international trade. *Journal of Economic perspectives*, *21*(3), 105-130.

Bräuninger, M., & Pannenberg, M. (2002). Unemployment and productivity growth: an empirical analysis within an augmented Solow model. *Economic Modelling*, *19*(1), 105-120.

Clerides, S. K., Lach, S., & Tybout, J. R. (1998). Is learning by exporting important? Micro-dynamic evidence from Colombia, Mexico, and Morocco. *The quarterly journal of economics*, *113*(3), 903-947.

Currie, J. (2009). Healthy, wealthy, and wise: Socioeconomic status, poor health in childhood, and human capital development. *Journal of economic literature*, *47*(1), 87-122.

Cutler, D. M., & Lleras-Muney, A. (2010). Understanding differences in health behaviors by education. *Journal of health economics*, *29*(1), 1-28.

Dixit, A. K., & Stiglitz, J. E. (1977). Monopolistic competition and optimum product diversity. *The American economic review*, *67*(3), 297-308.

Dmitrieva, K. (2019, May 10). Revived China Trade War Poised to Weigh on U.S. Economic Growth. Retrieved May 21, 2019, from https://www.bloomberg.com/news/articles/2019-05-10/revived-china-trade-war-poised-to-weigh-on-u-s-economic-growth

Dollar, D. (1992). Outward-oriented developing economies really do grow more rapidly: evidence from 95 LDCs, 1976-1985. *Economic development and cultural change*, *40*(3), 523-544.

Domar, E. D. (1946). Capital expansion, rate of growth, and employment. *Econometrica, Journal of the Econometric Society*, 137-147.

Edwards, S. (1992). Trade orientation, distortions and growth in developing countries. *Journal of development economics*, *39*(1), 31-57.

Edwards, S. (1993). Openness, trade liberalization, and growth in developing countries. *Journal of economic Literature*, *31*(3), 1358-1393.

European Commission. (n.d.-a). Anti-dumping - Trade - European Commission. Retrieved December 5, 2019, from https://ec.europa.eu/trade/policy/accessing-markets/trade-defence/actions-against-imports-into-the-eu/anti-dumping/

European commission. (n.d.-b). Safeguards - Trade - European Commission. Retrieved November 28, 2019, from https://ec.europa.eu/trade/policy/accessing-markets/trade-defence/actions-against-imports-into-the-eu/safeguards/

European Commission. (n.d.-c). The common agricultural policy at a glance. Retrieved October 3, 2019, from https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/cap-glance_en

Frankel, J. A., & Romer, D. H. (1999). Does trade cause growth?. *American economic review*, *89*(3), 379-399.

International Monetary Fund. (n.d.). About the IMF. Retrieved May 26, 2019, from https://www.imf.org/en/About

Johnson, H. G. (1953). Optimum tariffs and retaliation. *The Review of Economic Studies*, *21*(2), 142-153.

Lawrence, R. Z., & Weinstein, D. E. (2001). Trade and growth: import-led or export-led? Evidence from Japan and Korea. *Rethinking the East Asian Miracle*, 379-408.

Li, C., He, C., & Lin, C. (2018). Economic Impacts of the Possible China–US Trade War. *Emerging Markets Finance and Trade*, *54*(7), 1557-1577.

Maskus, K. E., & Wilson, J. S. (2001). *Quantifying the Impact of Technical Barriers to Trade: Can it be done?*. University of Michigan Press.

Melitz, M. J. (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity. *econometrica*, *71*(6), 1695-1725.

Panizza, U., & Presbitero, A. F. (2014). Public debt and economic growth: is there a causal effect?. *Journal of Macroeconomics*, *41*, 21-41.

Pavcnik, N. (2002). Trade liberalization, exit, and productivity improvements: Evidence from Chilean plants. *The Review of Economic Studies*, *69*(1), 245-276.

Polachek, S. W., Robst, J., & Chang, Y. C. (1999). Liberalism and interdependence: Extending the trade-conflict model. *Journal of Peace Research*, *36*(4), 405-422.

Rodríguez, F., Rodrik, D., 2001. Trade policy and economic growth: a skeptic's guide to cross national evidence. In: Bernanke,B.S., Rogoff, K.S. (Eds.), NBER Macroeconomics Annual 2000. MIT Press, Cambridge, MA, pp. 261–325

Rosen, S. (1989). Human capital. In *Social economics* (pp. 136-155). Palgrave Macmillan, London.

Sachs, J. D., Warner, A., Åslund, A., & Fischer, S. (1995). Economic reform and the process of global integration. *Brookings papers on economic activity*, *1995*(1), 1-118.

Saint-Paul, G., & Verdier, T. (1993). Education, democracy and growth. *Journal of development Economics*, *42*(2), 399-407.

Schultz, T. W. (1972). Human capital: Policy issues and research opportunities. In *Economic Research: Retrospect and Prospect, Volume 6, Human Resources* (pp. 1-84). NBER.

Solow, R. M. (1956). A contribution to the theory of economic growth. *The quarterly journal of economics*, *70*(1), 65-94.

South China Morning Post. (2018a, May 17). Trade war could slice 1 per cent off China's economic growth, top party official says. *South China Morning Post*. Retrieved from https://www.scmp.com/economy/china-economy/article/3010690/trade-war-could-slice-1-cent-chinas-economic-growth-top-party

South China Morning Post. (2018b, November 23). China data shows economic growth slowing as impact of trade war with US intensifies. Retrieved May 20, 2019, from https://www.scmp.com/economy/china-economy/article/2174541/china-data-shows-economic-growth-slowing-impact-trade-war-us

Wolfers, J. (2019, February 4). An A- for the U.S. Economy, but Failing Grades for Trump's Policies. *The New York Times*. Retrieved from https://www.nytimes.com/2019/02/04/business/us-economy-trump-taxes-trade.html

World Bank. (n.d.). Tariff rate, applied, weighted mean, all products (%) | Data. Retrieved November 6, 2019, from https://data.worldbank.org/indicator/tm.tax.mrch.wm.ar.zs

World Trade Organization. (2017). *World Tariff Profiles 2017*. Retrieved from https://www.wto.org/english/res_e/booksp_e/tariff_profiles17_e.pdf

World Trade Organization. (n.d.-a). WTO | Safeguard measures - Technical Information. Retrieved December 9, 2019, from https://www.wto.org/english/tratop_e/safeg_e/safeg_info_e.htm

World Trade Organization. (n.d.-b). WTO | Understanding the Sanitary and Phytosanitary Measures Agreement. Retrieved December 4, 2019, from https://www.wto.org/english/tratop_e/sps_e/spsund_e.htm

World Trade Organization. (n.d.-c). WTO | Understanding the WTO - Anti-dumping, subsidies, safeguards: contingencies, etc. Retrieved December 6, 2019, from https://www.wto.org/english/thewto_e/whatis_e/tif_e/agrm8_e.htm#subsidies

World Trade Organization. (n.d.-d). WTO | Understanding the WTO - Standards and safety. Retrieved December 2, 2019, from https://www.wto.org/english/thewto_e/whatis_e/tif_e/agrm4_e.htm#TRS

World Trade Organization. (n.d.-e). WTO | What is the WTO? - Who we are. Retrieved May 26, 2019, from https://www.wto.org/english/thewto_e/whatis_e/who_we_are_e.htm

Zandi, M. (2019, May 1). Why US economic growth isn't as strong as it looks. Retrieved May 20, 2019, from https://edition.cnn.com/2019/05/01/perspectives/us-gdp-first-quarter-economy/index.html

Appendix

Table 3: Variables GAMS model

Variable	Variable description
I_H	aggregate income of the home country
I_F	aggregate income of the foreign country
q1_H	Home country's domestic sales of average sector 1 variety
q1_HX	Home country's exports of average sector 1 variety
q2_H	Home country's domestic sales of average sector 2 variety
q2_HX	Home country's exports of average sector 2 variety
q1_F	Foreign country's domestic sales of average sector 1 variety
q1_FX	Foreign country's exports of average sector 1 variety
q2_F	Foreign country's domestic sales of average sector 2 variety
q2_FX	Foreign country's exports of average sector 2 variety
M1_H	Sector 1 firms active in the home country
M1_F	Sector 1 firms active in the foreign country
M2_H	Sector 2 firms active in the home country
M2_F	Sector 2 firms active in the foreign country
p1_H	Price of average sector 1 variety in the home country
p1_HX	Price of average sector 1 export variety in the home country
p2_H	Price of average sector 2 variety in the home country
p2_HX	Price of average sector 2 export variety in the home country
p1_F	Price of average sector 1 variety in the foreign country
p1_FX	Price of average sector 1 export variety in the foreign country
p2_F	Price of average sector 2 variety in the foreign country
p2_FX	Price of average sector 2 export variety in the foreign country

P_1H	Sector 1 price index in the home country
P_2H	Sector 2 price index in the home country
P_1F	Sector 1 price index in the foreign country
P_2F	Sector 2 price index in the foreign country
wS_H	Wage for skilled labor in the home country
wU_H	Wage for unskilled labor in the home country
wS_F	Wage for skilled labor in the foreign country
wU_F	Wage for unskilled labor in the foreign country
Term	Term related to the sunk market entry costs that is used to simplify the factor market clearing conditions
phi1_H	Average productivity parameter of the home country's sector 1
phi1_HX	Average productivity parameter of the home country's exporting firms sector 1
phi2_H	Average productivity parameter of the home country's sector 2
phi2_HX	Average productivity parameter of the home country's exporting firms sector 2
phi1_F	Average productivity parameter of the foreign country's sector 1
phi1_FX	Average productivity parameter of the foreign country's exporting firms sector 1
phi2_F	Average productivity parameter of the foreign country's sector 2
phi2_FX	Average productivity parameter of the foreign country's exporting firms sector 2
U_H	Utility of the home country
U_F	Utility of the foreign country
Vol_1HX	Volume sector 1 exports of the home country
Vol_2HX	Volume sector 2 exports of the home country
Vol_1FX	Volume sector 1 exports of the foreign country
Vol_2FX	Volume sector 2 exports of the foreign country
currentaccount_H	Value of the current account of the home country

Table 4: Equations GAMS model

Equation	Formula
Zero cutoff profit conditions	
EQ1	k*(sigma-1)*fc / (k - sigma + 1) =G= q1_H/phi1_H
EQ2	k*(sigma-1)*fc / (k - sigma + 1) =G= q2_H/phi2_H
EQ3	k*(sigma-1)*fc / (k - sigma + 1) =G= q1_F/phi1_F
EQ4	k*(sigma-1)*fc / (k - sigma + 1) =G= q2_F/phi2_F
EQ5	k*(sigma-1)*fX / (k - sigma + 1) =G= q1_HX/phi1_HX
EQ6	k*(sigma-1)*fX / (k - sigma + 1) =G= q2_HX/phi2_HX
EQ7	k*(sigma-1)*fX / (k - sigma + 1) =G= q1_FX/phi1_FX
EQ8	k*(sigma-1)*fX / (k - sigma + 1) =G= q2_FX/phi2_FX
Free entry conditions; for both sectors, for both countries	
EQ9	((k-sigma+1)/k)**(k/(sigma-1)) * fe/phiL**k * (k-sigma+1)/(sigma-1) =G= (1/phi1_H)**k * fc + (1/phi1_HX)**k * fX
EQ10	((k-sigma+1)/k)**(k/(sigma-1)) * fe/phiL**k * (k-sigma+1)/(sigma-1) =G= (1/phi2_H)**k * fc + (1/phi2_HX)**k * fX
EQ11	((k-sigma+1)/k)**(k/(sigma-1)) * fe/phiL**k * (k-sigma+1)/(sigma-1) =G= (1/phi1_F)**k * fc + (1/phi1_FX)**k * fX
EQ12	((k-sigma+1)/k)**(k/(sigma-1)) * fe/phiL**k * (k-sigma+1)/(sigma-1) =G= (1/phi2_F)**k * fc + (1/phi2_FX)**k * fX
Supply = demand conditions for all the average varieties	
EQ_I_H	I_H =E= L_H * wU_H + S_H * wS_H + tariff_1H * p1_FX * q1_FX * M1_F * (phi1_F/phi1_FX)**k
EQ_I_F	I_F =E= L_F * wU_F + S_F * wS_F + tariff_1F * p1_HX * q1_HX * M1_H * (phi1_H/phi1_HX)**k
EQ13	q1_H =E= alpha1 * p1_H**(-sigma) * P_1H**(sigma-1) * I_H
EQ14	q2_H =E= alpha2 * p2_H**(-sigma) * P_2H**(sigma-1) * I_H
EQ15	q1_F =E= alpha1 * p1_F**(-sigma) * P_1F**(sigma-1) * I_F
EQ16	q2_F =E= alpha2 * p2_F**(-sigma) * P_2F**(sigma-1) * I_F
EQ17	q1_HX/tau =E= alpha1 * (p1_HX * (1+tariff_1F) * tau)**(-sigma) * P_1F**(sigma-1) * I_F
EQ18	q2_HX/tau =E= alpha2 * (p2_HX * tau)**(-sigma) * P_2F**(sigma-1) * I_F
EQ19	q1_FX/tau =E= alpha1 * (p1_FX * (1+tariff_1H) * tau)**(-sigma) * P_1H**(sigma-1) * I_H
EQ20	q2_FX/tau =E= alpha2 * (p2_FX * tau)**(-sigma) * P_2H**(sigma-1) * I_H
Factor market clearing conditions, for unskilled and for skilled labor	
EQ21	L_H =G= (1-beta1) * (ws_H/wu_H)**beta1 * M1_H * (q1_H/phi1_H + fc + (phi1_H/phi1_HX)**k * (q1_HX/phi1_HX + fX) + phi1_H**k * Term) +(1-beta2) * (ws_H/wu_H)**beta2 * M2_H * (q2_H/phi2_H + fc + (phi2_H/phi2_HX)**k * (q2_HX/phi2_HX + fX) + phi2_H**k * Term)
EQ22	S_H =G= beta1 * (wu_H/ws_H)**(1-beta1) * M1_H * (q1_H/phi1_H + fc + (phi1_H/phi1_HX)**k * (q1_HX/phi1_HX + fX) + phi1_H**k * Term) +beta2 * (wu_H/ws_H)**(1-beta2) * M2_H * (q2_H/phi2_H + fc + (phi2_H/phi2_HX)**k * (q2_HX/phi2_HX + fX) + phi2_H**k * Term)
EQ23	L_F =G= (1-beta1) * (ws_F/wu_F)**beta1 * M1_F * (q1_F/phi1_F + fc + (phi1_F/phi1_FX)**k * (q1_FX/phi1_FX + fX) + phi1_F**k * Term) +(1-beta2) * (ws_F/wu_F)**beta2 * M2_F * (q2_F/phi2_F + fc + (phi2_F/phi2_FX)**k * (q2_FX/phi2_FX + fX) + phi2_F**k * Term)
EQ24	S_F =G= beta1 * (wu_F/ws_F)**(1-beta1) * M1_F * (q1_F/phi1_F + fc + (phi1_F/phi1_FX)**k * (q1_FX/phi1_FX + fX) + phi1_F**k * Term)

	+beta2 * (wu_F/ws_F)**(1-beta2) * M2_F * (q2_F/phi2_F + fc + (phi2_F/phi2_FX)**k * (q2_FX/phi2_FX + fX) + phi2_F**k * Term)
EQ_Term	Term =E= ((k-sigma+1)/(k * phiL**(sigma-1)))**(k/(sigma-1)) * fe
Definition of the price indices	
EQ25	P_1H =E= (M1_H * p1_H**(1-sigma) + M1_F * (phi1_F/phi1_FX)**k * (tau * p1_FX * (1+tariff_1H))**(1-sigma))**(1/(1-sigma))
EQ26	P_2H =E= (M2_H * p2_H**(1-sigma) + M2_F * (phi2_F/phi2_FX)**k * (tau * p2_FX)**(1-sigma))**(1/(1-sigma))
EQ27	P_1F =E= (M1_F * p1_F**(1-sigma) + M1_H * (phi1_H/phi1_HX)**k * (tau * p1_HX * (1+tariff_1F))**(1-sigma))**(1/(1-sigma))
EQ28	P_2F =E= (M2_F * p2_F**(1-sigma) + M2_H * (phi2_H/phi2_HX)**k * (tau * p2_HX)**(1-sigma))**(1/(1-sigma))
Definition of the profit maximizing prices for all the varieties	
EQ29	p1_HX =E= sigma/(sigma-1) * ws_H**beta1 * wu_H**(1-beta1) / phi1_HX
EQ30	p1_H =E= sigma/(sigma-1) * ws_H**beta1 * wu_H**(1-beta1) / phi1_H
EQ31	p2_HX =E= sigma/(sigma-1) * ws_H**beta2 * wu_H**(1-beta2) / phi2_HX
EQ32	p2_H =E= sigma/(sigma-1) * ws_H**beta2 * wu_H**(1-beta2) / phi2_H
EQ33	p1_FX =E= sigma/(sigma-1) * ws_F**beta1 * wu_F**(1-beta1) / phi1_FX
EQ34	p1_F =E= sigma/(sigma-1) * ws_F**beta1 * wu_F**(1-beta1) / phi1_F
EQ35	p2_FX =E= sigma/(sigma-1) * ws_F**beta2 * wu_F**(1-beta2) / phi2_FX
EQ36	p2_F =E= sigma/(sigma-1) * ws_F**beta2 * wu_F**(1-beta2) / phi2_F
Equations for measuring utility and the trade volumes	
EQ_U_H	U_H =E= I_H/(P_1H**alpha1 * P_2H**alpha2)
EQ_U_F	U_F =E= I_F/(P_1F**alpha1 * P_2F**alpha2)
EQ_Vol_1HX	Vol_1HX =E= p1_HX * q1_HX * M1_H * (phi1_H/phi1_HX)**k
EQ_Vol_2HX	Vol_2HX =E= p2_HX * q2_HX * M2_H * (phi2_H/phi2_HX)**k
EQ_Vol_1FX	Vol_1FX =E= p1_FX * q1_FX * M1_F * (phi1_F/phi1_FX)**k
EQ_Vol_2FX	Vol_2FX =E= p2_FX * q2_FX * M2_F * (phi2_F/phi2_FX)**k
EQ_currentaccount_H	currentaccount_H =E= Vol_1HX + Vol_2HX - Vol_1FX - Vol_2FX

Table 5: General equilibria GAMS models

	Open economy without transport costs				
	1st	2nd	3th	4th	5th
Elasticity of substitutions between any two varieties	5	5	5	5	5
Fixed production costs	5	5	5	5	5
Per period equivalent of sunk market entry costs	6,5	6,5	6,5	6,5	6,5
Fixed export costs	5	5	5	5	5
Shape parameter of Pareto distribution	8	8	8	8	8
Lowest possible productivity parameter	1	1	1	1	1
exponent for C1 in utility function	0,5	0,5	0,5	0,5	0,5
exponent for C2 in utility function	0,5	0,5	0,5	0,5	0,5
exponent for skilled labor for sector 1 varieties	0,6	0,6	0,6	0,6	0,6
exponent for skilled labor for sector 2 varieties	0,4	0,4	0,4	0,4	0,4
High-skilled labor endowment home	100	110	110	100	110
High-skilled labor endowment foreign	100	90	180	200	190
Low-skilled labor endowment home	100	90	90	100	90
Low-skilled labor endowment foreign	100	110	220	200	210
Iceberg transport cost parameter	1	1	1	1	1
country H domestic sales of average sector 1 variety	50,200	50,200	52,781	52,810	52,810
country H exports of average sector 1 variety	50,200	50,200	48,440	48,427	48,427
country H domestic sales of average sector 2 variety	50,200	50,200	52,781	52,810	52,810
country H exports of average sector 2 variety	50,200	50,200	48,440	48,427	48,427
country F domestic sales of average sector 1 variety	50,200	50,200	48,440	48,427	48,427
country F exports of average sector 1 variety	50,200	50,200	52,781	52,810	52,810
country F domestic sales of average sector 2 variety	50,200	50,200	48,440	48,427	48,427
country F exports of average sector 2 variety	50,200	50,200	52,781	52,810	52,810

sector 1 firms active in the home country	1,000	1,500	1,111	0,667	1,000
sector 1 firms active in the foreign country	1,000	0,500	1,754	2,667	2,000
sector 2 firms active in the home country	1,000	0,500	0,227	0,667	0,333
sector 2 firms active in the foreign country	1,000	1,500	3,564	2,667	3,333
Total production	401,600	401,600	673,727	675,048	674,913
Utility of the home country	238,793	238,793	252,290	251,207	251,207
Utility of the foreign country	238,793	238,793	546,136	547,887	547,887
	Open economy with transport costs				
	6th	7th	8th	9th	10th
High-skilled labor endowment home	100	110	110	100	110
High-skilled labor endowment foreign	100	90	180	200	190
Low-skilled labor endowment home	100	90	90	100	90
Low-skilled labor endowment foreign	100	110	220	200	210
Iceberg transport cost parameter	1,1	1,1	1,1	1,1	1,1
country H domestic sales of average sector 1 variety	48,290	48,935	50,332	49,503	50,139
country H exports of average sector 1 variety	53,119	51,838	50,071	50,996	50,272
country H domestic sales of average sector 2 variety	48,290	47,772	48,759	49,503	48,941
country H exports of average sector 2 variety	53,119	54,566	52,147	50,996	51,828
country F domestic sales of average sector 1 variety	48,290	47,772	47,138	47,458	47,205
country F exports of average sector 1 variety	53,119	54,566	57,334	55,742	56,955
country F domestic sales of average sector 2 variety	48,290	48,935	47,892	47,458	47,768
country F exports of average sector 2 variety	53,119	51,838	54,185	55,742	54,579
sector 1 firms active in the home country	1,364	1,679	1,474	1,118	1,399

sector 1 firms active in the foreign country	1,364	0,937	2,451	3,135	2,655
sector 2 firms active in the home country	1,364	0,937	0,625	1,118	0,756
sector 2 firms active in the foreign country	1,364	1,679	3,663	3,135	3,536
Total production	553,288	530,177	841,029	871,780	855,100
Utility of the home country	229,709	229,315	235,680	235,478	234,981
Utility of the foreign country	229,709	229,315	535,015	536,924	536,860
	Equilibrium with transport costs and a domestic import tariff on the first good				
	11th	12th	13th	14th	15th
High-skilled labor endowment home	100	110	110	100	110
High-skilled labor endowment foreign	100	90	180	200	190
Low-skilled labor endowment home	100	90	90	100	90
Low-skilled labor endowment foreign	100	110	220	200	210
Iceberg transport cost parameter	1,1	1,1	1,1	1,1	1,1
Import tariff on sector 1 imports of the home country	0,1	0,1	0,1	0,1	0,1
country H domestic sales of average sector 1 variety	47,913	48,739	49,771	48,728	49,505
country H exports of average sector 1 variety	54,121	52,184	50,665	52,203	50,994
country H domestic sales of average sector 2 variety	47,993	47,625	48,557	49,124	48,702
country H exports of average sector 2 variety	53,887	55,080	52,535	51,534	52,252
country F domestic sales of average sector 1 variety	47,204	46,819	46,568	46,822	46,619
country F exports of average sector 1 variety	56,963	59,606	62,357	59,575	61,691
country F domestic sales of average sector 2 variety	48,625	49,178	48,048	47,656	47,934
country F exports of average sector 2 variety	52,401	51,451	53,736	54,966	54,059

sector 1 firms active in the home country	1,681	1,865	1,743	1,511	1,700
sector 1 firms active in the foreign country	1,360	0,906	2,460	3,137	2,667
sector 2 firms active in the home country	1,206	0,804	0,485	0,960	0,611
sector 2 firms active in the foreign country	1,507	1,746	3,760	3,338	3,653
Total production	588,300	542,915	874,753	925,458	893,974
Utility of the home country	230,361	229,946	236,496	236,281	235,781
Utility of the foreign country	228,069	228,142	533,163	534,577	534,907
	Equilibrium with transport costs and a domestic import tariff on the second good				
	16th	17th	18th	19th	20th
High-skilled labor endowment home	100	110	110	100	110
High-skilled labor endowment foreign	100	90	180	200	190
Low-skilled labor endowment home	100	90	90	100	90
Low-skilled labor endowment foreign	100	110	220	200	210
Iceberg transport cost parameter	1,1	1,1	1,1	1,1	1,1
Import tariff on sector 1 imports of the home country	0	0	0	0	0
Import tariff on sector 2 imports of the home country	0,1	0,1	0,1	0,1	0,1
country H domestic sales of average sector 1 variety	47,993	48,419	49,714	49,124	49,573
country H exports of average sector 1 variety	53,887	52,827	50,732	51,534	50,906
country H domestic sales of average sector 2 variety	47,913	47,283	47,876	48,728	48,07
country H exports of average sector 2 variety	54,121	56,547	54,234	52,203	53,675
country F domestic sales of average sector 1 variety	48,625	48,167	47,364	47,656	47,425
country F exports of average sector 1 variety	52,401	53,42	56,161	54,966	55,882

country F domestic sales of average sector 2 variety	47,204	47,798	47,228	46,822	47,108
country F exports of average sector 2 variety	56,963	54,48	56,83	59,575	57,508
sector 1 firms active in the home country	1,206	1,522	1,319	0,96	1,24
sector 1 firms active in the foreign country	1,507	1,204	2,819	3,338	2,979
sector 2 firms active in the home country	1,681	1,38	1,135	1,511	1,234
sector 2 firms active in the foreign country	1,36	1,672	3,613	3,137	3,503
Total production	588,300	590,701	916,182	925,458	924,369
Utility of the home country	230,361	229,946	236,496	236,281	235,781
Utility of the foreign country	228,069	228,142	533,163	534,577	534,907
	A big home country with transfer costs and an import tariff on the first goods imports				
	21th	22th	23th	24th	25th
High-skilled labor endowment home	200	220	200	210	200
High-skilled labor endowment foreign	100	90	100	90	100
Low-skilled labor endowment home	200	180	200	190	200
Low-skilled labor endowment foreign	100	110	100	110	100
Iceberg transport cost parameter	1,1	1,1	1,1	1,1	1,1
Import tariff on sector 1 imports of the home country	0	0,1	0,1	0,1	0
Import tariff on sector 2 imports of the home country	0	0	0	0	0
country H domestic sales of average sector 1 variety	47,458	47,905	47,31	47,738	48,290
country H exports of average sector 1 variety	55,742	54,146	56,417	54,677	53,119
country H domestic sales of average sector 2 variety	47,458	47,037	47,25	47,083	48,290

country H exports of average sector 2 variety	55,742	57,957	56,718	57,661	53,119
country F domestic sales of average sector 1 variety	49,503	47,209	47,763	47,328	48,290
country F exports of average sector 1 variety	50,996	56,933	54,595	56,326	53,119
country F domestic sales of average sector 2 variety	49,503	50,674	50,004	50,511	48,290
country F exports of average sector 2 variety	50,996	49,763	50,403	49,906	53,119
sector 1 firms active in the home country	3,135	3,899	3,609	3,829	1,364
sector 1 firms active in the foreign country	1,118	0,511	1,091	0,666	1,364
sector 2 firms active in the home country	3,135	2,216	2,845	2,403	1,364
sector 2 firms active in the foreign country	1,118	1,564	1,305	1,508	1,364
Total production	871,780	840,864	912,843	864,309	553,288
Utility of the home country	536,924	536,113	538,102	537,942	229,709
Utility of the foreign country	235,478	234,008	232,913	233,132	229,709
	Retaliation by the foreign country				
	26th	27th	28th	29th	30th
High-skilled labor endowment home	100	110	100	100	110
High-skilled labor endowment foreign	100	90	200	200	190
Low-skilled labor endowment home	100	90	100	100	90
Low-skilled labor endowment foreign	100	110	200	200	210
Iceberg transport cost parameter	1,1	1,1	1,1	1,1	1,1
Import tariff on sector 1 imports of the home country	0,1	0,1	0	0,1	0,1
Import tariff on sector 2 imports of the home country	0,1	0,1	0	0,1	0,1
Beta's	0,5	0,5	0,5	0,5	0,5

country H domestic sales of average sector 1 variety	46,995	44,231	49,503	46,649	47,290
country H exports of average sector 1 variety	58,235	23,921	50,996	59,184	56,515
country H domestic sales of average sector 2 variety	48,290	42,022	49,503	48,182	49,613
country H exports of average sector 2 variety	53,119	48,135	50,996	53,393	50,856
country F domestic sales of average sector 1 variety	46,995	182,181	47,458	46,171	46,766
country F exports of average sector 1 variety	58,235	115,135	55,742	55,761	60,089
country F domestic sales of average sector 2 variety	48,290	28,880	47,458	46,737	47,408
country F exports of average sector 2 variety	53,119	154,584	55,742	51,166	55,961
sector 1 firms active in the home country	1,682	3,285	1,118	2,370	1,466
sector 1 firms active in the foreign country	1,682	0,000	3,135	3,624	3,632
sector 2 firms active in the home country	1,374	2,732	1,118	1,847	1,187
sector 2 firms active in the foreign country	1,374	1,330	3,135	2,883	3,058
Total production	632,666	714,195	871,780	1090,089	975,635
Utility of the home country	228,752	211,773	235,478	247,752	232,558
Utility of the foreign country	228,752	356,692	536,924	467,776	534,757

Table 6: Utility levels with different import tariffs

	11th		12th		13th		14th		15th	
High-skilled labor endowment home	100		110		110		100		110	
High-skilled labor endowment foreign	100		90		180		200		190	
Low-skilled labor endowment home	100		90		90		100		90	
Low-skilled labor endowment foreign	100		110		220		200		210	
Iceberg transport cost parameter	1,1		1,1		1,1		1,1		1,1	
Import tariff on sector 1 imports of the home country	Utility of the home country	Utility of the foreign country	Utility of the home country	Utility of the foreign country	Utility of the home country	Utility of the foreign country	Utility of the home country	Utility of the foreign country	Utility of the home country	Utility of the foreign country
10%	230,361	228,069	229,946	228,142	236,496	533,163	236,281	534,577	235,781	534,907
9%	230,388	228,193	229,940	228,224	236,500	533,301	236,319	534,767	235,794	535,055
8%	230,402	228,325	229,926	228,314	236,491	533,447	236,338	534,968	235,793	535,213
7%	230,399	228,466	229,903	228,410	236,468	533,605	236,335	535,179	235,775	535,381
6%	230,379	228,615	229,869	228,514	236,427	533,772	236,307	535,400	235,738	535,560
5%	230,337	228,774	229,823	228,626	236,367	533,951	236,252	535,631	235,681	535,749
4%	230,272	228,942	229,761	228,746	236,284	534,140	236,166	535,872	235,599	535,949
3%	230,179	229,119	229,682	228,874	236,177	534,341	236,049	536,122	235,492	536,161
2%	230,056	229,306	229,584	229,012	236,043	534,554	235,896	536,381	235,354	536,383
1%	229,901	229,502	229,462	229,159	235,878	534,779	235,707	536,649	235,185	536,616
0%	229,709	229,709	229,315	229,315	235,680	535,015	235,478	536,924	234,981	536,860

Table 7: Effects of import tariffs with different sized countries

	Equal countries		Foreign double in size		Home double in size	
Import tariff on sector 1 imports of the home country	0%	10%	0%	10%	0%	10%
Utility of the home country	229,709	230,361	235,478	236,281	536,924	538,102
Utility of the foreign country	229,709	228,069	536,924	534,577	235,478	232,913
Change in home's utility	0,652 (0,284%)		0,803 (0,341%)		1,178 (0,219%)	
Change in foreign utility	-1,640 (-0,714%)		-2,347 (-0,437%)		-2,565 (-1,089%)	

Table 8: AIC and BIC values for data with 15 countries. Excel file: small all

Lags of economic growth per capita			Lags of the first difference of the number of Technical Barriers to Trade			Lags of the first difference of the number of Sanitary and Phytosanitary measures		
↓	AIC	BIC	↓	AIC	BIC	↓	AIC	BIC
0	-100,936	-77,7607	0	-103,046	-75,2364	0	-101,214	-73,4043
1	-103,152	-77,66	1	-109,928	-79,8008	1	-99,7381	-69,6108
2	-101,915	-74,1054	2	-111,769	-79,3246	2	-103,753	-71,3084
3	-100,016	-69,8882	3	-109,862	-75,0994	3	-105,791	-71,0289
4	-101,749	-69,3046	4	-108,211	-71,1308	4	-103,843	-66,7627
Lags of the first difference of the number of Anti Dumping policies			Lags of the first difference of the number of countervailing duties			Lags of the first difference of the number of safeguards		
↓	AIC	BIC	↓	AIC	BIC	↓	AIC	BIC
0	-101,701	-73,8907	0	-102,193	-74,3829	0	-102,398	-74,5882
1	-100,403	-70,276	1	-101,115	-70,9874	1	-100,934	-70,8063
2	-100,333	-67,8879	2	-99,3967	-66,9519	2	-100,275	-67,83
3	-100,397	-65,6341	3	-99,2998	-64,5375	3	-98,3253	-63,563
4	-99,1232	-62,0434	4	-97,5151	-60,4353	4	-98,0721	-60,9923

Table 9: AIC and BIC values with data for 16 countries. Excel file: No MFN

Lags of economic growth per capita			Lags of the first difference of the number of Technical Barriers to Trade			Lags of the first difference of the number of Sanitary and Phytosanitary measures		
↓	AIC	BIC	↓	AIC	BIC	↓	AIC	BIC
0	-126.656	-101.661	0	-129.402	-99.404	0	-128.152	-98.155
1	-129.960	-102.462	1	-129.857	-97.359	1	-127.019	-94.521
2	-128.641	-98.644	2	-134.091	-99.093	2	-128.559	-93.562
3	-126.790	-94.293	3	-132.185	-94.688	3	-129.766	-92.269
4	-128.428	-93.431	4	-131.095	-91.098	4	-127.841	-87.844
Lags of the first difference of the number of Anti Dumping policies			Lags of the first difference of the number of countervailing duties			Lags of the first difference of the number of safeguards		
↓	AIC	BIC	↓	AIC	BIC	↓	AIC	BIC
0	-129.323	-99.325	0	-128.028	-98.030	0	-129.378	-99.380
1	-127.875	-95.378	1	-126.813	-94.315	1	-127.764	-95.267
2	-128.347	-93.350	2	-124.813	-89.815	2	-126.347	-91.349
3	-127.954	-90.457	3	-124.185	-86.688	3	-125.928	-88.431
4	-126.825	-86.828	4	-122.340	-82.343	4	-124.298	-84.301

Table 10: Regressions with the same sample size

Percentual economic growth per capita	(1) Standard	(2) Technical barriers to trade	(3) Sanitary and phytosanitary measures	(4) Anti-dumping measures	(5) Countervailing duties	(6) Safeguards
First lag	0.2191* (0.052)	0.1908 (0.1050	0.2201* (0.057)	0.1678 (0.160)	0.2470** (0.050)	0.1550 (0.190)
Δ Gross capital formation as a percentage of GDP	2.9605*** (0.001)	2.4742*** (0.006)	2.8456*** (0.003)	2.3929** (0.013)	2.8549*** (0.005)	2.7081*** (0.006)
Δ 5th lag of the secondary school enrollment rate	0.0973 (0.875)	-0.4696 (0.470)	0.0108 (0.987)	0.2697 (0.679)	0.1635 (0.814)	-0.1412 (0.830)
Δ 1st lag of the government expenditure on education as a percentage of GDP	-1.9481 (0.569)	0.9496 (0.789)	-1.5383 (0.668)	-2.3420 (0.498)	-1.7371 (0.640)	-1.9625 (0.588)
Δ 2nd lag	0.8754 (0.820)	1.7531 (0.660)	1.4020 (0.744)	0.3133 (0.937)	0.7189 (0.864)	0.5973 (0.884)
Δ 3th lag	-0.7018 (0.835)	1.0723 (0.763)	-1.3909 (0.705)	0.9319 (0.797)	-0.6861 (0.850)	-2.1264 (0.542)
Δ 4th lag	-1.8343 (0.546)	2.5479 (0.418)	-2.6100 (0.413)	-2.3167 (0.461)	-1.8414 (0.578)	-3.4858 (0.293)
Δ 5th lag	-0.1830 (0.953)	-0.7308 (0.808)	-0.5805 (0.857)	-0.6797 (0.845)	0.2392 (0.944)	-1.7333 (0.609)
Δ Total trade as a percentage of GDP	-0.0656 (0.795)	0.1571 (0.539)	-0.0736 (0.792)	0.0030 (0.991)	0.0077 (0.978)	-0.0213 (0.939)
%Δ labor force	-0.0000** (0.019)	-0.0000** (0.012)	-0.0000** (0.028)	-0.0000*** (0.009)	-0.0000** (0.026)	-0.0000** (0.032)
Δ number of the 'chosen' trade impediment		0.2408 (0.757)	0.6573 (0.609)	7.7400* (0.099)	3.6271 (0.876)	10.3693 (0.205)
1st lag		0.4726 (0.566)	0.7906 (0.519)	2.7661 (0.529)	3.9260 (0.848)	4.8874 (0.513)
2nd lag		-1.2118 (0.146)	1.5587 (0.114)	1.2007 (0.773)	12.1852 (0.518)	-0.6460 (0.892)
Interaction effect with income group		-0.0160 (0.947)	-0.2043 (0.628)	-2.7590* (0.072)	-1.3914 (0.849)	-4.8260 (0.126)
1st lag		-0.0790 (0.757)	-0.2464 (0.538)	-0.7500 (0.625)	-1.1581 (0.853)	-2.7999 (0.303)
2nd lag		0.4263 (0.107)	-0.4648 (0.148)	-0.0926 (0.947)	-4.0864 (0.488)	-0.3788 (0.841)
Constant term	8.1728*** (0.000)	0.8971 (0.827)	5.2988 (0.125)	8.610*** (0.001)	7.9659*** (0.002)	8.9265*** (0.000)
Observations	82	82	82	82	82	82
Groups	11	11	11	11	11	11
F-test	2.45	2.40	1.72	1.91	1.47	1.80
Prob > F	0.0157	0.0085	0.0695	0.0396	0.1446	0.0546
R^2 *within*	0.2866	0.4108	0.3338	0.3568	0.2997	0.3439
R^2 between	0.4115	0.0104	0.2590	0.1597	0.2995	0.1155

* p < 0.10, ** p < 0.05, *** p < 0.01 p-value between brackets

Table 11: Regression analysis with country sizes, big dataset

Percentual economic growth per capita	(1) Standard	(2) Technical barriers to trade	(3) Sanitary and phytosanitary measures	(4) Anti-dumping measures	(5) Countervailing duties	(6) Safeguards
First lag	0.1958*** (0.000)	0.1950*** (0.000)	0.1896*** (0.000)	0.2484*** (0.000)	0.2251*** (0.001)	0.1673** (0.014)
Δ Gross capital formation as a percentage of GDP	1.1625*** (0.000)	1.1599*** (0.000)	1.1867*** (0.000)	1.2153*** (0.000)	1.9696*** (0.000)	1.7703*** (0.000)
Δ 5th lag of the secondary school enrollment rate	0.3276** (0.030)	0.3407** (0.026)	0.2432 (0.189)	0.3142** (0.047)	0.1016 (0.677)	0.6073 (0.101)
Δ 1st lag of the government expenditure on education as a percentage of GDP	0.5621 (0.576)	0.6933 (0.493)	0.8872 (0.413)	1.2585 (0.273)	0.8210 (0.689)	0.9304 (0.641)
Δ 2nd lag	2.8181*** (0.007)	2.7855*** (0.008)	3.0746*** (0.006)	1.9900* (0.100)	-0.3317 (0.878)	2.4069 (0.269)
Δ 3th lag	-1.8900* (0.089)	-1.8862** (0.093)	-1.7791 (0.141)	-1.4919 (0.247)	-1.1314 (0.583)	-2.8204 (0.209)
Δ 4th lag	0.8435 (0.437)	0.5471 (0.618)	1.2011 (0.304)	1.5522 (0.232)	0.6859 (0.733)	-0.6645 (0.766)
Δ 5th lag	0.9339 (0.415)	1.0471 (0.364)	1.3124 (0.296)	1.1647 (0.390)	1.8035 (0.395)	0.8612 (0.702)
Δ Total trade as a percentage of GDP	0.1267** (0.040)	0.1321** (0.034)	0.1134* (0.087)	0.1625** (0.017)	0.2421 (0.131)	0.1140 (0.386)
%Δ labor force	-0.0000 (0.410)	-0.0000 (0.309)	-0.0000 (0.414)	-0.0000 (0.188)	-0.0000* (0.074)	-0.0000** (0.019)
Δ number of the 'chosen' trade impediment		0.1102 (0.243)	-0.0683 (0.760)	0.6056 (0.844)	-24.0969 (0.279)	-0.7232 (0.873)
1st lag		0.0021 (0.986)	-0.0773 (0.758)	5.2192* (0.072)	26.7342 (0.228)	-7.0791 (0.119)
2nd lag		0.0917 (0.396)	0.0988 (0.693)	-0.4424* (0.877)	18.2142 (0.382)	-7.8054 (0.128)
Interaction effect with income group		-0.0531** (0.035)	-0.0067 (0.898)	-0.5974 (0.264)	1.8876 (0.477)	-1.3315 (0.374)
1st lag		-0.0092 (0.753)	-0.0730 (0.209)	-0.4273 (0.389)	-3.3207 (0.191)	0.4187 (0.737)
2nd lag		-0.0166 (0.540)	-0.0765 (0.178)	0.7066 (0.158)	-2.4250 (0.315)	0.3458 (0.734)
Interaction effect with size group		0.0307 (0.107)	0.0221 (0.593)	0.1430 (0.825)	4.4469 (0.349)	0.5279 (0.516)
1st lag		0.0134 (0.518)	0.0875* (0.070)	-1.0259* (0.086)	-4.3039 (0.352)	0.8952 (0.323)
2nd lag		-0.0064 (0.762)	0.0356 (0.433)	-0.5741 (0.325)	-3.0066 (0.484)	1.2766 (0.205)
Constant term	4.5302*** (0.000)	4.1667*** (0.000)	4.7819*** (0.000)	4.4138*** (0.000)	3.9063*** (0.001)	7.6084*** (0.000)
Observations	632	632	557	503	219	189
Groups	83	83	75	58	24	24
F-test	13.09	7.43	6.11	7.86	2.82	5.62
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000
R^2 ***within***	0.1954	0.2104	0.2004	0.2596	0.2335	0.4223
R^2 **between**	0.3648	0.2185	0.3465	0.3517	0.1372	0.0378

*** p < 0.10, ** p < 0.05, *** p < 0.01 p-value between brackets**

Table 12: Aggregate correlation effects between the trade impediments and economic growth per capita, big dataset

Aggregate correlation effect	Technical barriers to trade	Sanitary and phytosanitary measures	Anti-dumping final measures	Countervailing duties	Safeguards	Average
Low-income countries	0,3278	0,5231	-1,1951	9,6837	-7,1322	0,4415
Lower middle-income countries	0,2541	0,3517	-3,3393	5,4648	-7,7224	-0,9982
Upper middle-income countries	0,1804	0,1803	-5,4834	1,2460	-8,3126	-2,4379
High-income countries	0,1068	0,0089	-7,6276	-2,9729	-8,9029	-3,8775
Income interaction effect	-0,0737	-0,1714	-2,1442	-4,2189	-0,5902	-1,4397
Total trade effect	0,1363	0,1203	0,1737	0,2469	0,1277	0,1553
Aggregate correlation with trade	-0,0100	-0,0066	0,0103	-0,0338	-0,0062	-0,0093

Table 13: Aggregate correlation effects between the trade impediments and economic growth per capita, small dataset

Aggregate correlation effect	Technical barriers to trade	Sanitary and phytosanitary measures	Anti-dumping final measures	Countervailing duties	Safeguards	Average
Low-income countries	-0,6158	3,8548	14,0665	25,9954	17,2911	12,1184
Lower middle-income countries	-0,2063	2,6810	9,7389	17,2560	7,8179	7,4575
Upper middle-income countries	0,2032	1,5072	5,4113	8,5165	-1,6554	2,7966
High-income countries	0,6127	0,33342	1,0838	-0,2229	-11,1287	-1,8643
Income interaction effect	0,4095	-1,1738	-4,3276	-8,7395	-9,4733	-4,6609
Total trade effect	0,1571	-0,0736	0,0030	0,0077	-0,0213	0,0146
Aggregate correlation with trade	-0,3508	-0,1836	-0,0667	-0,2019	0,0050	-0,1596

Table 14: Aggregate correlation effects between the trade impediments and economic growth per capita per country size group, big dataset

Aggregate correlation effect	Technical barriers to trade	Sanitary and phytosanitary measures	Anti-dumping final measures	Countervailing duties	Safeguards	Average
0% - 25% country size	0,2534	-0,0577	7,1613	26,9086	-18,7435	3,1044
25% - 50% country size	0,3002	0,1214	5,2227	23,2132	-15,5014	2,6712
50% - 75% country size	0,3471	0,3006	3,2842	19,5177	-12,2593	2,2381
75% - 100% country size	0,3939	0,4798	1,3457	15,8223	-9,0172	1,8049
Country size interaction effect	0,04683	0,17917	-1,93853	-3,69544	3,24210	-0,4332