Wageningen UR

Agricultural trade liberalization

And the reliability of models

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12/7/2011

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Abstract

This report provides an overview of the different trade barriers that exist and how different income countries use these policies to assist their producers and consumers. It shows the outcomes and the characteristics of the models that are developed, to see what the gains and losses will be when these protection policies are removed. Besides these facts it also looks at how the relevance of these models decline when there is a certain significant change that is not included in the baseline scenario of these models. As a case study the increase of the world food prices of 2008 is taken. What is shown by this case study is that there are indeed major changes in the trade balances of different countries in the year of the price increase compared with the year 2001, the start point of the baseline. When these changes are not taken into account in the baseline simulation, this can significantly damage the relevance of the outcome of the models. Whether or not this is the case, the real values of 2008 should be compared with the values of the baseline simulation of 2008. Since these values were not accessible, this report only looks at the expected damage of the relevance of the models.

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Summary

There are many different protection policies which the government can use to intervene in the market. Most of these policies are used to make the domestic price deviate from the world market price to reach the target price that a government wants to achieve. These protection policies can be transformed for each country to a nominal rate of assistance (NRA). The NRA in general is higher for countries with a higher income and therefore the NRA is relatively low for developing countries. Some of these developing countries have a negative NRA which implies that in total the farmers of these countries are taxed instead of assisted. The relative rate of assistance to agriculture is also lower for developing countries than for high-income countries, implying that developing countries relatively give more assistance to the non-agricultural sectors than to the agricultural sector. All regions have a negative agricultural trade bias, indicating that it is likely to assume that without protection policies there would be more trade among these regions. When these protection policies are removed the countries with a positive trade balance are likely to benefit the most because the world market prices will increase.

The models which calculate the expected benefits of trade liberalization consist of many characteristics that will determine the outcome of the models. Because there are differences between the chosen characteristics of the models, the outcomes of different models deviate from each other. One important outcome of these models is the increase of world market prices. The Linkage model shows that with full trade liberalization the greatest part of the gains in absolute values will go to the high-income countries. But also the developing countries will gain, in percentage compared with the baseline, even more than the high-income countries. Furthermore, the agricultural production, employment and real net farm income of developing countries will increase with full trade liberalization.

The outcomes of the different models vary a lot, which harms the reliability of the models. But also a false baseline simulation will harm the outcomes of the model. When the real situation deviates from the expected baseline simulation it will damage the relevance of the model. In the past years there has been a significant price increase, starting in 2006 with its peak in 2008. The question whether this price change harmed or did not harm the relevance of the models depends on whether this price increase was expected in the baseline simulations. A price increase can affect the import and export values, the balance of trade and the amount and height of the government interventions. These values are compared for the years 2001 and 2008 and it showed that in most countries the height of the government interventions did not change but the export and import values and thereby the balance of trade did change during the price increase.

Because there were no major changes in government interventions during the price increase this did likely not harm the relevance of the models. However, the trade balance of a lot of countries did change significantly and therefore this could cause irrelevance of the models.

To be really sure that the price increase harmed the relevance of the models a couple of things should be further investigated. Another better method should be used, more countries should be investigated, also it should be investigated if these changes in trade positions arose only by the price

increase or that more factors played a role and whether or not this price increase is a temporary case.

Introduction

The latest multilateral trade round of the WTO is the Doha Round, also known as the Doha Development Agenda. This new round of multilateral trade negotiations started in 2001. There were different reasons to start this new round, some wanted to expand the agriculture and services negotiations while others strived for greater political cohesion after the attack on September 11 (Fergusson, 2008). But the Doha Round is still not ended because the negotiators do not reach consensus. The big stumbling block in this round is the subject agriculture. Important stakeholders in this negotiation are the developing countries. Most of the world's poorest people, who mostly depend on agriculture, live in these countries. Some of whom enjoy preferential access to higher-income countries and who feel that they did not get a good deal out of the Uruguay Round, the round before the Doha Round (Anderson and Martin, 2005b).

At the start of the Doha Round many models were developed to get a clear picture of what the impact of trade liberalization would be on different countries and regions. But over the years that the negotiations took place a lot of things have changed. A major change was the increase of the world market prices of food commodities. Many of the arguments for free trade were based on the fact that free trade would result in higher world market prices. But in the meanwhile, these world market prices have increased while the negotiations continued. The models made in the beginning of the Doha Round could be irrelevant due to these price increases. The question addressed in this report is whether or not these models are still relevant after this price increase.

To understand trade liberalization one should understand how protection policies work, how these policies are used by different countries and regions and how these policies affect world trade. In chapter one these themes will be discussed. Chapter two gives an inside in how models are developed and what information is provided about gains and losses from trade liberalization by these models. In chapter three the relevance of the models is argued and whether or not the price increase in 2008 harmed this relevance. The last two chapters will concluded and discuss the findings.

Chapter 1 Agricultural protection policies and trade liberalization

Many countries use protection policies to protect the domestic prices of agricultural products. A government can choose to use these trade barriers to protect their consumers or their producers. Besides the effect of domestic prices of these protection policies, they can also have major effects on the world markets. This chapter shows the different protection policies a government can introduce, how these policies are used by developing and developed countries and the effects of these protection policies. At the end of this chapter the effects of trade liberalization are discussed.

1.1 Protection policies and there effects

Market protections are income policies which can be divided into two subcategories; market organization and subsidies. Market organization covers the policies that intervene in the market in such a way that the domestic prices are favourable. Examples are export subsidies, import tariffs or production quotas. Market organization can as well cost money as yield money. Subsidy policies do not intervene in the market. With subsidy policies there is money given to the producers or consumers. Examples are price subsidy, direct payments and input subsidies. Subsidies always involve government costs.

The choice of which of the different protection policies a country will use for an agricultural product depends on whether the country is exporting or importing the corresponding product. The choice also depends on the goal the country strives to reach. When a country wants to reach a lower domestic price compared with the world market price, they rather use a negative price support instead of a positive price support. An example is an export tariff. In this way one keeps the domestic price lower than the world market price and protects the country against the world market prices. This is common in some developing countries. It supports the consumers and also saves money for the government. But most common in the world is the use of market protections that keep the domestic prices above the world market prices.

1.1.1 Price support

If it is assumed that it is the government's goals to reach a higher domestic price than the world market price, price support will be positive. When a country is importing a specific product it could use an import tariff as a positive price support, when it is an exporting country it could use an export subsidy as a positive price support.

An import tariff has to be paid at the border and makes the price of the foreign product higher. The situation of an introduction of an import tariff in an importing country is shown in figure 1.1. Figure 1.1.1 shows the situation with free trade. The country then imports the difference between Q_d and Q_s and the domestic price is equal to the world market price. Figure 1.1.2 shows the situation with the introduction of an import tariff. The import tariff is as high as the difference between the world

market price and the target domestic price, shown by the arrow in the figure. The effect of the higher price caused by the import tariff is that the domestic farmers are going to produce more and the consumers are going to consume less compared to the situation with free trade, supply changes to Q_s^* and demand changes to Q_d^*. With this, producer surplus goes up and consumer surplus goes down. Figure 1.1.3 shows the change in producer surplus and consumer surplus. Consumer loss is given by *abfe* and producer gain is given by *abcd*. With this policy the government earns money, namely the import tariff times the quantity imported which is shown in the figure with the blue square. So with an import tariff, the government and the domestic producers will benefit. But the consumers have to pay the price for this and therefore will lose.

Figure 1.1 Introduction of an import tariff in an importing country

Figure 1.1.1 Situation without import tariff
Consumer and producer surplus
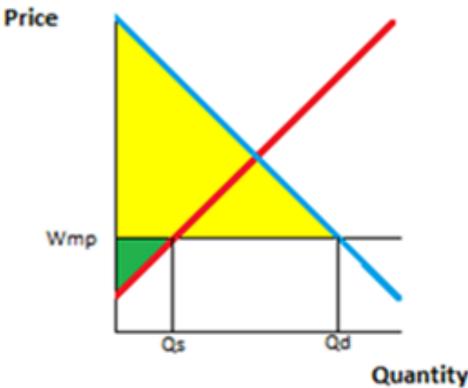
Figure 1.1.2 Situation with import tariff
Consumer and producer surplus
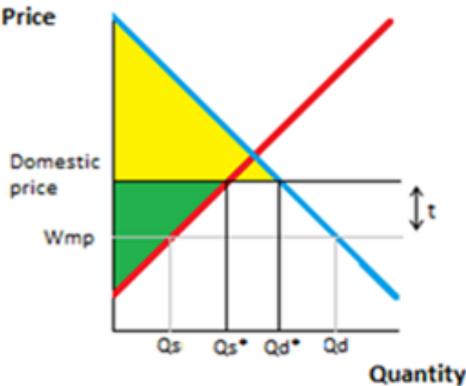
Figure 1.1.3 Situation with import tariff
Government revenue
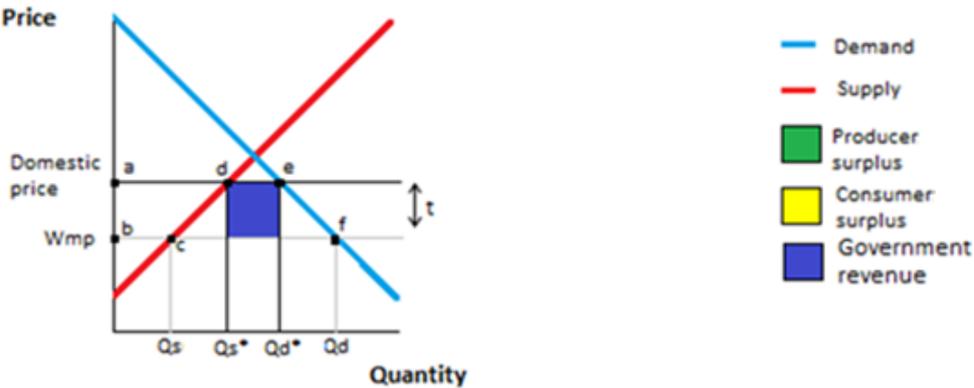
But often the consumers in the domestic country are not the only ones that have to pay the price for the introduced policy. When a government enters an import tariff it does not only affect the domestic market, but it can also influence the world market. This is only the case when the country

enforcing the import tariff is a significant large country. When this is the fact, the shift in demand and supply causes import to become smaller in the domestic country which can cause the world market price to go down. The decrease of the world market price has diverse effects on different countries. A decrease in the world market price for a certain product is beneficial for a country when this country imports this product. But the price increase is detrimental for farmers that produce the product in countries without protection and also for countries that export this product.

An import tariff also has an effect on the terms of trade of a country. The terms of trade of a country refers to the price of exports relative to the price of imports. The terms of trade is related to external prices. This ratio actually shows what can be imported with a certain amount of export. So when a country enforces an import tariff on a product which causes the relative world market price of this product to decline, this means that the external price of imports decreases which makes the terms of trade of that country increase.

When a country is exporting a product but wants to keep the domestic price for that product high, it can use an export subsidy. This is called dumping; exporting for a lower price than the domestic price and often below costs of production in exporting countries (Koning, N. and Pinstrup-Andersen, 2007). Dumping is an example of price discrimination because domestic customers and foreign customers are charged with different prices and is often regarded as unfair.

In figure 1.2 is shown what an export subsidy exactly does. Figure 1.2.1 shows the situation without subsidy and it shows what the consumer surplus and producer surplus will be in this situation. The country is an exporting country with a domestic price equal to the world market price. In figure 1.2.2 the situation with a subsidy is shown. With this subsidy the domestic price becomes higher than the world market price. Because of the higher domestic price, domestic producers will increase their production and consumers will decrease their consumption. In figure 1.2.2 it is shown that this results in bigger producer surplus and smaller consumer surplus. This also results in more export. The export subsidy that the producers get from the government is the difference between the world market price and the domestic price, indicated by the arrow in figure 1.2.2. An export subsidy costs the government money equal to the price of the subsidy times the quantity of the export, which is shown with the purple rectangle. This figure also shows the loss of consumer surplus given by *abcd* and the gain of producer surplus given by *aefd*. So when an export subsidy is introduced, producers will gain while the government and consumers will lose.

Like the import tariff, an export subsidy could have an impact on the world market price of the respective product when the country who is introducing the export subsidy has a significantly share of the world market. If that is the case, the world market price for the respective product will be lower because supply on the world market will increase. This means that the export subsidy hurts other exporting countries and producers in the countries with no protection. On the other hand it is beneficial for those countries that import the respective product.

The export subsidy has also an effect on the terms of trade of the country. Because the export subsidy causes the relative world market price of the respective product to decrease, it means that the external price of the export declines. This makes the terms of trade, and therefore the welfare, of the country worse off.

Figure 1.2 Introduction of an export subsidy in an exporting country

Figure 1.2.1 Situation without subsidy
Consumer and producer surplus

Figure 1.2.2 Situation with subsidy
Consumer and producer surplus

Figure 1.2.3 Situation with subsidy
Government loss

Demand
Supply
Producer surplus
Consumer surplus
Government loss

1.1.2 Subsidies

There are various forms of subsidies. There are export and import subsidies, named above, but there are also subsidies that support domestic producers or consumers. These subsidies are also known as domestic support. A price subsidy is one of them. Price subsidies affect the producers the same as price support does; the price they get is higher than the world market price and because of that supply rises. But the difference with price support is that the price the consumers have to pay is the same as in the situation with free trade. This means consumers will demand the same amount. The result is that supply will rise and demand will stay the same. Because of this the import will decrease and producer surplus will go up while consumer surplus will be unchanged. Though, the government costs are higher than with price support because the subsidy is paid over the whole production. So a price subsidy is beneficial for producers while it does not have any effect on the consumers because they will not gain nor lose. But the government faces losses with introducing a price subsidy, even more then with price support.

A direct payment is also a form of domestic support and is very similar to a price subsidy because they have the same effects for farmers, consumers and government spending. The difference is that the direct payments are paid based on the production in a base year instead of the current production, which makes this subsidy decoupled from production.

Another form of domestic support is an input subsidy, for example a subsidy on fertilizers. This makes the production costs for producers go down and therefore they are willing to produce more for the same price. The effects of an input subsidy are shown in figure 1.3 and are very similar to those from a price subsidy. Figure 1.3.1 shows the situation for an importing country with no input subsidy and its producer surplus and consumer surplus. In figure 1.3.2 is shown what the effect is of an input subsidy. The supply curve shifts to the right because producers are now willing to produce more for the same price, therefore import decreases. Demand does not change because the domestic price stays the same. Because of that, consumer surplus stays the same and producer surplus increases. But government costs are high with this policy.

Figure 1.3 Introduction of an input subsidy in an importing country

Figure 1.3.1 Situation without input subsidy
Consumer and producer surplus

Figure 1.3.2 Situation with input subsidy
Consumer and producer surplus
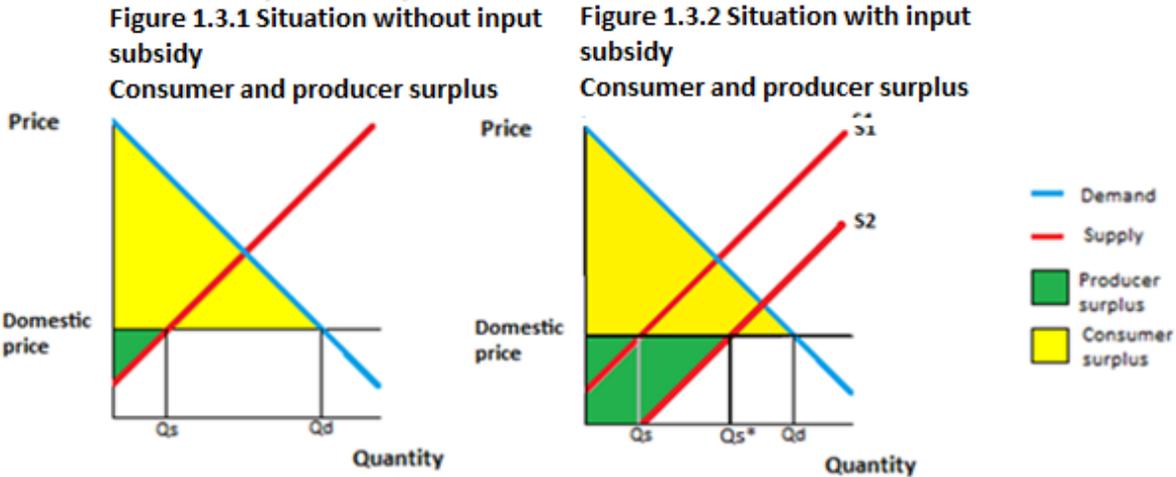
1.1.3 Production control

Another way to influence the domestic price is production control. Notice that when a country is exporting and the government introduces production control (or any other policy whereby the domestic price is kept higher than the world market price) it is always necessary to use import tariffs otherwise the foreign products will be imported because these products are less expensive. One way a government can introduce production control is by using a production quota. With this the government gives a maximum volume the producers can supply. The result from this is a supply curve that starts vertical at the maximum volume to produce. This instrument can be used with price support. The production quota then limits the increasing supply effect of the price support. The domestic price in this situation is higher and thus consumer surplus is lower than with free trade. Because the production quota stops the increasing supply effect of the price support, producer

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surplus will not rise as much as with the use of only an import tariff. Though, producer surplus will be higher than in the situation with free trade because the domestic price is higher. A production quota can be used in a country when it wants to raise their domestic price with an import tariff but wants to prevent the country from becoming an exporter. This way the government still earns money from the policy. The effects on the terms of trade of a country by introducing a production quota with an import tariff is that the terms of trade will increase because the world market price of the imported goods will be lower (when the country has a significantly share of the world market).

Another way to control production is to introduce a set aside policy. An example is that producers cannot use all of their land. The opposite of the situation with input subsidy happens, supply goes down which makes the domestic price go up. This only happens when there is also an import tariff entered as high as the price increase. This causes both producer surplus and consumer surplus to decrease. Land set aside can be mandatory or voluntary for a premium. Again, when the country has a significantly share of the world market this makes the world market price of the concerning product lower whereby the terms of trade of this country increases.

1.1.4 Intervention storage

When there is an oversupply, the government can choose for intervention storage. The government offers themselves as a demander and buys the oversupply out of the market. The producers now get the domestic price so they do not have to sell the products for the world market prices. The government can sell this storage when supply is low. When the government does not intervene, it is possible that supply will decrease whereby the equilibrium domestic price will be lower as the target domestic price set by the price support. Then the price support will be inefficient. For producers, intervention storage is beneficial because otherwise the price for which they can sell their product would be lower. For consumers it is less beneficial because without the intervention storage the price they had to pay would be lower. Therefore, producer surplus is higher and consumer surplus is lower than in the situation of free trade. Intervention storage is usually coupled to an intervention price. At this price the government buys the products out of the market whereby the intervention price automatically becomes the floor price in the market. The effects of the government are depended on the difference between the price that they have paid for the products and the price they get for the products when they sell it again.

1.1.5 Other international effects of protection policies

The world market prices are not stable and for this reason many policy mechanisms for protecting the domestic prices come in variable conditions. This implies that when prices change the protection mechanisms change simultaneously to keep the domestic prices stable at the target price. However, this has major impacts on the world market price. For example when an export subsidy in a certain country is variable it makes the world market prices more instable. This is because the variable export subsidy prevents the domestic market from buffering fluctuations in global supply. With free trade, oversupply on the world markets will be solved by a lower price which makes demand to increase. But when a large country uses variable export subsidies the domestic price will not change and thereby supply will not increase. Because of this, the oversupply will remain on the world market which lowers the world market price even more. One could say that using a variable export subsidy

prevents the domestic market from buffering fluctuation in global supply. Due to these variable protection mechanisms fluctuations in the domestic market will also not have an effect on the domestic market but on the world markets, which increase the price instability on the world market even more.

What also should be noticed is that the decrease of world market prices not always leads to the same change of the domestic price of a country. This is due to the fact that products that look similar are different in each country, for example because of other qualities and policies. Therefore the domestic price of what seemed to be the same product does not have to decrease when the world market price of this product decreases, this is called price transmission. For example when the world market price of a certain agricultural product, say potatoes, decreases this does not have to mean that the price of a certain brand of potatoes produced in a certain country also decreases. When this brand has specific qualities which distinguish it from other brands it is possible that this price decrease of potatoes will not be transmitted on the domestic price of this specific brand. The different preferences of a specific brand are comparable with the different policies of countries, which also make that the transmission of world market prices to domestic price does not always occur.

1.2 The use of protection policies

The way in which a country protects or taxes their producers and consumers differs widely among the world. In this section is shown what these differences are. To compare how different countries use protection policies these mechanisms should be classified. One way to do so is to divide these mechanisms between assistance to producers and assistance to consumers. Anderson (2010) also made use of this approach. In his article the nominal rate of assistance (NRA) and the consumer tax equivalents (CTE) are calculated for different countries and regions. The NRA tells us with what percentage the gross returns of farmers is higher or lower because of the government's policy that is introduced compared with the returns of farmers without the intervention. This means that the NRA is positive when the gross returns to farmers is higher with the intervention than without the intervention and that it is negative when the gross returns to farmers is lower with the intervention than without the intervention. In other words, when the NRA is positive the intervention is beneficial for farmers while when it is negative it is detrimental. The CTE gives us information about the extent to which consumers are subsidized or taxed. It compares the price that they have to pay for the product and the price of that product at the border. A high CTE means that the consumers in a country are highly taxed and so they get little assistance. The NRA and CTE are highly correlated because when the NRA is high it is likely that this causes the domestic price to be higher which increases the CTE. Differences between the NRA and CTE can be caused by transfer policies and taxes/subsidies making the price paid by consumers and the price received by producers deviating from each other (Anderson, 2010).

Table 1.1 shows the NRA for different countries for the period 2000-04. What is remarkable is that the NRA tends to be higher when the income per capita of a region is higher (indicated in the first column). In the table all NRAs are above zero except from one, the NRA of Africa is -7. This indicates that the interventions in Africa carried out by the government makes the gross returns to farmers

less than when these interventions where not introduced. For all the other countries the interventions of the governments make the gross returns to farmers higher.

Table 1.1 Nominal rates of assistance to agriculture for different regions in 2000-04 (%)

Regions	NRA
Africa (14% of global per capita GDP in 2000-04)	-7
Asia (20% of global per capita GDP)	12
Latin America (64% of global per capita GDP)	5
All developing countries	9
Eastern Europe and Central Asia (48% of global per capita GDP)	18
High-income countries (540% of global per capita GDP)	32
All focus countries (weighted average):	18

Source: Anderson, K. 2010, table 3

Anderson (2010) divides this NRA in the NRA to agricultural exportables and import competing products. This means that he looks at the nominal rate of assistance to farmers producing export products and farmers producing products that are also imported. In the second and third column of table 1.2 this is shown. Both the NRA for agricultural exportables and agricultural import competing products are more than twice as high for high-income countries as for developing countries. The NRA for agricultural exportables in developing countries is even negative -3, and is again the lowest in Africa.

Table 1.2 NRA to agricultural exportables, import competing products, trade bias index, NRA to agricultural and non-agricultural tradables and the RRA for different regions in 2000-04 (%)

	NRA		TBI	NRA		RRA
	agric. exportables	agric. imp-comp		agric.	non-agric	
Africa	-24.6	1.6	-0.26	-12	7.3	-18
Latin America	-4.6	20.6	-0.21	4.9	5.4	-0.5
South Asia	-6.2	26.5	-0.26	12.7	10.1	3.4
China and Southeast Asia	0.1	12.3	-0.11	7.1	5.5	1.5
Developing countries	-3	23	-0.21	7.4	6.3	1.1
European transition econs.	-1	35.7	-0.27	16.1	4.6	11
High-income countries	6.9	50.7	-0.29	33.9	1.3	32.1
World	0	36	-0.26	18.6	4	14

Source: Anderson, K. 2010, table 4 and 5.

These figures tell something about the trade bias of a country. The trade bias index is given by (Anderson, 2010):

$$TBI = \left[\frac{1 + NRAag_{ex}}{1 + NRAag_{im}} - 1 \right]$$

(1)

where NRAag$_{ex}$ and NRAag$_{im}$ are the average NRAs for the agricultural exportables and the agricultural import competing products (not in percentage), respectively. When the TBI is zero this means that the production of import competing products and exportable products are equally assisted. What is seen in table 2 is that all values of the NRA for agricultural import competing products are higher than the values of the NRA for agricultural exportables. This means that in all regions the TBI is below zero (shown in column 4 of table 1.2) which indicates a negative agricultural trade bias for all regions. That implies that the governments assist the producers of products that are also imported more than the producers of export products. A government can do this to improve their trade balances.

Besides comparing these two forms of NRA, Anderson (2010) also compares the NRA of agricultural products and non-agricultural products. This is shown in column 5 and 6 of table 1.2. The NRA is for all regions and products positive except for agricultural products in Africa (-12). In most regions the NRA for agricultural products is higher than for non-agricultural products, except from the regions Africa and Latin America. Also with this information Anderson (2010) made an index, the relative rate of assistance (RRA). The equation for the RRA is as follows (Anderson, 2010):

$$RRA = 100 * \left[\frac{(100 + NRAag)}{(100 + NRAnonag)} - 1 \right]$$

(2)

When the outcome of the equation is zero, then the agricultural and the non-agricultural sector are equally assisted. When it is below zero, the country has an anti-agricultural bias while when it is above zero it has a pro-agricultural bias. This is shown in the last column of table 1.2. It is obvious that the high-income countries have a significant agricultural bias while the developing countries have just an agricultural bias with an outcome of 1.1. As said before, the NRA of Africa and Latin America is higher for non-agricultural products than for agricultural products and therefore their RRA is negative. This means that those countries give more assistance to producers of non-agricultural products than to agricultural products.

One could also have a look at how the protection policies affect the consumers in a country. This is shown by the CTE. It is obvious that the correlation between the NRA and CTE is high. When a country is introducing an import tariff, this will be beneficial for producers reflected in a higher NRA while it is damaging the consumers reflected in a higher CTE. While the NRA of high-income countries is higher than the NRA of developing countries, it is not surprising that the CTE of high-income countries is also higher than the CTE of developing countries. To be precise the total agricultural CTE of developing countries is 8 percent in 2000-2004 while it is 27 percent for high-income countries (Anderson, 2010).

What can be concluded form this data is that the higher the income of a country the more assistance to producers. This implies that the assistance to producers in developing countries is relatively low compared with the assistance to producers in high-income countries. In some cases, like Africa, there is not even assistance of producers but the government is taxing their producers. A reason for this can be, and is often done in history, that the government wants to earn money at the expense of the agricultural producers. They do this so that they can transfer this money to invest in the industry of the country. It looks like this is also the case in Africa because their relative rate of assistance is significantly negative, resulted from the positive NRA for non-agricultural products and the negative NRA for agricultural products. Furthermore, the data indicates for all regions a negative agricultural trade bias. Indicating that it is likely to assume that without these interventions there would be more trade among these regions.

1.3 The case of trade liberalization

As discussed, the protection mechanisms introduced by a country can have different effects for a country. When a large country increases their domestic price of a product that is imported by introducing a protection mechanism it will benefit their producers and, because of the lower world market price, this will increase their terms of trade of that country. Countries who are importers of the relevant product will also gain from the intervention because the world market price will be lower. But this intervention will be at the costs of other countries. For example the countries who are exporting this product will lose. Because these effects differ widely among countries the opinions of whether trade liberalization should be introduced are diverse. Therefore the major argument that countries are using against or for free trade are based up on the expected rise of the world market prices when full liberalization is introduced. This can be good or bad for a country depending on their situation on the world market.

The protection policies that raise domestic prices often depress the world market prices. This lower world market price has different effects on a country that is exporting this product and a country that is importing the product. When these countries do not use any protection mechanisms the domestic price will be the same as the world market price. This would be beneficial for the consumers in the importing and exporting country, because they have to pay a lower price, while it is unfavourable for producers because they get a lower price. When these protection policies are taken away it is expected that the world market prices will increase. This is beneficial for those countries who are exporting these products, while the countries who are importing the product will lose. The main question is thus if the country is a net exporter or a net importer (McCalla A.F. and Nash F, 2007). In table 1.3 an overview is given of which countries are net exporters and net importers of agricultural products. One can see here that in total there are more net importers than net exporters, this would imply that more countries would lose than that they would gain with free trade. The country group that is expected to lose most is the middle-income group of countries, since they have relatively the most net importers compared with net exporters. On the other hand the low-income countries are expected to gain most, because the number of net exporters is higher than the number of net importers. The gains or losses for the industrial countries are expected to be neutral, because the number of net exporters is almost the same as the number of net importers. Having only this information, one could say that the low-income countries are expected to gain most from trade liberalization. This is a very general assumption because it is only based on whether the country is a

net importer or a net exporter, while the actual gains from free trade depend on a lot more characteristics of a country's situation.

An example of this are the benefits that a price increase may entail for certain importing countries. Especially in developing countries were most of the poor depend directly or indirectly on agriculture for their main income (Anderson, 2010). High-income countries depress the world market prices with their protection policies and so, when this price decrease is transmitted to the domestic market of developing countries, they can depress the earnings of farmers in developing countries. With free trade the prices will increase instead of decrease. When this increase in prices is transmitted to the domestic market consumers will have to pay more, but farmers in these countries will earn more. With this, production that has been depressed by the low domestic and world market prices will go up in developing countries, which make the earnings of farmers even higher. If the production increase is high enough it can even change a country from a net importer to a net exporter. Furthermore, these developments can also have multiplier effects on other sectors in these countries which can have a positive effect on economic growth and the reduction of poverty (Koning and Pinstup-Andersen, 2007). Due to these effects it is possible that free trade is beneficial for all countries, whether they are net importer or net exporter but that differences exist in the value of these gains.

Table 1.3: Country classifications by all agricultural trade

	Number of countries in all agricultural trade		
Country group	Net exporter	Net importer	Total
Industrial countries	16	17	33
Middle-income countries	41	64	105
Low-income countries	34	24	58
World, total	91	105	196

Source: Ng, F., Aksoy, A. 2008, table3.

But besides the fact that most low-income countries are net exporters and farmers in low-income countries will benefit from free trade, there are some negative sides of free trade for low-income countries. First of all it remains to be seen whether a low-income country can make use of the benefits of it. The multiplier effects are hard to occur when the resources are not available. Many low-income countries have poor domestic infrastructure, limited access to technology and poor domestic agricultural policies (Koning, N. and Pinstrup-Andersen, P, 2007). But another disadvantage for low-income countries is that some of these have preferential access (preferential trade arrangements (PTA)) to different OECD markets which they will lose with free trade, so called preference erosion. This means that they do not have a better position compared with other low-income countries in world trade, and that the competition on the market will be higher. For countries with preferential access this can be one of the reasons for opposing to free trade.

In this chapter was shown that there exist multiple forms of protection policies and that the higher the income countries the more the producers are protected. When these protection policies are removed an important factor determining the results is whether a country is a net importer or a net exporter. How these outcomes of free trade can be calculated and what these outcomes are will be discussed in the next chapter.

Chapter 2 Models and their outcomes

A model is a simplified representation of (a part of) reality and helps to visualize the impacts of a policy to support the decision making process. During the Doha Round many models are made to give an impression of the expected welfare gains of trade liberalization. But time has taught us that it is difficult for politicians to make significant decisions based on the developed models. Often these models are criticized on the fact that they are not transparent enough and that the empirical foundations of the models are weak (Hess and Von Cramon-Taubadel, 2008). Besides this, perhaps even more worrisome, the outcomes of the different developed models are not identical, some even contradictory. Figure 2.1 shows the simulated welfare gains of selected studies. It presents three studies whereby a 50 percent reduction in global agricultural protection is applied and 5 studies whereby a 100 percent reduction is applied. What one can conclude from this figure is that the welfare gains within the chosen liberalization size vary and there is no obvious conclusion about what the impact of the liberalization size is. This indicates that there are more differences between the models then the degree of liberalization that is applied.

Figure 2.1 Simulated Welfare Gains from Agricultural Liberalization, Selected Studies

Simulated Welfare Gain due to Agricultural Liberalization (billion US$)
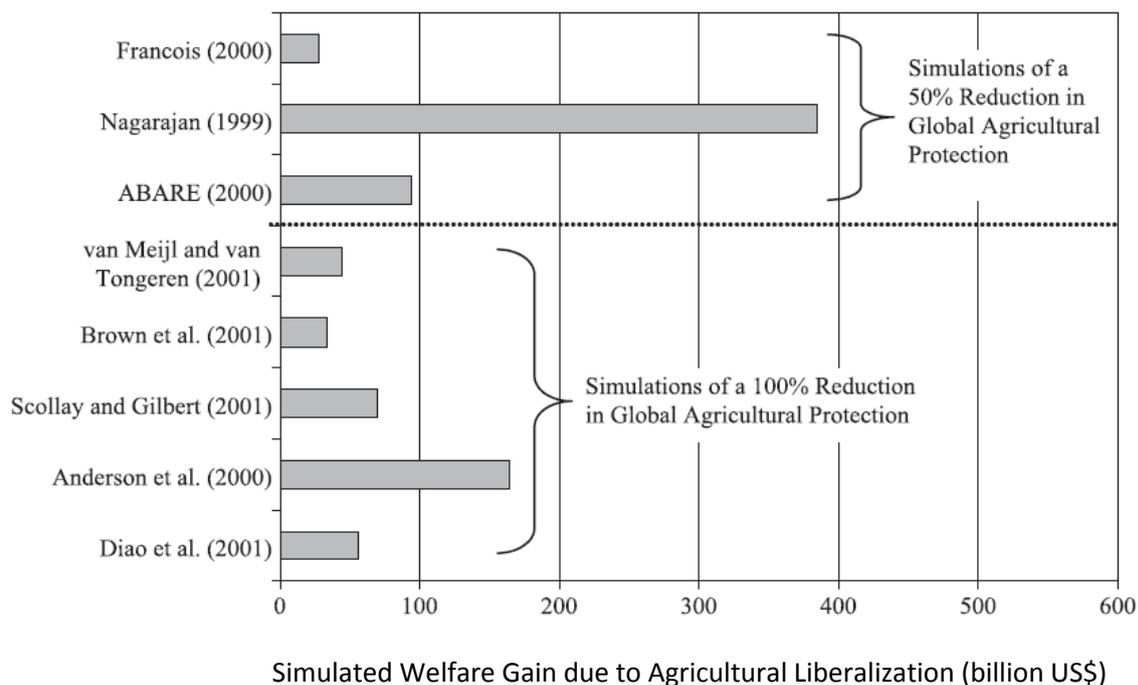
Source: Hess and Von Cramon-Taubadel, 2008. Figure 1.

2.1 Model characteristics and factors

To understand where the variation in the simulated welfare gains comes from; one has to understand the different model characteristics and other factors that are associated with the simulated welfare gains. Hess and von Cramon-Traubadel (2008) examine in their article which factors and characteristics of a model are associated with the variation between the different

models. Their goal is, after all characteristics and factors of the models are determined, to analyze how these different characteristics and factors are associated with the simulated welfare gains. They divided the characteristics and factors in the following groups:

Different measures of outcomes

When one develops a model, the measure of the outcome has to be chosen. The effects of liberalization can be displayed by for example in changes in GDP, trade flows, or equivalent variation (EV). Most of the models express the effects of trade liberalization in EV (Bouwmeester *et al.*, 2003). When there is a price change or an income change the EV indicates the amount of money that should be paid to people to compensate for the price or income change, in a way that the utility of that person stays the same. The equivalent variation will not be the same for everyone at an equal price or income change, due to the fact that the utility of one dollar differs for different people, countries or regions.

Different liberalization steps

A modeler also has to choose which level of liberalization he will apply. Models can use for example a 100 percent liberalization level, a 50 percent liberalization level or a 33 percent liberalization level by all countries. Hess and Von Cramon-Taubadel (2008) indicate that while models appear to have the same liberalization levels, major differences can exist in the simulated welfare gains. In their article they come up with the formula whereby the domestic price of an imported good is dependent on the price of that good, the initial ad valorem tariff levied on the imports and the proportional reduction. When the proportional reduction in the different models is the same, say a cut of 50 percent on all protection, the outcome can differ between the models when the other variables are not interpreted the same. For example, the initial ad valorem tariff levied on imports can vary between different models due to different calculation of these tariffs. This could lead to different outcomes of the impact of the identical liberalization level. The modeler also has to decide on which products the liberalization steps are introduced, for example on only agricultural products or on all merchandise goods.

Different model specifications

The article of Hess and Von Cramon-Taubadel (2008) shows that there are a lot of model specifications concerned with the outcome of the models. Here a selected number of them:

General equilibrium (GE) models versus partial equilibrium (PE) models. While general equilibrium models include all markets, partial equilibrium models only include a single market. Overall, general equilibrium models are expected to show higher welfare gains than partial equilibrium models.

Multi-country general equilibrium versus a single-country general equilibrium. Hess and Von Cramon-Taubadel (2008) state that the single-country GEs generally assume the country has fixed trade balances and fixed exchange rates and that there are no endogenous capital inflows. Therefore they expect the single-country GE models to have lower welfare outcomes. Besides the number of countries involved in the model, the outcome is also associated with the number of sectors and agricultural products captured in the model.

Observations based on comparative static versus dynamic modeling. Comparative static models measure the variation between two equilibrium points at a certain time leaving out the path that leads to the differences between these points (Bouwmeester *et al.*, 2003). While dynamic modeling compares the two equilibrium points over a time period and thereby include this path. Hess and Von Cramon-Taubadel (2008) state that dynamic modeling is expected to be associated with higher simulated welfare gains. Bouwmeester *et al.* (2003) notes this too but also points out that the empirical fundaments for this assumption are weak. What Hess and Von Cramon-Taubadel (2008) also remark is the fact that the length of the simulations of dynamic models is also a factor that influences the outcomes of the models. Simulations with longer runs are expected to have higher welfare gains, they state, partly due to the result of increases in the size of the world economy.

Perfect competition and constant returns to scale (CRTS) versus imperfect competition and increasing returns to scale (IRTS). IRTS means that when there changes something in the input, the output will change with the double amount. Therefore it is expected that IRTS will result in higher benefits from free trade. In case of competition there are arguments why perfect competition will result in higher gains with free trade and arguments why imperfect competition will result in higher gains. Perfect competition can result in higher gains than imperfect competition because with imperfect competition it can be possible that monopolists do not react at the price increase because they can set their own price. While imperfect competition can result in higher gains because with free trade the market is more open which is expected to decrease the amount of monopolists because more competition arises, which result in higher benefits. Hess and Von Cramon-Taubadel (2008) are probably a supporter of the latter proposition because they believe imperfect competition will lead to higher gains from free trade.

Whether the capital stock is assumed to be fixed in the model or not is also expected to entail different welfare gains. Assuming capital accumulation is expected to associate with higher welfare gains. This could be due to the fact that capital accumulation could cause investment to grow which can lead to higher welfare.

The assumed magnitude of the Armington elasticity also influences the outcome of the different models. The Armington elasticity tells us something about the degree of substitution in demand between identical products produced in different countries (Zhang, 2006). This elasticity deals with the different price transmissions in countries. As discussed before, a change of the world market price will not have the same effects on the domestic price in each country. Therefore for each product and each country the change in the domestic price after a change in the world market price has to be calculated, which is called the Armington elasticity. This is a complex calculation and also hard to calibrate. But it has an important impact on the outcomes of free trade. When the Armington elasticity is high, it means that the substitution in demand between identical products produced in different countries is easy and therefore the world market price will be transmitted to the domestic price. When a model includes a high Armington elasticity it is expected to result in higher welfare gains (Hess and Von Cramon-Taubadel, 2008). This is argumentative, because when the world market prices increase because of free trade more benefits are likely to occur when this price increase also causes a price increase in the domestic market.

The most common used model is the Global Trade Analysis Project (GTAP) model (Bouwmeester *et al.*, 2003). This model exists in different versions. The newer versions of the GTAP, like GTAP 6, already captured a part of the reductions in protections (Hess and Von Cramon-Taubadel, 2008). These are more realistic and result in lower welfare gains due to the lower protections included. It is obvious that different data sets will also lead to different model outcomes.

As is shown, there are many facets of a model that are involved in the results of the different models. Hess and Von Cramon-Taubadel (2008) strived in their study to derive quantitative estimates of these facets that influences the models to increase the transparency about their impact on the simulation results. While they do explain a proportion of the variation in the simulated welfare changes they do not give an insight in what the right model is. This is question is most relevant. The best model is the model that is most similar to reality. Because reality is complex, the answer to this question is not obvious. Without the 'right' model it is hard to make significant statements for the future.

2.2 The Linkage model

To give an example of the precise outcomes a model provides, this paragraph will show the outcomes of the Linkage model. This paragraph is based on Anderson *et al.* (2005a) who used the Linkage model in combination with the GTAP version 6.05 database to asses sectoral and welfare effects of trade distortions on agricultural markets and farm incomes. What distinguishes the Linkage model from the GTAP and other standard comparative static models is that the model is recursive. This means that the model can be solved for any year till 2015.

What the Linkage model provides is a baseline for the world economy to 2005 and to 2015, starting at 2001. After that, a line is created which shows the effects of total liberalization implemented over 2005-2010. The deviation between the baseline in 2015 and the created line with liberalization in 2015 is examined.

2.2.1 Price increase on world market with free trade

In the debate about free trade a major argument is that with free trade the world market prices will increase. This price increase is also shown by Anderson *et al.*(2005a) with the Linkage model, shown in table 2.1. This model states that the prices of all agriculture and food will be 3.1 percent higher with full global liberalization than without full global liberalization. Especially cotton, oilseeds and dairy products will have a higher price with full liberalization than without full liberalization.

The increase of prices will be caused by the fact that important countries on the world market that use intervention, like the US and the EU, will no longer suppress the world market prices with their government intervention. In figure 2.2 a situation is outlined where the graph on the right hand side represents the exporting OECD countries and the graph on the left hand side represents the rest of the countries as importers. The blue line (WMP) represents the world market price. Without intervention this is also the domestic price for both country groups. When the OECD countries introduce a protection policy to increase their domestic price, their domestic price will shift from the blue line to the black line above, the DMP OECD. With this, export rises and therefore the world

market price drops from the blue line to the lower black line (WMP*). Because the other countries' governments do not introduce a protection policy their domestic price becomes equal to this lower world market price. This causes import to increase in these countries. When free trade is introduced, this situation is recovered and the world market price will rise again.

Table 2.1 Impact of full global liberalization on real international product prices, 2015

	Percent relative to baseline
Rice	4.2
Wheat	5
Other grains	7
Oilseeds	15.1
Vegetable oils and fats	1.9
Sugar	2.5
Cotton	20.8
Fruit and vegetables	2.8
Other crops	2.6
Livestock	2.5
Processed meats	4.3
Dairy products	11.9
Other food, beverages, and tobacco	-0.7
All agriculture and food	3.1
All primary agriculture	5.5
All processed foods	1.3

Source : Anderson et al. 2005a, table 15.

Figure 2.2
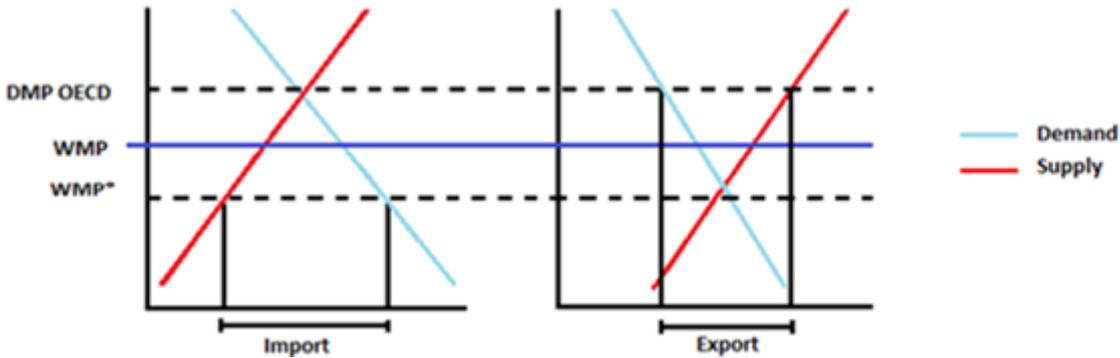
2.2.2 Other effects of free trade

As was shown in paragraph 2.2.1 the world market prices will be higher with free trade than without free trade. Figure 2.2 shows that when there is free trade introduced the import will decrease in the graph on the left hand side while export will decrease in the graph on the right hand side. With these

changes come more changes. This subparagraph will look at what the Linkage model predicts these changes will be on different parts of the economy.

In their article, Anderson *et al.* (2005a) are looking at the effect of all trade barriers of global merchandise trade being removed together. Table A.1 shows the impacts of this on the real incomes of countries/regions. What the table shows is that the world total real income will gain with $287.3 billion a year, $201.6 of which goes to the high-income countries and $85.7 of which goes to the developing countries. When one compares this outcome to the baseline income in 2015 (the expected situation in 2015 without liberalization) it shows that the developing countries gain relatively more from liberalization than the high-income countries do, namely 0.8 percent and 0.6 percent respectively. Within the group of developing countries, the middle-income countries and low-income countries both gain 0.8 percent compared with the baseline income in 2015. But there are major differences within these groups. For example, China has got a total real gain of only 0.2 percent while Vietnam has got a total real gain of 5.2 percent.

Table A.2 gives a closer look from which sector these welfare gains come from. The biggest share, 63 percent, of the welfare gains come from agriculture and food. Again is showed that that the region that is liberalizing agriculture and food gain most of the liberalization in percent.

The next table, table A.3, shows that the effect on trade, output and consumption of the full liberalization of trade on agricultural and food. What we see in the high-income countries is that the export increases per year but less than the import. Here also consumption decreases and thereby total output decreases. In the developing countries it is the other way around, export increases more than output and also consumption increases. Thereby the output increases. Because of this the self-sufficiency ratio[1] in general for developing countries is unchanged, while the self sufficiency ratio in general for high-income countries will be smaller. The higher world market prices that will arise from the liberalization will have an impact on the consumption in that country. The real income change is a major factor in what this effect will be. It is the question whether the increase in real income will more than offset the rise in prices. In general the consumption will rise with 1.2 percent in the developing countries each year and will decrease every year in the high income countries. This is the general case, when one looks further in the table one can see that there are differences between the countries. That is the case for example in Russia, a middle-income country, were the consumption decreases with 1.3 percent per year while in Korea and Taiwan, both high-income countries, the consumption will rise with 14.6 percent per year.

One cannot straightforward say, considering these data, that an increase or decrease in consumption means that the consumer surplus will also increase or decrease, respectively. The effect of a change in consumption depends on the elasticity of demand and the price change. For developing countries, when prices stay the same but consumption rises then the consumer surplus will increase. But when the price also changes this can be different. When the price decreases, then consumer surplus will still increase. But when the price will increase then it is the question if the rise in consumption more than offset the rise in price, this depends on the elasticity of demand. The

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[1] Self sufficiency is here defined as the domestic production as a percentage of domestic consumption measured in value terms at free on board prices (Anderson *et al.*, 2005).

same goes for high-income countries. Their consumption lowers but when the price lowers too, it is again the question whether the decrease in prices will offset the decrease in consumption. When one assumes that the prices after liberalization will also be higher than the domestic prices with trade barriers, then one can assume that the consumer surplus in high-income countries will be lower with free trade.

Besides the effects of trade liberalization on consumption we can also have a look at the effect on output provided by the producers. We can see in table A.4 that the agricultural output as an annual percentage growth with full liberalization will be higher than without free trade for developing countries, namely 3.9 percent without free trade and 4.2 percent with free trade. In the high-income countries it is a totally different story. There the annual growth percentage of agricultural output will be -0.1 percent with free trade, while it would be 1.6 percent without free trade. The same story goes for the consumer surplus, whether the producer surplus will increase or decrease depends on a combination of output change, price change and the elasticity of supply. The output in developing countries will increase more than in the situation without free trade and when the domestic price of these countries will not decrease after free trade, producers surplus will rise. When the domestic price of the developing countries does decrease, then it is again the question if the rise in output more than offsets the decrease of the price which depends on the elasticity of supply. In the high-income countries the output growth will be less than without free trade, therefore the only way for producer surplus to be higher than without free trade is that the price will increase so much that it will offset the decrease in output. Again, this depends on the elasticity of demand.

Table A.4 also shows the impact of full liberalization on the annual farm employment growth in percentage between 2005 and 2015. Anderson *et al.* (2005a) states that economic growth leads to declines in absolute numbers of people working in farming when a country becomes a middle-income country, due to the decline in the relative importance of agriculture. This is reflected in table 4 where most of the high-income and a lot of middle-income countries face a decline of farm employment with full liberalization. High-income countries in general would have a farm employment growth of -1.5 percent and with full liberalization -3.1 percent. While the developing countries face a higher growth with full liberalization, namely they would have a farm employment growth of 1.0 percent without full liberalization and a 1.2 percent farm employment growth with full liberalization.

One could also have a look at where the benefits for employees end up, this is shown in table A.5. Here one can see the impact of full global merchandise trade liberalization on unskilled and skilled wages. Anderson *et al.* (2005a) quote the theory of trade here, which expects unskilled labor to rise more than skilled labor in developing countries and the other way around for developed countries. This is reflected in table A.5 where the unskilled wages for developing countries are 3.5 percent higher compared with the baseline in 2015 while the skilled wages are 3.0 percent higher. For developed countries it is indeed the other way around, unskilled wages are 0.6 percent higher than the baseline while skilled wages are 1.1 percent higher compared with the baseline. It is obvious that developing countries will gain the most by these changes in wages due to trade liberalization especially because the majority of the people in developing countries are unskilled. Table A.6 shows the effects of full liberalization of global agricultural and other merchandise trade on agricultural value added. Here we see that net farm income rises with 2.9 percent for developing countries and

decreases with 19.4 percent for high-income countries compared with the baseline. Again developing countries will gain more than the developed countries in this case.

The overall conclusion drawn from the Linkage model is that in developing countries the agricultural production, employment, and real net farm incomes will increase by 2015 with full trade liberalization.

2.3 Relationship between model outcomes and the balance of trade

In chapter 1 was suggested that the benefits of trade liberalization would depend on the balance of trade of a country. Expected was that when a country is a net importer the benefits would be less than when a country is a net exporter. To see if there is a relationship between the model outcomes and the balance of trade this section compares the trade balances of the countries in 2001 with the total real gain with free trade as an percentage of the baseline income in 2015, which was found in table A.1. Table 2.2 shows some specific countries that were net exporters in 2001 and their import and export values in 2001. To make a good comparison between the balance of trade and the total real gain, a relative trade balance should be made. In table 2.2 this is done by dividing the export by the trade balance, shown in the fifth column. When this number is high it means that the amount of trade balance fits multiple times in the total export value and therefore the trade balance is not very high relatively to the total value of export. The other way around, when this number is low it means that that the amount of trade balance fits just a few times in the total export value and therefore the trade balance is very high relatively to the total export value. Expected is that when the positive trade balance is relatively high, the benefits of free trade are high. This means that it is expected that when the number in the fifth column is low, the total real gains in the sixth column are high. This pattern is reflected in table 2.2. The countries are ordered by the relative trade balances, from high to low. The lower percentage of the total real gain compared with the baseline in column six are almost all on the upper half of the table while the higher percentages are in the lower half of the table. There are some exceptions from this but the overall pattern is indeed that when the relative positive trade balances is high, the total real gains with free trade as percentage of the baseline income in 2015 are also higher.

The same is done in table 2.3 for net importing countries. To create a relative trade balance, import is divided by the trade balance of a country, presented in the fifth column. When this value is little negative this means that the negative trade balance is relatively low and when this value is highly negative this means that the negative trade balance is relatively high. It is expected that the highly negative values are correlated with the lowest gains from trade. In the table the countries are ordered by the relative trade balance, from high to low. In this case there is no obvious pattern found. Therefore we cannot say that it is indeed the case that a country with a more negative trade balance will have lower gains from free trade than a country that has a less negative trade balance.

Table 2.2 Net exporting countries, export and import values in current million dollars

Country	Exports (2001)	Imports (2001)	Trade balance (2001)	Export/trade balance	Total real gain with free trade as percentage of baseline income in 2015[a]
United States	70017	68400	1617	43,3	0.1
Indonesia	7024	5350	1674	4,2	0.7
India	6329	4513	1816	3,49	0.4
Canada	33721	15574	18147	1,86	0.4
South Africa	3200	1465	1735	1,84	0.9
Thailand	12055	4798	7257	1,66	3.8
Viet Nam	4317	1561	2757	1,57	5.2
Argentinia	12199	1471	10782	1,31	1.2
Brazil	18440	3914	14526	1,269	1.5

Source: WTO: time series on international trade

Table 2.3 Net importing countries, export and import values in current million dollars

Country	Exports (2001)	Imports (2001)	Trade balance (2001)	Import/trade balance	Total real gain with free trade as percentage of baseline income in 2015
Russian Federation	7339	10727	-2738	-0,68	0.6
Japan	5157	57052	-51895	-1,1	1.1
Bangladesh	380	1917	-1537	-1,25	0.2
Mexico	8796	12167	-3371	-3,61	0.4
China	16626	20125	-3499	-5,75	0.2
European Union (27)	231168	255308	-24140	-10,58	0.6

Source: WTO: time series on international trade

When table 2.2 and 2.3 are compared one can see that the average of the total real gain with free trade as percentage of the baseline income in 2015 (all countries equally weighted) of the net exported countries (1,58 percent) is higher than the average of the net imported countries (0,52 percent). So in this case the gains from free trade are indeed higher for the net exported countries than for the net imported countries.

Chapter 3 The effects of a price increase on the relevance of the models

In the previous chapter was shown that outcomes of the different models deviate a lot from each other, which makes the decision process hard. The model with the most relevant outcomes is the model that is closest to reality. As discussed in the previous chapter, a model provides a baseline simulation in which no trade liberalization is implemented and a reform simulation in which trade liberalization is implemented. On a certain time point these two simulations are compared with each other and the variation between these lines indicates the predicted gain or loss from trade liberalization. These two simulation lines have to be close to reality, so that the outcomes of the model are reliable. Besides creating a reliable reform simulation, developing a reliable baseline simulation is also crucial. This baseline simulation, like the reform simulation, contains all different kinds of assumptions about the future. Besides the chosen characteristics, named in the previous chapter, there are also assumptions made about growth rates from different economic facets for example labour, population, and productivity growth (Mensbrugghe and Beghin, 2005). These assumptions are made after studying trends and determining elasticities. It is obvious that the resulted baseline simulation can vary from the future's real situation. This can be due to circumstances that were not expected at time of making the baseline simulation.

Whether or not the change of a certain circumstance affects the relevance of the outcome of the models is a question of great importance. There are many unforeseen changes that can occur that makes the real situation deviate from the assumed baseline. If one takes a look at the past few years a seemingly abnormal situation occurred, namely the food price increase starting in 2006 with its peak in 2008. In figure 3.1 is shown that in this period of two years the world food prices almost doubled. In this chapter the question addressed is whether this increase in world food prices harmed the outcomes of the models and made them less relevant. Whether or not this is the question depends on how this increase of food prices is included in the baseline scenario of the models and if not, how this rise in food prices affected the position of country in world trade.

Figure 3.1 Index of Oil, Food and All Commoditites, 1992-2008, January 1992=100
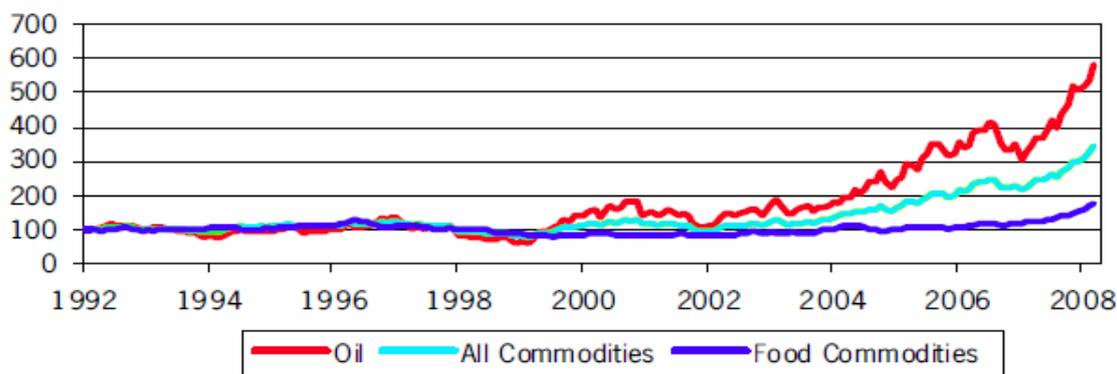
Source: Banse *et al.*, 2008, figure 2.

# 3.1 The impact of increased food prices on trade and trade liberalization

The overall trend of food prices in the long run is that they decline because of technical change and inelastic demand (Banse *et al.*, 2008). But the opposite happened in 2008. Figure 1 shows that in 2008 food commodity prices were almost twice as high as in the period of 2004 till 2006. This price increase can have major impacts on the consumers in the world, especially those in developing countries. Besides that the food commodities increased in prices, all other commodities did too. For example, also the energy and fertilizer prices increased and therefore also the costs of the production of the food commodities increased, which again can rise the food prices.

Prices are determined by the equilibrium that is established by demand and supply. Therefore, changes in demand or supply effect prices and the other way around. The price increase in 2008 therefore is also projected in demand and supply of food commodities and other commodities. The change in prices can be caused by temporary causes or long-run effects. One can assume that the temporary causes do not play a role in the model outcomes.

Prices and demand and supply are dependent from each other. Because of this, a shift in one of these can have major influences in the efficiency of protection policies. On the one hand, when the prices for agricultural products in a country increase, the production of these products will go up because producers can get a higher price for their product. On the other hand, consumers will buy less of the products because they have to pay a higher price. In what amount the production will go up and the consumption will go down when the price of a product increases depends on the elasticity of supply and the elasticity of demand, respectively, of that product. Figure 3.2 gives an example of a situation of a world market price increase. In the first two graphs the situation is given for the OECD countries as exporters with intervention (on the right handed side) and the rest as importers without intervention (on the left handed side). With intervention introduced by the OECD countries their domestic price becomes the upper line (DMP OECD). With this, their export volume increases. Because the OECD countries have major influence on the world market the increase in their export causes the world market price to decrease. In the importing countries the domestic price is equal to the world market price and because of the intervention this price decreases and becomes the bottom line (WMP*) which increases their import. This situation can represent the baseline simulation in the models. In figure 3.2.1 is shown what happens with this baseline when the world market price increases. In this case the world market price increase is caused by a lower supply in the OECD countries, which for example can be caused by the higher bio fuel demand and a higher demand in the rest of the world for example due to higher population growth or a higher income. These two shifts cause the world market price to go up. What one can see in figure 3.2.2 is that when this price increase is high enough, the new world market price can now be at the same height as the domestic price of the OECD with intervention is. When this is the case the OECD countries can choose to not introduce intervention because the world market price is now equal to their target price. In this case, the world market price is both the domestic price for the OECD countries as for the rest of the countries. When figure 3.2.1 is used in the baseline scenario in a model, but the real world situation is figure 3.2.2 the model outcomes will not be relevant. This because there is no intervention in the situation of figure 3.2.2, so full liberalization of trade will have no effect while in

the case of figure 3.2.1 full liberalization will have major effects and therefore there also will be gains and/or losses for the different countries.

Figure 3.2

Figure 3.2.1 Baseline scenario

Figure 3.2.2. World market price increase
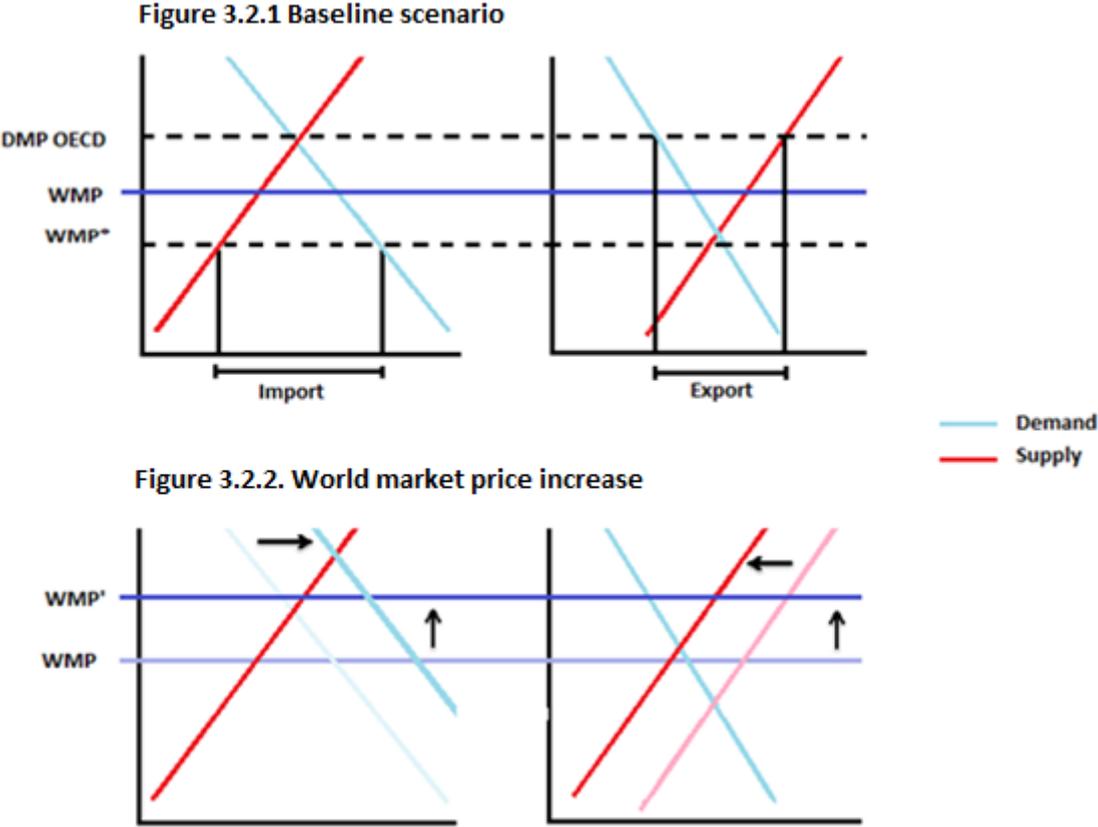
Besides that the world market price increase can influence the amount and height of protection mechanisms set by a countries government it can also chance ones trade position. By example, the price increase of a product that is imported by a country makes the price of the imported good in the country higher which is an incentive for the home producers to start producing more of this relevant product. This may imply that the countries imported value declines or even disappears. Overall, this could mean that a country becomes a net importer instead of a net exporter. When in the model a country is addressed as a net importing country and it is expected to be so for the whole baseline simulation, one could imagine that when a country becomes a net exporting country this could have major effects on the relevance of the model. This would mean that the model compares the full liberalization simulation with a false baseline simulation. When a country is addressed as a net importing country in the model but is a net exporting country is the real world, gains calculated can be underestimated.

Thereby an extra, more political, concern is that one of the main reasons to plead for full liberalization was the predicted higher world market prices. When the model focuses on a baseline with lower prices than in the real world and it expects the prices to be higher with free trade, the outcome of the models can be overestimated because in the real world prices are already higher. The less the variation between the simulated price with free trade and the price in the real world, the more this argument can be seen as weak.

3.2 The real situation

Whether the change in agricultural prices indeed affect the relevance of de simulation outcomes is shown in the difference between the simulated baseline and the real values at a certain time point. As discussed, the degree of government intervention and the trade balance of a country can be influenced by a price increase and can have major effects on the relevance of the model outcomes. Therefore, this section focuses on the differences of the size of these data between the simulated baseline and the real world.

In this section the Linkage model discussed in the previous chapter is used. In this model a baseline is created starting at 2001 and ending in 2015. Besides this it creates a reform simulation where full liberalization is implemented over the years 2005 till 2010, ending in 2015. These two end points are compared to each other to calculate the gains of full liberalization. This section focuses on the baseline simulation. At the start point of the baseline it is known whether a country is a net exporter or a net importer and also the degree of government's intervention of that country is known, and from this an expected baseline can be drawn. Now one can look how the real situation of these two values deviates from this line and if this deviation is significant enough to conclude that the relevance of the model is affected. Because models do not give absolute values of the baseline, this chapter compares the starting point of the baseline, 2001, with the situation in 2008. This will be discussed for the European Union, The United States, the BRIC and some specific low-income countries.

3.2.1 The European Union

In figure 3.3 the situation for the European Union is given. In figure 3.3.1 one can see that the export and import in the European Union changed simultaneously over the years. For this reason the trade balance did not changed much. At the starting point in 2001 the balance of trade was negative; the EU was a net importer. In 2001 this balance of trade was -$24140 million while in 2008 this was -$46566 million. So one could say that the balance of trade has worsened, but this is not a very significant change, reflected in the figure. So the price increase did not significantly influence the balance of trade. These export and import values are displayed in current million dollars, this means that when the prices of export and import increases the value of export and import will also increase. This is also reflected in figure 3.3.1 where the import and export values both increases in times of the price increase.

So the trade balance did not change significantly compared with 2001. What about the intervention of the EU´s government? In figure 3.3.2 the consumer nominal protection coefficient (NPC) and the producer nominal assistance coefficient (NAC) of the EU are shown. The consumer NPC is an indicator of the nominal rate of protection for the consumers. It is calculated by measuring the difference between the price of products paid by the consumer and the border price (OECD, no date). This is comparable with the CTE. The producer NAC is an indicator for the nominal rate of assistance to producers. It is calculated by measuring the value of gross farm receipts of the produced products and the gross farm receipts valued at world market prices (OECD, no date). The first one is with support the second one without support. This indicator is comparable with the NRA. Figure 3.3.2 shows these two values for the EU for the period 2001-2009. What is reflected again is

that consumer NPC and the producers NAC are strongly correlated. What the figure also shows is that there is a big difference between the consumer NPC and the producer NAC, which indicates that the EUs government uses interventions that benefit the producers but do not harm the consumers. It could be that the EUs government support the incomes of farmers but that this support is decoupled from production. What is shown in the figure is that both values decline over time. The decrease seems steeper in times of the price increase, showing that indeed the intervention from the government has declined in times of the price increase. While this is not a major decline it can have influence on the relevance of the models. When this decline is not taken into account in the baseline simulations the outcomes of the model will be overestimated, while the intervention of the EU already declined without free trade.

3.2.2 The United States of America

The same data are available for the US in figure 3.4. If one takes a look at the change of the values of import and export of the US in figure 3.4.1, one can see that there has been a lot of change. First of all the value of import seems to rise linear but then decreases in the period of the price increase. This shows that because of the price increase the value of import decreased. This was expected because with higher world market prices the import becomes more expensive whereby the quantity of import is likely to decrease. The value of export increases in the period of the price increase. This can be caused by the fact that it is more attractive to produce the certain product because of the higher price and therefore export will increase. Another reason for the increase of export value can be the price increase, which makes the value of the same export higher. But these two reasons together could also ensure that the export value has risen in times of the price increase. An interesting result of the shifts in export value and import value is that the balance of trade changes a lot compared with 2001. In 2001 the U.S. had a positive trade balance with only a size of 1617 million dollar while the trade balance in 2009 is significant positive with a size of 18839 million, this is a major increase. This increase is significantly and therefore can have major impacts on the relevance of the model. When this increase in the trade balance is not taken into account in the baseline this would mean that the outcomes of the models are underestimated.

While there is a major change in the trade balance in time of the price increase, there is almost no change in the consumer NPC and the producer NAC in time of the price increase. While they both decline over time, there is no abnormal evolution during the period of price increase, reflected in figure 3.4.2.

Figure 3.3 The situation of the EU, 2001-2009

Figure 3.3.1 Export and import values of agricultural products in US dollars at current prices (millions)
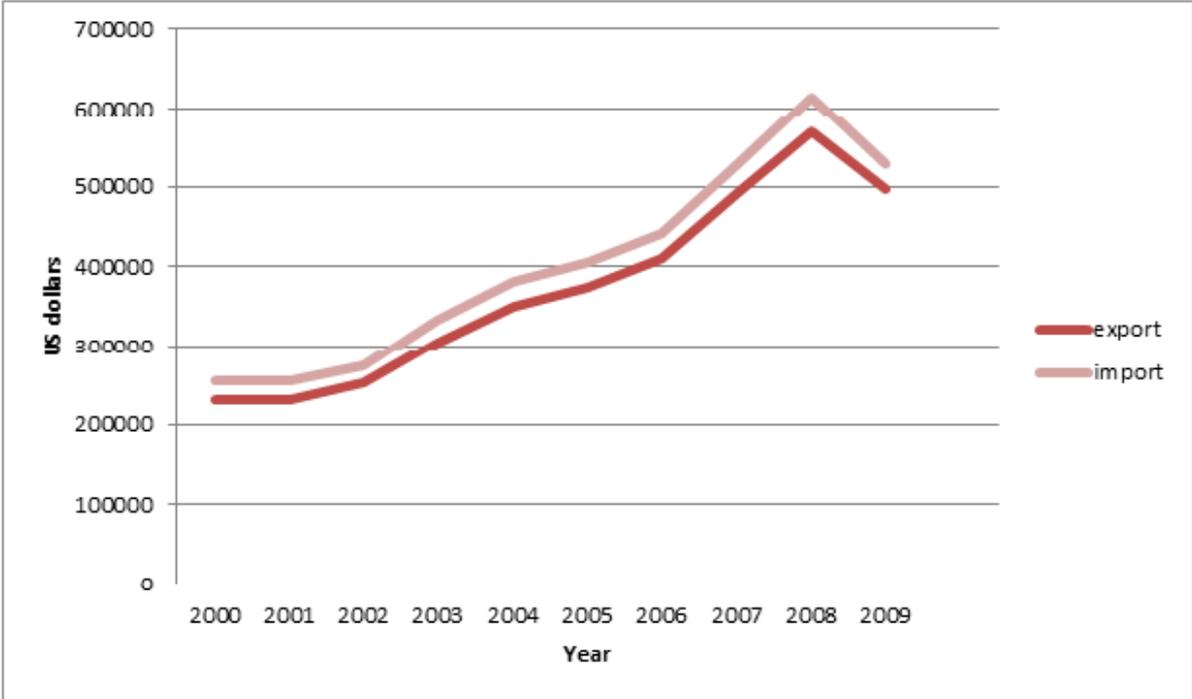
Source: WTO: time series on international trade

Figure 3.3.2 Consumer NPC and producer NAC
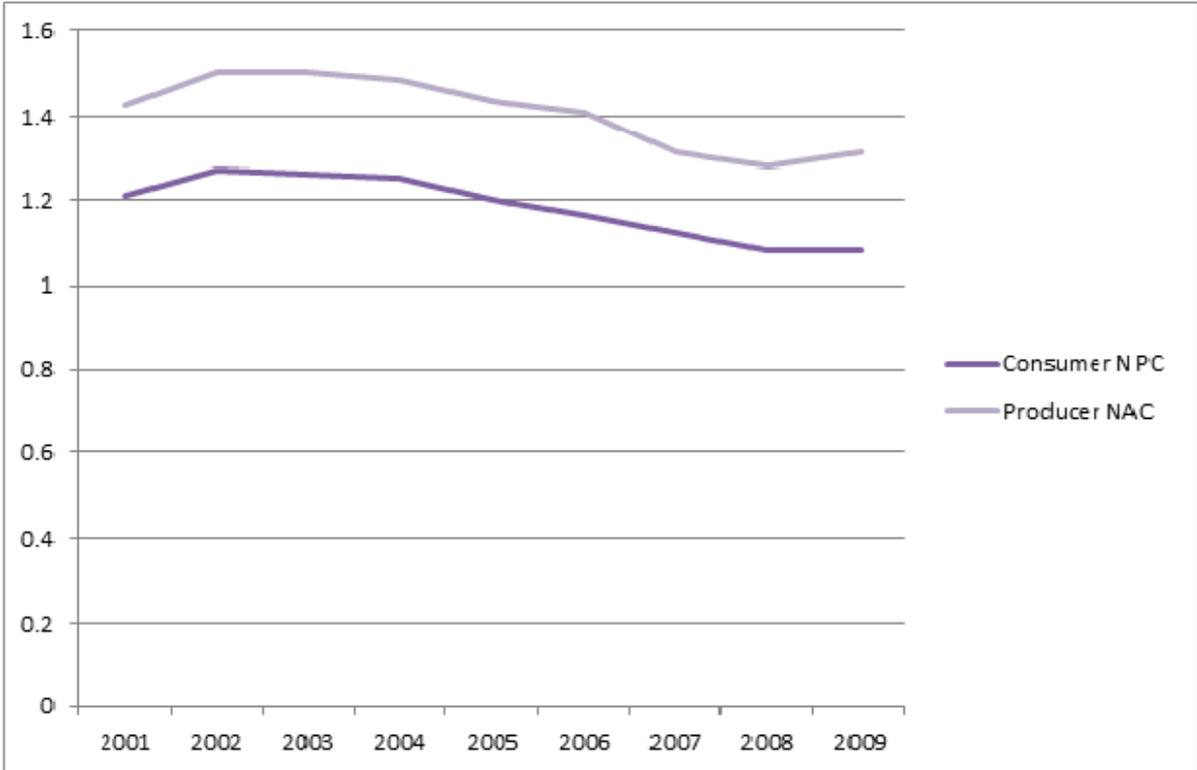

Source: OECD.Stat

Figure 3.4 The situation of the US, 2001-2009

Figure 3.4.1 Export and import values of agricultural products in US dollars at current prices (millions)

Source: WTO: time series on international trade

Figure 3.4.2 Consumer NPC and producer NAC

Source: OECD.Stat

3.2.3 The BRIC-countries

Brazil, Russia, India and China are subjected to the BRIC. In India and Russia there was not much change because of the price increase and therefore only Brazil and China, which are both middle-income countries, are detailed here.

The situation of Brazil is presented in figure 3.5. As one can see, figure 3.5.1 shows major changes. The import of Brazil just increased a little in the time of the prices increase, but the export of Brazil increased significantly. In 2001 Brazil had already a positive trade balance of $14526 million but because of the major export increase the trade balance in 2008 was $ 49451 million, almost 3.5 times as high as in 2001. One could say that Brazil benefited from the price increase. When this change was not taken into account in the baseline scenario the outcomes of the models can be significant underestimated.

Brazil show the same pattern as the US, while there are major changes in the trade balance there are almost no change in the government's intervention in time of the price increase. The consumer NPC increases from 1 (2001) to 1.06 (2008) and the producer NAC from 1.04 to 1.07. This is not a major change and therefore it is likely not to cause irrelevance of the models.

In figure 3.6 the situation for China is presented. The export, shown in figure 3.6.1, shows a normal progress. It increases simultaneously with the price increase what was expected. But simultaneously the import of China rises tremendously. In 2001 China had a negative trade balance of -$3499 million and was therefore a net importer. But due to the tremendously rise of the import the trade balance in 2008 was -$51710 million, almost 15 times more negative. This is a high significant difference. When this change is not taken into account in the baseline simulation this has a major effect on the relevance of the models. In this case, the outcomes of the models then are overestimated which is way more worrisome then underestimated. It means that the real gains from free trade for China would be much less than the models predict.

The value of the producer NAC and the consumer in NPC for China did not changed significantly. They are both lower in 2008 than in 2001, the producer NAC is 0.04 lower while the consumer NPC is 0.06 lower. The consumer NPC does show a little negative peak in 2008. But this seems not to be significant.

Figure 3.5 The situation of Brazil, 2001-2009

Figure 3.5.1 Export and import values of agricultural products in US dollars at current prices (millions)
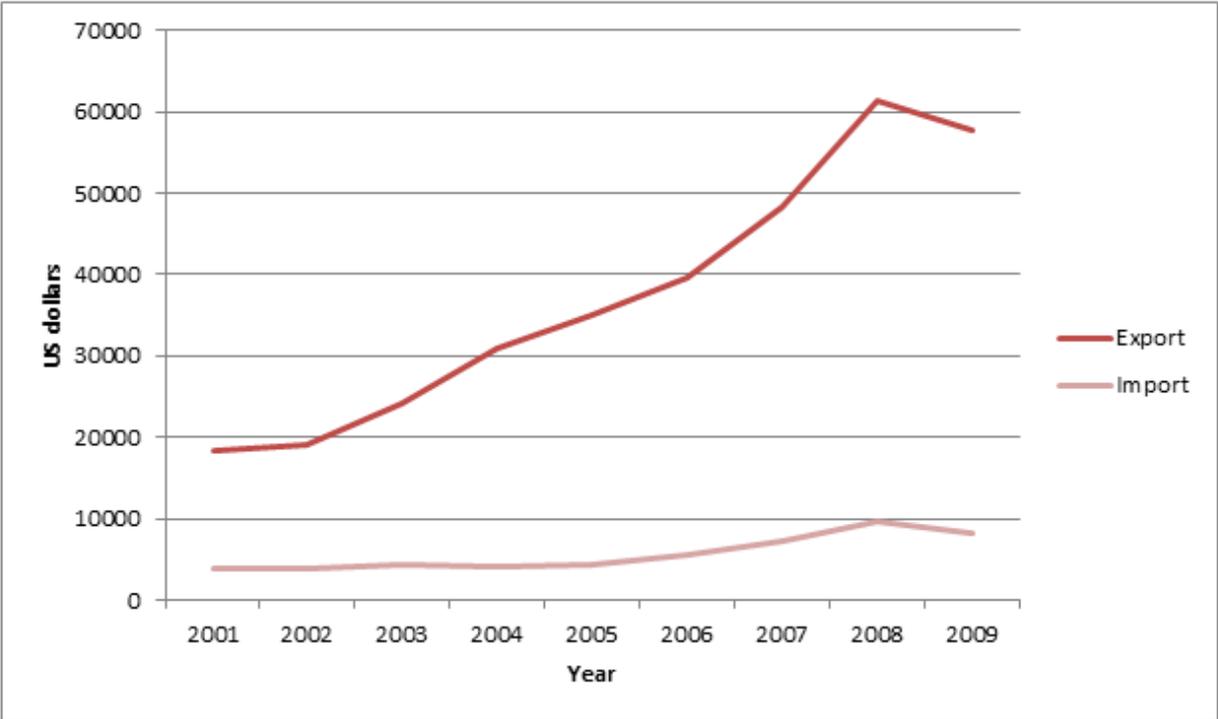
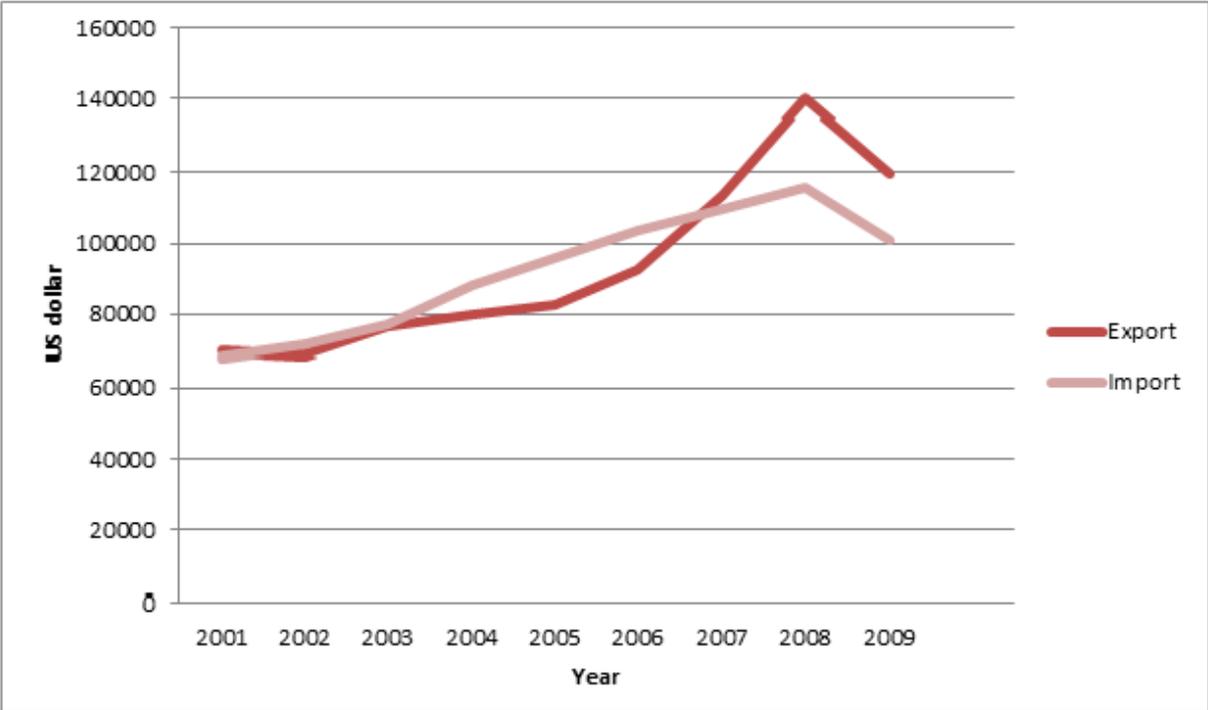Source: WTO: time series on international trade

Figure 3.5.2 Consumer NPC and producer NAC
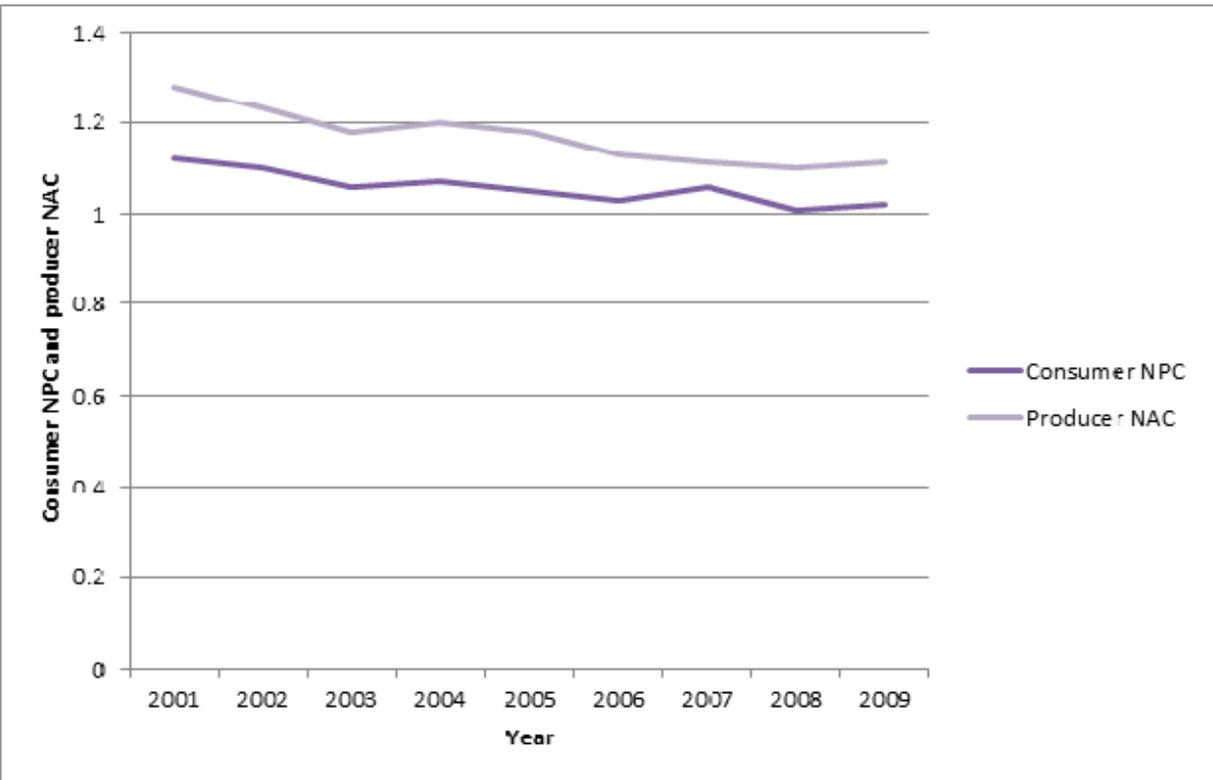

Source: OECD.Stat

Figure 3.6 The situation of China, 2001-2009

Figure 3.6.1 Export and import values of agricultural products in US dollars at current prices (millions)

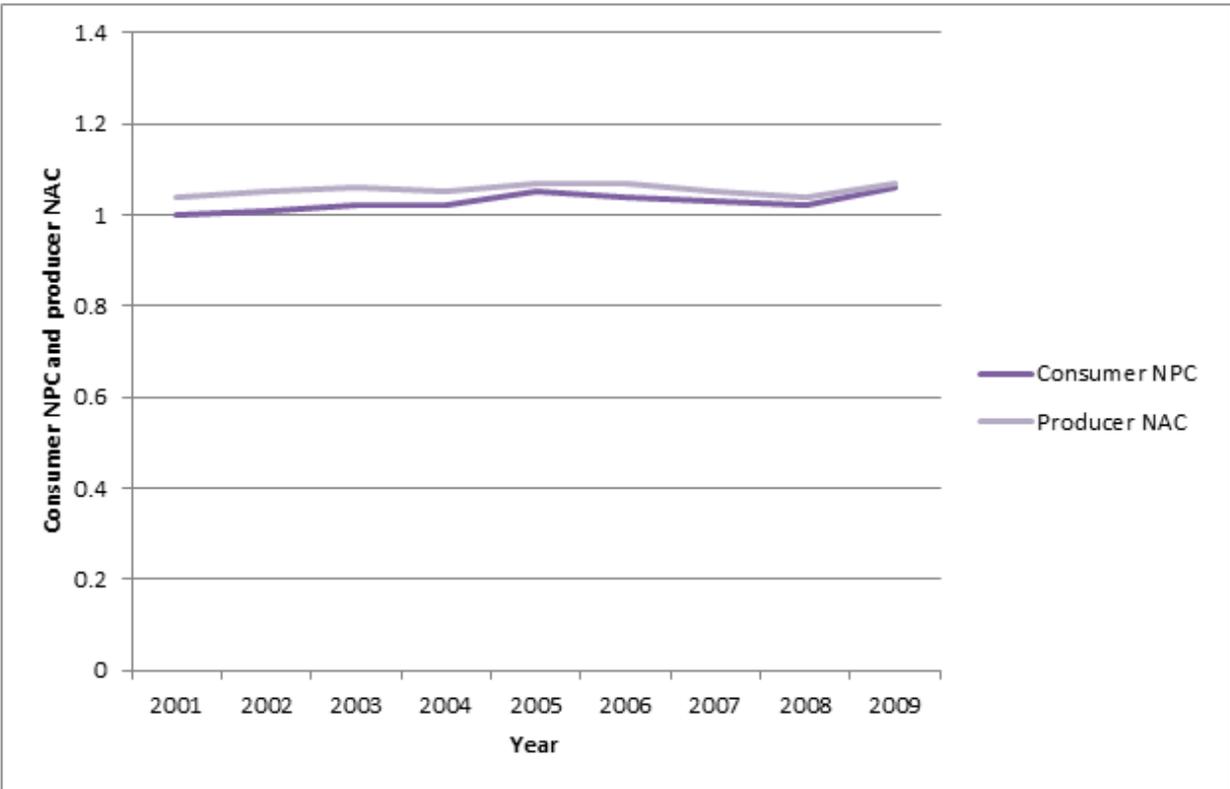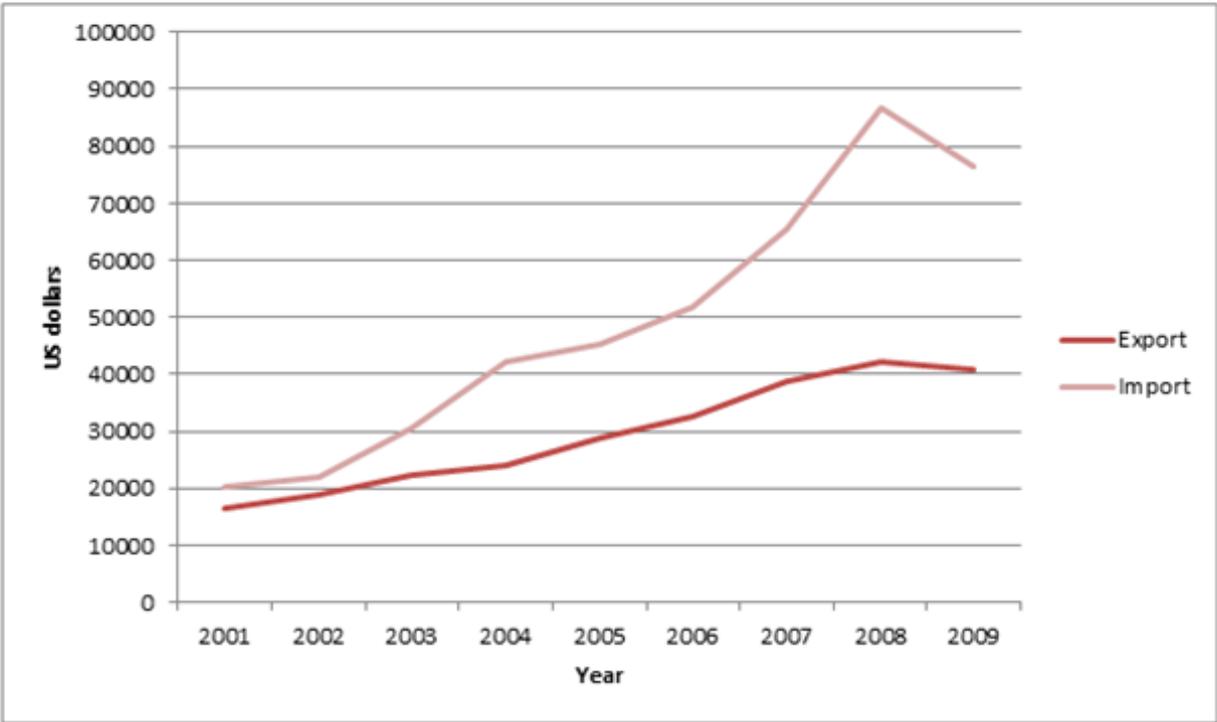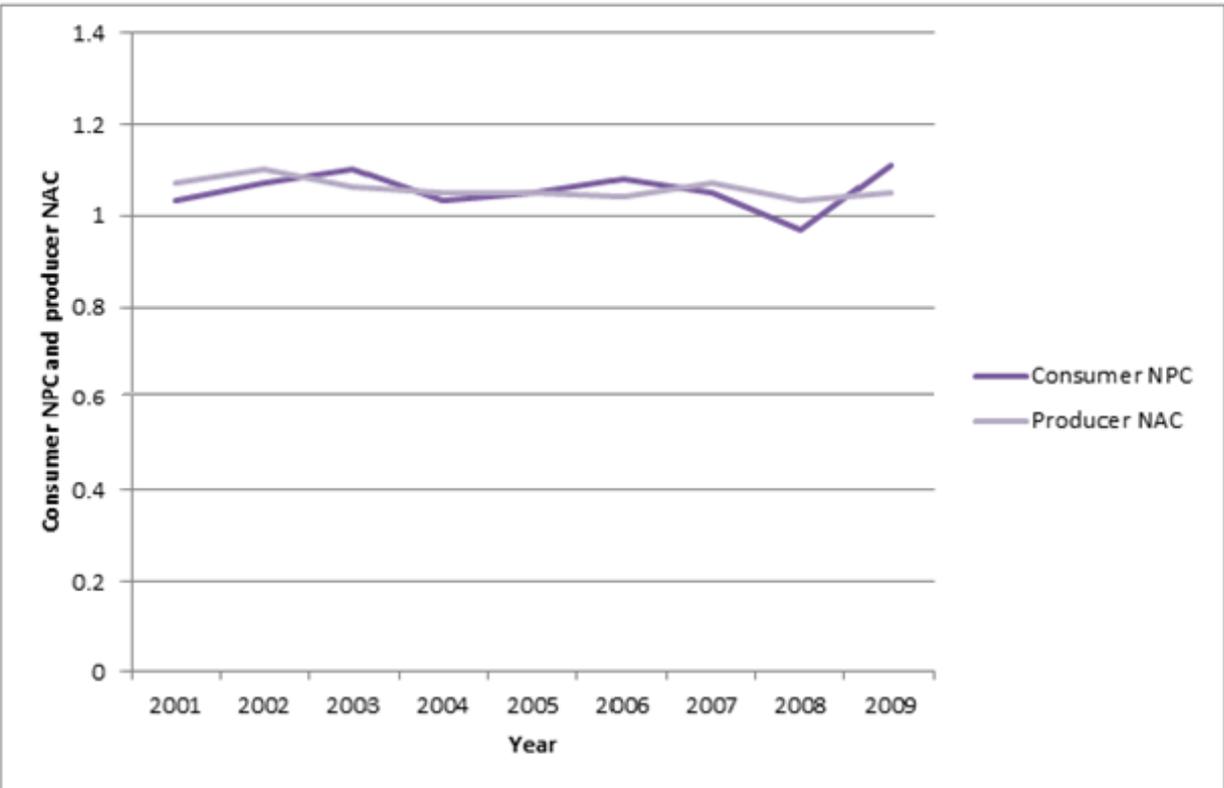Source: WTO: time series on international trade

Figure 3.6.2 Consumer NPC and producer NAC

Source: OECD.Stat

3.2.4 The low-income countries

To also shed a light at the change of the position of the low-income countries due to the price increase this subparagraph discusses the situation for Viet Nam and Bangladesh. These two countries are both low-income countries and where expected to have very different outcomes from free trade. Viet Nam was expected to have one of the highest gains from free trade while Bangladesh was expected to have one of the lowest gains (table A.1). These results are mostly expected be caused by the price increase resulting from free trade. Now, one can see whether the price increase in 2008 indeed did cause great positive effects in Viet Nam and little or negative effects in Bangladesh.

Figure 3.7 shows the export and import values of agricultural products in Viet Nam. What one can see in this figure is that the export and import value simultaneously increases until 2004. After 2004 the export value increased more than the import value and therefore the trade balance in 2008 is higher than in 2001, 2801 million dollar and 5828 million dollar respectively. So the prediction made in table A.1. could be right, because Viet Nam did indeed benefit from this price increase.

Table 3.8 shows the export and import values of agricultural products in Bangladesh. In table A.1 was expected that Bangladesh would have one of the minimum benefits of free trade. What is shown in table 3.8 is that the negative trade balance of Bangladesh significantly increased in times of the price increase. In 2001 Bangladesh had a negative trade balance of -$1537 million while in 2008 it was -$4378 million. This is a significantly decrease of the trade balance. Therefore table A.1 probably predicted correct that Bangladesh will not benefit very much of free trade because here is shown that with a price increase the trade balance of Bangladesh will worsen.

So in both cases table A.1 probably predicted the right result of a price increase in these two countries. But the question is whether this price increase in 2008 was already calculated in the baseline scenario. When this was not the case, the estimated values in table A.1 are underestimated. Which means that the benefits for Viet Nam actually will be higher with free trade while the benefits for Bangladesh will be lower with free trade.

Figure 3.7 Export and import values of agricultural products in Viet Nam in US dollars at current prices (millions), 2001-2009
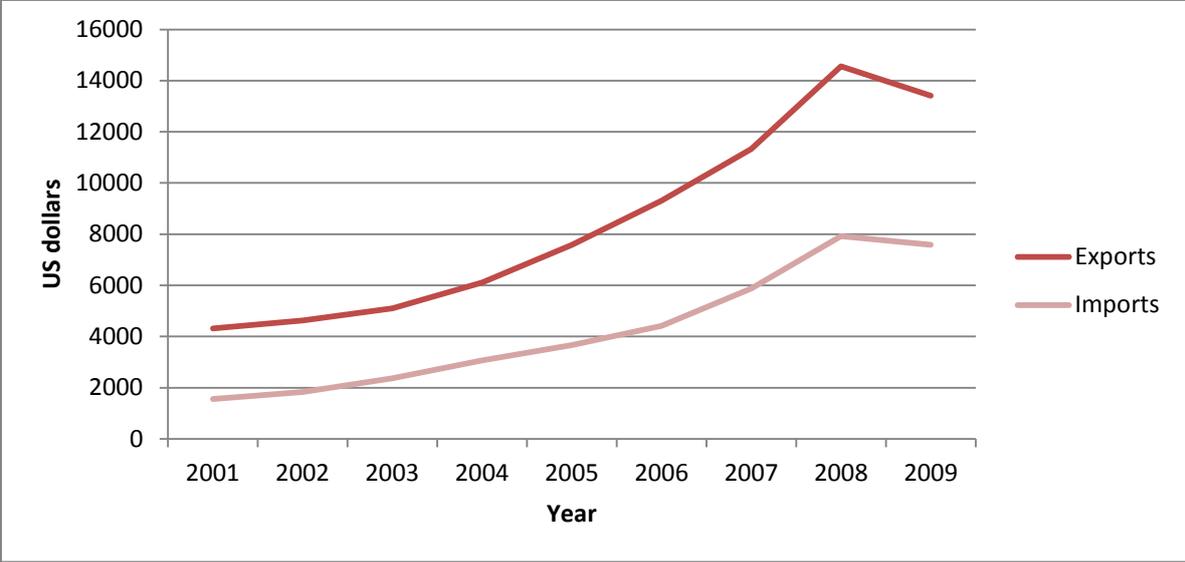
Source: WTO: Time series on international trade

Figure 3.8 Export and import values of agricultural products in Bangladesh in US dollars at current prices (millions), 2001-2009
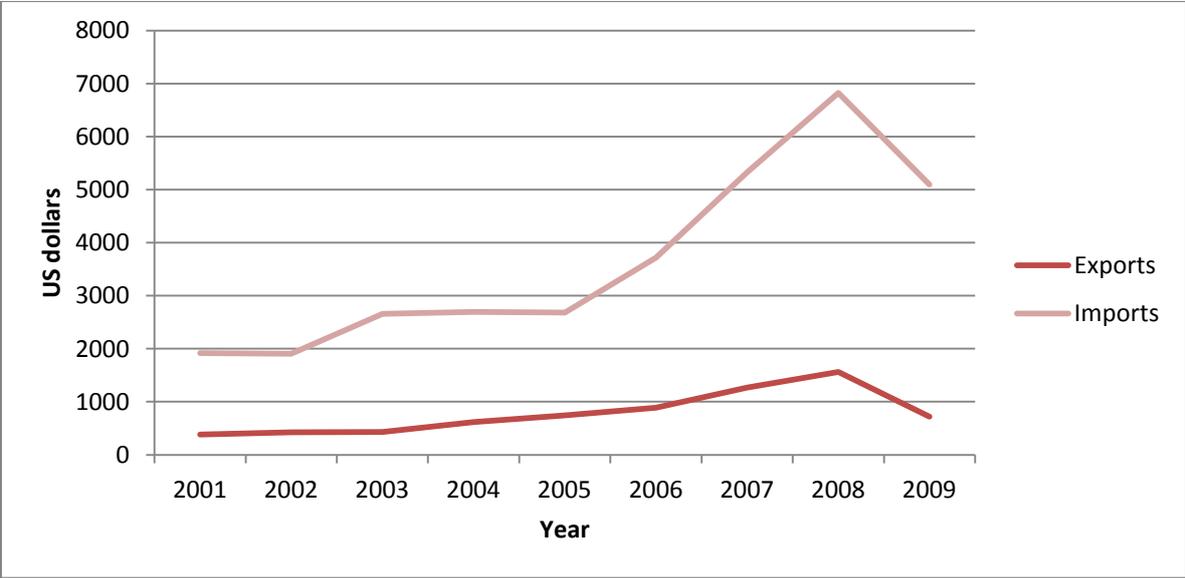
Source: WTO: time series on international trade

3.3. The situation in 2001 and 2008 compared

What the previous section showed is that there were a lot of changes in the import values and export values of the countries examined. In most of the countries this caused a significantly change in the trade balances.

In table 4 the outcomes found in section 3.2 are clearly shown. When there is a change in the certain value during the price increase then this is indicated in the table with a plus sign, when there is no change in the certain value this is indicated with a minus sign. Important to know is that these changes in table 3 are significant changes in times of the price increase. So there can be a minus sign while there is change over time. This means that unless the value changes over time, the value does not seemingly change abnormal during the price increase.

Table 4.1

	Change of import during price increase	Change of export during price increase	Change of trade balance during price increase	Change of government intervention during price increase
EU	+	+	-	+
US	+	+	+	-
Brazil	+	+	+	-
China	+	+	+	-

The most obvious result from section 3.2 that can be drawn from table 4.1 is that the most change during the price increase can be found in the change of import and export while the least change during the price increase can be found in the change of government intervention. For all countries the import and export significantly changes during the price increase. In most countries, three out of four, this led to a significant change in their balance of trade. But in only one of the four countries a significant change in government intervention can be found. In the three other countries there is change in the government intervention, but no specific change in time of the price increase. What was shown in section 3.3.2 is that also for some low-income countries there were major changes in import, export and the balance of trade in times of the price increase.

Chapter 4 Conclusion

High-income countries give more assistance to their producers of agricultural products compared with the developing countries, of which some even tax their farmers instead of assist. When full liberalization would be introduced the gains will be higher in the high-income countries than in the developing countries, but according to the Linkage model all countries will gain from the liberalization. According to this model also developing countries will benefit while they will have higher agricultural production, employment and real net farm incomes. But when the different models are compared to each other the outcomes deviate. This deviation comes from the many characteristics that are involved in developing a model. These characteristics should be chosen carefully so that both the baseline and the intervention simulation are most similar to what the real situation would be. What was shown in chapter 3 is that the relevance of the models can be harmed when there is an unforeseen change in the real world which makes the baseline simulation irrelevant. In this chapter the conclusion will be drawn about whether or not the relevance of the models is harmed by the price increase in 2008.

The question to be answered was whether the increase in world food prices in 2008 harmed the outcomes of the models and made them less relevance. From the results found, one could say that the price increase does indeed significantly change the trade position of some countries but does not change the government intervention significantly (concerning the discussed countries). This means that the intervention ratios in the baseline simulation are likely to be well estimated and are therefore not harming the relevance of the models. This also implies that the price increase did not trigger a step to liberalization in these countries, what was expected, and thus there are still benefits to be gained with introducing trade liberalization.

But the export and import values and the balance of trade did significantly change. What was shown in section 2.4 was that the outcomes of the models were likely to be correlated with the trade balance of a country. This means that the change in the balance of trade because of the price increase can influence the results of the models. Assuming that the baseline simulation did not take these major changes into account, one could say that these changes harmed the relevance of the models. What the precise implications from the changes are for the outcome of the models depends on each country separately but in general this would mean that when a country's trade balance is more positive than it is in the baseline simulation the outcomes of the model will be underestimated, while when a country's trade balance is more negative than in the baseline simulation the outcomes of the model will be overestimated. The last situation is more worrisome because the actual benefits of full liberalization will be less than was predicted in the model.

While a model is developed to visualize the impacts of a policy to support the decision making process a model should be as close to reality as can be. But what was shown is that in the past years there were major changes in the trade position of countries and therefore the possibility that the outcomes of these models deviate from the reality are high. Therefore, in my opinion, old models should be updated or new models should be created to have a clear few which outcomes full liberalization will have. Only with reliable models policy decisions can be made.

Chapter 5 Discussion

The conclusion shows that the increase in food prices is expected to harm the relevance of the models. But hard proof for this was not available; it still depends on what the baseline simulation exactly predicts. To come up with hard evidence, better research has to be done. To start with, the method that is used in order to see if the changes in import, export and government intervention are deviating from the baseline simulation is not optimal. What is done here is comparing the starting point, 2001, with the year of the price peak, 2008. But when there is a significant change found it remains uncertain whether this change is included in the baseline simulation or not. And therefore only expected harm of relevance can be found and no hard proof. A better method would be to compare the absolute values of the baseline simulation for the year 2008 with the real values of 2008. When these differ significantly one has proven that this will harm the relevance of the models. In this case the first method is used because these absolute baseline values were not accessible.

Another way to improve the reliability of the outcomes is to involve more countries in the comparison of import, export and government intervention changes. Now only 4 countries are involved in the comparison of intervention changes and 8 countries in the comparison of import and export values. To have a clearer and more reliable representation of reality it would be helpful to include more countries in the comparison.

In addressing the question whether the price increase in 2008 harms the relevance of the model outcomes, there is observed whether there were changes in import, export and government intervention during this period. What was not excluded was the fact that these changes can be due to other circumstance than the price increase. Therefore, one cannot state with all certainty that the relevance of the models is harmed by the price increase because other factors can have played a role in it too.

Another critical point is that a deviation from the baseline scenario and the real scenario in 2008 will cause irrelevance at that time point, but this does not have to imply that the relevance of the final outcome of the model is irrelevant too. It can be that at the end point the baseline scenario is again equal to the real scenario. Then it is the question how this deviation from the baseline around 2008 influenced the real outcomes. What we can see in most of all figures in chapter 3 is that after 2008 the changes turn again to the situation before the increase in prices. This could indicate that the price peak is just a temporary peak and that after this peak the situation will expire the same as was expected in the baseline. When this price increase was not a long-term effect it can be expected not to influence the outcomes of the models, as discussed in section 3.1. Whether or not this price increase was a temporary change or not should be investigated.

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Attachments

Table A.1 Impacts on real income from full liberalization of global merchandise trade, by country/region, 2015 (relative to the baseline, in 2001 dollars and percent).

	Total Real Income Gain p.a. ($billions)	Total Real Gain as Percentage of Baseline Income in 2015[a]
Australia and New Zealand	6.1	1.0
EU 25 plus EFTA	65.2	0.6
United States	16.2	0.1
Canada	3.8	0.4
Japan	54.6	1.1
Korea and Taiwan	44.6	3.5
Hong Kong and Singapore	11.2	2.6
Argentina	4.9	1.2
Bangladesh	0.1	0.2
Brazil	9.9	1.5
China	5.6	0.2
India	3.4	0.4
Indonesia	1.9	0.7
Thailand	7.7	3.8
Vietnam	3.0	5.2
Russia	2.7	0.6
Mexico	3.6	0.4
South Africa	1.3	0.9
Turkey	3.3	1.3
Rest of South Asia	1.0	0.5
Rest of East Asia	5.3	1.9
Rest of LAC	10.3	1.2
Rest of ECA	1.0	0.3
Middle East and North Africa	14.0	1.2
Selected sub-Saharan African countries	1.0	1.5
Rest of sub-Saharan Africa	2.5	1.1
Rest of the world	3.4	1.5
High-income countries	**201.6**	**0.6**
Developing countries	**85.7**	**0.8**
Middle-income countries	69.5	0.8
Low-income countries	16.2	0.8
East Asia and Pacific	23.5	0.7
South Asia	4.5	0.4

Europe and Central Asia		7.0	0.7	
Sub-Saharan Africa		4.8	1.1	
Latin America and the Caribbean		28.7	1.0	
World total		**287.3**	**0.7**	

Source: Anderson *et al.*, 2005a, table 3.

Notes: EFTA: European Free Trade Association; LAC: Latin American Countries; ECA: Europe and Central Asia.

Table A.2 Regional and sectoral source of gains from full liberalization of global merchandise trade, developing, and high-income countries, 2015 (relative to the baseline scenario)

	Gains by Region in $billion			Percent of Regional Gain		
	Developing	**High Income**	**World**	**Developing**	**High Income**	**World**
Developing countries liberalize						
Agriculture and food	28	19	47	33	9	17
Textiles and clothing	9	14	23	10	7	8
Other merchandise	6	52	58	7	26	20
All sectors	43	85	128	50	42	45
High-income countries liberalize						
Agriculture and food	26	109	135	30	54	47
Textiles and clothing	13	2	15	15	1	5
Other merchandise	4	5	9	5	3	3
All sectors	43	116	159	50	58	55
All countries liberalize						
Agriculture and food	54	128	182	63	63	63
Textiles and clothing	22	16	38	25	8	14
Other merchandise	10	57	67	12	29	23
All sectors	86	201	287	100	100	100

Source: Anderson *et al*., 2005a, table 4.

Table A.3 Impacts of full global trade liberalization on agricultural and food trade, output and consumption, by country-region, 2015 (relative to baseline)

	$billion			Percent Change Relative to Baseline			
	Exports	**Imports**	**Output**	**Exports**	**Imports**	**Output**	**Consumption[a]**
Australia and New Zealand	18.0	1.4	27.9	38.0	23.0	20.5	11.1
EU25 plus EFTA	21.7	103.5	−185.8	−10.8	39.3	−12.3	−3.6
United States	18.4	16.5	30.7	11.6	25.6	0.0	0.5
Canada	14.6	6.9	7.2	40.2	54.3	4.8	−0.4
Japan	2.8	34.7	−91.7	60.4	169.7	−18.4	−5.2

Korea and Taiwan	33.2	12.3	−0.4	600.2	189.8	20.2	14.6
Hong Kong and Singapore	7.0	1.5	7.4	115.2	7.6	35.4	4.8
Argentina	10.4	0.7	12.2	44.2	36.9	11.5	1.5
Bangladesh	0.8	0.4	−2.5	60.9	15.6	0.8	−0.3
Brazil	38.0	2.8	66.4	120.6	48.4	34.0	16.9
China	15.1	24.1	−9.9	145.6	27.3	−0.9	−0.1
India	5.1	13.4	−23.8	53.2	165.4	−3.7	−0.1
Indonesia	3.6	1.9	4.5	32.2	23.5	2.4	1.1
Thailand	5.6	5.2	5.3	29.2	57.2	4.7	7.5
Vietnam	1.2	3.3	−2.1	13.9	170.4	−13.3	1.7
Russia	0.7	4.4	−7.8	15.4	22.3	−5.4	−1.3
Mexico	11.9	6.7	6.2	66.0	52.9	2.2	0.2
South Africa	2.4	1.1	1.4	55.9	40.2	4.9	1.6
Turkey	4.3	4.3	−0.1	109.4	140.3	0.5	2.8
Rest of South Asia	2.9	3.7	−1.5	57.1	83.3	−1.8	0.1
Rest of East Asia	9.4	5.8	7.4	61.7	50.7	6.8	5.3
Rest of LAC	36.0	9.6	37.0	68.1	42.3	11.7	2.9
Rest of ECA	9.2	10.9	−22.2	106.0	90.5	−1.6	−0.8
Middle East and North Africa	13.2	17.5	−7.8	64.1	43.1	−1.2	0.8
Selected SSA countries	4.5	1.3	5.3	50.0	74.4	9.2	3.8
Rest of sub-Saharan Africa	9.5	8.1	−4.1	45.4	79.2	−0.6	−1.3
Rest of the world	8.2	5.8	2.9	168.3	123.3	4.4	3.2
High-income countries	**115.8**	**176.7**	**−204.7**	**15.7**	**65.5**	**−5.3**	**−1.0**
Developing countries	**191.9**	**131.0**	**66.8**	**67.4**	**51.5**	**2.2**	**1.2**
Middle-income countries	156.1	93.1	88.2	72.7	41.9	3.2	1.4
Low-income countries	35.8	37.9	−21.4	52.3	99.3	−1.0	0.4
East Asia and Pacific	34.8	40.4	5.2	54.4	35.5	0.1	0.8
South Asia	8.9	17.5	−27.8	55.1	122.9	−3.0	−0.1
Europe and Central Asia	14.2	19.6	−30.0	79.7	62.6	−1.9	−0.5
Sub Saharan Africa	16.4	10.5	2.6	47.7	71.6	2.1	0.1
Latin America and the Caribbean	96.3	19.8	121.8	75.7	46.1	13.8	4.8
World total (excl intra-EU trade)	**307.7**	**307.7**	**−137.8**	**36.3**	**59.8**	**−1.3**	**0.2**

Source: Anderson *et al*., 2005a, table 6.

ᵃ The consumption changes are in volume terms, whereas the other columns refer to values.

Table A.4 Agricultural output and employment growth, baseline, and full liberalization, 2005-2015 (annual percent growth between 2005 and 2015)

	Output Growth		Employment Growth	
	Baseline	Full Global Liberalization	Baseline	Full Global Liberalization
Australia and New Zealand	3.5	5.2	0.4	1.9
EU-25 plus EFTA	1.0	−1.5	−1.8	−3.9
United States	2.2	1.3	−0.8	−2.1
Canada	3.5	5.2	0.2	1.9
Japan	0.5	−4.3	−2.7	−6.5
Korea and Taiwan	2.2	0.1	−1.3	−3.9
Hong Kong and Singapore	2.8	3.3	0.0	0.2
Argentina	2.9	5.1	0.9	3.3
Bangladesh	4.2	4.4	1.1	1.2
Brazil	3.3	6.1	1.1	4.0
China	4.3	4.3	0.8	0.7
India	4.3	4.1	1.0	0.6
Indonesia	3.0	2.9	−0.7	−0.7
Thailand	−0.1	1.3	−4.6	−3.7
Vietnam	5.8	6.1	3.9	3.5
Russia	1.5	1.0	−2.3	−2.7
Mexico	3.9	4.1	2.0	2.3
South Africa	2.5	3.3	0.0	0.8
Turkey	3.0	2.6	−0.5	−1.2
Rest of South Asia	4.8	4.8	2.0	1.9
Rest of East Asia	3.7	3.5	0.2	−0.1
Rest of LAC	4.4	6.6	1.9	3.8
Rest of ECA	3.3	3.3	0.0	−0.1
Middle East and North Africa	4.0	4.0	1.5	1.4
Selected sub-Saharan African countries	5.3	5.7	3.0	3.3
Rest of sub-Saharan Africa	4.6	4.8	2.2	2.5
Rest of the world	5.0	6.4	2.4	3.5
High-income countries	**1.6**	**−0.1**	**−1.5**	**−3.1**
Developing countries (WB)	**3.9**	**4.2**	**1.0**	**1.2**
Middle-income countries	3.7	4.1	0.4	0.3
Low-income countries	4.4	4.5	1.2	0.9
East Asia and Pacific	4.0	4.0	−0.5	−0.8
South Asia	4.4	4.2	1.5	1.4
Europe and Central Asia	3.0	2.9	2.3	2.6
Middle East and North Africa	4.0	4.0	1.7	3.4
Sub-Saharan Africa	4.5	4.9	0.2	0.0

Latin America and Caribbean	3.8	5.8	0.4	1.9
World total	**3.2**	**2.9**	**−1.8**	**−3.9**

Source : Anderson *et al.*, 2005a, table 9.

Notes: EFTA: European Free Trade Association; LAC: Latin American Countries; ECA: Europe and Central Asia.

Table A.5 Impacts of full global merchandise trade liberalization on unskilled and skilled wages, 2015 (relative to the baseline in 2015, percent)

	Unskilled Wages	Skilled Wages
Australia and New Zealand	3.1	1.1
EU-25 plus EFTA	0.0	1.3
United States	0.1	0.3
Canada	0.7	0.7
Japan	1.3	2.2
Korea and Taiwan	6.5	7.1
Hong Kong and Singapore	3.2	1.6
Argentina	2.9	0.5
Bangladesh	1.8	1.7
Brazil	2.7	1.4
China	2.2	2.2
India	2.8	4.6
Indonesia	3.3	1.5
Thailand	13.2	6.7
Vietnam	25.3	17.6
Russia	2.0	2.8
Mexico	2.0	1.6
South Africa	2.8	2.5
Turkey	1.3	3.4
Rest of South Asia	3.7	3.2
Rest of East Asia	5.8	4.2
Rest of LAC	5.7	1.4
Rest of ECA	2.3	4.2
Middle East and North Africa	4.1	4.1
Selected sub-Saharan African countries	6.0	1.6
Rest of sub-Saharan Africa	8.2	6.5
Rest of the world	4.4	2.7

High-income countries	**0.6**	**1.1**
Developing countries	**3.5**	**3.0**
Middle-income countries	3.2	2.6
Low-income countries	4.2	3.9
World total	**1.2**	**1.5**

Notes: EFTA: European Free Trade Association; LAC: Latin American Countries; ECA: Europe and Central Asia.

Table A.6 Effects of full liberalization of global agricultural and other merchandise trade on agricultural value added, by country region, 2015 (relative to baseline, billion U.S. dollars and percent)

	Value (US$ billions)	Percent change
Australia and New Zealand	6.4	25.6
EU-25 plus EFTA	−39.1	−26.4
United States	−18.2	−15.0
Canada	3.4	23.3
Japan	−17.7	−39.5
Korea and Taiwan	−9.5	−33.3
Hong Kong and Singapore	0.1	7.5
Argentina	6.1	33.8
Bangladesh	−0.5	−4.4
Brazil	15.1	46.3
China	0.3	0.1
India	−17.1	−8.1
Indonesia	0.8	2.7
Thailand	3.8	25
Vietnam	0.8	13.6
Russia	−1.4	−6.5
Mexico	0.9	2.5
South Africa	0.5	9.6
Turkey	−2.0	−7.2
Rest of South Asia	−0.6	−1.3
Rest of East Asia	−0.2	−0.7
Rest of LAC	22.9	30.2
Rest of ECA	−1.1	−1.8
Middle East and	0.3	0.3

North Africa			
Selected sub-Saharan African countries	1.5	9.1	
Rest of sub-Saharan Africa	2.3	5.4	
Rest of the world	3.1	16.4	
High-income countries	−74.6	−19.4	
Developing countries	35.6	2.9	
Middle-income countries	45.3	5.3	
Low-income countries	−9.7	−2.5	
East Asia and Pacific	5.5	1.1	
South Asia	−18.1	−6.8	
Europe and Central Asia	−4.5	−4.0	
Middle East and North Africa	0.3	0.3	
Sub-Saharan Africa	4.3	6.7	
Latin America and the Caribbean	45	27.4	
World total	−39.0	−2.4	
World total	−39.0	−2.4	

Source: Anderson *et al*. 2005a, table 13.

Notes: EFTA: European Free Trade Association; LAC: Latin American Countries; ECA: Europe and Central Asia.