Agricultural Trade Policy

The Impact of Export Restrictions during Commodity Price Booms

Craig Peter Taunton

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Summary

The world endured exceedingly high prices on food commodities in the period leading up to May 2008. Grain prices, in particular, experienced rapid growth, with grain commodities selling at well over double the price received in 2006. Countries reacted by implementing export restrictions on rice and wheat, which further exacerbated prices and market volatility. Consequently, many economic authors have attempted to explain the rising prices. Most of the papers produced in the months following the price peak focused on the impact of the expansion in bio-fuel production and the effect of dollar depreciation. Furthermore, policy recommendations were proposed in line with these apparent causes. However, this thesis will rather pay attention to the effect of trade policy on the agricultural commodity markets.

One of the more important objectives of the thesis is to understand the rationale behind countries utilising export restrictions. It can be argued that large food-exporting countries could be acting optimally in their implementation of export restrictions. Advantages arise due to an improvement in terms-of-trade and depressed prices on the domestic market for the commodity. In spite of this, the restrictions place pressure on the international market, with prices becoming high and volatile. The thesis analyses the decisions facing food-importers under such circumstances. Furthermore, it assesses the impact of trade strategies on income and welfare in large exporting and importing countries, as well as small importing countries.

Several global agreements and programs have been utilised in the past to deal with the issues of high and erratic prices. The most anticipated agricultural trade discipline is the current round of WTO trade discussions, namely the Doha Development Agenda. Yet, the slow progress of the discussions has necessitated the development of other avenues of stabilisation. This thesis will put forward and discuss some of the more important of these policies. Furthermore, it assesses the potential impacts of certain strategies that have been mooted for the future.

Preface

First and foremost, I would like to extend my gratitude to my supervisor, Geir Asheim. Particularly important assistance was provided in the construction of models and in general economic theory.

In terms of the layout, presentation and general economic advice, I owe a debt of gratitude to Rasmus Bøgh Holmen. His editorial skills are second to none, and he provided invaluable insight. I would also like to thank Espen Willassen Hoel, who offered the necessary proof-reading assistance. All remaining errors and inaccuracies are purely my own.

Finally, I would like to thank my wife, Eli Dorthea, who has provided much support after many long hours at university.

Oslo, 31 January 2011

Craig Peter Taunton

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1 Introduction

High grain prices, leading up to May 2008, have put the world's food supply under strain. The Food Crisis, as it is known by convention, has been the topic of fierce discussion in development circles of late, as it is argued that it is the poor consumer who bears an increasingly difficult burden. With this in mind, the thesis shall maintain the underlying objective of studying the impact on the national welfare of low-income countries.

The first point of order, undertaken in section 2, will be to create a better understanding of the environment that gives rise to high food prices in the agricultural commodity markets, with a particular focus on the staple grain markets, such as those for wheat and rice. On a general level, I shall look to identify those factors that have broken the long-term trend and analyse whether they are significant in explaining the volatility market conditions, which we are currently experiencing. To this end, I put forward some of the most popular and acceptable reasons which attempt to explain high food prices, taken from a broad perspective to encapsulate longer-term trends in the agricultural commodity market. As we shall see, the reasons provided are given starkly different weightings from different economic authors. I shall provide comments on whether or not these estimations can be justified.

An interesting point to note, regarding the survey undertaken in section 2, is that the general opinion of the surveyed economists seems to have evolved over the last two years. Early papers focused, quite pointedly, on the impact of the expansion in bio-fuel production and the effect of dollar depreciation, both of which we cover in detail. It seems quite logical, after being faced with such drama on the agricultural commodity markets, that a stream of economic papers would follow, attempting to explain the situation. Some of the major contributors included Rosegrant (2008) of the International Food Policy Research Institute (IFPRI) and Mitchell (2008) of the World Bank, who gave elaborate reasons for the high food prices. They did, however, base their findings on models that were more suited to analysing market trends from a medium- to long-term perspective. To understand the point further, let us consider an earlier IFPRI report by von Braun (2007). He made use of the IMPACT[1]

[1] International Model for Policy Analysis of Agriculture Commodities and Trade

model to predict future increases in food prices. The model predicted that, for the period 2006-2015, world grain prices in current US dollars were to increase by 10 to 20 percent. Even with the effect of dollar depreciation, the figures cannot be compared to reality, where we experienced grain prices in mid-2008 of well over double those experienced in 2006. Based on this, it can be argued that the effects arising from expansionary bio-fuel production and dollar depreciation were initially overstated in their impact on the agricultural commodity prices.

However, there has been a recent acknowledgement, by some authors, that the effect of trade policy is critically important, and perhaps more salient, in its effect on the international commodity markets. It is for this reason that I shall focus largely on the effects of trade policy in this thesis. In line with this thinking, I shall introduce the concept of export restrictions in section 3 in order to create a better understanding of why we see export restrictions in practice. It can be argued, in this respect, that a more interesting question would be why we see quantitative restrictions, such as quotas and bans, instead of a manipulation of taxes. When compared to quantitative restrictions, export taxes are generally considered to generate a less distortionary effect on welfare when placed on a commodity with a relatively low elasticity of demand, with staple goods being a prime example (Mitra and Josling, 2009). Even so, I shall put forward reasons in an attempt to rationalise this behaviour. In addition, contemporary examples of export restrictions will be examined.

Nevertheless, the actions of grain exporters should not be considered in a vacuum. Accordingly, in section 4, the impact of trade policy actions, by large grain importers, will be assessed. I shall focus largely on the retaliatory potential of importers, as opposed to exporters, as I believe that it provides a more interesting scope for discussion. Large exporting countries will be able to retaliate to other nations' trade manipulations, by implementing their own restrictions on exports. Yet, importers would face a trade-off if they decided to manipulate tariffs. This issue will be in discussed in section 4.1, with a related analysis in section 7.2.

The most prominent consequences of export restrictions are that they produce both high and erratic prices. Hence, we shall look to expand on these areas in section 5. The focus will be on the impacts of welfare in low-income countries. In this respect, farmers could be negatively

impacted by making production decisions based on current prices and not controlling for international and domestic market movements. Agricultural commodity traders would be affected in a similar way. The impact of high prices on poor households represents a more recognised consequence of export restrictions. A contentious issue is that pertaining to the welfare impact on farmers in an environment of rising food prices. In this regard, I put forward the key results of a paper by de Janvry and Sadoulet (2009), which assesses the impact of a hypothetical increase in food prices on different segments of the population.

Several global agreements and programs have been utilised in the past to deal with the issues of high and erratic prices. I shall briefly discuss some of the more important of these policies in section 6.1. Furthermore, I shall put forward some ideas that have been mooted for the future. The most anticipated agricultural trade discipline is the current round of WTO trade discussions, namely the Doha Development Agenda. Still, the slow progress of the discussions has necessitated the development of other avenues of stabilisation. Several regional agreements have been under-par in terms of effectiveness. Nonetheless, we shall look at a recent paper by Blanc and Singh (2009), which puts forward an interesting proposal for a certain bilateral agreement in the international market for rice. If undertaken, this agreement could serve to substantially decrease market volatility for the commodity known as 'white gold'.

I have placed a theoretical analysis of certain key topics in section 7. This section could quite easily have been placed in the appendix, as it does not add much to the flow of the argument. Due to the importance of the concepts, though, I would like to discuss them before the recommendations contained in the conclusion. Firstly, section 7.1 will put forward a two-country model, which deals with the impact of quantitative export restrictions and export taxes on the international commodity market. Additionally, we shall observe that exporting countries face certain practicality considerations when weighing up the relative merits of quotas and taxes.

Section 7.2 will cover the effect of retaliation, by importing countries, on the back of export restrictions. In this respect, large importing countries can protect their domestic price level by lowering tariffs on imports. Unfortunately, this market liberalisation would only serve to

heighten the volatility and prices on the international market. Moreover, large exporting countries could be enticed to further restrict their exports, given the import-induced price rise.

I shall introduce an equilibrium model in section 7.3 in order to discuss the impacts of trade policy on different market actors. The model will be based on a recent analysis by Bouët and Laborde (2010) but will differ in certain key areas. The importance of this model is that it allows us to assess the effects on income in a large food-exporting country, a large food-importing country and a small food-importing country, separately.

Finally, in section 7.4, we shall put forward a basic model to discuss the effects of rising food prices on low-income countries. The model is important in analysing the welfare effect on farmers, as it expressly differentiates between food-based income and non food-based income.

2 Background

2.1 Recent Developments in the Agricultural Markets

In order to better understand governmental policy issues, one should first look at how prices and price volatility on the international grain commodity markets have evolved over the years. We consider these two areas separately for reasons that will become apparent later in the text.

When one looks at grain prices over the past century, the agricultural commodity markets have only been characterised by three major spikes in food prices: the first occurred as a direct result of World War II, the second was the notorious 1970s food shock, and the third, and most recent, reached a climax in 2008 (Von Braun, 2008). Aside from these three events, prices of agricultural commodity goods have decreased steadily, relative to manufacturing goods, over the last century (Gilbert, 2008).

According to Figure 1 below, grain prices have been in the ascendancy since the early 2000s. Yet, this growth has been moderate compared to the upward movement in prices, as well as an increase in price volatility, from mid-2006. The index reached its peak in March 2008, where it stood at well over twice the level of a year before. Prices subsided significantly in the months to follow, partly as result of bumper crops in major exporting countries, including the US, Canada, Ukraine and Russia.

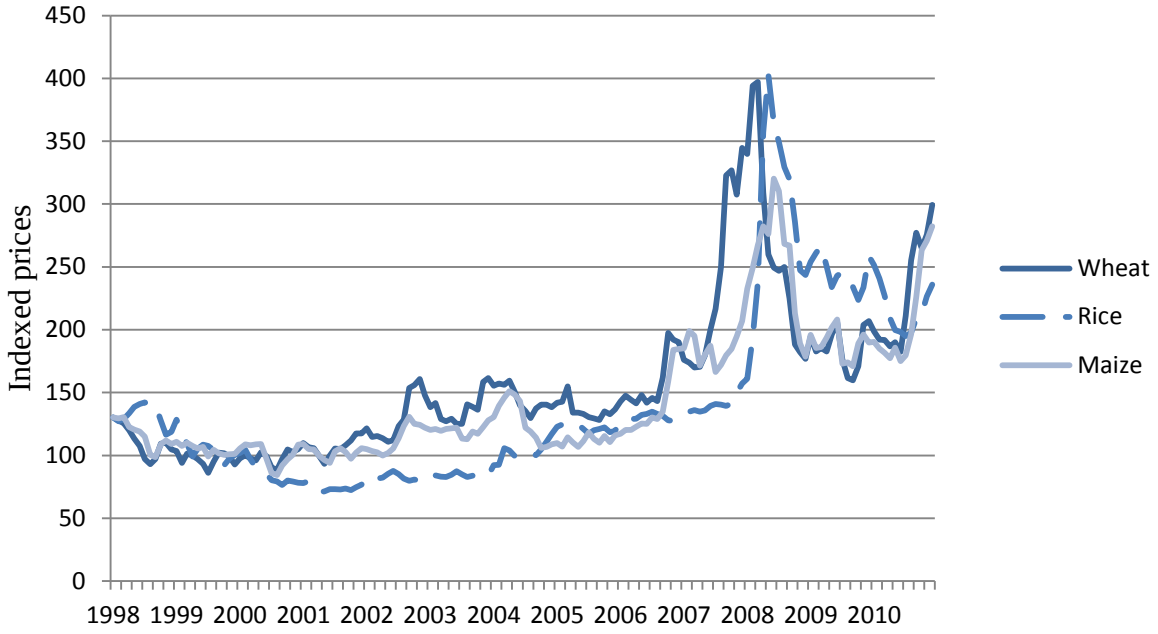

Figure 1. Grain prices: Indexed price averages for the period 1998-2010.

Author's compilation; Data obtained from FAO (2010)

Adverse weather conditions in some parts of the world during 2006 and 2007 led to decreased production of grains, placing strain on both the international supply and on stock levels. Droughts in Australia, and poor crops in the EU and Ukraine, led to a reduction of around 18.5 million tons in wheat supply in 2007 (WFSG, 2010), though they were nonetheless offset by bumper harvests in Kazakhstan, the US, Russia and Argentina (Mitchell, 2008).

Table 1 in the appendix shows the variations in some of the world's major wheat suppliers´ production and export quantities. According to the figures, global wheat declined by 3.7 percent in 2006, although it did retrace by 2.5 percent in 2007. Successful crops in 2008 helped to increase production by 11.8 percent from 2007 prices. In total, global grain production saw a decline of 1.3 percent in 2006, but this was followed by a 4.7 percent increase in 2007.

Rice production, on the other hand, was in the ascendancy in the years up to, and including, 2008, as can be seen in Table 2 in the appendix. In fact, each of the six sampled rice producers, which together make up 64 percent of global production, had experienced a

significant increase in production levels over the period 2005-2008. Additionally, each country reported a positive growth in production in 2008 compared with 2007 figures.

One can conclude that production of wheat and rice, leading up to the height of the food crisis in mid-2008, was relatively successful. Figure 2 represents the situation over the course of 50 years. The selected grain products of wheat, rice and maize have exhibited increasing production since the 1960s. Maize, in particular, has had some particularly good crop seasons from 2003 to 2008. This creates a paradoxical situation, where we see high grain prices on the back of abundant grain production.

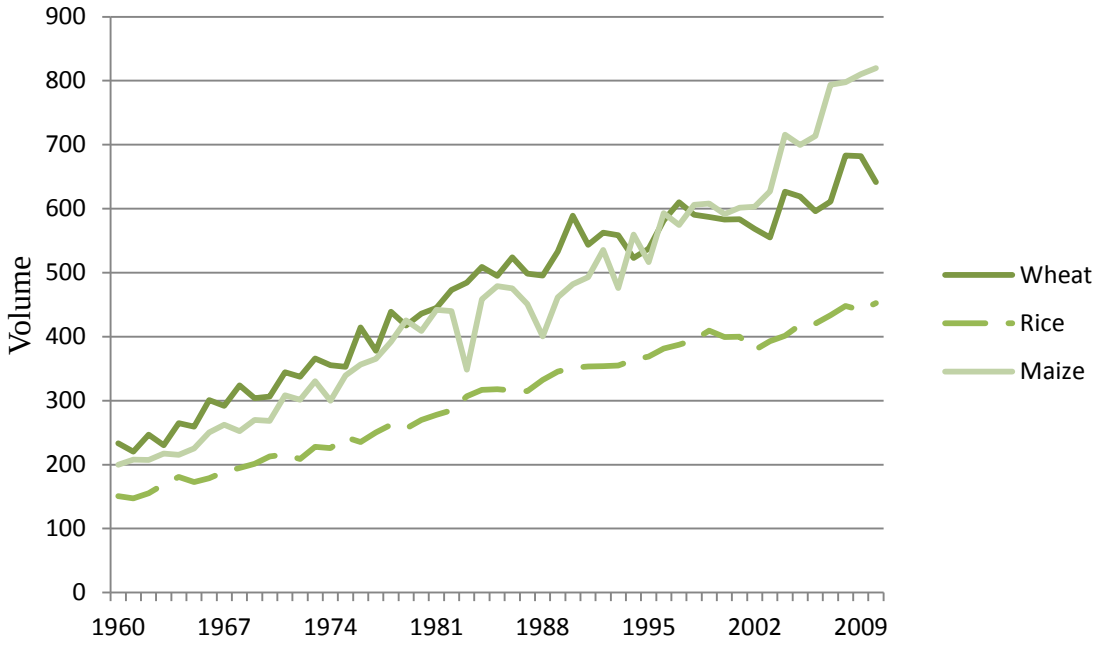

Figure 2. Global grain production for the period 1960-2010

Values calculated in (`000 000 tons). Author's compilation; Data obtained from WFSG (2010)

Mitchell (2008) points out that erratic grain production alone would not explain large increases in the grain prices. Other factors, such as increased bio-fuel demand and production, changes in land usage, and declining stocks, combine to place upward pressure on the price level. We shall take a look at this topic in the next section.

A contemporary issue that has been discussed in the media and in various planning committees is that of climate change and, in particular, its effects on specific grain-producing

climatic regions. Climate change has been attributed by many authors to have enhanced the inconsistencies in agricultural conditions, with more volatile flood and drought cycles and changing crop seasons. Australia, as an example, has experienced abnormally severe droughts for the last five years. Its 2006 production quantity of wheat, for which it is the world's third largest exporter, was 57 percent below its 2005 level, while the following crop year was 46 percent below the 2005 production level.[2] The Intergovernmental Panel on Climate Change (IPCC) assessment report states that droughts and floods are expected to become more frequent and to affect production in a negative manner, with subsistence areas in low-latitude areas being particularly affected (Metz et al., 2007).

2.2 Factors Contributing to High Food Prices

In order to better understand the circumstances surrounding the volatile conditions in the agricultural commodity markets, I shall now put forward likely causes of the high food prices over the decade relating to the years 2000-2010. After surveying a number of leading economic articles, I will propose five factors for consideration, namely bio-fuel, energy prices, speculation, the depreciation of the US dollar and agricultural trade policy.

2.2.1 Bio-fuel

The move by governments and regional unions towards further research and development of alternative sources of fuel in recent years has placed significant pressure on the markets for bio-fuel feedstocks. Currently, the most important bio-fuel feedstocks are maize, soybean, sugarcane and, to a lesser degree, cassava, sorghum and palm oil. The problem is, of course, that maize, soybean and cassava represent staple diets for many people in low-income countries. Higher prices received in the market for maize have prompted producers to reallocate resources, including land usage, from wheat and rice production to maize for the production of bio-ethanol. Similar market forces have made soybean more attractive to farmers than other crops due to its importance in the production of bio-diesel. Higher prices have also forced consumers to shift purchases from maize to wheat and rice. These demand and supply effects create upward pressure on the prices of rice and wheat as well as other agricultural products.

[2] These empirics can be found in Table 1 in the appendix.

Rosegrant (2008) looked at the impact of bio-fuels on food price increases in a paper written as a testimony for the US Senate Committee on Homeland Security and Governmental Affairs. At that point in time, the Food and Agriculture Organisation of the United Nations (FAO) reported that 37 countries were facing drastic food shortages. Rosegrant used IFPRI's IMPACT model, a partial-equilibrium modelling framework that captures the interactions among agricultural commodity supply, demand and trade for 115 countries and the world. It also includes demand for food, feed, bio-fuel feedstock, and other uses. The model analyses three areas, including the recent food price evolution with and without high bio-fuel demand, the impact of a freeze on bio-fuel production from all crops at 2007 levels, and the impact of an elimination of bio-fuel production after 2007.

For the first point, Rosegrant estimated that the increased bio-fuel demand from 2000-2007 accounted for 30 percent of the price increase in weighted average grain prices. Secondly, he shows that if one were to freeze bio-fuel production at 2007 levels, maize prices would be projected to decline by 6 percent by 2010 and 14 percent by 2051, with smaller price reductions for the other feedstocks. As a third point, if one were to eliminate bio-fuel production after 2007, prices of key food crops would drop more significantly, with a 20 percent decrease for maize, 14 percent for cassava and 8 percent for wheat by 2010.

Naylor et al. (2007) looked at the issue from another perspective by analysing the impact of a large global expansion of the bio-fuels production capacity on net food producers and consumers in low-income countries. They show that it would present problems for food policy planners and would raise the question of whether sustainable development targets at a more general level can be reached. They argue that there will be widespread ripple effects on food security and on the environment at local, regional and global scales. The ripple effects will be either positive or negative depending on the country in question and the specific policies in use.

There have been varying estimations of the impact of bio-fuels on food prices. The World Bank (Mitchell, 2008) believes that bio-fuel expansion is the 'dominant force' behind food commodity prices increases, while the International Monetary Fund (IMF) (Lipsky, 2008) estimates it to explain around 70 percent of the increase in maize prices and 40 percent of the increase in soybean prices. As reported above, Rosegrant (2008) argued that it accounted for

30 percent of real grain price increases. Not surprisingly, however, the United States Department of Agricultural (USDA) claims that only 3 of the 40 percent increase in global food prices can be attributed to bio-fuel production (Ciaian, 2010). It is interesting that these papers contain such varied results, though they should be taken in context. The models used by the World Bank, IMF and IFPRI are considered to be quite effective in analysing medium- and long-term trends in foods prices. In this respect, factors that occur in the short-term are not specifically accounted for. Furthermore, the models used compare different products, prices and time periods.

2.2.2 Energy Prices

As one of the most productive economists in this field, Anderson (2009) argues that grain prices have only recently, in the last twenty to thirty years or so, started to exhibit a positive correlation to energy prices. He estimates that the coefficient of correlation of energy and food prices was -0.18 between 1960 and 1999, compared with 0.84 for 2000-2007, representing a much closer relationship between the two indices. Indeed, Figure 3 below shows that the major grain commodities seem to have had a strong correlation with the oil price over the last decade.

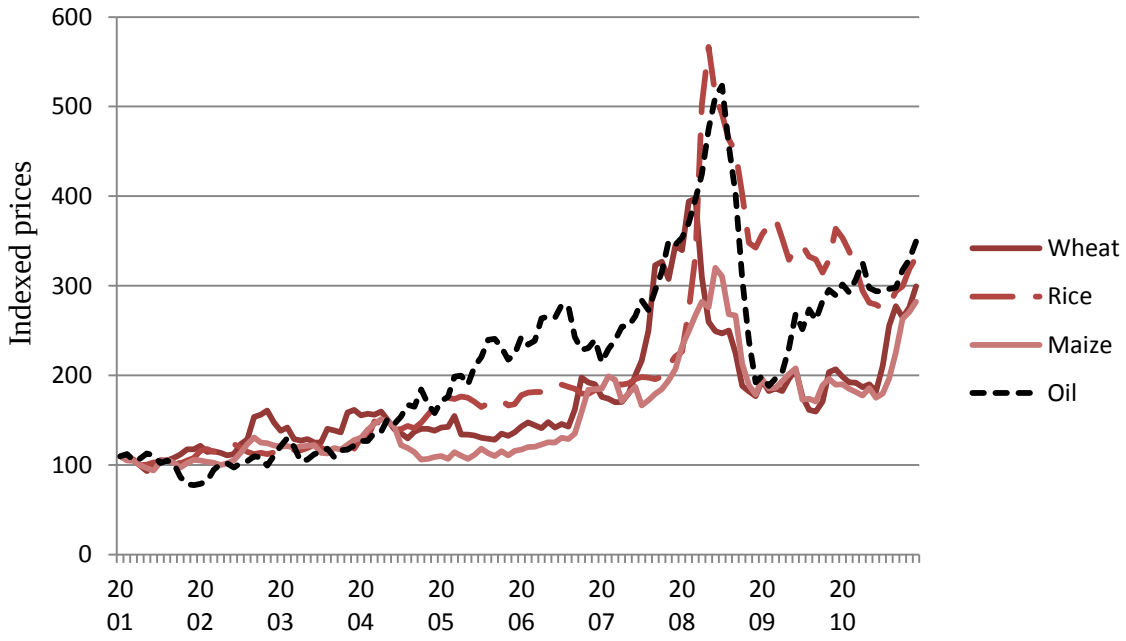

Figure 3. Relationship between the oil price and grain markets: Indexed monthly price averages for the period Jan 2001-Dec 2010

Author's compilation; Data obtained from WFSG (2010) and IMF (2010).

This close correlation between the energy markets and the agricultural commodity markets could be explained by two key events: the development of bio-fuels and the increasing reliance on the use of energy inputs in agriculture.

Ciaian and Kancs (2010) develop a vertically integrated multi-input, multi-output model with two channels of price transmission: a direct bio-fuel channel and an indirect input channel. Their objective was to study the interdependencies between energy, bioenergy and food prices. They test the theoretical hypothesis by applying time-series analytical mechanisms to nine major traded agricultural commodity prices, along with one weighted average world crude oil price. The empirical findings confirm the hypothesis of interdependency between the prices of oil and agricultural commodity.

Likewise, Naylor et al. (2007) believe in the interdependency between the energy and agricultural markets. They maintain that bio-fuels will remain a critical energy development target in many parts of the world as long as petroleum prices exceed $55-60 per barrel. Even if petroleum prices dip, policy support for bio-fuels, as a means of boosting rural incomes in several key countries, will likely generate continued expansion of bio-fuels production capacity. Moreover, the authors allege that total energy use will continue to escalate as incomes rise in both industrial and developing countries. The ongoing development of China and its growing middle class can be seen as an example in this regard. For instance, Trostle (2008) shows that the oil imports of China grew by more than 21 percent per year from 194 million barrels in 1996 to 1.37 billion barrels in 2006.

A more direct effect is observed in the increased price of fertilizers and chemicals used in agriculture, which are either produced from energy or are produced through a heavy use in energy. Higher energy prices lead to an increased cost of transportation as well. Trostle estimates that the increased cost of transportation in the US could have added 10.2 percent to the prices of wheat and maize.

2.2.3 Speculation

It has been proposed that speculative activity by investors exacerbated the inflationary pressure on prices. The flow of speculative capital from investors into the agricultural commodity markets was significant, with a large increase in the volume of globally traded futures and options for the period from May 2007 to May 2008 (von Braun & Torero, 2009). According to Sanders et al. (2008), the open interest for many agricultural futures markets doubled from the end of 2004 through 2006, with the open interest for wheat futures on the Chicago Board of Trading increasing by 275 percent. Open interest describes the total number of futures contracts of a given commodity that have not yet been offset by an opposite futures contract or fulfilled by delivery of the commodity. The increase in open interest may be attributed to electronic trading, easier access to markets, inflationary conditions in commodity markets and an increase in the use of commodity futures as an investment tool and inflation hedge (Sanders et al., 2008).

Interestingly, even with strong increase in open interest, there has been a substantial growth in the ratio of the monthly volume of futures and options to open interest (Von Braun & Torero, 2009). A speculator taking opposite positions in the futures market, within a relatively short period of time, serves to increase the total monthly volume of trade, without affecting the monthly open position that much. So, in this respect, the aforementioned ratio is a good indicator of speculative activity. Von Braun and Torero (2009) estimate that, during 2008, this ratio increased by 27 percent and 19 percent for soybean and rice, respectively. The ratio for wheat, on the other hand, increased by 19 percent. This was after decreases in 2005 and 2006, which occurred on the back of the rapid growth in open interest.

2.2.4 Depreciation of the US Dollar

The dollar has depreciated in value since 2002 and has shown a degree of correlation with rising food prices. It can be argued that an explanation for this correlation lies in two areas.

The first reason is that as the dollar loses value relative to an importing country's currency, it reduces the cost of importing commodities in dollars. This drives up foreign imports from the US, which is a major exporter of several agricultural commodities, including wheat, maize

and soybean. Moreover, the cost reduction due to dollar depreciation places upward pressure on global demand commodity prices.

A second important consequence of the falling dollar is that it entices investors to hedge. Investors have looked to reinvest assets into commodities, with oil the initial avenue, but thereafter into other commodities (Timmer, 2008). This consequently drives up the demand for commodities as financial instruments and places further upward pressure on prices. A complimentary impact, in terms of this latter point, could be the effect of the US Federal Reserve's decision to cut the interest rate at periodic intervals since mid-2007. Lower rates and market uncertainty provide incentive for investors to redirect capital from interest-bearing assets to commodities. According to the Bank of International Settlements (Domanski and Heath, 2007), commodities, as a channel of investment, have grown in popularity in the last few years among private investors. I would argue then that the elasticity of dollar commodity prices, with respect to dollar depreciation, has subsequently risen.

There is a general feeling of disagreement regarding the impact of the weak dollar on commodity prices. Abbot et al. (2008) appear to be the most supportive of it being a dominant force. However, the general perception seems to be that it was more of a contributing factor than an important driving force. Mitchell (2008), for instance, believes that dollar depreciation explained around 20 percent of the rise in food prices. Gilbert (2008), on the other hand, is of the opinion that the depreciation has not been sufficiently large or general to be a contributing factor. My impression is that this topic will remain a source of contention until someone finds a more acceptable method of identifying the relationship between investor activity, commodity prices and the value of the dollar.

An important point that should be taken into account is that most of the authors that analyse the effects of the dollar on grain prices do so in terms of the grain commodity prices denominated in dollars. This should be taken into account when dealing with the effect on low-income countries. A depreciating dollar, whilst pushing up commodity prices denominated in dollars, creates a downward effect on commodity prices denominated in other currencies. Therefore, the impact on low-income countries will need to be assessed on a case-to-case basis. For example, when looking at a few of the largest importers of US wheat, the results are mixed. The Columbian Peso and the Philippines Peso experienced an appreciation

against the dollar in the two years leading up to the food crisis, while the Nigerian Nairu, Indonesian Rupiah and Mexican Peso maintain relatively constant rates (US Fed, 2011). An interesting study would be of the effects of the post-crisis dollar exchange rate, as the dollar has appreciated significantly against most currencies, including those identified above.

2.2.5 Agricultural Trade Policies

A topic that has, by and large, been accepted as a cause of high food prices, is the policies that governments have used to protect their agricultural sector. We shall use this section to take a look at trends that have developed over the last few decades, focusing rather on the underlying factors explaining market distortions, than on their impact.

Anderson et al. (2010) state that, generally speaking, many developing countries have moved toward liberalisation in the agricultural commodity markets over the last twenty-five years. Notwithstanding this trend, there are three remaining areas that are negative:

1. Developing countries have increasingly provided protection to the import-competing sub-sector of their agricultural sector. In fact, since the 1960s, the rate of growth of that protection has been nearly the same as in high-income countries. This degree of subsidisation serves to weaken the countries' comparative advantage in farm products.
2. Countries are still showing support across industries even though the sectoral rate of distortion has been falling.
3. Countries are also continuing to insulate their domestic markets from the year-to year fluctuations in international markets for farm products.

Anderson et al. (2008) analyse the net economic effects of agricultural price and trade policy changes since the early 1980s. Next, the authors compare those estimates with projections of how global markets, farm incomes and economic welfare, from 2004 onwards. They arrive at the conclusion that farm incomes and welfare would significantly improve if the remaining global policy distortions were removed.

In addition, Anderson et al. state that agricultural liberalisation has brought the world just over halfway towards free trade since the early 1980's. Despite this, agricultural trade policies

still make up 70 percent of the welfare cost of remaining distortions to goods policies. However, this could be stunted if certain developing countries in the WTO get their way. According to Hertel et al. (2005), these countries are currently seeking a Special Safeguard Mechanism that allows them to set tariffs even higher than their ceiling bindings should food prices collapse or imports. This would significantly increase the volatility of international food prices and decrease global trade.

We shall, specifically, analyse one part of this discussion, namely the effect of agricultural export restrictions on trade and welfare. On top of that, we shall also briefly look at the effect of import tariff manipulation on the international market but only to the extent that it is executed as a reaction to the increased volatility created by export restrictions. The contention is that trade policy has played a far more significant role, than many authors believe, in explaining the high prices.

3 Trade Policy – Exporters

In the wake of large price hikes in the international grain markets, many countries placed restrictions on their exports. These restrictions were argued to be critical and implemented in order for governments to safeguard the stock of grain products domestically. Nevertheless, we shall see that trade policies, undertaken by the largest grain net-exporters, can have widespread effects across other countries. This is particularly true for the countries that are reliant on the imports of staple food products.

As a point of departure in dealing with this topic, it would seem logical to define what we mean by a 'large net-exporting country' and proceed to identify those countries that could be defined in terms of this category. A large country, for our purposes, refers to a country that can affect the world price for a certain commodity by adjusting trade policy in this commodity.

The six countries represented in Figure 4 below account for 70.6 percent of global wheat exports. The figures were calculated as the aggregated value over the ten-year period from January 2000 to December 2009.[3] During this time, the United States accounted for 21.61 percent of global wheat exports. This figure has been declining continuously since the 1970s where the share stood at around 41 percent. Significantly, the EU has become a large net-exporter after decades of importing. During the 1970s, the EU was importing at around 10 percent of global trade, but this trend was reversed in 1978. According to Mitchell and Mielke (2005), the emergence of the European Union as a major exporter can be attributed to the Common Agricultural Policy (CAP), which led to highly subsidised production and exports. Though, wheat intervention was reduced significantly in 1992 when the CAP system was reformed.

[3] Data used for this section can be found at WFSG (2010).

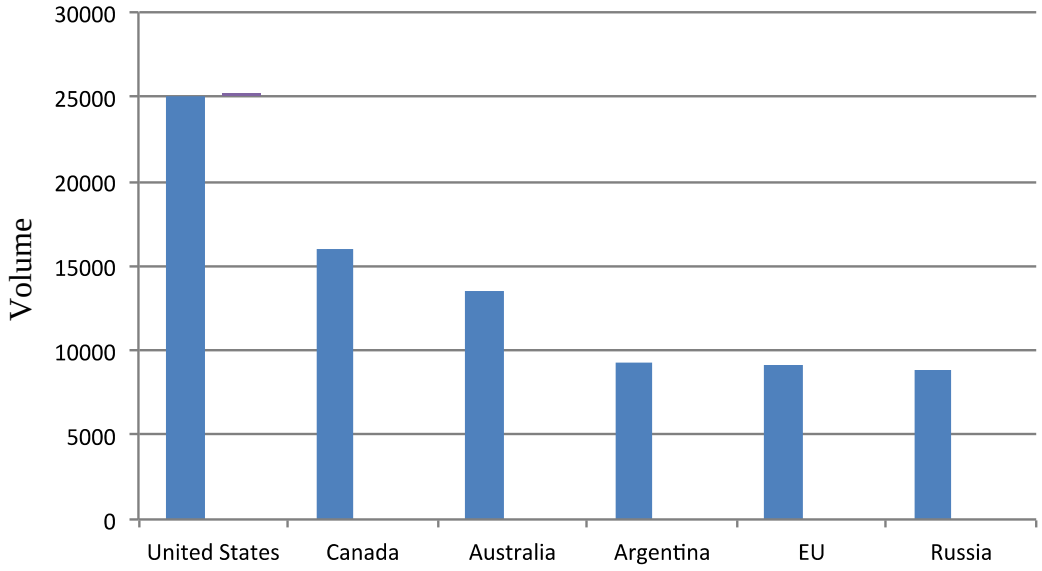

Figure 4. Wheat: Net exports, Average for the period 2000-2009

Values calculated in (`000 tons). Author's compilation; data obtained from WFSG (2010)

3.1 Policy Tools

Lustig (2009) states that there are two main policy options for domestic governments to decide upon. The first would be to allow domestic prices to adjust to flex international prices. In this way, the burden will be shifted onto the domestic citizen and can have large, adverse effects on welfare targets. The second option would be for the government to use policy tools such as food subsidies or export restrictions. In this thesis, I will focus on export restrictions to a greater degree than food subsidies.

The export restrictions that have been utilised, during the last few years, include export taxes, export bans, regulated exports and supervised exports. Several leading exporters of grain commodities imposed bans in early 2008. Nonetheless, there are certain fundamental flaws that arise from utilisation of this policy. There is a degree of short-termism in its design and it is generally not considered to be credible in the long term. For one, the effectiveness of the ban is seriously curtailed by the anticipation that it might end and it often leads to smuggling over the borders (Marks et al., 1998). It would also endanger the country's trade relationships with importing countries. Regulated exports include quotas and licensing requirements.

Quotas define a certain maximum volume of export, while licensing requirements require that a commodity can be exported only through approved exporters. This system is often adopted in order to economic rents associated with the country's perceived market power, though it may encourage the formation of large and powerful cartels (Piermartini, 2004). Supervised exports represent a form of control to ensure adequate domestic supply of essential goods at a reasonable price.

3.2 Rationale behind Export Restrictions

Export restrictions have become an important reality across commodity-exporting countries and many of them have permanently adopted these trade measures. In the following section we outline the most apparent factors that contribute to governments implementing export restrictions.

3.2.1 Food Security

The area that is most vehemently defended by protagonists of export restrictions is that of food security. Exporting countries, facing low levels of supply relative to consumption, are able to limit the volume of produce crossing their borders, predominantly through the use of export taxes and quantitative restrictions. Food insecurity arguably arises due to three factors: Growth in consumption, unstable supply and production shocks.

Owing to circumstances of economic improvement and population growth in countries like China, domestic food consumption has grown at a rate that is too fast too sustain suitable stock levels. If domestic production does not expand at a similar rate, then countries become more reliant on imports from other countries. Supply volatility is also an important issue, with recent examples being the widespread fires across Russia and droughts in Australia, as well as protectionist trade policies by exporters. These shocks have caused countries to scramble for the remaining tradable supply at a much higher cost. In countries where crop production is particularly seasonal, policies need to be implemented to maintain food inventories at a desirable level. India, for example, has to rely on only one crop of wheat per year. Thus, the government would need to allow for a sufficient storage policy.

3.2.2 Stabilisation of Domestic Prices

Countries often look to reduce the domestic price variability by implementing export restrictions. Price volatility is particularly damaging in terms of welfare loss, as I will discuss later in the thesis. The use of variable tax rates by some developing countries can be an effective tool in this regard. Papua New Guinea, for instance, uses an export tax equal to one-half the difference between the reference price, which is calculated as the average of the world price in the previous ten years, and the actual price for that year (Piermartini, 2004).

Countries have traditionally used wheat carryover to provide a buffer against wheat shortages during years of low production or rapid increases in demand in order to stabilise prices. Typically, we observe a negative correlation between stock levels and price levels. When prices are low, governments tend to build up their reserves, and when prices are high, they attempt to stabilise domestic prices by releasing stocks. However, we have seen a movement away from large inventories among exporting countries in recent years. This creates a problem in extended periods of high prices, when inventories start drying up.

The world's largest wheat exporters, namely Argentina, Australia, Canada, the EU and the US, account for over three-quarters of global net-exports.[4] Interestingly, trend has developed in that the share of global wheat stocks, held by these exporters, has declined from 80 percent in 1960 to 20 percent in 2002 (Mitchell and Mieke, 2005). This reduction can be explained by two main reasons. First, the five major exporters experienced decreasing shares in global production from 46 percent in 1963 to 33 percent in 2002. This was due to the expansion of wheat production in developing countries during this time. The second reason can be put down to policy changes in the exporting countries regarding stocks. Food aid, for instance, has increased in response to food emergencies or persistent food shortages.

Mitchell and Mielke show that 85 percent of global wheat food aid during the 1990s was provided by four of the world's largest wheat exporters, with the US providing a significantly high 54 percent of world wheat food aid. Conversely, there is evidence that food aid is partly used by exporting nations as a tool to dispose of surplus production. Food aid is generally much higher in times where the price of wheat is quite low, and vice-versa.

[4] The figures are taken from Table 1 in the appendix.

The price level is important for governments to consider, since it affects the purchasing power of consumers, and has a direct effect on welfare. As far as low-income consumers are concerned, excessive prices on essential foods are tantamount to quantitative food supply insecurity. Political parties also tend to use the final consumer price as a tool in order to gain support from lower-income voters. By implementing a system of export restrictions near to an election, for instance, the incumbent governmental regime can provide evidence of positive action. Another point is that export taxes and restrictions on primary commodities serve as an indirect subsidy to manufacturing and processing industries by lowering input costs (Bouët & Laborde, 2010). According to Zhou and Thomson (2009), export taxes are utilised in Malaysia in order to keep the price of palm oil at acceptably low levels as part of the country's National Bio-Fuel Policy. In this respect, maintaining a low price level on agricultural commodities serves to promote other domestic industries.

3.2.3 Terms-of-trade

A large country is able to derive an improvement in their term-of-trade by increasing the relative price of exports in terms of inputs. This allows the country to import more, which will have a positive effect on welfare. According to Bouët and Laborde (2010), the argument is similar to the optimal tariff argument, which states that a large importing country can implement an import tariff in order to significantly decrease demand for the commodity. This puts downward pressure on the world price of the commodity and leads to an improvement in the country's terms of trade. Bouët and Laborde make the point that export taxes and import tariffs exhibit strong similarities and can, at times, be equivalent in terms of their impact on domestic and foreign welfare. Nonetheless, the penalties stipulated by the World Trade Organisation (WTO) that exist in the sphere of import tariffs do not extend to their export tax equivalent. This apparent similarity is represented, theoretically, in section 7.3 below.

3.2.4 Financing Government Expenditure

Export taxes have served as an important source of government revenue in many developing countries, and the instability of export earnings may generate serious imbalances. Furthermore, they are significant in the respect that they imply a redistribution of income from domestic producers to domestic consumers.

According to Guillaumont et al. (2003), the lack of alternative 'tax handles' in many developing countries, especially in Africa, creates a situation where government revenues are particularly vulnerable to changes in the value of export earnings. During boom periods, increasing tax revenue and easier recourse to external lending leads to an increase in public expenditure, which opens up the risk of large public deficits during periods of declining prices (Guillaumont et al., 2003). Over the period 1991-2001, import duties comprised 34 percent and 22 percent of government revenues in the least developed and non-least developed countries in Africa, respectively, compared to an average of 15 percent for developing countries (UNCTAD, 2003)

3.3 Arguments against Implementation of Restrictions

3.3.1 Comparative Advantage

One of the most important arguments in favour of trade relates to the advantages arising through comparative advantage. This concept finds its roots in the theories developed by David Ricardo[5]. A country is deemed to have a comparative advantage in the production of a good relative to another country, if the former has a lower opportunity cost in production than the latter. This difference in opportunity cost could arise from technological differences between the countries. According to this theory, countries should exploit their comparative advantages by specialising in the production of goods in which they have relatively low opportunity costs. A country could gain a comparative advantage through differences in technological advancement.

Another possibility is that comparative advantages are explained by differences in factor access. The Hecksher-Ohlin theory dictates that countries have a comparative advantage in the production of a good, if the necessary factors of production are relatively abundant locally. As an example, we can take a look at the Eastern Asian economies of China and Japan. The relatively larger labour force in China, compared to the amount of capital, could imply that China has a comparative advantage in basic goods, whilst Japan has a comparative advantage in high-tech goods. As such, China should specialise in basic good industries, and Japan should focus on high-tech industries. Following this line of argument, countries should

[5] References to the well-known economic theories contained in this subsection can be found in a range of sources, including Feenstra (2004).

be wary of imposing export restrictions on agricultural trade if they have a comparative advantage in this industry, as they lose out on the 'gains from trade' discussed in the theories.

However, it is important to realise that the advantages of comparative advantage are relevant in a static setting. Unfortunately, it does not provide a sufficient explanation as to why a country like South Korea would choose to focus its resources and protection on sectors in which it does not have a comparative advantage. The infant industry argument has been used to explain why this country, with its historically strong agricultural sector, would instead choose to protect its automotive industry. This theory adds weight to the argument that countries should look to protect certain industries so as to improve economies of scale and to develop new technology and factor base. In this way, the industry would attain a comparative advantage in the long run (Krugman, 1981).

Additionally, the argument against protecting the agricultural sector stems from the understanding that it does not give rise to lasting growth to the same degree as other industries (Matsuyama, 1991). In this sense, Matsuyama argues that countries with a high level of productivity in agriculture might find their growth stunted in the long run, as they do not find it necessary to shift the focus to other industries.

3.3.2 Terms of Trade

The terms-of-trade argument, discussed in 3.2.3 above, has potential for bestowing benefits onto large exporting countries. Yet, to attain a similar benefit, small countries would be required to collude with other exporters in order to gain in this area. According to Piermartini (2004), many international commodity agreements have been signed in the last few decades but most are ill-fated and unsuccessful. This could be attributed to the fact that the agreements must be maintained over an extended period and are particularly influenced by changes in policy and political regime.

3.3.3 Trade War

Export taxes and terms-of-trade agreements are susceptible to 'beggar-thy-neighbour' tactics. Such circumstances could arise if other exporting countries implement export restrictions, or if importing countries lower their import tariffs, in retaliation to an export restriction. If these countries are involved in specific trade agreements, this might give rise to a classic 'prisoners´

dilemma' situation. Furthermore, if other countries are likely to react in such a way, then the export tax might not deliver the desired welfare results that the countries were aiming for. We look at this issue in Section 7.2 below.

3.3.4 Lack of Knowledge

Another key point relates to the critical importance of countries having an accurate knowledge of the world market conditions in determining the optimal export tax. The risk of under- or over-estimation could lead to large welfare losses. Warr (2001) reports that there has been a wide variety in estimates for the world demand elasticity of Thai rice. Estimates range between -1 and -4 and imply 'optimal' tax rates ranging from 25 to 100 percent. In such a case, the probability of attaining large welfare losses is quite high. In addition, Warr contends that the value of the optimal export tax depends on assumptions regarding contestability of markets and the degree of market competition. The argument is generally put forward that if domestic firms are perfectly competitive in the domestic market, then the optimal export tax is equal to the inverse of the absolute value of the world price elasticity of export demand for that commodity (Piermartini, 2004). Imperfectly competitive markets, on the other hand, create uncertainty regarding the optimal tax value. It may then be that an incorrect model specification leads to an unnecessarily high welfare loss.

3.3.5 Credibility

Extensive use of export restrictions can, over time, lead to reduced credibility of the country on the international market for the commodity. In fact, this could also be extended to trade in other commodities if confidence has been reduced to such a level that the country is perceived to be an irrational actor and a poor trade partner. In addition, it could prompt other countries to invest in agricultural technology to the point were they would be the preferred option.

3.4 Economic Implications of Export Restrictions

Let us assume that a 'large food-exporting country' implements an export tax on an agricultural commodity. The immediate effect is that the domestic price of the commodity is depressed, whilst the international price is increased and the volume of trade is decreased.[6] The domestic price depression comes about as the domestic producers increase the sale of the commodity on the domestic market. The supply of the commodity on the domestic market rises, while the international market supply falls. Since domestic producers must receive the same price on both markets, the price differential will equal the tax.

Upon implementation of the export tax, both the large exporting country and importing countries receive an efficiency loss, created by the distorting effects of the tax. Production distortions arise from the fact that too little is produced in the exporting country, while too much is produced in the importing country. The tax discourages efficient domestic producers from producing, while foreign consumers are forced into buying more expensive goods in their home country, rather than importing the cheaper alternative. Consumption distortions arise from the fact that domestic consumers are consuming too much, to the point where the marginal utility of an additional unit of consumption of the good is equal to the lower price subsidised by the export tax, while foreign consumers consume too little (Piermartini, 2004).

What is more, one finds a terms-of-trade effect in both exporting and importing countries, which was discussed earlier. Thus, one observes two main effects of contrasting nature. The terms-of-trade effect is positive in the case of large food-exporting countries and negative for food-importing countries. Small countries are unable to influence the international price of the commodity and thus do not benefit from the terms-of-trade effect. The only positive gain, in their case, would be the gain to consumers of lower domestic prices.

Hence, the net national effect can either be positive or negative and will depend crucially on the ability of the country to impose their trade decisions on the international market. Overall, the effect will always be negative if the export tax is implemented by a small country. The importing country will lose on both the terms-of-trade and efficiency effects. On top of that, the overall world effect will be unambiguously negative. The terms-of-trade effect will be null

[6] This effect will be analysed more formally in Section 7.3.

in aggregation, and the total effect will thus be a summation of the production and consumption efficiency losses.

Let us take a look again at a central and important issue in our analysis, namely the effect of export restrictions on the welfare of the low-income consumer. The effects of increased prices and the price volatility associated with export restrictions are largely nullified within countries implementing such strategies. However, the poor are still affected in certain key areas. Assume that the government levies an export tax on wheat. As the price falls in the domestic market, the return to factors of production, including land and labour, will fall. Landowners and unskilled labour will receive lower remuneration, while skilled labour and owners of mobile capital, used in the production of alternative commodities, will receive higher remuneration.

Under the restricting assumptions that there is not an institutionally-set minimum wage, and that there is high unemployment prevailing in the country, the low-income labour participants, whom tend to provide the unskilled manpower, will suffer a negative gross income effect (Piermartini, 2004). Conversely, a positive purchasing power effect is brought about by a reduced domestic price for the commodity. This effect will be greater for those market participants that spend a larger proportion of their income on the affected commodities. Typically, this is characteristic of the low-income segment of the population. The overall effect on household income also depends on the government's redistribution of tax revenue. Consequently, the more redistributive the government policy, the greater change there will be to poor household disposable income.

Export bans, on the other hand, imply an efficiency loss and terms of trade improvement in the domestic economy of the country that introduces them. The price transmission mechanism occurs through the increased availability of the product on the domestic market, leading to a reduction in price of the good on the domestic market. The extent of the price distortion that follows, according to von Braun (2007), will depend on the price elasticity of the good. Staple goods with an inelastic demand require a large decrease in price to absorb the increase in domestic supply of the good. As a result, the inelastic supply characteristic of agricultural produce leads to large movements in price under such circumstance.

Of course, quantitative export restrictions, with export bans in the extreme case, do not attain the added advantage of increased government tax revenue that one sees in the export tax case. Therefore, one could argue that export taxes are necessarily better than quantitative restrictions under the objective of domestic price stability and food security. However, as we shall see in section 7.1 below, this is not always the most practical solution.

3.5 Country-Based Export Restrictions and Impacts

3.5.1 Rice

India, an important exporter of rice, has played a leading role in the export restriction of this grain. Slayton (2009) reports that India effected a change in trade policy as a result of a number of failed programs. These programs included a Public Distribution System, which provided food rations to the low-income population at subsidised prices. Unfortunately, the government failed to raise its price on the food rations in line with inflation, while increasing the sizes of said rations, from 2001-2008. Furthermore, the Indian government has increased the centrally-set prices paid to domestic growers significantly. Such strategies apparently give more to electoral leverage than to financial soundness, as several of the programs have been driven into bankruptcy.

The Indian government subsequently sought to avoid the ramifications of such failures by instituting export restrictions in the form of banning non-Basmati rice exports from October 2007 onwards. This, in turn, triggered export restrictions and overly-cautious hoarding in several other countries. The ban on non-Basmati rice was replaced three weeks into existence by a series of increasingly higher minimum export prices, but reverted back to an outright ban on April 1, 2008. According to WFSG (2010), Indian exports accounted for around 16.5 percent of total world trade in non-Basmati rice in 2007, which created pandemonium in markets as prices soared. In total, Indian exports of rice dropped by 64 percent from 5.5 million tons in 2006 to 2 million tons in 2008 (Mitra and Josling, 2009).

Vietnam placed further pressure on the global rice supply by effectively banning new export sales of rice in February 2008. According to Slayton (2009), the Vietnamese contribution to

the volatility in the markets stemmed from its own fears of shortages, after poor crops in some markets and its own inflationary sensitivities. The higher world price, caused by export cuts in Vietnam, resulted in a speculative attack on the domestic market, leading to prices on the domestic market to double over a couple of days in late April 2008 (Slayton, 2009). However, after the prices receded, international demand for Vietnamese rice was greatly reduced. The deflated prices compounded the impact of a large amount of unsold stock, leading to extensive losses in export earnings.

Impacts of the above-stated restrictions can be see in the Philippines, the world's largest importer of rice. The import price of rice in this country soared up from an average price of $332 per ton in 2007 to the point where, in April 2008, the National Food Authority paid $1,220 for an import tender (Brahmbhatt et al., 2008). Largely, this was due to panic-purchases by the Philippines government on the back of poor growing conditions and public perception. The high prices and animosity regarding food security led to social unrest, and riots ensued. Figure 5 below depicts the situation on the international market for Thai rice between June 2007 and December 2008.

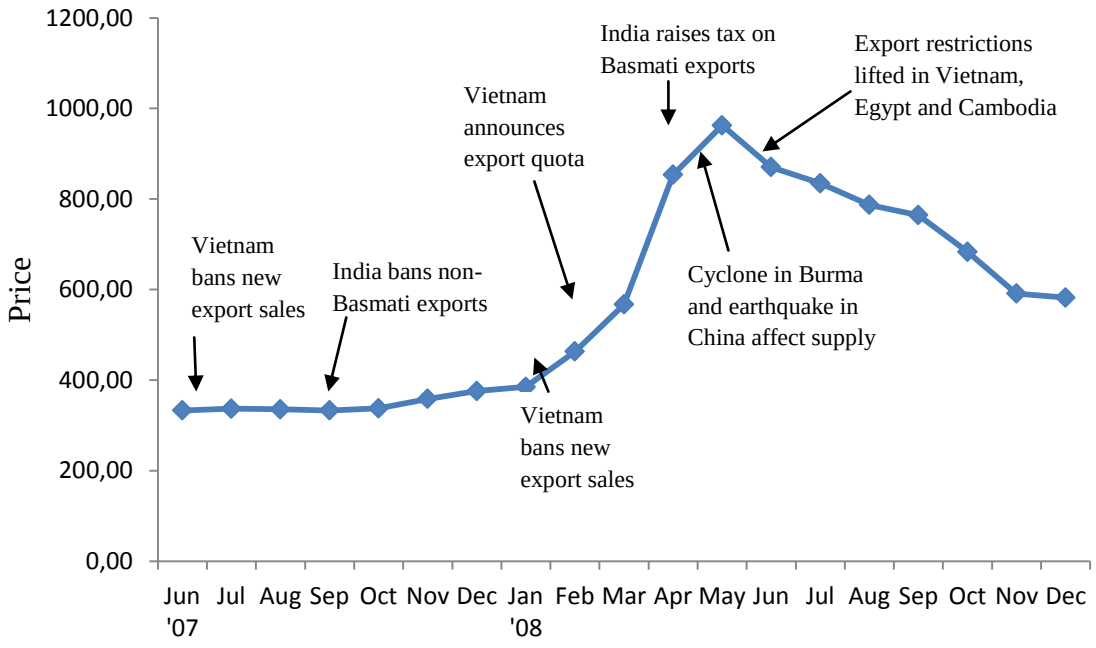

Figure 5. International market price for Thai 100% B Second Grade Rice

Values calculated in ($US per ton). Author's compilation with information from Slayton (2009); data from FAO (2010)

3.5.2 Wheat

One of the most critical wheat export restrictions occurred in the Ukraine. We can observe from Table 1 in the appendix that the country reduced exports by 73 percent from 2006 to 2007 levels. Dollive (2008) finds the consequence of this alteration to be quite significant. Indeed, many of Ukraine's largest trade partners switched entirely to other grain markets, such as Australia, France, Argentina, North America, Russia and Kazakhstan. The Ukraine ban increased demand dramatically in the latter two countries, with record-high export levels in 2007, which halved their stock-to-use ratios and put significant pressure on their markets. According to Heady (2010), the ban was the main reason for Russia and Kazakhstan implementing export restrictions.

Russia implemented restrictions at the end of January 2008 by announcing that it would institute a 40 percent tax on exports outside its customs union. This was extended to its customs area in the following month. Kazakhstan followed in line by implementing an export tax in March, as well as an outright ban from April to September. According to Table 1 below, this had the effect of reducing exports by 45 percent from 2007 figures. With this in mind, it can be argued that the ban in the Ukraine was responsible for creating a 'cascading effect' on the international market for wheat by forcing other countries to implement restrictions (Dollive, 2008).

Argentinean exporters also faced restrictions on the international market. The authorities placed quantitative restrictions on wheat exports amounting to an *ad valorem* export tax of 32.5 percent from March to November 2007 (Mitra and Josling, 2009). The uncertainty regarding the longevity of the liberalisation, after the restrictions were lifted in November, created a situation where the Argentinean exporters flooded the market with exports in January 2008. Later in November of that year, export taxes were raised on maize, soybean and wheat to 25 percent, 35 percent and 28 percent, respectively. In December, Argentina announced that they would ban the export of wheat indefinitely. With the exception of a brief allowance in January, the ban continued through to May 2008 (Dollive, 2008).

India provides an interesting example as it produces a considerably high quantity of wheat each year, second only to China in terms of global dominance. Nevertheless, much of this production is used to sustain the population. Major changes to export policy have seen India

implement quantitative restrictions from 2006 onwards. Indeed, aggregated over the period 2006-2010, Indian wheat exports made up only 2.2 percent of the corresponding figures in the period 2000-2005.

The Russian export ban in 2010 has received much coverage in the media, especially in light of the restriction discussed above. With the situation in 2008 still fresh in the mind, market anxiety increased, and many countries began to boost their wheat stockpiles and search for new sources of wheat supply (Pleven et al., 2010). Egypt, the world's largest wheat importer, suddenly found itself short 360,000 tons, which was due to arrive from Russia during August and September (Ehab, 2010). We can see the dramatic effect of Prime Minister Putin's announcement of the ban in Figure 6 below.

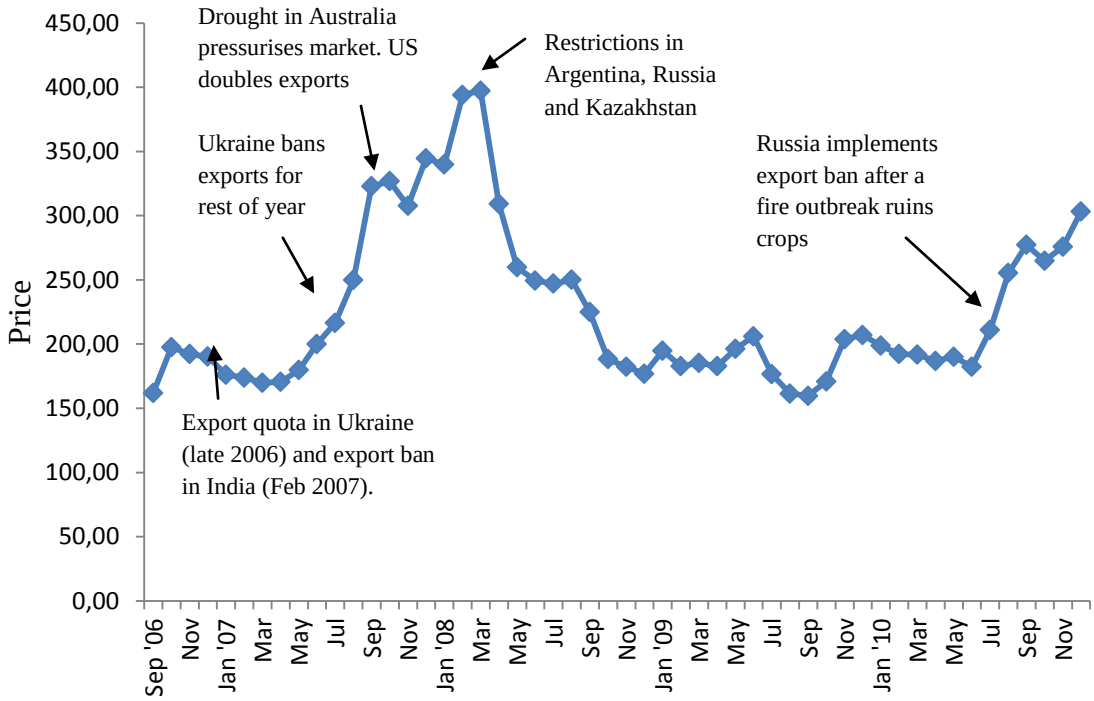

Figure 6. International market price for US No. 2 Soft Red Winter Wheat

Values calculated in ($US per ton). Author's compilation ; data obtained from FAO (2010)

4 Trade Policy – Importers

Let us first take a look at countries that could potentially fall into the category of large food-importers, which, following the central definition, refers to importing countries that are able to manipulate world prices on the international market. During our discussion, we will look to focus on low-income importing countries, due to their greater propensity to be hurt by rising food prices.

The ten countries with the highest net imports in the world are represented in the figure 7 below. Immediately obvious is the fact that at least eight of the represented countries can be categorised as 'developing' countries. Notable exclusions from the list are China and Russia, as although they were importing significant quantities in previous decades,[7] they have altered their respective importing policies through significantly increased domestic production.

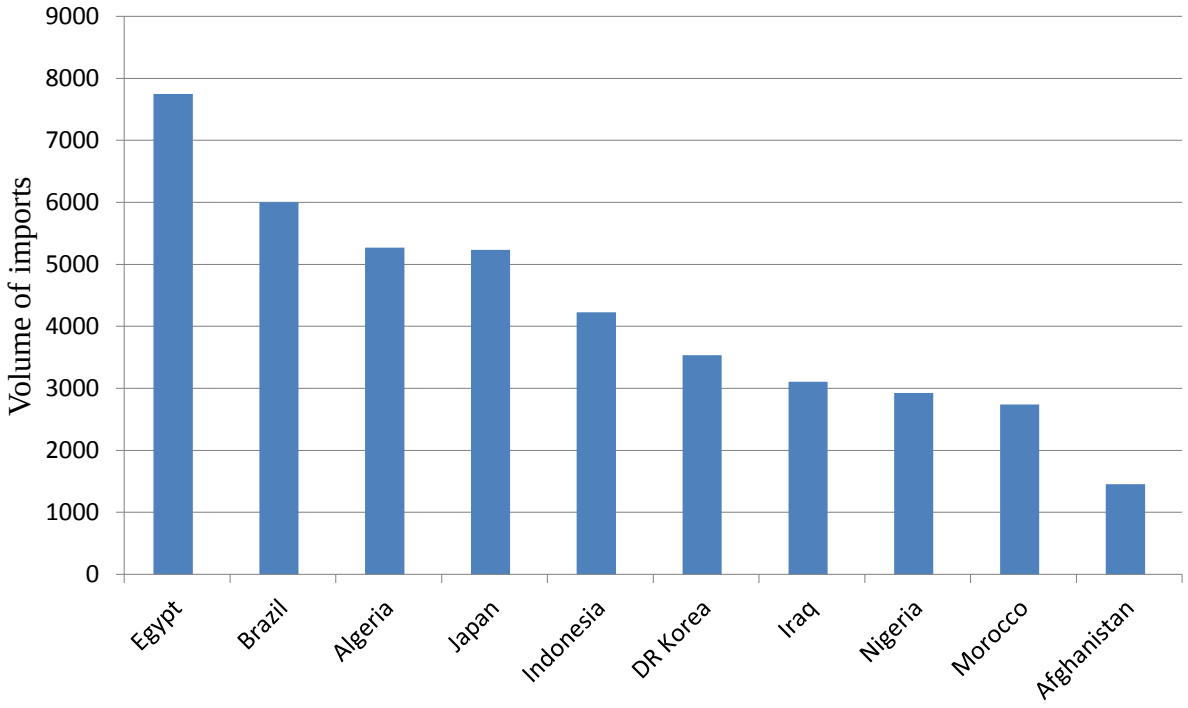

Figure 7. Wheat: Net imports, Average for the period 2000-2009

Values calculated in (`000 tons). Author's compilation; data obtained from WFSG (2010).

[7] China and Russia had aggregate export volumes of 8,560 and 11,402 over the period 1987-1995. (WFSG, 2010)

According to Mitchell and Mielke (2005), global imports have only experienced a moderate growth since 1980. This followed a rapid increase in the 1970s due to major economic and policy changes in several regions and countries. Some of the more significant changes include expanded wheat exports by OPEC[8] and much larger net imports in the Former Soviet Union and Eastern Europe due to low levels of production. In addition to this, there was an import expansion in China, following a shift in policy. OPEC's imports show a positive correlation with the oil price, and hence exhibited stagnation in the 1980s, before increasing again from 1999 onwards. Mitchell and Mielke show that, during the period 1990-2000, Brazil, China, Egypt, Japan, and Russia were the largest importers, accounting for between 5 and 7 percent of global imports each.

Egypt, with the highest import quantity over the last couple of decades, considers wheat a strategic commodity. This is in spite of it only being able to produce half of its wheat consumption of 12 million tons a year. According to several reports,[9] the country has been placed under significant strain by the Russian wheat embargo.

4.1 Policy Tools

On the back of increasing prices and export restrictions by grain-exporters, importing countries have the opportunity to adjust their import tariff levels in order to influence trade in the commodity. The question that arises is whether or not such manipulations serve to decrease price volatility and improve welfare conditions from a national and international perspective.

Let us consider the case of a large grain-importer, such as Egypt in Figure 7 above, to the extent that they are able to manipulate world prices through an alteration their tariff rate. Three courses of action are open to the country:

a. It can raise its tariff level. Upon incidence of export restrictions by large grain-exporters, the terms-of-trade will turn in favour of these countries. An importing country can look to gain through the terms-of-trade effect by raising its import tariff, with a corresponding decrease in the volume of international trade. However, this will

[8] Organisation of Petroleum Exporting Countries
[9] These reports include articles in the media by Ehab (2010) and Thomas White (2010).

compound the burden placed on the domestic consumer, as the already high prices for that commodity will be increased further. Thus, while feasible under an environment of stable prices, one would not expect to witness such an action in low-income importing countries during a food crisis.

Another aspect to take into account is that an increased import tariff could be met with retaliation by other importing countries, which can increase their import tariffs. This would decrease the gains made through the terms-of-trade effect and further decrease trade volume. According to the much-cited paper by Johnson (1954), a country may gain by imposing an optimal tariff, even if other countries retaliate, under the condition that the elasticity of demand for imports is relatively high. This can be shown graphically by Figure 8, which is a simplified version of a figure in the Johnson paper.

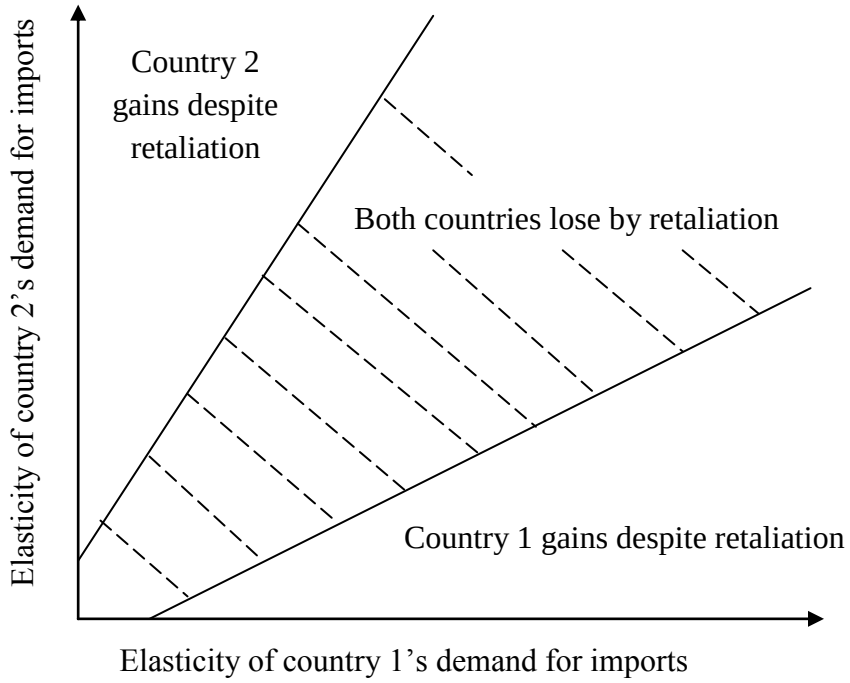

Figure 8. Optimal tariff and retaliation

Source: Johnson (1954)

b. It can lower its tariff level. In this way, importing countries are able to exert downwards pressure on the domestic price of the commodity. Besides, the liberalisation will also increase the volume of trade on the international market, which is seen to be a move in the right direction by many, including the World Trade Organisation (WTO) and the International Monetary Fund (IMF).

   However, several authors disagree that lowering import tariffs can be advantageous [10]. According to Anderson and Nelgen (2010), import tariffs are equivalent to a consumer tax and a producer subsidy. So, lowering an import tariff on a grain commodity has the effect of reducing assistance to farmers. This could create negative effects on the demand for farm labour and the welfare of the rural population.

   Another salient point is that if a large importer were to lower an import tariff, it would result in a deterioration of its terms-of-trade. Furthermore, the reduction of the tariff in question would raise the excess demand for the commodity on the international market. This would result in upward pressure being placed on the world price. I argue, in section 7.2 below, that if an importing country retaliates to an export restriction by lowering its tariff, the resulting price could shift back to the pre-tax level. Yet, this would come at the price of higher volatility and uncertainty on the international market. Additionally, the exporting country could look to implement further restrictions, which would continue the cycle. In this line, Martin and Anderson (2010), maintain that the exporting country will always benefit from this situation, as it will continually improve its terms-of-trade. Moreover import tariffs cannot be reduced below zero. Import subsidies are also limited in their operation.

c. The country could, of course, decide to leave import tariffs unchanged. We shall use Section 6 to look at other options available to countries in an environment of rising food prices.

[10] See for instance Anderson and Nelgen (2010) and Bouët and Laborde (2010)

4.2 Import Tariff Adjustments in Practice

Several large countries and regions manipulate import tariffs to protect price levels. The EU has an upward bound of import tariff dictated by the Uruguay Round of Negotiations in 1994, but member countries are able to adjust the tariff rate within these bounds (Shaffnit-Chaterjee, 2010). This has allowed them to lower the import tariff on cereals to zero in order to protect domestic prices during the recent price spike, which subsequently increased less than on the international markets.

The question as to whether low-income importers are able to benefit from such strategies, to the same degree, is questionable. Pinckney (1993) analyses whether countries like Zambia and Zimbabwe, with high variability in domestic food production, can deal with the impacts arising from import tariff reductions. The author uses a stochastic, dynamic model to describe the free market solution and to design stabilisation policies. The results show that although a move towards free trade yields profits for maize marketing and earns foreign exchange for the country concerned, it creates highly unstable maize prices. Declines in real income, tariff revenue reduction, rapid fluctuations in price and possible political chaos are all salient issues that need to be taken into account in an analysis of the potential gains and losses from implementation liberalisation strategies.

5 Effects of High Prices and Volatility

Surely, the most important point to consider, in dealing with a constantly evolving international agricultural market, is the impact on the welfare of the poorest consumers. An often-stated reason for a protectionist trade policy is that the low-income members of the population need to be protected against paying high prices for staple foods. Nonetheless, an equally important feature of the recent food crisis is that prices have been highly variable. We shall take a look at both these features and analyse their effects on welfare.

5.1 Price Volatility

Following the discussion in Schaffnit-Chatterjee (2010), the ease of price transmissions from global to domestic agricultural commodity markets is dependent on the degree of trade undertaken on the international market in that commodity. The author argues that since 19 percent of the total quantity of wheat produced globally is traded on the international market, one should see a close correlation between domestic and international price movements. His argument might seem a bit oversimplified, as one would also need to consider the degree of openness of the countries, as well as the transportation costs. Notwithstanding, his argument holds in essence. The degree of international price transmission is important when considering to what extent an exogenous event, like an export ban in the Ukraine, would affect a country's domestic market.

This relatively high level of price transmission means that the volatility experienced on the international markets translates to highly variable domestic prices, particularly in small importing countries that are unable to stabilise their domestic price. We can observe from Figure 1 that price variability has risen substantially over the last few years, particularly from 2007 onwards. Gilbert and Morgan (2010) confirm this by showing that price variability has been much higher over the last year than in the period 2006-2007, i.e. the period before the most recent food crisis.

It is important to consider the effect of price volatility on welfare. Economists like Adebusuyi (2004) and Guillaumont et al. (2003) argue that price instability is particularly damaging to owners of small rural farms. The argument is that they are not usually covered by insurance, nor able to rapidly adjust produce levels, as agricultural crop decisions are usually undertaken several months before crop fruition. The price uncertainty also restricts their access to credit markets. This forces farmers to rely on low-risk, low-yield techniques.

Sørensen and Whitta-Jakobsen (2005) note that fluctuations in prices can also be damaging to welfare insofar as households under- or overestimate price levels and make incorrect budgetary decisions. In this way, the inelastic demand characteristic of staple food means that the economic decisions of households are much less flexible in an environment of high food prices. When prices rise quickly, households are forced to forgo certain important expenses, such as healthcare and child education.

5.2 Price Level

It is common among economists to relate high price levels with decreased welfare in developing nations, particularly when these countries have consumers that spend a high percentage of their disposable incomes on food. Trostle (2008) estimates that a 50 percent increase in staple food prices in high-income countries would cause retail food expenditure to rise by only 6 percent. Furthermore, the percentage of income spent on food would only be expected to increase from 10 to 10.6 percent. This is in stark contrast to food-importing countries with low income levels, where the same price shock would increase food expenditure by 21 percent, whilst the percentage of income spent on food rises from 50 to 60 percent.

A point of contention is the effect on low-income countries that have relatively large domestic agricultural markets. It is true that one finds many small farm owners in Asia and Africa that depend on the income provided through the sale of their modest produce. Rice, for instance, is dominated by Asian exporters, with Thailand, India and Vietnam responsible for 60 percent of global exports (WFSG, 2010). The vast majority of rice production in these countries is sourced through smallholdings, with rice also making up a large portion of their diets

(Headey, 2010). Such smallholdings will obviously experience both negative and positive effects from increased prices in the market for their produce.

De Janvry and Sadoulet (2009) assessed the effect of rising food prices on welfare in India. The authors explain how the Indian government was able to suppress domestic prices for commodities that had risen sharply on the international markets, by implementing a range of trade and stock policies. Furthermore, the government increased spending on agricultural subsidies for fertilisers, pesticides, electricity and diesel. The results are evident: Grain prices have only increased domestically by 6.4-6.8 percent per year, which was in line with the national inflation rate of 6 percent.

As a study, de Janvry and Sadoulet created a simulation of the hypothesis that grain prices had indeed risen at the rate seen on the international markets, to better understand the welfare effects of such increases. General perception was that the urban poor would be the biggest losers in such circumstances, and that farmers would gain. Nonetheless, the results, rather surprisingly, disproved this notion. It showed that the rural sector loses the most, with rural households accounting for 79 percent of the aggregate welfare loss among the poor. On the contrary, the urban poor only account for 22.9 percent of the total number of poor losers, and only 22.4 percent of the total expenditure losses of the poor.

The largest impact of rising prices in the domestic grain market was experienced by rural non-farmer households. Their level of expenditure decreased by 15.6 percent compared to the 11.7 percent decrease for urban non-farmers. As far as farm owners are concerned, they are understandably better off as they receive positive benefits from higher food prices. However, according to the regression, large farm owners only received a positive increase of 1.1 percent of total expenditure. On the other hand, small and marginal farm owners suffer a loss of 4.5 percent and 10.6 percent respectively with an aggregated loss of 4.7 percent across farm owners. Farms are categorised as being large if the land covers an area of one hectare or more. Even though large farm owners do not receive a substantial gain in absolute terms from rising food prices, they are still better off in relative terms, compared to smaller farm-owners. When one considers low-income countries with a high percentage of farmers in its population, this impact disparity between wealthy and poor farmers accentuates the difference in income distribution between the groups.

This study is important, as it is general practice to focus attention on the urban poor during times of rapidly rising food prices. I argue that this apparent focus on the urban poor can be explained by the fact that:

i. The urban poor are most likely the easiest to reach in terms of social support programs and social investments. It is far more practical, for example, to maintain a ration shop or to deliver school lunches in the cities, as opposed to distant rural areas.
ii. The urban poor tends to be much more vocal, politically speaking, and more capable of effective protesting.
iii. The urban poor are more susceptible to politicking than the traditionally more conservative rural poor. Thus a well-timed transfer to the poor, or change of policy right before an election, might be more effective if aimed at the urban poor.

We shall thus continue our discussion, in the rest of the thesis, under the assumption that higher prices and greater variability in prices affect low-income countries negatively, regardless of the size of the agricultural sector.

6 Trade Agreements and Policies

We shall now take a look at how the issues described above have been addresses on the various levels. Section 6.1 will deal with global trade policies and agreements, both attempted and proposed. We shall then continue with a discussion of the merits of a diverse range of agreements and strategies on the regional, national and farm levels, respectively. The aim for this section is to create a better understanding of the issues involved in implementing certain strategies, and their desirability, going forward.

6.1 Global Policies and Trade Disciplines

Several attempts to introduce and maintain an equitable solution have been put forward over the last few decades. The General Agreement on Tariffs and Trade of 1947 (GATT) is still used by the 153 member countries of the World Trade Organisation (WTO). GATT explicitly prohibits the use of export restrictions, other than duties, taxes or other charges in Article XI (GATT, 1947).[11] However, an exception is made, in terms of Article XI.2,[12] that quantitative restrictions will be allowed if instituted in order to 'prevent or relieve critical shortages of foodstuffs or other products essential to the exporting contracting party.'

Of course, the definition of 'essential' is up for interpretation. Piermartini (2004) gives an example of the Indonesian government considering cooking oil as an essential commodity, whereby they imposed export taxes in order to keep the price of palm oil products down. Indeed, this lenient subsection of legislation did not dissuade several countries from implementing export restrictions during the 1970s food crisis (Mitra and Josling, 2009), nor during the commodity price boom in 2008, under the argument that grain stocks were at critical levels.

The Uruguay Round Agreement on Agriculture (URAA) was implemented in order to establish a 'fair and market-oriented agricultural trading system ... through substantial progressive reductions in agricultural support and protection.' (Piermartini, Page 14). Some of

[11] GATT Article XI is a section that bears the title: 'General Elimination of Quantitative Restrictions'.
[12] GATT Article XI.2 contains a list of exemptions to Article XI.

the more important results of this agreement were that countries committed to replacing non-tariff import barriers with bound tariffs[13] and reducing those tariffs over an implementation period. In addition, they consented to opening their markets to imports under minimum access provisions, limiting and reducing the most traded-distorting forms of domestic support and capping export subsidies. As pointed out by Mitra and Josling, the Uruguay Round describes the situation regarding export restrictions more explicitly than GATT. It states that members countries should:

- Consider the effect of the prohibition or restriction on importing members' food security,
- Provide notification and explanation to the Committee on Agriculture,
- Consult importing countries with regards to the proposed restriction.

These provisions are relaxed in the case of developing country members.

Despite the significant advances made by the Uruguay Round, the amount of trade liberalisation achieved was modest, owing to the way in which the reforms were implemented (Mitchell and Mielke, 2005). Tariffs were often set at a high level, and bound tariffs even higher, leaving open the possibility of future tariff increases. Wheat export subsidies were reduced by the US and the EU, but this could be attributed to budget constraints rather than to the URAA. In terms of export restrictions, countries have not seemed to abide by the directives stated by the agreement. None of the countries that imposed restrictions during the 2008 complied with notification provision of the URAA.

The Doha Development Agenda (DDA) is the current round of trade negotiations, which started in November 2001. The most salient issue is that of lowering trade barriers. Switzerland and Japan have been particularly vocal in this regard, pushing for an elimination of taxes and restrictions on exports, with an exception made for developing countries (Mitchell and Mielke, 2005). The members of the Cairns Group, a coalition of 19 agricultural exporting countries, have vehemently opposed this. The Group consists of both developing and developed countries, with notable exceptions being EEA members and the US

[13] This refers to an upper limit on the rate of duty that a country can set on its imports.

A recent draft of the DDA does not seem to be in line with the proposals put forward by Switzerland and Japan. It requires that the WTO be notified within a period of 90 days after the imposition of an export restriction. The draft states that the restriction should not 'normally' last longer than one year, with consent from importers required if it lasts longer than 18 months (WTO, 2008). I would imagine that a food crisis, such as that which we experienced in 2008, would not be defined as 'normal' circumstances. This follows that exporting countries would be allowed to impose restrictions for 18 months under such circumstances, without negotiation with the relevant stakeholders. It is no great surprise that Switzerland and Japan found this insufficient.

Given the uncertain outcome and vested interests to exporters and importers, the reliance on the DDA for a feasible solution in the short-term would not be recommended. It would be interesting at this point to consider global policies that have been attempted in the past, and others that have been proposed, in order to consider the effects of future policy implementation.

6.1.1 Price-Band Policy

A new international commodity policy was proposed by United Nations Conference on Trade and Development (UNCTAD) in Nairobi in 1976. This policy, the 'New International Economic Order' (NIEO), included price-band rules that establish floor prices, at which stocks are purchased, and ceiling prices, at which stocks are sold. The weakness of the idea was that prices tended to be far less stable around the mid-point of the bar than at the extremes (the ceiling and floor prices), and there was uncertainty whether it led to a reduction in price volatility.[14] History shows that the programs tended to fail quickly and resulted in a great degree of destabilisation, when they impose these bands. Moreover, it has proved to be a difficult task in setting and adjusting the price-bands.

6.1.2 Physical Buffer Reserve

A global storage policy would be desirable for efficiency and food security purposes, providing an optimal amount of stocks and storage costs. Von Braun and Torero (2009), however, argue that it would be difficult to open up the stocks on a trading system, as too

[14] Several papers discuss the effectiveness of the NIEO, including Wright (2010) and Adams, et al. (1981).

many barriers exist. They instead propose an innovative plan to moderate prices. Participating countries, proposed to be the Group of Eight Plus Five (G8+5), i.e. Canada, France, the US, the United Kingdom, Russia, Japan, Italy, Germany, Brazil, China, South Africa, India and Mexico, would commit funds towards the management of the reserve. It is proposed that the World Food Programme (WFP) should be charged with the running of the reserve, which should be used exclusively for emergency response and humanitarian assistance. The WFP would then have access to the grain reserve, physically located at strategic points, at pre-crisis prices. An emergency fund would be used to cover the cost resulting from the price differential.

6.1.3 Virtual Reserve

A more recent version of the NIEO price-band buffer stock strategy is a proposed 'virtual reserve' (Wright, 2010, page 47). The strategy would operate in commodities that are served by futures exchanges. A designated authority would buy and sell future contracts, taking unhedged positions in order to keep the price of the commodity within a predetermined range. A similar strategy is usually undertaken with a physical buffer stock, but without the need to buy or hold the physical commodity stock. Speculators would be discouraged to take up a position and would hence not exert any exacerbating effect on the commodity price movements. The cost of using this strategy, or indeed any option strategy, relates to the margin payment on the transaction, which is a calculated as a fraction of its final value.

6.2 Regional Policies

Countries can enter into long-term bilateral agreements to protect and stabilise their supply of key commodities. According to Mitra and Josling (2009), there were several agreements of this kind existing in the 1970s, the period of the previous major food crisis, on the international commodity market. These included the pacts on grain between the US and USSR, soybean between the US and Japan and sugar between Japan and Australia. The major difference between the current and former situation is that it was common to handle such trade agreements by state trading entities in earlier times. Mitra and Josling argue against a similar system working today. This is due to the fact that it leads to heightened price volatility and uncertainty for countries that are not involved in the agreement. Furthermore, it

removes the opportunity, for participating countries, to negotiate with other parties that might offer better prices.

An interesting case of a regional agreement that should have been more effective in stabilising supply is that of the 1979 ASEAN Food Security Reserve scheme. The operators of the Reserve were tasked with maintaining stocks of 87,000 tons as a precautionary measure in case one of the members experienced a shortage. Yet, the scheme, which is still in operation, has been limited in its effectiveness as member states have been extremely reluctant to announce emergency situations.

Blanc and Singh (2009) propose that large net-exporting countries need not intervene until a critical point has been reached. They develop a strategy for India to undertake to achieve rice price stability and food security. In their model, it can be rational for India to follow the practice of imposing export restrictions when the price reaches a certain level, under a regime where volatility is high, because other countries impose restrictions.

The authors maintain that the first-best scenario would entail that no country implements restriction. As a side note, von Braun (2008) produces IFPRI data to show that if all countries were to agree to remove all export and import restrictions on grain, there would be a reduction in prices by as much as 30 percent of those that prevailed in 2007-2008.

Nevertheless, Blanc and Singh propose that a second-best scenario would be created if both India and Thailand[15] decide against restricting imports, even if many other countries were to implement restrictions. According to the model, this would prevent the domestic price in India from reaching the critical level. It follows that India's task would be to negotiate an arrangement with Thailand that pointedly excludes restrictions, as this would reduce price volatility and negate the need for export restrictions. This would involve a change in policy direction for India, as it has actively used intervention to protect the domestic rice price and supply.

[15] India and Thailand are the world's largest exporter of wheat, accounting for nearly half of global exports in 2006.

The major problem with regional and multilateral agreements among countries, is that of the divergent incentives of importers and exporters. Exporters are interested in high prices and stable prices for their commodities, while importers favour price ceilings and supply guarantees. In order for exporters to receive an above-market price for their commodities, one would expect that supplies would be required to be restricted. This shifts the balance of power to the exporters, who are able to break trade agreements by implementing export restrictions. The objective would then be to either find a way to institute punitive sanctions on transgressors or to incentivise the appropriate actions.

6.3 National Policies

The actions of governments are important as they send out messages of support and willingness to lessen the impact on those adversely affected.

Several countries, including most of the Middle East and North Africa, subsidise the price of bread in order to offset the damaging effects of price movements on the domestic citizen. Nonetheless, this can be highly disadvantageous when the cost of importing wheat increases. Egypt, for example, had to rapidly shift supply partners from Russia to Western Europe and the US, after the former announced that they were banning wheat exports from 15 August to 31 December. According to estimates by the World Bank, the fiscal impact of the increase in the import cost will be around 0.5 percent of GDP in 2010/2011 (World Bank, 2010).

National stock reserves can be an effective solution to the problem facing individual countries, especially if they are land-locked, low-income countries with poor access to trade routes (Lustig, 2009). Wright (2010) proposes that low-income countries can offset the effects of high food prices by designing reserves to meet certain quantitative requirements for food distribution. In addition, countries can utilise ‘food-for-work and targeted feeding programs. Such programs would lower the total costs and reduce the leakage that is usually associated with feeding schemes.

Countries that have active bio-fuels policies have a further avenue to explore in order to stabilise prices. Bio-fuel support may be considered as an alternative to stock-holding for corn, sugar cane and vegetable oil crops. Therefore, it can be seen to be an effective way to

stabilise prices of agricultural products. In the case of anticipated food shortage leading to extreme prices, a suspension of the bio-fuel mandate can re-direct crops towards food use, thereby providing domestic price stabilization and raising food supply. As mentioned above, bio-fuels are recognised as chief contributor of increasing price prices in agricultural markets, due to its substitution effect with other fuels, as well as its usage of scarce land.

6.4 Farm-Level Practices

1 Farmers can use a number of hedging strategies to protect themselves against unexpected negative outcomes. Possible strategies could include the adoption of inventory stocks, as well as transacting on the futures market. In terms of the latter, option contracts are the most commonly used.

A farmer could offset rainfall risk by entering into a long call option, a put option or a combination of the two. A put option could be a beneficial tool for farmers facing volatile prices too, while still retaining upside potential. By providing them with the right, but not the obligation, to sell a futures contract for an underlying commodity, once the strike price falls to a certain level, farmers can protect themselves against poor returns. This will result in there being a virtual floor price on the commodity market. Geyser and van der Venter (2001) provide an example of the high drought risk months of January and February in Australia. Farmers have the opportunity to purchase two-month put options to protect themselves against lower returns. If the rainfall during this period is not sufficiently high, the farmer can exercise the option.

Despite the volatility in prices that farmers receive for their agricultural produce, use of hedging strategies, like futures, are used rather sporadically (Simmons, 2002). Pannell et al. (2008) theoretically derive the optimal hedge ratio within a mean-variance framework to show that this limited confidence in hedging strategies is understandable and consistent with rational decision-making. In addition, the authors analyse the concepts of basis risk, transaction costs and uncertainty about production. Their findings are that these concepts have only a moderate effect on the optimal hedge ratio, with uncertainty having only a minor influence. Beside, lower price uncertainty reduces the optimal hedge ratio.

Other authors have provided reasons as to why the optimal hedge is lower than expected. Lence (1996), for instance, shows that the degree of diversification of farmers' investment portfolios has a negative relationship with their optimal hedging ratios. Another reason is that other risk management strategies are likely to reduce the optimal hedging strategy (Pannell, 2008). An example, in this respect, could be the degree of prominence of government support for farmers. In a recent study by Anderson et al. (2010), Norway was estimated as having the highest NRA (Nominal Rate of Assistance) of the 75 sampled countries, which together made up between 90 and 95 percent of global agricultural production.

7 Theoretical framework

7.1 The Dynamics of Export Restriction Manipulation

In this section, I shall introduce a simple two-country model, which is a variation of the model used in a paper by Shei and Thompson (1977). However, in the second part of the model, I shall bring forward some important economic insight by Nakajima (1977) and build it into the model accordingly. This analysis will be used in order to gain an understanding of the consequences of government policies aimed at protecting the domestic price level. Moreover, we shall also look to gain a further understanding as to the reasons countries utilise quantitative export restrictions. We will look at the effect in the market for one commodity in a large food-exporting country, a large food-importing country and the international market for this commodity. This will be done under the assumption that the supply of the commodity to be stochastic and that it is produced and traded in both countries. I shall also use the assumption that the commodity is a staple food product and, as such, it has a relatively low price elasticity of demand.

Figure 9 presents the model graphically. The countries' supply and demand curves are shown in panel (a) and (c). Panel (c) depicts the excess demand curve of the net-importer and the excess supply curve of the net-exporter. The vertical axes describe the price level and the horizontal axes show the quantity level in the international and domestic markets.

Assume the *ex ante* scenario is represented by a price level of P, where markets are unrestricted and open for trade, and transport and logistical costs are not represented. The exporting country exports an amount of AB, which is equivalent to E on the international market and GH in imports in the importing country. We assume there to be an exogenous shock in the importing country that decreases their supply of the commodity, for instance a breakout of fires, which destroys much of the cropland. The importing country supply curve shifts to the left (SS_m to SS'_m), which reduces their self-sufficiency and makes them more

reliant on the international market. This leads to a rightward shift in the excess demand curve from ED to ED'. The price level rises in all three markets to P' and exports rise in the exporting country together with a imports in the importing country to CD and IJ respectively.

Now assume that the exporting country decides to use protectionist policies to stabilise its domestic commodity price by implementing an export quota. Suppose the country limits its exports to an amount AB. In this case the international commodity price and importing country domestic market price will increase to P''. This increase from P to P'' is much higher than the free trade scenario from P to P' and represents greater volatility in the international and importing country domestic markets.

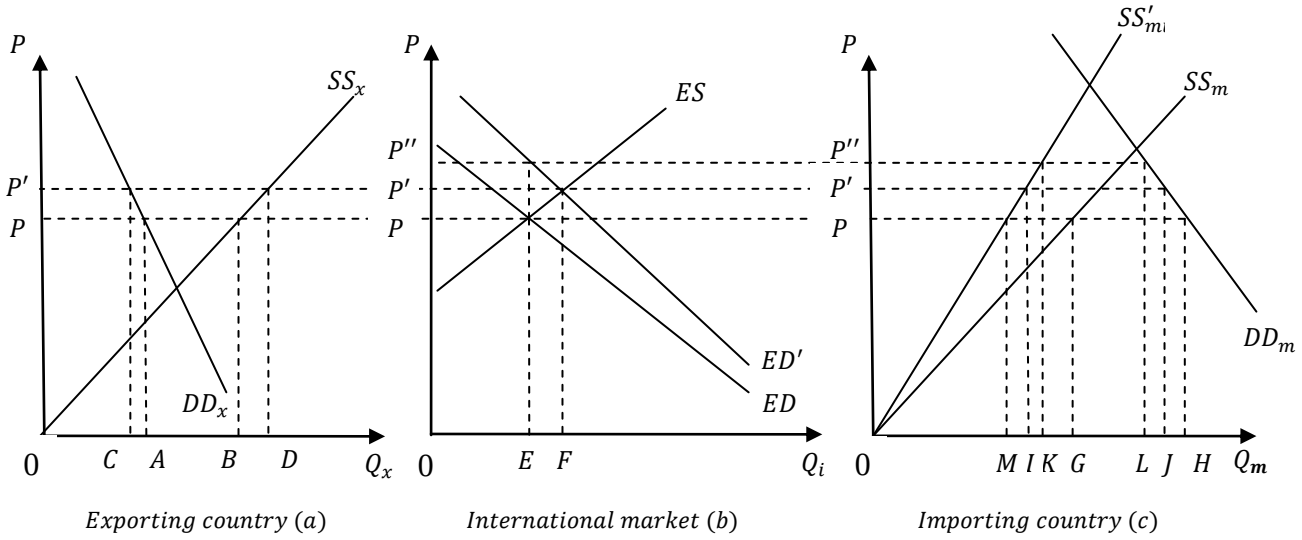

Figure 9. Two-country model of export restrictions

Source: Shei and Thompson (1977)

Let us now consider a model of an exporting country implementing a system of both export taxes and export quotas, before the price shock has occurred. Let us say that they institute a tax equal to T, on top of the quantitative restrictions already in place, where:

$$T = P' - P_a = P'' - P = P''' - P'$$

If one follows the graphical representation in figure 10, producers of the export goods in country (a) reduce their domestic price to P_a in response to the higher costs of exporting the commodity and sell a greater quantity of the good domestically, lowering their available export quantity. The price on the international and importing-country domestic market rises to P' in response to the decreased quantity of the good on the international market and corresponding with a shift of the excess demand curve from ES to ES'. The exporting country exports an amount, $MN = U$, which is lower than in the initial equilibrium case without taxes.

Suppose, as before, that a supply shock in the importing country shifts demand on the international market to the right. The price on the international market rises to P'' and the price in the exporting country rises to P, corresponding with a shift of the excess demand curve on the international market from ED to ED'. The exporting country exports a greater amount, equivalent to line segment AB in the exporting country, with the quantity of the good on the international market rising to E. At this point, the export quota of AB does not affect the equilibrium.

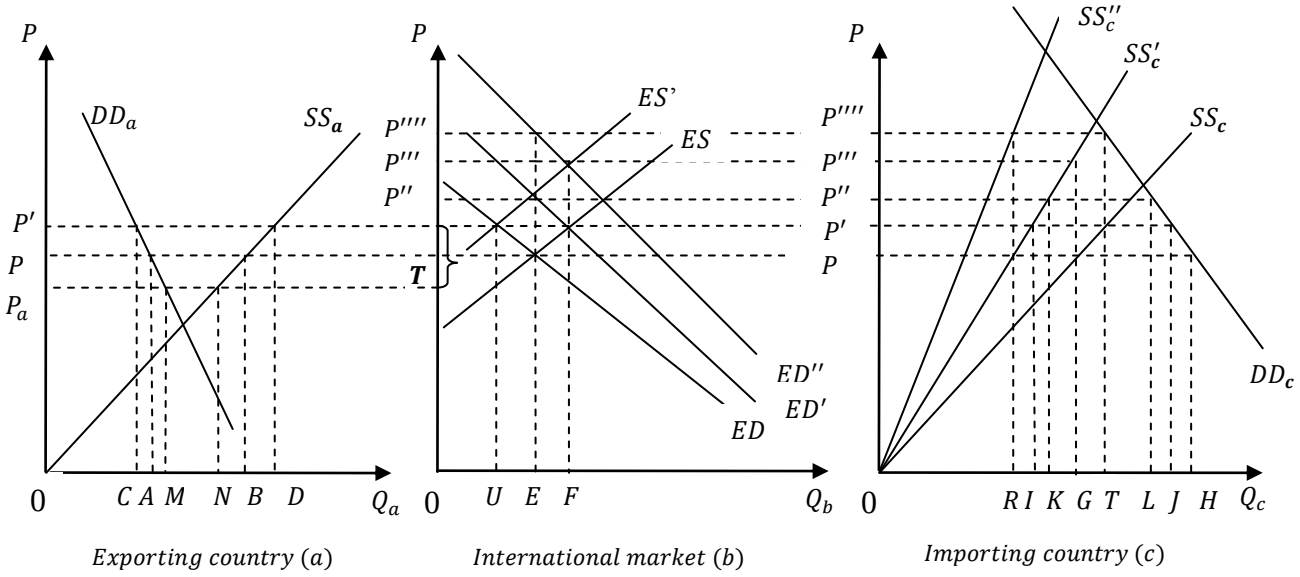

Figure 10. Model of a system with export tax and export quota

Adapted from Shei and Thompson (1977)

Nevertheless, a further rightward shift of the supply curve in the importing country (and the excess demand curve on the international market), for whichever reason, would make the restriction non-trivial. In this case, the increased excess demand does not affect the domestic price level or quantity in the exporting country, but it pushes prices on the international market and in the importing country to P'''', instead of to P''', as would have been the case had the quota not been in place. The importing country will import an amount of RT. It should be noted that the government in the exporting country could have placed a tax equal to $(P'''' - P)$, without needing to install a quantitative restriction, thereby increasing tax revenue. However, this would mean that the government would have to know the exact level of P'''', which would be extremely difficult, given a volatile market for the commodity.

The shift illustrates that when overseas demand shifts upwards due to reasons discussed earlier in the text, it is not always necessary to restrict the volume of exports of the commodity in order to maintain a suitable domestic price, as one could, instead, raise the commodity export tax (Nakajima, 1977). In reality, it quite difficult to use export taxes in this way. This is due to the fact that overseas demand does not move up and down in clearly defined units of measure but will, instead, move up and down rather continuously. Hence, one can see the challenge in adjusting export taxes in order to keep domestic prices constant at a certain level.

Therefore, in terms of practicality alone, it is understandable that exporting countries utilise quantitative restrictions as a safety measure against shocks in demand on the international market for the specified commodity. The argument, though, in favour of taxes is that they produce a lower domestic welfare loss than in the case of quantitative restriction when applied commodities with have relatively low price elasticities of demand (Mitra and Josling, 2009).

7.2 Key Impacts of an Export Tax

Let us take a closer look at the situation on the international market relating to panel (b) in the above model and depicted in Figure 9 above. I will extend a simple theoretical model used in a paper by Martin and Anderson (2010) by incorporating three countries, instead of two groups of numerous countries, in order to investigate the situation from a broader perspective. Let us introduce a three-country model, where we have a large exporting country, a large importing country and a small importing country. Furthermore, let us assume that the large exporting country restricts exports by raising the export tax. The motivation for such a policy could be to reduce the domestic price of the commodity relative to the world price, after an exogenous shock has reduced stocks and raised prices on the international market.

Say that, *ex ante*, the economy is at point a in Figure 11 below. The excess demand curve, ED, and excess supply curve, ES, relate to the situation after an exogenous shock has occurred, but before an adjustment in the export tax. Upon implementation of the tax, the excess supply curve shifts to the left to ES'. On the other hand, the world price rises from P_W to $P_W{}'$ and the domestic price in the exporting country falls from P_D to $P_D{}'$.

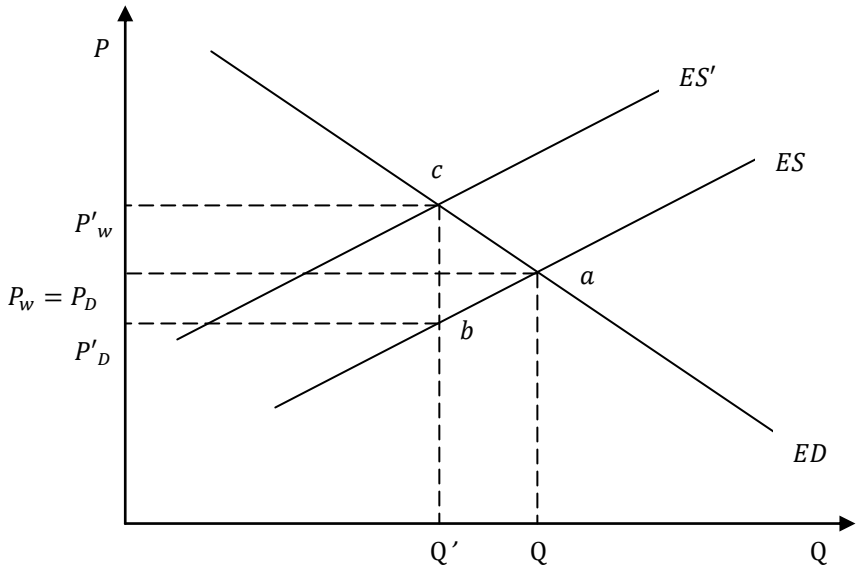

Figure 11. Impact of an export tax on the international market

Source: Martin and Anderson (2010)

The global social cost arises from producer and consumer distortions, referred to in section 3.4 above, and can be represented graphically by the triangle abc. The loss to private agents in the importing countries is represented by the area acP'_WP_w, whereas the loss to private agents in the exporting country is covered by the area $abP_D{}'P_D$. There is also a gain in terms of government revenue, represented by the area $cbP_DP'_W$. The exporting country will gain from the export restrictions if the upper rectangle, which represents the terms of trade effect, is larger than the lower triangle, which represents the corresponding deadweight loss. Conversely, there will be an unambiguous loss to the importing countries.

The situation will be different if the large importer reacts to the export tax by making adjustments to import policy. The situation is addressed in Figure 12 below. Suppose that the importer was able to insulate its domestic market by lowering import tariffs on the agricultural commodity. This reaction would shift the excess demand curve to the right, and the resulting world price would be pushed to an even higher level, characterised by point d.

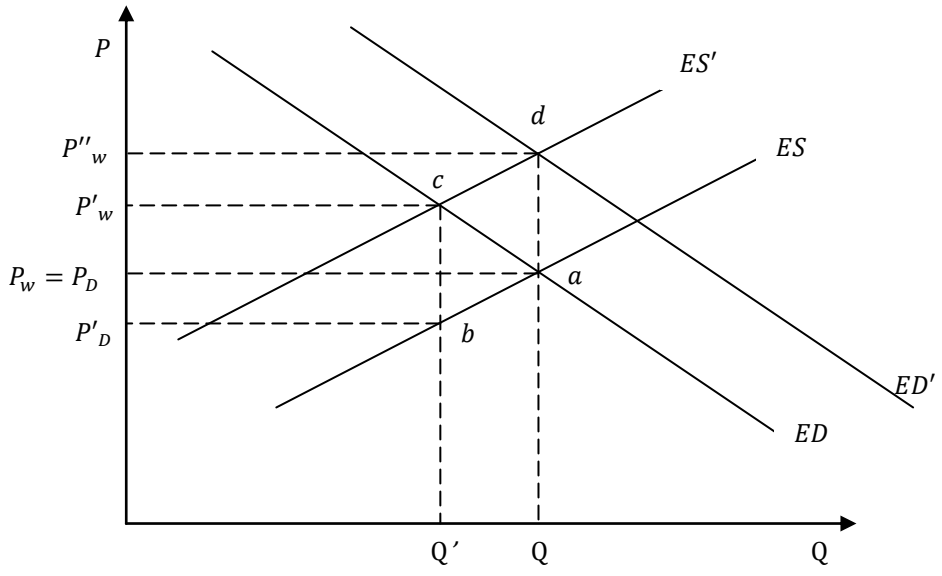

Figure 12. Impacts of equivalent export tax and import tariff

Source: Martin and Anderson (2010)

The domestic price in the exporting country could, conceivably, be back at the original level. Nevertheless, the small importer would be unambiguously hurt by higher world prices. According to Martin and Anderson (2010), the consequence would be compounded by the terms-of trade effect in favour of the large exporter and would multiply the variance of the income redistributions by a factor of four.

An important understanding from this section is that the large exporting country would be faced with important decisions regarding possible actions on the back of greatly inflated prices. On the one hand is the need to secure adequate food supply and keep the domestic price level low, while on the other hand is the fact that the effect will be reduced if importers react by lowering import tariffs. Even so, both export restrictions and import tariff reductions serve to improve the terms-of-trade in favour of the large exporting country

7.3 Equilibrium Analysis of Different Market Actors

In order to gain a better understanding about the distinction and the comparative decisions facing countries, which differ fundamentally in terms of choice of product and scale of production, I shall put forward a general equilibrium analysis of international trade. The foundation of the model is from a paper by Bouët and Laborde (2010). Nonetheless, they do not provide sufficient explanation of their thinking behind the model or of the steps undertaken. Furthermore, they use quite a strange method of deriving the derivative of income expression. Another difference between the two models is that they analyse the impact through changing prices, whereas I explicitly analyse the situation through the changing tax or tariff. In addition, I shall put forward a more thorough investigation of the impacts of trade policy on income, making use the equivalent variation concept.

We shall introduce a model of international trade involving two large countries, 1 and 2, and a small country, 3. Following the definition used thus far in the text, the small country cannot influence the world price of the commodity, while the large countries can influence the world price. The countries each produce two commodities, an agricultural good, A, and an industrial good, I. Countries 2 and 3 have a comparative advantage in and export the industrial good, while country 1 has a comparative advantage in and exports the agricultural good.

Country i has a welfare function as denoted by U_i, with the domestic demand/consumption of country i for good k represented by D_i^k, where $\forall i = 1,2,3; \forall k = A, I$. We shall assume that welfare depends only on domestic consumption of the goods.

The production of good k in country i is represented by X_i^k. We shall denote π as the relative price of the agricultural good on the world market in terms of the price of the industrial good, while p_i is the relative domestic price of the agricultural good in country i. The industrial good price is treated as numeraire. The income in country i is represented by y_i.

I shall make the simplifying assumptions that there are no transport costs and that government revenue generated by the instruments is redistributed without loss. Further assumptions are made that competition is perfect within the respective countries in the factor and product

markets, and that the government will attempt to maximise national welfare by selecting either an import tariff, or an export tax.

We shall assume that trade is balanced in each of the countries:

$$X_i^I - D_i^I = \pi \left(D_i^A - X_i^A \right) \tag{7.1}$$

7.3.1 Case 1: Export Tax in a Large Food-Exporting Country

We shall attempt to show the effect of a tax, t_1, on agricultural exports and income in the large agricultural exporter, Country 1. The relationship between domestic and international prices can be expressed as:

$$\pi = p_1 t_1 + p_1 \tag{7.2}$$

The supply of agricultural exports can be represented as:

$$E_1^A = X_1^A \left(X_1^I \left(p_1 \right) \right) - D_1^A \left(p_1, y_1 \right) \tag{7.3}$$

where agricultural production decisions are based on the relative price and production of the industrial goods. Differentiating this equation by use of the chain rule and product rule equates to:

$$dE_1^A = \frac{\partial X_1^A}{\partial X_1^I} \frac{\partial X_1^I}{\partial p_1} dp_1 - \frac{\partial D_1^A}{\partial p_1}(p_1, y_1) dp_1 - \frac{\partial D_1^A}{\partial y_1}(p_1, y_1) dy_1 \tag{7.4}$$

We can see from this expression that a rise in price will effect the export level through a change a production as well as a change in domestic consumption. Let us now turn an analysis of the impact of an export tax on domestic income in Country 1. We can represent the budget constraint as:

$$D_1^I + p_1 D_1^A = y_1 = X^I + p_1 X_1^A + p_1 t_1 E_1^A \tag{7.5}$$

which encapsulates income generated from the productive facilities of the country in terms of relative prices and income generated from agricultural commodity export.

By inserting for equations (7.2) and (7.3), and re-arranging, we can write the expression as:

$$D_1^I + p_1 D_1^A = X_1^I + p_1 X_1^A + (\pi - p_1)(X_1^A - D_1^A)$$
$$= X_1^I + \pi X_1^A - (\pi - p_1) D_1^A$$
$$D_1^I + \pi D_1^A = X_1^I + \pi X_1^A \tag{7.6}$$

which provide us with the consumption and production relationship in terms of the world price. If the country's indirect utility function is:

$$V_1 = V_1(p_1, y_1) \tag{7.7}$$

then , by using Roy's theorem, we can find the following expression for domestic consumption of the agricultural commodity in Country 1:

$$D_1^A = -\frac{\frac{\partial V_1(p_1, y_1)}{\partial p_1}}{\frac{\partial V_1(p_1, y_1)}{\partial y_1}} \tag{7.8}$$

And thus:

$$\frac{\partial V_1}{\partial y_1} D_1^A = \frac{\partial V_1}{\partial p_1} \tag{7.9}$$

We shall now look to find an expression for dy_1. The concept of equivalent variation will be used to find the change in income appropriate to keep consumers on the same utility level, after a change in the tax rate. The following equation represents the concept.

$$V_1\left(p_1 + \frac{dp_1}{dt_1} dt_1,\ y_1 + \frac{dy_1}{dt_1} dt_1\right) - V_1(p_1, y_1) = V(p_1, y_1 + dy_1) - V_1(p_1, y_1) \tag{7.10}$$

Differentiating the left-hand side, with the right-hand side equating to zero, provides us with:

$$\frac{\partial V_1}{\partial p_1} \frac{dp_1}{dt_1} dt_1 + \frac{\partial V_1}{\partial y_1} \frac{dy_1}{dt_1} dt_1 = \frac{\partial V_1}{\partial y_1} dy_1 \tag{7.11}$$

Inserting (7.9):

$$(7.12) \qquad \left(-\frac{\partial V_1}{\partial y_1} D_1^A\right)\frac{dp_1}{dt_1}dt_1 + \frac{\partial V_1}{\partial y_1}\frac{dy_1}{dt_1}dt_1 = \frac{\partial V_1}{\partial y_1}dy_1$$

Factorising this equation leaves us with:

$$(7.13) \qquad \frac{\partial V_1}{\partial y_1}\left(\frac{dy_1}{dt_1} - D_1^A\frac{dp_1}{dt_1}\right)dt_1 = \frac{\partial V_1}{\partial y_1}dy_1$$

Solving for dy_1, we find:

$$(7.14) \qquad dy_1 = \left(\frac{dy_1}{dt_1} - D_1^A\frac{dp_1}{dt_1}\right)dt_1$$

This equation shows us the effect of the tax rate on income and consumption. We now look to expand the first term in brackets. Let us reintroduce our Country 1 income equation (7.5) and differentiate it with respect to t_1.

$$(7.15) \qquad \frac{dy_1}{dt_1} = \frac{dX_1^I}{dt_1} + p_1\frac{dX_1^A}{dt_1} + X_1^A\frac{dp_1}{dt_1} + \frac{d(p_1 t_1 E_1^A)}{dt_1}$$

Inserting this expression back into (7.14)

$$(7.16) \qquad dy_1 = \left\{\left(\frac{dX_1^I}{dt_1} + p_1\frac{dX_1^A}{dt_1} + X_1^A\frac{dp_1}{dt_1} + \frac{d(p_1 t_1 E_1^A)}{dt_1}\right) - D_1^A\frac{dp_1}{dt_1}\right\}dt_1$$

Since we are assuming perfect competition, the economy is located on the production frontier, and as such: $\frac{dX_1^I}{dt_1} + p_1\frac{dX_1^A}{dt_1} = 0$. Thus:

$$(7.17) \qquad dy_1 = \left\{\left(X_1^A\frac{dp_1}{dt_1} - D_1^A\frac{dp_1}{dt_1}\right) + \frac{d(p_1 t_1 E_1^A)}{dt_1}\right\}dt_1$$

Using our supply definition, equation (7.3), we can simplify the equation to:

$$(7.18) \qquad dy_1 = \left(E_1^A\frac{dp_1}{dt_1} + \frac{d(p_1 t_1 E_1^A)}{dt_1}\right)dt_1$$

Using the product rule, we can expand this to read:

$$dy_1 = \left(E_1^A \frac{dp_1}{dt_1} + E_1^A \frac{d(p_1 t_1)}{dt_1} + p_1 t_1 \frac{dE_1^A}{dt_1}\right) dt_1 \quad (7.19)$$

Inserting for equation (7.2), we find that:

$$dy_1 = \left(E_1^A \frac{dp_1}{dt_1} + E_1^A \frac{d(\pi - p_1)}{dt_1} + p_1 t_1 \frac{dE_1^A}{dt_1}\right) dt_1 \quad (7.20)$$

This allows us to simplify the expression to read:

$$dy_1 = \left(E_1^A \frac{d\pi}{dt_1} + p_1 t_1 \frac{dE_1^A}{dt_1}\right) dt_1 \quad (7.21)$$

The higher export tax will lead to several effects. Firstly, it increases the cost of exporting, which entices domestic producers to sell a larger quantity domestically and less on the international market. This brings down the domestic price and raises the world price, since the country is a large exporter. The first term on the right-hand side represents the effect of a higher export tax on the world price and represents a positive term-of-trade effect for Country 1. The second term represents the effect of a higher export tax on export volume.

Figure 13, below, depicts the situation facing country 1, the large food-exporter. The vertical axis represents agricultural commodity volume, while the horizontal axis represents industrial commodity volume. The level of production is situated on the frontier of the production possibilities frontier. Initially, the world price of the agricultural good is π, while the domestic government has the objective of maintaining prices at p_1. In order to achieve this, the country implements a tax of t_1 on agricultural exports, where the difference between the international and domestic prices is $t_1 p_1$. If the international market conditions change to the point where the world price increases to π', then Country 1 will need to raise its export tax to compensate, such that the domestic price remains the same. One can see in the figure that the country's income rises from Y to Y' in line with the reasons given above.

Domestic consumption of both goods in Country 1 will increase in line with the new budget constraint, which we take from equation (7.6):

$$D_1^I + \pi D_1^A = X_1^I + \pi X_1^A \quad \Rightarrow \quad D_1^I + \pi' D_1^A = X_1^I + \pi' X_1^A$$

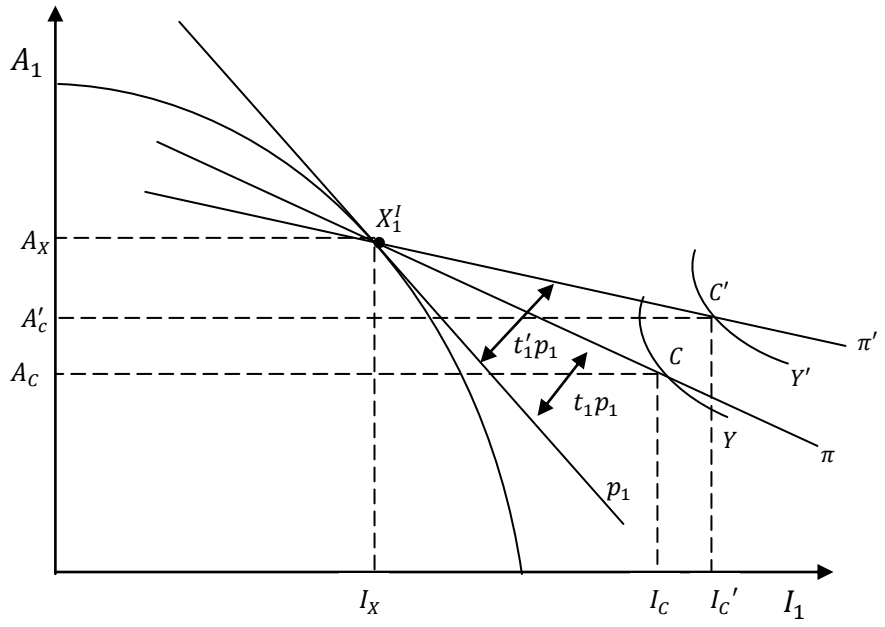

Figure 13. Country 1: Export tax policy under domestic price target

Source: Bouët and Laborde (2010)

7.3.2 Case 2: Import tariff in a large food-importing country

We shall now look at a similar situation in the case of an import tariff, t_2, in Country 2. The relationship between the domestic price in Country 2 and the world price for the agricultural commodity can be represented as:

(7.22) $\quad p_2 = \pi + \pi t_2$

Once again, we begin with the trade equation, where the demand for agricultural imports can be represented by:

(7.23) $\quad M_2^A = D_2^A\,(p_2, y_2) - X_2^A(X_2^I\,(p_2))$

Differentiating this equation yields:

$$dM_2^A = \frac{\partial D_2^A}{\partial p_2}(p_2, y_2)dp_2 + \frac{\partial D_2^A}{\partial y_2}(p_2, y_2)dy_2 + \frac{dX_2^A}{dX_2^I}\frac{dX_2^I}{dp_2}dp_2 \tag{7.24}$$

The budget constraint for Country 2 can be represented by:

$$\begin{aligned} D_2^I + p_2 D_2^A = y_2 \; &= X_2^I + p_2 X_2^A + \pi t_2 M_2^A \\ &= X_2^I + p_2 X_2^A + (p_2 - \pi)\left(D_2^A - X_2^A\right) \\ &= X_2^I + \pi X_2^A + (p_2 - \pi)D_2^A \end{aligned} \tag{7.25}$$

This expression can be written as:

$$\begin{aligned} D_2^I + p_2 D_2^A &= X_2^I + p_2 X_2^A + (p_2 - \pi)\left(D_2^A - X_2^A\right) \\ &= X_2^I + \pi X_2^A + (p_2 - \pi)D_2^A \end{aligned}$$

$$D_2^I + \pi D_2^A = X_2^I + \pi X_2^A \tag{7.26}$$

With the use of the concept of equivalent variation, we can use a similar method to the one used above to find an approximation for dy_2.

$$dy_2 = \left(\frac{dy_2}{dt_2} - D_2^A \frac{dp_2}{dt_2}\right) dt_2 \tag{7.27}$$

Once again, we differentiate our expression for country income, which is equation (7.25) in this case, with respect to the tariff, t_2.

$$\frac{dy_2}{dt_2} = \frac{dX_2^I}{dt_2} + p_2 \frac{dX_2^A}{dt_2} + X_2^A \frac{dp_2}{dt_2} + \frac{d\left(\pi t_2 M_2^A\right)}{dt_2} \tag{7.28}$$

The expression for dy_2 can be found by inserting (7.28) into (7.27).

$$dy_2 = \left\{\left(\frac{dX_2^I}{dt_2} + p_2 \frac{dX_2^A}{dt_2} + X_2^A \frac{dp_2}{dt_2} + \frac{d\left(\pi t_2 M_2^A\right)}{dt_2}\right) - D_2^A \frac{dp_2}{dt_2}\right\} dt_2 \tag{7.29}$$

Using similar manipulations to those used above, we find that:

$$dy_2 = \left(-M_2^A \frac{d\pi}{dt_2} + \pi t_2 \frac{dM_2^A}{dt_2}\right) dt_2 \tag{7.30}$$

As in the case with Country 1, equation (7.30) tells us that Country 2's income can be affected either by a change in world prices or by a variation in traded quantities. The term-of-trade effect in this case would be negative if the country were to decrease its import tariff, as it would lead to a higher world price and, thus, a higher cost of importing.

We can depict the case of Country 2 in Figure 14, below. Country 2 is tasked with maintaining a domestic price of p_2 for the agricultural commodity. The world price of the agricultural commodity is initially at π, which a corresponding import tariff of t_2. Supposing a positive demand shock on the international commodity, that increases the world price to π', Country 2 will decrease its import tariff from t_2 to t_2', such that p_2 remains the same. The country's income level will subsequently decrease, as represented in the figure by the move from Y to Y'. Moreover, the consumption of both goods will decrease.

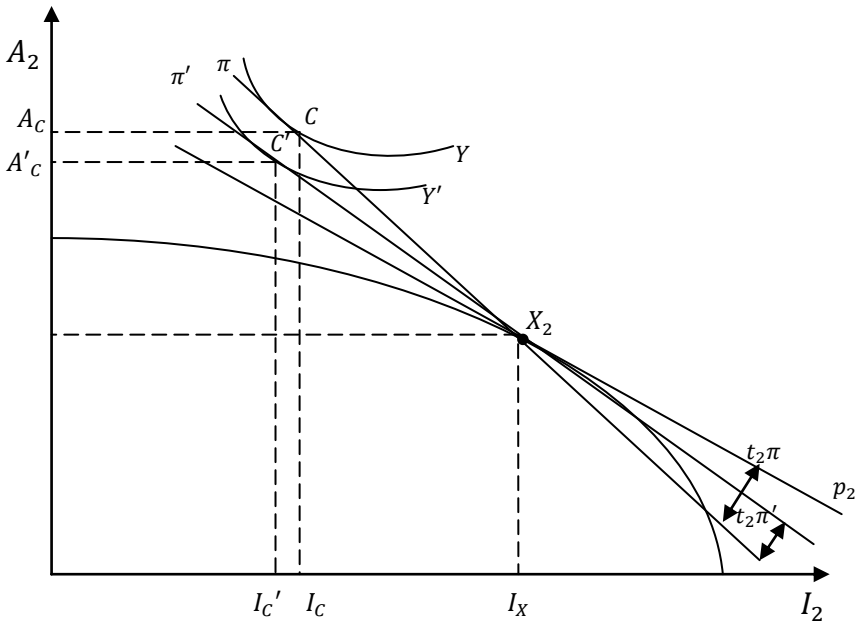

Figure 14. Country 2: Import tariff policy under domestic price target

Source: Bouët and Laborde (2010)

7.3.3 Case 3: Import Tariff in a Small Food-Importing Country

We can also briefly deal with the situation of Country 3. We know that it has a comparative disadvantage in the production of the agricultural good and thus imports this good. Its change in real income can be represented as:

$$dy_3 = \pi t_3 dM_3^A \tag{7.31}$$

Since it is a small country, it is unable to manipulate the world price of the agricultural good and, as such, cannot influence its terms of trade. The right-hand side of (7.31) shows that the decreased level of imports, arising from an increase in the import tariff, will lead to decreased tariff revenue and will lower income.

Overall, we see graphically that an international agricultural commodity shock, such as an export ban in another country that causes uncertainty in the markets that raises the relative world price to π', will have opposing effects in the two large countries. While Country 1 will see an increase in income, Country 2 will be faced with a decrease, and the terms-of-trade effect will be positive for Country 1 and negative for Country 2. From the model, we can also see that Country 3 will be affected negatively and will be faced with a decreased level of income. Total world welfare will be effected negatively.

We can make two observations about the behaviour of the countries, under the assumptions given in the model above:

i. There are two main effects following from an increase of a tax and a decrease in a tariff in the large food-exporter and large food-importer, respectively. There will be an improvement in the terms of trade of the country implementing the change and a deterioration for the other country. Moreover, there will be an additional decrease in traded volume for all involved in the trade of the commodity with that country, including the country itself. This understanding follows from the expressions for real income changes. The terms of trade improvement comes about due to the changing in relative prices. The relative price of the agricultural commodity will, for instance, decrease for the large food-exporter, when the country in question implements an export tax. The large countries may decide to

decrease their tax to deteriorate their terms of trade and increase trade volume. The rationale behind this would be to breathe life into a struggling sector by reducing the distortionary effect of the tax. There could be certain political advantages to such a decision.

ii. If both of the large countries look to place a downward influence on their respective domestic food prices, the large food-exporter will increase its export tax and the large food-importer will decrease its import tariff. The effects of both actions will be towards an increased world price of the agricultural good. Country 3 will inevitably be hurt both in terms of welfare and food security.

7.4 Welfare Effects of Food Price Increases

We have already discussed the issues pertaining to welfare effects in low-income importing countries. These countries bear the brunt of the export restrictions and import tariff reductions implemented by large countries. I shall use this opportunity to put forward a model similar to that used in a paper by de Janvry and Sadoulet (2008) to analyse the impact of food price increases on individual households. The model takes into account potential positive welfare effects on food producers, i.e. farmers, which is necessary in any analysis of low-income countries with large agricultural economies.

Consider that a household produces and consumes a certain amount of non-food and food items. Income is received from labour and transfers. In addition an amount of food and non-food products, q_F and q_{NF}, can be sold at their respective market prices, p_F and p_{NF}. Labour income is characterised by wL and T represents other income, including government transfers.

The household's indirect utility function can be written as:

$$(7.1) \quad V = V(p, y)$$

$$= V(p, p_F q_F + p_{NF} q_{NF} + wL + T)$$

Production and labour are set at the levels that maximise utility. We can solve the problem using Roy's theorem, with non-food and food being considered as a vector of items:

$$(7.2) \quad dV = \frac{dV}{dy} [p_F(q_F - c_F) d \ln p_F + p_{NF}(q_{NF} - c_{NF}) d \ln p_{NF} + wL \, d \ln w]$$

The expression in square brackets is a measure of the change in real income, which comes about through changes in the price level and subsequently, the wage level. An increase in the price of food, p_F, leads to a positive welfare effect, if the household is a net seller of food and a negative welfare effect, if it is a net buyer.

Thus, the welfare effect of prices shocks can be represented by:

$$(7.3) \quad dW = p_F(q_F - c_F) d \ln p_F + p_{NF}(q_{NF} - c_{NF}) d \ln p_{NF} + Lw \, d \ln w$$

One can extend the model of de Janvry and Sadoulet by looking at the analysis from a purchasing power perspective. Let purchasing power of a representative farming household be represented by γ and let α represent the portion of the household budget spent on food.

$$(7.4) \quad \gamma = \frac{y}{p}$$

$$= \frac{p_F q_F + p_{NF} q_{NF} + wL + T}{\alpha(P_F) + (1 - \alpha)(P_{NF})}$$

Hence, small food-importing countries, such as country 3 above, would be faced with differing welfare effects of increased world prices, depending on the degree of reliance on the commodity in question as a staple food. It would also depend on the wage elasticities.

As shown in the model in section 7.1, export restrictions create environments with high price volatility. We also found in section 5, based on the available economic literature, that increased price volatility necessarily worsens national welfare of small low-income countries, regardless of the degree of agricultural establishment. The model in section 7.3 represents the effects of export taxes and import tariffs on the international commodity market. It tells us that both country 2 and country 3 will experience decreased income, and the lower volume of trade on the international market would put upward pressure on the world price of the commodity.

8 Conclusion

In this thesis, I have presented a survey of existing literature on trade policies during the 2007-2008 Food Crisis. It is accepted that high prices leading up to May 2008 were the result of certain key factors. Nonetheless, I have laboured under the assumption that protectionist trade policies have been the most prominent source of erratic conditions in the agricultural commodity market. This follows from my argument that initial estimates of the importance of certain factors did not take into account short-term market interventions.

Throughout the thesis, I have paid cognisance to the fact that there is more than one actor in the global economy. In this respect, it can be seen from the analysis that grain export restrictions do not exist in a vacuum and must be seen from a holistic perspective. One of the key roles of this thesis is to explain the rationale used by different market actors in their utilisation of trade policy.

Despite the improvement in domestic conditions in food-exporting countries upon implementation of tightening trade barriers, several consequences may follow. If implemented by countries large enough to affect the global market, the international commodity price will be driven up. The closure of previous avenues of supply on the market leaves countries scrambling for the remaining grain supply, increasing the competition and forcing prices up. Consequences of higher food prices are significant when dealing with the welfare of consumers in low-income countries.

It is not unreasonable that large exporting countries implement export restrictions. Under the circumstances, their actions can be considered optimal from their perspective. Even with the distorting effects of an export restriction, giving rise to production and consumption inefficiencies, large exporters experience a total gain through the terms-of-trade effect. Furthermore, there are other advantages accruing to exporters from the implementation of export restrictions. Political leaders gain as they are seen to be supportive of the needs of the electorate by keeping food prices under control and providing an adequate supply level. Additionally, if the export restriction takes the form of a tax, the increased revenue can be use to stabilise the consumption of the poor.

However, as far as global welfare is concerned, export restrictions lead to an unambiguous loss. Food-importing countries are faced with a policy dilemma, during periods of high prices. On one hand is the need to dampen the domestic effect by lowering import tariffs, which comes at the cost of a worsened terms-of-trade. Moreover, this would further destabilise the international market. On the other hand, attempting to improve the terms-of-trade effect by raising import tariffs will result in higher domestic prices for the commodity. Perhaps more importantly, we have seen that small countries face a losing battle as they are unable to manipulate prices in their favour.

I have outlined some of the more important policies that decision-making bodies can undertake on supranational, regional and national levels. My opinion is that it would be expedient to differentiate between policy targets. If the aim of a government is to ensure food security, then it would make sense to rather implement strategies to stabilise consumption levels. Conversely, if a government has the objective of stabilising prices, it should use different policies.

For the first objective, I propose that countries should attempt to identify certain minimum, consumption requirements that would be sufficient to meet the needs of poor consumers. This could be accomplished using four complementary strategies. First and foremost, the domestic price should be left to move with the trends in the international market. Furthermore, domestic farmers and grain traders should be incentivised to sell a certain quota of the grain produce locally, at a government prescribed price. After meeting the quota, they would be allowed to sell their excess on the international market at the world price. In addition, a national grain inventory should be utilised during periods of supply shortage, rather than as a price-stabilising buffer policy. Lastly, targeted feeding programs should be used to supplement the other strategies.

As far as the price-stability objective is concerned, I believe that the utilisation of a virtual reserve could be an effective method. An important advantage of such a tool would be that it prevents speculators from trading in a way that exacerbates the commodity price movements. In addition, the second-best strategy model, developed by Blanc and Singh (2009), is interesting and deserves further attention. In their model, India and Thailand enter into a

mutually-beneficial agreement to refrain from restricting exports of rice. Prices were estimated to decrease significantly on the international market.

On top of these objective-based tools, governments should be advised to invest in areas that would promote long-term supply side stability. This would include investments into agricultural infrastructure and irrigation, as well as promoting further research. In terms of the latest WTO discussions, I share the opinion of other authors that argue in favour of similar penalties being placed on the manipulation of import tariffs to those which exist in the realm of export restrictions.

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Appendix

	2005 Production	2005 Export	2005 Prod Index	2006 Production	2006 Export	2006 Prod Index	2007 Production	2007 Export	2007 Prod Index	2008 Production	2008 Export	2008 Prod Index
Argentina	13800	9635	100	16300	10721	118	18600	11209	135	10100	6767	73
Australia	25173	16012	100	10822	8728	43	13569	7487	54	21420	14747	85
Canada	25748	16020	100	25265	19434	98	20054	16116	78	28611	18812	111
China	97445	1397	100	108466	2783	111	109298	2835	112	112464	723	115
Russia	47700	10514	100	44900	10584	94	49400	12552	104	63700	17000	133
Kazakhstan	11000	3817	100	13500	8089	123	16600	8181	151	12500	4500	113
Ukraine	18700	6461	100	14000	3366	75	13900	1236	74	25900	13037	139
US	57243	27291	100	49217	24725	86	55821	34363	98	68016	27635	119
EU	132356	15701	100	124870	13813	94	120133	12272	91	151114	25319	114
Total	429165	106848	100	407340	102243	95	417375	106251	97	496825	128540	116
Global	619224	116985	100	596105	111825	96	611185	117282	99	683259	143760	110

Table 1. Shocks to global wheat production

Values calculated in (`000 tons). Author's compilation; data obtained from WFSG

	2005 Production	2005 Export	2005 Prod Index	2006 Production	2006 Export	2006 Prod Index	2007 Production	2007 Export	2007 Prod Index	2008 Production	2008 Export	2008 Prod Index
Cambodia	3771	350	100	3946	450	105	4238	500	112	4520	800	120
China	126414	1216	100	127200	1340	101	130224	969	103	134330	783	106
Egypt	4135	979	100	4383	1203	106	4385	750	106	4402	550	106
India	91790	4688	100	93350	5740	102	96690	4654	105	99180	2090	108
Thailand	18200	7376	100	18250	9557	100	19800	10011	109	19850	8570	109
Vietnam	22772	4705	100	22922	4522	101	24375	4649	107	24393	5950	107
Total	267082	19314	100	270051	22812	101	279712	21533	105	286675	18743	107
Global	418621	29696	100	420297	31455	100	433645	31193	104	448147	28937	107

Table 2. Global rice production

Values calculated in (`000 tons). Author's compilation; data obtained from WFSG