Economics and Political Economy of Trade Interventions in Response to Commodity Price Spikes

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Abstract

This thesis analyses the economic effects and the political economy causes of actual and proposed trade policy interventions in response to agricultural commodity price spikes. It does so by employing a theoretical model of world trade that incorporates both import and export policies in a common framework.

The thesis begins with an analysis of the economic effects of trade interventions by investigating terms of trade effects, welfare implications, and distributional impacts within countries. The international price effect of trade policy interventions of large (or sufficiently large group of small) food-importing countries in response to a price spike is to reinforce the initial exogenous price spike. Insofar as the policy reactions of importing countries trigger exporting countries to respond with trade policies, the price spike is further accentuated. The own-welfare effects also are accentuated. This thesis shows that if countries began with some trade restrictions, the national welfare effects are more complex. The welfare of countries that do not intervene in trade also is affected by interventions of other countries. The within-country distributional effects show that the effects on households‟ real income depend on initial proportions of their income from different productive factors and the initial proportions of their consumption expenditure on agricultural and non-agricultural tradables and on non-traded goods.

The thesis then explains why countries alter their intervention in trade in response to a price spike despite their global economic cost, and analyses the implications for policy outcomes between food-importing and exporting countries. A political economy model is developed which predicts that government preferences for averting losses for domestic interest groups from a price spike lead to a change in trade distortions. In particular, trade interventions in response to a downward price spike are predicted as proposed by some developing country members of the World Trade Organization (WTO) for an agricultural Special Safeguard Mechanism. The model predicts that higher import tariffs are likely in a non-cooperative setting, and that higher export subsidies/lower export taxes will emerge in exporting countries in response to the raising of those tariffs. Another contribution of the thesis is to show that cooperative trade policies could lead to a more efficient outcome, and while self-enforcement of cooperation is unlikely in a one period game, in a repeated game setting and with possible involvement of the WTO an efficient outcome is possible.

Drawing from the same political economy model to provide a political economy explanation for trade interventions in response to an upward price spike, the results show that the higher the concern for consumers, the higher will be the assistance received by them in the form of insulation from the international price spike. Similar to the results of the case of a downward price spike, the model predicts that cooperative trade policies are welfare improving for both importers and exporters even though the cooperation may not be self-enforcing in one period. An

efficient trade policy outcome between food-importing and food-exporting countries can be achieved in a repeated game setting and with possible involvement of the WTO.

Declaration

This work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution to T.M. Jayanthi Upamalika Thennakoon and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

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Chapter 1

Introduction

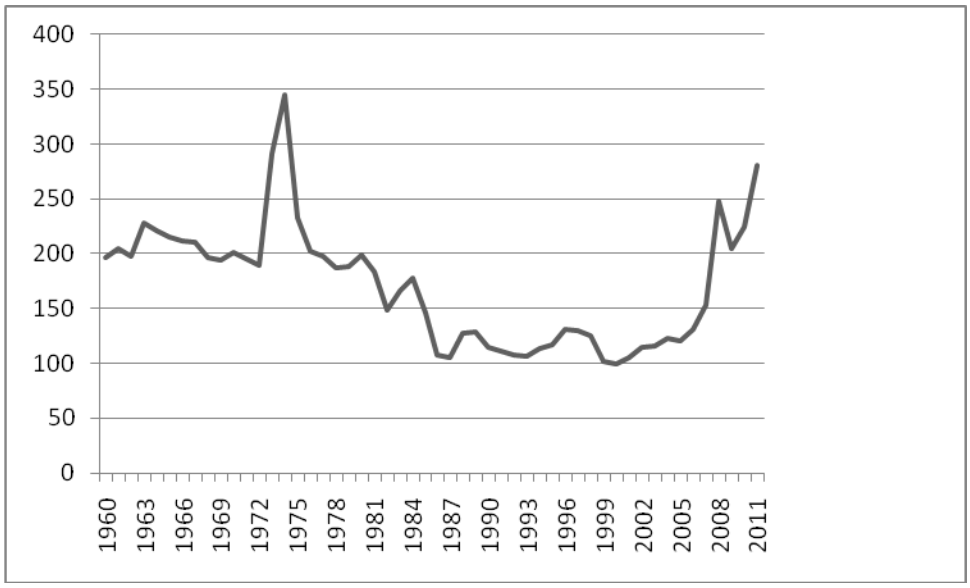
The recent price volatility in international food markets has re-kindled interest in the trade policy community as to the role for – and contribution of – trade restrictions when food prices spike. Even though upward price spikes have attracted the most attention in recent years, low prices also have received much publicity in recent years following debate in the Doha Round of multilateral trade negotiations over an agricultural Special Safeguard Mechanism (SSM) being proposed by some developing country members of the World Trade Organization (WTO).

Price volatility is natural for weather-dependent farm products, and price spikes[1] in international food markets seem to occur at least once every generation (Figure 1.1). In the past few decades, there have been both upward and downward price spikes, in the mid-1970s and mid-1980s, respectively. The World Bank"s real international food price index since 1960 peaked in 1973-74 before tracing a downward trend in the next two decades with relatively small upward and

[1] The term "price spikes" is hereafter used to refer to sharp and large price movements up or down that seem to occur roughly once in a generation, as depicted in Figure 1.1.

downward spikes around that trend until the spikes of 2008 and 2010-11 (reasons for which have been much discussed in the literature as surveyed by, for example, Wright, 2011). The prices of staple foods including rice, wheat and maize reached their highest levels in three decades in mid-2008 before recording a temporary decline later that year and then a further upward spike (Rapsomanikis and Sarris, 2010).

Figure 1.1: Real international food price index, 1960-2011 (2000 = 100)



Source: World Bank (2011)

The issue of price volatility for agricultural commodities has been a controversial part of the agricultural trade liberalization agenda. It has often been a key political

obstacle to trade reforms because price volatility poses significant economic challenges to consumers, producers and national government finance ministries. Governments have responded to exogenous commodity price spikes by introducing trade distortive policy measures including greater import restrictions by food-importing countries and export subsidies or a lowering of export taxes by some food-exporting countries during a downward price spike, and import tariff reductions and greater export restrictions by food-importing and exporting countries, respectively, during an upward price spike.

With recognition of the adverse implications of low commodity prices, the WTO has offered member countries a number of legal policy measures to manage import surges and rapid price declines. The Special Agricultural Safeguard (SSG) of the Agreement of Agriculture (AoA) established during the Uruguay Round is one such key policy instrument available for WTO members to deal with price depressions and import surges. However, this facility is only available to countries that undertook tariffication, as a reward for their commitment to liberalization through tariff reduction commitments. The many developing countries that did not formally bind their tariffs within the AoA tariffication process, however, are not eligible to use the existing SSG to deal with import surges and price depressions. The limitations of the existing system of SSG led developing countries to lobby for an improved safeguard modality during the Doha Round negotiations. As a response to developing countries‟ concern that the sudden increase of cheap imports has adverse implications on their domestic producers, agreement was

reached in July 2004 to include the proposal of SSM in the Doha Development Agenda (DDA).[2] As originally drafted, and reiterated later, the SSM is viewed by its proponents as an instrument allowing developing countries to address food and livelihood security and rural development concerns (WTO, 2003 and 2010). The SSM would authorize developing importing countries to impose an additional duty in the case of an increase in the volume of imports beyond a certain level or a fall in the price of the products below a certain level (WTO, 2008).[3]

The proposed SSM remains one of the most contentious issues under the agricultural negotiations in the WTO largely due to its wide availability, no

[2] The Doha Development Round is the current round of trade negotiations in the WTO. It began in late 2001 following a meeting of trade ministers in Doha, the capital of Qatar.

[3] There are two types of safeguards available for developing countries under the current proposal, namely the price-based SSM and volume-based SSM (WTO, 2005). As regards the price based SSM, if the c.i.f. import price of a shipment falls below 85 per cent of the average monthly import prices from all sources in the proceeding three-year period (trigger price), an additional duty can be applied to remove 85 per cent of the shortfall (WTO, 2008). As regards the volume-based SSM, if the import volume in a year exceeds the proceeding three-year average, additional duties can be applied based on the import surge; an additional duty of 25 per cent of the current bound rate for 110 to 115 per cent import surge; a duty of 40 per cent for an import surge of 115 to 135 per cent and a 50 per cent duty if the import surge exceeds 135 per cent (WTO, 2008). Final remedy caps are applied if the pre-Doha bound tariff is breached (WTO, 2008).

commitments to further liberalization, scope to increase tariffs above bound rates,[4] no requirement of an injury test, and no compensation required to offer to trading partners affected (WTO, 2010; Wolfe, 2009; Blustein, 2009[5]). It was one of the key causes of the collapse of the recent Doha Round trade talks in 2008, which weakened the momentum of multilateral negotiations and thereby undermined the substantial potential gains otherwise available from multilateral reductions in bound tariffs and subsidies.[6] Negotiations on the proposed SSM are still progressing very slowly due to the failure to reach a compromise between member countries.

Export trade policies have also gained increased attention of policy-makers and the national governments in recent years. High prices in world commodity markets recently have led countries to impose or tighten various export restrictions plus price controls, and to release stocks and provide food consumer programmes. The recent most common policy response by countries has been at the border, such as introducing export restrictions (taxes, minimum export prices, quotas, licensing

[4]Whether the developing country members of the WTO should be allowed to apply SSM tariffs above pre-Doha bound tariffs is still a contentious issue in the negotiations. This is despite the fact that many developing countries still have large gaps between their applied and bound tariffs.

[5] As cited in Grant and Meilke (2011).

[6] Trade economists have long recognized the potential benefits of trade liberalization through tariff bindings and enormous gains related to tariff bindings have been well documented. See, for instance, François and Martin (2004).

requirements) and even outright prohibitions (OECD, 2010a). The number of countries applying export duties was higher during 2003-2009 than during 1997-2002 (OECD, 2010b).

Despite the apparent political attractiveness of these trade policy instruments from the narrow viewpoint of national governments seeking to manage domestic political risks associated with commodity price spikes, from a global perspective such interventions by many countries distort agricultural commodity markets. Tyers and Anderson (1992) argue that widespread use of safeguards in importing countries, as suggested in the SSM, could increase the volatility of world prices. Among the few other studies highlighting the negative economic effects of the proposed agricultural SSM, especially pertinent are Grant and Meilke (2006, 2011), Hertel, Martin, and Leister (2010), Finger (2010) and Ivanic and Martin (2011). As with the implications of the SSM, too many export restrictions have negative implications for national economies as well as for the global economy (Mitra and Josling, 2009; OECD, 2010a and 2012b).

Evidence also suggests that both food-importing countries and food-exporting countries simultaneously intervene in trade in response to the same commodity price spike (Martin and Anderson, 2012). In addition, policy reactions of one group of countries can trigger the affected trading partners also to respond. Yet the literature analysing both food import policies and export policies in a common framework is limited. The implications of trade policy interventions of one country

(or a group of countries) in the presence of trade policy responses of the affected trading partners have been ignored in much of the theoretical work. One motivation of the present study is to help fill this lacuna.

Another motivation for this research is to uncover the effect of trade interventions by small open economies when they act together in response to a food price spike. Even though it is known that a small open economy cannot affect the world price by intervening in trade, a sufficiently large number of small countries whose net purchases have an impact on world excess demand conditions can produce terms of trade implications for the world. Thus, the role of small countries cannot be ignored in the current discussion of price volatility. An important point to consider in this context is that the larger the number of countries intervening in trade in response to a price spike, the more other countries may also choose to intervene in trade to assist their domestic interest groups. The consequence of this beggar-thy-neighbour behaviour of countries is to exacerbate the effect on world prices and increase the instability of international food markets. This contingent effect is very important in analysing the effects of trade interventions in response to sudden food price spikes, but it has not been adequately analysed in the literature to date.

Yet another pertinent area that needs further research is why countries alter their intervention in trade, despite wide acceptance of the global economic cost and inter-country welfare transfers associated with these trade interventions. Most of these trade interventions appear to be driven by political economy and non-

economic interests.[7] Nevertheless, the standard political economy trade models do not provide sufficient explanations for such considerations, except for a few initial explorations such as Freund and Özden (2008) and Tovar (2009). Having an understanding of the political economy behind trade interventions is important because it provides insights into how the political economy factors shape trade policy outcomes between food-importing and food-exporting countries. Thus, more work is needed to analyse them in a common framework involving both import and export policies.

The above discussion highlights the importance of further research on the issue of commodity price spikes. The current global food and overall economic and financial crisis further underline the need for more work. The adverse economic implications of price-distorting policies highlighted above may worsen in the midst of the current economic recession, because the deteriorating macroeconomic climate could lead governments to increasingly rely on trade restrictions to support their domestic interest groups. Global warming and climate change would also add to the current and future commodity price volatility. Hence, openness to trade, leading to more market oriented and more predictable policies, is now more important than ever. With this background the aim of this thesis is to analyse the

[7] These „non-economic" motivations are in fact associated with economic variables, but are different to the standard economic variables. In the case of non-economic objectives, the government maximizes welfare subject to an exogenously specified objective function containing constraint variables different to standard economic variables (Bhagwati, 1971).

economic effects and the political economy causes of actual and proposed trade policy interventions in response to agricultural commodity price spikes. It does so by employing a theoretical model of world trade that incorporates both import policies and export policies in a common framework.

The contribution of this research is to extend previous applications of international trade theory to uncover the stylized facts and better understand the economic effects and the political economy behind trade policy interventions in response to commodity price spikes. The results are of practical importance for policy-makers formulating unilateral trade policies and strengthening multilateral disciplines on trade interventions.

Chapter 2 of this thesis contributes to a better understanding of the impacts of trade policy responses on international prices and markets, as well as on the welfare of policy imposing countries and the rest of the world. This chapter examines the implications of government responses in both exporting and importing countries to price spikes, which is an improvement on the usual approach, which is to focus on either just exporters‟ or importers‟ policy reactions. [8] Also analysed are the within-country distributional effects. By investigating the economic implications of trade interventions, Chapter 2 also provides insights into whether the multilateral disciplines should be strengthened to achieve a globally efficient outcome during food price spike periods. Chapters 3

[8] An early exception is Josling (1977).

and 4 provide political economy explanations for trade policy interventions to commodity price spikes. Chapter 3 focuses, particularly, on trade interventions in response to a downward price spike, as proposed by some developing country members of the WTO in the Doha Round for an agricultural SSM. Chapter 4 differs from Chapter 3 in that it focuses on upward price spikes. Given that the political economy behaviour of a government in response to a downward price spike differs from that in response to an upward price spike, it is helpful to analyse these in detail in two individual chapters. Understanding the political economy behind these trade interventions is helpful in explaining the policy behaviour of governments, which shapes the trade policy outcomes between countries, and guiding the future policy responses. Chapter 3 and 4 also examine whether the involvement of the WTO leads to an efficient outcome between food-importing and exporting countries during food price spikes. These results thereby provide inputs into multilateral trade negotiations in the WTO. The results of Chapter 3 are of particular importance for the current WTO negotiations on the proposed agricultural SSM.

The thesis is organized as follows. Chapter 2 provides a theoretical analysis of the economic effects of trade interventions by investigating terms of trade effects, welfare implications and distributional impacts within countries, employing a three-country model of world trade. This chapter first analyses the global implications of trade policy interventions by examining the price and welfare effects of trade policy responses of food-importing countries, the effects of trade

interventions when the initial trade interventions are not equal to zero, and potential implications when both food-importing and exporting country groups respond to the same price spike. The distributional impacts within countries are then analysed. Chapter 3 explains why countries alter their intervention in trade in response to an exogenous price spike, and analyses the implications for trade policy outcomes between food-importing and food-exporting countries. This chapter presents a model that can explain political economy behind trade interventions in response to a food price spike. The model is then used to analyse the proposed agricultural SSM as an application. Chapter 3 also provides explanations for whether an efficient outcome is possible between food-importing and food-exporting countries in the repeated game setting or with possible involvement of the WTO. Chapter 4 draws from the same political economy model developed in Chapter 3 to provide a political economy explanation for trade interventions in response to an upward price spike such as occurred twice during the past four years. In Chapter 5 some concluding remarks complete the thesis by providing policy implications and lessons for further research. The thesis follows the now-standard structure of containing three separate standalone papers, even though this means there is some repetition in describing the analytical model used in both Chapter 3 and Chapter 4.

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Chapter 2

Economics of Trade Policy Interventions in Response to Commodity Price Spikes

World commodity prices are volatile and occasionally exhibit upward and downward price spikes. Recent price spikes in agricultural commodity markets have brought renewed interest in trade interventions by national governments because volatile food prices have created a number of problems and challenges both in macroeconomic and microeconomic policy. Even though vulnerability to external markets is of particular concern to low income and developing countries, the volatile prices produce adverse economic implications for the agricultural sector in both developed and developing countries. Governments have responded to exogenous commodity price spikes by introducing trade distortive policy measures including import restrictions by food-importing countries and export subsidies by food-exporting countries during a downward price spike, and import tariff reductions and export restrictions by food-importing and exporting countries, respectively, during an upward price spike. Evidence also suggests that both food-importing countries and food-exporting countries intervene in trade in response to the same commodity price spike (Martin and Anderson, 2012).

Trade policy interventions in response to commodity price spikes are intended to avoid adverse impacts of price spikes on influential domestic interest groups, but produce numerous implications for the policy-imposing country as well as for the rest of the world. For an individual small economy, trade policies only produce domestic implications. However, if a sufficient number of small countries intervene in the same way as a large group, their policy actions affect the world excess demand and supply conditions, and produce global implications. Also, the larger the number of countries intervening in trade in response to a price spike, the more other countries may also require intervening in trade to assist their domestic interest groups (Anderson and Nelgen, 2012). The consequence of this beggar-thy-neighbour behaviour of countries is to exacerbate the effects of trade interventions.

Considerable work has been done to empirically explore the issue of trade policy interventions in response to price spikes, both historically and in recent literature. Following the growing concerns that emerged during the 1970s and 1980s regarding the distortionary consequences of interventions in agricultural trade, Roningen and Dixit (1990) estimated the cost of both importing and exporting industrial countries‟ domestic stabilizing policies in times of price variability. Among recent explorations, especially pertinent are Martin and Anderson (2012), Anderson and Nelgen (2012a, b) and Hoekman and Martin (2011), which examine the nature and magnitude of trade policy interventions of national governments by employing cross-country empirical analysis. Croser and Anderson (2011) also

examine the changing contribution of different agricultural policy instruments to global trade and welfare. Studies analysing the causes and consequences of trade interventions, particularly, in response to upward price spikes, include Childs and Kiawu (2009), Baffes and Haniotis (2010), and Hochman et al. (2010). These studies have found evidence to suggest that trade interventions in general produce negative implications for global trade and welfare.

The potential effects of price-distorting policies have been well recognized also in the theoretical literature. Following the 1973-74 commodity price spike Johnson (1975) published a classic work that explains the impact on prices of altering export interventions when importers were trying to maintain domestic prices. A follow-up article by Josling (1977) addresses the implications of both importers‟ and exporters‟ trade policy responses during periods of price spikes, and argues that attempts to use trade measures to stabilize domestic prices further destabilize international prices. This literature does not go on to formally analyse the issue in a coherent modelling framework to validate its conclusions. More-recent work employing modelling frameworks to formally derive the effects of price-distorting policies focuses only on one side of the story. For example, Bhagwati et al. (1983) and Gardner and Kimbrough (1990) focus on import tariff policies, while Feenstra (1986), Itoh and Kiyono (1987), Abbott et al. (1987), and Bohman et al. (1991) focus on export subsidy policies. The literature analysing both food import policies and export policies in a common framework is thus very limited. Hence, more work is needed to analyse the effects of contingency trade policies of one group of

countries in the presence of trade policy actions of the affected trading partners on the same good.

Further to the above discussion on global implications of trade interventions, changes in trade policies in response to a commodity price spike also produce distributional effects. The existing theoretical literature, including Bhagwati and Johnson (1961), argues that changes in the domestic price of an importable resulting from import tariffs also affect the distribution of income of a country through changes in relative prices of factors. The relationship between product prices, factor prices and trade policies has been well established in the literature, such as the studies by Mussa (1974), Jones (1971, 1975) and Ruffin and Jones (1977) providing important insights into the relationship between trade policies and income distribution. These distributional implications are also different in the presence of the non-tradable sector (Anderson, 1995). Despite the fact that trade interventions benefit certain sectors or interest groups of the economy, not all individuals in an economy necessarily benefit from such interventions. This is particularly true when we analysed the effects on welfare of households with different endowments. Thus, who gains from trade interventions is uncertain.

Given this background, this chapter theoretically analyses the economic effects of trade policy interventions in response to commodity price spikes. It does so by employing a theoretical model of world trade that incorporates both import and export policies in a common framework. The contribution of this chapter is to

extend previous international trade theory to uncover the stylized facts and better understand the economic effects of trade interventions. The chapter first investigates the terms of trade and related welfare implications for the policy-imposing country as well as for the rest of the world by employing the duality theory in terms of the expenditure-revenue approach of Dixit and Norman (1980) in a framework of a three-country model of the world economy. Given that the global model of three countries is limited in analysing within-country effects, an extension of the Ricardo-Viner model, which is more realistic in modelling the agricultural sector will be used to examine the within-country distributional impacts of trade interventions –this will be analysed afterward.

This chapter is organized as follows. The following section introduces the analytical model. After describing the model, the effects of trade policy responses of food-importing countries are examined first assuming that the exporting country does not react to the initial exogenous price spike. We moreover assume in this section that the importing country has zero initial tariffs prior to the price spike. We begin with the case of a small country and then extend the model to find out the effects of trade interventions by large (or a sufficiently large group of small) food-importing countries. We also examine the effects of trade interventions when the initial trade interventions are not equal to zero, and also the case of the optimal tariff for the importing country to complete the analysis. After analysing the policy behaviour of food-importing countries, this chapter then extends the model to include both food-importers‟ policies and food-exporters‟ policies in one

framework to see potential implications and understand the magnitude of the problem when both country groups respond to the same price spike. This chapter finally examines the within-country distributional effects of trade interventions in response to a price spike. Some concluding remarks complete the chapter.

2.1 Analytical Model

2.1 Basic setup

Consider a world consisting of three countries: the food-importing country, the food-exporting country, and a third country. Each country is producing two traded goods, good A (agricultural) and good N (non-agricultural). We assume that in the initial equilibrium, good A is imported by the food-importing country while the exporting country exports this good. We let importing and exporting country governments apply trade policies in response to a price spike. The third country is either an importing country or an exporting country and has no border policies. We define the equilibrium using the balance of payment approach.

Following Dixit and Norman (1980),[1] we model consumer behaviour using the expenditure function. The consumer‟s decision is to minimize the expenditure necessary to achieve a certain level of utility at given prices. Letting „*c*‟ denote the

[1] The same framework has been used in studies such as Bhagwati, Brecher and Hatta (1983), Abbott, Paarlberg and Sharples (1987), Bandyopadhyay and Majumdar (2004), and Bohman, Carter and Dorfman (1991).

consumption level and „*p*“ denote the price, the importing country“s expenditure function related to good A is,

$$e(p,u) = \min\{p.c; u(c) \geq u\} \qquad (1)$$

Expenditure functions for the food-exporting country and the third country are similarly defined. The well-known solution to this problem is the Hicksian demand function, „*c (p,u)*“. We assume that the expenditure function is concave and homogeneous of degree one in prices holding „*u*“ fixed. Therefore, from Euler“s theorem we have,

$$p.e_p(p,u) = e(p,u) \qquad (2)$$

We model producer behaviour using the revenue function where „*v*“ is the inputs of primary factors, „*p*“ is the price and „*x*“ is the output of goods. Following Dixit and Norman (1980), factor inputs are assumed to be fixed throughout the analysis, so we do not need to model the factor market explicitly. Producers choose a technologically feasible „*x*“ to maximize the value of output and this maximized value of output is the revenue function (Dixit and Norman, 1980):

$$r(p,v) = \max\{p.x \setminus (x,v)\, feasible\} \qquad (3)$$

This revenue function, which is a convex function of „*p*“ and „*v*“, embodies properties of homogeneity of degree one in „*p*“ for fixed „*v*“ and homogeneity of degree one in „*v*“ for fixed „*p*“. Employing these properties, the shadow prices of the factors are:

$$r_v(p,v) = w(p,v) \tag{4}$$

Using Euler“s theorem, we also have $p.r_p(p,v) = r(p,v)$.

Using the properties of the expenditure and revenue functions defined above, the compensated import demand function is given by,

$$e_p(p,u) - r_p(p,v) = z(p,u) \tag{5}$$

2.2 Economic Effects of Trade Interventions Following Price Spikes

2.2.1 Effects of importers' response to price spikes

Let“s now consider an exogenous shock that induces the world price to deviate from its initial equilibrium. We begin with the case of a small country assuming that the small country chooses an *ad valorem* import tariff if the world price goes

down or an import subsidy if the world price goes up, such that, $p = (1+t)p^*$, where p^* is the relative world price; and t is positive for a tariff and negative for an import subsidy.

The budget constraint of the small country in the presence of an *ad valorem* trade tax-cum-subsidy is,

$$e(p,u) = r(p,v) + t\ p^* z(p,u) \tag{6}$$

Partial differentiation of equation (6) with respect to tariffs yields,

$$e_u \frac{du}{dt} = -z\frac{dp^*}{dt} + t\ p^* \frac{dz}{dp}.\frac{dp}{dt} \tag{7}$$

Provided that a small country faces a fixed world price with $\frac{dp^*}{dt} = 0$ and $\frac{dp}{dt} = 1$, the equation (7) is reduced to,

$$e_u \frac{du}{dt} = t\ p^* \frac{dz}{dp}. \tag{8}$$

At a zero tariff we have,

$$e_u \left. \frac{du}{dt} \right|_{t=0} = 0. \tag{9}$$

This shows that the welfare of the small country reaches a critical point at the point, t=0.

The second derivative of equation (8) at t=0 yields,

$$e_u \left. \frac{d^2u}{dt^2} \right|_{t=0} = p^* \frac{dz}{dp} < 0 \tag{10}$$

implying that welfare of the small country is maximized at zero trade tax-cum-subsidy.

Following Feenstra (2004), the loss in welfare from a trade intervention can be obtained from second-order Taylor series approximation around the free trade point as,

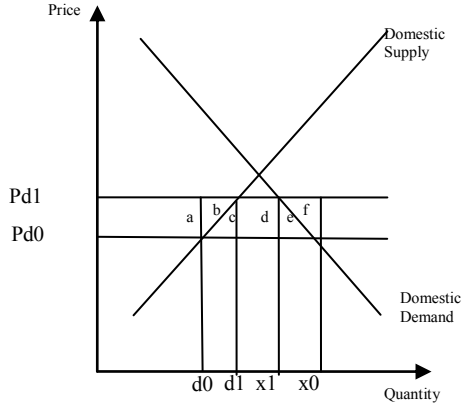
$$u(t) \approx u(0) + t \left. \frac{du}{dt} \right|_{t=0} + \frac{1}{2} t^2 \left. \frac{d^2u}{dt^2} \right|_{t=0} \tag{11}$$

Using equations (9) and (10),

$$u(t) - u(0) \approx \frac{1}{2} t^2 \frac{d^2 u}{dt^2}\bigg|_{t=0} = \frac{1}{2} t^2 \frac{dz}{dp} < 0 \qquad (12)$$

Equation (12) concludes that the welfare of a small country facing the fixed world price is negatively affected by a trade tax-cum-subsidy. This loss in welfare of a border policy for a small country can be illustrated in a partial equilibrium diagram, as shown in Figure 2.1.

Figure 2.1: Economic effects of import tariffs and import subsidies



In the initial equilibrium of free trade, domestic price, Pd0, is equal to the world market price. If the importing country government introduces an import tariff following a downward price spike, the tariff-embodied price is denoted by Pd1, which is higher than the initial domestic price, Pd0. Consumers suffer from the tariff imposition amounting to the area a+b+c+d+e in the figure, while the producers gain, which is denoted by area a+b. The government revenue increases (denoted by area d). Nevertheless, tariffs produce a deadweight loss (the area of

c+e, which is equal to area b+f). An import subsidy, which is applied by the importing country following an upward price spike, can be depicted in the same figure by defining Pd0 as the subsidy-embodied domestic price and Pd1 as the domestic price in a free trade situation. With an import subsidy, consumers benefit (area a+b+c+d+e) while the producers lose (a+b). The cost of subsidy to the government is b+c+d+e+f. The import subsidy results in a net loss of c+e, which is equal to area b+f.

Even though a small open economy, by introducing price distorting policies, can not affect the world equilibrium price, a sufficiently large group of small open economies whose net purchases have an impact on the world excess demand, affect the world price and thereby produce terms of trade implications for the world. Let‟s now extend the model to assume that the three countries are large countries or sufficiently large groups of small countries. We begin the analysis with trade policy behaviour of the importing country group following a price spike resulting from an exogenous shock. In this section we moreover assume that the exporting country group does not react to the commodity price spikes by intervening in trade. This assumption is relaxed later in the analysis.

Following Gardner and Kimbrough (1990), the equilibrium conditions for the world economy can be defined as follows. Superscripts in the equations denote the country groups; importing country group (M), exporting country group (X) and the third country (T).

$$z(p,u)^T + z^M(p^*,u^M) + z^X(p^*,u^X) = 0 \tag{13}$$

$$e^M(p,u) = r^M(p,v) + t\ \ p^* z^M(p,u) \tag{14}$$

$$e^T(p,u) = r^T(p,v) \tag{15}$$

$$e^X(p,u) = r^X(p,v) \tag{16}$$

Equation (13) is the market clearing condition for good A and the other three equations denote the budget constraints of the importing country group, the third country and the exporting country group, respectively. With an import tariff, the importing country‟s expenditure is equal to the value of the domestic production plus the revenue accruing from the tariff proceeds. With an import subsidy (or a negative import tariff), the budget constraint of the importing country in equation (14) denotes the subsidy cost such that the expenditure is equal to the value of production minus the subsidy cost.

The implications of trade policy changes for the equilibrium are determined by totally differentiating the above system of equations (see Appendix A.1 for derivation). Staring from zero initial tariffs, the resulting system yields,

$$z_p{}^M(p^* dt\ \ + dp^*) + z_u{}^M du + z_p{}^T dp^* + z_u{}^T du + z_p{}^X\ dp^* + z_u{}^X du = 0 \tag{17}$$

$$e_u{}^M du = -z^M dp^* \tag{18}$$

$$e_u{}^T du = -z^T dp* \tag{19}$$

$$e_u{}^X du = -z^X dp* \tag{20}$$

where $z_p = \frac{\partial z}{\partial p} < 0$ is the partial derivative of the import demand function with respect to price.

Effects on prices

The resulting system of equations is now solved to determine the effects of importers‟ trade interventions in response to an exogenous international price spike. Substituting equations (18) to (20) in equation (17), the following result is obtained for a marginal increment in their import tariff from zero in response to a downward price spike (see Appendix A.2).

$$\frac{dp*}{dt} = \frac{-1}{\Delta}\left[p* z_p{}^M\right] < 0 \tag{21}$$

The market stability requires the Marshall-Lerner condition to be negative as given below,

$$\Delta = z_p{}^X - \frac{z^X z_y{}^X}{p*} + z_p{}^M - \frac{z^M z_y{}^M}{p*} + z_p{}^T - \frac{z^T z_y{}^T}{p*} < 0$$

where $z_y^H = p^* \frac{z_u}{e_u}$ is the marginal propensity to spend on good A. The terms z_y^X and z_y^M are similarly defined.

The expression in equation (21) implies an improvement in the importing country group‟s terms of trade because an import tariff decreases the world excess demand for importables at the initial world price of imports. This occurs because the food-importing country as a large country or a sufficiently large group of small countries, affects the world price by introducing price-distorting policies. The effect of the tariff is to reinforce the initial downward price spike.

By contrast, if the importing country group had imposed an import subsidy (s^m)[2], in response to an exogenous upward price spike, equation (21) becomes,

$$\frac{dp^*}{ds^m} = \frac{1}{\Delta}\left[p^* z_p\right] > 0 \qquad (22)$$

[2] Even though both import subsidy applications and import tariff reductions are practised in the real world in response to an upward price spike, we model only the import subsidy policy because the basic model assumes that the trade policy is starting from the initial free trade policy. However, the analytical results can be generalized for the case of reduction in tariffs as both policies work in the same direction.

Equation (22) suggests that the introduction of an import subsidy by the importing country group in response to an initial price hike leads to further increase the world price compared to the initial situation.

Effects on welfare

Turning to the welfare implications of a marginal increment in an import tariff from zero, the expressions for the respective countries are found by substituting equation (21) into the differentiated forms of the individual budget constraints of each country. Thus, they highlight the impacts of terms of trade changes on the welfare of the countries involved.

Equation (23) shows welfare implications for the importing country group,

$$e_u{}^M \frac{du}{dt} = \frac{1}{\Delta}\left[p * z^M z_p\right] \tag{23}$$

It is evident that the welfare of the importing country group is positively affected by the tariff policy and these welfare gains are seen through the import quantity multiplied by the terms of trade change. This means that during a period in which the international price of food spikes downward, a large (or sufficiently large

group of small) food-importing countries gain additionally from a sufficiently small increment in their import tariff from zero.[3]

The corresponding welfare equation for the exporting country group is given in equation (24). Being the exporter of good A and thereby having a negative import demand function, the rest of the world exporters‟ welfare is negatively affected. Equation (24) implies that the welfare loss from the exogenous downward price spike for the food-exporting countries is worsened by the trade policy responses of food importers.

$$e_u{}^X \frac{du}{dt} = \frac{1}{\Delta}\left[p^* z^X z_p{}^M\right] \tag{24}$$

Thus, it can be argued that the welfare improvement associated with tariff interventions of the food-importing countries in response to a downward price spike comes at the welfare cost of food-exporting countries.

Effects on the welfare of the third country depend on whether the third country is an importing country or an exporting country.

[3] It is also important to find out welfare implications associated with positive initial tariffs, given that a large importing country tends to have positive initial tariffs under any state of nature. This is discussed in Section 2.2.2.

$$e_u{}^T \frac{du}{dt} = \frac{1}{\Delta}\left[p^* z^T z_p{}^M\right] \tag{25}$$

Recalling that z^T is negative for an exporter and positive for an importer, trade policy responses of food importers improve the welfare of the third country, via the changes in their international terms of trade, if it is an importer while the same policy reduces the welfare of the third country if it is an exporter. Despite the free trade situation maintained by the third country during the period in which the international price of food spikes downward, its welfare is affected by food importers‟ trade policy actions in response to the same price spike.

Let‟s tum to the welfare effects of an import subsidy, which is applied by the food-importing country in response to an exogenous upward price spike. The following equation suggests that the welfare of the importing country group is further worsened by the import subsidy.

$$e_u{}^M \frac{du}{ds^m} = \frac{-1}{\Delta}\left[p^* z^M z_p\right] \tag{26}$$

Nevertheless, the welfare gain from the exogenous upward price spike for the food-exporting country is further enhanced by the import subsidy policy of food importers, as shown in equation (27).

$$e_u{}^X \frac{du}{ds^m} = \frac{-1}{\Delta}\left[p^* z^X z_p\right] \tag{27}$$

As discussed above, welfare effects on the third country depend on whether it is an importer or exporter.

The above findings provide important insights into the real world implications of trade interventions during a period of a food price spike. Despite the fact that some countries voluntarily refrain from intervening in trade in response to a short-term price spike, their welfare is affected by trade policy interventions of countries responding to the same price spike, via changes in their international terms of trade. The neutral countries may then require intervention in trade in response to the resulting price spike that has been reinforced by the trade policy responses of other countries. If they also alter their intervention in trade, the international price spike, and hence the national welfare effects, would be further accentuated.

2.2.2 Price and welfare effects in the presence of initial trade tax or subsidy

So far we have assumed in the analysis that the countries, in response to a price spike, alter their intervention in trade starting from zero intervention level. The welfare implications can nevertheless be more complex if trade taxes and subsidies were already in place. In the following, we relax the assumption of zero initial

policies and extend the discussion to examine the effects in the presence of positive initial taxes or subsidies.

Following Lahiri and Raimondos-Møller (1997), we extend the analytical framework to include positive initial trade tax-cum-subsidies. The price linkage equation is modified to $p = p^*(1+t)$ where $t = t^n + t^i$. New and initial tariffs are denoted by superscripts „n" and „i", respectively. Negative tariffs imply positive import subsidies. We moreover assume for simplicity that the initial *ad valorem* tariff rate does not change and any changes in tariffs represented by *dt* in the model capture an introduction of a new tariff or subsidy. Then, the system of equations from (13) to (16) can be redefined to include an initial positive tax-cum-subsidy and totally differentiated as below (see Appendix A.3 for the derivation).

$$z_p{}^M(p^*dt^n + dp^* + tdp^*) + z_u{}^M du + z_p{}^T dp^* + z_u{}^T du + z_p{}^X dp^* + z_u{}^X du = 0 \tag{28}$$

$$e_u{}^M du = \frac{-zdp^* + tp^* z_p dp^*(1+t) + tp^* z_p p^* dt^n}{(1-tz_y)} \tag{29}$$

$$e_u{}^X du = -z^X dp^* \tag{30}$$

$$e_u{}^T du = -z^T dp^* \tag{31}$$

where $1 - tz_y > 0$,which can be defined as the trade policy multiplier.

The terms of trade implications in the presence of initial positive trade taxes or subsidies are determined by substituting equations (29) , (30) and (31) into the differentiated form of the market clearing condition in equation (28) (see Appendix A.4 for the derivation). Focusing on tariffs, the terms of trade effects are found to be,

$$\frac{dp^*}{dt} = \frac{-1}{\Delta(1-tz_y)}\left[p^* z_p{}^M\right] \tag{32}$$

where

$$\Delta = z_p(1+t) - \frac{[z - tp^* z_p(1+t)]z_y}{p^*(1-tz_y)} + z_p{}^X - \frac{z^X z_y{}^X}{p^*} + z_p{}^M - \frac{z^M z_y{}^M}{p^*} < 0$$

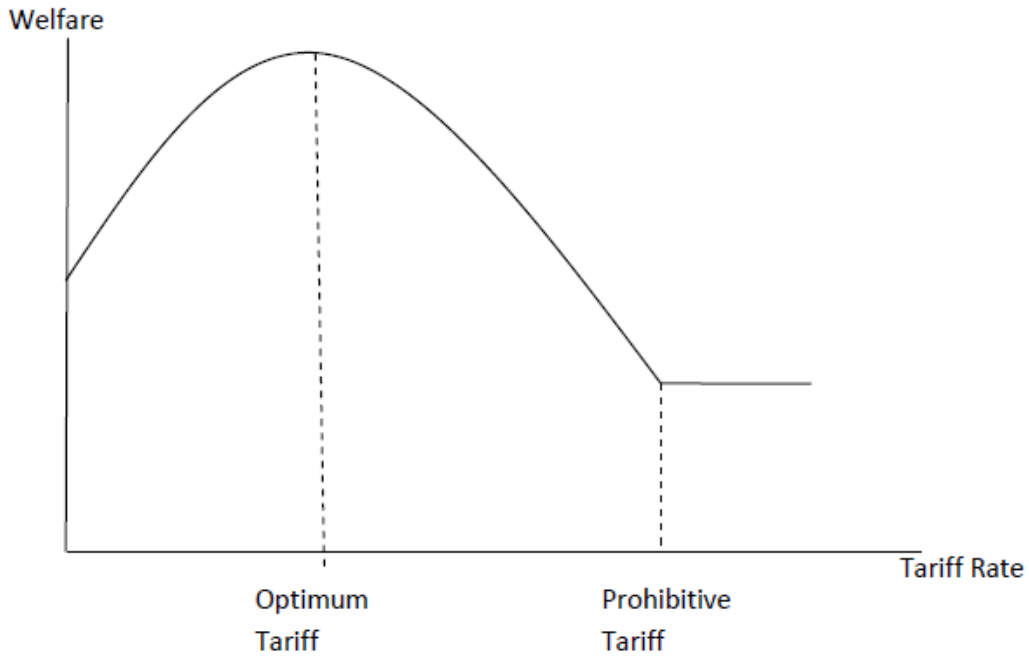
As evident from equation (32), the downward pressure on the world price, which has now been triggered by both initial tariffs and new tariffs imposed following the price spike, is larger compared to the price effects associated with a marginal increment of tariffs from zero.

The equation for import subsidies can be similarly derived with a sign change implying that the upward pressure on the world price of an import subsidy is larger when the importing country already had initial subsidies.

Provided that the terms of trade effects are larger, the related welfare effects are also found to be larger. It is important to note that the welfare improvement, resulting from a positive initial tariff imposed before the price spike, is further enhanced by a small additional tariff applied in response to a downward price spike. Nevertheless, as the new tariff is imposed on top of an already imposed tariff, it is possible that the new tariff is welfare reducing for the tariff-imposing country depending on the initial tariff and the tariff increase. If the importing country raises the tariff too much, the gain from improved terms of trade can be more than offset by the deadweight losses associated with tariffs. Thus, it is not certain whether the importing country gains or loses from tariff intervention unless we examine the case of the optimal tariff. In the following, we derive the optimal tariff for the importing country to complete the analysis. As shown graphically in Figure 2.2, any tariff increase above the optimal tariff rate results in a welfare loss for the tariff-imposing country.

We begin by assuming that the government preferences represent the representative consumer‟s preferences, and therefore the „utility‟ denoted in the expenditure function, $e(p,u)$ also represents the social utility.

Figure 2.2: Social welfare and the optimal tariff



Recalling the importing country‟s budget constraint, we here assume that the government has a specific revenue target $\overline{R}$ to help the import-competing industry affected by the downward price spike.[4] This is represented in the following expression.

$$\overline{R} = tp * (e_p - r_p)^M \qquad (33)$$

[4] The non-economic concerns behind this revenue target are analysed more in Chapter 3 of this thesis where the political economy of trade interventions is discussed.

Then the optimal tariff problem is to maximize the welfare subject to the above constraint given by equation (33). We can formulate the problem formally as follows,

$$t^{opt}(u,p) = Max\{u : \overline{R} = tp*(e_p - r_p)^M = 0\} \tag{34}$$

The resulting constraint maximization problem is,

$$L = U + \lambda\{tp*(e_p - r_p)^M - \overline{R}\} \tag{35}$$

Recalling that $(e_p - r_p) = z$ and defining z as a function of ‚p" only, the first order condition yields,

$$t^{opt} = -\frac{z}{z_p} \tag{36}$$

leading to,

$$\frac{t^{opt}}{p} = \frac{1}{pz_p / z} \tag{37}$$

which is also equal to the inverse of the exporting country‟s supply elasticity. Any tariff level above the optimal tariff given in equation (36) results in a welfare loss for the tariff-imposing country.

Thus, the welfare implications of tariffs for the importing country can now be redefined as,

$e_u^{\,M} \dfrac{du}{dt} > 0$ if and only if $t \le t^{opt}$

In the real world, many food-importing countries have positive initial tariffs. Therefore, any increase in tariffs following a downward price spike is welfare reducing, irrespective of the contingency situation and protective objective of the tariffs, if the final tariffs exceed the optimal tariffs.

2.2.3 Effects of both exporters' and importers' reactions to an international price spike

Responses to downward price spikes

We assumed in the previous analysis that only the food-importing countries alter their intervention in trade in response an initial exogenous price spike while the food-exporting countries voluntarily refrain from trade interventions. Let‟s now

relax this restrictive assumption and assume that both food exporters and food importers respond to an exogenous world price spike. Let‟s first discuss the effects of trade policy behaviour of food-importing and food-exporting countries during a period in which the international price of food spikes downward.

Assume that the initial downward price spike induces importing countries to rely on import tariffs and exporting countries to respond with export subsidies. The discussion below is based on the assumption that both import tariffs and export subsidies are increased marginally from the zero level. The equations defining the policy behaviour of the importing country group are equivalent to those in the previous analysis. Turning to the exporting country, we restrict trade policy instruments available for its government to export subsidies such that $p^X = (1 + s^x)p^*$, where „s^x“ denotes export subsidies,[5] which can be equivalent to an export tax reduction. The system of equations can then be redefined with both import tariffs and export subsidies present in the same model.

[5] Despite the fact that both export tax reductions and export subsidies are practised in the real world, our analysis is limited to export subsidies. The model in the proceeding section analyses the impacts of trade policy instruments assuming that the initial policy level is zero, and therefore reduction in an initial policy level is excluded. Nevertheless, the results of introducing export subsidies are intuitively similar to a reduction in export taxes because both policies work in the same direction.

$$z(p^*(1+t),u)^M + z^T(p^*,u^T) + z^X(p^*(1+s^x),u^X) = 0 \quad (38)$$

$$e^M(p^*(1+t),u) = r^M(p^*(1+t),v) + tp^* z^M(p^*(1+t),u) \quad (39)$$

$$e^T(p,u) = r^T(p,v) \quad (40)$$

$$e^X(p^*(1+s^x),u) = r^X(p^*(1+s^x),v) - s^x p^* z^X(p^*(1+s^x),u) \quad (41)$$

With both import tariffs and export subsidies present in the model, the terms of trade effects are determined by totally differentiating the above system of equations leading to:

$$dp^* = \frac{-1}{\Delta}\left[z_p{}^M p^* dt + z_p{}^X p^* ds^x\right] \quad (42)$$

Equation (42), compared to equation (21) in the previous analysis which focused only on the effects of importing country behaviour, shows that the world price decline is larger when both importing and exporting countries apply border policies on the same commodity in response to a downward price spike. This shows that if food-exporting countries also intervene in trade by raising assistance to their farmers in addition to food-importing countries protecting import-competing producers following a decrease in the world price, the negative terms of trade implications for the world are larger. Nevertheless, most of the existing trade policy literature is limited in analysing both import policies and export policies in the same model by simply assuming that only one group responds with trade

policies while the other group is policy neutral throughout the analysis. By doing so, those studies have largely overlooked the potential implications.[6]

The resulting welfare implications are found to be,

$$e_u{}^M du = \frac{1}{\Delta}\left[p * z^M (z_p{}^M dt + z_p{}^X ds)\right] \tag{43}$$

From equation (43), the welfare gain from the initial exogenous downward price spike for the importing country is further improved by its own import tariff policy as well as by the export subsidy policy of food exporters. The magnitude of welfare gain for the importing country is larger when both importing and exporting countries intervene in response to the downward price spike compared to the welfare gain associated with the importer‟s trade policy alone, as highlighted in previous section.

The welfare implications for the exporting country group are given in the following equation, which now includes the effects of both country groups‟ policy actions.

$$e_u{}^X du = \frac{1}{\Delta}\left[p * z^X (z_p{}^M dt + z_p{}^X ds)\right] \tag{44}$$

[6] Exceptions to this include some empirical studies such as Martin and Anderson (2012).

It can be seen that the welfare loss from the initial exogenous shock for the exporting country group is further worsened by its own export subsidy and also by trade policy actions of food-importers in response to the initial downward price spike.

These results provide valuable insights into the possible domestic policy failures highlighted in the literature, for instance by Martin and Anderson (2012). If the importers group and exporters group formulate trade policies to fully neutralize the international price impact on their domestic markets, the increase in import tariffs and the increase in export subsidies have offsetting implications for domestic prices in each country. As a result, despite the policy objectives and benefits intended to be achieved, trade policies of both countries become less effective as stabilizing policies at the border. Focusing on importers, we note that an increase in tariffs raises the domestic price compared to the international price, but a fall in export taxes or an increase in export subsidies drives back the domestic price in the importing country down. Thus, the intended benefits of the tariff increase to protect the domestic producers in the importing country from the downward price spike have been offset by export subsidies in the exporting country. Domestic producers in the importing country now experience a decrease in welfare because the world price has further declined. Losses in the producer surplus may thus lead to further tariffs by the importing country in response to the reinforced downward price spike to support the domestic producers.

As discussed above, welfare implications for the third country depend on whether it is an importer or an exporter, implying a welfare gain for the third country if it is an importer and a welfare loss if it is an exporter. The results establish that the neutral country is more affected when both food exporters and food importers apply trade policies on the same commodity in response to the downward price spike compared to the effects associated with only one group of countries‟ policy actions.

$$e_u{}^T du = \frac{1}{\Delta}\left[p * z^T (z_p{}^M dt + z_p{}^X .ds)\right] \qquad (45)$$

Responses to upward price spikes

Let‟s now assume that both exporters and importers simultaneously respond to upward world price spikes by introducing export taxes (or reducing export subsidies) and by reducing import tariffs (or introducing import subsidies), respectively. The results of the analysis can also be intuitively generalized to those of a dynamic analysis where the exporting country acts first and the importing country reacts next following the implications for the world price of the exporters‟ action.

Modifying the system of equations to include export taxes (t^x) and import subsides (s^m) and solving the system of equations for marginal changes, we find that the world price increases with simultaneous policy actions by exporters and importers.

$$dp^* = \frac{1}{\Delta}\left[p^* z_p{}^M ds^m + p^* z_p{}^X dt^x\right] \tag{46}$$

From equation (46), when both importers and exporters respond with border policies to avoid the adverse impacts on the domestic interest groups in their respective countries following an upward price spike, the impacts on the world price are larger compared to the effects of policy actions of only one of them. The world price effect of the food-importers‟ policies analysed in the previous section has now been magnified by its trading partner‟s export policies on the same good highlighting the potentially large global costs associated with price-distorting policies when both importers and exporters try to stabilize their domestic prices following an upward price spike in the international commodity market.

Turning to the welfare effects, it is found that the welfare loss from the exogenous upward price spike for the importing country group is further worsened when both exporters and importers respond to the upward price spike by introducing export taxes and by introducing import subsidies, respectively.

$$e_u{}^M du = \frac{-1}{\Delta}\left[p * z^M (z_p ds^m + z_p{}^X dt^x)\right] \quad (47)$$

The implications of policy responses of both country groups for the exporting country group show that the overall welfare further increases, as in the following equation,

$$e_u{}^X du = \frac{-1}{\Delta}\left[p * z^X (z_p ds^m + z_p{}^X dt^x)\right] \quad (48)$$

The effects on the third country are found to be,

$$e_u{}^T du = \frac{-1}{\Delta}\left[p * z^T (z_p ds^m + z_p{}^X dt^x)\right] \quad (49)$$

which implies a welfare loss for the third country if it is an importer.

Let‟s further explore the issue with an extreme case to analyse the implications for the domestic markets. If the importing country, in response to the upward price spike, imposes import subsidies or reduces import tariffs to fully offset the price transmission while exporting countries are determined to fully neutralize the international price impact by introducing export taxes or reducing export subsidies, the decrease in tariff in the importing country decreases the domestic price compared to the international price, but the increase in export taxes in the

exporting country drives the domestic price in the importing country down. As a result, despite the policy objectives, trade policies of both countries can become less effective and efficient at the border as stabilizing instruments.

It is also worth highlighting at this point the possible negative implications of the contingency trade interventions for the incentives of using efficient instruments to deal with price volatility. There are various policy instruments such as storage and commodity reserves available with considerable merits to deal with the problems associated with price fluctuations while simultaneously keeping the markets open and promoting the long-run adjustment process. Private stock-holding can reduce the price volatility through disposal or accumulation of reserves in the case of steep price increases and falls, respectively (Wright, 2011). Private storage activities provide relatively low cost ways of reducing price variations while private-public partnership in storage activities can also be a feasible policy for many developing countries. Nevertheless, if governments intervene and artificially support the uncompetitive sectors from temporary price shocks, incentives for efficient policy instruments such as storage disappear and domestic producers tend to rely more on trade distortive measures and government assistance.

2.3 Price Spikes, Trade Intervention and Income Distribution within Countries

After analysing the terms of trade implications, we now analyse the within-country distributional impacts of price-distorting policies. Even though the three-country world trade model used in the previous section has its merits in examining global implications of trade interventions, it has limitations in investigating within-country distributional effects. Hence, this section of Chapter 2 employs an extension of the Ricardo-Viner model, which exhibits short-run distributive properties while holding the same properties of the world model. Our model has features similar to the models in Mussa (1974), Jones (1971, 1975) and Ruffin and Jones (1977). The income distributive effects in the Ricardo-Viner framework are different from those in the Heckscher-Ohlin model because some factors cannot move freely and costlessly between industries, which is a more realistic assumption for the agricultural sector. By employing the specific factor model we examine the impacts on factor rewards of the product price changes resulting from trade taxes and subsidies.

Recalling that the country groups consist of a set of small developing countries, we analyse the distributional impacts within these small developing countries. Following Anderson (1995), here we introduce the non-tradable sector in the

model because non-tradables are a significant part of the economy. With these modifications, we now analyse a three-sector small open economy with two tradable goods – an agricultural good and a non-agricultural good, and one non-tradable good. The three goods are denoted by subscript „j‟ where j=1,2,3.[7] Similar to the standard Ricardo-Viner model, all goods are assumed to be produced using respective sector specific factors K and a mobile factor L. The quantity of each specific factor is fixed while L is fully mobile between sectors.

Letting α_{LJ} and α_{KJ} represent the amount of mobile factors and specific factors employed in producing one unit of agricultural, non-agricultural and non-tradable goods, respectively, and X_j denote the industry output, the full employment conditions are stated as,

$$\sum_{j=1}^{3} \alpha_{Lj} X_j = L \tag{50}$$

$$\alpha_{Kj} X_j = K_j \tag{51}$$

By totally differentiating the zero profit condition, the competitive profit conditions are met with the following equality,

[7] The goods numbered 1, 2 and 3 denote the agricultural, non-agricultural and the non-tradable goods, respectively.

$$\alpha_{Lj} w + \alpha_{Kj} r_j = p_j \tag{52}$$

where w , r and p_j denote the return to the mobile factor, specific factor and the price of the commodity *j*. In this analysis we assume that the domestic prices of agricultural (p_1) and non-agricultural goods (p_2) are determined by their international prices whereas the price of the non-tradable good (p_3) is determined by domestic demand and supply such that,

$$C_3(p_1, p_2, p_3, Y) = X_3 \tag{53}$$

where C , X and Y are domestic demand, supply and national income, respectively. Demand and supply conditions for the agricultural and the non-agricultural good can be defined by introducing quantities traded (*T*) such as, $C_j = X_j + T_j$ for the import-competing sector and $C_j = X_j - T_j$ for the export sector.

Having defined the basic set-up, our next task is to derive a set of equations that can be used to analyse the effects of trade-distorting policies by differentiating equation (52) and expressing it in terms of proportional changes, such as,

$$\theta_{Lj}\hat{w} + \theta_{Kj}\hat{r}_j = \hat{p}_j \tag{54}$$

where θ is the distributive share of the factors in the value of the sector *j*‟s output. The proportional changes are denoted with „^‟s. The equation (54) follows from the relationship below,

$$\theta_{Lj}\alpha_{Lj} + \theta_{Kj}\alpha_{Kj} = 0 \tag{55}$$

which reflects the fact that the small change in production technology would not change the unit cost in cost minimization (Jones, 1975).

By totally differentiating, equations (50) and (51), and using the assumption that the factor endowments are fixed, we obtain the following equilibrium conditions,

$$\sum_{j=1}^{3} \lambda_{Lj}\hat{X}_j + \sum_{j=1}^{3} \lambda_{Lj}\hat{\alpha}_{Lj} = 0 \tag{56}$$

where λ is the fraction of the labour force employed in sector *J*.

Also,

$$X_j = -\hat{\alpha}_{Kj} \tag{57}$$

Substituting equation (57) into equation (56) , we find

$$\sum_{j=1}^{3} \lambda_{Lj} (\hat{\alpha}_{Lj} - \hat{\alpha}_{Kj}) = 0 \tag{58}$$

In order to link changes in factor prices to changes in factor proportions, we employ the definition of elasticity σ in the model as,

$$(\hat{\alpha}_{Kj} - \hat{\alpha}_{Lj}) = \sigma_j (\hat{w} - \hat{r}_j) \tag{59}$$

Substituting equation (58) into (59) yields,

$$\sum_{j=1}^{3} \lambda_{Lj} \sigma_j (\hat{w} - \hat{r}_j) = 0 \tag{60}$$

Having defined the necessary relationships, we now analyse the impacts of trade policy changes on the production of each industry through changes in factor rewards. As previously assumed, the production of each sector depends on availability of the specific factor in each sector. By using equation (55) related to weighted averages of factor shares and equation (59) related to elasticity, and substituting them into the expression for the output changes in equation (57), the following important result is found,

$$\hat{X}_j = \theta_{Lj}\sigma_j(\hat{r}_j - \hat{w}) \tag{61}$$

which implies that the sectors with relatively higher returns to the specific factor compared to the mobile factor expand while the sectors with lower returns to the specific factor compared to the mobile factor contract (Jones 1975).

Let"s now analyse the effects on consumption using the domestic demand conditions defined above. Following $C_j = C_j(p_1, p_2, p_3, Y)$, changes in consumption can be defined as,

$$dC_j = \sum_{h=1}^{3} \frac{\partial C_j}{\partial p_h} dp_h + \frac{\partial C_j}{\partial Y} dY \qquad \text{j=1, 2, 3} \tag{62}$$

Equation (62) depicts price and income effects of commodity price changes resulting from a change in the trade tax structure. For instance, if the country has import tariffs, the consumers are adversely affected by the price rise of the consumption goods provided that their food basket comprises more of these goods despite that the specific factor owners benefit from protection in the agricultural sector.

Following Anderson (1995) and decomposing the income and price effects, we find:

$$dC_j = \sum_{h=1}^{3} \left. \frac{\partial C_j}{\partial p_h} \right|_U dp_h + \frac{\partial C_j}{\partial Y} \left(dY - \sum_{h=1}^{3} C_h dp_h \right) \tag{63}$$

In the presence of tariff revenue or subsidy cost the national income (Y) defined in the equation above is,

$$Y = \sum_{j=1}^{3} p_j X_j + \sum_{j=1}^{2} T_j p_j * t_j \tag{64}$$

where „T" is the volume of trade and „t" is the trade tax rate. Negative t implies a subsidy.

Provided that $\sum_{j=1}^{3} p_j dX_j = 0$ as well as the initial trade tax being zero, differentiation of equation (64) yields,

$$dY = \sum_{j=1}^{3} X_j dp_j + \sum_{j=1}^{2} T_j p_j * dt_j \tag{65}$$

Following the fact that the domestic price change is equal to the trade policy change for a small open economy and $X_j + T_j = C_j$ the second part of equation (63) disappears. With some manipulation and by expressing the equation with proportional terms, we have:

$$\hat{C}_j = \sum_{h=1}^{3} E_{jh} \hat{p}_h \tag{66}$$

where E is the income-compensated elasticity of demand for good J with respect to the price of good h. (Anderson, 1995).

Recalling that $C_j = X_j$ for the non-tradable good, and using equations (66) and (61), we can obtain the following condition for the non-tradable sector to complete the model.

$$\theta_{L3}\sigma_3(\hat{r}_3 - \hat{w}) = \sum_{h=1}^{3} E_h \hat{p}_h \tag{67}$$

Following Anderson (1995), we can now derive the expressions for factor changes with respect to domestic price changes by using equation (54) for the zero profit condition, equation (60) for the full employment condition and equation (67) for the equilibrium condition for the non-tradable sector. These are,

$$Ew_j \equiv \frac{\hat{w}}{p_j} = \frac{A_j\theta_{L3}\sigma_3 - A_j\theta_{K3}E_3 - \theta_{K3}E_j}{\theta_{L3}\sigma_3} \tag{68}$$

$$Er_{jj} \equiv \frac{\hat{r}_j}{p_j} = \frac{\theta_{L3}\sigma_3 + \theta_{Lj}\theta_{K3}E_j + Aj\theta_{Lj}\theta_{K3}E_3 - A_j\theta_{Lj}\theta_{L3}\sigma_3 - A_j\theta_j\theta_{L3}\sigma_3}{\theta_{Kj}\theta_{L3}\sigma_3} \tag{69}$$

$$Er_{hj} \equiv \frac{\hat{r}_h}{p_j} = -\frac{Ew_j\theta_{Lh}}{\theta_{Kh}} - \frac{\theta_h A_j}{\theta_{Kh}} \tag{70}$$

$$Er_{3j} \equiv \frac{\hat{r}_3}{p_j} = \frac{E_j + A_j\sigma_3 + A_j E_3}{\sigma_3} \tag{71}$$

$$Ep_{3j} \equiv \frac{\hat{p}_3}{p_j} = A_j \tag{72}$$

where

$$Aj = \frac{B_j\theta_{L3}\sigma_3 + (B_1 + B_2 + B_3)\theta_{K3}E_j}{(B1 + B2)\theta_{L3}\sigma_3 - (B_1 + B_2 + B_3)\theta_{K3}E_3 + (B_1\theta_{h1} + B_2\theta_{h2})\theta_{L3}\sigma_3}$$

and

$$Bj = \lambda_{Lj}\sigma_j / \theta_{Kj}\sum_{h=1}^{3}\lambda_{Lh}\sigma_h$$

Import restrictions and export subsidies are imposed by food-importing and exporting countries, respectively, during downward price spikes while they respectively apply import subsidies and export restrictions during upward price spikes. Import tariffs and export subsidies raise the domestic prices of import and export goods, respectively, in food-importing and exporting countries. Import subsidies and export taxes decrease the domestic prices in respective countries. Focusing on tariffs, the model predicts that the owners of the agricultural specific factors benefit from tariff protection following a downward price spike while the owners of the non-agricultural specific factors suffer from tariff protection in the agricultural sector. Impacts on the mobile factor owners are ambiguous and depend on their relative consumption share of the three goods. Nevertheless, all groups, as consumers, are adversely affected by price rise of the consumption goods, including the non-tradable goods. The results are similar for export subsidies. Nevertheless, the opposite results are obtained for import subsidies and export taxes imposed by importing countries and exporting countries, respectively, in response to an upward price spike.

Beyond these general results, let‟s now turn to examine the effects of trade policies on households endowed with a mixture of mobile and specific factors by using the results in equations (68) to (72). Focusing on each household, the aggregate household income (y) is equal to the sum of the income from specific factors as well as from mobile factors, such that,

$$y = \sum_{h=1}^{3} a_{Kh} r_j + a_L w_j \tag{73}$$

where a_K and a_L are proportions of the factor income from specific and mobile factors in the total household income, respectively. Given that trade interventions result in some factors benefiting and some factors loosing, the change in the aggregate household income is the sum of the changes in factor rewards. By expressing this in elasticity terms, the change in the household income with respect to changes in prices of the consumption goods is,

$$Ey_j = \sum_{h=1}^{3} a_{Kh} Er_{hj} + a_L Ew_j \tag{74}$$

where E denotes the income elasticity with respect to the price. For instance Er_{hj} is the elasticity of income from specific factor „*j*" with respect to the price of good „*h*".

From equation (74), it is evident that the impact of border policies on the net household income depends on the relative importance of the different factor shares in the aggregate household income and the percentage change in factor rewards due to the price-distorting policies at the border.

Factor owners are also the consumers of the household. When the domestic price of a tradable commodity rises as a result of an import tariff by an importing country or an export subsidy by an exporting country, consumers of that good are negatively affected despite the fact that there is a rise in the returns to the agricultural specific factors. The price of the non-tradable good also increases, further eroding the real income of the household. The larger the fraction of the household income spent on the import good, the larger will be the increase in the non-tradable price. Nevertheless, import subsidies and export taxes yield opposite results as those policies decrease the domestic price compared to the international price. Putting factor returns and consumption expenditure together in the equation and letting b denote the initial share of the household income spent on the consumption of good j where j=1,2,3 and the sum of the total shares of income spent on consumption goods is unity, the impacts of commodity price changes on the real income of the household are found to be similar to Anderson (1995) as,

$$Ey_j = \sum_{h=1}^{3} a_{Kh} Er_{hj} + a_L Ew_j - \sum b_j - b_3 \frac{\hat{p}_3}{\hat{p}_j} \qquad (75)$$

The above equation can be used to analyse the effects of price-distorting policies on real income of the households owning different combinations of factor endowments. For the households endowed with a mixture of both mobile and specific factors, the change in the household‟s real income depends on the relative contribution of each factor income in the total household income and the share of

household income devoted to the consumption of the three goods. Focusing on tariff interventions, it is evident that the higher the share of the non-agricultural and mobile factor income in the total household income and the higher the consumption share of the import good in the household consumption basket, the higher will be the likelihood that the household‟s real income is negatively affected by the tariff change. Equation (75) also implies that real income of the rich and the poor households are affected differently depending on their consumption behaviour, because the likely sizes of the expenditure proportions differ between rich and poor households. Food does not typically account for a large share of the consumption basket of the rich households while the share of food in the consumption basket of the poor households is typically larger. Hence, the domestic price rise resulting from import tariffs is likely to affect poor households more than the rich households.

2.4 Conclusion

In this chapter we theoretically analyse the economic effects of trade policy interventions in response to commodity price spikes by investigating terms of trade effects, related welfare implications, and distributional impacts within countries. The analysis, by employing the duality theory in terms of the expenditure-revenue approach, shows that during a period in which the international price of food spikes downward, large (or a sufficiently large group of

small) food-importing countries would gain additionally from a marginal increment in their import tariff from zero while the welfare loss from the exogenous shock for food-exporting countries would be worsened by that trade policy response of food importers. The opposite results are found for trade interventions by food importers in response to an upward price spike, such as the introduction of an import subsidy. The effect of these interventions is to magnify the national welfare effects of an initial exogenous international price spike. The own-welfare effects are more complex if trade taxes were already in place and the governments alter them as a response to the exogenous price spike. If the importing countries had positive initial tariffs, any further increase in their import tariff, as a contingency protection, can be welfare reducing irrespective of the contingency situation - depending on the starting and finishing tariff rates. The analysis then shows that, as the same commodity price spike triggers the food-exporting countries also to respond by altering their intervention in trade, the international price spike and hence the national welfare effects are further accentuated. Nevertheless, the existing trade policy literature is certainly limited in analysing both importers‟ responses and exporters‟ responses in a common framework. By doing so, those studies have largely overlooked the potential implications.

The welfare of the countries that do not intervene in trade is also affected by trade interventions of other countries, via changes in their international terms of trade. As a result, these neutral countries may also require intervention in trade in

response to the resulting price spike that is reinforced by the trade policy responses of other countries. If they had also intervened, the international price spike, and hence the national welfare effects are further magnified.

By looking at the distributional effects of trade policy interventions in response to a downward price spike, such as import tariffs by importing countries and export subsidies by exporting countries, the results suggest that, the specific factor owners in the agricultural sector benefit from an increase in the respective trade policies, but the same cannot be said about the welfare of all households of the economy, in particular if we analysed the effects on the households owning a mixture of specific and mobile factors. The effects on a household‟s real income depend on the initial proportions of their income from different productive factors and the initial proportions of their consumption expenditure on agricultural and non-agricultural tradables and on non-traded goods. The opposite results are found for import subsidies by importing countries and export taxes by exporting countries in response to an upward price spike such that the agricultural specific factor owners suffer from the respective trade policy changes, but the non-agricultural factor owners benefit. The results also provide insights into the political economy of trade policy determination implying that the protection in one sector hurts other sectors of the economy, and the stakeholders of the booming sectors are likely to lobby for contingency assistance while the sectors that are contracting can be expected to stand against such politically motivated assistance.

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Chapter 3

Political Economy of Trade Policy Interventions in Response to Commodity Price Spikes

Despite the global economic costs and inter-country welfare transfers associated with trade interventions highlighted in the literature, national governments alter their intervention in trade in response to agricultural commodity price spikes. Evidence suggests that governments try to insulate domestic prices from international price changes to smooth the variations in the domestic prices in a way that rewards politically influential groups affected by these price spikes (Martin and Anderson, 2012). The most commonly stated motivations behind these price-distorting policies include concerns for consumers in the case of an upward price spike and concerns for domestic producers in the case of a downward price spike. As evident from recent upward price spikes, governments have tended to formulate trade policies in favour of food consumers. The proposed Special Safeguard Mechanism

(SSM),[1] which is being proposed by some developing country members of the World Trade Organization (WTO) to deal with issues associated with a downward price spike, is viewed by its proponents as an instrument allowing developing countries to address certain non-trade concerns, namely food and livelihood security and rural development (WTO, 2003 and 2010).

Even though non-trade concerns are important in trade policy determination, particularly in developing countries, the standard political economy models including the leading political economy models of trade protection by Grossman and Helpman (1994, 1995) do not provide explanations for such considerations, and have been mostly confined to terms of trade considerations for trade policy intervention. Much of the work in this tradition include for instance, a seminal work by Johnson (1954), later work by Bagwell and Staiger (1999, 2005) and Maggi and Rodriguez-Clare (2005).

Non-trade concerns and non-economic political interests behind trade interventions did not gain attention in political economy trade literature until behavioural elements were introduced in trade policy models recently.[2] Among

[1] The SSM allows countries to raise their tariffs in the case of an increase in volume of imports beyond a certain level (volume trigger) or a fall in the price of the products below a certain level (price trigger) (WTO, 2008).

[2] Non-economic motives for trade interventions have been initially explored in the literature, for instance by Corden (1997), Bhagwati (1971) and Bhagwati and Srinivasan (1969). Although the word „non-economic" is employed, these motivations are in fact associated with economic variables, but different to the standard economic variables. In the case of non-

the few recent attempts to acknowledge the importance of non-economic and political forces in shaping trade policies, especially pertinent are Freund and Özden (2008) and Tovar (2009). Freund and Özden (2008) have introduced behavioural elements such as loss aversion, reference dependence and diminishing sensitivity into the standard political economy trade model, while Tovar (2009) has offered an empirical explanation for the importance of loss aversion in trade policy determination. Loss aversion offers a political economy explanation for why import-competing industries are frequently offered protection, reflecting the fact that the governments are influenced more by losses in trade policy determination than by gains. Although these studies are helpful in explaining non-economic motives behind border policies, more work is needed to analyse the implications of these political economy concerns in an integrated framework that incorporates both import and export policies.

The trade policy literature is certainly limited in analysing food-import policies and export policies in a common framework even though it seems clear from empirical facts that both export policies and import policies have been practised in response to price spikes (Martin and Anderson, 2012). Most of the existing models only characterize symmetric policies[3] or assume that the affected parties remain policy neutral throughout the analysis and do not react

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economic objectives, the government maximizes welfare subject to an exogenously specified objective function containing constraint variables different to standard economic variables (Bhagwati, 1971).

[3] with some few exceptions such as Maggi and Rodriguez-Clare (2005)

by applying border policies on the same good.[4] The impacts of trade policies of one group of countries in the presence of trade policy responses of the affected trading partners have been ignored in much of the work.

With this background, the aim of this chapter is to provide a political economy explanation for actual and proposed trade policy interventions in response to a commodity price spike by employing a model that incorporates both import policies and export policies in a common framework. This model is then used to analyse trade interventions in response to a downward price spike as suggested in the agricultural SSM being proposed by some developing country members of the WTO.

The remainder of the chapter is structured as follows. Section 3.1 introduces the analytical model. The general model is then extended to analyse the proposed SSM at the WTO as an application in section 3.2. Here we examine trade policy outcomes between food-importing and food-exporting countries in both non-cooperative and cooperative international settings. Then, the analysis is briefly extended to a basic infinitely repeated game in order to find out whether the behaviour of the governments is different in a multiple period with repeated interactions. We also analyse whether an efficient outcome is possible between food-importing countries and food-exporting countries with possible involvement of the WTO. Section 3.3 concludes.

[4] Some of these include Bale and Lutz (1979), Zwart and Meilke (1979), Zwart and Blanford (1989) and Devadoss (1992) etc.

3.1 Analytical Model

3.1.1 The basic economic structure

In this section, we propose a partial-equilibrium model[5] to provide a political economy explanation for trade policy interventions in response to an exogenous price spike. A government objective function is defined following Baldwin (1987), and the concerns for loss aversion are introduced into the government objective function as in Freund and Özden (2008) but in a partial equilibrium framework. Trade policy is set by the government to maximize its objective function assuming that is the only policy instrument available.[6]

We consider a two-country world with trade interactions between a large food-importing country and a large food-exporting country in the presence of political lobbying influences. These two countries can also be thought of as two sufficiently large groups of small countries, a food-importing country group and a food-exporting country group.

[5] The basic model is a partial equilibrium version of Maggi and Rodriguez-Clair (2005), modified to incorporate behavioural elements and extended to a repeated game and WTO involvement.

[6] The assumption that trade policy is the only instrument available for governments to deal with price volatility is a restrictive and less-than-realistic assumption, especially, in the context of non-trade concerns. Nevertheless, the focus of the present study is limited to trade policy interventions due to the complexity of the problem when it is associated with many instruments.

Supply and demand

The two countries trade good A, which is an agricultural commodity. The price of the good in the domestic markets in the food-importing and food-exporting countries are p and p^*, respectively. The demand functions for the food-importing country and food-exporting country are defined symmetrically in terms of domestic prices. These demand functions, which take simple linear forms, are:

$$d(p) = a - p \tag{1}$$

$$d^*(p^*) = a - p^* \tag{2}$$

Consumer surplus associated with these demand functions are denoted by *cs* and *cs**, respectively.

The good is produced in each country, and the good is assumed to be produced from a specific factor such that the input-output coefficient is one. Letting x denote the specific factor used to produce the agricultural commodity, total supply of the good in the food-importing and food-exporting countries, respectively are,

$$S = x \tag{3}$$

$$S^* = x^* \tag{4}$$

Assuming all other conditions equal for both countries, the exporting country has a larger supply of the good $(x^* > x)$ and therefore is the natural exporter of this good to the importing country. With these definitions, the returns to the agricultural specific factor (i.e. the profit functions) in each country are denoted by px and $p^* x^*$, respectively.

Price determination

In response to an exogenous downward (upward) price spike, trade policy intervention in this agricultural market is assumed to be limited in the importing country to an import tariff (import subsidy) which drive the price away from its free trade level. The corresponding price linkage equation is:

$$p = p^w + t \tag{5}$$

where p and p^W are the domestic price in the importing country and the international price at its border, respectively. This domestic price in excess of the international price implies a specific tariff, which is assumed to be non-prohibitive. A negative import tariff implies an import subsidy.

We depart from most of the standard literature in which only food-importing countries‟ trade policies are assumed to be affected. In this study, we let the

food-exporting country also react in response to an exogenous international price spike. This formulation is motivated by the empirical fact that both importing countries and exporting countries in the real world respond to food price spikes (Martin and Anderson, 2012). We assume that following an exogenous downward (upward) price spike, the exporting country government responds by imposing an export subsidy (an export tax) to support its farmers, so that:

$$p^* = p^w + t^* \tag{6}$$

where p^* and t^* are the domestic price in the exporting country and a non-prohibitive export subsidy, respectively. A negative export subsidy implies an export tax.

Having defined the production and the demand side of the economy, the international equilibrium price can be determined from the market-clearing condition by equalizing the excess demand in the food-importing country group and the excess supply in the food-exporting country group such that:

$$d(p) + d(p^*) = S + S^*$$

$$p^w = a - \frac{1}{2}(x + x^* + t + t^*) \tag{7}$$

Equation (7) implies that the market-clearing price depends on each country's trade policy, and is negatively related to these trade policies.

Trade volumes

Now we define the market-clearing trade volumes. Net imports of the good in the food-importing country are given by $m = d(p) - x$, which is equal to $m = 1/2(\Delta x + t^* - t)$ where Δx =x*- x, which is positive. Revenue from the trade tax is given by $tm = t(d(p) - x)$. The foreign counterpart of the trade tax revenue (i.e., the export subsidy cost) can be defined similarly.

Government objective function

We now define the objective functions of the respective governments. We assume that the governments intervene only during the periods in which the international price of food spikes upward or downward, and maintain free trade in every other period. Hence, the objective function of the government of a small individual country during periods of relatively stable prices represents a preference for free trade, and is characterized without any political influences. Nonetheless, sudden price spikes pose economic challenges for the countries, and the governments‟ policy decisions are assumed to be influenced by at least one of the groups affected adversely by these price spikes. That is, the governments seeking to assist those affected parties may deviate from free trade. During the period of a price spike, the governments insulate their domestic markets from the international price so as to smooth the short-run variations in the domestic price in a way that avoids losses to politically

influential interest groups. We do not explicitly model the special interest politics and lobby interactions behind trade policy determination, but simply assume that the government‟s decision of policy intervention is influenced by the most politically influential domestic interest group.

A government objective function that represents political preferences for price insulating policies builds on Baldwin (1987) and Freund and Özden (2008). We follow Baldwin (1987)[7] in assuming that the government maximizes a weighted sum of returns to producers (px), consumers (cs) and tariff revenue (tm), and follow Freund and Özden (2008)[8] to modify the government objective function to represent the welfare costs associated with deviations from policy-makers‟ preferred equilibrium. Consistent with the Bagwell and Staiger (2001, 2005) approach, we represent political influences in the government objective function with the assumption that the government places different weights on producer surplus, consumer surplus and tariff revenue depending on its political interests and the political influences following an exogenous international food price spike.

[7] As cited in Baldwin (1987), the partial equilibrium version of the government objective function has been popularly used in the literature, for instance, in the studies by Dixit (1985), Venables and Smith (1986), Rodrik (1987) and Baldwin and Krugman (1986, 1987).

[8] Our point of departure from Freund and Özden (2008) is that we define the loss aversion concerns in a partial rather than general equilibrium framework.

A political preference for a price-insulating policy depends on the nature of the price spike. In the case of a downward price spike, producer profits (px) are adversely affected and we assume that the food-importing country government tries to avoid losses to the import-competing farmers. We assume that the government places a higher weight on the producer surplus above the consumer surplus (cs) and tariff revenue (tm) in its objective function, if the producer profits fall below reference level $(p\bar{x})$ (more specifically, if the loss to the producers $(p\bar{x} - px)$ is above a certain level denoted by λ^{px}, i.e. if $p\bar{x} - px > \lambda^{px}$). If the producer profits deviate from desirable level (i.e. reference level), the government welfare is negatively affected. A government objective function that represents political preferences for assisting consumers in the case of an upward price spike can be similarly defined. If the consumer surplus is below the reference level $(c\bar{s})$ (i.e., if the loss in consumer surplus $(c\bar{s} - cs)$ is above a certain level λ^{cs}), a higher weight is assigned to the consumer surplus in the government objective function. The government objective function representing such political economy concerns is given in the following set of equations:

$$\left.\begin{array}{l} \varpi = \gamma^{px} px + tm + cs - \theta(\bar{p}x - px) \text{ if } (\bar{p}x - px) > \lambda^{px} \\ \varpi = px - tm + \gamma^{cs} cs - \theta(c\bar{s} - cs) \text{ if } (c\bar{s} - cs) > \lambda^{cs} \text{ m} \\ \varpi = px + cs \text{ if } (\bar{p}x - px) < \lambda^{px} \text{ and } (c\bar{s} - cs) < \lambda^{cs} \end{array}\right\} \quad (8)$$

where ϖ is the welfare experienced by the government, and the term γ^{px} and γ^{cs} denotes the political weight assigned to the producer surplus and the consumer surplus in the cases of a downward price spike and an upward price spike, respectively. The term θ is the loss aversion coefficient, which is positive, i.e. $\theta > 0$. The loss aversion coefficient specifies how much the government welfare is affected by the deviations from a preferred equilibrium. The parts of the equations starting from the loss aversion coefficient therefore highlight the political economy incentives for trade interventions. It reflects that any deviations from policy-makers‟ desired equilibrium that results in losses to the domestic interest groups derive negative welfare for the government. It also confirms that an increase in rewards above the desirable level does not add additional gains to the government‟s welfare. This formulation of trade intervention to avert losses is closely related to Freund and Özden (2008).

Similar to the case of food-importing countries, we assume that the government of the exporting country also exhibits special political concerns following an exogenous price spike. With loss aversion concerns for producer returns and consumer losses, the objective function of the exporting country government is:

$$\begin{cases} \varpi = \gamma^{px} p^* x^* - t^* m + cs^* - \theta(\bar{p}^* x^* - p^* x^*) \text{ if } (\bar{p}^* x^* - p^* x^*) > \lambda^{px^*} \\ \varpi = p^* x^* + t^* m + \gamma^{cs} cs^* - \theta(c\bar{s}^* - cs^*) \text{ if } (c\bar{s}^* - cs^*) > \lambda^{cs^*} \\ \varpi = p^* x^* + cs^* \text{ if } (\bar{p}^* x^* - p^* x^*) < \lambda^{px^*} \text{ and } (c\bar{s}^* - cs^*) < \lambda^{cs^*} \end{cases} \quad (9)$$

The expression on the first line of equation (9) implies that the food-exporting country‟s government cares more about producers if the producer profits fall below a threshold level. The second line represents the government objective of assisting consumers during a period of an upward price spike. The expression on the last line of equation (9) specifies that the government treats producers and consumers equally.

3.2 Special Safeguard Mechanism at the WTO in Response to Downward Price Spikes: an Application of the Model

The agricultural SSM is an alternative tariff policy instrument being proposed by some developing country members of the WTO allowing them to raise their applied tariffs in the case of an increase in the volume of imports beyond a certain level or a fall in the price of the products below a certain level (WTO, 2008).[9] The proposal of the SSM was included in Doha Development Agenda

[9] There are two types of safeguards available for developing countries under the current proposal of the SSM, namely the price-based SSM and volume-based SSM (WTO, 2005). With regard to the price-based SSM, if the c.i.f. import price of a shipment falls below 85 per cent of the average monthly import prices from all sources in the preceding three-year period (trigger price), an additional duty can be applied to remove 85 per cent of the short fall. With regard to the volume-based SSM, if the import volume in a year exceeds the preceding three-year average, additional duties can be applied based on the import surge; an additional duty of

in 2004 as a response to developing countries‟ concern that the sudden increase of cheap imports has had adverse implications on their domestic producers. Despite its provisional acceptance in the Doha Development Agenda, the proposed SSM remains one of the most contentious issues under the agricultural negotiations in the WTO largely due to its wide availability, no commitments to further liberalization, no requirement of an injury test and no compensation required to offer for affected trading partners.

Some initial empirical explorations on the SSM, including Valdes and Foster (2003, 2005), Anderson and Martin (2005), Bown and McCulloch (2007) and Hallaert (2005), have argued that the SSM could be used as a protectionist devise leading to increased instability of world markets. There have also been a few attempts to empirically quantify the range of possible effects of an SSM including a technical analyses by Montemayor (2007, 2009) on possible impacts of SSM duties on individual countries, and a simulation analysis by Grant and Meilke (2006, 2008, 2011) suggesting modest impacts of SSM on the world wheat market. Following Grant and Meilke (2008), Hertel, Martin, and Leister (2010), by using a GTAP analysis on the world wheat market, have found that SSM increases domestic price volatility in developing countries. Furthermore, Finger (2010) and de Gorter, Kliauga, and Nassar (2009) argue

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25 per cent of the current bound rate for a 110 to 115 per cent import surge; a duty of 40 per cent for an import surge of 115 to 135 per cent and a 50 per cent duty if the import surge exceeds 135 per cent. Final remedy caps are applied if the pre-Doha bound tariff is breached.

that the proposed SSM is likely to impose more restrictions on developing country exporters than on developed country exporters. Although these studies are partly helpful in understanding potential impacts of the SSM, more work is needed particularly to explain the political economy behind the proposed SSM, and to analyse the implications for the trade policy outcomes between food-importing and food-exporting countries in a political economy framework that incorporates both import and export policies.

In the following discussion, we employ the general model developed in the previous section to provide a political economy explanation for trade interventions in response to a downward price spike as suggested by the proposed agricultural SSM. The model is also extended to find out whether an efficient outcome is possible between food-importing and food-exporting countries in the repeated game setting, and with possible involvement of the WTO.

3.2.1 Trade policy formulation in a non-cooperative international setting

Let‟s now consider a downward commodity price spike resulting from an exogenous shock. Both country groups observe the world price decline and simultaneously set their trade policies in response to the downward price spike. We assume that the importing country government faces political pressure from import competing farmers and the price decline is sufficiently large to

trigger the SSM (i.e. $(\bar{p}x - px) > \lambda^{px}$). The reaction of the exporting country government is to introduce export subsidies or reduce export taxes. Even though both export subsidy applications and export tax reductions are practised in the real world in response to an international price fall, export policies in this analytical model are limited to export subsidies provided that the conclusions derived from introducing export subsidies can be generalized for the case of export tax reductions since both policies work in the same direction.

As originally drafted, and reiterated later, the SSM is viewed by its proponents as an instrument allowing developing countries to address certain non-economic concerns, namely food security, livelihood security and rural development (WTO, 2003 and 2010).[10] We do not explicitly model the three main objectives of the SSM separately, but assume that incorporation of loss aversion into the government objective function, i.e. $\varpi = \gamma^{px} px + tm + cs - \theta(\bar{p}x - px)$,[11] captures all three concerns, provided that

[10] It has been theoretically established that three policy instruments are needed to address three policy objectives. Nevertheless, as SSM has been proposed on the DDA by some developing country members of the WTO, it is aimed at attaining three basic objectives. Building on Corden (1997) and Bhagwati (1971) on the standard discussion of „theory of distortion and optimal policy intervention", it can be easily shown that the SSM as a single policy instrument is unlikely to simultaneously attain all of its primary objectives while it can be an inferior policy instrument to achieve any of the objectives. It raises serious concerns about the potential of the proposed SSM to achieve its stated primary objectives.

[11] The political weight γ^{px} is hereafter denoted as γ for notational simplicity.

income losses in the import-competing sector resulting from a downward price spike is the main concern behind all three primary objectives.

We first characterize one period outcome of a trade policy game between food-importing and food-exporting countries. We begin with deriving the equilibrium when both countries formulate their trade policies unilaterally, in other words, the Nash equilibrium trade policy formulation. Nash equilibrium occurs when each country plays their best trade policy action given the action that its trading partner uses.

In the non-cooperative policy setting, the importing country government would choose t to maximize its own welfare by ignoring the possible welfare impacts of its actions on the exporting country. The first order conditions yield (see Appendix B.1 for derivation),

$$t = R_x(t^*) = 1/3[2x(\gamma + \theta - 1) + t^* + \Delta x] \tag{10}$$

Equation (10) is the best response function of the importing country government given the exporting country‟s trade policy. From equation (10), implications of loss aversion for trade policy determination are confirmed. The Nash tariff response function is increasing monotonically in θ reflecting the desire for protection that is positively associated with the loss aversion coefficient. The equation also increases with γ implying that, the higher the political weight assigned to the returns of the import-competing farmers in the

government objective function, the higher will be the protection received by those farmers. In the case of the SSM, the loss aversion coefficient also captures the magnitude of the SSM tariffs that are set according to the world price fall. We can see from equation (10) that the higher the world price fall, the higher will be the SSM tariffs in equilibrium.

Let‟s now examine the analytical outcome in equation (10) to find out possible terms of trade improvement. Even though an individual small importing country, by imposing tariffs, does not gain from terms of trade, their collective action as a sufficiently large group produces terms of trade implications for the world. In fact, the last two terms in the parentheses of equation (10) capture the terms of trade motive for tariff intervention. However, according to the analytical outcome of the present study, the terms of trade motive is not the only reason for protection whereas other political motives and loss aversion play an additional role in determining protection. These results are different to those in the standard political economy literature, which highlight the exclusive terms of trade motives for protection.

Let‟s now figure out the equilibrium for the exporting country. In the non-cooperative setting, the exporting country government maximizes its political objective function ignoring the possible welfare impacts of its actions on the importing country. The first order conditions yield the following best response function.

$$t^* = R_x(t) = 1/3[2x^*(\gamma^* + \theta^* - 1) + t - \Delta x] \quad (11)$$

Equation (11) specifies the importance of loss aversion concerns and the special political economy preferences in shaping the trade policy outcome of the exporting country government. As evident, the Nash export subsidy function is positively related to the loss aversion coefficient and the political economy parameter.

Finally, the Nash equilibrium trade policies for the importing and exporting governments can be derived using Nash equilibrium conditions in (10) and (11)[12] (see Appendix B.2 for derivation), respectively as,

$$t^N = 1/4[(\gamma + \theta - 1)(3x + x^*) + \Delta x] \quad (12)$$

$$t^{*N} = 1/4[(\gamma + \theta - 1)(3x^* + x) - \Delta x] \quad (13)$$

The Nash equilibrium[13] entails SSM tariffs and export subsidies corresponding to unilateral welfare maximization. Equations (12) and (13) reflect the political motives and loss aversion motives for protection in each country. In both

[12] In order for exporters‟ trade policy to be an export subsidy policy, the condition $\gamma + \theta > \frac{\Delta x}{3x^* + x} + 1$ needs to be satisfied, reflecting the fact if the political considerations and loss aversion are relatively important, the exporting country applies an export subsidy.

[13] In the analysis we have assumed that $\theta = \theta^*$ and $\gamma = \gamma^*$ for notational simplicity. Without this assumption, both countries‟ variables are shown in the equations.

countries, an increased government concern for producers increases producer profits.

Moreover, by looking at the international equilibrium price, which is negatively related to import tariffs and export subsidies, we note that both policies work in the same direction of pushing the international price further down despite the domestic policy objectives. Having an impact on the international price, the SSM-imposing countries bear less than its full cost of protection and impose deadweight losses on the world economy. An SSM by food-importing countries reinforces any downward price spikes, and more so the larger the policy response by food-exporting countries. The consequence of this in a multi-country real world is that the resulting international price fall may, in turn, encourage further safeguard actions by another set of importing countries. The larger the world price fall, the higher will be the loss-aversion coefficient and more countries would impose higher safeguard tariffs as a response to a larger world price fall. Higher export subsidies will also emerge in response.

3.2.2 Trade policy formulation in a cooperative international setting

Having described the non-cooperative trade policy equilibrium in the previous section, we now study the equilibrium between both countries if they manage to set trade policies cooperatively in a one-period game. Here we examine the

equilibrium SSM tariffs resulting from possible cooperation between the SSM-imposing country and the affected food-exporting country, which can lead to an outcome that is more efficient than the non-cooperative trade policy outcome.[14] The cooperation between a particular food-importing country and a food-exporting country can be seen as a formal or informal mutual agreement between them depending on their political relationship and the welfare concerns.

We assume a simplified Nash bargaining procedure and further assume that each country has equal bargaining power in negotiation. In the negotiation game each country maximizes a joint welfare function and sets jointly optimal trade policies. Then, the respective objective functions of importing and exporting countries are,

$$\varphi = \varpi + \varpi^* \tag{14}$$

$$\varphi^* = \varpi^* + \varpi \tag{15}$$

The negotiation outcome is assumed to be efficient since it is the maximization of the joint welfare.

[14] Here we examine whether an efficient outcome can be achieved if the importing country and the exporting country can negotiate an alternative trade policy agreement, even though this possibility is not provided for in the current SSM proposal.

From the first order conditions, we find the equilibrium import tariffs and export subsidies, which maximize the welfare of the two governments [15] (see Appendix B.3 for derivation[16]) so that,

$$(1-\gamma-\theta)\Delta x+(t^*-t)=0 \tag{16}$$

$$(\gamma+\theta-1)\Delta x+(t-t^*)=0 \tag{17}$$

Similar to the standard conclusion of the political economy trade policy literature,[17] we note from (16) and (17) that the level of trade policies are indeterminate and only the difference between t and t^* is determined in the equilibrium. The equilibrium path is a straight line in the t and t^* space. Countries can choose a trade policy pair on this path depending on each country's self interest, which can be decided in an agreement between them. On reflection, both governments can increase trade policy levels holding the equilibrium difference between trade policy levels constant. This implies a continuous increase in trade tax revenue in the importing country and fall in tax receipts in the exporting country. It also reflects that an efficient negotiation game may entail possible transfers from the exporting country to the importing country. Nevertheless, setting a trade policy pair above the non-cooperative trade policy pair is not individually rational and therefore countries will always

[15] Given that the objective function incorporates loss aversion concerns, the equilibrium cooperative trade policy is not equal to zero.

[16] we have assumed that $\theta=\theta^*$ and $\gamma=\gamma^*$ for notational simplicity

[17] Including Grossman and Helpman (1995).

choose a trade policy pair within the t and t^* space decided by their best response tariff functions.

As the non-cooperative trade policy equilibrium is associated with higher level of interventions, it is likely that the importing country government may not cooperate with the exporting country government for a joint welfare improvement in a one period game. There is an incentive for deviating from cooperation because the SSM protection received by the import-competing farmers is higher in the non-cooperative trade policy equilibrium than in the cooperative equilibrium. Then, the importing country government will always choose to set higher tariffs ignoring the possible impacts of its policy actions on the exporting country. Therefore, cooperation may not be self-enforcing in a one period game.

3.2.3 Self-enforcement of cooperation under repeated game setting[18]

So far we have examined the political economy behaviour of food-importing and food-exporting countries in a one period game. Let‟s now study whether the behaviour of the governments is different in multiple periods with repeated

[18] In this section, the game is analysis only in the context of downward price spikes because the focus is on the SSM, which is used to manage risks associated with downward price spikes. A repeated game allowing for both upward and downward price spikes is analysed in Chapter 3 of this thesis.

interactions because the factors affecting countries in multiple periods can be different to those in one period. The governments may consider reputational concerns in international trade, nature of the political relationship between them and so on if their political life time does not end in one period. It was shown in the previous analysis that the self-enforcement of cooperation may not be possible in the one period game. Let‟s now briefly extend the analysis to a basic infinitely repeated game to see whether self-enforcing cooperation is possible in this case

The game can be defined as follows. In each period both governments set their trade policy simultaneously. The food-importing country imposes SSM tariffs and the food-exporting country reduces export taxes or imposes export subsidies. The outcome is observed by each trading partner, and they proceed to the next period. The trigger strategy is to set cooperative tariffs in each and every period as long as the trading partner sets its trade policy cooperatively. If one country deviates from the cooperation in the first period, the other country sets non-cooperative trade policies in the remainder of the game. This is the punishment phase. Here we allow the exporting country government to act against the importing country‟s protection and respond to the same downward price spike by imposing export subsidies within their legal bound levels or by reducing export taxes. By defining the problem in this way, we can find out

whether an efficient outcome would be possible if the exporting country group acts against the SSM protection of the importing country group.[19]

Before deriving the analytical outcome, let"s first briefly discuss the incentives for cooperation. As the game is defined, if the food-importing country group deviates from the cooperative equilibrium in the first period and set non-cooperative tariffs in response to the international price fall, the food-exporting country group will employ a non-cooperative export subsidy policy. This will in turn lower the international price further, producing offsetting implications for domestic prices in each country making the respective policies less effective as stabilizing measures. The intended benefits of SSM protection to protect farmers from a downward price spike are therefore offset by the export subsidies of the exporting country. Thus, the response of the SSM-imposing government, whose political objective function is characterized with loss aversion for import-competing producers, is likely to impose further tariffs to protect them. Nevertheless, it is not individually rational for the importing country to set its tariffs above the non-cooperative equilibrium tariffs, which is costly. Since the importing country government is aware of this cost of

[19] Despite the fact that the current SSM proposal does not allow affected countries to retaliate against the safeguard-imposing country, the affected exporting countries, in response to the same downward price spike, can impose export subsidies within their legally bound levels to assist their farmers. The export subsidies have not been completely phased out from the multilateral trading system. Or they can reduce the export taxes that are already in place.

deviating from cooperation it may agree with cooperation.[20] Moreover, if the importing country has ever used a non-cooperative policy, the exporting country government is assumed to forever apply non-cooperative trade policies, which may be a huge political cost to the importing country. This may also provide an incentive for the SSM-imposing country to cooperate with the exporting country.

We now define the payoff of each government under different scenarios. Let $\varpi(t^C \setminus t^{*C})$ and $\varpi^*(t^{*C} \setminus t^C)$ denote the welfare of importing and exporting country governments, respectively when both country groups set cooperative trade policies, and $\varpi(t^N \setminus t^{*N})$ and $\varpi^*(t^{*N} \setminus t^N)$ denote the welfare of respective countries under Nash equilibrium trade policies. If the importing country plays Nash equilibrium policy given the exporting country‟s cooperative policy and the exporting country plays the cooperative policy given importers‟ Nash policy, the respective welfare levels are $\varpi(t^N \setminus t^{*C})$, and $\varpi^*(t^{*C} \setminus t^N)$. Similarly, we can define the welfare of the importing country government with the cooperative policy given exporters‟ Nash policy as $\varpi(t^C \setminus t^{*N})$, and exporters‟ welfare with Nash policy given the importers‟ cooperative policy as $\varpi^*(t^{*N} \setminus t^C)$.

[20]It may also be likely that the importing country government will cooperate in the second period though it may not cooperate in the first period, because it may realize in the second period the cost of non-cooperation (i.e., reputational problems and lack of trust leading to loss of international business). Nevertheless, we do not analyse this possibility.

Let $\delta \in (0,1)$ be the discount factor associated with the future value of welfare reflecting the rate at which the government discounts the future where $\delta = \frac{1}{1+r}$. The term *r* is the rate of return. Using the proposed strategy, which implies a cooperative policy of the importing country government in the first period and in every other period given that the exporting government chooses a cooperative action in every period, the present value of welfare from cooperation for the importing country government is found to be,

$$\frac{1}{1-\delta} w(t^C \setminus t^{*C}) \tag{18}$$

The incentive for deviation from cooperation and implementation of higher protection is,

$$w(t^N / t^{*C}) + \delta \frac{w(t^N / t^{*N})}{1-\delta} \tag{19}$$

which is the welfare of the importing country government from the Nash policy in the first period and welfare in the remainder of the period when the exporting country government responds with a Nash policy. The incentive constraint for the importing country government to sustain the cooperation and not to implement Nash tariffs can therefore be defined as,

$$\frac{1}{1-\delta} w(t^C / t^{*C}) > w(t^N / t^{*C}) + \delta \frac{w(t^N / t^{*N})}{1-\delta} \quad (20)$$

where the discount factor is such that the condition (20) is satisfied. From equation (20), the cooperation can be self-enforcing in an infinitely repeated game.

The self-enforcing cooperation however requires that both governments are patient and place a high value on the future (i.e. a low *r* and high discount factor), which can be a restrictive requirement. It requires the importing country government to value the welfare of future generations higher than the welfare of generations in the current period, which seems to be a less realistic assumption particularly regarding developing countries. Developing country governments are likely to be less patient and seem to rely on short-run popular policies by giving less consideration to long-run implications for the country. If the government values the welfare of the future generations less than the current generation, the discount factor falls and a self-enforcing cooperative outcome is unlikely. Nevertheless, we can still assume that the government is patient enough to place a sufficiently high value on the future welfare.

Assuming that the importing country government is sufficiently patient, what drives a cooperative outcome is the trade policy reactions of the affected exporting countries against SSM protection. If the affected exporting countries respond to the same price spike by imposing export subsidies within their legally bound levels or by lowering export taxes that are already in place, it

would lead to a more-efficient outcome. Alternatively, one way to induce safeguard-imposing countries towards a more efficient cooperative outcome is to allow retaliatory trade policy actions by the affected exporting countries within the current provisions of the SSM. Even though this may be less realistic in the current institutional set up of the SSM, it will lead to an efficient outcome without direct involvement of a third party, the WTO.

3.2.4. Truthful revelation under WTO involvement

As per the current provisions of the proposed SSM, the SSM-imposing countries are not required to provide evidence of injury to justify the SSM initiation (WTO, 2008), Therefore, how much the domestic producers are hurt by a downward price spike is private information to the tariff-imposing country. In the absence of strict disciplines on the use of safeguards in the SSM proposal, it is likely that the food-importing country hides true information on the level of injury and claims for higher tariffs. This section, building on Beshkar (2010), examines whether the involvement of the WTO reduces incentives for such opportunistic behaviour by deriving the incentive constraints for food-importing and exporting countries to truthfully reveal their state of the domestic worlds and set the trade policies accordingly. Our focus is on the importing country while the equations can be similarly defined for the exporting country due to symmetry.

We assume that the food-importing country group and food-exporting country group negotiate for a trade policy pair, which is set according to their respective state of the worlds, ε and ε^*.[21] Negotiated higher tariffs and export subsidies, t^H and t^{H*} are chosen by importing and exporting countries, respectively, if the state of the world is bad, i.e., $\varepsilon = \varepsilon^* = \bar{\varepsilon}$ and this occurs with the probability of ρ. Conversely, lower tariffs t^L and subsidies t^{L^*} are chosen with probability of $1-\rho$ when the state of the world is good, $\varepsilon = \varepsilon^* = \dot{\varepsilon}$. Each government is assumed to privately observe its state of the world. In this private information setting, a potential incentive compatibility problem arises because both governments have incentives to claim for a higher level of trade policies even if the actual state of the world is good. Following Beshkar (2010), here we introduce a judging body, the WTO, which can be requested to be involved by the affected party, and assist the governments in their trade policy decisions. For instance, if the exporting country government is not happy with the importer‟s trade policy level, it can request that the WTO get involved. The WTO is assumed to observe the true state of the world or the actual level of injury to domestic producers with probability α such that $\alpha \in [0,1]$. If the WTO approves the claim of the exporter, then the exporter is allowed to retaliate against the importer by imposing higher export subsidies and the importer is then not allowed to impose higher tariffs.

[21] The state of the world may also represent the injury to the domestic interest groups (eg. producers) following an exogenous shock.

If both countries state their trade policies truthfully, we can calculate the expected payoffs under different contingencies, as follows.

When both countries experience good state of the world where the probability of this contingency is $(1-\rho)^2$, both countries will set low level of trade policies. The expected pay off to the importing country government is,

$$\varpi(t^L;\dot{\varepsilon}/t^{L^*}) \tag{21}$$

If the importing country experiences a bad state of the world, while the exporting country experiences a good state of the world, the expected pay off to the importing country government is,

$$\alpha.\varpi(t^H;\bar{\varepsilon}/t^{L^*})+(1-\alpha).\varpi(t^L;\bar{\varepsilon}/t^{H^*}) \tag{22}$$

The first part of equation (22) specifies that with probability α, the WTO correctly observes the bad state of the world in importing country and the government can continue to set higher tariffs. However, as in the second part of equation (22), if the WTO is unable to observe the true state of the world in importing country, the exporting country government is allowed to retaliate with probability $1-\alpha$ and the importing country government is not allowed to set higher tariffs.

With probability $p(1-\rho)$, the importing country experiences good state of the world while the exporting country experiences a bad state of the world. The expected pay-off to the importing country government is,

$$\alpha.\varpi(t^{L};\dot{\varepsilon}/t^{H^*})+(1-\alpha).\varpi(t^{H};\dot{\varepsilon}/t^{L^*}) \tag{23}$$

If both food-exporting and food-importing countries experience bad state of the world, which could happen with probability ρ^2, the pay off is,

$$\begin{aligned}&\alpha^2.\varpi(t^{H};\bar{\varepsilon}/t^{H^*})+(1-\alpha)^2.\varpi(t^{H};\bar{\varepsilon}/t^{H^*})+\\&\alpha(1-\alpha)\varpi(t^{H};\bar{\varepsilon}/t^{L^*})+\alpha(1-\alpha)\varpi(t^{L};\bar{\varepsilon}/t^{H^*})\end{aligned} \tag{24}$$

In order to characterize the incentive constraints for the importing country government for truthful revelation, we assume that the exporting country government tells the truth throughout this analysis.

The payoff to the importing country government for claiming higher tariffs when the domestic state of the world is good given that exporter's state of the world is also good, is $\alpha.\varpi(t^{L};\dot{\varepsilon}/t^{H^*})+(1-\alpha).\varpi(t^{H};\dot{\varepsilon}/t^{L^*})$. With probability α the importing country government faces retaliation from the exporting country government where the exporter is allowed to provide a higher level of assistance to its producers while the importer is forced to set lower tariffs. On the other hand, the pay-off to the importer for truthful revelation of the state of

the world is $\varpi(t^L;\dot{\varepsilon}/t^{L^*})$. Therefore the incentive constraint for the importing country government to reveal the state of the world truthfully is,

$$\alpha.\varpi(t^L;\dot{\varepsilon}/t^{H^*})+(1-\alpha).\varpi(t^H;\dot{\varepsilon}/t^{L^*})\le\varpi(t^L;\dot{\varepsilon}/t^{L^*}) \tag{25}$$

Similarly, the incentive constraint for truthful revelation of the importer‟s domestic state of the world when the exporting country experiences bad state of the world is,

$$\alpha.\varpi(t^L;\dot{\varepsilon}/t^{H^*})+(1-\alpha).\varpi(t^H;\dot{\varepsilon}/t^{H^*})\le\varpi(t^L;\dot{\varepsilon}/t^{H^*}) \tag{26}$$

With $\alpha=1$, the WTO‟s observation of the true state of the world is entirely accurate and the second terms of the incentive constraints given in equations (25) and (26) disappear. It is therefore confirmed that the higher the accuracy of the WTO‟s observation of the true state of the world, the higher will be the incentive for food-importing country to set the SSM tariffs according to their true state of the world. There are two things guaranteeing this truthful revelation. First, the affected parties need to be allowed to request WTO assistance within the framework of the SSM if they presume that the importing country sets tariffs opportunistically. Second, if food-importing countries act opportunistically, affected parties need to be allowed to respond against such protection.

3.3 Conclusion

In this chapter, we explain why countries alter their intervention in trade in response to a commodity price spike, and analyse the implications for trade policy outcomes between food-importing and food-exporting countries. We formulate a partial equilibrium model incorporating both import policies and export policies in a common framework that can explain the importance of non-economic and political economy concerns in shaping trade policy intervention by the governments.

Providing a political economy explanation for the proposed agricultural SSM, the model predicts that a political preference for averting losses for farmers from an exogenous international downward price spike leads to a rise in food import protection. That triggers food-exporting countries also to respond by raising assistance to their farmers (e.g. by reducing taxes on farm exports or imposing export subsidies). The higher the political weight given to the producer profits in the government objective function, and the higher the government‟s concern for loss aversion, the higher will be the protection in the form of insulation from the international price spike.

In a non-cooperative trade policy setting, higher SSM tariffs are likely, and higher export subsidies will also emerge in response to the raising of those tariffs. Cooperative trade policies are, on the other hand, welfare improving for both groups of countries and lead to lower import tariffs and lower export subsidies than non-cooperative outcomes. However, self-enforcement of

cooperation is unlikely in the one-period trade policy game. Nevertheless, our model yields predictions about self-enforcing cooperation in a repeated game setting assuming that the governments are sufficiently patient. Moreover, in the case of WTO involvement, the study predicts that the higher the accuracy of the WTO decision on the true state of the world, the higher will be the incentive for importing countries to set their tariffs according to the true state of the world.

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Chapter 4

Political Economy of Trade Interventions in Response to Recent Upward Price Spikes

Trade interventions in response to upward price spikes have gained increasing attention in trade policy literature following the recent commodity price hikes. Commodity prices began climbing since early 2000 and spiked twice during the past four years. The prices of staple foods including rice, wheat and maize reached their highest in three decades in 2008 (Rapsomanikis and Sarris, 2010). The most recent surge was recorded during 2010-2011 with a large and rapid price rise in many commodities. The upward price spikes in international food markets are not unprecedented in history with the most notable upward price spike occurring in the mid-1970s.

Sudden upward price spikes appear to have created a number of policy challenges for the governments. Following the recent price rises, the countries faced deterioration of their balance of payments and foreign reserves at the macro level while at the micro level the poor consumers were badly affected by

the sharp price rises (OECD, 2010a). Ivanic and Martin (2008) highlighted adverse implications for poverty of rise in food prices in low income countries. These impacts have in turn triggered countries to rely on trade interventions to manage the market risks associated with price volatility. Evidence suggests that both export restrictions and import tariff reductions have been practised in response to upward price spikes (Martin and Anderson, 2012).

Much of the discussion following the recent upward price spikes, including for instance Childs and Kiawu (2009), Baffes and Haniotis (2010), Hochman et al (2010), has acknowledged the effects of trade interventions as a major contributing cause behind these spikes. The historical emphasis of the issue is seen in the study by Johnson (1975). Among the recent attempts to examine the economic effects of trade interventions in response to the upward price spikes, Bouet and Debucquet (2012) highlight the economic costs associated with export taxation in the context of a food crisis by employing both partial and general equilibrium theoretical models and a computational general equilibrium (CGE) model. Mitra and Josling (2009) conclude that the export restrictions result in welfare losses for the tax-imposing country as well as for the rest of the world. More micro-level analysis is provided by Warr (2001).

Despite the economic costs associated with trade interventions frequently highlighted in literature, countries continue to alter their intervention in trade. The policy intention of these trade interventions in response to upward price spikes may be to achieve certain domestic policy objectives, in particular, some

non-economic objectives. While the political economy motivations for these interventions vary depending on the commodities, they include concerns for consumers. As has been found in empirical literature while both food-importing and food-exporting countries actively rely on trade restrictions in response to volatility in the world price, the governments in developing countries are more likely to protect the consumers from upward price spikes than the producers. Also, in response to a world price rise, food surplus (food exporting) developing countries have tended to tax the exporting agriculture while the food deficit (food-importing) developing countries have tended to reduce the import tariffs (Anderson and Nelgen, 2012). Among the few other empirical studies to examine the nature, magnitude and the political economy behaviour of the governments, specially pertinent are Martin and Anderson (2012), which examine evidence from the two major upward price spikes by considering both import and export policy reactions to the same upward price spike and their relative importance during the respective time periods.

Despite the considerable interest shown in the empirical literature on non-economic concerns behind trade interventions, the standard theoretical political economy literature does not provide sufficient explanation for such considerations except for a few recent attempts such as Freund and Özden (2008) and Tovar (2009).[1] Most of the existing models focus on terms of trade motives for trade policy determination. The literature is also certainly limited

[1] Noneconomic motives for trade interventions have been highlighted in initial explorations, for instance by Corden (1997), Bhagwati (1971) and Bhagwati and Srinivasan (1969).

in analysing both food-importing and exporting policies in a common framework even though the empirical evidence suggests that both import and export policies are practised in response to a food price hike in the real world (Martin and Anderson, 2012). This chapter, employing a partial equilibrium model incorporating loss aversion, provides a political economy explanation for trade policy interventions in response to an upward price spike such as occurred twice during the past four years. It also analyses the implications for trade policy outcomes between food-importing and exporting countries by employing a model that incorporates both import and export policies in a common framework. It further examines how an efficient outcome can be achieved in a repeated game setting and with possible involvement of the WTO.

This chapter is organized as follows. The analytical model is introduced in section 4.1 and the trade policy behaviour of food-exporting and importing countries is examined in subsequent sub-sections. In sections 4.2 and 4.3, we analyse the trade policy interaction between food-importing and food-exporting countries in non-cooperative and corporative settings, respectively. The model is then extended to a repeated game setting in section 4.4 and introduces the WTO in section 4.5 to see whether an efficient outcome is possible. Some concluding remarks complete the chapter.

4.1 Analytical Model

4.1.1 The basic economic structure

We propose a partial equilibrium model[2] to provide a political economy explanation for trade policy interventions in response to an upward price spike. We consider a two-country world with trade interaction between a large food-importing country and a large food-exporting country in the presence of political lobbying influences. These two countries can also be thought of as two sufficiently large groups of small countries -- a food-importing country group and a food-exporting country group.

Supply and demand

The two countries trade good A, which is an agricultural commodity. The price of the agricultural good in the domestic markets in the food-importing and exporting countries are p and p^*, respectively. The demand functions for the food-importing country and –exporting country are defined symmetrically in terms of domestic prices. These demand functions, which take simple liner form, are

$$d(p) = a - p \tag{1}$$

$$d^*(p^*) = a - p^* \tag{2}$$

[2] This model is a partial equilibrium version of Maggi and Rodriguez-Clair (2005) modified to incorporate behavioural elements and extended to a repeated game and WTO involvement.

The good is produced in each country, and the good is assumed to be produced from a specific factor such that the input-to-output coefficient is one. Letting x denote the specific factor used to produce the agricultural commodity, total supply of the agricultural commodity in food importing and -exporting countries, respectively are,

$$S = x \tag{3}$$

$$S^* = x^* \tag{4}$$

Assuming all other conditions equal for both countries, we assume that the exporting country has a larger supply of the good $(x^* > x)$ and therefore it is the natural exporter of this good to the importing country. With these definitions, the returns to the agricultural specific factor (i.e., profit functions) in each country are denoted by px and $p^* x^*$, respectively.

Price determination

In response to an exogenous upward price spike, trade policy intervention in this agricultural market is assumed to be limited in the exporting country to an export tax, which drives the price away from its free-trade level. The corresponding price linkage equation is:

$$p^* = p^w - t^* \tag{5}$$

P^* and P^w are the domestic price in the exporting country and the international price at its border, respectively.

We let the importing country also react in response to the exogenous upward price spike by assuming that the importing country government applies an import subsidy to support its consumers, so that:

$$p = p^w - t \tag{6}$$

p and t are the domestic price in the importing country and an import subsidy, respectively.

Having defined the production and the demand side of the economy, the international equilibrium price can be determined from the market-clearing condition by equalizing the excess demand in the food-importing country group and the excess supply in the food-exporting country group such that,

$$d(p) + d(p^*) = S + S^*$$

$$p^w = a + \frac{1}{2}(-x - x^* + t + t^*) \tag{7}$$

Trade volumes

Now we define the market clearing trade volumes. Net imports of the good in the food-importing country are given by $m = d(p) - x$, which is equal to $m = 1/2(\Delta x + t - t^*)$ where Δx =x*-x, which is positive. Revenue from the trade taxes in the exporting country is given by, $t^* m = t^*(d(p) - x)$.

4.1.2 Exporter's response to an upward price spike

Let"s now turn to analyse the behaviour of food-exporting country group to reflect the political economy considerations behind trade interventions in response to an upward price spike. The new international equilibrium price results in welfare losses to some sectors of the economy. We assume that the exporting country government faces political pressure from influential interest groups and sets its trade policy response to smooth short-term variations in the domestic price in a way that rewards these influential interest groups.

We follow Baldwin (1987)[3] in assuming that the government maximizes a weighted sum of returns to producers (px) , consumers (cs) and tariff revenue (tm) , and follow Freund and Özden (2008)[4] to modify the government

[3] As cited in Baldwin (1987), the partial equilibrium version of the government objective function has been popularly used in the literature, for instance, in the studies by Dixit (1985), Venables and Smith (1987), Rodrik (1987) and Baldwin and Krugman (1986, 1987).

[4] Our point of departure from Freund and Özden (2008) is that we define the loss aversion concerns in a partial rather than general equilibrium framework.

objective function to represent the welfare costs associated with deviations from policy-makers‟ preferred equilibrium. Consistent with the Bagwell and Staiger (2001, 2005) approach, we represent political influences in the government objective function with the assumption that the government places different weights on producer surplus, consumer surplus and tariff revenue depending on its political interests and the political influences following an exogenous international food price spike.

In the case of an upward price spike, consumers are adversely affected and we assume that the food-exporting country seeks to support consumers. We assume that the government places a higher weight on the consumer surplus above the producer surplus and tariff revenue in its objective function, if the consumer surplus (cs^*) fall below reference level ($\overline{cs}^*$) (more specifically, if the loss to the consumers ($\overline{cs}^* - cs^*$) is above a certain level denoted by λ (i.e. if $\overline{cs}^* - cs^* > \lambda$)).

The objective function [5] of the government that specifies such political economy concerns is:

[5] Countries in the real world are also concerned with costs of their policy actions on their trading partners. In that case, the objective function of the government should also include a variable to denote such concerns. The extent of these concerns can be represented by its coefficient. This variable is negatively related to the political welfare function. Our political welfare function does not specify this variable or assumes that the coefficient is equal to zero.

$$\varpi = p^{*}x^{*} + t^{*}m + \gamma^{*}cs^{*} - \theta^{*}(\overline{cs}^{*} - cs^{*}) \quad \text{if } (\overline{cs}^{*} - cs^{*} > \lambda) \tag{8}$$

where ϖ is the welfare experienced by the exporting country government, and the term γ^{*} denotes the political weight assigned to the consumer surplus in the cases of an upward price spike, respectively. The term θ^{*} is the loss aversion coefficient, which is positive, i.e. $\theta > 0$. The loss aversion term starting from θ^{*} in the above equation implies that the exporting country government experiences a welfare loss if the consumers experience losses following an upward price spike. Consistent with the loss aversion definition of Freund and Özden (2008), we further assume that a consumer surplus gain above the reference level does not add additional gains to the welfare function of the government.

Let‟s now discuss how these political economy concerns determine the level and the magnitude of trade policies of food-exporting countries. By differentiating the political objective function of the exporting country government with respect to export taxes, the first order conditions yield (see Appendix C.1 for derivation),

$$t^{*} = \frac{-2x + (2 - \gamma^{*} - \theta^{*})t + (\gamma + \theta)(x + x^{*})}{(4 - \gamma^{*} - \theta^{*})} \tag{9}$$

where $\frac{\partial t^{*}}{\partial \theta^{*}} > 0$

implying that, the higher the government concern for averting losses for consumers from an upward price spike the higher will be the export taxes levied on the agricultural good in order to encourage domestic production sold in the domestic market, which reduces the domestic price of the good.

Even though a small exporting country facing the fixed world price cannot affect the world equilibrium price by intervening in trade, a sufficiently large group of small open economies whose net purchases have an impact on the world excess demand conditions, affects the world market price, and produces terms of trade implications for the world. The effect of an export tax in response to an upward price spike is to push the world price further up. Recalling the welfare implications derived in Chapter 2, during a period in which the international price of food spikes upward, large (or sufficiently large group of small) food-exporting countries gain additionally from a marginal increment in their export tax from zero while the welfare loss from the exogenous shock for the food–importing countries are worsened by that trade policy response of food-exporters.

4.1.3 Importer's response to an upward price spike

Let"s now turn to analyse the policy behaviour of food importers in response to an upward price spike. Following the price spike, we assume that the importing countries face political pressure from their domestic interest groups. As for the

case of the exporting country government, the importing country government also cares more about consumers affected by the upward price spike if they are influential in government policy alterations. We assume that if the consumer surplus (cs) is below the reference level $(\overline{cs})$ (i.e. if the loss in consumer surplus $(\overline{cs} - cs)$ is above a certain level λ), a higher weight is assigned to the consumer surplus in the government objective function. If consumers as an interest group are politically more influential, the government political objective function is modified in a way that rewards consumers so that;

$$\varpi = px - tm + \gamma cs - \theta(\overline{cs} - cs) \qquad \text{if } (\overline{cs} - cs) > \lambda \tag{10}$$

The equation states that the welfare of the government is negatively affected if the consumers are adversely affected by the upward price spike and the consumer welfare deviates from the long-term trend.

The first order conditions of the welfare maximization problem yield,

$$t = \frac{-2x^* + (2 - \gamma - \theta)t^* + (\gamma + \theta)(x + x^*)}{(4 - \gamma - \theta)} \tag{11}$$

where $\frac{\partial t}{\partial \theta} > 0$

implying that the higher the concerns for consumers, the more import tariffs will be reduced or the more import subsidies will be introduced by the importing country government.

The effect of an import subsidy is to increase the international equilibrium price further. Assuming that only the importing country group responds to the upward price spike, the welfare implications highlighted in Chapter 2 of this thesis show that the welfare loss from the exogenous upward spike for the importers is further worsened by its own import subsidy policy while the exporters gain additionally from the trade policy action of food importers. Welfare implications are further accentuated if both importing and exporting countries respond with trade interventions.

Let"s now turn to find out how the differences in consumption behaviour would affect the consumer-loss-aversion coefficient and trade policy formulation in food-importing and food-exporting countries in the real world. We know that the higher the price of a commodity, the larger will be the consumer surplus loss. Similarly, the individuals or households whose food baskets consist more of these commodities, are hurt more by an upward price spike. If these consumers are an influential interest group of the economy, the political welfare function of the government is modified to represent policy preference to assist these consumers through the loss aversion coefficient depending on deviations of the price from its trend level as discussed before. Then, we can argue that the size of the consumer-loss-aversion coefficient depends on the

composition of the consumption basket. Thus, the higher the contribution of food in the consumption basket the larger will be the consumer-loss-aversion coefficient. This provides important insights into the likely sizes of loss aversion coefficients between countries. The consumer-loss-aversion coefficient can be larger for the countries whose individuals consume more food items. Anderson (1995) states that farm products account for about half of household expenditure in poor countries while the share is much smaller in high income countries. Thus, we can argue that the consumer-loss-aversion coefficient is larger for poor countries than for rich countries. This is particularly true for net food-importing poor countries provided that imported food items comprise a large part of their food basket (Ruffin and Jones, 1977). The size of the loss-aversion coefficient also depends on the importance of the services component of food. As services are a larger component of food in rich countries than in poor countries, international price changes have a bigger impact on poor countries‟ final consumers than on those in rich countries. Poor countries thus have a larger loss-aversion coefficient. Applying these findings into our model, it suggests that the developing country importers are likely to reduce import tariffs during upward price spikes more than the high income countries do while developing country exporters are likely to increase export taxes more than high income countries do following an upward price spike. The high-income food importers or exporters with very small consumer-loss-aversion coefficients may not even intervene in trade if the cost of trade policy alterations through legislations exceeds the potential benefits of such actions provided that the consumers are not the most influential interest group in their

economies. The differences in size of the consumer-loss-aversion coefficient between low-income and high-income countries also justify the difference in the level of the lobbying activities in these countries.

4.2. Trade Policy Formulation in a Non-cooperative International Setting

Let‟s now turn to analyse how the non-economic and political economy reasons explained in the proceeding analysis affect the trade policy outcome between food-importing and food-exporting countries. In a game theoretical set up, equations (9) and (11) represent non-cooperative unilateral trade policy interventions by exporting countries and importing countries, respectively in response to an upward price spike. Assuming that there are only two countries or two groups of countries in the world, equations (9) and (11) are also the best response function of the importing and exporting governments, respectively, given the corresponding trade policy in their trading partners. In the non-cooperative international setting, the Nash equilibrium trade policies can be determined from Nash equilibrium conditions in equations (9) and (11) (see Appendix C.2 for derivation[6]),

$$t = -\left[\frac{(4-\gamma-\theta)x^{*}+(2-\gamma-\theta)x}{2(3-\gamma-\theta)}\right]+\frac{(\gamma+\theta)(x+x^{*})}{2} \qquad (12)$$

[6] [6] We have assumed that $\theta = \theta^{*}$ and $\gamma = \gamma^{*}$ for notational simplicity.

$$t^* = -\left[\frac{(4-\gamma-\theta)x+(2-\gamma-\theta)x^*}{2(3-\gamma-\theta)}\right]+\frac{(\gamma+\theta)(x+x^*)}{2} \quad (13)$$

As discussed in Chapter 2, the implications of policy responses of both country groups for the exporting country group show that the overall welfare further increases. Welfare gains nevertheless depend on the initial export tax level and the extent of the increase in it given that any export tax above the optimal export tax is welfare reducing. Welfare reduction in the importing country group is larger when both exporters and importers act in response to the world price hike. Furthermore, when both food-importing and exporting countries act together in response to an upward price spike, the intended benefits of an export tax to avoid adverse impacts on domestic consumers of an upward price spike are offset by a reduction in import tariffs or imposition of import subsidies in the importing country. Domestic consumers in the exporting country then experience a decrease in welfare because the world price has further risen. Despite the producer gain, losses in the consumer surplus can lead to further export taxes by the exporting country in response to the resulting upward price spike. Implications for the importing country are similar, requiring them to impose further import subsidies to protect consumers from upward price spikes. Thus, the consequence of initial trade policy interventions in a multi-county real world is that the international price further goes up even more with export taxes by exporting countries and import subsidies by importing countries, which may in turn require further trade policy responses by both countries. The higher the world price rise, the higher will be the loss

aversion coefficient and more countries would intervene in trade in response to higher upward price spikes triggered by initial actions.

4.3 Trade Policies in a Cooperative International Setting

Let‟s now study the trade policy equilibrium between food-importing and food-exporting countries if they manage to set their trade policies cooperatively in one period. A cooperative outcome can be seen as a formal or informal mutual agreement between them depending on their political relationship and the welfare concerns. A cooperative outcome is likely in the real world if both food-exporting countries and their food-importing partners realize the costs associated with the non-cooperative outcome, which results in a domestic policy failure as import policies and export policies on the same good have offsetting implications for domestic prices in each country.

A simplified Nash bargaining procedure is assumed with equal bargaining power for both countries in negotiation. In the negotiation game each country maximizes the joint welfare of both countries and sets jointly optimal trade policies.

The equilibrium cooperative export taxes and import subsidies are (see Appendix C.2 for derivation[7]),

$$(t^* - t)(2 - \gamma - \theta) = 0 \tag{14}$$

$$(t - t^*)(2 - \gamma - \theta) = 0 \tag{15}$$

We note from equations (14) and (15) that the level of trade policies are indeterminate. This is similar to the standard conclusion of the political economy literature with a similar framework. Moreover, both countries set exactly the same level of trade policies in cooperation. The equilibrium path is a straight line in the *t* and *t** space. Both governments can choose a trade policy pair on this path depending on their self interests and welfare concerns. The trade policy pair is decided in an agreement between them. Nevertheless, as setting a higher tariff than the non-cooperative Nash tariffs is not individually rational and a non-cooperative outcome always results in a larger welfare loss, countries will always choose a trade policy pair within the *t* and *t** space decided by their best response tariff functions and lower than the non-cooperative outcome.

Nevertheless, provided that the cooperative outcome will not let countries set higher level of trade policies to assist domestic consumers, it is likely that the countries may not cooperate for joint welfare maximization in a one period

[7] [7] We have assumed that $\theta = \theta^*$ and $\gamma = \gamma^*$ for notational simplicity

game. There is an incentive for both countries to deviate from the cooperative outcome as Nash equilibrium trade policies yield higher levels of trade interventions to assist consumers.

4.4 Cooperation in an Infinitely Repeated Game Setting

It was shown in the previous analysis that self-enforcement of cooperation may not be possible in a one period game. Let‟s now study whether the behaviour of the governments is different in a multiple period because the factors affecting countries in multiple periods are different to those in one period. These factors are elaborated in detail in this section.

Here we briefly extend the model to an infinity repeated game assuming that if one country deviates from cooperation in the first period, the other country sets a non-cooperative trade policy in the remainder of the game as a punishment. For instance, if the exporting country deviates from cooperation in the first period and imposes non-cooperative export taxes in response to the upward price spike, the importing country sets its import subsidy policy equal to the non-cooperative level in the remainder of the period. The effect of both countries‟ trade policy actions is to reinforce the upward price spike. Moreover, policy actions of both countries in response to the upward price spike have offsetting implications for domestic prices in each country making the respective policies less effective as stabilizing measures. Focusing on the

exporting country, the intended benefits of export taxes to avoid adverse impacts on domestic consumers of upward price spikes have been offset by import subsidies of the importing country. Thus, the response of the exporting country government whose political objective function is characterized with loss aversion for consumers is likely to reintroduce further export taxes to avert losses for consumers from the resulting upward price spike. Nevertheless, it is not individually rational for the exporting country government to raise its export taxes above the non-cooperative Nash equilibrium level. As the exporting country is aware of this cost of deviation from cooperation in the first period, it may agree with a cooperative trade policy outcome. Other incentives for cooperation include reputational concerns. As the game is defined, the importing country government will forever apply non-cooperative trade policies if the exporting country has ever used non-cooperative policy, which may be a huge political cost to the exporting country. If their political life-time does not end in one period, the governments may also be sensitive to concerns such as possible damages to national reputation in international trade transactions, which may cause future loss of business.

Let‟s now derive the conditions focusing on food-exporting countries while a similar analysis can be done for the food-importing country.

Denoting $\delta \in (0,1)$ the discount factor associated with the future value of welfare reflecting the rate at which the government discounts the future where

$\delta = \frac{1}{1+r}$, the present value of welfare from cooperation for food-exporting countries is found to be,

$$\frac{1}{1-\delta} w^*(t^{*C} \backslash t^C) \tag{16}$$

where $w^*(t^{*C} \backslash t^C)$ denotes the welfare of the exporting country when both country groups set cooperative trade policies.

The incentive for deviating from cooperation and offering higher assistance to its consumers is,

$$w^*(t^{*N} / t^C) + \delta \frac{w^*(t^{*N} / t^N)}{1-\delta} \tag{17}$$

The first part of equation (17) represents the welfare of the food-exporting country that is associated with non-cooperative export taxes in the first period given the cooperative import subsidies in the importing country. The second part reflects the welfare of the exporting country government in the remainder of the period when the importing country responds with non-cooperative import subsidies to assist its consumers. The incentive constraint for the exporting country government to sustain the cooperation and not to implement Nash export taxes can therefore be defined as,

$$\frac{1}{1-\delta} w^*(t^{*C} / t^C) > w^*(t^{*N} / t^C) + \delta \frac{w^*(t^{*N} / t^N)}{1-\delta} \quad (18)$$

where the discount factor is such that the condition (18) is satisfied.

Cooperation in a repeated game requires that the government of the food-exporting country is sufficiently patient and cares for future generations. It requires the government to value welfare of future generations higher than the welfare of the generations in the current period. This can be a restrictive assumption particularly in case of developing countries because developing country governments are likely to be less patient and to rely on short-run popular policies by giving less consideration to long-run implications for the country. Nevertheless, in general, the model yields predictions about a self-enforcing cooperation in trade negotiations in a repeated game setting assuming that the exporting country government is patient enough to place a sufficiently high value on future welfare.

4.4.1 Incentives for cooperation in a repeated game allowing for both upward and downward price spikes

From the above analysis it is likely that the exporting country may not cooperate for a cooperative trade policy pair in a repeated game setting provided that an export tax and an import subsidy guarantee continuous income redistributions to exporters from importers during booms. The situation may

change if there is a possibility that the exporting country faces a downward price spike with some probability where the income is redistributed to importers from exporting country group. In that case the exporting country may cooperate with the importing country group as the government of the exporting country is aware of the cost of deviation from cooperation. Let‟s now extend the analysis to see whether the cooperation is possible in a repeated game allowing for both downward and upward price spikes. Our focus is on the exporting country but the game can be similarly defined for the importing country.

We assume that with probability ρ the exporting country faces an upward price spike following an exogenous shock to the world market and imposes an export tax. With probability $(1-\rho)$, it faces a downward price spike and imposes export subsidies. The expected pay off to the exporting country government in the first period is $\rho.w(t^*)+(1-\rho)w(s^*)$ where t and s [8] denote trade taxes and trade subsidies, respectively.

The game is defined as follows. In each period both governments set their trade policy simultaneously. They observe the trade policy outcome of their trading partner at the end of the first period and proceed to the next period. The trigger strategy is to set cooperative trade policies in each and every period as long as the trading partner sets cooperative trade policies. If one country deviates from

[8]Provided that the same country applies both subsidies and taxes in response to different price spikes, a subsidy in this section is denoted by „s‟ instead of „t‟ for notational clarity.

cooperation in the first period, its trading partner sets its non-cooperative policy in the remainder of the game as a punishment.

Defining the discount factor as $\delta \in (0,1)$ where $\delta = \frac{1}{1+r}$ and following the proposed strategy, the present value of welfare from cooperation is,

$$\frac{1}{1-\delta}\left[\rho w(t^{*C} / s^{C}) + (1-\rho) w(s^{*C} / t^{C})\right] \tag{19}$$

The equation specifies that the exporting country imposes cooperative export taxes and export subsidies in response to an upward and a downward price spike, respectively, given the cooperative policy of the importing country government in both contingencies.

The incentive for deviating from cooperation in the first period and imposing a higher level of export taxes or export subsidies is,

$$\left[\rho.w(t^{*N} / s^{C}) + (1-\rho).w(s^{*N} / t^{C})\right] + \delta \frac{\left[\rho.w(t^{*N} / s^{N}) + (1-\rho) w(s^{*N} / t^{N})\right]}{1-\delta} \tag{20}$$

The term in the first bracket of equation (20) defines the pay-off associated with the exporting country‟s non-cooperative trade policy in the first period given the cooperative trade policy of the importing country while the term in

the second bracket shows the payoff to the exporting country government in the remainder of the period when the non-cooperative trade policies are imposed by the importing country government as a punishment.

Given the proposed strategy the incentive for cooperation is such that the present value of the payoff to the exporting country government from corporation should be larger than the present value of the payoff associated with a non-cooperative outcome, which is found to be,

$$\frac{1}{1-\delta}\left[\rho w(t^{*C}/t^{C})+(1-\rho)w(s^{*C}/t^{C})\right]> \left[\rho.w(t^{*N}/s^{C})+(1-\rho).w(s^{*N}/t^{C})\right]+\delta\frac{\left[\rho.w(t^{*N}/s^{N})+(1-\rho)w(s^{*N}/t^{N})\right]}{1-\delta} \quad (21)$$

The discount factor is such that the equation (21) is satisfied.

The self-enforcing cooperation requires that the exporting country government places a sufficiently high value on the discount factor and values future welfare higher than the welfare of the current generations. This may be a restrictive requirement particularly in case of the developing countries because governments of developing countries are likely to be less patient and rely on short-run popular polices. Nevertheless, this requirement is not critical in this case as now the game is defined allowing both upward and downward price spikes. Thus, we can still argue that the governments are patient enough and

place a sufficiently high value on the discount factor that guarantees a self-enforcing cooperative outcome.

4.5 Efficient Outcome under WTO

Let‟s now examine whether an efficient outcome is possible with the involvement of the WTO. It is assumed in this section that both food-importing countries and food-exporting countries negotiate for a trade policy pair following an upward price spike, and respectively set export taxes or import subsidies depending on the level of the injury to the interested sectors of the economy. Negotiated higher export taxes and import subsidies, t^{H*} and t^{H} are chosen if the injury is serious i.e. $\varepsilon = \varepsilon^* = \bar{\varepsilon}$ whereas lower export taxes t^{L*} and import subsidies t^{L} are chosen when the injury is not serious, $\varepsilon = \varepsilon^* = \dot{\varepsilon}$. Following Beshkar (2010), the WTO can be requested to get involved if the affected party believes that trade taxes or subsidies of its partner are higher than those representing the true level of injury. The WTO is assumed to observe the true injury level with probability $\alpha \in [0,1]$. Our focus is on the exporting country while the equations can be similarly defined for the importing country due to symmetry.

The payoff of the exporting country government for cheating by announcing a injury level higher than the true injury level and setting higher export taxes, is:

$$\alpha.\varpi(t^{L*};\dot{\varepsilon}/t^{H})+(1-\alpha).\varpi(t^{H*};\dot{\varepsilon}/t^{L}) \tag{22}$$

It implies that, with probability α, the WTO observes that the stated injury level is not true, and hence the exporting country government faces retaliation from the importing country where the importing country is allowed to provide higher level of assistance to its consumers. The exporter is forced to set lower export taxes in this case. However, if the WTO is unable to observe the true state of the world of the exporting country, the exporting country can set higher export taxes with probability $1-\alpha$.

The pay-off of the exporting country government for setting the trade policy levels according to the true injury level is:

$$\varpi(t^{L*};\dot{\varepsilon}/t^{L}) \tag{23}$$

The incentive constraint for the exporting government to reveal the true injury level given the good state of the world in the importing country is,

$$\alpha.\varpi(t^{L*};\dot{\varepsilon}/t^{H})+(1-\alpha).\varpi(t^{H*};\dot{\varepsilon}/t^{L})\leq\varpi(t^{L*};\dot{\varepsilon}/t^{L}) \tag{24}$$

Similarly, the incentive constraint for setting export taxes to cover the true injury when the importing country experiences a serious injury level following the upward price spike is,

$$\alpha.\varpi(t^L;\dot{\varepsilon}/t^{H^*})+(1-\alpha).\varpi(t^H;\dot{\varepsilon}/t^{H^*})\leq\varpi(t^L;\dot{\varepsilon}/t^{H^*}) \quad (25)$$

With $\alpha=1$ the WTO‟s decision of the true injury level is entirely accurate and the second terms of the incentive constraints in equations (24) and (25) disappear. It is therefore confirmed that the higher the accuracy of the WTO‟s decision, the higher will be the incentive for the food-exporting country group to set the taxes according to their true injury level without behaving opportunistically.

4.6. Conclusion

In this chapter we formulate a partial equilibrium model incorporated with loss aversion to provide a political economy explanation for trade interventions in response to an upward price spike such as occurred twice during the past four years. It also analyses the implications of political economy concerns for trade policy outcomes between food-importing countries and food-exporting countries. The political economy behind trade interventions involves concerns for consumer protection. The model predicts that the higher the government‟s concern for consumers, the higher will be the assistance received by the consumers in the form of insulation from the international price spike. The results also suggest that cooperative trade policies are welfare improving for both country groups and lead to lower export taxes and lower import subsidies than non-cooperative outcomes even though the cooperation may not be self-enforcing in one period. An efficient trade policy outcome between food-

importing and food-exporting countries can nevertheless be achieved in a repeated game setting and with possible involvement of the WTO.

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Chapter 5

Conclusion and Policy Implications

This thesis contributes to a better understanding of the economic effects and the political economy causes of actual and proposed trade policy interventions in response to agricultural commodity price spikes. It does so by extending previous applications of international trade theory and employing a theoretical model of world trade that incorporates both import policies and export policies in a common framework whereas the existing literature is certainly limited in analysing food-importing policies and exporting policies in the same model. Overall, this thesis, by shedding light on important policy issues, highlights the importance of openness to trade and more market-oriented and more predictable policies, particularly in the current context of the global food and overall economic and financial crisis. The results are of practical importance for policy-makers formulating unilateral trade policies and strengthening multilateral disciplines on trade interventions.

Chapter 2 highlights the adverse economic effects and welfare costs associated with trade interventions of large (or a sufficiently large group of small) countries

in response to a commodity price spike. An important policy message to draw from Chapter 2 is that, insofar as the policy reactions of one group of countries trigger their trading partners also to respond with price insulating policies, the international price spike and hence national welfare effects are further accentuated. The welfare of countries that do not intervene in trade is also affected by trade interventions of other countries, via changes in their international terms of trade. The implication for the real world is that the larger the number of countries intervening in trade in response to a price spike, the more other countries may also choose to intervene in trade to assist their domestic interest groups. The consequence of this beggar-thy-neighbour behaviour of countries is to exacerbate the effect on world prices and increase the instability of international food markets.

Focusing particularly on the proposed SSM, it is highly likely that the SSM will destabilize the international price. Higher commodity price volatility associated with lower average prices resulting from initial safeguard actions would in turn result in other developing countries introducing safeguard measures more intensively. Therefore, once a SSM is imposed, it is highly likely that it may be re-imposed more easily depending on the state of the world. Lower price triggers followed by intensive use of SSM actions by a large set of countries would add more volatility to the international price.

Chapter 3 and 4 provide a political economy explanation for trade interventions and show that political preferences for averting losses for domestic interest groups from an exogenous international price spike lead to a rise in protection or assistance. Having an understanding of why and how governments alter their intervention in trade in response to a food price spike is important because it provides insights into how the political economy factors shape trade policy outcomes between food-importing and food-exporting countries. Our model predicts that if the governments multilaterally agree with a cooperative trade policy pair following a commodity price spike, it will lead to a more efficient outcome. It also provides insights into how an efficient outcome can be achieved with possible involvement of the WTO, reaffirming the importance of WTO involvement in the establishment of a more market-oriented and more predictable trading system. Thus, the results provide inputs into multilateral trade negotiations on the Doha Development Round. The results are of particular importance for the current WTO negotiations on the proposed agricultural SSM as the results clearly highlight the potential implications of the proposed SSM for the countries imposing safeguards as well as for the rest of the world, while providing important suggestions for the design of the SSM so that an efficient outcome is achieved.

As with the global implications of the import policies, so too many export restrictions produce trade-distorting effects and have negative implications for national economies as well as for the global economy. Nevertheless, such export restrictions have not yet been subject to international disciplines even though,

following the recent spikes, WTO members who are the net food importers, have called for disciplinary measures to be introduced in the WTO. The results of this thesis further emphasize the importance of the trade disciplines on export policies as a matter of necessity, particularly in the context of current global food and overall economic and financial crises.

As suggested in this thesis, there is also a strong case for cooperative trade policies among a small group of countries or regions. Such an agreement may be easier to achieve compared to an agreement among a large group of countries in the multilateral setting. If the significant trading partners of a particular product emerge in the same region or their number is small, the respective governments can regionally agree to set cooperative trade policies or even refrain from adjusting border measures in response to a price spike, which is welfare improving for all the trading partners involved. There is evidence of cooperative interactions between countries following food price spikes, for instance in Asia in the case of price hikes associated with rice trade. This thesis further encourages such cooperative policy behaviour among countries.

By highlighting the potential adverse implications and global welfare costs of price insulating policies, this thesis also reaffirms the importance of domestic policies to assist domestic interest groups without relying on trade interventions. Attainment of domestic objectives using trade interventions involves economic costs and adverse welfare effects. Imposing trade restrictions to protect the poor

from price shocks can also be wasteful of the limited resources in these countries, because not only the poor receive the assistance but also the rich who do not need such assistance. Thus, trade restrictions are not the best way to address the concerns of the domestic interest groups while the domestic policy measures such as tax-cum-subsidies are less costly and more efficient.

The policy instruments that may be most relevant include tools to insure against the risk of price volatility such as storage, income insurance schemes, targeted supporting programmes both in inputs and outputs, safety net programmes, futures and options and other credit market developments. Better institutional arrangements and infrastructure developments would also ensure smooth transmission of gains from trade to the poor while education has a vital role in assisting farm families to manage their farm better in the wake of unstable prices and ease the adjustment out of agriculture. These optional policy instruments are available with considerable merits to deal with the problems associated with price fluctuations while simultaneously keeping the markets open and promoting long-run adjustment process. If the developing countries face public expenditure constraints in implementing these policies, one solution would be to provide financial assistance from international agencies. This assistance could be regarded as aid for facilitating the adjustment environment in resource-poor countries to ensure their successful participation in the international trading system. Nevertheless, if governments intervene and artificially support the uncompetitive sectors in response to temporary price shocks, incentives for efficient policy

instruments disappear and domestic producers tend to rely on trade distortive measures and government assistance more.

Focusing particularly on developing and low income countries, the nature of the agricultural sector in a growing economy needs to be considered when designing policy instruments. The agricultural sector typically shrinks when the economy grows. Therefore, some adverse impacts are inevitable. Structural transformation of agriculture is essential in order to face the new conditions of competition and enhance gains from international trading. By protecting an uncompetitive industry to continue its operation, these policies, including the proposed SSM, can impede the adjustment. Any policy instrument addressing domestic non-trade concerns should be designed to be constructive with respect to the long-term objective of modernization of the agricultural sector. The agricultural sector in developing countries is already characterized by poor functioning of markets for staple, and therefore the policy-makers should not introduce new trade controls but remove existing controls to enhance access to the foreign markets and ensure smooth functioning of markets.

Despite the main contributions of this thesis that would help better understanding of economic effects of trade policy interventions and the political economy causes of these interventions, there are several ways that the research could be further improved.

The model in Chapter 2 contributes to understanding the static effects of trade interventions, but it can be extended to a two-period analysis to examine the economic effects in a dynamic framework. That extension will also represent a more realistic representation of the real world, which enables analysing dynamic policy behaviour of the countries. It is also possible to complement the analysis in Chapter 2 with an analysis on trade interventions and distributional impacts within large countries without limiting to the small country case.

Chapter 3 and 4 of this thesis focus on the trade policy game between food-importing and food-exporting countries in the context of the simultaneous-move game though the sequential nature of the trade policy game has been briefly examined in the repeated game approach. Nevertheless, a sequential game may provide a deeper understanding of the policy behaviour of the countries. For that reason, it is useful to extend the analysis from the beginning to define the trade policy game in a sequential-move framework.

Repeated game-setting analysed in Chapter 3 and 4 can also be developed to analyse the case of possible cooperation in the second period. As the trigger strategy defined in Chapter 3 and 4, if one country deviates from cooperation in the first period, the other country sets Nash trade policy in the remainder of the game as a punishment. However, this may change if the respective countries have incentives to cooperate in the second period. It is likely that the governments may cooperate in the second period though they may not cooperate in the first period,

because they may realize in the second period the cost of non-cooperation (i.e. reputational problems and lack of trust leading to loss of international business, etc).

Yet another possible extension is to incorporate in the models the alternative strategies and policy instruments that could be used to meet the same government objectives. Inclusion of many policy instruments in the model will improve the model capacity to represent real-world government behaviour, particularly in the context of non-trade concerns.

Further research could also be done to empirically test the theoretical results of this thesis. While there has been some empirical evidence suggesting that there is a strong association between the political economy concerns and the level of trade policies, the evidence based on structural modelling to define the relationship is limited particularly in agricultural trade policy literature. More work is needed to accurately estimate the loss aversion coefficient in the context of agriculture, and incorporate these regressors in econometrics studies to correctly establish the link between agricultural trade policies and loss aversion. Another possible empirical extension of the theoretical models presented in the thesis is to estimate the implications by looking at the speed of price changes and the duration of contingency policy reactions.

Appendix A: Economics of trade policy interventions in response to commodity price spikes

A.1 Derivation of equation (18)

$$e^{M}(p,u) = r^{M}(p,v) + t\ \ p^{*} z^{M}(p,u)$$

By totally differentiating,

$$e_{p}^{M} dp + e_{u}^{M} du = r_{p} dp + t\ \ p^{*} dz^{M} + z(p,u) p^{*} dt$$

$$e_{p}^{M}(p^{*} dt + dp^{*} + tdp^{*}) + e_{u}^{M} du = r_{p}(p^{*} dt + dp^{*} + tdp^{*}) + z(p,u)\left(tdp^{*} + p^{*} dt\right) + tp^{*} dz^{M}$$

Following that the initial tariff is zero,

$$tdp^{*} = 0$$

$$t\ \ p^{*} dz^{M} = 0$$

$$z(p,u)t\ \ dp^{*} = 0,$$

Therefore,

$$e_p{}^M (p^* dt + dp^*) + e_u{}^M du = r_p (p^* dt + dp^*) + z(p,u) p^* dt$$

Substituting $z = e_p - r_p$,

$$e_u{}^M du = -z^M dp^* - z^M (p,u) p^* dt + z^M (p,u) p^* dt$$

$$e_u{}^M du = -z^M dp^*$$

Equations (19) and (20) can be similarly derived.

A.2 Terms of trade effects

Total differentiation of the market-clearing condition is,

$$z_p{}^M (p^* dt \ + dp^*) + z_u{}^M du + z_p{}^T dp^* + z_u{}^T du + z_p{}^X \ dp^* + z_u{}^X du = 0$$

Substituting equations (18), (19) and (20),

$$z_p{}^M(p*dt+dp*)-\frac{z_u{}^M z^M dp*}{e_u}+z_p{}^T dp*-\frac{z_u{}^T z^T dp*}{e_u}+z_p{}^X\ dp*$$
$$-\frac{z_u{}^X z^X dp*}{e_u}=0$$

Substituting $z_y = p*\frac{z_u}{e_u}$,

$$z_p{}^M(p*dt+dp*)-\frac{z^M z_y{}^M dp*}{p*}+z_p{}^T dp*-\frac{z^T z_y{}^T dp*}{p*}+z_p{}^X\ dp*$$
$$-\frac{z^X z_y{}^X dp*}{p*}=0$$

$$\left(z_p{}^M-\frac{z^M z_y{}^M}{p*}+z_p{}^T-\frac{z^T z_y{}^T}{p*}+z_p{}^X\ -\frac{z^X z_y{}^X}{p*}\right)dp*=-z_p{}^M p*dt$$

$$\frac{dp*}{dt}=\frac{-1}{\Delta}\left[p*z_p{}^M\right]$$

where

$$\Delta=z_p{}^X-\frac{z^X z_y{}^X}{p*}+z_p{}^M-\frac{z^M z_y{}^M}{p*}+z_p{}^T-\frac{z^T z_y{}^T}{p*}$$

A.3 Derivation of equation (29)

$$e^{M}(p,u) = r^{M}(p,v) + t \;\; p * z^{M}(p,u)$$

By totally differentiating,

$$e_{p}^{M}\, dp + e_{u}^{M}\, du = r_{p}^{M}\, dp + tp * dz^{M} + z(tdp * + p * dt^{n})$$

Substituting $z = e_{p} - r_{p}$,

$$e_{u}^{M}\, du = -zdp + tp * dz + z\left(tdp * + p * dt^{n}\right)$$

With positive initial tariffs, $dp = dp * + tdp * + p * dt^{n}$,

$$e_{u}^{M}\, du = -z\left(dp * + tdp * + p * dt^{n}\right) + tp * dz + z\left(tdp * + p * dt^{n}\right)$$

$$e_{u}^{M}\, du = -zdp * + tp * dz$$

Substituting $dz = z_{p}\left(dp * + tdp * + p * dt^{n}\right) + z_{u} du$

$$e_u{}^M du = -zdp^* + tp^* \left(z_p \left(dp^* + tdp^* + p^* dt^n \right) + z_u du \right)$$

$$e_u{}^M du - tp^* z_u du = -zdp^* + tp^* z_p dp^* + tp^* z_p tdp^* + tp^* z_p p^* dt^n$$

$$e_u{}^M du = \frac{-zdp^* + tp^* z_p dp^* (1+t) + tp^* z_p p^* dt^n}{(1 - tz_y)}$$

Equations (30) and (31) are derived similarly.

A.4. Terms of trade implications with positive initial tariffs

Total differentiation of the market-clearing condition is,

$$z_p{}^M (p^* dt^n + dp^* + tdp^*) + z_u{}^M du + z_p{}^T dp^* + z_u{}^T du + z_p{}^X dp^* + z_u{}^X du = 0$$

Substituting equation (29), (30) and (31),

$$z_p{}^M\,(p*dt^n + dp* + tdp*) - \frac{z_u\left(-zdp* + tp*z_p dp*(1+t) + tp*z_p p*dt^n\right)}{e_u\left(1-tz_y\right)}$$

$$+ z_p{}^T dp* - \frac{z_u{}^T z^T dp*}{e_u} + z_p{}^X\, dp* - \frac{z_u{}^X z^X dp*}{e_u} = 0$$

$$z_p{}^M dp*(1+t) + z_p p*dt^n - \frac{z_y{}^M z dp*}{p*\left(1-tz_y\right)} + \frac{z_y tz_p(1+t)dp*}{1-tz_y} + \frac{z_y tz_p p*dt^n}{1-tz_y}$$

$$+ z_p{}^T dp* - \frac{z_u{}^T z^T dp*}{e_u} + z_p{}^X\, dp* - \frac{z_u{}^X z^X dp*}{e_u} = 0$$

$$\left(z_p{}^M(1+t) - \frac{z_y z}{p*\left(1-tz_y\right)} + \frac{z_y tz_p(1+t)}{1-tz_y} + z_p{}^T - \frac{z_u{}^T z^T}{e_u} + z_p{}^X - \frac{z_u{}^X z^X}{e_u} \right) dp*$$

$$= -z_p p*dt^n - \frac{z_y tz_p p*dt^n}{1-tz_y}$$

$$\frac{dp*}{dt^n} = \frac{-1}{\Delta(1-tz_y)}\left[p*z_p{}^M\right]$$

where

$$\Delta = z_p(1+t) - \frac{[z - tp*z_p(1+t)]z_y}{p*(1-tz_y)} + z_p{}^X - \frac{z^X z_y{}^X}{p*} + z_p{}^M - \frac{z^M z_y{}^M}{p*} < 0$$

Appendix B: Political economy of trade policy interventions in response to commodity price spikes

B.1 Derivation of non-cooperative import tariffs for the food-importing country

$$\varpi = \gamma px + tm + cs - \theta(\bar{p}x - px)$$

$$\varpi = \gamma x(p^w + t) + t\left(\frac{1}{2}(\Delta x + t^* - t)\right) + \frac{(a-p)^2}{2} - \theta(\bar{p}x - x(p^w + t))$$

$$\varpi = \gamma x\left[a - \frac{1}{2}(x + x^* + t + t^*) + t\right] + t\left(\frac{1}{2}(\Delta x + t^* - t)\right) + \frac{\left[a - \left(a - \frac{1}{2}(x + x^* + t + t^*)\right) - t\right]^2}{2}$$

$$- \theta\left(\bar{p}x - x\left[a - \frac{1}{2}(x + x^* + t + t^*) + t\right]\right)$$

$$\frac{\partial \varpi}{\partial t} = \frac{\gamma x}{2} + \frac{\Delta x}{2} - t + \frac{t^*}{2} - \left(a - t - \left(a - \frac{1}{2}(x + x^* + t + t^*)\right)\right)\left(\frac{1}{2}\right) - \frac{\theta x}{2} + \theta x$$

$$0 = \frac{\gamma x}{2} + \frac{\Delta x}{2} - \frac{3t}{4} + \frac{t^*}{4} - \frac{1}{4}(x + x^*) + \frac{\theta x}{2}$$

$$3t = 2\gamma x + 2\Delta x + t^* - (x + x^*) + 2\theta x$$

Substituting $\Delta x + x = x^*$,

$$t = \frac{1}{3}(2x(\gamma + \theta - 1)) + t^* + \Delta x$$

Non-cooperative export subsidies for the food-exporting country can be similarly derived.

B.2 Nash equilibrium tariffs for the exporting country

$$t^* = \frac{1}{3}(2x^*(\gamma + \theta - 1)) + t - \Delta x$$

Substituting best response tariffs: $t = \frac{1}{3}(2x(\gamma + \theta - 1)) + t^* + \Delta x$,

$$t^* = \frac{1}{3}(2x^*(\gamma + \theta - 1)) - \Delta x + \frac{1}{3}\left(\frac{1}{3}(2x(\gamma + \theta - 1) + t^* + \Delta x)\right)$$

$$\frac{8}{9}t^* = \frac{6x^*(\gamma+\theta-1)+2x(\gamma+\theta-1)-2\Delta x}{9}$$

$$t^* = \frac{1}{4}\left((\gamma+\theta-1)(3x+x^*)+\Delta x\right)$$

Nash equilibrium import tariffs can be similarly derived

B.3 Cooperative tariffs for the food-importing country

$$\varphi = \varpi + \varpi^*$$

$$\varphi = \gamma px + tm + cs - I\theta(p\bar{x} - px) + \gamma p^* x^* - t^* m + cs^* \\ - I\theta(\bar{p}x^* - p^* x^*)$$

$$\varphi = \gamma x\left[a - \frac{1}{2}\left(x + x^* + t + t^*\right) + t\right] + t\left(\frac{1}{2}(\Delta x + t^* - t)\right) + \frac{(a-p)^2}{2}$$

$$-\theta\left[\bar{p}x - x\left[a - \frac{1}{2}\left(x + x^* + t + t^*\right) + t\right]\right] + \gamma x^*\left(a - \frac{1}{2}\left(x + x^* + t + t^*\right) + t^*\right)$$

$$-t^*\left(\frac{1}{2}\left(\Delta x + t^* - t\right)\right) + \frac{\left(a - p^*\right)^2}{2} - \theta\left[\bar{p}x^* - x^*\left[a - \frac{1}{2}\left(x + x^* + t + t^*\right) + t^*\right]\right]$$

$$\frac{\partial \varphi}{\partial t} = -\frac{\gamma x}{2} + \gamma x + \frac{\Delta x}{2} - t + \frac{t^*}{2} - \frac{1}{4}\left(x + x^* + t + t^*\right) + \frac{1}{2}t - \frac{\theta x}{2} + \theta x - \frac{\gamma x^*}{2} + \frac{t^*}{2}$$

$$-\frac{t^*}{2} + \frac{1}{4}\left(x + x^* + t + t^*\right) - \frac{\theta x^*}{2}$$

$$0 = 2\gamma x + 2\Delta x + 2t^* - 4t - \left(x + x^* t + t^*\right) + 2t + 2\theta x - 2\gamma x^* + 2t^* - 2t^*$$

$$+\left(x + x^* + t + t^*\right) - 2\theta x^*$$

$$0 = \left(\gamma + \theta\right)\left(2x - 2x^*\right) + 2\Delta x + 2t^* - 2t$$

Substituting $\Delta x = x^* - x$,

$$0 = (1 - \gamma - \theta)\Delta x + (t^* - t)$$

Equilibrium cooperative tariffs for the exporter can be similarly derived.

Appendix C: Political economy of trade interventions in response to recent upward price spikes

C.1 Derivation of non-corporative export taxes for the food-exporting country

$$\varpi^* = p^* x^* + t^* m + \gamma^* cs^* - \theta^* (c\bar{s}^* - cs^*)$$

$$\varpi^* = x^* \left[a + \frac{1}{2}(-x - x^* + t + t^*) - t^* \right] + t^* \left[\frac{1}{2}(\Delta x + t - t^*) \right] + \frac{\gamma^* (a - p^*)^2}{2}$$

$$- \theta^* \left[c\bar{s} - \frac{(a - p^*)^2}{2} \right]$$

$$\frac{\partial w^*}{\partial t^*} = -\frac{x^*}{2} + \frac{\Delta x}{2} + \frac{t}{2} - t^* + (\gamma^* + \theta^*) \left[\frac{1}{4} t^* - \frac{1}{4} t + \frac{1}{4}(x + x^*) \right]$$

$$(4 - \gamma^* - \theta^*) t^* = -2x^* + 2\Delta x + (2 - \gamma^* - \theta^*) t + (\gamma^* + \theta^*)(x + x^*)$$

$$t^* = \frac{-2x + (2 - \gamma^* - \theta^*) t + (\gamma + \theta)(x + x^*)}{(4 - \gamma^* - \theta^*)}$$

Non-corporative import subsidies for the importing country can be similarly derived

C.2 Derivation of Nash equilibrium export taxes for the food-exporting country

$$t^* = \frac{-2x + (2-\gamma-\theta)t + (\gamma+\theta)(x+x^*)}{(4-\gamma-\theta)}$$

$$t^* = \frac{-2x + (\gamma+\theta)(x+x^*)}{(4-\gamma-\theta)} + \frac{(2-\gamma-\theta)t}{(4-\gamma-\theta)}$$

Substituting $t = \frac{-2x^* + (\gamma+\theta)(x+x^*)}{(4-\gamma-\theta)} + \frac{(2-\gamma-\theta)t^*}{(4-\gamma-\theta)}$,

$$t^* = \frac{-2x + (\gamma+\theta)(x+x^*)}{(4-\gamma-\theta)} + \frac{(2-\gamma-\theta)}{(4-\gamma-\theta)}\left[\frac{-2x^* + (\gamma+\theta)(x+x^*)}{(4-\gamma-\theta)} + \frac{(2-\gamma-\theta)t^*}{(4-\gamma-\theta)}\right]$$

$$t^* = \frac{(4-\gamma-\theta)[-2x + (\gamma+\theta)(x+x^*)] - 2x^*(2-\gamma-\theta) + (2-\gamma-\theta)^2 t^*}{(4-\gamma-\theta)^2}$$

$$+ \frac{(2-\gamma-\theta)(\gamma+\theta)(x+x^*)}{(4-\gamma-\theta)^2}$$

$$t^* - \frac{(2-\gamma-\theta)^2}{(4-\gamma-\theta)^2} = \frac{-2x(4-\gamma-\theta)-2x^*(2-\gamma-\theta)+(6-2x-2\theta)(\gamma+\theta)(x+x^*)}{(4-\gamma-\theta)^2}$$

$$t^* = -\left[\frac{(4-\gamma-\theta)x+(2-\gamma-\theta)x}{2(3-\gamma-\theta)}*\right]+\frac{(\gamma+\theta)(x+x^*)}{2}$$

Nash equilibrium import subsidies can be similarly derived

C.3 Derivation of Corporative export taxes

$$\varphi = \varpi^* + \varpi$$

$$\phi = p^* x^* + t^* m + \gamma cs^* - \theta(c\bar{s}^* - cs^*) + px - tm + \gamma cs - \theta(c\bar{s} - cs)$$

$$\frac{\partial\phi}{\partial t^*} = \frac{-x^*}{2} + \frac{\Delta x}{2} + \frac{t}{2} - t^* + (\gamma+\theta)\left[\frac{1}{4}t^* - \frac{1}{4}t + \frac{1}{4}(x+x^*)\right] + \frac{x}{2} + \frac{t}{2}$$

$$+(\gamma+\theta)\left[-\frac{1}{4}t + \frac{1}{4}t^* - \frac{1}{4}(x+x^*)\right]$$

$$0 = t - t^* + 2(\gamma+\theta)\left[\frac{1}{4}t^* - \frac{1}{4}t\right]$$

$$0 = t - \frac{(\gamma + \theta)t}{2} - t^* + \frac{(\gamma + \theta)t^*}{2}$$

$$0 = [2 - (\gamma + \theta)](t - t^*)$$

Corporative import subsidies can be similarly derived.

All references cited in thesis

[Note: Each chapter in the thesis has a self-contained reference list. This is a consolidated list of references to satisfy the University of Adelaide's thesis specification requirements.]

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