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On the Economics of the Special Safeguard Mechanism (SSM) for Imports of Agricultural Products

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Abstract

A Special Safeguard Mechanism (SSM) has been proposed in the negotiations on agriculture that are part of the Doha Round in the World Trade Organization. The objective of the SSM from the viewpoint of the G-33 is to provide improved livelihood security for poor farm households in developing countries. The proposed instrument to achieve this objective is an increase in the applied tariff once the import price has fallen below some trigger level or once the quantity imported exceeds some target level. The purpose in the paper is to analyse in this context the effects of market structure and tariffs on the behaviour of prices under uncertainty. The analysis is conducted using Monte Carlo simulation of an n-firm Cournot oligopsony/oligopoly of intermediaries to evaluate the effects of the tariff on the mean and standard deviation of prices. It is concluded that the objective of the SSM is unlikely to be achieved through the permitted instrument, viz., an increase in ad valorem tariffs.

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1. Introduction

The negotiations on agriculture in the Doha Round continue to prove difficult to conclude. While there has been some convergence of negotiating positions on modalities for reducing domestic support and tariffs, and there has been agreement to phase out export subsidies entirely, there has been almost no convergence on the modalities for the Special Safeguard Mechanism (SSM). Although the concept of an SSM has been in the background of the negotiations since at least the start of the Doha Round, it was only at the meeting of the World Trade Organization (WTO) in July 2008, when modalities were discussed, that it made headlines. It was the failure to agree to these modalities that was one of the main reasons why the negotiations stalled (Wolfe, 2009).

Wolfe makes the case that the negotiations on the SSM failed, not just because of two very different interpretations of what the SSM is intended to achieve, but also because there had been a lack of prior technical analysis. As a consequence, the negotiators, not understanding the implications of agreeing to the proposed modalities, chose not to agree. One interpretation of the objective of the SSM, and the one advanced by the G-33, is that the SSM is to provide livelihood security for poor farmers in developing countries and to protect them from the vagaries of volatile prices in international markets.[1] Therefore, it would be a mechanism that could be used only by Members of the WTO that are self-designated developing countries and used without restriction on the number of tariff lines affected or on the size of the tariff increase. The second interpretation is that the SSM is designed to provide temporary security as an aid to encouraging trade liberalisation, in much the same way that the Special Agricultural Safeguard provided insurance after the implementation of the Uruguay Round Agreement on Agriculture (Article 5) (WTO, 1995).

The SSM is another example of negotiators making proposals for new trade rules without the necessary adequate technical economic analysis to demonstrate feasibility and to ensure that the objective of the new rule would be achieved. Instead of solving a problem, in this case the lack of livelihood security for poor farmers in developing countries, such behaviour by current negotiators merely creates further problems for a later generation of

[1] It is surprising that there does not appear to be concern for poor food consumers, given the nature of the long history of government intervention in developing countries. In the World Bank study on agricultural distortions (Anderson and Valenzuela, 2008), the time series data on distortions show clearly that governments in developing countries have tended to tax farmers and to subsidise consumers of food. The SSM would appear to mark an abrupt break in this tradition.

trade negotiators to solve. Other examples include the introduction of tariff quotas and the treatment of exporting state trading enterprises but not of importing state trading enterprises, both of which can distort international trade (see OECD, 2001).

The objective in this paper is to evaluate the extent to which the SSM makes economic sense. If price transmission from the international to the domestic market is less than perfect, if there is substantial water in the tariff, and if domestic instruments further disconnect domestic producer prices from international ones, then what role is there in practice for an SSM?

To undertake this evaluation, a brief summary of the SSM is given as the modalities were proposed in December 2008 (WTO, 2008) (section 2). To date, quantitative modelling of the SSM has been conducted in either a stochastic partial or stochastic general equilibrium framework but in both approaches, perfect competition has been assumed as well as the absence of intermediaries. The principal conclusions from these models are reviewed (section 3). The model developed in this paper is a stochastic partial equilibrium model that departs from previous work by allowing for imperfect competition amongst importing firms in a large country. Sales of the imported product compete with sales of domestically produced product. These products are homogeneous (section 4). The model is calibrated to artificial parameters and the effect of tariffs on price volatility evaluated (section 5). There follows a discussion of the results in the context of the interpretation of the SSM adhered by the G-33 and the conclusions drawn are summarised (section 6).

2. The Special Safeguard Mechanism

The SSM has gone through a number of revisions. The version summarised here is revision 4 (WTO, 2008) with certain of the finer details omitted. Governments in developing countries have a choice between a quantity trigger and a price trigger in stemming either import surges or falling import prices or both simultaneously. The quantity trigger is defined on the basis of a moving average of the previous three years of imports. Once the trigger has been activated, the response depends upon the extent to which imports in the current period are greater than the trigger quantity. The details are provided in the first two columns of Table 1. Clearly, the boundaries of the tiers are arbitrary, as are the responses in terms of the size of the increase in the tariff.

The price trigger is defined as a reference price that is based on average import prices over the three-year period immediately prior to the current year. The SSM is triggered when the price of an individual shipment from a single export source falls below 15 per cent of the reference price. The response to the price trigger is much simpler than that for the quantity trigger. Regardless of the size of the price fall in excess of 15 per cent of the trigger, only 85

per cent of that fall below the trigger can be compensated through an increase in the tariff rate (Table 1, last two columns).[2]

The wisdom of taking a continuous variable, either import price or imported quantity, and arbitrarily making it discontinuous, is open to question. Not only are the boundaries of the tiers arbitrary, so too are the responses allowed within the tiers. One of the grounds on which the negotiators have failed to agree is the extent to which an increase in the applied tariff is permitted. The G-33 maintains that there should be no restriction on the size of the increase, even if it raises the applied tariff above the bound rate agreed in the Uruguay Round (Wolfe, 2009). Naturally, the exporting countries take a different position and object in principle to allowing a breach of the previously agreed bound rate.

Table 1: The Essentials of the Proposed SSM Triggers

Quantity trigger		**Price trigger**	
Import surge (m)	Response	Import price fall (p_m)	Response
$m \leq 110\%$	none	$p_m < 0.85\ p_T$	$\Delta t^A \leq 0.85\left(p_T - p_m\right)/\ p_m$
$110\% < m \leq 115\%$	$max[0.25t^B$, 25% points]		
$115\% < m \leq 135\%$	$max[0.4t^B$, 40% points]		
$m > 135\%$	$max[0.5t^B$, 50% points]		

Note: m is the quantity of imports relative to the trigger quantity; t^B is the current bound tariff rate; Δt^A is the increase in the tariff permitted; p_m is the *cif* import price in domestic currency; and p_T is the trigger price.

Source: adapted from Grant and Meilke (2011, Table 8.1).

3. Literature Review

The literature on the SSM was split into two by Grant and Meilke (2011) using the criterion of whether or not the analysis was based on a behavioural economic model. Qualitative models did not use an explicit model whereas quantitative ones did. In the qualitative models the two important research questions were: (i) how frequently will the SSM be triggered: and (ii) is it effective once triggered?

The research findings in the qualitative strand that were reviewed include Valdés and Foster (2005), Finger (2009) and Montemayor (2010). One conclusion to emerge from

[2] The details of the SSM as it was proposed in WTO (2008) are more complicated than the summary given in Table 1. Nevertheless, the summary of how the triggers are defined and the content of Table 1 give an indication of the details over which the negotiators can negotiate.

Finger's work is that the SSM can be triggered when it is not needed and it is not always triggered when it needs to be. One explanation for this outcome is that the price trigger can be activated on an individual shipment from a single exporting country. With export prices from developing countries often lower than those from developed countries, the SSM will be activated. Clearly, this outcome does not enhance South-South trade (Grant and Meilke, 2011).

In the quantitative strand of the literature, both partial and computable general equilibrium models have been used. Grant and Meilke (2009) using a stochastic partial equilibrium model of the world wheat market, ran three policy experiments to evaluate the welfare effects and the quantity and price effects of the SSM. Experiment (i) implemented the tariff cuts as set out in WTO (2008); experiment (ii) added the SSM to (i) but did not allow the increase in tariff to breach the pre-Doha bound rate; and experiment (iii) the same as (ii) except that the pre-Doha bound rate could be exceeded. They concluded that under (i), world welfare in the wheat market would increase by $1.240 billion; under (ii) it would increase by $1.036 billion; and under (iii) it would increase by $1.017 billion. The difference between the gains in (ii) and (iii) raises the question: does $19 million warrant preventing a breach of pre-Doha bound rates, unless of course as a matter of principle? They also found in experiment (ii): that in 74 per cent of developing countries, the domestic price rose on average; that in 68 per cent of these countries, the domestic price became more volatile; and that in 87 per cent of them quantities imported were stabilised.

In a stochastic CGE study, Hertel, Martin and Leister (2010) investigated the differences between the price and the quantity triggers using a regionally disaggregated model of the world wheat market. They ran three simulations with identical sets of stochastic shocks. The first simulation created the baseline which represented no SSM. The second simulated the effects of the quantity trigger SSM and the third, the price trigger SSM. The authors came to several conclusions, four of which are as the follows. First, the SSM with a quantity trigger induces greater volatility in the world market price when compared with either the case where there is no SSM or where the SSM is based on the price trigger. Second, the quantity-based SSM reduces the mean and the standard deviation of the quantity imported. Third, the quantity-based SSM increases the volatility of the producer price. Fourth, the price-based SSM is more benevolent with respect to international trade, increasing the quantity imported rather than decreasing it but, in other respects, it produces outcomes very similar to those in the baseline.

The findings from both approaches raise some serious questions about the efficacy of the SSM using the interpretation of it insisted upon by the G-33. First, the rise in the domestic price, while benefiting poor producers, if net suppliers, will harm poor consumers

and poor producers, if net buyers. Second, increased volatility of prices in the domestic market is an outcome that the SSM is designed to avoid. To the extent that producers and consumers are risk averse, the increased domestic price volatility may be detrimental to their welfare. And third, if the quantity trigger induces greater volatility in the international price, this too, is undesirable because it may cause governments to continue to intervene on the export side by taxing or banning exports, thereby exacerbating existing volatility.

4. A Stochastic Model of Imperfectly Competitive Intermediaries

The models used by Grant and Meilke (2009) and by Hertel, Martin and Leister (2010) to evaluate the SSM have assumed away the role of intermediaries as import firms. Given the prevalence of such firms in the importation of agricultural products, it is important to analyse the effect that such intermediaries have on price transmission and how they respond to tariffs. Both aspects have a bearing on the efficacy of an SSM.

In the context of trade liberalisation, the effect of the removal of a tariff in the presence of downstream domestic market power has been analysed by Sexton *et al*. (2007) for a specific tariff and by Hoque and Schroeter (2010) for an *ad valorem* tariff. The effects of each are shown to be different in several respects.

In the stochastic model developed here, imperfectly competitive intermediaries procure from both the domestic and international markets and they sell to domestic consumers.[3] The market structure is one of oligopsony/oligopoly.[4] The model is specified initially without tariffs and later with an *ad valorem* tariff.

4.1 Small Country with no Intermediaries

Assume initially that there are no intermediaries, that the importing country is small, that there is no government intervention in the domestic market, that a deterministic import demand function is defined, and that the country imports freely from the world market where the price is stochastic. Specifically, assume that the world price, p_w, is a random variable with mean μ and variance σ^2. Then, the domestic price and the international price distributions are identical. There is also a simple functional relationship between price and quantity imported.

Suppose now that imports are subject to a tariff. With the import price being stochastic, the type of tariff matters for the behaviour of the domestic price. For an *ad*

[3] In the substantial literature on the firm under uncertainty, the model that is closest to the one developed here, is in Blair (1974). He analyses a monopoly facing random input prices.

[4] This market structure is only one of many that are observed in importing countries. In some instances, imports are undertaken exclusively by a state trading enterprise. This enterprise may or may not have rights to procure in the domestic market as well. For an analysis of various combinations of mixed oligopsony/oligopoly, see McCorriston and MacLaren (2005).

valorem tariff of rate *t*, the domestic price has mean $(1+t)\mu$ and variance $(1+t)^2\sigma^2$. Thus an *ad valorem* tariff increases the mean of the domestic price at free trade by the power of the tariff but it increases the variance by the square of the power of the tariff. Therefore, the *ad valorem* tariff increases the volatility of the domestic price by $(1+t)^2$ compared with that of the international market price and it does so significantly for 'large' *t*. Whether an increase in the tariff rate as proposed under the SSM is welfare-improving for poor farm households will depend upon whether they are net sellers or net buyers and their attitude towards risk. Because the increase in the tariff rate increases both the mean and the variance of the domestic price distribution, it is not possible to draw any general conclusion about the sign of the change in welfare.

The behaviour of the domestic price with a specific tariff differs from that when the tariff is *ad valorem*. Let the specific tariff be the amount τ. Then the mean of the domestic price distribution is $\mu+\tau$ and the variance is σ^2. Thus the mean of the domestic price distribution exceeds that of the international distribution but the variance is the same. Risk averse producers are likely to prefer the specific to the *ad valorem* tariff.

If the import demand function is deterministic, then there remains a simple functional relationship between the world price and the quantity imported. However, if it is now assumed that the import demand function is also stochastic, then that relationship breaks down. The domestic price remains determined only by the world price as it is modified by the type of tariff applied but the quantity imported depends on both the world price and the position of the import demand function. Therefore, it is possible to have import surges that are caused by smaller domestic supplies which bear no relationship to the direction of movement, if any, in the world price. It has been found that 85 per cent of import surges are accompanied by no fall in the domestic price (South Centre, 2009). This outcome begs the question: is the SSM designed to achieve domestic price stability or quantity stability or income stability for domestic producers? These outcomes cannot be the same and they raise the further issue: is the import price or the quantity imported the more appropriate trigger?

4.2 Imperfectly Competitive Intermediaries

Suppose now that the country is large and that there is an *n*-firm Cournot oligopsony/oligopoly that imports, that procures from the domestic market and that sells the homogeneous good to domestic consumers. The firm makes its decision about procurement before the uncertainties about the inverse supply functions are resolved. The demand function in both the importing country and the exporting region are taken to be deterministic.

Let the domestic inverse demand function be given by

$$p = A - B(Q_h + Q_m) \tag{1}$$

where: A and B are constant parameters; and Q_i is the total quantity procured from the domestic market ($i = h$) and from imports ($i = m$). The domestic inverse supply function is stochastic and is specified as

$$p_h = \tilde{\phi} Q_h \tag{2}$$

where: p_h is the procurement price and $\tilde{\phi}$ reflects uncertain yields. This specification is consistent with argument made by Hazell and Scandizzo (1975) that the stochastic term, which is generated by random yields, should enter the supply function multiplicatively and not additively. No particular assumption is made about the attitude of domestic producers towards risk. However, it has been known since at least Sandmo (1971) that the risk averse, perfectly competitive firm will produce less than the risk neutral firm. Differences in attitudes to risk will affect decisions about area to plant. These are already incorporated implicitly in equation (2).

The inverse import supply function is derived from an assumed deterministic demand function for the rest of the world and its stochastic supply function. The demand function is taken to be $Q_d = \gamma - \delta p$ and the supply taken to be $Q_s = \tilde{\theta} p$ which, together, define the export supply function $Q_x = -\gamma + (\delta + \tilde{\theta}) p$. Writing this function in inverse form gives

$$p_m = \frac{\gamma}{(\delta + \tilde{\theta})} + \frac{Q_m}{(\delta + \tilde{\theta})} = \tilde{C} + \tilde{D} Q_m \tag{3}$$

The representative firm has a profit function

$$\pi = (p - p_h) q_h + (p - p_m) q_m \tag{4}$$

where: q_h is the quantity procured from domestic producers and q_m the quantity imported. This firm has a von-Neumann-Morgenstern expected utility function with profit as the argument. The firm maximises the expected utility of profit

$$\underset{q_h, q_m}{Max}\ E\{U(\pi)\} \tag{5}$$

giving the following first-order conditions

$$\begin{aligned} &E\{U'(\pi)\}[A - B(n+1)q_h - B(n+1)q_m] - (n+1)q_h E\{U'(\pi)\tilde{\phi}\} = 0 \\ &E\{U'(\pi)[A - B(n+1)q_h - (B + \tilde{D})(n+1)q_m]\} - E\{U'(\pi)(\tilde{C} + \tilde{D}(n+1)q_m)\} = 0 \end{aligned} \tag{6}$$

The second-order conditions will hold under reasonable assumptions about the utility function. Separating the stochastic from the non-stochastic terms and making use of the definition of covariance, the equations can be re-arranged to give

$$\begin{aligned} &MR = E\{\tilde{\phi}\}(n+1)q_h + (n+1)q_h Cov\{U'(\pi)\tilde{\phi}\} / E\{U'(\pi)\} \\ &MR = E\{\tilde{C}\} + (n+1)q_m E\{\tilde{D}\} + [Cov\{U'(\pi)\tilde{C}\} + (n+1)q_m Cov\{U'(\pi)\tilde{D}\}] / E\{U'(\pi)\} \end{aligned} \tag{7}$$

The representative firm maximises the expected utility of profit by setting marginal revenue, which is deterministic, equal to expected marginal expenditure in each procurement market plus the covariance term in each. The sign of each covariance term depends upon the firm's attitude to risk. For risk averse firms, each is positive. To see this, partially differentiate $U'(\pi)$ with respect to $\tilde{\phi}$ to get $\partial U'(\pi)/\partial\tilde{\phi} = U''(\pi)\,\partial\pi/\partial\tilde{\phi}$. If the firm is risk neutral, then $U''(\pi) = 0$ because $U(\pi)$ is linear. If it risk averse, then $U''(\pi) < 0$. From equations (2) and (4), $\partial\pi/\partial\tilde{\phi} < 0$. Therefore, for the risk averse intermediary, $Cov\{U'(\pi)\,\tilde{\phi}\} > 0$. A similar explanation leads to the conclusion that the covariance term in the second equation is also positive. Therefore, the risk averse intermediary will procure less in each market than would a risk neutral firm and it will also procure less in the market with the greater risk. The differences in procurement depend upon the size of the covariance terms which, in turn, depend upon the firm's attitude to risk. This attitude can be represented by the Arrow-Pratt measures of absolute and relative risk aversion.

To simplify the analysis that follows and to avoid the need to specify the firm's utility function, assume that each firm is risk neutral. Then the first-order conditions for the aggregate of the *n* firms can be written as

$$\begin{bmatrix} (n+1)(B+E\{\tilde{\phi}\}) & 0 & (n+1)B & 0 \\ -n & 1 & 0 & 0 \\ (n+1)B & 0 & (n+1)(B+E\{\tilde{D}\}) & 0 \\ 0 & 0 & -n & 1 \end{bmatrix} \begin{bmatrix} q_h \\ Q_h \\ q_m \\ Q_m \end{bmatrix} = \begin{bmatrix} A \\ 0 \\ A - E\{\tilde{C}\} \\ 0 \end{bmatrix} \tag{8}$$

The solution of these equations provides the constant levels of procurement for the risk-neutral industry. Given the Cournot assumption, these quantities are an increasing function of the number of firms. Letting *n* tend to infinity will cause procurement to approach the levels of a perfectly competitive industry. However, for the purposes of this study, it is the behaviour of prices that is of interest and, in particular, the combined effect of tariffs and imperfect competition on the mean and the standard deviation of the domestic producer price.

Substitution of the optimal values of Q_h and Q_m from equation (8) into equations (1), (2) and (3), together with specific values of the parameters in these equations, will generate prices that depend on the values taken by the parameters. To evaluate the effect of intermediaries on prices, a Monte Carlo simulation exercise was undertaken with artificial parameters and assumed normal probability distributions.

4.3 The Effect of an Ad Valorem Tariff

It was shown in section 4.1 that an *ad valorem* and a specific tariff have different effects when the import price is stochastic and the country is small. It is also known under imperfect competition in the large country case, that these two tariffs are again not equivalent.

Because the *ad valorem* tariff makes the slope of the inverse import supply function steeper, it also makes the expected slope of the marginal expenditure function steeper and reduces imports more than does the specific tariff, which leaves the slope unchanged. Under the proposed modalities of the SSM, the only response available to Members is to increase the *ad valorem* tariff (see Table 1). For this reason, the analysis that follows uses this type of tariff.

Equation (3) was modified to incorporate an *ad valorem* tariff at the arbitrary rate of 25 per cent and equation (8) modified accordingly to generate new optimal values for Q_h and Q_m. The new equations are

$$\begin{bmatrix} (n+1)(B+E\{\tilde{\phi}\}) & 0 & (n+1)B & 0 \\ -n & 1 & 0 & 0 \\ (n+1)B & 0 & (n+1)(B+E\{\tilde{D}\}/(1-t)) & 0 \\ 0 & 0 & -n & 1 \end{bmatrix} \begin{bmatrix} q_h \\ Q_h \\ q_m \\ Q_m \end{bmatrix} = \begin{bmatrix} A \\ 0 \\ A-E\{\tilde{C}\}/(1-t) \\ 0 \end{bmatrix} \qquad (8')$$

These values, Q_h and Q_m, then allowed the free trade exercise to be repeated to give new values for the means and standard deviations of prices (Figures 3 and 4).

5. Results

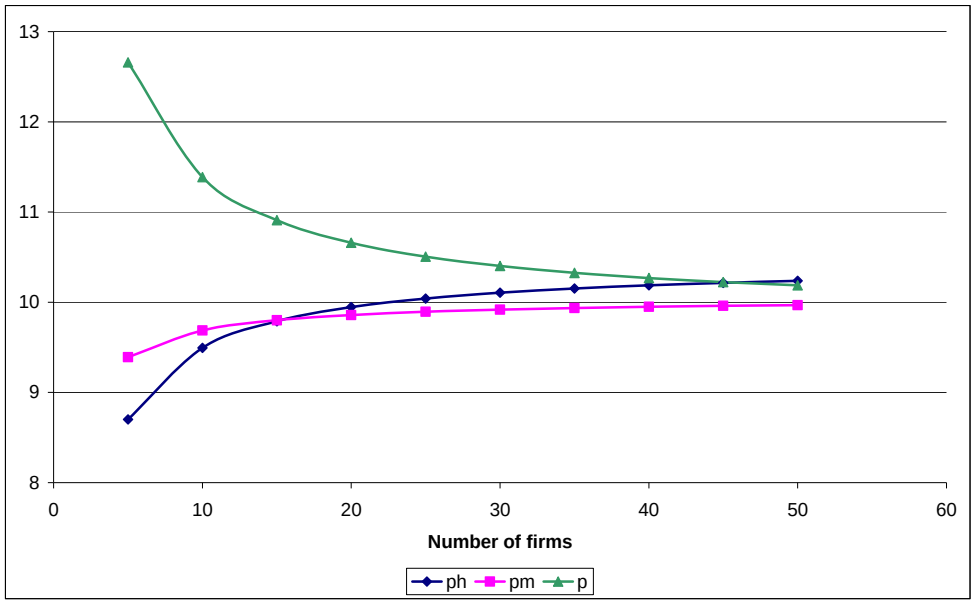
The values chosen for the parameters of equations (1), (2) and (3) are given in Table 2. With n = 5, the price flexibility of consumer demand is –1.1, giving an elasticity of –0.9. The price flexibility and price elasticity of the domestic supply is unity (see equation (2)). The import inverse supply function has a price flexibility of 0.34, giving a price elasticity of 2.9. Values for the stochastic parameters in the inverse supply functions, $\tilde{\phi}$, $\tilde{C}$ and $\tilde{D}$, were generated from 1,000 random draws from normal distributions with means and standard deviations given in Table 2.

Table 2: Parameters

Parameter	Mean	Standard Deviation
A	26.67	
B	1.33	
$\tilde{\phi}$	3.33	1.3
$\tilde{C}$	6.0	0.75
$\tilde{D}$	0.4	0.05

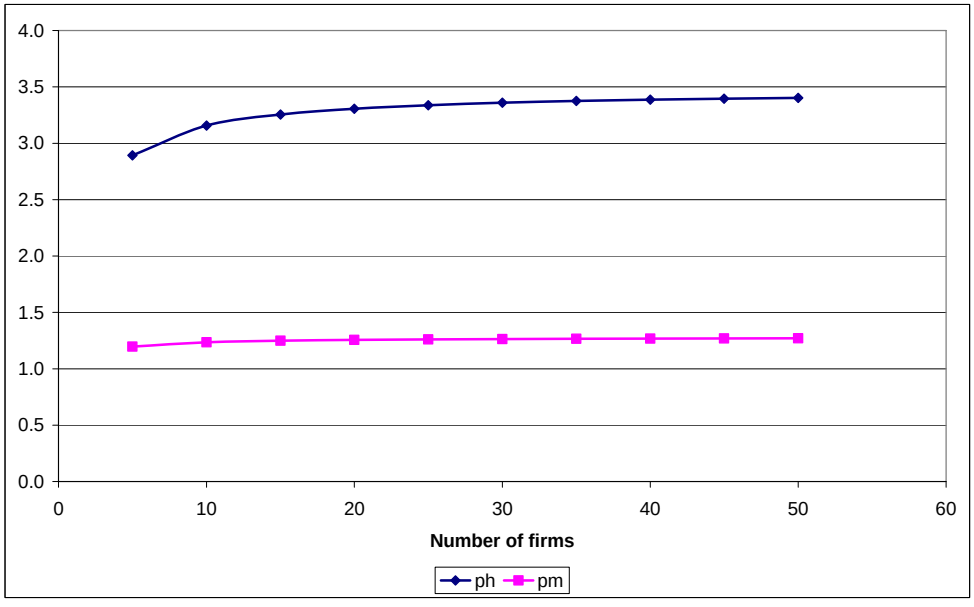
Using the solution to equation (8) for a given n, 1,000 values of p, p_h and p_m were obtained from the 1,000 random values of $\tilde{\phi}$, $\tilde{C}$ and $\tilde{D}$ and the mean and standard deviation of each price series calculated. This exercise was repeated for different values of the number of firms (n = 5, 10, … , 50).

Figure 1: Means of Prices as a Function of *n*



It is known from the deterministic Cournot oligopoly model that the industry's sales increase with the number of firms. The model being evaluated here is a Cournot oligopsony/oligopoly model and the effect of *n* on the total quantity procured is the same. Thus the effect of *n* on the consumer price is the same – the increased quantity procured lowers the consumer price (Figure 1). At the same time, the intermediaries, as purchasers of the inputs, procure more in total and in doing so, drive up procurement prices. This outcome is also evident in Figure 1. With the price flexibility of domestic supply being greater than that of import supply, it would be expected that the increase in the domestic price would be greater than the increase in the import price for a given increase in quantity procured. This intuition is verify in Figure 1.

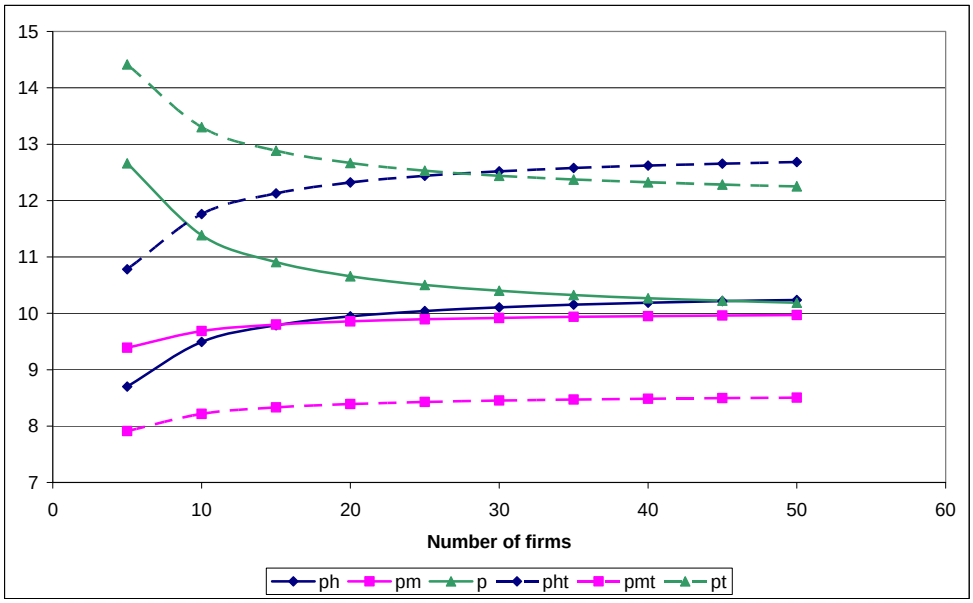
Figure 2: Standard Deviations of Prices as a Function of *n*



The interesting result in Figure 2 is that the standard deviation of each of the procurement prices increases with the number of firms. Given the relationship amongst the parameter values in the inverse supply functions, the variability of the domestic procurement price exceeds that of the import price, but this is probably not a general result. It can be concluded that the more competitive the intermediaries, the more volatile the procurement prices. The corollary is that greater the market power, the smaller is the standard deviation of prices.

As expected, the 25 per cent tariff increases the mean of the domestic consumer price but it does so more markedly as n increases. For n = 5, the mean price with free trade is 12.7 and with the tariff is 14.4, a 13.4 per cent increase. The corresponding prices with n = 50 are 10.2 and 12.3, respectively, a 20.6 per cent increase. With this market structure, it can be concluded that the pass-through of the tariff is less than the increase in the tariff rate, the pass-through being an increasing function of n. This result of course is also dependent upon the slope of the inverse import supply function but it suggests that when n is 'small', the firms absorb more of the tariff than they do when n is large, an outcome that is consistent with the deterministic Cournot oligopsony model.

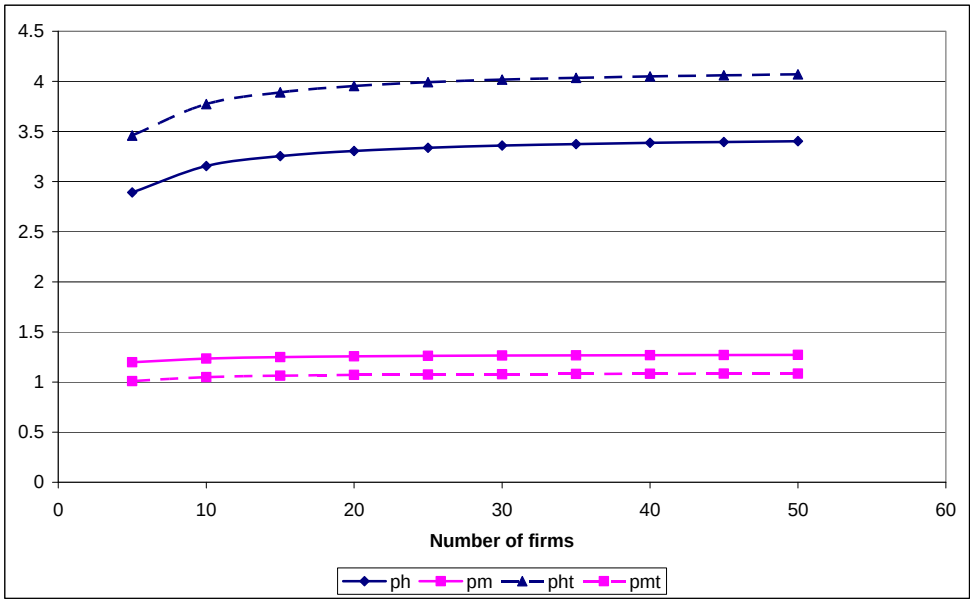
Figure 3: Means of Prices as a Function of *n* with a 25% Tariff



The tariff causes the mean of the domestic procurement price to increase with, again, the effect being more marked as n increases. With n = 5, the difference between p_{ht} and p_h is 2.1, a 22.3 per cent increase, whereas at n = 50, the difference is 2.5, a 23.9 per cent increase. The mean procurement price of imports falls with the tariff with the absolute size of the fall depending again on n – it diminishes marginally with n. The percentage fall is 18.7 per cent at n = 5 and 14.1 per cent at n =50. This result is again consistent with the standard

oligopsony result that the ability of the firms to exploit their buying power diminishes as *n* increases.

Figure 4: Standard Deviations of Prices as a Function of *n* with a 25% Tariff



The imposition of the tariff also affects the volatility of prices (Figure 4). Note that with the demand function assumed to be deterministic, the consumer price is constant regardless of the realisations of the stochastic parameters (see equation (1)) because the quantities available for consumption are determined from the solution of equation (8'). Therefore, in contrast with the results in section 4.1, quantities are completely stabilised. The procurement prices, however, are random. The volatility of the domestic procurement price, as measured by its standard deviation, increases. This result is consistent with that given in section 4.1. The import price becomes less volatile. Of course, this result was not obtainable in section 4.1 because of the small country assumption. Greater volatility is associated with increases in *n* and they are more pronounced for the domestic procurement price, given the choice of parameters.

6. Conclusions

The purpose of the SSM, as advanced by the G-33, is to increase livelihood security for poor farmers in developing countries. When putting this purpose into an economic framework, it becomes less obvious how security is defined and how the proposed price trigger or quantity trigger will achieve the objective. The empirical reality would appear to be that import surges, which presumably are associated with reduced livelihood security, in most cases are not accompanied by a change in the domestic price. For a small country, this suggests that the surge occurs without any change in the world market price. It also suggests that the variability in the import demand function is a more important source of instability and

livelihood risk than is the world price. Therefore, a tariff increase will be less effective in moderating livelihood security than a domestic instrument would be. The tariff is a second-best instrument if the source of the problem is found in the domestic market.

The analysis in section 4.1 has shown that if the government of a small importing country restricts imports using an *ad valorem* tariff, the effect is not only to increase the mean domestic price but also to increase its variance. This outcome is inconsistent with the objective of the SSM of increasing livelihood security, unless poor farm households are risk loving, which is counterintuitive.

The analysis in section 4.2 has shown that with imperfectly competitive intermediaries, the mean level of the consumer price falls as the number of firms increases and that the procurement prices increase. From the viewpoint of the suppliers of this input, the more competitive the buyers, the better off they are – they sell more and at a higher price. However, the more competitive the buyers, the greater is the variability of the price received by suppliers. Therefore, whether or not they are indeed better off will depend upon their attitude to risk. Again, suppliers of the input in the domestic market may or may not have their livelihood security enhanced by more competitive intermediaries. This outcome may be consistent with the insistence in some countries that importing state trading enterprises are an essential component in market structure.

The analysis in section 4.3 has shown that an *ad valorem* tariff moves the mean of each price series in the direction expected – the consumer price and the domestic procurement price increase and the import procurement price decreases. It was also shown that the degree of pass-through of the tariff was directly related to the number of firms. The second result from this section is the effect of the tariff on the standard deviation of each procurement price. For the import price, the tariff reduced its variability, which might or not be beneficial to foreign suppliers, recalling that the mean of price is also reduced. On the other hand, the tariff increases the variability of the domestic procurement price. Poor farm households that are net buyers are made worse off with the increase in the mean of the consumer price: poor farm households that are net suppliers may or may not be better off.

The conclusion from this research is that the analysis of the effects of tariffs becomes quite complex once imperfectly competitive intermediaries are introduced in a stochastic environment. However, that complexity provides a richer set of results than those derived under the assumptions of a small country, perfect competition and the absence of intermediaries. This complexity allows for the mean and the variance of prices to be evaluated in the move from free trade to protection by an *ad valorem* tariff. The analysis has shown that increasing an *ad valorem* tariff increases rather than decreases domestic price

volatility. The sign of the change does not depend upon market structure but the size of change does depend upon the details of the market structure that exists between suppliers, both domestic and exporters, and consumers. On the basis of this analysis, it is concluded that it is highly improbable that the concept of the SSM, let alone the proposed modalities, can achieve the objective set for it by the G-33, i.e., the protection of livelihood security for poor farm households.

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