A Theoretical Analysis of Special Safeguards

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Abstract

Special safeguards for agriculture are WTO sanctioned tariffs triggered when imports for certain products exceed a predetermined threshold or when price falls below a predetermined floor. This policy tool emerged originally as part of the Uruguay Round Agreement of Agriculture for those nations that agreed to tarrification. A new, but similar special safeguard mechanism (SSM) has been proposed in the ongoing Doha Round for developing nations. The SSM has been highly contentious and commonly blamed for several breakdowns in negotiations. The purpose of this paper is to investigate theoretically the implications of quantity based special safeguards for agriculture in the presence of imperfect competition. The paper presents four models: one involving two foreign firms exporting to a nation without a domestic industry and three version of a model with one domestic firm and one foreign exporter. Based on the market situation, the models show how foreign firms will try and lower imports in the current period to prevent triggering the tariff. We also document how firms can store imports in the pre-tariff period and sell in the post-tariff period and on what happens when the domestic firm is allows to import from a third party.

Keywords: Special Safeguards, Agricultural Policy, Developing Nations

JEL Codes: L12, Q17, Q18

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I. Introduction

Member nations that agreed to tarrification of agricultural imports under the Uruguay Round (UR) of GATT are allowed to apply special safeguard (SSG) tariffs when import volume (price) exceeds (falls below) a predetermined level. Unlike antidumping and general safeguard measures, use of the SSG requires no judicial actions associated with proof of injury or compensation to injured parties. Essentially, SSGs were allowed to protect newly tarrified agricultural goods (and thus rural economies) from potentially precipitous price declines in the new open market structure void of strict quotas.

A recurring point of contention with SSGs was its limited access: of the 148 WTO Members in 2005, only 39 had legal rights to the SSG. In the Doha Round trade negotiation, begun in 2001, the developing nation member contingent has called for access to SSGs or the abandonment of the program. After the unsuccessful 2003 Cancun Ministerial Conference, the G-33 developing nation group presented their proposal a close variant of the SSG: the Special Safeguard Mechanism (SSM). At the 2005 Hong Kong Ministerial Conference, the SSM for developing nations was formally proposed as a way for developing nation members to use import quantity and price triggers and engage the SSM as core component for future negotiations involving agricultural trade (World Trade Organization, 2005).

Since at least 2005, the proposed SSM has had a central and tumultuous role in the extended Doha Round of the WTO trade negations. Indeed, many have suggested that the SSM is the key linchpin leading to the breakdowns in Doha Round negotiations (i.e. Valdez and Foster, 2009). At the present time, the process for defining special safeguards for all countries has yet to be finalized and remains hotly contested (ICTSD, 2010). Despite the uncertainties, it appears
that special safeguards for agriculture are likely to remain a policy tool for WTO countries for many years to come.

In this paper we develop theoretically the implications of a quantity based SSM\(^1\) in the presence of imperfectly competitive international markets.\(^2\) Both the SSG and proposed framework for the SSM use a predetermined volume or price trigger known to industry participants. Under the assumption of perfect competition, the trigger mechanism seems safe from strategic manipulation by small domestic or international firms. In less competitive environments, there exists the potential for the SSM trigger to be endogenized in the decision process of each firm. In small developing nations, which are the main focus of the Doha Round, aggregate demand for specific food items can oftentimes be met with only one or two firms. In these types of economic settings, the presence of a SSM is likely to change the way in which importing and domestic firms determine market shares, prices and oligopoly rent. Because the trigger mechanism causes a predictable and large price shock on imports, the implications for strategic interaction can be quite complex and varied across nations and industries with different market structures. As a result, a targeted theoretical approach likely provides the best means to shedding light on the use of SSMs under oligopoly.

Only a limited body of research has emerged to evaluate the economic and policy ramifications of this policy mechanism. Hallaert (2005) reviews how special safeguards have been used since 1995. He reports that continuous use of the SSG is not rare, which conflicts with the original intent to be a temporary protective measure. Hallaert (2005) argues for proof of injury and that a shorter time limit be invoked before the trigger is reset. Jales (2005) provides

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\(^1\) For convenience we adopt for the remainder of the paper the use of the acronym ‘SSM’ to reference the special safeguard policy apparatus for agriculture. The current SSM is a proposed policy framework in the Doha Round with the same basic features of the SSG mechanism currently used by specific nations.

\(^2\) Because our models assume product homogeneity, pricing based special safeguard tariffs cannot avoid the Bertrand paradox and are not considered here.
useful and detailed information about the proposed SSM and offers a case study analysis of likely impacts in Jamaica. Several studies simulate how the proposed SSM is likely to perform (Somwaru and Skully, 2005; Grant and Meilke, 2006; Valdes and Foster, 2005). These simulations point generally to small reductions in global welfare relative to full liberalization, stabilized imports to nations using the SSM and higher world prices.

Thus far, all the literature on SSGs or the proposed SSM fail to recognize the added dimension of imperfect competition. This is somewhat surprising given that agricultural trade often involves single desk state trading enterprises (i.e. Canadian Wheat Board, Australian Barley Board and many others) and large multinational agribusinesses, some that have engaged in hard core cartels (i.e. Archer Daniel Midlands) and may otherwise tacitly collude in controlling prices and quantities. Certainly, such firms and organizations may not see special safeguards as benign trade policies that simply parameterize their markets. As we show in this paper, oligopolistic firms will likely see special safeguards as a mechanism with which to either facilitate market power or as an endogenous variable in determining the market outcome.

In the next section, we present an initial model built on a framework of duopoly exporters marketing into a nation no domestic production. This approach follows in the tradition of a considerable number of strategic trade papers that recognized the ability of exporters to shift rent through the use export subsidies and taxes (see Stiegert, 2007 for a review). Then a second set of models are presented also using a duopoly structure but involve a single exporter marketing into a nation with a single domestic firm. We conduct research on three cases, each of which make differing assumption about the ability of the domestic firm to store product or import. Throughout, we presume that each firm has complete information about the special safeguard and that they interact strategically. All models set up as a two stage game with linear inverse
demand given by \( p = a - bq \) in both periods. Detailed solutions regarding equilibrium prices, quantities, and profits are available from the authors upon request. In all models, the standard Cournot equilibrium in each period acts a base solution. Firms decide about whether to trigger the tariff based on the summed profits they earn from each period. The game is solved using the traditional backward induction approach.

II. Model 1: duopoly exporters, no domestic production.

In this model, the SSM represents a protective import barrier to firms with close substitute products. A good example would be imports of wheat into an Asian country concerned about its traditional rice farming sector. Each firm \( i=1,2 \) in each period \( j=1,2 \) choose quantity \( q_{ij} \). If aggregate imports in first period exceeds a trigger level \( \overline{q} \), \((q_{i1} + q_{21} > \overline{q})\), then the government imposes tariff \( t \) per unit of import in the second period. If the SSM is not triggered, the game ends up as a repetition of one-shot Cournot equilibrium played out in both stages.

Before discussing the equilibrium conditions, we present the first period response set of firm 1 given firm 2’s choice of \( q_{21} \). As will we see shortly, this exercise yields a critical equation that defines a switching point in a discontinuous reaction function at the trigger point. Firm 1’s choice in period 1 is really quite simple: it either chooses the one-period optimum (Cournot output) or it chooses output below the one-period optimum to avoid a tariff in the next period.

Consider Diagram 1 which defines the three choice regions of firm 1 based firm 2’s output level:

**Diagram 1**

\[
\begin{align*}
&\text{(b)} & &\text{(c)} & &\text{(a)} \\
&0 & &2\overline{q} - \frac{a - c_1}{b} & &\overline{q} & &q_{21}
\end{align*}
\]
Regions (a) and (b): Both regions represent trivial solutions. In region (a), \( q_{21} > \bar{q} \).

Because firm 2’s output exceeds the trigger, firm1 cannot strategically avoid the SSM and chooses the one period optimum \( q_{11} = (a - c_1 - bq_{21}) / 2b \). In region (b), \( q_{21} \) is so small that choosing the one period optimum does not induce the tariff.³

Region (c): if \( \bar{q} - (a - c_1) / b < q_{21} \leq \bar{q} \) : in this case, firm 1 chooses either

(c-1) one period optimum \( q_{11} = (a - c_1 - bq_{21}) / 2b \), or

(c-2) output below the one period optimum \( q_{11} = \bar{q} - q_{21} \) to avoid the tariff.

Firm 1 chooses the path that generates the greater total payoff \( \pi_{11} + \pi_{12} \) from the two-stage game.

Calculating the total payoffs in (c-1) and (c-2),

\[
\begin{align*}
(1) \quad \left[ \pi_{11} + \pi_{12} \right]_{(c-1)} &= \frac{(a - c_1 - bq_{21})^2}{4b} + \frac{(a - 2c_1 + c_2 - t)^2}{9b}, \\
(2) \quad \left[ \pi_{11} + \pi_{12} \right]_{(c-2)} &= (a - c_1 - bq)(\bar{q} - q_{21}) + \frac{(a - 2c_1 + c_2)^2}{9b}. 
\end{align*}
\]

Equation (1) is the payoff when the safeguard is triggered in period 1, while equation (2) is the tariff avoidance strategy in which firm 1 chooses \( q_{11} = \bar{q} - q_{21} \) in the first period. To compare and analyze the total payoffs \( \left[ \pi_{11} + \pi_{12} \right]_{(c-1)} \) and \( \left[ \pi_{11} + \pi_{12} \right]_{(c-2)} \), we introduce three functions;

\[
\begin{align*}
 f(q_{21}) &= \frac{(a - c_1 - bq_{21})^2}{4b} + \frac{(a - 2c_1 + c_2 - t)^2}{9b} - \frac{(a - 2c_1 + c_2)^2}{9b}, \\
 g(q_{21}) &= (a - c_1 - bq)(\bar{q} - q_{21}), \\
 h(q_{21}) &= \frac{(a - c_1 - bq_{21})^2}{4b}.
\end{align*}
\]

³ Note also that when the trigger level (\( \bar{q} \)) is small enough, \( 2 \bar{q} - (a - c_1) / b \) becomes negative and region (b) is empty.
The functions \( f(\cdot) \) and \( g(\cdot) \) correspond respectively to (1) and (2) and that the sign of \([f(\cdot) - g(\cdot)]\) determines the choice of firm 1 in period 1. The function \( h(\cdot) \) is a useful reference corresponding to firm 1’s profit for choosing the one period optimum when the tariff is not imposed. Inspection of the above terms reveal that \( f(\cdot) \leq h(\cdot) \), and the equality holds when \( t \) is zero. Additionally, \( g(\cdot) \leq h(\cdot) \), since \( h(\cdot) \) maximizes the period 1 profit, while \( g(\cdot) \) corresponds to a lower payoff for choosing \( q_{i1} = \bar{q} - q_{21} \). The equality holds when the period 1 optimum \( q_{i1} = (a-c_1-bq_{21})/2b \) coincides with \( q_{i1} = \bar{q} - q_{21} \). Now, we define \( \tilde{q}_{21} \) to be the value of \( q_{21} \) at which \( f(\cdot) \) and \( g(\cdot) \) intersect. As a result, \( \tilde{q}_{21} \) is the switching quantity in the sense that:

\[
q_{21} \leq \tilde{q}_{21} \iff f \leq g \iff (c-1) q_{i1} = \bar{q} - q_{21} \text{ is optimal, tariff not imposed.}
\]

\[
\tilde{q}_{21} \leq q_{21} \iff f \geq g \iff (c-2) q_{i1} = (a-c_1-bq_{21})/2b \text{ is optimal, tariff imposed.}
\]

Combining with the results of (3) and (4), we obtain firm 1’s best response function as follows.

\[
q_{i1}(q_{21}) = \begin{cases} 
\frac{a-c_1-bq_{21}}{2b} & (q_{21} \leq 2\bar{q} - \frac{a-c_1}{b}, \tilde{q}_{21} \leq q_{21}) \\
\bar{q} - q_{21} & (2\bar{q} - \frac{a-c_1}{b} \leq q_{21} \leq \tilde{q}_{21}) 
\end{cases}
\]

Firm 1’s response function is presented graphically in panels A and B of Figure 1. In both panels, the lines connecting points AB and CD are the standard one-stage response functions for firm 1 and firm 2, respectively. The lines connecting points EF in both figures represent period 1 quantity combination that precisely match the safeguard trigger level: \( q_{i1} + q_{21} = \bar{q} \). The explicit expression of the jump point, \( \tilde{q}_{21} \), is given by:

\[
\tilde{q}_{21} = 2\bar{q} - \frac{a-c_1}{b} + \frac{2\sqrt{(a-2c_1+c_2)^2-(a-2c_1+c_2-t)^2}}{3b},
\]

where \( \tilde{q}_{21} \) is easily seen to be increasing in \( t \). The jump point, \( \tilde{q}_{21} \), may be less than (Figure 1-A) or greater (Figure 1-B) than the Cournot equilibrium.
We are now ready to discuss the equilibrium conditions for our first model. We focus on the case when \( \bar{q} \) is less than the period one Cournot outcome \( (q_1^*, q_2^*, \bar{q}) \) so that \( \bar{q} \) may bind the Cournot equilibrium. Solving the game, we show regions that define when the SSM \((\bar{q}, t)\) is binding and when it is not. This is critically important to the domestic government, since if \((\bar{q}, t)\) is not binding then it means that the SSM fails to facilitate the restraint of imports in the first stage and prices decline to the Cournot level and quantities trigger the SSM.

To simplify things a bit, we assume identical technology \( c_1 = c_2 = c \) across firms, which means that the response function specified in (5) is now the same for both firms. Let \( q_i \) and \( q_c \) denote equilibrium quantities of the one-shot Cournot game with and without the tariff, respectively. Depending on the location of \( \bar{q} (= \bar{q}_{11} = \bar{q}_{21} \) by symmetry), we have three cases for equilibrium, which are presented in Figure 2, panels A, B, and C and referenced below as cases 1, 2, and 3, respectively. In each panel, Firm 1’s response function is AGHIB while Firm 2’s response function is DG’H’T’C. As we saw in Figure 1, Firm 1’s response function is kinked at G and jumps from H to I. Likewise, Firm 2’s response function is kinked at G’ and jumps from H’ to I’.

**Case 1, \((q_c > \bar{q})\):** Panel A shows that for this case, the jump occurs before the safeguard is triggered leaving each firm with no choice but to trigger the safeguard by choosing the one-shot Cournot point \((q_c, q_c)\). Therefore, the two-stage equilibrium outputs are: \((q_{11}, q_{21}, q_{12}, q_{22}) = (q_c, q_c, q, q_i)\), \( \bar{q} \) is not binding (i.e. safeguard is triggered), and tariff is imposed in period 2.

**Case 2, \((\bar{q}/2 < \bar{q} \leq q_c)\):** As shown in Panel B, in addition to the intersection of each response function at the Cournot point \((q_c, q_c)\), the response functions overlap along HH’ in advance of the jump points. Thus, we have case of two possible equilibriums, one which triggers
the safeguard: \( (q_{11}, q_{21}, q_{12}, q_{22}) = (q_c, q_c, q_c, q_c) \), \( \bar{q} \) is not binding, tariff is imposed in period 2] and one that does not \( (q_{11}, q_{21}, q_{12}, q_{22}) = (q_{11}, q_{21}) \) is such that \( q_{11} + q_{21} = \bar{q}, q_{11} \leq \bar{q} \text{ and } q_{21} \leq \bar{q}, q_{12} = q_{22} = q_c \), \( \bar{q} \) is binding, tariff is not imposed in period 2].

**Case 3, \( (q_c < \bar{q}) \):** As shown in Panel C, the Cournot point \((q_c, q_c)\) is no longer a possible equilibrium. Equilibrium occurs at the symmetric output point in the overlap region HH’:

\[
(q_{11}, q_{21}, q_{12}, q_{22}) = ((q_{11}, q_{21}) \text{ is such that } q_{11} + q_{21} = \bar{q}, q_{11} \leq \bar{q} \text{ and } q_{21} \leq \bar{q}, q_{12} = q_{22} = q_c),\]

\( \bar{q} \) is binding, tariff is not imposed in period 2].

Using (6) and adding the assumption of symmetric firms, the inequalities of each case are translated in terms of \((t, \bar{q})\) as follows:

1. **Case 1:**
   \[
   q_c < \frac{a-c}{3} - \frac{4}{9} \sqrt{t(2(a-c)-t)} < \bar{q} < \frac{2}{3} - \frac{4}{9} \sqrt{t(2(a-c)-t)}.
   \]

2. **Case 2:**
   \[
   \frac{2}{3} - \frac{4}{9} \sqrt{t(2(a-c)-t)} \leq q_c \leq \bar{q} < \frac{2}{3} - \frac{4}{9} \sqrt{t(2(a-c)-t)} + \frac{1}{3} \sqrt{t(2(a-c)-t)}.
   \]

3. **Case 3:**
   \[
   q_c < \bar{q} < \frac{2}{3} - \frac{4}{9} \sqrt{t(2(a-c)-t)} - \frac{1}{3} \sqrt{t(2(a-c)-t)} < q_c.
   \]

Using equations (7)-(9), Figure 3 presents the regions that Cases (1-3) are active under relevant ranges of the SSM tariff levels and trigger points. Case 1 corresponds to the positive region (AOE) but below the arc AD (hereafter AOED). Case 2 corresponds to the region above the arc AD but below the arc AC (hereafter ADC). Case 3 corresponds to the region above the arc AC (hereafter ACB). Note that when either the tariff \((t)\) or the trigger \((\bar{q})\) is small, firms will most likely end up operating under Case 1, which triggers the tariff. In Case 1, the either the tariff is too small to worry about or the trigger point is too low for the firms to exercise strategic restraint.

On the other extreme, a large and burdensome tariff along with a trigger point not too far from
the Cournot outcome will certainly give firms the incentive to reduce period 1 imports and avoid the tariff.

Two additional points provide additional insights. First, fix $\bar{q}$ above $(a - c) / 3b$ and read the graph from right to left. When the tariff is small, Case 1 holds, $\bar{q}$ is non-binding and the tariff is imposed in the 2\textsuperscript{nd} period. As the tariff increases, the equilibrium rules shift to Case 2, which has two equilibria. While our model does not state which of the two equilibria will be chosen, if we were paying the tariff as in Case 1, and the tariff rate rose, it seems most plausible that we would continue to trigger the safeguard and pay the tariff. If on the other hand, we had entered the Case 2 region from the Case 3 region, it seems reasonably that firms may initially try and avoid the tariff as they had done previously. Whatever is chosen initial is of second level importance: Case 2 presents the possibility for unstable strategic interactions among the duopolists. Next, consider the case of collusion such that $q_{11} + q_{21} = q_M =$ monopoly output. This corresponds to the middle point between A and G on the $\bar{q}$-axis. Note that when $\bar{q}$ is between AG, it is always closer to $q_M$ than combined Cournot outcome (i.e. $q_C + q_C$, A in figure 3) is to $q_M$. When $\bar{q}$ between AG is combined with a tariff level that puts us in the Case 2 region, then the binding equilibrium is dominant over the non-binding Cournot equilibrium. In reference to Figure 2, Panel B, this mean that equilibrium $(\bar{q} / 2, \bar{q} / 2)$ is dominant over $(q_C, q_C)$.

III. Model 2

For the second model we evaluate three versions (Models 2A, 2B, and 2C) of the case of one foreign exporter competing with one domestic producer in the presence of a SSM. Unlike the first model in which both firms view tariff through the same lens, in this model, the domestic firm sees the SSM as a potential way to extract rent. The domestic firm stands to benefit if either the SSM disciplines period 1 imports to avoid the tariff or if the tariff is triggered in period 1.
leading to higher import costs in period 2. Model 2A is similar in all other respects to model 1. Model 2B extends Model 2A by allowing for the foreign firm to store period 1 imports and market them in period 2. In this case, the foreign firm avoids the SSM on stored product but faces storage costs on. Model 2C extends model 2A by allowing the domestic firm to import, which gives the domestic firm the ability to trigger the tariff if it chooses.

Model 2A: One domestic and one foreign firm

Consider a model with one foreign importer (indexed 1) and one domestic producer (indexed 2). Each firm produces a homogeneous good for the domestic market with linear inverse demand given by \( p = a - bq \). As before, the SSM is characterized by a pair \((\bar{q}, t)\) of the trigger level and tariff. If imports by the foreign firm in the period 1 exceeds \(\bar{q} \), then tariff \(t\) per unit is imposed on imports in period 2.

We evaluate the best response function of firm 1 (foreign) in period 1 given firm 2’s choice set for production \((q_{21})\). As shown in Diagram 2, Firm 1 either chooses one-period optimum, or gives up one-period optimum to avoid tariff in the next period:

Diagram 2

\[
\begin{align*}
0 & \quad \frac{a - c_1}{b} - 2\bar{q} & \quad \frac{a - c_1}{b} \\
& \quad (c') & \quad (b')
\end{align*}
\]

Region \((b')\), \((a - c_1 - 2b\bar{q})/b \leq q_{21}\) represents a trivial condition. In this region, \((a - c_1 - bq_{21})/2b\) (i.e. the one period optimum) is at or below the trigger \((\bar{q})\), which means that the firm 1 is free to import the optimum quantity without triggering the tariff.

Region \((c')\), \(0 \leq q_{21} \leq (a - c_1 - 2b\bar{q})/b\): In this case, firm 1 chooses either
(c’-1) one-period optimum \( q_{i1} = (a - c_i - bq_{21}) / 2b \), or

(c’-2) \( q_{i1} = \bar{q} \) to avoid the tariff and give up the one period optimum.

Firm 1 chooses the quantity that maximizes the total payoff \( \pi_{i1} + \pi_{i2} \) from the two-stage game.

Calculating the total payoffs in (c’-1) and (c’-2) gives,

\[
[\pi_{i1} + \pi_{i2}]_{(c’-1)} = \frac{(a - c_i - bq_{21})^2}{4b} + \frac{(a - 2c_i - 2t + c_2)^2}{9b}
\]

\[
[\pi_{i1} + \pi_{i2}]_{(c’-2)} = (a - c_i - b(\bar{q} + q_{21}))\bar{q} + \frac{(a - 2c_i + c_2)^2}{9b}.
\]

Let \( \tilde{q}_{21} = q_{21} \) equal firm 1 level of imports when (10) = (11):

\[
\tilde{q}_{21} = \frac{a - c_i}{b} - 2\bar{q} - \frac{2}{3} \sqrt{L(t)} \frac{L(t)}{b},
\]

where \( L(t) = (a - 2c_i + c_2)^2 - (a - 2(c_i + t) + c_2)^2 \). Equation (12) identifies the trigger point for firm 1. Case (c’-1) is chosen when \( q_{21} \leq \tilde{q}_{21} \iff q_{i1} = (a - c_i - bq_{21}) / 2b \) is imported and the tariff is imposed for period 2. Case (c’-2) is chosen when \( \tilde{q}_{21} \leq q_{21} \iff q_{i1} = \bar{q} \) is optimal and the tariff is not imposed.

The quantity \( \tilde{q}_{21} \) defined in equation (12) also defines a discontinuous point in firm 1s best response function, which is given by:

\[
q_{i1}(q_{21}) = \begin{cases} 
\frac{a - c_i - bq_{21}}{2b} & (q_{21} \leq \tilde{q}_{21}, \ a - c_i - 2\bar{q} \leq q_{21}) \\
\frac{a - c_i}{b} - 2\bar{q} & (\tilde{q}_{21} \leq q_{21} \leq \frac{a - c_i}{b} - 2\bar{q}) \\
\bar{q} & (\tilde{q}_{21} \leq q_{21})
\end{cases}
\]

Although firm 2’s profit in the second period depends on whether or not the tariff is triggered, he cannot induce firm 1 into choosing the one period optimum when \( \bar{q} \) would otherwise be chosen.

This is artifact of the simultaneous move structure of the game. When firm 1’s best response is
the marginal cost of jumping to the one period optimum is measured in the lost revenue in the second period, which is constant and related to the size of the tariff.

Figure 4 presents range of possible outcomes (arranged in three panels: A, B, C) from this game structure. Each outcome depends on the location of the region defined by $\triangle ABC$. Note that trigger level $\bar{q}$ determines the position of $\triangle ABC$ and $t$ determines its size. As $t$ increases, the region $\triangle ABC$ enlarges, which increases the likelihood that the SSM policy distorts trade. When the trigger level $\bar{q}$ is increasing (decreasing), $\triangle ABC$ slides upward (downward) toward point D (E). Beginning with a large trigger level and then reducing it, we present three sequential cases that relate to different equilibrium outcomes.

Case 1: As shown in panel A, decreasing $\bar{q}$ causes firm 2's reaction function to eventually cut through $\triangle ABC$. In this case, firm 1 is disciplined to reduce imports in period 1 down to the trigger level to avoid the tariff in period 2. Aggregate quantity in the first period declines relative to the Cournot equilibrium leading to a price increase in period one. Equilibrium quantity in the first period is $Q^* = (\bar{q}, (a-c_2-b\bar{q})/2b)$.

Case 2: As $\bar{q}$ is reduced further, $\triangle ABC$ slides down and to the right, and both points C and A are now below the Cournot equilibrium. However, the reaction function of firm 2 still cuts through a part of $\triangle ABC$ such that we have two possible equilibria: The Cournot point and $Q^*$. The latter one takes the form of Case 1 described above and former takes the form of Case 3.

Case 3 As $\bar{q}$ is lowered further, $\triangle ABC$ slides further down and to the right. Now firm 2's reaction function is entirely to the left of $\triangle ABC$. In this case, $\bar{q}$ is not binding, firms 1 and 2 choose the Cournot outcome in period 1 and the tariff is imposed in period 2. The tariff acts to

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4 We do not show the trivial case when $\bar{q}$ large enough to be above the one period optimum for the firm 1, which leads to the one-period optimum for both periods for each firm. In panel A of Figure 4, this would be shown as intersection of both reaction functions to the right of point C.
increase the marginal cost of firm 1, which leads to a lower market share in period 2. Period 2 equilibrium quantities for firms 1 and 2 are: \( q_{1t} = q_{1c} - \frac{2}{3b} t \) and \( q_{2t} = q_{2c} + \frac{1}{3b} t \). Note that aggregate quantity in period 2 drops below the Cournot level leading to a price increase above the base case.

In each panel, there is useful information about the relative positions of the Cournot output and the trigger point. Point A in panel A is above and to the left of the Cournot point \( \overline{q} + \sqrt{L(t)/3b} > q_{1c} \). In panel B, point A is below to the right of the Cournot output \( \overline{q} + \sqrt{L(t)/3b} \leq q_{1c} \) and that point B is below the reaction function for firm 2 (line FG) \( \overline{q} \leq q_{21}^{-1}(\overline{q}_{21}(t)) \), where \( q_{21}^{-1}(q_2) = -2q_2 + (a - c_2)/b \) is the inverse function of the one-period best response function of firm 1. In panel C, point A is below and to the right of the Cournot level \( \overline{q} + \sqrt{L(t)/3b} \leq q_{1c} \) and point B is above firm 2’s reaction function (line FG) \( \overline{q} > q_{21}^{-1}(\overline{q}_{21}(t)) \). Using the relative position of each equilibrium, we can now construct a figure that identifies the choice regions in \( t \overline{q} \)-space for each of the three cases. As shown in Figure 5, this exercise allows for several general interpretations of the equilibrium outcome under the SSM \((t, \overline{q})\). First, triggering the tariff (Case 3) is not likely to emerge very often except when combinations of \( \overline{q}s \) and \( ts \) that are quite small: the foreign firm observes a small penalty in period 2 for triggering the tariff, and large payoff in period 1 for importing beyond an otherwise restrictive trigger level. Second, while mid-range combinations of \( t \) and \( \overline{q} \) induce the foreign firm into the region for Case 2, like Case 1, also has a rather narrow range in the \( t \overline{q} \)-space unless the trigger level is small, Recall we also have multiple equilibria under Case 2, which makes for possible unstable outcomes over time. Third, Case 1 is shown to be chosen across a
wide range of policy situations. Indeed, when the trigger level \((\bar{q})\) increases to half or more of the Cournot level, the foreign firm chooses Case 1 for nearly all tariff levels beyond the smallest ones.

Model 2A provides some interesting insights into the ways in which the SSM distorts trade and welfare outcomes. First, for a fixed trigger level \((\bar{q})\), increasing \(t\) cannot make the domestic firm worse off provided that we remain within the same case-region. When \((t, \bar{q})\) is in the Case 3 region, increasing \(t\) makes domestic firm strictly better off because, in period 2, it increases the domestic firm’s market share and it shifts rent from the foreign to the domestic firm. When \((t, \bar{q})\) is in the Case 1 region, increasing or decreasing \(t\) doesn’t affect domestic firm’s payoff and foreign firm’s payoff, nor does it cause a change in equilibrium quantities, prices or consumer welfare. For a fixed \(t\), decreasing \(\bar{q}\) always makes domestic firm better off up to a “switching level.” As long as \((t, \bar{q})\) is in Case 1 region in figure 5, lowering \(\bar{q}\) makes domestic firm better off, because it binds import tighter in period 1. If \(\bar{q}\) is reduced to the point that we switch into Case 2 or Case 3 region and also trigger the tariff, the change in aggregate profit of the domestic firm cannot be signed over the entire parameter space. Also, shifting from Case 1 into Case 2 opens up the uncertainty of multiple equilibria.

**Model 2B: One domestic and one foreign firm with product storage.**

Model 2B extends model 2A by including an option to store homogeneous goods operating under the SSM tariff structure. In this setting, the quantity imported in period 1 can now be sold in period 2 without having to pay the SSM tariff. This provides a way for the foreign supplier to evade partially the tariff. Because model studied here is a modification of model 2A, we present our results in table with a comparison to Model 2A and refer to the previous figures when
relevant. The principal difference between Models 2A and 2B is the introduction of a storage
cost function $s(k_i)$, where $k_1$ represents the level of imports in period 1 that are stored for period
2 consumption. To avoid a corner solution, the cost of storage is assumed to be quadratic:

$$s(k_i) = \frac{1}{2}k_i^2.$$  

The use of a quadratic function captures time, cost of storage, and depreciating
quality that is inherent in storing product for later use.\(^6\)

Solving via backward induction, Firm 1’s problem in the second period is given by:

$$\max_{q_{12}} (a - b(q_{12} + k_1 + q_{22}))(q_{12} + k_1) - (c_1 + t)q_{12},$$

where $k_1$ is the amount stored in period 1 by firm 1. Because the model is limited to two periods,
$k_1$ is assumed to be sold in the period 2. It is also assumed $k_1$ passes customs in the first period
and is a part of total imports $q_{11} + k_1$ in the first period. Note that in (14), $q_{12}$ is the only control
variable: $k_1$ is assumed exogenous in the period 2 problem. When the tariff is not triggered ($t=0$
in equation (14) in period 1, then $k_1 = 0$, and the model the base Cournot outcome for period 2:

$$q_{12} = q_{1c}, \quad q_{22} = q_{2c}$$

$$\pi_{12} = \frac{(a - 2c_1 + c_2)^2}{9b}, \quad \pi_{22} = \frac{(a + c_1 - 2c_2)^2}{9b}$$

When the SSM tariff is triggered in period 1 and relying on our assumption that the level of
stored product is not large, the solution to the period 2 game is not much different from Model
2A. There is a reduction in tariff revenue for the government, but the quantities sold and prices
are unchanged:

\(^5\) Since the cost of production for firm 2 (domestic) doesn’t change if the tariff is triggered, there is no incentive for
firm 2 to store period 1 production for later sale in period 2. Thus, the optimal $k$ for firm 2 is zero.
\(^6\) With a small enough storage costs or large enough tariff, it would be possible for the foreign firm to import and
store all period 2 sales in period 1. Therefore, we assume throughout that $k_1$ is not very large in relation to the period
2 Cournot outcome.
\begin{align}
q_{12} + k_1 &= q_{1c} - \frac{2}{3b} t, \quad q_{22} = q_{2c} + \frac{1}{3b} t \\
\pi_{12} &= \frac{(a - 2c_1 - 2t + c_2)^2}{9b} + (c_1 + t)k_1, \quad \pi_{22} = \frac{(a + c_1 + t - 2c_2)^2}{9b}
\end{align}

The payoff in equation (18) for firm 1 includes the added term \((c_1 + t)k_1\) that is not present in the solution in Model 2A. This term simply adds back the tariff revenue that was avoided due to storage and the cost of producing the stored commodities, which was accounted for in the first period.

Now consider the decision facing each firm in the first period. Because firm 2 will not store in period 1, its decision problem is straightforward: \([\max_q (a - b(q_{11} + q_{21}))q_{21} - c_2q_{21}]\), and optimal \(q_{21}(q_{11})\) is the same as in the one-shot Cournot game. Firm 1s problem considers the benefits of reducing imports to avoid the period 2 tariff against triggering the tariff, paying quadratic storage costs from period 1 imports sold in period 2, and then paying the tariff on remaining imports:

\begin{equation}
\max_{q_{11}, k_1} (a - b(q_{11} + q_{21}))q_{11} - c_1(q_{11} + k_1) - s(k_1) + \frac{(a - 2c_1 - 2t + c_2)^2}{9b} + (c_1 + t)k_1
\end{equation}

The first order condition for \(q_{11}\) is the same as in the one-shot Cournot game. The first order condition for \(k_1\) is \(-s'(k_1) + t = -s \cdot k_1 + t = 0\), which means that the foreign firms stores up to the point where the marginal savings \((t)\) is just equal to the marginal cost of storage. As a result, the optimal \(q_{11}\) given \(q_{21}\) is the same as in the one-shot Cournot game and the optimal storage \(k_1 = t / s\). With the tariff triggered, production cost changes from \(c_1\) to \(c_1 + t\) in period 2 and quadratic storage cost assures optimal \(k\) is strictly positive. We also see that as the tariff increases or as the cost of storage declines, the optimal level of storage increases. If the tariff is
not triggered, there is no incentive of firm 1 to pay to store commodities for period 2 consumption. Thus, if firm 1 decided to let the SSM bind the Cournot outcome in the first period, no product will be stored.

To highlight the role of storage, Table 1 compares the outcomes from Model 2A (Case 3 and Case 1) in relation to the outcomes in model 2B. In the binding case with the tariff not triggered, the ability to store does not change the outcome. We note that in the upper half of Table 1, all the Model 2B outcomes are the same as in Model 2A. In the non-binding case (tariff triggered), the foreign firm stores a strictly positive amount in period 1. Imports in period 1 increase from \( q_{1c} \) to \( q_{1c} + t/s \). For small enough levels of storage, the equilibrium outcome is not affected by the storage component. Given that stored imports from period 1 incurred a sunk cost of storage, the marginal costs of the stored goods first goods sold in period 2 is effect only through the tariff that was avoided on stored product. However, by assumption, the marginal effect of the tariff return to the problem after stored (and committed) imports are sold in period 2. The equilibrium condition still recognizes the added marginal cost that the importer pays on the product imported in period 2, which leads to a reduction in market share for the foreign firm and an increase in market share for the domestic firm.

**Model 2C: Domestic Firm Able to Import**

In this section of the paper, we step back to Base Model 2A and then extend it to allow the domestic firm to import product from an arbitrary and higher priced third party supplier. The extension gives us the opportunity to evaluate the home firm’s ability to either trigger the tariff or provide a credible threat to do so. We assume the domestic firm has the option to import quantity \( q_{3t} \) in period \( t=1 \) with an associated marginal cost given by \( c_3 \). It is assumed that \( c_2 < c_3 \): domestic production is cheaper than the domestic firm’s ability to import. We also relax the
restriction $\bar{q} < (a - 2c_1 + c_2)/3b = q_{1c}$, which was imposed on model 2A to exclude the trivial case of choosing $q_{1c}$ in period 1 without triggering the tariff. All other structural components remain the same as model 2A. The period 2 equilibriums with and without the tariff triggered are the same as in model 2A. When the tariff is triggered, firm 2 enjoys a marginal cost advantage over firm 1 in period 2 leading to increased market share and higher profit relative to the base Cournot outcome (see Table 1).

In the first period, firm 2 has to decide whether or not to import enough quantity to trigger the tariff leading to the superior period 2 results. Therefore, we now develop and analyze firm 2’s period 1 best response function. Aggregate imports in the 1st period is $q_{11} + q_{31}$. When $q_{11} + q_{31} > (\leq) \bar{q}$, the tariff is (not) triggered. When $q_{11} \leq \bar{q}$, firm 2 has two choices:

(c''-1) choose the one-period optimum and not trigger the tariff (i.e. $q_{31} = 0$)

(c''-2) trigger the tariff with sufficient imports.

If firm 2 chooses (c''-2) and triggers the tariff, they do so with the smallest $q_{31}$ possible because imports cost more than production. We now introduce a term ($\delta$) to represent the discrete nature of import quantities. The term $\delta$ represents the minimum shipment the domestic firm can import. The term $q_{31}$ therefore must take the form $q_{31} = z_{31}\delta$ where $z_{31}$ is nonnegative integer.

Minimizing $z_{31}\delta$, subject to $z_{31}\delta > (\bar{q} - q_{11})$, implies that we minimize $z_{31}$ subject to $z_{31} > (\bar{q} - q_{11})/\delta$. The term $z_{31} = \lceil(\bar{q} - q_{11})/\delta \rceil$ where $\lceil \cdot \rceil$ is the smallest integer not smaller than $(\bar{q} - q_{11})/\delta$. The optimal $q_{31}$ when firm 2 intends to trigger the tariff becomes $q_{31} = z_{31}\delta$.

The objective of firm 2 in region (c''-2) is: $\max_{q_{21},q_{31}} (a - b(q_{11} + q_{21} + q_{31}))(q_{21} + q_{31}) - c_2q_{21} - c_3q_{31}$. 


Substituting $q_{31} = \frac{\bar{q} - q_{11}}{\delta}$ and solving for $q_{21}$, we obtain

$$q_{21}(q_{11}) = \frac{a - c_2 - bq_{11}}{2b} - \frac{\bar{q} - q_{11}}{\delta}.$$ 

We can now specify (c''-1) and (c''-2) as follows.

(20)  \( q_{21}(q_{11}) = \frac{a - c_2 - bq_{11}}{2b} \) and $q_{31} = 0$, tariff is not imposed.

(21)  \( q_{21}(q_{11}) = \frac{a - c_2 - bq_{11}}{2b} - \frac{\bar{q} - q_{11}}{\delta} \), tariff is imposed.

In (c''-2), $q_{21}(q_{11}) + q_{31}(q_{11})$ is equal to the one-period optimum $(a - c_2 - bq_{11})/2b$ given $q_{11}$.

While firm 1 in both (c''-1) and (c''-2) supply the one-period optimum, a sufficient level of imports to trigger the tariff in (c''-2) means that domestic production may actually decline in the presence of the SSM. Calculating the total payoffs in (c''-1) and (c''-2),

(22) $[\pi_{21} + \pi_{22}]_{(c''-1)} = \frac{(a - c_2 - bq_{11})^2}{4b} + \frac{(a + c_1 - 2c_2)^2}{9b}$

(23) $[\pi_{21} + \pi_{22}]_{(c''-2)} = (a - b(q_{11} + q_{21}(q_{11}) + q_{31}(q_{11}))(q_{21}(q_{11}) + q_{31}(q_{11}))$

$$-c_2q_{21}(q_{11}) - c_2q_{31}(q_{11}) + \frac{(a + c_1 + t - 2c_2)^2}{9b}$$

Let $\tilde{q}_{11}$ be the solution to (22) = (23) and solving by treating all the variables continuous, we obtain:

(24) $\tilde{q}_{11} = \bar{q} + \delta - \frac{M(t)}{9b(c_3 - c_2)}$, where $M(t) = (a + c_1 + t - 2c_2)^2 - (a + c_1 - 2c_2)^2$.

By equation 24, we can say

$q_{11} \leq \tilde{q}_{11} \Leftrightarrow [\pi_{21} + \pi_{22}]_{(c''-2)} \leq [\pi_{21} + \pi_{22}]_{(c''-1)} \Leftrightarrow \text{firm 2 chooses (22)(c''-1)}$

$\tilde{q}_{11} \leq q_{11} \Leftrightarrow [\pi_{21} + \pi_{22}]_{(c''-1)} \leq [\pi_{21} + \pi_{22}]_{(c''-2)} \Leftrightarrow \text{firm 2 chooses (23)(c''-2)}$

$\tilde{q}_{11}$ is the break point that divides the region (c'') in the diagram 3 into (c''-1) and (c''-2).
The best responses discussed so far, corresponding to each region in diagram 3, are collected below.

\[ q_{21}(q_{11}) = \frac{a - c_2 - bq_{11}}{2b} \text{ and } q_{31} = 0 \]

\[ (25) \]

\[ q_{21}(q_{11}) = \frac{a - c_2 - bq_{11} - q_{31}}{2b} \]

\[ q_{31}(q_{11}) = \frac{\bar{q} - q_{11}}{\bar{q} - q_{11}}/\delta, \]

\[ (26) \]

\[ \delta \text{ is assumed to be small so that } \bar{q}_{11} < \bar{q} \text{ holds. We see in (24) that } \bar{q}_{11} \text{ is decreasing in } t \text{ and increasing in } c_3. \text{ Therefore, as } t \text{ increases, triggering the tariff hurts firm 1 more, which causes the tariff triggering region (c'') to widen, which means a decrease in } \bar{q}_{11}. \text{ As } c_3 \text{ (marginal costs of imports) increases, triggering the tariff is more costly for firm 2, thus tariff triggering region (c''-2) shrinks, which means an increase in } \bar{q}_{11}. \]

We now solve the equilibrium outcomes by considering the reaction of firm 1 (foreign). The foreign firm’s best response is either to choose the one-period optimum given the domestic firm’s total supply is \( q_{21} + q_{31} \)

\[ (27) q_{11} = \frac{a - c_1 - b(q_{21} + q_{31})}{2b} \]
or to choose

\[ q_{11} = \bar{q} - q_{31} \]  to avoid tariff

Equations (25) and (26) represent the two possible best responses for firm 1 in period 1, and equations (27) and (28) are the counterpart best responses for firm 2. Thus, we need to analyze each combination of these best responses in each region of diagram 3 to determine all possible equilibrium outcomes. Each of the four possible equilibriums are labeled I-IV:

I  equations 25 and 27:  \[ q_{11} = (a - c_1 - b(q_{21} + q_{31}))/2b \] and \[ q_{31} = 0 \]

\[ q_{21} + q_{31} = (a - c_2 - bq_{11})/2b \] : tariff is triggered,

II  equations 25 and 28:  \[ q_{11} = \bar{q} - q_{31} \] and \[ q_{31} = 0 \]

\[ q_{21} + q_{31} = (a - c_2 - bq_{11})/2b \] : tariff is not triggered,

III  equations 26 and 27:  \[ q_{11} = (a - c_1 - b(q_{21} + q_{31}))/2b \] and \[ q_{31} > 0 \]

\[ q_{21} + q_{31} = (a - c_2 - bq_{11})/2b \] : tariff is triggered,

IV  equations 26 and 28:  \[ q_{11} = \bar{q} - q_{31} \] and \[ q_{31} > 0 \]

\[ q_{21} + q_{31} = (a - c_2 - bq_{11})/2b \] : tariff is not triggered,

It is easy to show IV is not a possible equilibrium. When \( q_{11} + q_{31} < \bar{q} \), the tariff is not triggered and firm 2 will always prefer II over IV: domestic production is cheaper than imports. When \( q_{1c} \) is region (b’’) of diagram 3, a trivial solution emerges: both firms choose the one-period optimum without firm 2 committing to any imports. Therefore the equilibrium outcome is I (combination of equations (25) and (27): \( q_{11} = q_{1c} \), \( q_{21} = q_{2c} \) and \( q_{31} = 0 \) and the tariff is triggered).

This outcome here is similar to the outcome show in figure 4, panel C when the trigger point is set so low that each firm loses any strategic edge and simply chooses the one period optimum.
When \( q_{1c} \leq \tilde{q}_{11} \) (i.e. region (c’’-1) of diagram 3), the equilibrium outcome is also (I). This is also a trivial condition because the one period optimum does not trigger the tariff. Note that (II) reduces to (I): in region (c’’-1), firm 2 chooses not to import and \( q_{1c} \leq \tilde{q} \). Thus, there is no reason to choose \( q_{11} = \tilde{q} - q_{31} = \tilde{q} \). Note also that (III) is excluded. (III) implies \( q_{11} = q_{1c} \) and \( q_{21} + q_{31} = q_{2c} \). However, firm 2 deviates from (III) to (I) because imports do not trigger the tariff.

When in region (c’’-2) \( \tilde{q}_{11} < q_{1c} \leq \tilde{q} \), there is either no equilibrium or (III) is the only equilibrium outcome. (I) and (II) are excluded. (I) implies \( q_{11} = q_{1c} \) and \( q_{21} = q_{2c} \). However, in region (c’-2), firm 2 prefers triggering the tariff and deviates from (I) to (II). (II) implies \( q_{11} = \tilde{q} \), which falls on region (c’’-2). Then firm 2 deviates from (II) to (IV) to trigger the tariff with its own imports. As discussed above, this leaves firm 1 to choose (III) over (IV).

One key finding from this model is that the presence of an import opportunity by the domestic firm expands the range of situations when the tariff will be triggered. We see this in region (b’’) in diagram 3. Although imports by the domestic firm is zero, it plays the role of breaking the binding equilibrium in model 2A. This is because the possibility of triggering tariff by domestic firm annihilates the incentive of foreign firm to attempt avoiding the tariff by choosing \( q_{11} = \tilde{q} \). In regions (c’’-1) and (c’’-2), we can observe the switching from triggering or not triggering the tariff as function of the position of \( \tilde{q}_{11} \). In these regions, there is an incentive for firm 2 to trigger tariff by its import, but this incentive is low when the tariff rate \( t \) is low or when their cost of imports \( c_j \) is high. Inspection of equation (24) shows that \( q_{11} \) is decreasing in \( t \) and increasing in \( c_j \). Thus low \( t \) and high \( c_j \) implies high \( \tilde{q}_{11} \), corresponding to (c’’-1) and high \( t \) and low \( c_j \) implies low \( \tilde{q}_{11} \), corresponding to (c’’-2).

**Summary of Findings**
In this paper, we constructed several two-period quantity setting duopoly models to analyze the implications of SSM\((t, \bar{q})\) tariffs \((t)\) charged to imports in the second period when imports in the first period go beyond a trigger level \((\bar{q})\). The first model (model 1) is constructed with two exporting firms selling into a nation without a domestic industry. In the second model (model 2A), a single exporting firm sells into the domestic nation and competes with a single domestic firm. The third model (model 2B) adds a storage component to the second model. The fourth model (model 2c) considers a structure like the second model, but allows the domestic firm to import from a third party. The equilibrium outcomes have two distinct patterns. One is the case in which \(\bar{q}\) binds import levels and the tariff is not imposed. The other is the case in which \(\bar{q}\) is not binding and tariff is imposed. The SSM tends to bind first period imports when the tariff is small and/or the trigger is high. In these situations, exporters observe that they can avoid a large and costly tariff by making small sacrifices in the first period. The tariff tends to be triggered when it is small and/or the trigger level is low.

Each model provided additional and unique insights. From model 1, when the tariff is avoided, prices rise in the first period and rents increase to the foreign firm. Thus, the model highlights the importance of imperfect competition and shows that the policy gives foreign firms a potential facilitating practice to increase their market power. In model 2A, the domestic firm is not able to induce the foreign firm toward triggering the tariff, but benefits from the presence of the SSM whether or not the tariff is triggered. The foreign firm cannot gain from the presence of the SSM. If the tariff binds the Cournot equilibrium in the first period, the foreign firm has given up first period sales to avoid the tariff. This shifts rent to the domestic firm due to higher sales and higher price. If the tariff is triggered, home first obtains a marginal cost advantage in period 2 leading to increased market share and increase profit in period 2. In model 2B, the foreign firm
can mitigate part of the lost rent they face by importing and storing in the first period some of the product they sell in period 2. This tends to increase the use of the SSM. Storage options that are inexpensive and that do not lead to product decay can change the behavior of firms. Additionally, if the conditions for storage favor its use, we are likely to observe a market with increased erratic imports with spikes potentially observable in the period the tariff is triggered.

Model 2C provides added flexibility for the home firm but complicates greatly the nature of the game and its equilibriums. We see that there is an equilibrium outcome in which the domestic firm imports to trigger the tariff even when imports are more costly than domestic production. In this model, domestic firm has greater control over the SSM. The tariff benefits the domestic firm because tariff pushes down supply by foreign firm in period two. Several other key findings were uncovered by this model. First, the domestic firm will never import without triggering the tariff. Second, adding domestic import flexibility (a practical addition in most trade settings) breaks down partially the strategic nature of the game. In fact, because the domestic firm can now more easily trigger the tariff, the foreign firm has less incentive to behave strategically. It simply chooses one-shot Cournot in most cases. Third, when the home firm imports as an optimal strategy, this reduces the demand for domestic production.

There are several general findings that emerge from all of our models. First, moving the tariff and trigger levels as part of some sort of overreaching strategic policy tool can be a difficult venture fraught with surprises and potentially numerous unintended consequences. Thus, it does not seem likely governments will get into this game. Second, governments may have difficulty managing SSMs. Whole industries can potentially benefit when the presence of the safeguard binds initial period imports, but these benefits may not be readily observable: (i.e. it is hard to observe excessive imports that did not materialize). Firms may complain that the
policy is ineffective and demand for greater restrictions, leading to excessive triggering of SSMs. Most agricultural commodities traded internationally have some degree of storability. Thus, storage patterns are likely to be more volatile as a result of the SSM, which could be detrimental to fragile rural economies.

There are several directions in which studies should be developed to further evaluate SSMs. First, the whipsaw effects that storage brings into the global agricultural market should be given first and strongest considerations. Though our models are duopoly in structure, it appears that our storage outcomes would generalize to most any other market structure including perfect competition. Ironically, WTO tariffication of quotas was partially justified by the destabilizing effects that quotas bring to world markets (i.e. the common notion that quotas export price risk to the world markets). It seems that SSMs have the potential to move agricultural markets back toward such undesirable outcomes, but for significantly different reasons. How destabilizing safeguards can be is certainly an important empirical question. Second, if we combined storage with the ability of the domestic firms to import, it is not clear that safeguards could be avoided very often. From our modeling exercises, it is not surprising that Hallaert (2005) found common and continuous use of special safeguards. If they are constantly being triggered, they are not in any way achieving a real policy objective of temporary protection to fragile domestic industry. They would be better classified as noisy, destabilizing, second best policy artifact derived from a political process. Third, it would be useful to incorporate uncertainty in our models. If the production level and imports in the first period can be assumed to be stochastic, the effects of safeguards also becomes uncertain, and the policy maker job even tougher.
Table 1: Comparison of Models 2A, 2B, and 2C

<table>
<thead>
<tr>
<th>Firm 1 (Foreign)</th>
<th>Period 1, no tariff</th>
<th>Period 2, no tariff</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Figure 4A)</td>
<td></td>
</tr>
<tr>
<td><strong>Firm 1 Sales</strong></td>
<td>$q_{ij}$</td>
<td>$q_{1c}$</td>
</tr>
<tr>
<td>Sales ($q_{ij}$)</td>
<td>Same</td>
<td>Same</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Storage (k)</strong></td>
<td>$n/a$</td>
<td>$n/a$</td>
</tr>
<tr>
<td>Storage ($k$)</td>
<td>0</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Imports</strong></td>
<td>$\bar{q}$</td>
<td>$q_{1c}$</td>
</tr>
<tr>
<td>Imports</td>
<td>Same</td>
<td>Same</td>
</tr>
<tr>
<td>$(a - c_2 - b\bar{q})$</td>
<td>$\frac{2b}{2}$</td>
<td></td>
</tr>
<tr>
<td>Firm 2 Sales</td>
<td>Same</td>
<td>Same</td>
</tr>
</tbody>
</table>

| Firm 2 Sales     | $\frac{a - c_2 - b\bar{q}}{2b}$ | $q_{2c}$ | Same |
| Period 1, tariff triggered | (Figure 4C) | |
| Sales ($q_{ij}$) | $q_{1c}$ | Same |
| Storage ($k$)    | $n/a$ | n/a |
| Imports          | $q_{1c}$ | $q_{1c} - \frac{2t}{3b}$ |
| Firm 2 Sales     | $q_{2c}$ | Same |

| Firm 2 Sales     | $\frac{a - c_2 - b\bar{q}}{2b}$ | $q_{2c} + \frac{t}{3b}$ | Same|
| Period 2, tariff triggered | | | |
| Sales ($q_{ij}$) | $q_{1c}$ | Same |
| Storage ($k$)    | $n/a$ | n/a |
| Imports          | $q_{1c} - \frac{2t}{3b}$ | $q_{1c} - t/s - \frac{2t}{3b}$ |
| Firm 2 Sales     | $q_{2c} + \frac{t}{3b}$ | Same |

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Figure 1. Relative Position of the Cournot Equilibrium.
Figure 2: Equilibrium conditions.
Figure 3

Case 1
(Non-binding $\bar{q}$, tariff)

Case 2
(Non-binding $\bar{q}$, tariff),
(Binding $\bar{q}$, no tariff)

Case 3
(Binding $\bar{q}$, no tariff)

$q_c + q_c = \frac{2}{3} \frac{a - c}{b}$

$q_m = \frac{1}{2} \frac{a - c}{b}$

$\frac{1}{3} \frac{a - c}{b}$

$\frac{2}{9} \frac{a - c}{b}$

$\bar{q}$

O

B

A

G

C

F

D

E

$0$

$t$

$a - c$
Figure 4.

Panel A

Panel B

Panel C
Figure 5

Case 1
(Binding $\overline{q}$, no tariff)

Case 2
(Non-binding $\overline{q}$, tariff)
(Binding $\overline{q}$, no tariff)

Case 3
(Non-binding $\overline{q}$, tariff)
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