Incentives of small countries to participate in a global free trade agreement in agriculture: a theoretical analysis

Daniel E. May
Harper Adams University College, Department of Rural Affairs/Environment. Newport, Shropshire, TF10 8NB, United Kingdom.
Correspondence author: dmay@harper-adams.ac.uk

Abstract

D. May. 2011. Incentives of small countries to participate in a global free trade agreement in agriculture: a theoretical analysis. During the last two decades a number of international rounds have been carried out with the objective of reaching a global free trade agreement in agriculture (GFTA). However, little progress has been made. A recent theoretical research based on the new literature on international trade networks revealed that the existing lack of agricultural liberalisation could equate to a structural problem under the assumption of identical countries in market size. The present article extends this new research to study in particular the incentives of small countries such as Chile to deviate from GFTA (i.e. when countries are asymmetric in market size).

Key words: International Trade Networks, Agricultural Trade Liberalization, Compensatory Payments.

INTRODUCCION

It has formally been recognised that multilateral negotiations in agriculture have made little progress (Devadoss, 2006; and Conforti and Salvatici, 2004). Researchers have used two complementary arguments to explain this lack of agricultural liberalisation. Firstly, it is argued that developing countries are unwilling to form a global free trade agreement in agriculture (GFTA) with developed countries because the levels of domestic support in the latter are high. Some researchers support this hypothesis by arguing that domestic policies can be used to offset market concessions resulting from international agreements, and this fact is what disincentives developing countries to participate in trade agreements (Khor, 2003). Secondly, it has been argued that policy-makers in developed countries are unwilling to remove domestic supports because they set policies under the influence of pressure groups (Conforti and Salvatici, 2004; Gardner, 1987; and Becker, 1983). According to these arguments, therefore, a successful GFTA is conditional upon the existence of domestic supports used by developed countries.

Recently, May and Worrall (2010) challenged these arguments as the main reason explaining lack of agricultural liberalisation. The authors extended the international trade network model developed by Goyal and Joshi (2006) and proved that even in an ideal world characterised by countries without domestic policies, a GFTA could not be reached. They found this result under the following conditions: (i) international markets of agricultural commodities are oligopolistic; and (ii) governments are biased in favour of their domestic firms. According to May and Worrall, when both conditions hold, GFTA is not a stable because countries have always
an incentive to deviate from GFTA by cutting several agreements simultaneously. The reason is because biased policymakers can favour agricultural firms by breaking existing agreements as this increases market power in the domestic market. This alternative explanation for the existing lack of agricultural liberalisation is realistic as evidence of the existence of oligopolistic international markets of agricultural commodities has been found (see, for instance, Reimer and Stiegert, 2006; Lloyd et al., 2006; McCorriston, 2002; and Boehlje and Doreing, 2000). Empirical evidence has also revealed that policy makers in some countries place policies under the influence of pressure groups (see, for example, Devadoss, 2006; Conforti and Salvatici, 2004).

On the other hand, May (2011) found that bilateral agreements rather global agreements can be used as alternative tools to reach GFTA. According this author, bilateral agreements can be stimulated by means of lump sum transfers (i.e. compensatory payments) financed by consumers and given to domestic firms. This offers an alternative mechanism to reach GFTA in a world where agricultural liberalisation seems to be unreachable.

The results of May and Worrall (2010) and May (2011) considered a world composed of symmetric and identical countries (i.e. countries having the same market size with domestic firms facing the same marginal cost). What is not clear, however, is whether these results hold in a more realistic world formed of asymmetric countries. In particular, could the policy recommendations made by these authors be applied in small countries such as Chile? The objective of this paper is to answer this question by adopting the theoretical approach developed by (May, 2011; May and Worrall, 2010; and Goyal and Joshi, 2006).

**MATERIALS AND METHODS**

Given the theoretical nature of the present work, the method adopted to analyse the incentives of small countries to deviate from GFTA was based on the theoretical contribution of Goyal and Joshi (2006). These authors developed a network model in which each country was represented as a node into the network framework, and bilateral agreements among countries were represented as links. In this model, it was assumed that countries sign bilateral agreements of break existing ones with the objective of increasing domestic welfare defined as consumer surplus plus total profits made by domestic firms. The network model is formally presented as follows:

**a) The basic international social trade network model (Goyal and Joshi, 2006)**

In the international trade network model an international agreement between countries \(i\) and \(j\) is described by a link, given by a binary variable \(g_{ij} \in \{0,1\}\). If \(g_{ij} = 0\), then no agreement exist between countries \(i\) and \(j\). If \(g_{ij} = 1\), then an agreement exists between them. A network \(g \in \{(g_{ij})_{i,j \in N}\}\) is a description of the international agreements that exist between the countries in \(N\), where \(N = \{1, 2, \ldots, N\}\) is the set of identical countries, and \(N\) is the total number of countries. Network \(g^c \) is the complete network \((g_{ij} = 1 \ \forall i,j \in N)\) and corresponds to global free trade, and Network \(g^e \) is the empty network \((g_{ij} = 0 \ \forall i,j \in N)\) and corresponds to the network in which all countries are in autarky. Let \(G\) denote the set of all possible networks of international agreements between countries. Let \(N_i(g) = \{j \in N : g_{ij} = 1\}\) be the set of countries with whom country \(i\) has an international trade agreement in network \(g\). Assume that \(i \in N_i(g)\). That is, \(g_{ii} = 1\). The cardinality of \(N_i(g)\) is denoted by \(\eta_i(g)\).

In this model \(\eta_i(g)\) is also the number of active
firms in country $i$ and in network $g$ because of the assumption that each country has only one firm. Let $L_i(g) = \{(g_{ji})_{j \in N} : j \in N_i(g)\}$ be the set of links existing in country $i$ in network $g$. Note that $g_{ii} \in L_i(g)$. Let $h_i \in L_i(g) - \{g_{ii}\}$ be a link subset, and let $\mu_i$ be the cardinality of $h_i$. Finally, let $W_i(g)$, $CS_i(g)$ and $\pi_i(g)$ be welfare, consumer surplus, and total profit, respectively, in country $i$ and in network $g$. In this model governments sign new agreements or break existing ones with the objective of maximising the following welfare function:

\begin{equation}
W_i(g) = a_i CS_i(g) + b_i \pi_i(g)
\end{equation}

where $a_i$ and $b_i$ are exogenous weights that the government puts on consumer surplus and total profits, respectively.

**b) Market structure**

In order to simplify the analysis without losing generality, it was assumed that each country has a single domestic firm that produces the unique agricultural good of the world. This good can be sold in the domestic market or can be exported. In this framework tariffs are placed exogenously. That is, if two countries do not have an agreement, then they establish a prohibitive tariff preventing any level of trade between them. If these countries form an agreement, then they offer full access to their domestic markets (i.e. tariffs between these countries are removed). Domestic firms of different countries play Cournot competition in each market where they compete. Formally, let $P_i - Q_i$ be the inverse demand of the unique good in country $i \in N$, where $P_i$ is the price of this good in the domestic market in country $i$, $\alpha_i$ represents the size of this market, and $Q_i$ is the total output demanded in this country. Let $\gamma_i < \alpha_i$ be the marginal cost of the firm in country $i$. Because the objective of this article is to study the incentives of small countries to sign bilateral agreements when they have different market size, but not different levels of productive efficiency, it was assumed that $\gamma_i = g$ for all $i \in N$. In addition, it was assumed that country $i$ (i.e. the small country) has a small domestic market. That is, $\alpha_j = \alpha$ for all $j \in N - \{i\}$, and $\alpha_j < \alpha$.

The equilibrium output of the firm in country $i$ in the domestic market is $Q_i = (\alpha_i - \gamma_i)/\eta_i(g) + 1$ and the total output of equilibrium in this market is $Q_i(g) = (\alpha_i - \gamma_i)/\eta_i(g) + 1$. Likewise, the equilibrium output of the firm in country $i$ that is sold in country $k$ is $Q_k(g) = (\alpha_i - \gamma_i)/\eta_k(g) + 1)$. Consumer surplus in country $i$ (i.e. $CS_i(g)$), profit of the firm in country $i$ in the domestic market (i.e. $\pi_i(g)$), and profit of the same firm in country $k$ (i.e. $\pi_k(g)$) are given by $Q_i(g)^2/2$, $(P_i - \gamma_i)Q_i(g)$, and $(P_i - \gamma_i)Q_k(g)$. By replacing the equilibrium quantities and the inverse demand into these expressions, the following equations are obtained:

\begin{align}
(2) \quad CS_i(g) &= (\alpha_i - \gamma_i)^2\eta_i^2(g)/2(\eta_i(g) + 1)^2 = (\alpha_i - \gamma_i)^2 CS_i(g) \\
(3) \quad \pi_i(g) &= (\alpha_i - \gamma_i)^2/\eta_i(g) + 1)^2 = (\alpha_i - \gamma_i)^2 \pi_i(g) \\
(4) \quad \pi_k(g) &= (\alpha_i - \gamma_i)^2/\eta_k(g) + 1)^2 = (\alpha_i - \gamma_i)^2 \pi_k(g)
\end{align}

Finally, the total profit of the firm in country $i$ in network $g$ is $\pi_i(g) = \sum_{k \in N_i(g)} \pi_k(g)$. From these expressions the welfare function defined in (1) becomes:

\begin{align}
W_i(g) &= a_i (\alpha_i - \gamma_i)^2 CS_i(g) + b_i \sum_{k \in N_i(g)} (\alpha_k - \gamma_k)^2 \pi_k(g) \\
&= a_i \frac{1}{2} (\alpha_i - \gamma_i)^2 \eta_i^2(g) + b_i \sum_{k \in N_i(g)} (\alpha_k - \gamma_k)^2 (\eta_k(g) + 1)^2.
\end{align}

**c) Stability**

*Strongly pairwise stability* was adopted to determine the stability of the international trade network (May, 2008). This stability concept is
defined as follows: (a) the marginal benefit of country $i$ when deleting at the same time $h_i$ \( L_i(g) - \{g_{i}^h\} \) international agreements is: \( D_i(g, h) = W_i(g) - W_i(g - h) \); (b) a network $g \in G$ is strong link deletion proof if for every player $i \in N$ and every $h_i \mid L_i(g) - \{g_{i}^h\}$ it holds that $D_i(g, h) > 0$; and (c) a network $g \in G$ is link addition proof if for all $i,j \in N$: $W_i(g + g_j) > W_i(g)$ implies that $W_i(g + g_j) < W_i(g)$. A network $g \in G$ is strongly pairwise stable if $g$ is strong link deletion proof as well as link addition proof.

RESULTS

Before studying whether small countries have an incentive to deviate from GFTA, it is important to show the results obtained by May and Worrall (2010) and May (2008) for the case of identical countries. This information will be used as a benchmark to determine whether these results are robust under the presence of a small country. According to these authors, there are three effects arising when countries break one or more international agreements. One of them is the consumer surplus effect denoted here as $CS_i(g) - CS_i(g - h)$. The authors showed that consumer surplus always decreases as countries break existing international agreements. This is because a decrease in the number of agreements in a country increases market power in its domestic market. As a consequence, domestic price increases negatively affecting consumer surplus. This is why in this model consumers always support additional agreements. That is, it always holds that $CSE_i(g) > CSE_i(g - h)$ for all $i \in N$, $g \in G$, and for all $h_i \mid L_i(g) - \{g_{i}^h\}$. On the other hand, the competition effect, denoted here as $\pi_{i}^{g}(g) - \pi_{i}^{g}(g - h_i)$, refers to the change in domestic profits that a firm makes in the domestic market when the country breaks one of more existing international agreements.

It can be shown that $\pi_{i}^{g}(g) < \pi_{i}^{g}(g - h_i)$ for all $i \in N$, $g \in G$, and for all $h_i \mid L_i(g) - \{g_{i}^h\}$ (see May and Worrall 2010). The reason is because the decrease in the number of agreements in a country increases market power in its domestic market. As a result, the domestic firm increases the profit that it makes in this market after these agreements are broken. Finally, the last effect identified by May and Worrall (2010) is the expansion effect denoted here as $\pi_{i}^{g}(g) - \pi_{i}^{g}(g - h_i)$. This effect corresponds to the loss of profits that domestic firms make in external markets when a country breaks one or more international agreements. Because this effect represents a loss of external profits, it holds that $\pi_{i}^{g}(g) > \pi_{i}^{g}(g - h_i)$. In summary, the three effects arising when a country breaks $h_i$ existing links are:

(i) Consumer surplus effect: \(CS_i(g) - CS_i(g - h) > 0\)

(ii) Competition effect: \(\pi_{i}^{g}(g) - \pi_{i}^{g}(g - h_i) < 0\)

(iii) Expansion effect: \(\pi_{i}^{g}(g) - \pi_{i}^{g}(g - h_i) > 0\)

Note that the consumer effect and the expansion effect both favour the formation of international agreements. In contrast, the competition effect plays against these agreements. Considering these effects, May (2008) found that when countries are identical and politically unbiased (i.e. $a_i = b_i$ in Equation 5), the competition effect is dominated by the consumer surplus and the expansion effect. As a consequence, countries have an incentive to trade. This is why in this case GFTA is stable. The same happens when governments are biased in favour of consumers (i.e. $a_i = 1$ and $b_i = 0$ in Equation 5). This is because in this case the consumer surplus effect is the only relevant effect affecting the welfare function. Finally, when countries are biased in favour of domestic firms (i.e. $a_i = 0$ and $b_i = 1$ in Equation 5), GFTA is not stable. This is because the expansion effect is dominated by the competition effect. Therefore, when governments are biased in favour of their domestic firms, they have an incentive to deviate from GFTA with the objective of favouring their domestic firms.
May. Incentives of small countries...

The effects described above were used to determine whether a small country has an incentive to deviate from GFTA. For this purpose, it was considered the change of welfare (i.e. marginal welfare) that is verified when the small country deviates from $g_c$ (i.e. from GFTA) by breaking the subset of links $h_i \subset L(g_c) - \{g_{ii}\}$. The change in welfare is shown in the following expression:

$$W_i(g_c) - W_i(g_c - h_i) = a_i(\alpha_i - \gamma)\left[\frac{CS_i(g_c)}{CS_i(g_c - h_i)}\right]$$

$$+ b_i(\alpha_i - \gamma)^2\left[\frac{\pi_i(g_c)}{\pi_i(g_c - h_i)}\right]$$

$$+ b_i(\alpha_i - \gamma)^2\left[\frac{\pi_i(g_c)}{\pi_i(g_c - h_i)}\right]$$

(6)

The right side of this equation shows that the change in welfare is explained by three components: (i) $a_i(\alpha_i - \gamma)\left[\frac{CS_i(g_c)}{CS_i(g_c - h_i)}\right]$ which corresponds to the consumer surplus effect; (ii) $b_i(\alpha_i - \gamma)^2\left[\frac{\pi_i(g_c)}{\pi_i(g_c - h_i)}\right]$ which represents the competition effect; and (iii) $b_i(\alpha_i - \gamma)^2\left[\frac{\pi_i(g_c)}{\pi_i(g_c - h_i)}\right]$ which represents the expansion effect.

**Proposition 1.** If the domestic market of a country is small enough, then this country does not have an incentive to deviate from GFTA.

**Proof.** From Expression 6, $\lim_{\alpha_i \to g} W_i(g_c) - W_i(g_c - h_i) = b_i(\alpha_i - \gamma)^2\frac{\pi_i(g_c)}{\pi_i(g_c - h_i)}$ when $\alpha_i$ is small enough (i.e. when $\alpha_i \to g$), the most relevant component of the marginal change in welfare is the marginal change in profits that the domestic firm in country $i$ makes in the rest of the world, $\pi_i(g_c) - \pi_i(g_c - h_i)$ (i.e. the expansion effect). Because $\alpha_i > \gamma$ (this assumption was introduced to avoid having a negative output in equilibrium), it is concluded that $\lim_{\alpha_i \to g} W_i(g_c) - W_i(g_c - h_i) > 0$ when $\frac{\pi_i(g_c)}{\pi_i(g_c - h_i)} > \frac{\pi_i(g_c)}{\pi_i(g_c - h_i)}$. Now, because $\pi_i(g_c) = (N - 1)/(N + 1)^2$ and $\pi_i(g_c - h_i) = (N(g_c - 1))/(N + 1)^2$, it is concluded that $\lim_{\alpha_i \to g} W_i(g_c) - W_i(g_c - h_i) > 0$ for all $N > \eta(g)$.

This result shows that when the market size of a country is small enough, the consumer surplus effect and the competition effect both become irrelevant. What really defines the incentives of the authorities of this country is the expansion effect which always favours the formation of international agreements. This is why this country does not have an incentive to deviate from GFTA.

**DISCUSSION AND CONCLUSIONS**

The result obtained in Proposition 1 has important implications. Firstly, it can be inferred from this result that independently of any bias of the government (any value of $a_i$ and $b_i$), the small country will never deviate from GFTA. As a consequence, the results obtained by May and Worrall (2010) and May (2008) do not hold in this case. In other words, the existence of small countries in the trade network system favours agricultural trade liberalisation. Secondly, the result obtained in Proposition 1 implies that the use of compensatory payments is not needed to sustain GFTA in the case of small countries. This is an interesting result because when countries are identical and when governments are biased in favour of domestic firms, GFTA can only be reached and sustained when governments use lump sum transfers to compensate domestic firms for trade losses (May, 2011).

It is important to clarify, however, that this result does not mean that GFTA is stable when the world is formed by heterogeneous countries including small countries. To see that, note that when a country is large and when the government is biased in favour of domestic firms, the domestic market becomes the most relevant component in the welfare function. This can easily be inferred from Equation 6. If the government is biased in favour of the domestic firm (i.e. $a_i = 0$ and $b_i = 1$ in Equation 6), then the only effects that can affect governments’ deci-
sions about deviating from GFTA are the competition and the expansion effect. Therefore, if this country is large enough (i.e. if \( \alpha_i - g \) is large enough), then the expansion effect is dominated by the competition effect. As a consequence, the large country has an incentive to deviate from GFTA. This suggests that the efforts to stimulate agricultural trade liberalisation have to be focused mainly in large countries. It is in those countries where lump sum compensatory payments should be introduced as a strategy to change authorities’ incentives in favour of agricultural free trade.

Finally, it would be interesting to extend the present research to study countries’ incentives to form a GFTA when domestic firms face different marginal costs. In addition, empirical analyses could be adopted to determine whether the results obtained in this article are consistent with the behaviour of the authorities in small and large countries. These relevant extensions are left for future research.

RESUMEN

Un número significativo de rondas internacionales se han desarrollado en las últimas décadas con el objetivo de alcanzar un acuerdo comercial global en agricultura. Sin embargo, no se ha logrado la liberación comercial esperada. Investigaciones recientes en el área de las redes comerciales internacionales han revelado que la falta de liberación comercial agrícola se podría deber a problemas estructurales asociados a la arquitectura de la red comercial internacional y de la existencia de mercados internacionales agrícolas oligopólicos. En particular, se ha descubierto teóricamente que bajo estas condiciones países con gobiernos sesgados en favor de empresas agrícolas domésticas tienen incentivos de desviarse unilateralmente de un eventual acuerdo comercial global en agricultura. Sin embargo, estos resultados fueron obtenidos bajo el supuesto de que los países tienen mercados domésticos del mismo tamaño. El objetivo de este artículo es extender esta investigación con el fin de determinar si estos resultados son robustos cuando la red comercial internacional también incluye países pequeños como Chile. Los resultados del análisis teórico mostraron que países pequeños no tienen incentivos de desviarse de un eventual acuerdo global. Esto implica que los esfuerzos para lograr la liberación comercial agrícola deben concentrarse en países grandes ya que son ellos los que tienen mayores incentivos de desviarse de esta condición.

Palabras clave: Redes Comerciales Internacionales; Liberación Comercial de la Agricultura; Pagos Compensatorios.

REFERENCES