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IMPERFECT COMPETITION AND STRATEGIC TRADE POLICY IN THE FOOD INDUSTRIES

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ABSTRACT

The current GATT negotiations on farm policy are aimed at removing distortions in the international trade of agricultural products. However, a large proportion of the world's trade in food and agricultural products occurs in high-value processed food products where markets can often be described as having imperfectly competitive market structures, characterised by high seller concentration, economies of scale and product differentiation.

In this context, recent developments in the international economics literature have focussed on the impact of imperfect competition in international markets. In particular, a theoretical rationale has been given for the use of protectionist trade policies. Therefore, the overall aim of this paper is to explore the relevance of these theoretical developments to trade in highly processed food and related products.

The paper is outlined as follows: Section 1 presents an outline of the arguments for active trade policy where markets are imperfectly competitive. Section 2 considers the optimal policies for an exporting and importing country respectively. The results indicate that even though export subsidies and import tariffs may be justified, such policies may be inferior to alternative forms of trade intervention such as maximum export and import prices. The application of the theoretical results to the US brewing and processed cheese sectors is presented in Section 3, whilst Section 4 provides a summary and conclusion.

INTRODUCTION

A large proportion of the world's trade in food and agricultural products now occurs in high-value processed products. In the 1960s, bulk commodities and processed products accounted for roughly equal shares of agricultural trade, however, by the late 1980s the share of processed products had increased to 60 per cent of world trade whilst the share of bulk commodities had fallen to 20 per cent, the remainder being accounted for by intermediate products (FAO). Also, much of the trade in processed products now occurs where markets are less than perfect, involving state marketing boards, multinational firms and firms involved in food processing (see McCalla, 1981, Handy and MacDonald and Elleson for discussion).

In this context, it is relevant to consider recent developments in the international economics literature which have focussed on the impact of imperfect competition in international markets. In particular, a theoretical rationale has been given for the use of protectionist or what have been termed strategic trade policies. Whilst imperfect competition has been incorporated into agricultural trade analysis, strategic trade policy has largely been ignored, the principal exception to this being the recent work of Thursby and Krishna and Thursby who have focussed on markets where state marketing boards are important participants in agricultural trade. This paper extends such analysis to trade in high-value food products. This is important because, despite the current round of GATT negotiations aimed at removing trade distortions in agricultural products, recent debates on US trade policy have been characterised by demands for targeted US export subsidies designed to both counter the export restitutions offered to European exporters (see Choices) and to improve the export performance of the US food and agricultural sector.

Therefore, the overall aim of this paper is to explore the relevance of strategic trade policy to trade in highly processed food and related products. The paper is outlined as follows: Section 1 presents an outline of the arguments for active trade policy where markets are imperfectly competitive. Section 2 considers the optimal policies for an exporting and an importing country respectively. In contrast to much of the literature which focusses on the effects of subsidies, tariffs and quotas, a comparison is made between the welfare effects of price control policies on exports and imports and export subsidies and tariffs. The application of the theoretical results to the US brewing and processed cheese sectors is presented in Section 3, whilst Section 4 provides a summary and conclusion.

1. Trade Policy and Imperfect Competition

The standard justification for strategic trade policy is that of "rent-shifting" (see for example, Brander and Spencer, 1984, 1985, and Dixit, 1984). The basic idea is that a government can alter the nature of competition between firms for monopoly rents in imperfectly competitive markets. Hence, in a quantity-setting framework, it can be shown that export subsidies and tariffs can increase the welfare of exporters and importers respectively. Brander and Spencer (1985), who pioneered this argument, also show that in the absence of cooperation, both governments have an incentive to intervene, the structure of the policy game being similar to the Prisoner's dilemma.

Although imperfect competition in international trade has received some attention from agricultural economists, this has focussed on either the role of government interactions in trade, e.g. see McCalla (1966), Alaouze, Watson and Sturgess, and Schmitz, McCalla,

Mitchell and Carter, or the presence in international markets of intermediaries such as marketing boards, e.g. see Just, Schmitz and Zilberman, and Markusen. However, recently, Thursby has applied the Brander and Spencer-type arguments to agricultural trade in third-country markets. This paper extends the analysis by examining additional policies to subsidies and tariffs.

2. Theoretical Framework

(i) Basic Model

The theoretical model used in this paper follows that of Dixit (1988) and is similar to Cheng. A situation is considered where domestic producers of a processed agricultural product compete with imports from another country, the essential features of the model being: the use of a general conjectural variations approach, where the conjectural variations parameters are left free, allowing different forms of oligopolistic behaviour; firms' costs are assumed to exhibit economies of scale; home produced goods (subscript 1) and imported goods (subscript 2) are treated as imperfect substitutes.

Focussing on the home market, consumer surplus is given by:

(1)
$$\Gamma = f(Q_1,Q_2) - p_1Q_1 - p_2Q_2$$

where the utility function $f(Q_1,Q_2)$ is defined as:

(2)
$$f(Q_1,Q_2) = a_1Q_1 + a_2Q_2 - \frac{1}{2}(b_1Q_1^2 + b_2Q_2^2 + 2kQ_1Q_2)$$

From (1) and (2) the inverse demand functions for the home produced and imported goods can be derived:

(3)
$$p_1 = a_1 - b_1Q_1 - kQ_2$$

(4)
$$p_2 = a_2 - kQ_1 - b_2Q_2$$

where all parameters are positive, $b_1b_2 - k^2 > 0$ since the products are imperfect substitutes, p_1 and p_2 are prices and Q_1 and Q_2 are quantities.

On the supply side, there are n_i firms in the home and foreign economies. Profits for a representative firm in each country are given by:

(5)
$$\pi_1 = (p_1 - c_1)q_1 - f_1$$

(6)
$$\pi_2 = (p_2 - c_2 + s - t)q_2 - f_2$$

where prices and quantities are as defined above, c_i are constant marginal costs and f_i are fixed costs[1], s is an export subsidy paid to the foreign firm and t is a tariff imposed on imports.

As noted earlier, the model is one where firms' reactions to one another are treated as a Nash equilibrium with conjectural variations[2]. The conjectural variations parameters are derived from the first-order conditions of the respective profits functions:

(7)
$$p_1 - c_1 + q_1 dp_1/dq_1 = 0$$

(8)
$$p_2 - c_2 + s - t + q_2 dp_2/dq_2 = 0$$

where dp_i/dq_i is the conjectural variations parameter, i.e. the firm's expectation of how market prices will vary with changes in its output. Therefore, if a representative firm plays Cournot, it believes rival firms will not change output in response to a change in q_i, hence

$dp_i/dq_i = -b_i$, the slope of the inverse demand function. If the market were perfectly competitive, a change in one firm's output would have no effect on market price, i.e. $dp_i/dq_i = 0$.

Aggregating over the n_i firms generates:

(9)
$$p_1 - c_1 - Q_1V_1 - 0$$

(10)
$$p_2 - c_2 + s - t - Q_2V_2 - 0$$

where V_i is the aggregate conjectural variations parameter. Thus, for Cournot behaviour, $V_i = -b_i/n_i$ and as n_i increases, the more competitive the Cournot outcome becomes. In the limit $V_i = 0$, i.e. perfect competition. The V_i can be calculated for a particular market equilibrium given data on prices, quantities and costs.

Equilibrium prices and quantities in the model are obtained by combining (3) and (4) with (9) and (10), the explicit solutions for prices and quantities being:

(11)
$$\begin{bmatrix} Q_1 \\ Q_2 \end{bmatrix} - \frac{1}{\Delta'} \begin{bmatrix} b_2 + V_2 & -k \\ -k & b_1+V_1 \end{bmatrix} \begin{bmatrix} a_1 - c_1 \\ a_2 - c_2 + s - t \end{bmatrix}$$

(12)
$$\begin{bmatrix} p_1 \\ p_2 \end{bmatrix} - \begin{bmatrix} a_1 \\ a_2 \end{bmatrix} - \frac{1}{\Delta'} \begin{bmatrix} \Delta + b_1V_2 & kV_1 \\ kV_2 & \Delta + b_2V_1 \end{bmatrix} \begin{bmatrix} a_1 - c_1 \\ a_2 - c_2 + s - t \end{bmatrix}$$

where $\Delta = (b_1b_2 - k^2)$ and $\Delta' = (b_1 + V_1)(b_2 + V_2) - k^2 = (\beta_1 \beta_2 - k^2)$

(ii) Exporters' Policies

In the case of export policies, it is assumed that exporting firms can segment foreign from domestic markets, i.e. there is no arbitrage, and also it is assumed that the importing country imposes no tariff. Hence the aim of the exporting country's government is to maximise

domestic economic welfare which is defined simply as the sum of firms' profits and government revenue as given by:

(13)
$$W^e = (p_2 - c_2 + s)Q_2 + sQ_2$$

(a) Optimal Subsidy Policy

If an export subsidy is the main trade policy instrument available to the government, the optimal value for such a policy is derived by maximising (13) with respect to s[3]. If the first-order condition is positive it suggests an export tax; if negative, an export subsidy. Given (2) and (10), the first-order condition for welfare maximisation is:

(14)
$$\frac{\delta W^e}{\delta s} = V_2(p_2 - c_2 + 2s) + p_2 - c_2 + s$$

Re-arranging (14) gives an expression for the optimal export subsidy:

(15)
$$s = \frac{-[(V_2 + 1)(p_2 - c_2)]}{2V_2 + 1}$$

Given a relatively small value for V_2, expression (15) will tend to approximate the exporting firms' current mark-up over costs. Clearly, if exporting firms are dumping, i.e. $p_2 < c_2$, the government should employ an export tariff rather than a subsidy[4].

(b) Optimal Export Price Policy

Most discussion of strategic trade policy has focussed on export subsidies. However, this paper considers an alternative policy instrument which involves the government choosing an export price that maximises domestic welfare, i.e. given s is zero, (13) is maximised with respect to p_2. Given (2) and (10), the first-order condition for welfare maximisation is:

(16)

$$\frac{\delta W^e}{\delta p_2} - p_2(1 + 2V_2) - c_2(1 + 2V_2)$$

Re-arranging (16) gives an expression for the optimal export price:

(17)

$$\overline{p_2} - c_2\left[\frac{1 + 2V_2}{1 + 2V_2}\right]$$

Expression (17) indicates that the optimal export price is equal to current production costs, i.e. there should be a maximum export price, a result similar to that of Collie and de Meza. The intuition of this result is straightforward, the price control will expand the level of exports, and given economies of scale in production, rents will be shifted to the exporting firms. A maximum export price will have advantages over an export subsidy due to its revenue implications and impact on domestic income distribution(5).

(iii) Importers' Policies

In the case of the importing country, the government's aim is to maximise domestic economic welfare which is defined as the sum of consumer surplus, domestic firms' profits and government revenue as given by:

(18)

$$W^i - \Gamma + Q_1(p_1 - c_1) + tQ_2$$

which, substituting for Γ from (1), can be re-written as:

(19)

$$W^i - f(Q_1,Q_2) - c_1Q_1 - p_2Q_2 + tQ_2$$

In examining import policies, it is assumed that export subsidies are set to zero.

(a) Optimal Tariff Policy

If a tariff is the main trade policy instrument available to the government, the optimal value for such a policy is derived by maximising (19) with respect to t. Using (2) and (10), the first-order condition for welfare maximisation is:

(20)
$$\frac{\delta W^i}{\delta t} = \frac{V_2(a_2 - b_2Q_2 - kQ_1) + (p_2 - c_2)}{(1 - V_2)}$$

As Q_1 and Q_2 are endogenous, (20) can be solved by substituting in (11) to give:

(21)
$$t = \frac{a_2V_2 - \frac{V_2b_2}{\Delta'}[\beta_1(a_2 - c_2) - k(a_1 - c_1)] - \frac{V_2k}{\Delta'}[\beta_2(a_1 - c_1) - k(a_2 - c_2)] + (p_2 - c_2)}{1 - V_2}$$

Clearly the tariff is a function of the demand parameters, relative costs and the degree of imperfect competition.

(b) Optimal Import Price Policy

As an alternative, suppose the government were to choose an import price that maximises domestic welfare, then (19) is maximised with respect to p_2. Using (2) and (10), the first-order condition is:

(22)
$$\frac{\delta W^i}{\delta p_2} = -(a_2 - b_2Q_2 - kQ_1) - (p_2 - c_2)/V_2$$

Again, given that Q_1 and Q_2 are endogenous, (22) can be solved by substituting in (11) to give:

(23)
$$\overline{p_2} = -a_2V_2 + \frac{b_2V_2}{\Delta'}[\beta_1(a_2 - c_2) - k(a_1 - c_1)] + \frac{V_2k}{\Delta'}[\beta_2(a_1 - c_1) - k(a_2 - c_2)] + c_2$$

Again the optimal import price is a function of the demand parameters, relative costs and conjectural variations. In effect, it represents the maximum price at which imported goods can enter the domestic market.

3. Trade Policies for the US Brewing and Cheese Processing Sectors

These theoretical results can be evaluated empirically by using a computable partial equilibrium model originally suggested by Dixit (1987). Since details of this model can be found elsewhere, the main points have been confined to an Appendix. The essence of this technique, of which there are only a few examples, is to calibrate the model with the data from external empirical sources such that the parameters of the demand system are consistent with equilibrium in a given period.

In the case of optimal export policies, the focus is on the US brewing industry, and in particular its exports to the UK. This sector was chosen for several reasons: first, the US and UK brewing industries both have imperfectly competitive market structures (see Connor *et al* and Monopolies and Mergers Commission); second, there has been a structural shift in UK beer demand away from traditional ales to lager-type beer, the major product of the US brewing industry (Monopolies and Mergers Commission); third, US brewers currently license (Sheldon and Henderson) the production of their beer in the UK, however, the proposed and actual re-structuring of the retailing of beer in the UK may provide an incentive for direct exporting (Monopolies and Mergers Commission and New York Times, March 1990).

Using price, quantity and elasticity data for the brewing industry, values for the optimal export subsidy and maximum export price were derived for 1985 as shown in Table 1. (Details of the data used are given in the Appendix).

Table 1 US Brewing: Optimal Subsidy and Maximum Export Price ($/barrel, 1985)

	Policy Value
Optimal Export Subsidy	21.56
Maximum Export Price	50.40

The results suggest that there may be a case for using an export subsidy, which approximates the US mark-up over costs whilst a maximum export price would correspond to US production costs. Using (3), (4), (9) and (10), the effects of these policies on welfare were calculated and are shown in Table 2. Relative to the original level of welfare, the maximum export price has a positive effect on net welfare compared to the export subsidy. Whilst the export subsidy increases domestic firms' profits, it redistributes income away from US taxpayers to US exporters, hence it would appear that the maximum export price is the superior policy[6].

Table 2 US Brewing: Welfare Effects of Optimal Trade Policies ($m, 1985)

	Original Welfare	s	$\bar{p}_2$
Domestic Firms' Profits	0.17	0.56	0.26
Government Revenue	--	-0.58	--
Total Welfare	0.17	-0.02	0.26

Focussing on the US cheese processing sector, the effects of optimal import policies can also be examined. As there are a large number of varieties in this grouping, the analysis

is confined to US imports of blue-vein cheese from the EC. This type of cheese was chosen for several reasons: first, it is a sector where there is a clear demand for government support, the US having protected it with import quotas since 1951 (see Hornig for a useful discussion); second, the US and EC cheese processing sectors are to varying degrees imperfectly competitive (see Hornig); third, blue-vein cheese is largely exported from the EC by private firms compared to other cheese varieties which tend to be exported by marketing boards and other organisations; and finally, most US imports of blue-vein cheese originate from the EC.

Using price, quantity and elasticity data for blue-vein cheese, the model was calibrated for the years 1980 and 1985. Since import quotas currently affect the US cheese market, the model was initially used to simulate the effects on prices and quantities of liberalisation in the world dairy market, the estimated price changes being based on those of Tyers and Anderson. The model was then re-calibrated such that the parameters were consistent with these hypothetical free market values. Details of the data used are given in the Appendix.

Table 3 US Cheese Processing: Optimal Tariffs and Maximum Import Prices ($/lb)

	1980	1985
Optimal Import Tariff	0.12	0.16
Maximum Import Price	1.39	1.87

Given the calibration, values for the optimal tariff and maximum import price were derived for 1980 and 1985, the values being shown in Table 3. In accordance with the theoretical analysis, there appears to be some justification for the use of a tariff on US imports from the EC given the structural characteristics of the two markets. For both 1980

and 1985, the tariff represents 8 per cent of the original import price, whilst, in contrast, the maximum import price is 8 per cent less than the original import price. Essentially, since the exporter is assumed to have a price-cost markup (see Appendix), the optimal tariff is shifting rents from EC firms to the US economy. In the case of the maximum import price, the US government is forcing EC firms to forego their rents on exports by ensuring that the import price is equal to their costs of production, i.e. EC firms are being forced to play competitively. These results are evident from inspection of equations (21) and (23) respectively, since $(p_2 - c_2)$ dominates (21) and c_2 dominates (23).

In order to evaluate the effects of these policies on economic welfare, new equilibrium prices and quantities for the US cheese market were derived using (3), (4), (9) and (10), the welfare effects being described in Table 4. With reference to the optimal tariff, it is evident that this only marginally improves economic welfare in the US cheese sector. Relative to the original levels of welfare, tariffs raise welfare by 0.2 per cent and 0.2 per cent in 1980 and 1985 respectively. Such small gains from tariffs are consistent with Dixit's (1987) study of the US car market and Baldwin and Krugman's study of semi-conductors. Therefore, the effect of an optimal tariff is largely distributional, consumers losing from the policy whilst domestic firms' profits and government revenue increases.

In contrast, the maximum import price appears to be a superior policy instrument, the gain in welfare being larger than that from the optimal tariff. For 1980 and 1985 respectively, welfare increases by 2.8 per cent and 3.3 per cent relative to original welfare. Again there are distributional effects, although in this case, the gains to consumers from lower priced imports outweigh the losses in domestic firms' profits.

Table 4 US Cheese Processing: Welfare Effects of Optimal Trade Policies ($m)

	1980			1985		
	Original Welfare	t	$\bar{p}_2$	Original Welfare	t	$\bar{p}_2$
Consumer Surplus	26.50	25.87	27.38	32.96	31.97	34.26
Domestic Firms' Profits	4.39	4.42	4.37	5.27	5.32	5.22
Government Revenue	--	0.68	--	--	1.02	--
Total Welfare	30.89	30.97	31.75	38.23	38.31	39.48

The intuition as to why maximum import prices are superior is as follows: the optimal tariff restricts competition in the domestic market, the increase in firms' profits and government revenue (marginally) outweighing the losses to consumers; however, the maximum import price forces foreign firms to sell at prices near to cost which, in effect, imposes competitive discipline on domestic firms, and results in consumer gains outweighing the losses to domestic firms' profits. In general, the policy of setting a maximum import price raises a question against the standard strategic trade policy argument since it suggests that, under certain circumstances, making the market more competitive is better than making it less competitive.

4. Summary and Conclusion

The theory of strategic trade policy suggests that there may be a normative justification for active trade policy where markets are imperfectly competitive. This may have important implications for agricultural trade where a growing proportion is conducted by state organisations, marketing boards and large-scale food processors, and also there are

increasing demands for trade intervention, despite the current GATT negotiations on farm trade.

In this context, this paper has considered the relevance of export subsidies and import tariffs and maximum export and import prices for trade in processed agricultural and related products. The results indicate that the use of price controls would increase welfare by more than if export subsidies and import tariffs were used(7). Export subsidies shift profits to firms in the exporting country but generate domestic income distribution effects. Maximum export prices, on the other hand, allow firms to credibly expand their output without government incurring any budgetary costs. Import tariffs only marginally increase economic welfare, whilst maximum import prices would enhance competitive discipline in the importing country's market. However, even if price controls have superior welfare/distributional implications, they are rarely, if ever, observed in practice. Consequently, as Collie and de Meza note, the failure to adopt welfare-maximising price controls brings into question the use of strategic trade policy to rationalise export subsidies and tariffs.

In conclusion, there is clearly considerable scope for further analysis of these arguments with respect to agricultural trade. First, the theoretical model needs to be extended to deal more explicitly with the characteristics of imperfectly competitive agricultural markets. Second, the simulation results presented in this paper are simply meant to be illustrative, therefore, more detailed empirical analysis is required to test these theories based on improved model specification, including the use of econometric models and better quality data.

NOTES

1. Fixed costs are sufficient to ensure falling average costs in the model, however, in order to deal empirically with economies of scale, the procedure suggested by Helpman and Krugman is adopted. The inverse index of economies of scale is defined as, $v = MC/AC$, hence given an estimate of marginal costs, and assuming that in the base period there is free entry such that price is equal to average cost, the elasticity of costs with respect to output can be imputed.

2. There are theoretical objections to such an approach, however none of the alternatives are particularly tractable (see Helpman and Krugman).

3. It is assumed that government intervention affects neither the demand parameters nor firms' conjectures.

4. Eaton and Grossman have shown that if firms play Bertrand, an export tariff will be optimal.

5. Both policies are being treated in a partial equilibrium setting and hence ignore the impact on factor prices (see Dixit and Grossman, 1986).

6. The impact of these policies on costs have been weighted by the size of exports relative to domestic sales. Given the dominance of domestic beer sales, this explains the negative net welfare effect, i.e. costs do not fall far enough for the increase in firms' profits to outweigh the cost of the export subsidy.

7. Sensitivity analysis indicates that for both brewing and cheese processing, the overall conclusion on the policy effects holds.

APPENDIX

In order to derive the optimal trade policies and simulate their effects, it is necessary to have estimates of the parameters in the demand system. These are calculated by calibrating the theoretical model such that the parameters are consistent with equilibrium in the market in a given period. Focussing on the demand functions (A1) and (A2), there are five unknown parameters, A_1, A_2, B_1, B_2 and K. Since actual prices and quantities give two relations between them, three further relations are required to solve the system.

(A1)
$$Q_1 - A_1 - b_1 p_1 + K p_2$$

(A2)
$$Q_2 - A_2 + K p_1 - B_2 p_2$$

Following Dixit (1987), expressions for the price elasticity of demand and elasticity of substitution can be derived and then set equal to empirically observed values. In order to ensure local homotheticity of the utility function, the parameters must satisfy the following fifth relation:

(A3)
$$p_1(A_1 K + A_2 B_1) - p_2(A_2 K + A_1 B_2)$$

Given this procedure, the model was calibrated for 1980 for the brewing industry and 1980 and 1985 for the cheese processing sector. Price and quantity data for the brewing sector were derived from Modern Brewery Age and Monopolies and Mergers Commission. No precise beer elasticity estimates exist, however, Elzinga notes that the overall price elasticity tends to be inelastic whilst the elasticity of substitution between brands tends to be elastic, consequently, values of 1.5 and 5.0 respectively were used, the latter value being based on an Australian estimate by Higgs. It should be noted that sensitivity analysis was

conducted with different values of the elasticity parameters (see note 7). Brewing cost data were derived from Cockerill and Keithann.

In the case of blue-vein cheese, price and quantity data were derived from USDA Dairy Market Statistics, USDA Dairy Products and USDA Foreign Agricultural Trade. The value of the price elasticity of demand for blue-vein cheese was derived from Anderson. No US estimate exists for the elasticity of substitution, so a value of 1.6 was used based on an Australian estimate made by Higgs. Again sensitivity analysis was conducted with different values of the elasticity parameters. No precise data for costs were available, consequently, costs for both the US and EC were assumed to be 8 per cent below wholesale prices which accords with the level of the price-cost mark-up reported by Hornig.

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