THE COMPLEXITIES OF THE INTERFACE BETWEEN POLICY AND TRADE

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"The world is full of complexities, making empirical welfare economics difficult"—Andrew Schmitz

OVERVIEW

I will make the following points that are often neglected in the trade literature:

1. Often, two distortions exist, such as import quotas along with production controls—the case of Canadian supply management. Here the welfare costs can be large even though trade may not be restricted as a result of supply management. In addition, this type of modeling highlights an element often ignored in trade analysis—the impact of trade on sectors beyond the farm gate.
2. In modeling the impact of price supports, one clearly has to incorporate both the domestic and trade sector. It is difficult for one to speak about trade in the absence of agricultural policy. In addition, it is necessary to include not only price supports and their impact on trade, but also input subsidies. These two distortions can lead to both huge trade and welfare effects. The case of U.S. cotton policy clearly highlights that the impact on trade can be significant along with the welfare cost. Furthermore, there can be negative gains from trade, a concept often ignored in trade discussions.
3. Direct Production subsidies are not the only policy instruments that affect trade. For example, with ethanol production, even in the absence of price supports, trade is affected by indirect subsidies to corn producers via tax credits to ethanol processors. In this case, corn producers become better off, consumers of food lose, and the value of corn exports can decrease. From a general equilibrium text, one has to explore the welfare effects, taking into account the cost of the subsidy and the impact of ethanol production on the overall fuel market. The study of the impact of ethanol tax credits clearly highlights the need to identify the gain to processors and other sectors beyond the farm gate. Many of our studies on trade estimate only the impact of a policy change on producers and consumers.
4. Under the Byrd Tariff, processors, for example, can gain relative to free trade. Under the Byrd Amendment, theoretically, processors can extract large hidden rents by receiving monopolistic and monopsonistic rents that the Byrd Tariff brings about.
5. The welfare effect of price distortions can be significant for an individual country but the net gains from trade, taking into account trading partners can be relatively small.

CANADIAN SUPPLY MANAGEMENT

The key to supply management is the use of import quotas and domestic production controls (Vercammen and Schmitz 1992). Both of these policy instruments are modeled in Figure 1. Domestic demand is given by the curve D_0 and domestic supply is given by S. Under free trade, the domestic (border) price is P_b, domestic production is Q_1, and domestic consumption is Q_2. Imports total $(Q_2 - Q_1)$.

Under supply management imports are restricted to $\left(Q_2 - Q_1''\right)$. Now domestic producers face the demand curve D'. For the domestic producers to maximize profits, the production quota is set where the marginal revenue curve MR equals the supply curve S, which results in domestic production Q_m. Producers gain $\left(P_e P_b ea - ehi\right)$. The quota value for any producer will be the discounted value of $\left(P_e - P_s\right)$ per unit of quota. The total approximate quota value for the industry will be the discounted value of $\left(P_e P_s ha\right)$.

CANADIAN SUPPLY MANAGEMENT (CONT.)

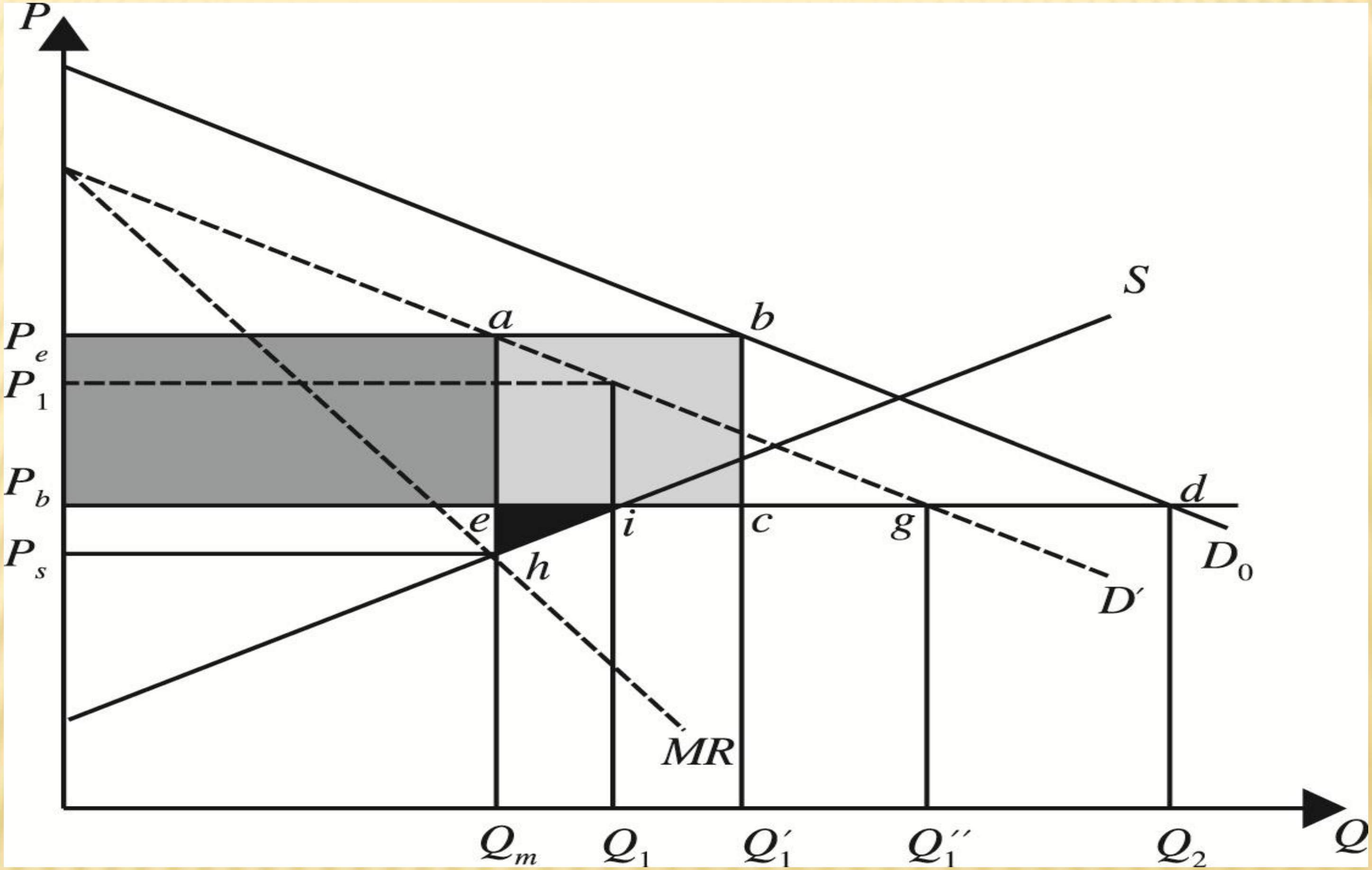

Figure 1. Model of supply management

CANADIAN SUPPLY MANAGEMENT (CONT.)

In Figure 1, consumers lose $(P_e P_b db)$ and importers gain $(aecb)$. The availability of import quotas gives importers (many of whom are also domestic food retailers) incentives for rent-seeking behaviour, because import quotas have value equal to $\left[(P_e - P_b)(Q_1' - Q_m)\right]$, or $(aecb)$. This value arises because importers buy the product at P_b and sell it in the domestic market at P_e. Producers challenged the right of importers to capture these rents in the courts; however, the decision ruled in favour of the importers. Triangle $bcd + ehi$ in Figure 1 is the deadweight loss (DWL) of the supply management program.

KEY POINTS

- Supply management can result in large welfare costs, but need not cause trade distortions. For example, (in Figure 1) one could draw the demand curve D' through the point i in which case, supply management would not have a trade distortionary effect even though it would result in inefficiency losses.
- Because of the nature of demand and the allocation of the output to various markets, conflicts often arise between producers and industrial processors. We show that processors can gain from supply management. Unfortunately, in many trade models, impacts of removing distortions only focus on producers and consumers and ignore processors and other players in the vertical marketing channel.

INPUT SUBSIDIES AND PRICE SUPPORTS

Here we focus on the interaction of price supports, which for our purpose include both countercyclical payments (CCPs) and loan rate payments (LRPs), and input subsidies. We analyze these instruments taken together and individually, and demonstrate that they operate in a multiplicative rather than an additive manner. Figure 2 presents a combined input subsidy and price support payment model. In addition, this figure explicitly represents each policy program instrument separately. In the model, S and S' represent, respectively, the supply curve with and without the water-subsidy. The domestic demand curve D_d, and T_d is the total demand curve.

Under the multiplicative effects (ME) scenario given, the support price for cotton is P_s, the water-subsidized supply curve is S' output quantity is $q*$ and the world price is P_w. Domestic producers receive $\left(P_s P_f\, fmno\right)$ as a net gain, while domestic consumers gain $\left(P_f P_w cd\right)$. Also, $\left(dcbf\right)$, is referred to as slippage, representing rents received by importing countries. The cost to the government for the input subsidy is $\left(mnoa\right)$, while the cost of the government price support payments equals $\left(P_s P_w bo\right)$. Therefore, the combined net domestic cost to society of the two subsidies applied together is $\left(dcbaf\right)$. The net cost comparison is made with reference to point f, where P_f and q_2 are free from distortions.

INPUT SUBSIDIES AND PRICE SUPPORTS

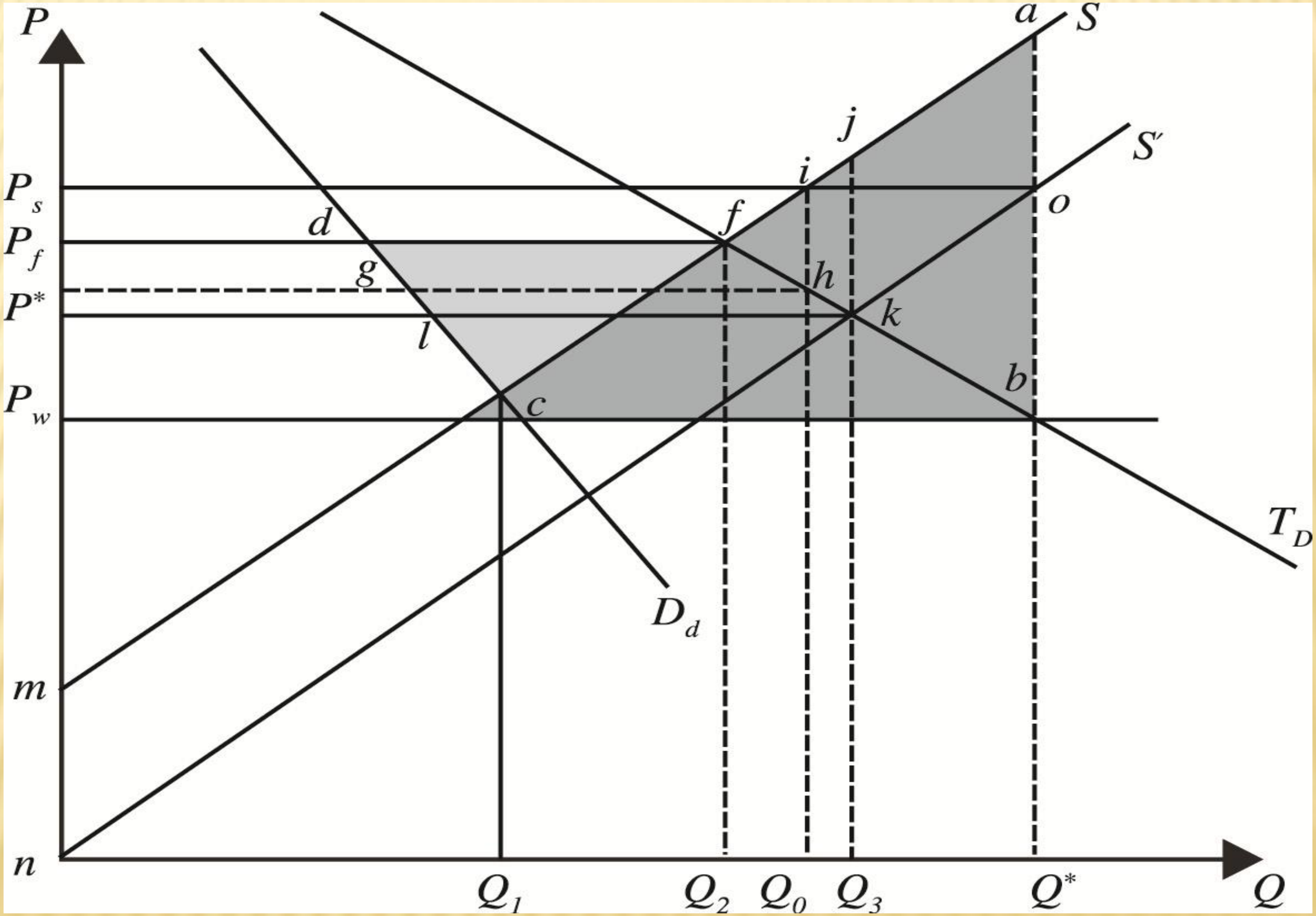

Figure 2. Multiplicative effects of water subsidy and cotton price supports: the ME model

INPUT SUBSIDIES AND PRICE SUPPORTS

In this model, the relative magnitude and distribution of the rents depends largely on the demand and supply elasticities, the amount of exports, and the per unit cost of the water subsidy. For example, the more elastic the supply, the greater the deadweight loss (DWL) also the higher the proportion of domestic production that is exported, the greater the net cost of the combined subsidies. Using this model framework, Schmitz, Schmitz, and Dumas (1997) theoretically and empirically show for U.S. cotton the existence of negative gains from trade (NGT).

For the theoretical ME model, depicted in Figure 2, domestic cotton producers gain more rents from the water subsidy $(mnoi)$, than from the price support payments $(P_s P_f fi)$, although the majority of the price support payments from the government go to domestic consumers $(P_f P_w cd)$, and to foreign countries $(dcbf)$, rather than to producers. However, the actual distribution of these rents is an empirical matter that illustrates how parameter changes affect the calculation and distribution of the subsidy rents and welfare losses.

INPUT SUBSIDIES AND PRICE SUPPORTS

A combination of the two subsidies distorts output more than when they each act alone, causing the multiplicative effects of the two instruments to be greater than a mere summation of the individual effects. For example, looking at Figure 2, the production quantity, Q^*, is established where the target price P_s intersects the input-subsidized supply curve S' at point o instead of at point i (associated with quantity Q_0), where it would otherwise be given only a price support. Thus, adding the water input subsidy to the price support increases production from Q_0 to Q^*. In addition to increased output, there is a significant decrease in the world price as it falls to P_w. Both of these effects increase the size of the price support payments made by the government, and in conjunction with price supports, the aggregate size of the input subsidy is greater than in the absence of price supports.

KEY POINTS

- The combination of price supports and input subsidies can lead to *negative gains from trade* (i.e., $dcf < dcbaf$).
- There are gainers and losers from domestic policy distortions. For example, importers and domestic producers gain at the expense of domestic tax payers.
- The net gain from free trade for both importer and exporter (taken together) is $afb,$ which is much smaller than the net welfare gain for the exporter which is $dcbaf$.

BIOFUELS

In Figure 3, S is the supply curve for corn and the derived demand curve for corn in the absence of ethanol production is given by T_d where D_d is the domestic demand for corn. The farm price is given by p_1 and production of corn is q_1. The consumer price for corn products is p^*. Suppose now that the ethanol tax credit to processors causes the total demand curve for corn to shift to $T_d^{'}$. The corn price increases to p_2, and output increases to q_5.

However the food price for corn containing products increases to p_3 as less corn is consumed as food. The amount of corn used for ethanol is $\left(q_5 - q_3\right)$ or ea. As a result of the tax credit for ethanol processors, corn producers gain $p_2 p_1 ba$, while domestic consumers and importers lose $p_2 p_1 be$. The change in corn exports is $\left(cq_2 q_1 b - dq_4 q_3 e\right)$.

Figure 3. Biofuels

BIOFUELS (CONT.)

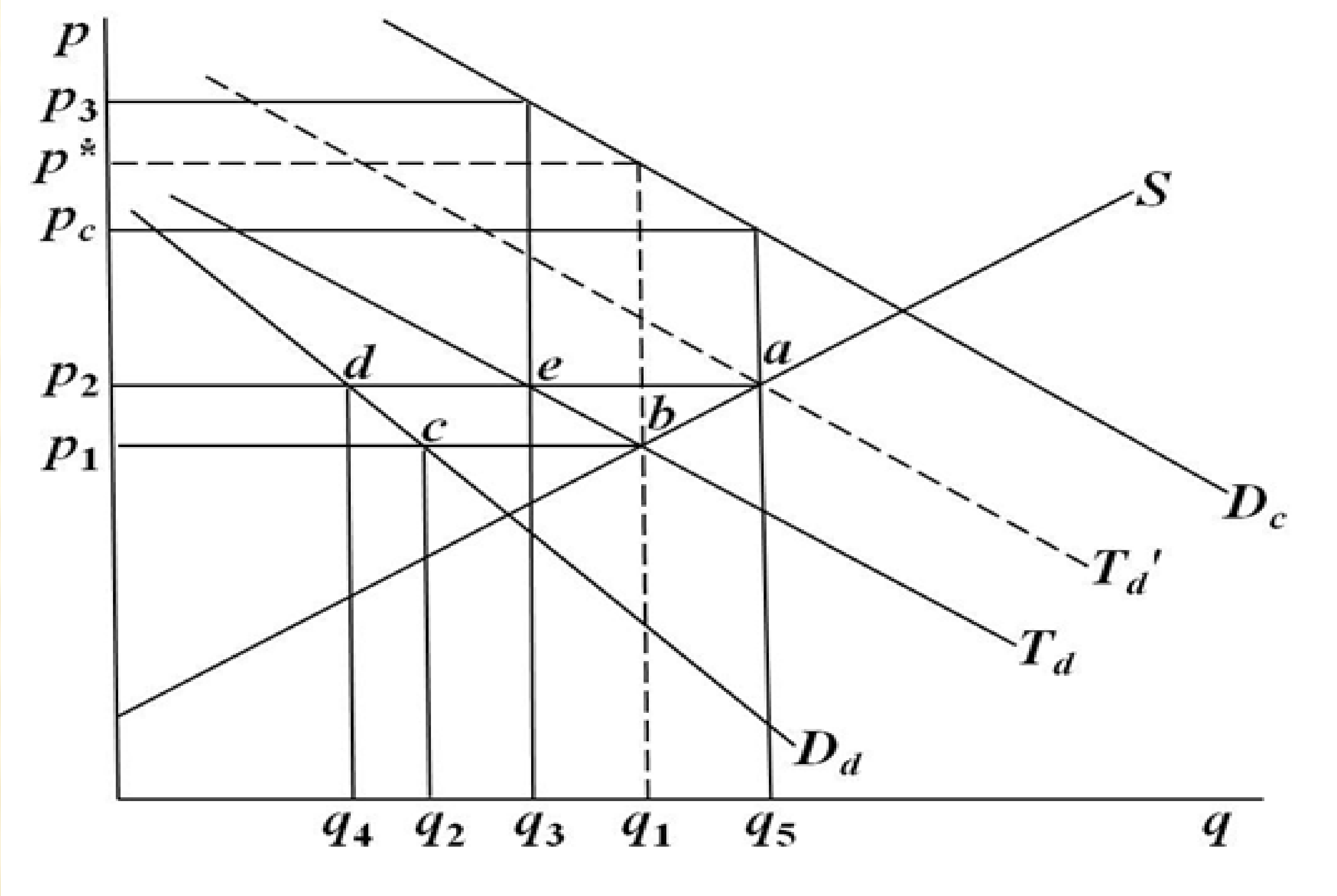

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Figure 4 presents a more complex model where ethanol is produced from corn. For the U.S. corn market S is the supply schedule and D_T is total demand. Given the loan rate under the 2002 Farm Security and Rural Investment Act of 2002 (FSRI), farmers receive a price of P_{LR} for each bushel of corn produced, yielding a total production of q_s bushels. Given a domestic demand curve D_d and a export demand curve of D_e, the total demand curve is D_T.

BIOFUELS (CONT.)

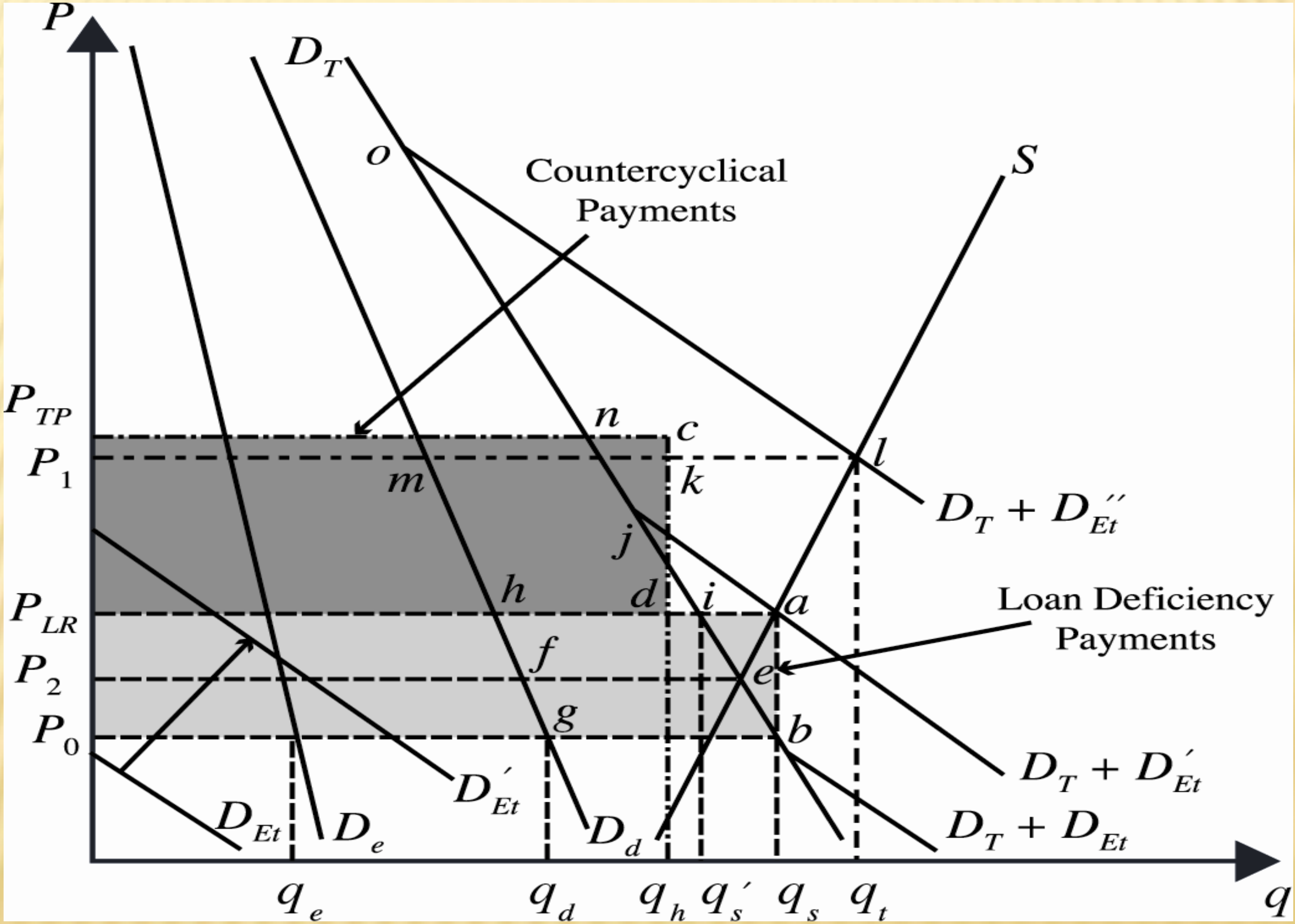

Figure 4. Ethanol Effects: Direct and Indirect Subsidies

BIOFUELS (CONT.)

These demand curves result in a market clearing price of P_0. With this market clearing price, q_d is consumed domestically and q_e is exported. At this equilibrium, the loan deficiency payments paid to farmers based on the level of production is represented by the area $p_{LR}abp_0$. In addition, farmers receive a countercyclical payment based on their historical level of production (q_k , typically 85% of historical yields) and the target price $\left(P_{TP}\right)$. Graphically, this payment is depicted by the area $P_{TP}cdP_{LR}$. The net cost of the subsidy program from the U.S. perspective is $aefgb$ of which $efgb$ is a gain to importers (the "slippage" effect).

In this original equilibrium we assume that the market clearing price $\left(P_0\right)$ is less than the choke price for the derived demand curve for corn used to produce ethanol $\left(D_{ET}\right)$. Thus, given the total demand curve of $D_T + D_{ET}$ no ethanol is produced. Next, we assume that increases in the price of gasoline shifts the derived demand for corn used to produce ethanol outward to $D_{ET}´$. This changes the shape of the total demand curve to $D_T + D_{ET}´$. This rightward shift in the derived demand for corn from ethanol producers is sufficient to raise the equilibrium price of corn to the loan rate, eliminating the loan deficiency payments to farmers. Thus, there are no direct subsidies based on production, but there are indirect subsidies to corn producers via ethanol tax credits.

BIOFUELS (CONT.)

Consider further the demand for corn derived from ethanol production. Starting from D_{ET}' (which assumes a fixed oil price), a sufficiently large increase in corn prices (above P_2 chokes off the demand for corn to produce ethanol). This point represents the corner solution in Figure 4. However, if one assumes an increase in oil prices for a given price of corn, the derived demand curve for corn shifts to the right.

In the first case, we assume that producers are not impacted by ethanol demand even though corn prices rise. This is because the loan deficiency payments no longer exist (and the countercyclical payments remain unchanged). Also, an important result is derived from the observation that market clearing prices rise from P_0 to P_{LR}, causing both domestic and export demand to fall for those components making up demand D_T. (The demand for corn for ethanol is $q_s - q_s'$.) Domestic consumers now pay a higher price for corn and related products, given demand D_d. Likewise, foreign importers pay a higher price for the corn they import.

BIOFUELS (CONT.)

To further show the interrelationship between ethanol production and government payments to corn farmers, we assume that the derived demand for corn used to produce ethanol shifts farther outward to D_T^{it}. This increased derived demand causes the total demand for corn to shift outward to $D_T + D_{ET}^{it}$ increasing the market equilibrium price to p_1 and the equilibrium quantity to q_t. Comparing this equilibrium with the equilibrium at the loan rate, producers gain P_1laP_{LR}. However, part of this gain (p_1kdp_{LR}) is offset by reductions in the countercyclical payments to farmers. Thus, the net producer gain is $kdal$. This shift results in an economic loss to domestic consumers of P_1mhP_{LR} and a loss to foreign consumers of $mndh$. Completing the model, the economic gain for ethanol producers is the area onl.

If the demand for ethanol shifts even farther to the right than D_{ET}^{it}, all government payments (including countercyclical payments) are eliminated. Thus, there a direct linkage between tax credit to ethanol and farm program payments.

KEY POINTS

- The analysis of production subsidies can be complex and difficult. In the ethanol case, one has to consider additional elements that are not easily captured in the corn market. One has to account for environmental impacts, and the value of distillers' grain. Also, perhaps more importantly, general equilibrium effects have to be considered. For example, how does ethanol consumption affect the overall fuels market? As we show below in Table 1, the benefit cost ratio for providing ethanol tax credits can be greater than one only if ethanol has a positive price depressing effect in the overall fuels market.
- While the domestic distortions created by subsidies can be significant, the impact of these subsidies on trade can be small indeed.
- In these models, while it is necessary to estimate the impact on ethanol producers such as ADM, it can be an extremely difficult exercise, partly because of the proprietary nature of data on companies such as ADM.

ETHANOL AND THE BROADER FUELS MARKET

Table 1. U.S. ethanol and the broader fuels market

	Supply Elasticities (Corn)			
	0.4	0.5	0.6	0.7
	Shift Based on 2006 Market Conditions			
Gasoline Market Price ($/gallon)	2.969	2.969	2.969	2.969
Gasoline Market Quantity (billion gallons)	139.726	139.730	139.733	139.733
Gain in Consumer Surplus (billion dollars)	4.369	4.390	4.411	4.411
Loss to Gasoline & Oil Producers (billion dollars)	−4.358	−4.378	−4.399	−4.399
Loss to Foreign Producers (billion dollars)	−3.042	−3.057	−3.071	−3.071
Loss to Domestic Producers (billion dollars)	−1.307	−1.314	−1.320	−1.320
Gain to Ethanol Producers (billion $)	0.046	0.046	0.046	0.046
Net Welfare Gain (billion $)	3.107	3.122	3.138	3.138
	2.0 Billion Bushel Shift in Demand			
Gasoline Market Price ($/gallon)	2.961	2.961	2.961	2.961
Gasoline Market Quantity (billion gallons)	139.897	139.904	139.907	139.907
Gain in Consumer Surplus (billion dollars)	5.397	5.439	5.460	5.460
Loss to Gasoline & Oil Producers (billion dollars)	−5.379	−5.421	−5.442	−5.442
Loss to Foreign Producers (billion dollars)	−3.753	−3.782	−3.797	−3.797
Loss to Domestic Producers (billion dollars)	−1.614	−1.626	−1.633	−1.633
Gain to Ethanol Producers (billion dollars)	0.069	0.070	0.071	0.071
Net Welfare Gain (billion dollars)	3.852	3.883	3.898	3.898

OPTIMAL BYRD TARIFF

Schmitz, Seale and Schmitz (2006) derived the optimal Byrd processor tariff in a vertical market structure. They consider a group of processors, referred to as the processing industry, who buy inputs for processing from abroad and from domestic producers. The excess supply curve for the exporter of an input for processing is ES (Figure 1). The importer's domestic supply schedule for producing the same input is S_d. The demand curve for the processor's output is D_c. The processor's derived-demand curve for the input is D_d. The free trade price for the input is P_f and exports are Q_f.

OPTIMAL BYRD TARIFF (CONT.)

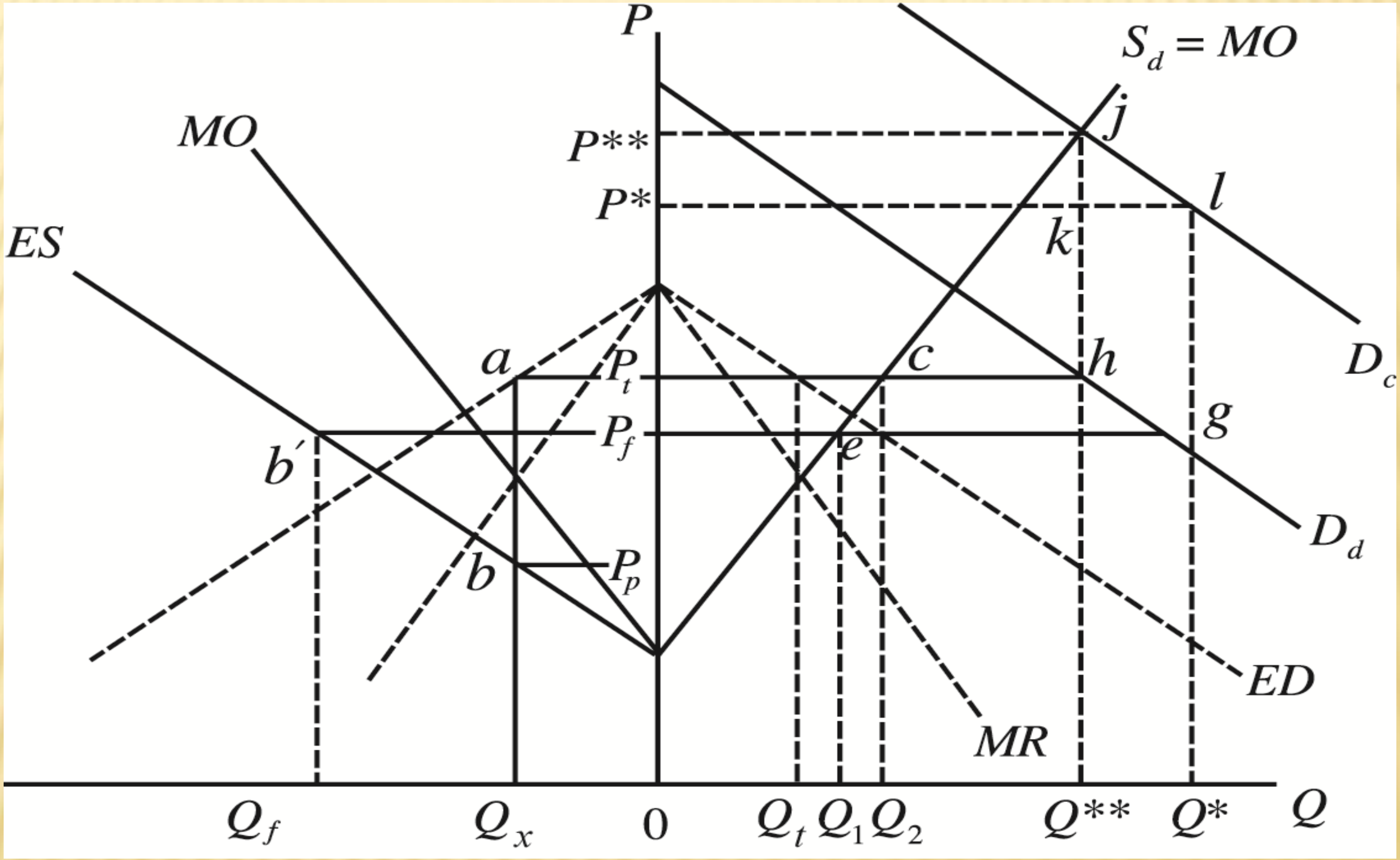

Figure 5. The Optimal Byrd Processor Tariff

OPTIMAL BYRD TARIFF (CONT.)

Under free trade, the raw-product processor will purchase Q_f from abroad at price P_f and will purchase Q_1 domestically at price P_f. The total outlay for the raw product will become $\left(P_f Q_f + P_f Q_1\right)$. In essence, the processor's input totals $(Q_f + Q_1)$, which is Q^*. A portion of the processed input comes in the form of imports, and the remainder is produced domestically. Under constant processor costs, given the consumer demand for the final product D_c, the processor will produce Q^* and will sell the final product at P^*.

Suppose the processor is effective when lobbying for a tariff on the raw product of size $\left(P_t - P_p\right)$. The processor now imports only Q_t (which equals Q_x of exports) of the input to be processed at price P_t. Under the Byrd Amendment, tariff revenue $abP_P P_t$ will be reimbursed to the processor; hence, its effective outlay on imports will be reduced to $P_P Q_t$. On the other hand, raw product processor expenditures on domestic inputs will increase from $P_f Q_1$ to $P_t Q_2$. Combining these two effects, total expenditures by the processor on purchases of both imports and the domestic raw products will actually decrease when the tariff revenue is rebated to the processor. When compared with free trade, a tariff of size $\left(P_t - P_P\right)$ will cause the processor to process Q^{**} of the input for sale at price P^{**}.

OPTIMAL BYRD TARIFF (CONT.)

The optimal processor tariff is derived where the marginal outlay curve MO intersects the marginal revenue curve MR at the excess derived-demand curve ED in Figure 1. The optimal processor tariff is thus $(P_t - P_p)$. Imports for the profit maximizing processor under the tariff are represented by Q_t, for which the processor pays producers in the exporting country price P_p. Producers in the importing country now will receive a higher price of P_t, but consumers also will be charged a higher price. Export producers will lose $\left(b^{'}bP_P P_f\right)$, import consumers will lose $\left(P_t P_f\, gh\right)$, domestic producers will gain $\left(P_t P_f ec\right)$, and processors will gain $\left(abP_P P_t\right)$.

At the optimal tariff $(P_t - P_P)$, processor profits are at a maximum. Essentially, the government tariff policy will create non-competitive rents for the processor. A processor under the Byrd Amendment will gain $\left(abP_P P_t\right)$ from the tariff relative to free trade, which is exactly equal to the tariff revenue rebated to the processors by the government.

PRODUCTION QUOTAS

Consider Figure 6 where the foreign supply curve is given by ES and the domestic demand is D. The free trade price and quantity are p_f and q_f, respectively. Under a production quota introduced by and exporter, price increases to p_1 and quantity is reduced to q_1. The domestic consumers lose from the production quota by an amount $p_1 p_f da$ while foreign producers gain by $\left(p_1 p_f b - bcd\right)$.

The net gain from free trade, with the quota removed, is acd. However, note that the gain is smaller in magnitude than either the net producer gain from the quota or the consumer cost from the quota.

Quotas also affect the benefit-cost ratios if they are eliminated, as shown in Table 2 below. In the no-trade case, quota removal will lead to a benefit-cost ratio greater than one, but this is not the case for trade.

PRODUCTION QUOTAS (CONT.)

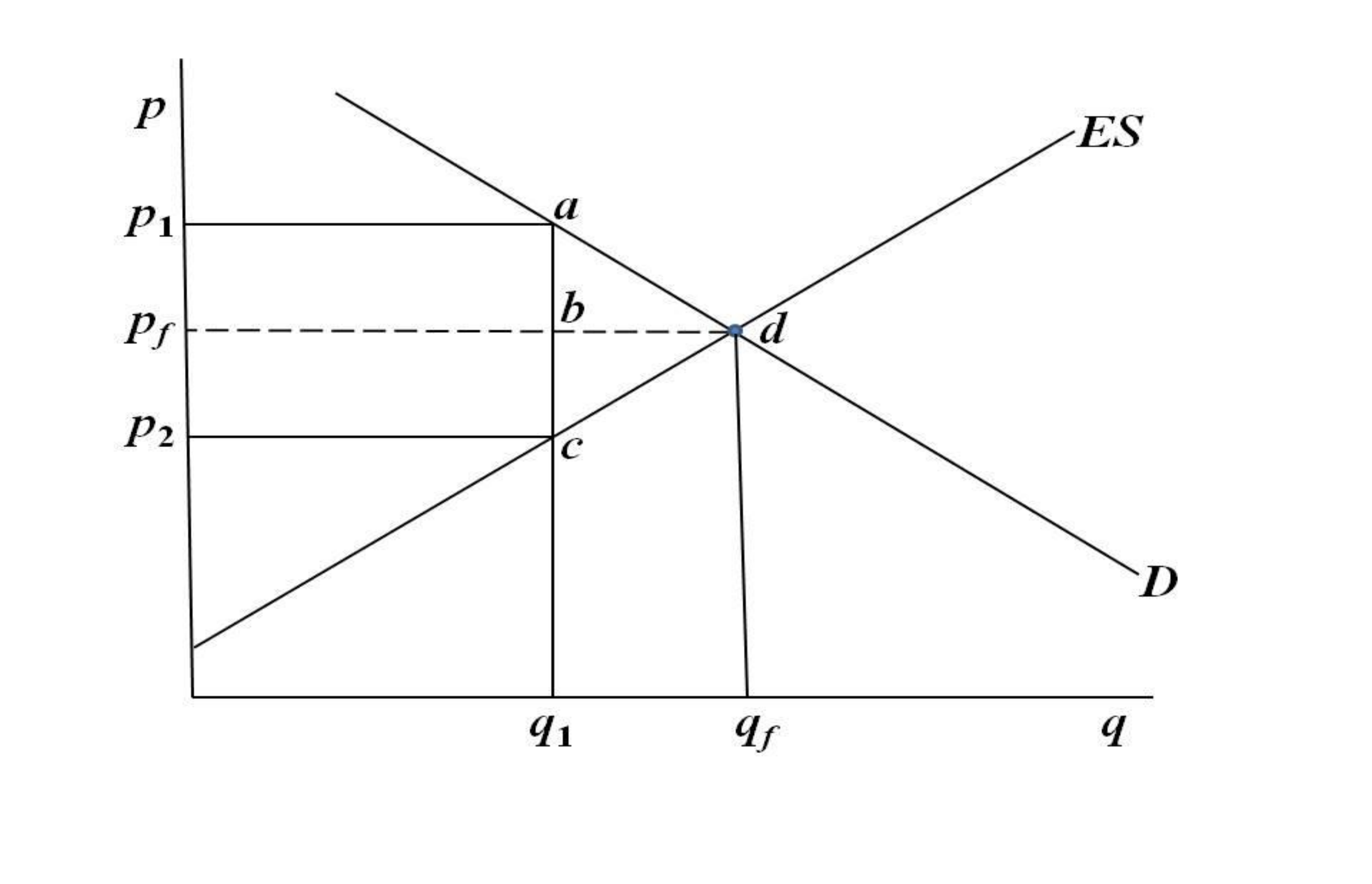

Figure 6. Production quotas and Trade

PRODUCTION QUOTAS (CONT.)

Table 2: B/C Ratios: Quota Introduction and Removal (Value of the Quota)*

	B/C Ratio			
	No Trade	**Area (Figure 2)**	**Trade**	**Area (Figure 2)**
Quota Introduction	B/C = 0.90	$\frac{\left[(p_1 p_0 da)-(dcb)\right]}{p_1 p_0 ba}$	B/C = 1.20	$\frac{\left[(p_1 p_0 da)-(dcb)\right]}{p_1 p_0 fe}$
Quota Removal	B/C = 1.10	$\frac{(p_0 p_2 cb)+(p_1 p_0 ba)}{p_1 p_2 ca}$	B/C = 0.88	$\frac{\left[(p_1 p_0 fe)+(p_0 p_2 cb)\right]}{p_1 p_2 ca}$

***Based on an $e_s = 1.3$ and an $e_d = -.58$

KEY POINTS

- Imperfect competition can lead to sizeable welfare gains for those countries or players with market power. However, these gains individually can be larger than the net gains from free trade where distortions are absent. This is also the case for the size of the negative impact on consumers brought about by imperfectly competitive behavior.
- The net gains from trade can equal the deadweight loss triangle.