Efficiency of Farm Programs and Their Trade-Distorting Effects

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CONTENTS

ABSTRACT

Government intervention in product and factor markets generally leads to trade distortions. Conventional measures of government intervention, such as the Producer Subsidy Equivalent and the Nominal Rate of Protection, are often used to compare the effects of alternative policies on trade. This chapter demonstrates that the size of a trade distortion is often not closely linked to the level of producer support or protection but is closely related to a more fundamental variable—the economic efficiency of a government program. Trade-distorting policies can generally be ranked; the least efficient policies are the most trade-distorting, and the most efficient policies are the least trade-distorting. An empirical examination of several important policies in Canada and the United States reveals that the efficiency criteria we propose can consistently rank policies according to their trade-distorting effects whereas more conventional measures, such as the Producer Subsidy Equivalent and the Nominal Rate of Protection, often fail to measure trade distortions.

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In many countries, governments intervene in agricultural markets in order to increase the welfare of producers at the expense of consumers and taxpayers. Not surprisingly, a debate has emerged regarding the extent to which government intervention distorts the trade of agricultural commodities. A widely held belief is that the size of the transfer to producers or the degree of protection for producers is positively related to the size of the trade distortion associated with the government program. Given this belief, it has been argued that the problem of measuring trade distortions effectively reduces to one of measuring levels of producer support and/or protection. In fact, much of the background research for the GATT negotiations has been steered in this direction. It has generally been found that farm programs have a high level of support as measured by the Producer Subsidy Equivalent (PSE).

In this paper, we show that the size of a trade distortion is often not well linked to the level of producer support or protection but is closely related to a more fundamental variable: the economic efficiency of a government program. Hence, when evaluating farm programs in terms of their effect on trade, it is generally not sufficient to examine only the level of support or the degree of protection. Rather, it is necessary to examine the determinants of program efficiency and the relationship between program efficiency and the associated trade distortion.

We show that, if a given program is efficient, it cannot be trade distorting even though the transfer may be large. This has important implications because, as Gardner (1987) shows in the context of U.S. agriculture, many programs are relatively efficient. Because efficient programs do not distort trade, it follows, by definition, that the gains from the removal of efficient programs are zero.

Specifically, the purpose of this paper is to provide a new look at how farm programs can be ranked according to their trade-distorting effects. We propose a general criterion. Trade-distorting policies can be ranked according to their degree of economic efficiency. For most classes of farm programs, the more efficient a program, the lower its trade-distorting effect. Thus, a necessary and sufficient condition for a policy to be nontrade distorting is that the program transfer be 100 percent efficient. This occurs when the size of the producer subsidy is equal to the size of government plus consumer transfer. Although our approach provides a number of new and useful insights into the problem of trade distortion measurement, it should be viewed as complementary to, and not a substitute for, the traditional measures.

The criterion we propose virtually always holds when the world price of a commodity is not affected by an individual country's programs; i.e., the small-country case. In the large-country case, the criterion breaks down in a number of instances; thus, several caveats must be added to strengthen the results. For this reason, we will consider small- and large-country policies separately.

We will examine traditional measures of trade distortions, such as the PSE, throughout this paper. In addition to the theoretical section, we will provide an empirical counterpart by examining select farm programs in Canada and the United States. When one does the theoretical and empirical analysis on the efficiency of farm programs, it becomes apparent that the PSE and other related measures of trade distortions have major shortcomings.

2.1 A General Classification Scheme

Bhagwati and Srinivasan (1984) cite four principal types of distortions that can arise in the international trade arena. The distortions caused by government intervention can be conveniently classified using this taxonomy. First, domestic producers and consumers may face the same internal price (once the appropriate marketing margins are accounted for), but this price differs from the world price of the commodity. This type of distortion will arise when border policies such as quotas, tariffs, or export taxes are imposed.

A second type of distortion arises when the domestic consumer price equals the border price but differs from the domestic producer supply price. Policies which cause this type of distortion include a producer tax or subsidy which may take the form of a deficiency payment, floor price, or stabilization payment. Alternatively, a third type of distortion results when the domestic price equals the border price but differs from the domestic consumer price. Such a distortion would typically be due to a consumer tax or subsidy. Finally, a fourth type of distortion arises when a policy creates a wedge between the price that producers pay for their factors of production and the undistorted factor price.

It should be clear from the above discussion that a necessary condition for a trade distortion is that a price wedge exists between one or more sectors of the world economy. It appears, therefore, that an index capable of measuring the trade-distorting effects of policy should be based on some type of aggregation of the prevailing price wedges. In fact, a number of such indices have been developed, including the Producer and Consumer Subsidy Equivalent (PSE and CSE), Trade Distortion Equivalent (TDE), and the Nominal and Effective Rate of Protection (NRP and ERP).

Roughly speaking, the PSE is a measure of the percentage of producer income attributable to government intervention. The CSE is analogously defined. The TDE, a refinement of the PSE, nets out the components of the PSE that do not directly distort trade. The NRP is based on a comparison of domestic and world market prices. The ERP is similar to the NRP except that it also accounts for differences in the level of protection among inputs and the final product. For a more detailed description of these indices, see Zietz and Valdes (1988).

Ideally, an index of trade distortion should be able to accurately measure the size of the trade loss stemming from a particular policy. Or, at the very least, an index should be capable of ranking policies both within and across countries in terms of increasing trade distortion. Unfortunately, the indices based on price wedges are not capable of doing either with reasonable consistency. These type of indices often fail because they are based on ex post prices, which may be decoupled from ex ante incentive prices. Another reason for their failure is that these indices generally do not take into account the relative supply and demand elasticity differences when making across country and across commodity comparisons. These and other weakness will be discussed in greater detail later in the paper.

2.2 The Concept of Economic Efficiency

Before discussing our approach, which relates the efficiency of a policy to its effect on trade, it is useful to define a number of concepts that will be used throughout the analysis and to develop an important qualification of our results. Figure 1 illustrates a closed economy with demand given by D and supply given by S. Before any policy is introduced, the market clearing price and quantity are P_f and Q_f, respectively. Now, suppose the government supports the producer price to P_s. Because producers will respond to the higher price and produce Q_s rather than Q_f, it is necessary for the consumer price to fall to P_c in order to induce them to consume the extra production. Since the government must pay producers the difference between the consumer price and the support price, it spends the amount, a+b+c+d+e.

Since producers gain a+b and consumers gain c+d, it is obvious that producers and consumers do not receive the full amount of the government transfer. Indeed, the government transfer exceeds the sum of producer and consumer gain by area e. Area e is the social welfare cost (i.e., the efficiency loss) of the farm program.

Formally, the degree of efficiency (E) of this program is defined as the ratio of producer gain and the sum of government expenditures and consumer costs. In Figure 1, $E = (a+b)/((a+b+c+d+e)-(c+d)) = (a+b)/(a+b+e)$. Because area e grows proportionately faster than government expenditures, the efficiency of the program decreases as the price support increases.[1] It is important to note that if the supply curve is price inelastic (i.e., vertical), then the price support program is 100 percent efficient. This is because all of the government transfer is actually received by the producers. In such a case, output is not affected by the price support program.

In the above context, the PSE measure can be specified. The U.S. Department of Agriculture (1988) defines the PSE as the ratio of producer support from a farm program to producer revenue, including government support. Chattin (1987) provides a good description of how the PSE has typically been used as a measure of government subsidies. In Figure 1, the PSE is equal to $[(P_s - P_f)Q_s]/P_sQ_s = (P_s - P_f)/P_s$. Notice that, given the support price P_s, the PSE is not affected by the nature of the supply curve even though the degree of efficiency of the farm program is affected. Thus, there is an inconsistency since the producer benefit from the government transfer is related to the nature of the supply curve.

Because we assumed that the commodity in question is not traded, it necessarily follows that there is no relationship between the efficiency of the policy and the level of trade distortion. This result also holds when a country insulates its producers and consumers by using an import or export quota. (For example, a subsidy provided to producers protected by an import quota is generally inefficient but it may not be trade distorting.) In such cases, the trade distortion is directly determined by the trade restriction and is no longer linked to other domestic policies. Consequently, for the remainder of the analysis we shall focus on open economies which do not place quantitative restrictions on trade.

Finally, it is important to note that the underlying framework of our analysis is inherently static in nature and must, therefore, be interpreted carefully in a dynamic context. For example, the U.S. target price and acreage set-aside policy may be both efficient and nontrade distorting in the short run because price and output are decoupled. However, over a period of several years farmers may attempt to have the program yields adjusted upward. If this should happen, the target price/acreage set-aside policy will no longer be efficient and will, consequently, distort trade. These dynamic effects are not explicitly captured by the criteria proposed in this paper; therefore, our results must be interpreted accordingly.

2.3 Small-Country Policies

2.3.1 Efficiency—Distortion Relationship

The notion of program efficiency is perhaps most relevant in the context of international trade. Figure 2 illustrates the case where the government of a net exporting country introduces a deficiency payment to raise its producer price to P_s, which is above the world price P_f. From the supply schedule, S, it follows that producers will increase production from Q_f to Q_s. This increase in production represents a trade distortion.

The cost to the government of providing the deficiency payment is given by area a+b in Figure 2. Notice, however, that producer welfare has only increased by area a. Consequently, the efficiency of the program is given by a/(a+b). There are two important points to note. The first is that, as the deficiency payment increases, area b grows proportionately faster than area a, implying that the efficiency of a policy is inversely related to the size of the deficiency payment.[2] Since the trade distortion necessarily increases as the deficiency payment increases, it therefore follows that the efficiency of a policy and the level of trade distortion are inversely related. The second point is that, the steeper the supply curve, the greater the efficiency of the transfer and the smaller the trade distortion for a given per-unit subsidy.

2.3.2 Rankings Across Commodities

The above analysis must be extended to rank the programs affecting different commodity groups. For example, suppose an equal price support is applied to two commodities, one with a relatively low export volume (commodity 1) and one with a relatively high export volume (commodity 2). Figure 3 illustrates the excess (export) supply curves of these two commodities. For simplicity, assume that both commodities are exported at a world price P_f. If the price of both of these commodities is supported to P_s, then the exports of commodity 1 will increase from Q_f^1 to Q_s^1 and exports of commodity 2 will increase by an identical amount, Q_f^2 to Q_s^2. Based on our previous discussion, it is clear that the program affecting commodity 1 is less efficient than program 2, even though the trade effects are identical.[3] However, measuring trade distortions in an absolute sense is not correct. Clearly, a trade distortion must be viewed in a relative sense. In Figure 3, the relative trade distortion for commodity 1 is $\left(Q_s^1 - Q_f^1\right)/Q_s^1$ and, for commodity 2, is $\left(Q_s^2 - Q_f^2\right)/Q_s^2$. Because $Q_s^1 - Q_f^1 = Q_s^2 - Q_f^2$ and $Q_s^2 > Q_s^1$, it follows that the program affecting commodity 2 (i.e., the relatively efficient program) causes a lower relative trade distortion than the program affecting commodity 1. Thus, our result: a relatively more efficient program will cause a relatively smaller trade distortion.

2.3.3 Supply-Side Polices Versus Border Policies

In the previous section we demonstrated that more efficient programs imply lower relative trade distortions regardless of the export volume of the commodity. In this section we show that certain types of policies are intrinsically more efficient than others, even though both types of policies may have similar effects on trade. In particular, for equal levels of trade distortion, programs that affect the producer price only (i.e., pure supply-side policies) are always more efficient than programs that affect both producer price and domestic consumer price (i.e., combined policies).

Figure 4 illustrates this point. Domestic demand and supply are given by D and S, respectively. At the world price, P_f, domestic production is $0Q_f$, domestic consumption is $0D_f$, and imports are Q_fD_f. If a per-unit tariff of $P_s - P_f$ is imposed on imports, then both domestic producer and consumer prices rise to P_s and imports are reduced to Q_sD_s. As a result of the tariff, domestic producers gain area c, the government gains area e+f in tariff revenue, and domestic consumers lose area c+d+e+f+g. The efficiency of the program is, therefore, given by c/(c+d+g) and the absolute trade distortion is given by $Q_fQ_s + D_sD_f$.

Suppose that a support price of P_s' rather than a tarrif had been used to support producer income in Figure 4. In this case, producers would gain area a+c and the government would spend area a+b+c+d+e, implying that the program efficiency is given by (a+c)/(a+b+c+d+e). Notice that the absolute trade distortion caused by the price support, Q_fQ_s', is identical to the absolute distortion caused by the tariff (i.e., $Q_fQ_s' = Q_fQ_s + D_sD_f$). However, the price support, which affects the producer price only, is more efficient than the tariff, which affects both the producer and consumer prices; i.e., c/(c+d+g) < (a+c)/(a+b+c+d+e).[4]

As a result of the intrinsic differences in program efficiencies, it is necessary to qualify the general relationship between program efficiency and trade distortion. For all pure supply-side policies, the original result holds: The more efficient a particular policy, the lower the relative trade distortion will be. Also, if a pure supply-side policy is less efficient than a combined supply-side—demand-side policy, then it necessarily must be more trade distorting. However, if a pure supply-side policy is more efficient than a combined policy, then it is not possible to tell which distorts trade more (unless the specific elasticities are known), since supply-side policies are intrinsically more efficient.

2.3.4 Ex Ante Versus Ex Post Policies

Some farm programs are ex ante in that the price support is known at the time of planting. In other programs, however, the policy is announced after production decisions have been made (e.g., the 1988 drought payments in Canada and the United States). The distinction between which programs are ex ante in nature and which are ex post can be important when examining trade impacts. It is also important to consider whether producers anticipate ex post programs prior to production. Indeed, at the extreme, the distinction between ex ante and ex post programs becomes irrelevant when programs are perfectly anticipated by producers. When this is the case, a dynamic expectations model is required to capture the true effects of farm programs on trade flows. The following illustrates our point.

Consider Figure 5, where D is domestic demand (assumed perfectly inelastic) and S is domestic supply. Initially, producers expect world price, P_s, so they produce Q_s and expect to export D_0Q_s. However, after planting, suppose that the price drops to P_w and the government introduces a deficiency payment of size $(P_s - P_w)Q_s$. Notice that this is a 100 percent efficient program since the total transfer is received by producers or, alternatively, output has not been affected. Also notice that the volume of exports has not been affected by the deficiency payment, implying that the trade distortion is zero even though the PSE would take on a positive value.

In the following year, if the deficiency payment is totally capitalized into expectations (i.e., producers expect the support price P_s) but the world price remains at P_w, then a trade distortion of Q_wQ_s will result. This expectation has the same effect on efficiency and trade as does an ex ante price support of P_s. On the other hand, if the transfer does not influence price expectations (i.e., producers expect P_w), then the deficiency payment from the previous year is not trade distorting. Interestingly, with a vertical supply curve, it makes no difference how a deficiency payment affects price expectations since, in such a case, neither a deficiency payment nor a price support can be trade distorting. In general, when the supply curve is less than perfectly inelastic, ex ante price supports will be less efficient and more trade distorting than will ad hoc type programs such as drought payments or deficiency type payments that are not linked to support payments.

2.3.5 Input Subsidies

Finally, it is useful to examine the efficiency and trade effects of an input subsidy. In Figure 6, domestic demand is given by D and domestic supply is initially given by S_0, implying that at the world price (P_f), consumption is D_f, production is Q_f, and exports are D_fQ_f. Suppose that the government subsidizes the inputs used by producers by $P_s - P_f$ per unit of output. This effectively shifts the supply curve down to S_1 and induces producers to supply Q_s; consequently, exports increase by Q_fQ_s.

The cost to the government of providing the input subsidy is given by area a+b. (Note that area a+b equals the area between the two supply curves up to Q_s.) However, because producers only benefit by area a, it follows that the efficiency of the subsidy is a/(a+b). Note that the input subsidy has the same effect on producer welfare, government expenditures, and trade as does a producer price support of P_s. However, the PSE measure differs. The PSE associated with the input subsidy is given by $(P_s - P_f)/P_f$, and the PSE associated with the price support is given by $(P_s - P_f)/P_s$. Consequently, farm programs which include input subsidies (e.g., Canadian freight subsidy) will register a higher PSE than will a price support policy, even if both policies have the same effect on trade.

2.4 Large-Country Policies

In many circumstances, a country's policies will have a nonnegligible effect on the world price, implying that the small-country assumption is no longer valid (for example, the U.S. wheat trade). In this section the relationship between the efficiency of a program and the program's affect on trade is developed for a large country. The results are not nearly so concise as they were in the small-country case, however. Nevertheless, with sufficient caveats, a number of weaker results can still be set forth.

2.4.1 Price Supports

Figure 7 depicts a model for an export good where price supports are used in the absence of quantitative restrictions. With a price support of P_s, trade is distorted by Q_1Q_2. The cost of the program, measured in absolute terms, is the cross-hatched area. It therefore follows that: (1) the more inefficient a program, the more its trade-distorting effect, and (2) for a given price support, the more elastic the excess demand schedule, the smaller the loss in efficiency; likewise, the more inelastic the excess supply curve, the smaller the loss in efficiency.

In comparing programs of different commodities, the following apply: (1) if the goods have identical supply and demand elasticities, the program having the higher price support is more inefficient and more trade distorting; (2) if two goods have the same price support and demand elasticities, the program corresponding to the good with the more elastic supply is less efficient and more trade distorting; and (3) if the commodities have the same price support and supply elasticities, the program corresponding to the good with the more inelastic excess demand is the less efficient and more trade distorting.

Figure 8 shows how both the efficiency and PSE criteria can break down in the large-country case. Two goods are considered with different supply and demand elasticities; both have price supports (P_s and P_s'). Note that program II is much more inefficient than program I, even though both affect trade equally. The PSE is larger for program II than for program I, if measured at prices P_w and P_w' rather than at free-trade prices P_f and P_f'. The opposite is true if the PSE is measured at free-trade prices. In either case, the PSE has the same problem as the efficiency measure in that it cannot rank programs according to their trade-distorting effects.

In Figure 8, note the difference in the effect of price supports on the total value of exports. With program I, the total value of exports increases, while in II it decreases. Thus, it appears that the lower the efficiency of a program, the greater the relative fall in the value of exports, even though the effects of the programs on physical trade do not vary. This result follows because, the more inelastic is the excess demand, the lower the program efficiency; in addition, as the price falls to importers due domestic price supports, the total value of exports drops if the excess demand curve is price inelastic.

2.4.2 Price Supports and Acreage Controls

Programs in the United States for commodities such as corn and wheat combine price supports and acreage set-asides. These cases are depicted in Figure 9. The free-trade price is P_f and free-trade exports are Q_f. Suppose that, at support price P_1, production is controlled to the free-trade level. This program is efficient and not trade distorting. However, the government has transferred the area, P_1abP_f, to producers . Note that, if the support is at P_2, the program is still efficient, even though government transfers increase to P_2cbP_f.

A problem with PSE measures is apparent. Large PSE measures are attached to the program, even though it is efficient and, hence, not trade distorting. Understanding this is crucial since, in the United States, major commodities such as corn and wheat have these types of programs. How far production is to the right of Q_f (due to the Farm Bill) is, as always, an empirical question. For a given commodity, the further production is to the right of Q_f when combined with price supports, the greater the trade-distorting effects and the degree of inefficiency.

Suppose, in Figure 9, a price support of P_1 generated an output of Q_1 and, hence, a trade-distorting effect of Q_fQ_1. The efficiency loss of the program is the cross-hatched area. It follows that, for a given price support and acreage set-asides, the greater the elasticity of the excess demand curve and the more inelastic the free-trade supply curve, the less inefficient the program. Note that, while the free-trade supply curve elasticity does not change the size of the trade distortion, it does affect the program's degree of inefficiency.

Figure 10 depicts programs for goods I and II. The price support is set at P_s for good I, and, at P_s' for good II. The PSE is the largest for good I, which is produced under the most efficient program; i.e., the cross-hatched area for good II is far greater than for good I. This model demonstrates that, given the production controls, the PSE can change without affecting either trade distortions or the farm program's degree of inefficiency. For example, if the price support for good II were increased to P*, the PSE would increase for good II but nothing else would change except that the government would increase its payments to producers.

2.5 Empirical Results

In this section, a number of the relationships derived earlier are reexamined in the context of Canadian and U.S. agricultural policy. The ultimate objective is to demonstrate that ranking policies according to their effects on trade is equivalent to ranking them by their degree of economic efficiency. To contrast this approach, the same policies will be ranked according to their associated PSE measure. Not surprisingly, the PSE ranking scheme does not consistently rank policies in terms of their effect on trade; the TDE, however, does.

2.5.1 Canadian Agricultural Programs

The programs included in the empirical exercise cover a wide range of Canadian policies. Fulton, Rosaasen and Schmitz (1989) provide a complete description of the most important of these policies. A summary of their work is provided below:

Western Grain Transportation Act (WGTA). Under this act, the Canadian government provides rail companies with an annual payment of up to $658.6 million (plus an inflationary index) to cover the transportation of eligible grain shipments to select shipping terminals. The program, enacted in 1983, is generally perceived by farmers as being a relatively stable policy.

Western Grain Stabilization Act (WGSA). This voluntary program allows farmers to contribute a percentage of their gross sales to a stabilization fund. The Canadian government also contributes to the fund by adding approximately 50 percent of the producer contribution. The program is designed to pay out when net cash receipts from the seven major grains produced in the Prairie region falls below 90 percent of the five-year average net cash flow. Payouts to the Prairie region equalled $223 million, $522 million, $859 million, and $1,398 million for the crop years 1983/84 to 1986/87 respectively. In 1987, it was necessary for the federal government to inject $750 million into the fund to offset the program's large deficit.

Crop Insurance. This is essentially a voluntary production-guarantee program. Premiums paid by producers are matched by the federal government; administrative costs are paid by the provincial governments. If necessary, the crop insurance program is supplemented with disaster relief payments to offset the effects of drought (such as in 1988/89) or flooding.

Special Canada Grains Program (SCGP). The SCGP was introduced in 1986 to facilitate a $1 billion transfer from the federal government to Canadian grain and oilseed producers. The purpose of the payout was to offset the loss incurred by producers resulting from the subsidy war between the United States and the European Community (EC). An additional $1.1 billion was paid out in 1987 as part of the same program.

Canadian Wheat Board (CWB) Initial Price Guarantee. As part of the price-pooling scheme implemented by the CWB, western Canadian wheat producers are guaranteed an initial payment for their commodity when delivery is made. The CWB, upon consultation with the federal government, sets the initial price at a level somewhat below the expected export price of the commodity. After all grain deliveries have been made, the residual balance in the CWB accounts is paid out to producers. If the residual balance is negative (due to an unexpected fall in the export price), then the federal government pays the deficit.

Agriculture Stabilization Act (ASA). The federal and provincial ASA programs provide price stabilization to a large number of commodities, including beef and pork. The federal ASA program requires no producer levies and makes payouts based on a trigger mechanism related to historical market prices and the indexed cost of production.

In the prairie region, wheat is the predominant agricultural commodity produced. Of the agricultural programs described above, all but the ASA have a direct affect on the revenues farmers derive from wheat production. In recent years, transfers from the Canadian government to wheat producers have been relatively large (Table 1). The efficiency of these transfers, as indicated in the previous section, depends on the elasticity of wheat supply and the extent to which ex post transfers affect ex ante production.

Incorporating data from Table 1, Table 2 details the efficiency of aggregate transfers to wheat producers in 1986 as well as the PSE associated with the transfers and the relative trade effects. The measures are derived under alternative supply elasticity assumptions and alternative assumptions regarding the proportion of the transfer affecting the ex ante supply price. Not surprisingly (but probably unrealistically), if none of the transfers influence production, then the policies are 100 percent efficient and result in a zero trade distortion, regardless of the elasticity of supply. On the other hand, if all of the transfers are assumed to affect production, then transfer efficiency is 96.2 percent for the relatively inelastic supply curve and 84.3 percent for the relatively elastic supply curve. The efficient transfer is associated with low relative trade distortion, while the inefficient transfer is associated with large relative trade distortion. If the supply elasticity equaled 0.4, and half of the transfers in 1986 influenced production, then a 13.3 percent distortion in trade (implying increased exports of roughly 3.7 million tonnes) would have resulted.

Interestingly, the level of trade distortion and the PSE measure are negatively correlated in Table 2. Notice that when the transfers are 100 percent efficient (implying a zero trade distortion), the PSE takes on its maximum value of 46.9 percent. Conversely, the least efficient program, which causes the highest relative trade distortion, has the lowest PSE (equal to 37.8 percent). This is because the transfer per unit of post-policy production is lower for more highly elastic supply curves, or when a higher fraction of the transfer is assumed to affect production. Clearly, the PSE would serve poorly as a indicator of relative trade distortion in this case.

It is also useful to rank a number of other Canadian agricultural policies using the methodology developed in this paper. To contrast how the efficiency of many of these policies has evolved, we will consider policies in place in both 1976 and 1986. Table 3 details Canadian domestic production and consumption levels, as well as the price wedges which existed for the selected commodities in 1976 [estimated by Harling and Thomas (1983)] and 1986 [estimated by USDA (1988)]. With no Canadian government intervention, all of the price wedges would necessarily be equal to zero. The price wedges were calculated using the following price definitions: The supply price is the price which producers are assumed to use when making their ex ante supply decisions. The incentive price is the supply price plus any input subsidies measured in terms of value per unit output. The market price is the total price received by producers, including decoupled ex post transfers. The price wedges for wheat and barley in 1986 were calculated using the assumption that the value of all programs other than WGSA and SCGP payments, divided by total production, equals the difference between the producer incentive price and the export price.

Table 4 details the assumed demand and supply elasticities and the derived estimates of consumer, producer, treasury, and social gains and losses from these Canadian programs. Table 5 presents these programs (both the 1976 and 1986 groupings) ranked in terms of their economic efficiency, CSE, PSE, and TDE measures. It also lists the calculated trade distortions, expressed in terms of absolute volume and value (measured at border prices), and as a percentage of post-policy production.

Table 5 demonstrates a number of noteworthy points. First, ranking policies according to increasing relative trade distortion is equivalent to ranking them according to decreasing economic efficiency. The 1976 policies tend to be relatively more efficient than those in 1986; they also tend to be relatively less trade distorting. The relationship between policy efficiency and trade distortion breaks down if policies are ranked in terms of volume of trade distorted as opposed to volume of trade distorted relative to post-policy production. For example, the Canadian sugar policy is the most inefficient but does not result in the highest absolute trade distortion.

Not surprisingly, policies ranked according to increasing PSE measures are not consistent with the original policy ranking. For example, sugar production in 1986 has the third highest PSE (49.38 percent), yet causes the highest relative trade distortion. Also, potatoes have a higher PSE than pork; but the relative trade loss is lower for potatoes. Note that 1976 barley policies and 1986 wheat policies have roughly the same proportional effect on trade, yet the PSE for wheat is nearly four times that of barley. Finally, the TDE, developed by Rausser and Wright (1987), provides a consistent ranking of policies because it nets out ex post transfers which, by assumption, do not affect the producer incentive price.

2.5.2 A Brief Look at U.S. Agricultural Policy

In the previous section, a number of Canadian policies were examined in detail. The general relationship between program efficiency and trade distortion stood up well in the Canadian case since Canada is generally classified as a small country in many of the agricultural commodities it trades. In this section, we examine certain U.S. programs, but in less detail. To facilitate this discussion, it is useful to contrast the effects of U.S. policy on the production of rice (where the United States has very little influence on world price) to policy effects on the production of wheat (where the United States has significant influence on the world price).

Rice versus Wheat. Consider ranking a relatively low volume export good such as rice, and a relatively high volume export good such as wheat, in terms of the degree of efficiency and effect on trade of their respective policies. In Figure 11, the excess supply curve for rice is S_r, and the excess supply and demand curves for wheat are ES and ED, respectively. A price support of P_s is used in rice, while wheat has a price support of P_s', and production restricted to Q_2'. Notice that the wheat program is more inefficient than the rice program. This would be the case even if a higher price support of P* was used for rice and production was restricted to Q_2. This result holds because, as already stated, the degree of inefficiency of a program depends on the elasticity of the excess demand curve. In the small-country case, the excess production generated by price supports can be sold without affecting price, since the excess demand curve is essentially horizontal.

Imported Commodities. Consider the case of an import good such as sugar. Historically, U.S. sugar has been protected by import quotas. As a result of the wedge between the U.S. domestic price and the world price, the U.S. sugar program is believed to be inefficient. In Figure 12, S is the supply curve of U.S. sugar and D is demand. Given the world price of P_w, a quota which restricts imports to Q_1Q_2 has an efficiency loss of the cross-hatched area. (Note that the abcd quota rents go to foreign exporters.) Thus, the sugar program appears to be both inefficient and trade distorting.[5]

These conclusions can be misleading if used as a basis for freeing up international sugar markets. As we will show, the world price is not the appropriate price to use as a base upon which to measure efficiency. Recall that, in earlier models, the free-trade price was always used as the point of reference. However, in Figure 12, the reference price, P_w, need not equal the free-trade price; in fact, for sugar, it is well below the free-trade price (Schmitz and Vercammen, 1990).

Table 6 illustrates that the measure of a program's efficiency critically depends on the external reference price (which is typically the world price). Due to the increase in the world sugar price between 1988 and 1989, for example, the U.S. gain from import quota removal decreased from $242 million in 1988 to $150 million in 1989. Presumably, these gains would decrease still further (and perhaps be eliminated) if world prices continue to rise. The point is that efficiency is a relative rather than an absolute concept. As we show below, the relationship between the efficiency of a program and its trade distorting effects will generally be misleading unless the correct reference price is used.

The major problem with using the world price, P_w, as a reference point during the trade distortion and efficiency calculations can be shown in a dynamic context. Referring to Figure 12, suppose that exporters (i.e., the "other country") subsidized production at price P^*, thereby driving the world price from P_s to P_w. The United States may impose an import quota of Q_1Q_2 in reaction to foreign exporter subsidies. However, this quota would merely reestablish the free-trade level of imports for the United States. Clearly, if the world returned to free trade in sugar, there would be no impact on the United States in terms of trade volumes or producer prices. In this example, import quotas, given a distorted price of P_w, need not be trade distorting if measured relative to the free-trade solution.

To support this assertion, Schmitz and Vercammen (1990) found, in a separate study using reasonable elasticity estimates, that the free-trade sugar price may indeed approximate the current U.S. sugar price of $0.20 per pound. Alternatively stated, Schmitz and Vercammen show that unilateral liberalization by the EC may result in the world price rising to the level of the current U.S. price, since the U.S. import quota would not be binding under a complete EC phase-out.

Thus, there is a problem with both the PSE and efficiency measures when they are based on the distorted price, P_w, rather than a free-trade price. It is true that current quotas may be inefficient, given existing world prices. However, it does not automatically follow that a free-trade solution (which is efficient) would alter U.S. sugar production, prices, or imports.

In recent years, it has been argued that sugar receives relatively more protection than corn or wheat, for example, and that the sugar program is relatively inefficient. However, even if the sugar program is relatively less efficient than programs governing corn or wheat (when measured using the current world price), it does not follow that trade liberalization will affect the trade volumes of sugar relatively more than corn or wheat. Indeed, as we have shown, the effect of removing sugar programs worldwide may well have less changes on trade volumes than analogous removals of the corn or wheat programs.

Implications. Some of the major U.S. programs are considered in Table 7. Alston and Carter (1989), using an efficiency criteria (i.e., the fifth column of values), found the dairy program to be the most inefficient. Cotton, wheat, and sugar programs ranked behind dairy, even though sugar, followed by dairy and then rice, had the highest PSE. The inconsistency of the PSE as a measure in ranking commodity programs according to decreasing efficiency (or equivalently, increasing trade distortion) is similar to the findings detailed earlier in this study for the Canadian programs.

A second important implication is that estimates of the efficiency of an import quota, and the trade distortion resulting from it, will generally be biased unless an adjusted reference price is used. In particular, if a depressed world price rather than the free-trade price is used as a reference, the efficiency of the import quota will be understated and the size of the trade distortion will be overstated. As discussed earlier, it does not follow that a multilateral liberalization of the world sugar trade will bring about major changes in U.S. sugar prices and levels of imports.

Finally, we have shown that the relationship between farm programs and their corresponding affect on trade relies heavily on demand and supply elasticities. In particular, the more inelastic the excess supply curve and the more elastic the excess demand schedule, the more efficient a specified policy will be. The elasticities in Table 7 (computed by Gardner, 1987), tend to be consistent with relatively efficient programs. Comparable estimates used by the OECD, however, are more inelastic with respect to price elasticities of demand. This, therefore, gives rise to some disagreement over the extent to which U.S. programs are efficient and distort trade.

2.6 Conclusions

A great deal of effort has been devoted to computing PSE measures for the GATT negotiations. In this paper, we show that additional research should have been carried out on the efficiency of farm programs. With further research, it would have been possible to determine which programs are trade distorting and which are not. Generally, traditional measures are not able to distinguish income distribution aspects of a program from trade-distorting components. We show that not all farm programs are trade distorting, even though there may be a large associated transfer.

It is still open to debate, and has yet to be empirically shown, whether or not U.S. farm programs are actually trade distorting, given that many incorporate production controls and, thus, are at least partially decoupled. Our results show that the size of trade distortions cannot be deduced from the many PSE estimates available. If they could, it would necessarily follow that U.S. farm programs do distort trade.

As a society, we are ultimately interested in trade and other associated gains from changes in farm programs, both at home and abroad. Supporters of GATT believe that "the gains from trade" are large numbers. In this paper, we have identified the relationship between the efficiency of a farm program and the program's effect on trade. The next research endeavor, therefore, should examine how program efficiency relates to the gains from a change in farm policy. The analysis of this latter relationship follows directly from the results established in this paper, since the gains from a program change are closely related to the reduction in the corresponding trade distortions because both depend upon net social cost.

The framework discussed here can also be used to assess alternative policy prescriptions for the EC. For example, it has been argued that EC policies are inefficient since they result in a sizeable net loss in welfare. Movement toward more efficient policies, such as a production quotas, could allow the EC to maintain farm incomes at current levels while significantly reducing the impact of their policies on world trade.

ENDNOTES

[1] For example, Figure 1 illustrates that, if the price support P_s-P_f doubles, the size of area e increases by a factor of 4, while the size of area a + b increases by a factor of less than 3.

[2] To see this result in Figure 2, notice that if the size of area b increases by a factor of 4, for example, then the size of area will increase by a factor of less than 3 when the price support is doubled.

[3] This is because the dead-weight loss associated with the price support is the same for commodities 1 and 2, but the transfer to the producers of commodity 2 is larger than the transfer to the producers of commodity 1. Thus, producers of commodity 2 are receiving a relatively higher transfer.

[4] This result can easily be proven using simple geometry.

[5] As indicated earlier, one must be careful when applying the efficiency criteria to policies that involve quantitative restrictions. If the import quota is the only policy in place, then the quota is equivalent to an import tariff and our earlier results hold. However, if other domestic policies are used in conjunction with import quotas, then the efficiency criteria generally break down. Indeed, controlling the production of a commodity, as is done with supply management in Canada, for example, will generally be inefficient but not trade distorting if imports are restricted (via a quota) to the free-trade level.

REFERENCES

Alston, Julian and Colin Carter (1989), "Causes and Consequences of Farm Policy," paper prepared for the 64th annual Western Economics Association International Conference, June 18-22, Lake Tahoe, CA.

Bhagwati, Jagdish N. and T.N. Srinivasan (1984), *Lectures on International Trade*, The MIT Press, Cambridge, MA.

Chattin, Barbara L. (1987), "Measures of Government Intervention in U.S. Wheat, Corn, Sugar and Dairy Markets," AAEA paper presented at AAEA Annual Meeting, August 2-5, East Lansing, MI.

Clark, Steve (1980), "An Economic Model of Soil Conservation—Depletion of Dryland Farming in Saskatchewan", Ph.D. dissertation, University of Saskatchewan, Department of Agricultural Economics.

Fulton, M., K. Rosaasen and A. Schmitz (1989), *Canadian Agricultural Policy and Prairie Agriculture*, Economic Council of Canada, Ottawa.

Harling, Kenneth F. and Robert L. Thomas (1983), "The Economic Effects of Intervention in Canadian Agriculture," *Canadian Journal of Agriculture Economics*, Vol. 31, pp. 153-176.

Gardner, Bruce L. (1987), "Causes of U.S. Farm Commodity Programs," *Journal of Political Economy*, Vol. 95, pp. 290-310.

Rausser, Gordon C. and Brian Wright (1987), "Alternative Strategies for Trade Policy Reform", Working Paper #441, Giannini Foundation, Department of Agricultural and Resource Economics, University of California at Berkeley, Berkeley, CA.

Schmitz, Andrew and James Vercammen (1990), "Trade Liberalization in the World Sugar Market: Playing on a Level Field?", Working Paper #563, Giannini Foundation, Department of Agricultural and Resource Economics, University of California at Berkeley, Berkeley, CA.

United States Department of Agriculture (1988), *Estimates of Producer and Consumer Subsidy Equivalents: Government Intervention in Agriculture, 1982-86.* ERS Staff Report No. AGE880127, Economic Research Service , Washington, DC.

Zietz, Joachim and Alberto Valdes (1988), *Agriculture in the GATT: An Analysis of Alternative Approaches to Reform*, International Food Policy Research Institute, Research Report 70, Washington, DC.

Figure 1: Program Efficiency in a Closed Economy

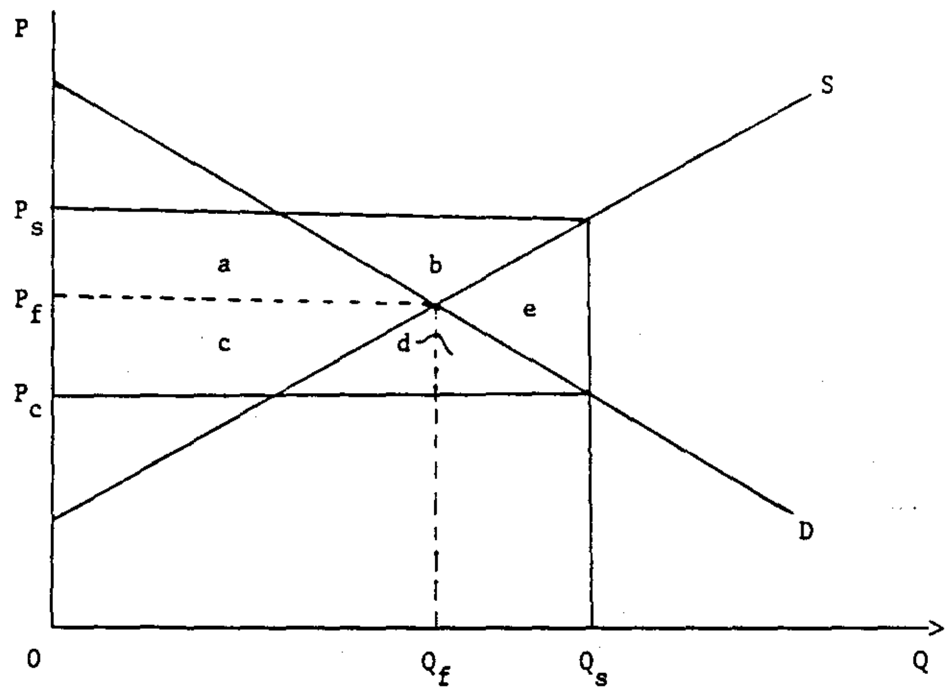


Figure 2: Program Efficiency and Trade Distortion

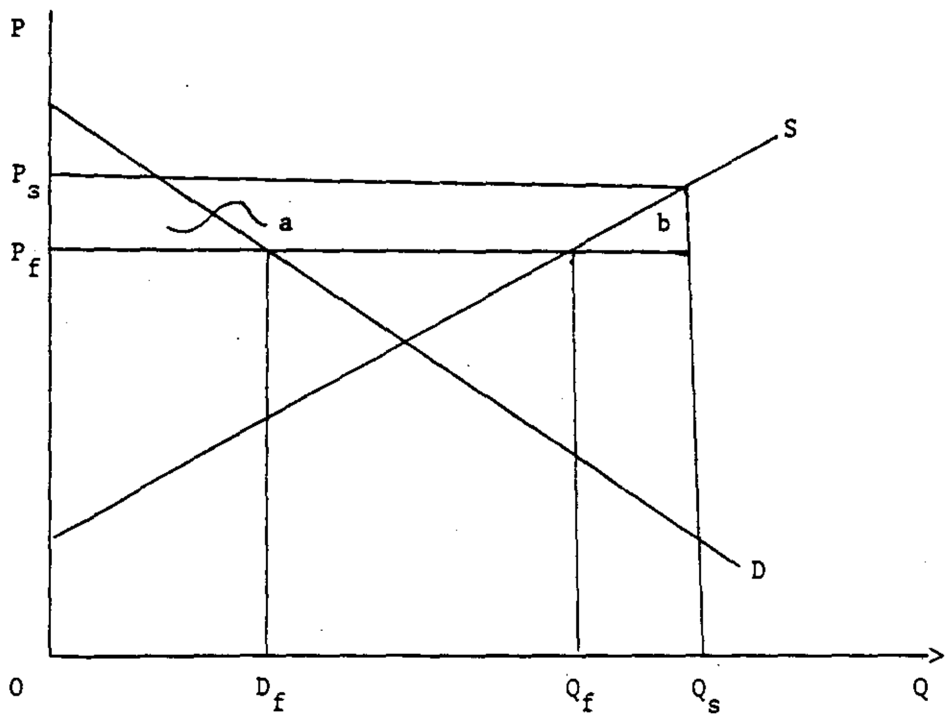


Figure 3: Efficiency and Trade Distortion under Alternative Outputs

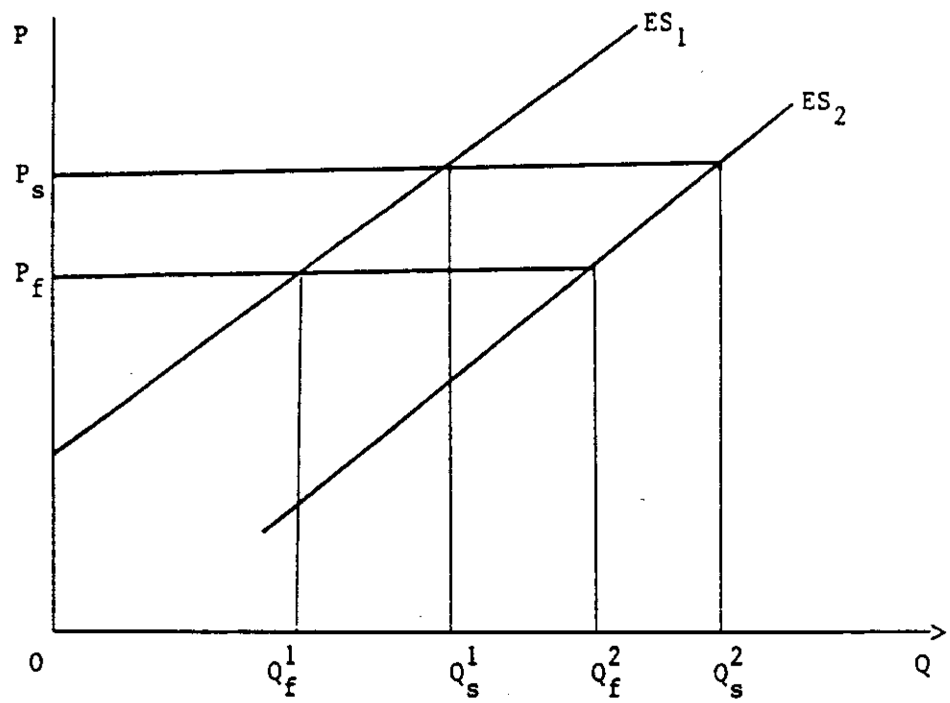


Figure 4: Comparison of Tariff Efficiency to Subsidy Efficiency

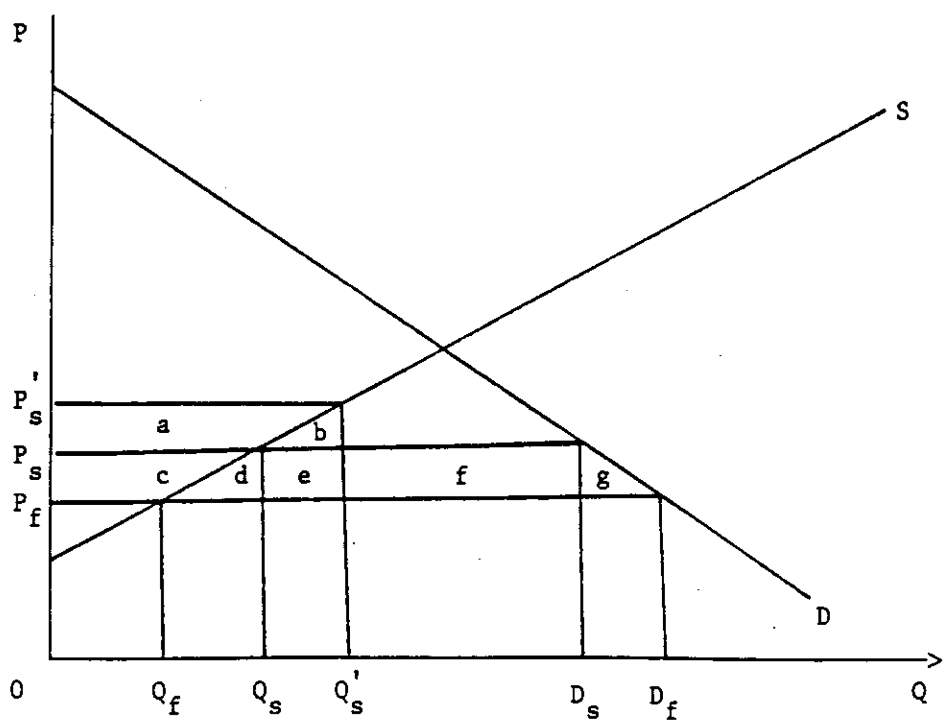


Figure 5: Comparison of Ex Ante and Ex Poste Policies

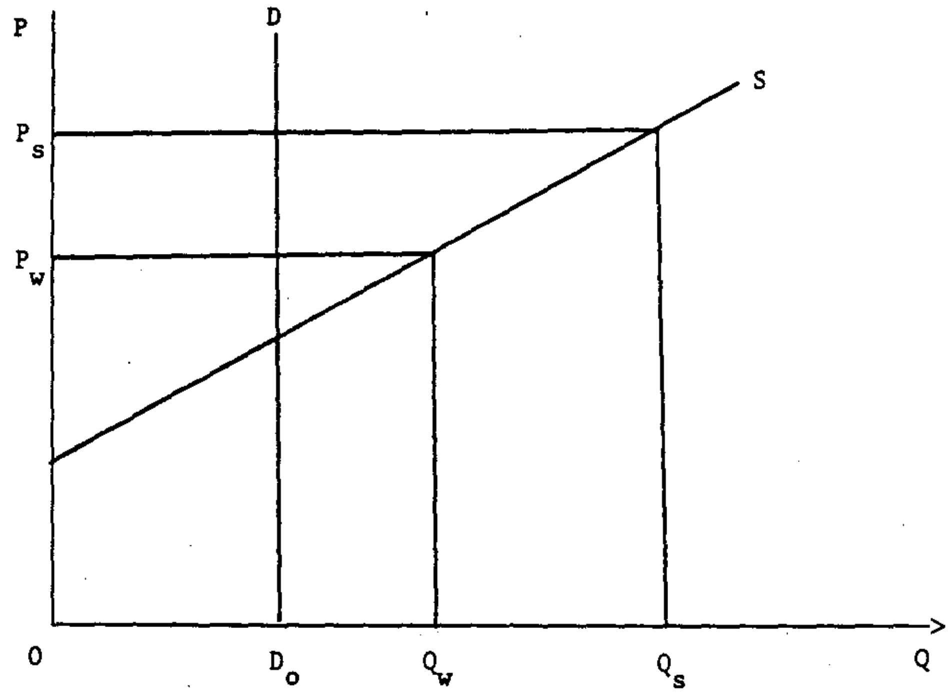


Figure 6: Efficiency and Trade Effects of an Input Subsidy

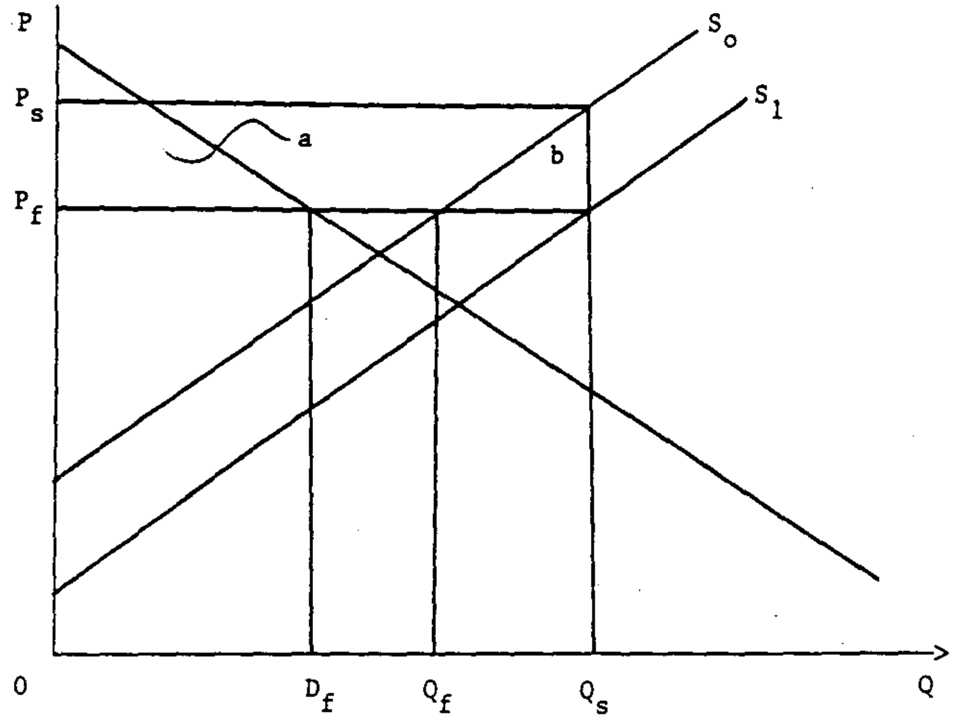


Figure 7: Price Supports in the Large Country Case

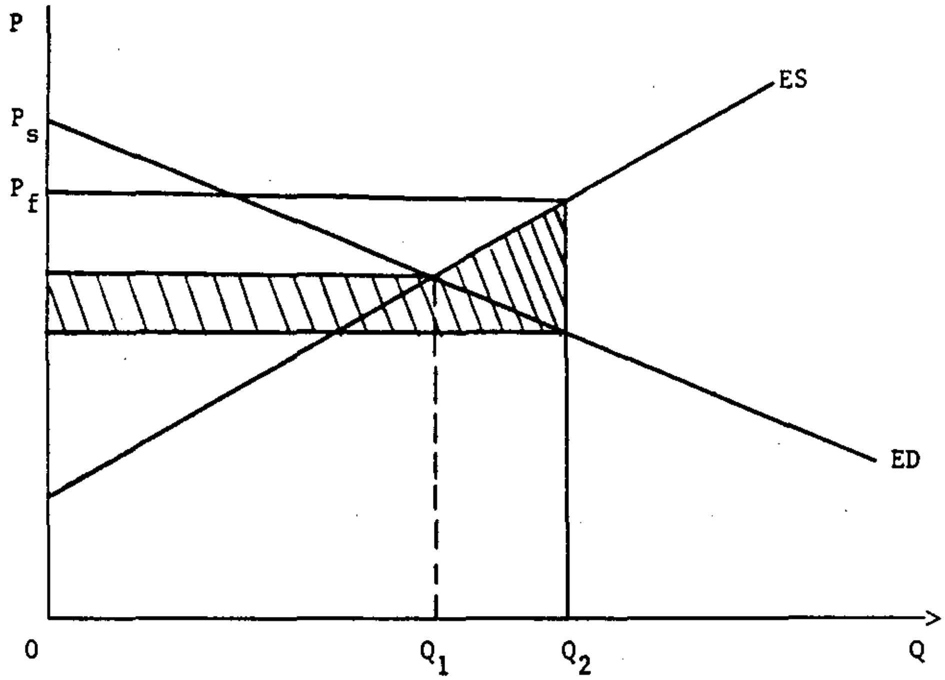
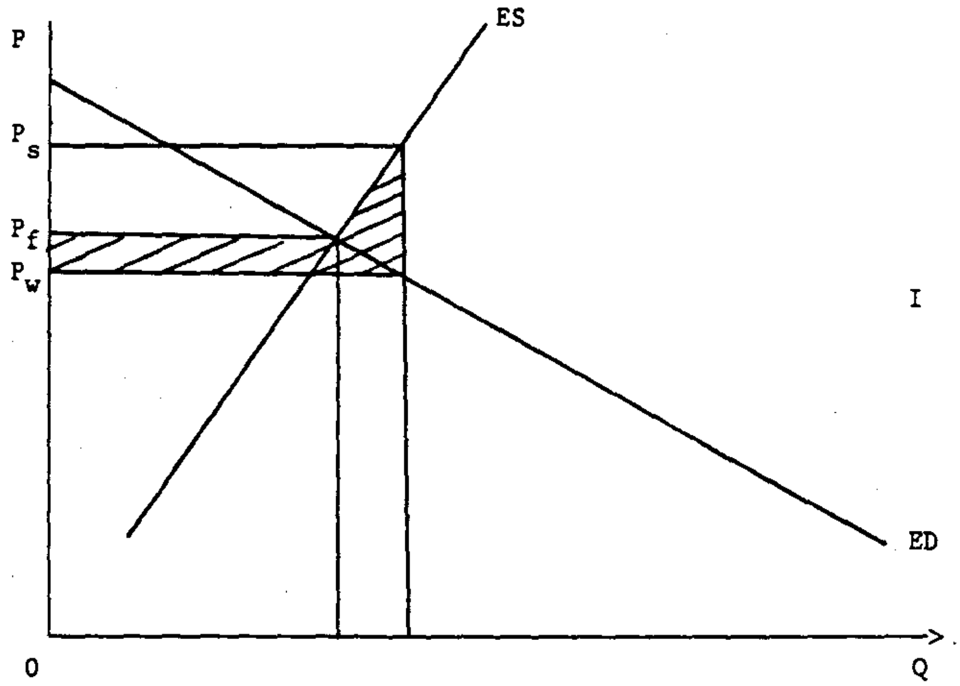


Figure 8: Efficiency Under Alternative Supply and Demand Elasticities



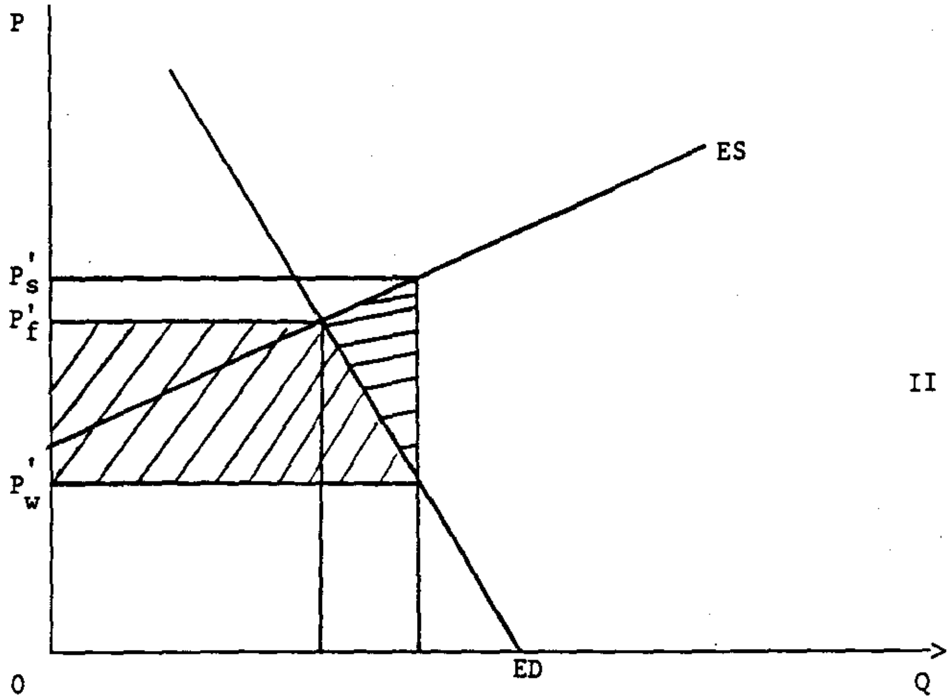


Figure 9: Price Supports, Acreage Set-Asides and Efficiency

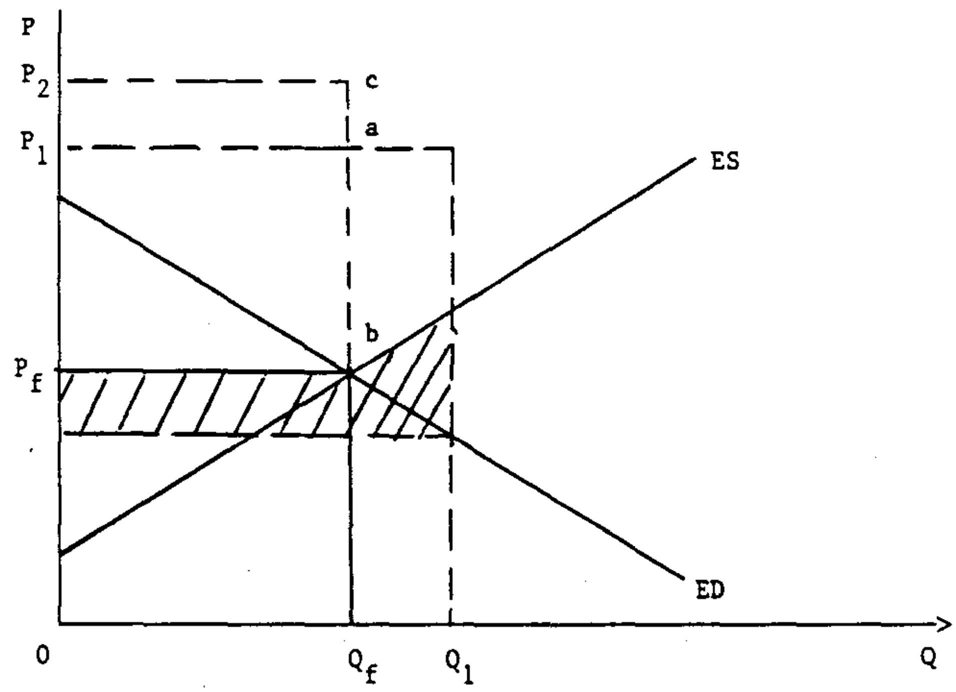


Figure 10: Price Supports, Acreage Set-Asides, and the PSE

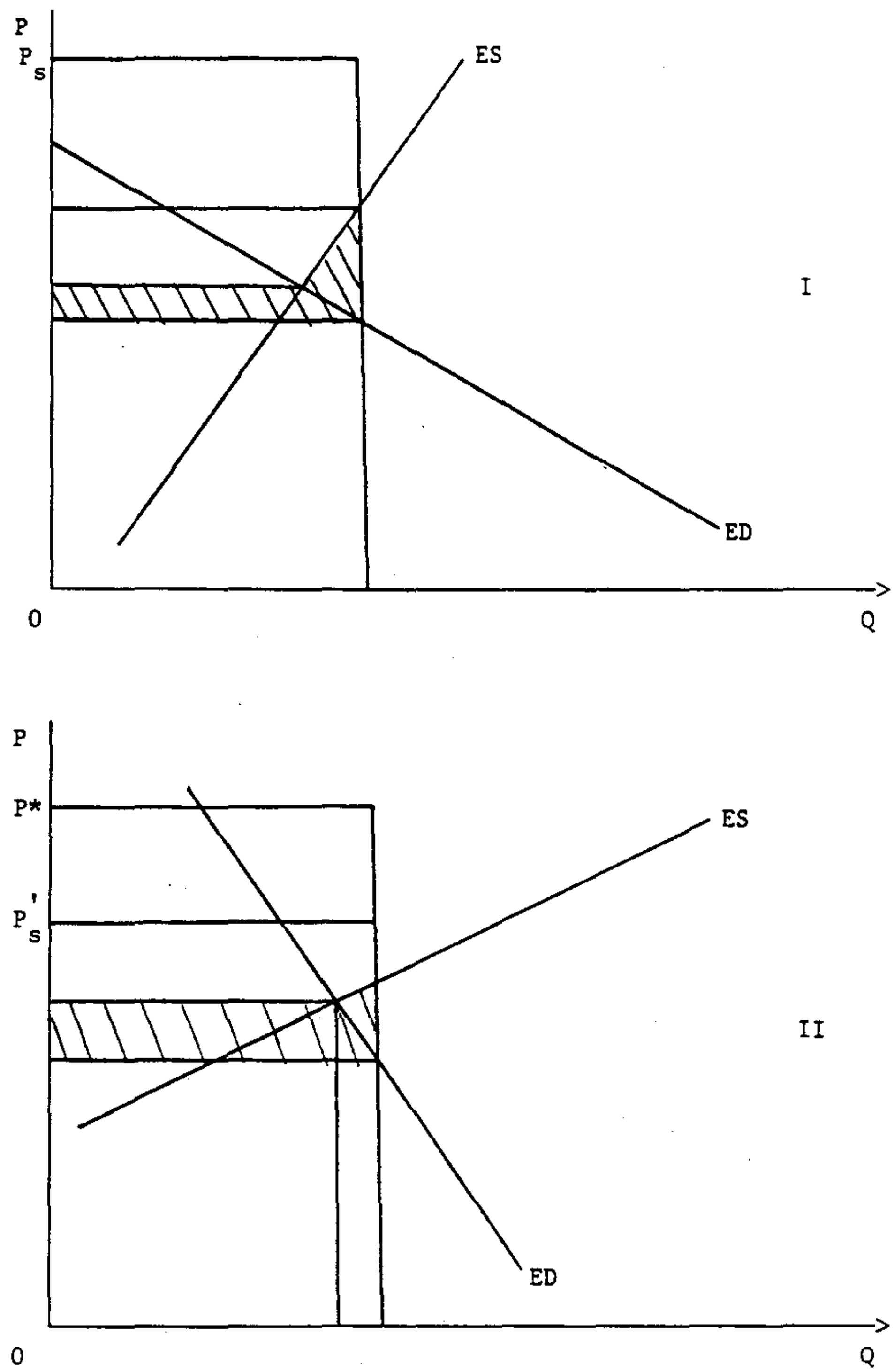


Figure 11: Comparison of Small Country and Large Country Price Supports

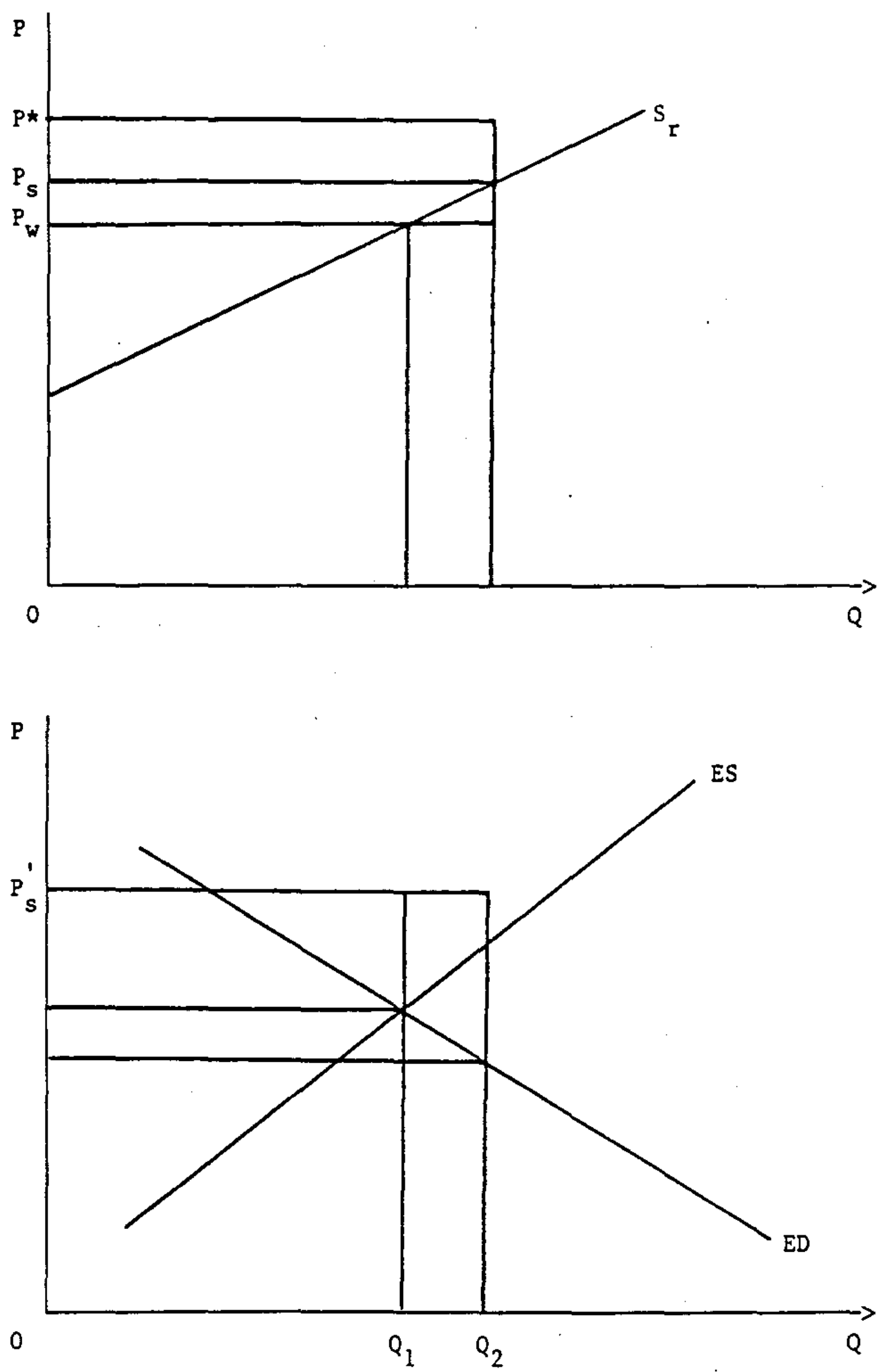


Figure 12: Trade Distortions with Two Large Countries

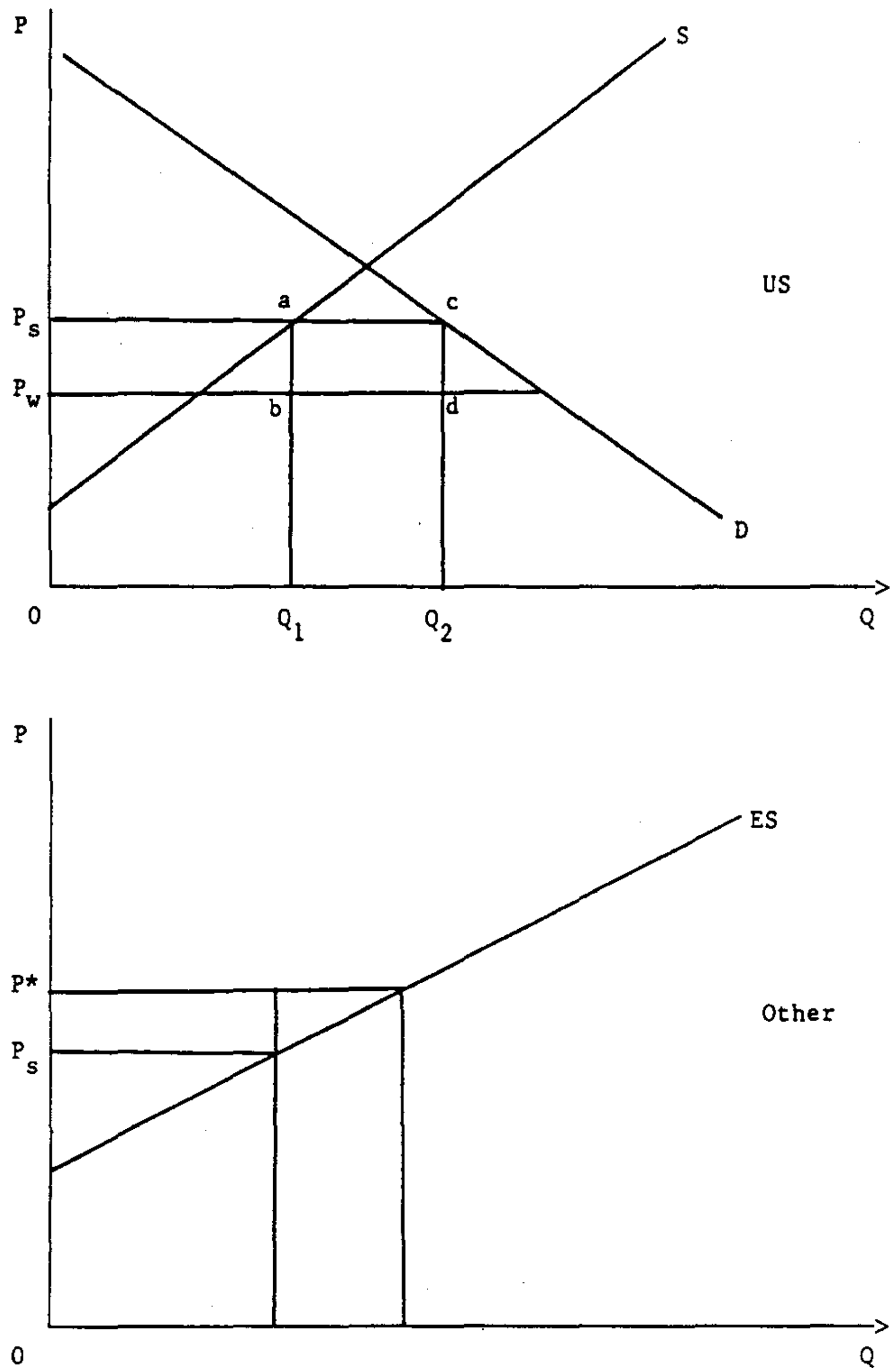


Table 1. **Transfers from the Canadian Government to Wheat Producers and Producer Subsidy Equivalent (PSE) Measures: 1982-1986**

	1982	1983	1984	1985	1986	1982-86 (average)
Level of production[a]	27	27	27	27	27	27
Producer price[b]	180	181	172	147	117	159
Value to producers[c]	4,835	4,992	4,140	4,289	5,162	4,684
Total policy transfers to producers[c]	681.7	1,007.9	1,413.9	1,452.3	2,575.5	1,426.3
Total income/price supports[c]	24.6	189.8	484.9	733.0	1,640.6	614.6
Agricultural Stabilization Act[d]	0.0	10.8	0.0	0.0	0.0	2.2
Western Grain Stabilization Act[d]	-38.8	108.1	327.8	516.3	850.5	352.8
Crop insurance[d]	61.9	67.5	174.7	211.7	131.4	129.4
Special Canada Grain Program[d]	0.0	0.0	0.0	0.0	506.7	101.3
Canadian Wheat Board pool deficit	0.0	0.0	0.0	23.0	0.0	4.6
Export credits	11.1	6.5	4.6	1.2	0.0	4.7
Corn competitive	-8.6	0.1	-0.8	0.0	0.0	-1.9
Two-price wheat	-1.0	-3.2	-21.4	-19.2	152.0	21.4
Total input subsidies[c]	25.0	27.4	39.0	87.3	59.1	47.6
Fuel subsidy	13.1	13.5	20.4	39.8	40.5	25.5
Other financial assistance	11.9	13.9	18.6	47.5	18.6	22.1

(continued)

Table 1. (continued)

	1982	1983	1984	1985	1986	1982-86 (average)
Total marketing subsidies[c]	454.9	609.3	683.5	463.2	704.6	583.1
Transportation	422.4	574.2	645.9	433.9	679.8	551.2
Inspection services	29.6	31.7	32.1	26.7	22.3	28.5
Marketing/promotion	2.9	3.4	5.5	2.6	2.5	3.4
Total long-term, structural[c]	76.7	88.9	96.6	61.9	58.4	76.5
Research and advisory	51.5	61.3	59.6	46.7	43.6	52.5
Development, structure	25.2	27.6	37.0	15.2	14.8	24.0
Provincial programs[c]	100.5	92.5	109.9	106.9	112.8	104.5
PSE	14.2%	20.2%	34.2%	33.9%	49.9%	30.4%
Total PSE (Canadian dollars/ton)	25.5	38.0	66.7	59.8	82.0	54.4
Total PSE (U.S. dollars/ton)	20.7	30.9	51.5	43.8	59.0	41.2

[a]In millions of tons.
[b]In Canadian dollars/ton.
[c]In millions of Canadian dollars.
[d]Payment to producers in addition to price received.

Source: *Estimates of Producer and Consumer Subsidy Equivalents: Government Intervention in Agriculture, 1982-86*, United States Department of Agriculture (1988), Agriculture and Trade Analysis Division, Economic Research Service, ERS Staff Report No. AGES880127, Washington, D.C.

Table 2. Policy Induced Trade Effects and Efficiency of Canadian Wheat Policy: 1986

Supply Elasticity[a]	Fraction of Transfer Coupled to Production 0	0.5	1	Results
0.1	0.00%	4.10%	7.60%	Trade Distortion
0.1	100.00%	98.00%	96.20%	Efficiency
0.1	46.90%	45.90%	45.00%	Producer Subsidy Equivalent (PSE)
0.4	0.00%	13.30%	21.70%	Trade Distortion
0.4	100.00%	93.40%	89.20%	Efficiency
0.4	46.90%	43.40%	40.90%	PSE
0.75	0.00%	20.80%	31.30%	Trade Distortion
0.75	100.00%	89.60%	84.30%	Efficiency
0.75	46.90%	41.20%	37.80%	PSE

[a] Elasticities based on 1982-1986 production and 1986 world price.

Note: Total transfers in 1986 were $2.5755 billion Canadian (see Table 1).

Source: Computed using data from *Estimates of Producer and Consumer Subsidy Equivalents: Government Intervention in Agriculture, 1982-86*, United States Department of Agriculture (1988), Agriculture and Trade Analysis Division, Economic Research Service, ERS Staff Report No. AGES880127, Washington, D.C.

Table 3. Canadian Post-Policy Production and Consumption Levels, and Policy-Induced Price Effects

Commodity	Post-Policy Production	Post-Policy Consumption	Border Price	Price Differential Between: Consumer & Border	Supply & Border	Incentive & Border	Market & Supply
	1,000 Tonnes		Canadian dollars/tonne				
1976							
Potatoes	2,314	1,595	132.27	0.00	2.65	3.51	0.00
Pork[a]	538	571	1,403.00	11.20	11.20	8.55	0.00
Beef	1,081	1,143	2,161.66	66.14	66.22	71.81	0.00
Wheat	20,175	5,166	139.19	-18.79	-4.81	10.84	0.00
Oats	4,533	4,053	93.04	0.00	0.00	12.23	0.00
Barley	10,610	6,377	90.27	0.00	0.00	12.73	0.00
1986							
Wheat	28,118	4,535	123.59	33.52	11.73	44.98	48.27
Barley	13,605	6,531	49.08	0.00	18.29	36.54	27.04
Sugar	816	945	23.52	4.66	15.69	19.36	0.00

[a]Data for 1976 based on 1975-1977 averages.

Source: K. F. Harling and R. L. Thomas (1983), "The Economic Effects of Intervention in Canadian Agriculture", *Canadian Journal of Agriculture Economics* 31:153-176.

Estimates of Producer and Consumer Subsidy Equivalents: Government Intervention in Agriculture, 1982-86, United States Department of Agriculture (1988), Agriculture and Trade Analysis Division, Economic Research Service, ERS Staff Report No. AGES880127, Washington, D.C.

Table 4. Canadian Policy-Induced Consumer and Producer Transfers and Social Cost

Commodity	Elasticities		Consumers		Producers			Treasury
					Coupled		Decoupled[b]	
	Demand[a]	Supply[a]	Gain	Social Cost	Gain	Social Cost	Gain	Net Cost
			Millions of Canadian dollars					
1976								
Potatoes	NR[c]	0.08	0.00	0.000	8.11	0.009	0.00	8.12
Pork	-0.23	0.64	-6.40	0.006	4.59	0.009	0.00	-1.80
Beef	-0.39	0.56	-76.04	0.438	76.93	0.701	0.00	2.03
Wheat	-0.10	0.52	96.31	0.757	214.27	4.428	0.00	315.01
Oats	NR[c]	0.50	0.00	0.000	53.62	1.822	0.00	55.44
Barley	NR[c]	0.50	0.00	0.000	130.30	4.762	0.00	135.07
1986								
Wheat	-0.10	0.30	-153.63	1.622	1,210.43	54.314	1,357.26	2,468.37
Barley	NR[c]	0.30	0.00	0.000	441.61	55.517	367.88	865.01
Sugar	-0.13	1.09	-4.45	0.047	9.88	5.915	0.00	11.39

[a]Demand elasticities are measured at consumer prices. Pork and beef supply elasticities are also measured at consumer prices; all other supply elasticities are measured at border prices.
[b]By definition, decoupled transfers do not have a social cost.
[c]Not required.

Source: K. F. Harling and R. L. Thomas (1983), "The Economic Effects of Intervention in Canadian Agriculture", *Canadian Journal of Agriculture Economics* 31:153-176.

S. Clark (1980), "An Economic Model of Soil Conservation—Depletion of Dryland Farming in Saskatchewan", Ph.D. dissertation, Universition of Saskatchewan, Department of Agricultural Economics.

Table 5. **Transfer Efficiency, Price Wedges, and Trade Loss for Selected Canadian Commodities**

Commodity	Transfer Efficiency[a]	Consumer Subsidy Equivalent	Producer Subsidy Equivalent	Trade Distortion Equivalent	Trade Loss[b] Volume	Trade Loss[b] Value	Trade Loss[b] Percentage
	Percent				1,000 Tonnes	1,000 Canadian $	
1976							
Potatoes	99.89	0.00	2.60	2.59	4.91	650	0.21
Pork	99.68	0.79	0.60	0.61	3.12	4,380	0.58
Beef	98.54	2.97	3.22	3.22	32.75	70,788	3.03
Wheat	97.98	-15.61	8.07	7.23	736.41	102,501	3.65
Oats	96.71	0.00	13.14	11.62	297.93	27,719	6.57
Barley	96.47	0.00	14.10	12.36	748.12	67,533	7.05
1986							
Wheat	95.71	21.34	50.79	26.68	2,511.78	310,431	8.93
Barley	88.83	0.00	67.34	42.68	3,038.67	149,138	22.33
Sugar	62.37	16.54	49.38	45.15	631.37	14,850	77.37

[a]Efficiency is calculated as the ratio of producer gain (basis incentive price) to the sum of treasury cost (less decoupled transfers) and consumer loss.
[b]The trade loss value is the trade loss volume valued at the border price.

Computed using data from Tables 3 and 4.

Table 6. Economic Welfare Effects of Removing Sugar Quotas in the United States: 1988-89

	1988	1989
Consumer Benefit		
On purchases of the domestic market	997	894
On purchases of the imported market		
Quota rents recovered	157	137
Deadweight loss recovered	126	74
Total Consumer Benefit	1,280	1,105
Producer Subsidy Cost	-1038	-955
Net Welfare Gain	242	150

Estimated by the staff of the U.S. Trade Commission.

Table 7. U.S. Income Transfer Costs and Market Elasticities

Commodity	Demand Elasticity	Supply Elasticity	Degree of Protection (100 = World Price)	Average Cost per Dollar Transferred (1987)[a]		Producer Subsidy Equivalent[b]
				(a)	(b)	
Feed Grains	.75	.40	127	$1.16	$1.38	27.06
Wheat	3.0	.50	137	$1.54	$1.85	36.49
Rice	2.2	.60	145	$1.20	$1.44	45.20
Cotton	.5	.50	140	$1.67	$2.00	
Sugar	.2	.40	178	$1.82	$1.82	77.37
Dairy	.65	.50	154	$2.00	$2.22	53.93
Tobacco, peanuts, and wool	1.5	.40		$0.80	$0.92	

[a]Average transfer costs from Gardner (1987) reported on column (a). Costs in column (b) reflect the assumption that the deadweight cost of raising taxes is 20 percent.
[b]Producer Subsidy Equivalent figures reflect 1982-1986 average.

Note: Blanks indicate data not available.

Source: Julian Alston and Colin Carter (1989), "Causes and Consequences of Farm Policy", paper prepared for the 64th annual Western Economics Association International Conference, Lake Tahoe, CA, June 18-22.

Bruce L. Gardner (1987), "Causes of U.S. Farm Commodity Programs", *Journal of Political Economy* 95:290-310.