The Impact of the U.S. Export Enhancement Program on the World Wheat Market

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Abstract

The U.S. Export Enhancement Program (EEP) was built into the 1985 U.S. Food Security Act with a major objective being to increase sales of U.S. agricultural commodities. Through the EEP, the U.S. government subsidizes exports of agricultural commodities to targeted countries. The EEP was applied to the majority of U.S. wheat sales in 1987/88 and 1988/89. Coincident with the 1985 act and EEP legislation, U.S. wheat exports have increased significantly.

This study uses a nonspatial, partial equilibrium model of world wheat trade to analyze the impact of the EEP on U.S. wheat exports and share of world wheat trade. The study indicates that the effect of the EEP on the wheat market over the period 1986/87 to 1988/89 has been a large displacement of commercial wheat sales (87-92%), with export additionality due to the EEP being only 8-13%. The impact of the EEP on other exporters' wheat trade and importer demand has been small relative to the magnitude of total EEP sales.

Introduction

U.S. wheat exports declined significantly from a peak level of 48.2 million metric tons (mmt) in crop year 1981/82 to 25.2 mmt in 1985/86. In addition, the value of export index for U.S. wheat declined by 45 percent over the same period.[1] The reasons for this dramatic decline were generally attributed to the appreciation of the U.S. dollar, debt problems of developing countries, slow income growth in many importing countries, legislated loan rate levels for wheat in the United States that caused a significant increase in U.S. government stocks and provided a high price floor for other exporters, and unfair export subsidization by competing wheat exporters (U.S. General Accounting Office 1988).

The dramatic reversal of export value and volume after a decade of steady growth was a significant factor in the design of the Food Security Act of 1985. This act, covering crop years 1986/87 to 1990/91, included, inter alia, significant reductions in U.S. Commodity Credit Corporation loan rates, high target prices to support U.S. farm income, acreage reduction programs to control domestic production, and the Export Enhancement Program (EEP) to provide export subsidies to certain importing countries to increase exports and remove excess commodity stocks.

Since the implementation of the 1985 act, U.S. wheat exports have increased significantly, to 43.3 mmt in 1987/88. This increase is attributed to many factors, including low yields due to drought in major wheat exporting countries; large increases in import demand by the Soviet

Union, the People's Republic of China, and Eastern Europe; depreciation of the U.S. dollar; the lower wheat loan rate legislated in the 1985 act; and increased wheat purchases by some importers whose imports are subsidized through the EEP (Bailey 1989). From the trade and domestic policies perspectives, it is important to isolate the effect of the EEP from other factors that have influenced U.S. wheat exports and the world wheat market.

The specific objectives of this study are (1) to analyze the impact of the EEP on U.S. wheat exports, trade share, and world price; (2) to evaluate the effect of the EEP on the displacement of U.S. commercial sales; and (3) to analyze the effect of the EEP on competing exporters' exports and trade shares.

The organization of this study is as follows. In the next section, a brief description of the Export Enhancement Program is given. In the third section, the structure and components of the world wheat trade model used in this study are explained. A detailed discussion of the theoretical analysis of incorporating the EEP into the world wheat trade model is also provided in this section. In the next section, empirical issues in incorporating the EEP into the model are discussed. In the fifth section, the impacts of the EEP on the U.S. and the world wheat markets are presented. The final section describes conclusions and limitations of this study.

The Export Enhancement Program

The EEP program was announced in May 1985 and later included in the 1985 act. As stated by the Foreign Agricultural Service of USDA, the

criteria for evaluating sales under the EEP were

1. Additionality: Sales must increase U.S. agricultural exports above what would have occurred in the absence of the program.

2. Targeting: Sales will be targeted to specific market opportunities, especially those that challenge competitors who subsidize exports.

3. Cost Effectiveness: Sales should result in a net gain to the overall economy.

4. Budget Neutrality: Sales should not increase the budget outlays beyond what would have occurred in the absence of a program.

The objectives of the EEP, as specified in the 1985 act, are (1) to make U.S. exports more competitive in the world market and (2) to offset the adverse effects on U.S. exports due to unfair trade practices or subsidies by exporters, U.S. price supports that are above competitors' prices, and fluctuation in exchange rates. This program mandated the United States Department of Agriculture to utilize a minimum of $1 billion to subsidize U.S. agricultural exports. Under this program about $2.9 billion has been allocated to subsidize U.S. agricultural exports through fiscal year (FY) 1990 (as of June 1989). Under the provisions of this program, export subsidies (bonuses) are offered to exporting firms that sell commodities to the targeted countries. Hence, the United States is able to increase exports by directly competing with the export subsidies offered by the European Economic Community, concentrating on the markets currently held by the EEC.

The EEP has played a large role in the U.S. wheat export program, being applied to 70 percent of U.S. wheat exports in 1987/88 and a projected 60 percent in 1988/89 (USDA World Grain Situation and Outlook, February 1989). By June 1989, a total of 61.0 mmt of U.S. wheat had been sold under the Export Enhancement Program, at an estimated average subsidy of $29 per ton. The EEP has been used to subsidize wheat sales in 26 importing countries, with major importers including the USSR (17.4 mmt), China (12.3 mmt), Egypt (6.1 mmt), Algeria (5.2 mmt), Morocco (4.2 mmt), India (2.0 mmt), Poland (2.0 mmt), Iraq (2.0 mmt), the Philippines (1.8 mmt), and Tunisia (1.1 mmt).

Recent studies by the U.S. General Accounting Office (1987) and Bailey (1988) have analyzed the net impact of the EEP in terms of additionality and cost effectiveness. Bailey, in particular, found that the net result of EEP in 1987/88 was displacement of commercial sales (90 percent), with only 10 percent additionality. Oleson (1987) concluded that U.S. wheat exports have not responded such that the EEP is justifiable from an export value basis. Although the increase in U.S. exports is only one objective of the EEP, the analysis of effectiveness of the EEP in this regard is necessary in understanding the recent world wheat trade markets.

The Methodology

In this section, the structure and components of the world wheat trade model are explained, and a theoretical analysis of EEP is presented.

The Structure and Components of the World Wheat Trade Model

The wheat trade model is a nonspatial, partial equilibrium model of trade. As such, it does not model trade flows between specific regions or cross-commodity impacts on the wheat sector. The model dynamically determines trade equilibrium through price adjustments to clear excess supply and demands. The model contains 19 country/regional submodels and market clearing conditions. Wheat exporters modeled include the United States, Canada, the EEC, Australia, and Argentina. Major importers modeled include the USSR, the People's Republic of China, India, Japan, Algeria, Brazil, Eastern Europe, Egypt, Mexico, Morocco, Tunisia, other Africa and Middle East, other Asia, and other Latin America. The model thus includes detailed specification of the major markets affected by the EEP.

The basic elements of a nonspatial, partial equilibrium supply and demand model are illustrated in Figure 1. The U.S. export supply curve (ESUS) is the difference between domestic supply (SUS) and demand (DUS) in the United States, which represents the quantity supplied in the world market at various price levels. Other exporters' supply and demand schedules are given in the lower panel. The curve ESO is the combined excess supply of all competing exporters, which is derived as the difference between the supply and the demand of all competing exporters. The import demand schedule (EDT) of all importers is their total demand minus total supply. Other competitors' export supply and importers' import demand are represented in the top panel, third diagram from the left. The export demand schedule (EDN) facing the United States is the

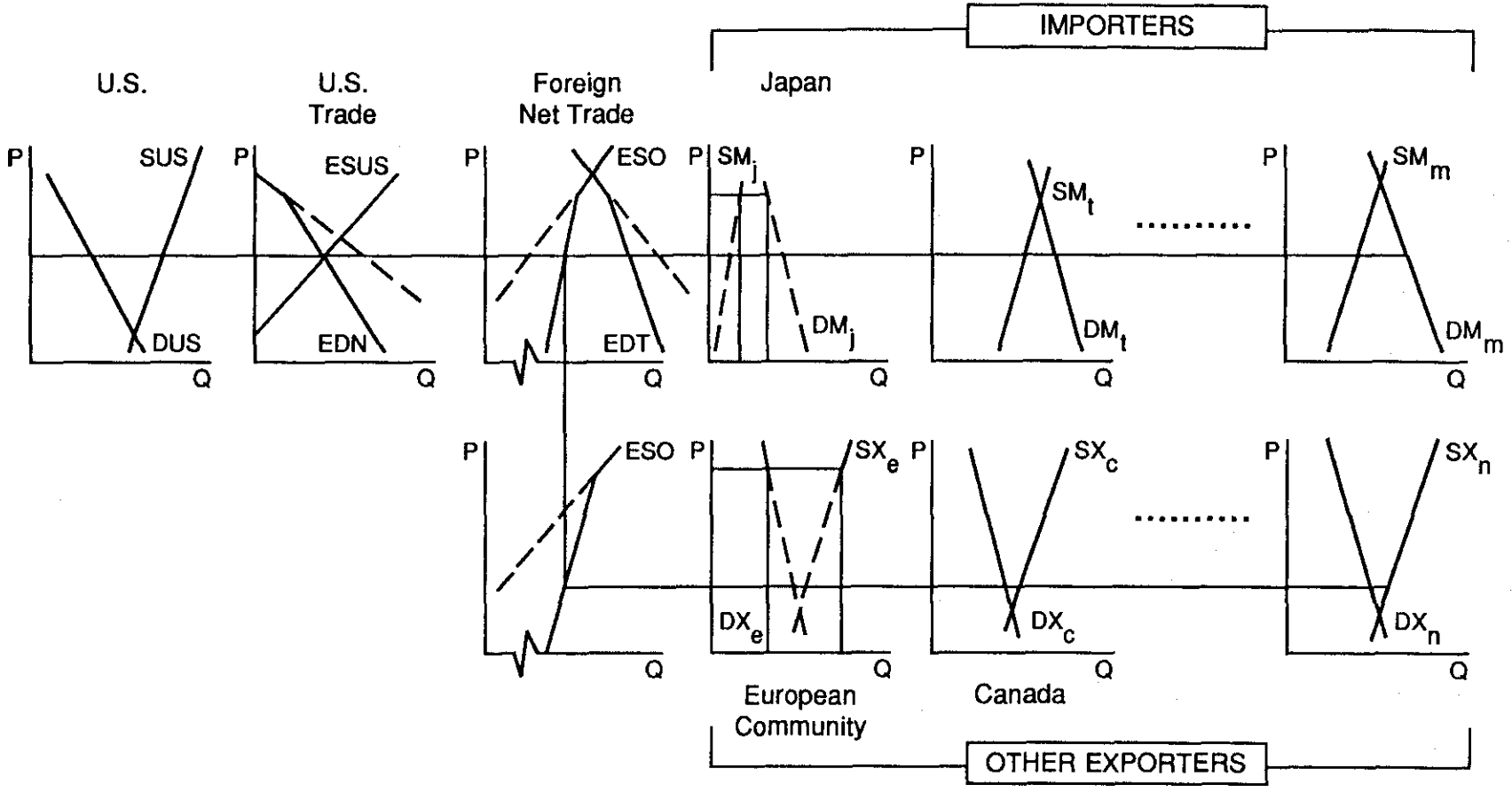

Figure 1. Determination of equilibrium prices and quantities in the wheat trade model

difference between the import demand of all importers and the export supply of competitors. The kinked, less elastic nature of the EDN results from the restricted trade policies pursued by some foreign countries, which insulate domestic prices from world price variability (see below for details). A trade equilibrium is allowed by the clearing of excess demands and supplies generated within each region. The model defines the degree of price transmission of world market conditions into each regional submodel through a price linkage equation. The algebraic forms of the necessary components of the model are given below.

$$EDT = \sum_{i}^{m}[FOD_i\ (PD_i, X_{1i}) + FED_i(PD_i, X_{2i}) + SD_i(PD_i, X_{3i}) - SU_i(PS_i, X_{4i})] \quad (1)$$

$i = 1, \ldots, m$ importers;

$$ESO = \sum_{j}^{n}\{SU_j(PS_j, X_{4j}) - [FOD_j(PD_j, X_{1j}) + FED_j(PD_j, X_{2j}) + SD_j(PD_j, X_{3j})]\} \quad (2)$$

$j = 1, \ldots, n$ other exporters;

$$ESUS = SU_u(P_u, X_{4u}) - [FOD_u(P_u, X_{1u}) + FED_u(P_u, X_{2u}) + SD_u(P_u, X_{3u})] \quad (3)$$

U.S. excess supply;

$$ESUS = EDN = EDT - ESO \quad \text{world market equilibrium;} \quad (4)$$

$$PD_i = G_i(P_u \cdot e_i, Z_i) \quad i = 1, \ldots, m \text{ importers; and} \quad (5)$$

$$PD_j = G_j(P_u \cdot e_j, Z_j) \quad j = 1, \ldots, n \text{ exporters,} \quad (6)$$

where

FOD = domestic food demand;

FED = domestic feed demand;

SD = domestic stock demand;

SU = domestic supply;

EDT = excess demand function of all importers;

ESO = excess supply function of all exporters, excluding the United States;

ESUS = excess supply function of the United States;

EDN = excess demand facing the United States;

PD = domestic market price;

PS = domestic supply price;

P_u = U.S. Gulf port price;

e = exchange rate;

Z = vector of policy variables (tariffs, subsidies) that influence the price transmission;

X_k = vector of demand shifters (k = 1, ..., 3); and

X_4 = vector of supply shifters.

Supply is determined as yield times acreage harvested, which is endogenously estimated. One of the salient features of the model is the inclusion of government programs in estimating the acreage functions. Particularly in the United States, program participation rates are endogenously estimated as a function of expected wheat net returns. Area planted under programs is determined from participation rate, base acres, and acreage reduction rate. Nonprogram planted acreage is endogenously

estimated. Total planted area is the sum of program and nonprogram planted area. The theoretical specification of food use is based on the consumer theory of utility maximization subject to budget constraint. The variables that enter the demand functions are own price (wheat price), prices of competing goods, and income. Because feed is used as input in livestock production, the theoretical specification of feed demand is estimated as a function of own price, prices of competing feed products, and livestock product prices. Stock demand is endogenized in the model by using speculative and transactions motives of inventory demand theory. Current price, expected production, and government stocks are used to capture the speculative motive. Current production is used to explain the transaction motive.

Equilibrium prices, quantities, and net trade are determined by equating excess demands and supplies across regions (Eq. 4) and explicitly linking domestic market prices in each region to the world price (Eqs. 5 and 6). Except where they are set by governments, domestic prices are linked to world prices via price linkage equations including bilateral exchange rates and transfer service margins. Inclusion of price linkage equations in the model allows one to endogenize the stabilizing and insulating behavior of government policies. Where some degree of insulation of domestic prices from external market conditions exists, the free adjustment of trade flows is restricted by limiting the quantity traded at the given level of domestic prices. The price linkage equation defines the degree of price transmission of external market conditions into the internal system.

Trade occurs whether price transmission is allowed or not. The quantity traded adjusts only to internal conditions if there is no price transmission.

The model is estimated over the sample period 1965-1986 using annual data. The supply, use, and price data for the U.S. component of the model came from various issues of USDA Agricultural Statistics. Policy variables such as target prices and loan rates were collected from the fact sheets of Agricultural Stabilization and Conservation Service (ASCS). Supply and use data for foreign countries come from the Foreign Agricultural Service (FAS) of the U.S. Department of Agriculture. Prices are from the Food and Agricultural Organization (FAO) of the United Nations, Canadian Grain Trade Statistics, and EC Grains, Oilseeds, and Livestock: Selected Statistics. Macroeconomic data for all countries are from the International Financial Statistics (IFS) of the International Monetary Fund.

The functional form of the model is linear in parameters. All supply and demand equations are estimated in quantity-dependent form in real prices and incomes. The estimation procedure used is ordinary least squares. The OLS estimation technique is preferred over simultaneous estimation techniques such as two-stage least squares and three-stage least squares because, with a large number of exogenous variables and a limited number of observations, simultaneous estimation techniques pose degrees-of-freedom problems. Furthermore, in many countries, prices are set by government policies. Prices are determined by supply and demand in only a few countries. As a result, any potential gain that could be

achieved by simultaneous estimation is offset by the potential loss if there is any misspecification in the model. The presence of serial correlation in the error structure is corrected using the Cochrane-Orcutt procedure.

In general, the statistical fit of the model is good, and the estimated coefficients in the behavioral equations conform to the a priori expectations.[2] The estimated supply, demand, and price transmission elasticities are given in appendix tables A.1 and A.2, which represent behavioral relationships in the model. The empirical model adequately reflects the structure of the world wheat market. Furthermore, since the model is frequently used for forecasting and policy analysis, a rigorous validation test was conducted to test the overall ability of the model to replicate the observed values of the endogenous variables. In the validation run, the structural form of the model was dynamically simulated over the study period. Simulation statistics used to measure the model's fitting performance include root mean square error, root mean square percent error, and Theil statistics. The simulation statistics indicate that the model performs satisfactorily.

Incorporation of the EEP in the World Wheat Trade Model

The EEP is an export subsidy program targeted to specific importers where each importer may receive a different subsidy level. The economics of an optimal targeted subsidy program have been outlined by Paarlberg (1984), and by Abbott, Paarlberg, and Sharples (1987). While noting that a general export subsidy program is always welfare-reducing for a large

country, a targeted subsidy program may lead to welfare increases. The exporter price discrimination strategy is to offer lower selling prices in markets with relatively price elastic demand, thus, taxing relatively inelastic markets, the net result is an export revenue increase.

The existence of an export subsidy in any market affects the ability of other competitive exporters to make sales at the "market clearing price." In highly competitive markets, the other exporters will have to fully match the EEP subsidy or forego their market share. Thus, other exporters' net prices are directly affected by the EEP subsidies. A unique feature of the EEP is that the export subsidies are paid in generic payment-in-kind (PIK) certificates, which are generally redeemed for Commodity Credit Corporation (CCC) stocks, but can also be sold for cash.[3] The issuance of PIK certificates under this program results in an increase in market availability of U.S. supplies of wheat. The incorporation of the effect of the PIK certificates in the analysis of the EEP was developed by Bailey (1988). This study adopts Bailey's approach but treats the response of other exporters differently.

Thus, three important features of the EEP that must be explicitly modeled are (1) the subsidy offered to each targeted import market, (2) the net price effect on competitive exporters' excess supply functions, and (3) the supply effect of PIK certificates issued as EEP Payments.

The effect of the EEP on the world market is illustrated in Figure 2. First consider the effect of targeted subsidy to the importers. The

price transmission equations of importers, which receive the targeted export subsidies, become

$$PD_i = G_i[(P_u - S_i) \cdot e_i, Z_i], \tag{7}$$

where S_i = EEP subsidy to importer i. This will result in a movement along the importer's excess demand curve by the amount of the subsidy. At every price level, the importers' effective excess demand curve will lie above their excess demand curve by the amount of the subsidy. In Figure 2 this is represented by an upward shift in a targeted importers' excess demand curves by the amount of the subsidy S_i.

Second, consider the effect of the EEP on competitors' wheat markets. This effect is modeled through the price linkage equation as

$$PD_j = G_j[(P_u - S_j) \cdot e_j, Z_j], \tag{8}$$

where S_j is the average effective subsidy (i.e., price reduction) offered by the j^{th} exporter on export sales to be competitive with EEP. This will result in a movement along the exporter's excess supply curve by the amount of the effective subsidy. At every price level, the exporter's effective excess supply curve will lie above their excess supply curve by the amount of the effective subsidy. In Figure 2, the impact on the EEC is merely an increase in the amount of export restitutions, while the impact of this effective subsidy on other exporters is represented by an upward shift in the competitors' total export supply curve of other exporters from ES2 to ES2'.[4] Thus, the excess supply curve of all other exporters shifts from ESO to ESO'. The specific conjectural variation

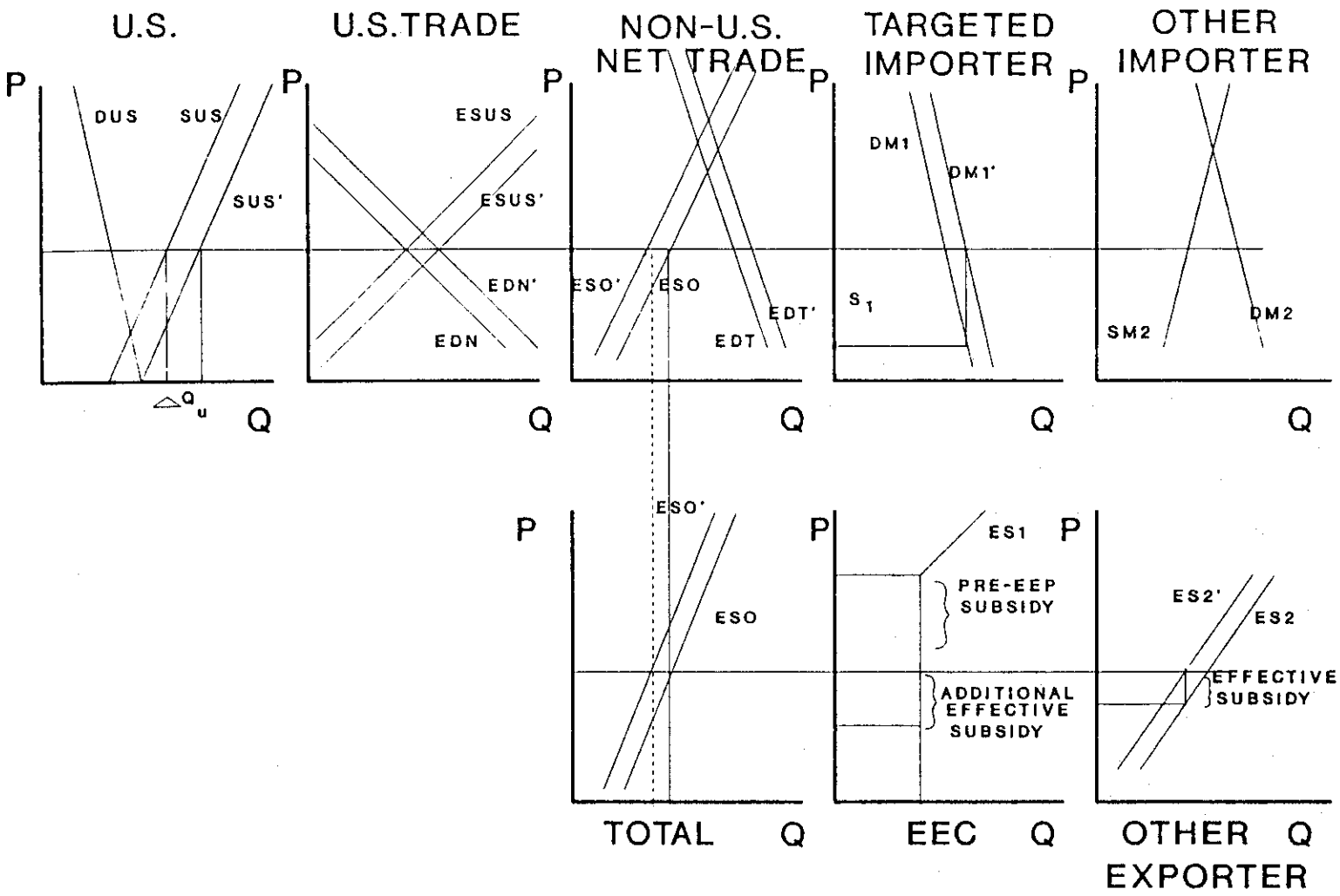

Figure 2. The impact of the EEP on world wheat trade

in this analysis is that competitive exporters respond to U.S. EEP subsidies with their own matching subsidies or price reductions.[5] Previous studies have used the conjectural variation of no response by other exporters (Abbott, Paarlberg, and Sharples 1987) or price response by only selected other exporters. Haley (1988) analyzed the impact of the EEP with the assumption of competitive price responses by the European Community only. Bailey (1988, 1989) analyzed the EEP using the conjecture that the EEC and Argentina responded, while Canada and Australia did not respond to the EEP with export price reductions. The approach of competitive price response by all other exporters will capture the world wheat market more accurately as evidenced by the competitors' actual price responses to the EEP.

Finally, consider the supply effect of the generic PIK certificates issued through the EEP. Use of the generic PIK certificates to redeem the CCC-owned wheat stocks will increase market supply of U.S. wheat. However, generic PIK certificates issued on EEP wheat sales can be used to redeem any available commodity in the CCC-owned stocks. As a result, only a portion of the certificates are used to redeem wheat stocks. For example, according to the USDA, in the 1987/88 crop year only 21 percent of total PIK certificates were used for wheat redemption. This extra wheat supply results in a rightward shift of the U.S supply curve from SUS to SUS' in Figure 2 and the U.S. excess supply curve from ESUS to ESUS'. This supply effect is captured by the equation

$$\Delta Q_u = [(\sum_{i=0}^{m} S_i \cdot ED_{ie}) \cdot \delta] \; / \; P_r \qquad 0 \leq \delta \leq 1, \qquad (9)$$

where ΔQ_u = change in market availability of U.S. wheat supplies,

ED_{ie} = net imports by i^{th} importer using EEP,

S_i = subsidy on imports by i^{th} importer,

P_r = PIK certificate redemption price for wheat in US$ per bushel, and

δ = proportion of PIK certificates used to redeem CCC wheat stocks.

Thus, the total EEP-issued PIK certificates used to redeem wheat stocks $[(\sum_{i=0}^{m} i\ S_i \cdot ED_{ie}) \cdot \delta]$ divided by the average redemption price defines the increase in U.S. marketable wheat stocks.

Thus, the EEP results in an upward shift in the net export demand facing the United States, which is caused by the increased import demand by the importers and reduced export supply of the competitors. This, combined with an outward shift in the U.S. excess supply schedule, will result in an unambiguous increase in U.S. wheat exports. The effect of the EEP on the market clearing price is ambiguous because of the offsetting excess demand-supply effects. In Figure 2, these offsetting excess supply and demand effects are shown as resulting in no change in the U.S. market clearing price, but either a price increase or decrease could alternatively have been illustrated. The overall impact of the EEP depends on the size of EEP subsidies, the price responsiveness of import demand, the price transmission elasticities of both import and export markets, the effective average subsidies offered by other exporters, the

the elasticity of supply of export competitors, and redemptions of U.S. CCC wheat stocks due to EEP-issued PIK certificates.

Empirical Incorporation of the EEP into the World Wheat Trade Model

The major empirical incorporations of the EEP into the world wheat trade model are the determination of (1) the appropriate average import subsidy S_i received by each targeted importer, (2) the appropriate average export subsidy S_j offered by each competitive exporter, and (3) additional U.S. wheat supply resulting from EEP-issued PIK certificates. This section discribes the empirical issues related to these three categories.

Subsidies to Importers

From the data collected on EEP sales announcements by the USDA, estimates were obtained for the subsidy on each sale and total EEP shipments by crop year to each targeted importer. The average EEP subsidy offered by the United States to a targeted importer in a crop year is computed as total subsidy divided by total shipments to that importer. The average export subsidies received by the importing countries are given in Table 1.

The average export subsidies (bonuses) paid by the United States were then assumed to be matched by all other exporters for their commercial sales (non-aid sales) into the specific market. For example, the USSR received an average export subsidy of $35.40/mt in 1987/88 for the U.S. EEP wheat exports, and it is assumed that other exporting countries also offered the same amount of subsidy to the USSR in

Table 1. Subsidies received by the importers for U.S. wheat EEP shipments

Country	1986/87	1987/88	1988/89[a]
USSR			
EEP Shipments (1000mt)	--	12,304	4,800
EEP as Percent of Total Imports	--	57	32
Average Bonus (US$/mt)[b]	--	35.40	22.02
China			
EEP Shipments (1000mt)	115	4,325	7,550
EEP as Percent of Total Imports	1	29	47
Average Bonus (US$/mt)	35.75	39.85	22.48
Egypt			
EEP Shipments (1000mt)	1,540	1,979	2,046
EEP as Percent of Total Imports[c]	25	29	32
Average Bonus (US$/mt)	32.40	33.82	19.26
Algeria			
EEP Shipments (1000mt)	1,194	2,015	1,205
EEP as Percent of Total Imports	35	53	28
Average Bonus (US$/mt)	36.89	37.91	20.59
Morocco			
EEP Shipments (1000mt)	895	1,680	760
EEP as Percent of Total Imports	60	88	51
Average Bonus (US$/mt)	42.60	37.67	20.55
India			
EEP Shipments (1000mt)	--	150	1,850
EEP as Percent of Total Imports	--	36	92
Average Bonus (US$/mt)	--	24.72	21.00
Iraq			
EEP Shipments (1000mt)	330	892	715
EEP as Percent of Total Imports	12	33	28
Average Bonus (US$/mt)	23.33	27.77	14.68
Tunisia			
EEP Shipments (1000mt)	562	450	50
EEP as Percent of Total Imports	50	52	0.5
Average Bonus (US$/mt)	23.32	38.02	24.52
Philippines			
EEP Shipments (1000mt)	--	437	1,143
EEP as Percent of Total Imports	--	40	100
Average Bonus (US$/mt)	--	27.77	12.97
Poland			
EEP Shipments (1000mt)	475	1,500	--
EEP as Percent of Total Imports	N/A	N/A	--
Average Bonus (US$/mt)	41.31	39.74	--

Note: Calculated on a June-May shipment basis.
[a] To June 1989.
[b] Estimated by contract announcement data and trade information.
[c] This total import figure includes aid shipments.
N/A = not available.

1987/88. Thus, the importer is assumed to receive the average subsidy on its entire commercial imports, excluding aid shipments. This is an extreme assumption in that the specific importer-exporter relationship with regard to long-term agreements, credit availability, and wheat quality consideration will affect the degree to which any exporter must compete with the effective U.S. price in the market. Also, subsidies are limited in most markets to the total EEP sales that will be completed, and this moderates the need of other exporters to be EEP competitive. This assumption will thus overestimate the impact of the EEP on U.S. wheat exports and total world trade in this nonspatial model.[6] This assumption was also used by Bailey (1988) in examining the impact of the EEP.

The incorporation of the EEP into importer submodels does not capture the impact of downward price pressure in markets not targeted for EEP sales, even though exporters displaced in EEP markets may price more competitively in the remaining non-EEP markets.

Effective Export Subsidies

The effective export subsidies (i.e., average price reductions) offered by U.S. export competitors were calculated by assuming the exporters generally responded to be competitive with the U.S. EEP subsidy. The average effective export subsidy is equal to the country's proportion of total commercial sales to targeted EEP markets weighted by the respective average EEP subsidies to each market. The results of this calculation are given in Table 2. For example, the average Canadian

Table 2. Effective export subsidies offered by exporters

Exporters	1986/87	1987/88	1988/89
		US$/mt	
Canada	6.00	18.00	7.00
Australia	12.00	15.00	7.00
EEC	8.00	15.00	13.00
Argentina	7.50	16.00	9.00

Note: These export subsidies are estimated average export revenue declines due to the U.S. Export Enhancement Program. For instance, the $7.50/mmt effective bonus offered by Argentina for its wheat exports in 1986/87 is the additional average discount for Argentine wheat below U.S. FOB Gulf port price due to EEP competition.

effective export subsidy, which is the decline in the average export revenue due to the EEP, is estimated to be US$18/mt in 1987/88. This is because approximately 32 percent[7] of Canadian exports go to China, which received an average EEP subsidy of US$39.85/mt, and 18 percent go to the USSR, which received an average EEP subsidy of US$35.40/mt. Other significant Canadian wheat export markets targeted by the EEP in 1987/88 were Algeria (3%), Brazil (3%), and Iraq (3%). Record Canadian wheat exports of 23.5 mmt in 1987/88 indicate that Canada was price competitive in 1987/88 and, in fact, Canadian ending stocks of wheat relative to 1986/87 were reduced by approximately 5.0 mmt.

The 1988/89 calculated average net price reduction for Canada of $7.00/mt is a reflection of significantly drought-reduced production in 1988. Estimates of Canadian exports of only 11.8 mmt for 1988/89 (50 percent of the 1987/88 level), and a very high average quality harvest, indicate that Canada need not have had to compete directly with EEP price levels. This was directly reflected in increases in the 1988/89 Canadian initial price to producers from C$120/mt (prior to harvest) to C$170/mt.

The incorporation of the EEP into exporter submodels does not account for downward price pressure in markets not targeted for EEP sales, even though exporters displaced in EEP markets may have priced more competitively in the remaining non-EEP markets.

Incorporation of EEP Issued PIK Certificates

The EEP subsidy payment to U.S. exporters in generic certificates increases the market access to CCC-held commodity stocks. The generic

certificates are fungible in the sense that they can be redeemed for any available CCC-held stocks or traded freely for cash. In this sense, it does not seem unreasonable to assume that EEP-issued PIK certificates would enter into the pool of generic certificates issued under other government programs and be redeemed for commodities at the historical rate. The 1986-1988 generic certificates supply and use are outlined in Table 3. In 1986/87, only $205 million of a total $8.1 billion certificates were issued through the EEP for wheat. PIK certificate redemptions for wheat in 1986/87 represented only 18.2 percent of the total. The certificates are assumed to be redeemed at the crop-year average rate, taking into account any PIK certificate premiums over face value.

The pattern of wheat certificate exchange has a direct impact on the U.S. wheat submodel and must be carefully analyzed. Table 4 shows the pattern of PIK certificate redemptions for 1986/87 and 1987/88. The CCC wheat auction was a dominant market force in 1987/88, accounting for 46 percent of wheat redemptions. This changed the pattern of wheat redemptions between nine-month loans, Farmer-Owned-Reserve (FOR) stock, and CCC stock from 1986/87 to 1987/88 as the CCC wheat auction released only CCC stocks.

The impact of wheat EEP-issued PIK certificates on U.S. marketable stocks of wheat is calculated by using Equation 9. The total wheat EEP-issued PIK certificates is estimated using EEP contract announcement data and market information on subsidy level per sale. The proportion of these generic PIK certificates that are actually redeemed for wheat

Table 3. Generic certificate supply and use

	1986/87	1987/88
	(Million US$)	
Carry-in	0	2,050
Certificates Issued	8,138	11,937
Wheat EEP Issued	205	1,026
Certificate Redemptions	6,088	10,020
Wheat	1,106	2,124
Wheat as Percent of Total Redemptions	18.2	21.2

SOURCE: Bailey and Houck 1989.

Table 4. U.S. generic certificate exchange for wheat

	1986/87	1987/88
Wheat Certificate Exchange (mil. $)	1,106	2,124
Wheat Redemptions (mil. bu)	457	834
9-month loans	221	190
FOR loans	84	64
CCC Stocks	152	580
CCC Wheat Auction Activity (mil. bu)[a]	0	385.2

SOURCE: Bailey and Houck 1989.
[a]Stocks released through CCC wheat auctions were CCC stocks (USDA 1989).

stocks is assumed to be the historical rate for total PIK redemptions; i.e., 18.2 percent in 1986/87, 21.2 percent in 1987/88, and 8 percent in 1988/89. The average redemption price for wheat was estimated by using the crop year average wheat price (on-farm) times the average cash premium of PIK certificates to their face value.

Results

The major aspects of the EEP were incorporated into the model, and a baseline simulation was developed for years 1985/86 to 1988/89. The impact of the EEP for crop years 1986/87 to 1988/89 was then determined by running the alternate (no-EEP) scenario in which (1) the EEP effects on importers and exporters were removed (i.e., all S_i and S_j were set to zero) and (2) U.S. market supply reductions resulting from fewer PIK certificates were incorporated. The analytical results from the baseline and no-EEP scenario are summarized in Tables 5-7. The impact of the EEP, measured as the difference between the two scenarios, is given in Table 8.

The results indicate that U.S. wheat exports increased by 31 million bushels in 1986/87 because of the EEP (Table 5), while actual EEP shipments were estimated to be 245 million bushels. Thus, the additionality (i.e., increase in U.S. exports above what would have occurred in the absence of the program) was 13 percent (31 million bushels) and commercial displacement was 87 percent (214 million bushels). The estimated cost of the EEP shipment subsidies for 1986/87 was $224 million (estimated by EEP contract announcement data and trade reported

Table 5. U.S. wheat supply and use under baseline and no-EEP scenario

Variables	Scenarios	1985/86	1986/87	1987/88	1988/89
Planted Area	Base	75.6	72.1	65.8	65.5
(million acres)	No-EEP	75.6	72.1	65.7	64.6
Production	Base	2,425	2,092	2,107	1,814
(million bushels)	No-EEP	2,425	2,092	2,102	1,787
Total Supply	Base	3,866	4,018	3,945	3,097
(million bushels)	No-EEP	3,866	4,018	3,969	3,168
Domestic Use	Base	1,046	1,193	1,094	1,057
(million bushels)	No-EEP	1,046	1,196	1,102	1,060
Ending Stocks	Base	1,905	1,821	1,261	538
(million bushels)	No-EEP	1,905	1,850	1,360	690
Exports	Base	915	1,004	1,592	1,501
(million bushels)	No-EEP	915	973	1,509	1,417
Farm Price	Base	3.08	2.42	2.57	3.68
(US$/bu)	No-EEP	3.08	2.37	2.39	3.62
U.S. Export Market	Base	32.7	32.6	45.5	46.9
Share (percent)	No-EEP	32.7	31.8	43.8	45.2
U.S. Gulf Port					
Price	Base	130.00	109.00	124.00	164.73
(US$mt)	No-EEP	130.00	106.98	117.24	162.34

Table 6. Competitors' wheat supply and exports

Countries	Scenarios	1986/87	1987/88	1988/89
Canada				
Area Harvested	Base	14.22	13.53	12.91
(million ha)	No-EEP	14.22	13.61	13.17
Production	Base	31.34	26.01	15.70
(mmt)	No-EEP	31.34	26.16	16.01
Exports	Base	20.98	23.54	11.80
(mmt)	No-EEP	21.11	23.93	12.04
Australia				
Area Harvested	Base	11.10	9.10	9.00
(million ha)	No-EEP	11.10	9.20	9.17
Production	Base	16.10	12.41	13.80
(mmt)	No-EEP	16.10	12.54	14.06
Exports	Base	15.60	9.60	11.50
(mmt)	No-EEP	15.60	9.98	11.68
EEC				
Area Harvested	Base	15.70	15.90	15.40
(million ha)	No-EEP	15.70	15.90	15.40
Production	Base	71.97	71.60	75.70
(mmt)	No-EEP	71.97	71.60	75.70
Exports	Base	14.48	14.29	19.00
(mmt)	No-EEP	14.48	14.29	19.00
Argentina				
Area Harvested	Base	5.00	4.80	4.50
(million ha)	No-EEP	5.00	4.85	4.61
Production	Base	8.90	9.00	7.40
(mmt)	No-EEP	8.90	9.10	7.57
Exports	Base	4.40	3.70	3.20
(mmt)	No-EEP	4.42	3.81	3.38

Table 7. Wheat net imports

Countries	Scenarios	1986/87	1987/88	1988/89
		(mmt)		
USSR	Base	15.50	21.00	12.00
	No-EEP	15.54	20.38	11.55
China	Base	8.51	15.00	15.01
	No-EEP	8.51	15.00	15.01
Japan	Base	5.80	5.70	5.40
	No-EEP	5.80	5.70	5.40
Eastern Europe	Base	1.99	1.41	-1.50
	No-EEP	1.99	1.41	-1.50
Egypt	Base	6.02	6.43	6.40
	No-EEP	6.02	6.43	6.40
Algeria	Base	3.41	3.80	3.70
	No-EEP	3.31	3.70	3.62
India	Base	-0.32	-0.45	2.45
	No-EEP	-0.32	-0.75	1.87
Brazil	Base	2.70	2.05	2.44
	No-EEP	2.70	2.03	2.43
Mexico	Base	0.46	0.75	1.20
	No-EEP	0.46	0.75	1.20
Tunisia	Base	1.13	0.85	1.10
	No-EEP	1.11	0.82	1.08
Morocco	Base	1.50	1.90	1.52
	No-EEP	1.38	1.72	1.38
Other Africa and Middle East	Base	14.44	13.45	12.96
	No-EEP	14.44	13.44	12.86
Other Latin America	Base	5.53	5.43	5.65
	No-EEP	5.54	5.49	5.72
Other Asia	Base	8.23	9.17	9.65
	No-EEP	7.68	8.64	9.21
Total Net Trade	Base	82.22	94.29	85.74
	No-EEP	81.51	92.60	84.08

Table 8. Impact of the export enhancement program on U.S. wheat exports

		1986/87	1987/88	1988/89[a]
		(million bushels)		
U.S. Wheat Exports	Base	1,004	1,592	1,501
	No-EEP	973	1,509	1,417
Change due to EEP		31	83	84
Actual EEP Shipments[b]		245	1,016	839
Commercial Displacement (percent)		87	92	90
Additionality (percent)		13	8	10
Estimated EEP Subsidies[b] (million US$)		224	997	474

[a]EEP shipments as of June 1989.
[b]Estimated using shipment data by contract announcement.

prices). This figure, the gross subsidy outlay, does not account for changes in carrying costs caused by reduced wheat stocks or for changes in CCC program costs caused by changes in the U.S. farm price for wheat. Although the size of the EEP varied over the three-year period, the estimated percentage of additionality remained relatively constant at 8-13 percent. In 1987/88 with 1,016 million bushels of EEP shipments, only 83 million bushels were estimated as additionality.

The EEP has had a noticeable impact on U.S. ending stocks, export levels and export market shares, U.S. farm price, and world price (U.S. Gulf port price) for wheat. In all years, 1986/87 to 1988/89, the price impact of the EEP-induced increased demand for U.S. exports has outweighed the U.S. domestic supply effect (caused by increased PIK certificates), resulting in a higher U.S. wheat price. This supports the view that the EEP tended to exaggerate the impact of the 1988 drought-reduced wheat supply in the United States. The world wheat price increased by US$6.76/mt in 1987/88 and US$2.39/mt in 1988/89 due to the EEP.

The response of other exporters to the EEP is summarized in Table 6. The results indicate only a minor negative impact of the EEP on exports from Canada, Australia, and Argentina. Wheat production levels in these countries also showed a minor negative impact of the EEP.[8] The European Community, with a price transmission elasticity of zero based on its variable import levy system of price supports, does not respond to the EEP in terms of total export volume. The EEC export of wheat was moderately displaced in certain Middle East markets, but increased exports

to the USSR and other countries have resulted in no significant reductions in EEC total exports. The analysis assumes domestic wheat programs of other exporters and importers as exogenous, and thus, any impact that the EEP may have had on EEC policy changes over this period is not captured in the analysis.

The impacts of the EEP on major wheat importers are given in Table 7. The impact of the EEP on importers depends upon the domestic price transmission elasticity with respect to the import price facing the country. For the People's Republic of China, the model assumes that the domestic price and domestic use are exogenous to the import price and, thus, that the EEP has no impact on China's wheat imports. Given a reported increase in total domestic wheat use in China over the period, the results for China may underestimate the impact of the EEP.[9]

Egypt, one of the largest EEP recipients, also exhibits no net import response to the EEP. This is a reasonable result given that actual Egyptian wheat imports have remained fairly constant since the introduction of the EEP. The composition of Egyptian imports by country of origin, however, has changed in favor of the United States since the introduction of the EEP.

The USSR total net import response to the EEP is also moderate because domestic demand and supply are only partially responsive to import prices. Again, the composition of USSR net imports may have been altered significantly by the EEP, but these net trade flows are not captured by the nonspatial equlibrium model.

The overall net wheat trade increased 0.7 mmt in 1986/87, 1.7 mmt in 1987/88, and 1.7 mmt in 1988/89 in response to the EEP.

Limitations and Conclusions

The result must be viewed in the context of the limitations of an annual nonspatial equilibrium model. The model assumes that wheat is a single homogenous commodity by each exporter. As such, the model does not capture the effect of quality differences between exporters and does not analyze the differential impacts across classes of wheat within the United States. The impact of the EEP on U.S. durum wheat is different from that for the U.S. white wheat market. Because the model is a partial equilibrium model, the cross-commodity effects, which may be significant, are not incorporated in determining the net impact of the EEP.

Because of the model's annual nature, it does not account for different seasons of production and shipping between northern and southern hemispheres. Thus, the model does not capture the differential impact of EEP in markets based on differing sale times. The EEP sales to Brazil were conducted during periods when Argentine sales revenue activity into this market was low; thus, the impact on Argentine sales may have been moderated. The EEP sales to the USSR, however, were conducted continuously and may have had a more depressing effect on Argentine sales returns from this market. The incorporation of the EEP into the world wheat trade model also does not capture the impact of downward price pressure in markets not targeted for EEP sales, even though exporters displaced in EEP markets may price more competitively for these remaining non-EEP markets.

The modeling of the EEP also assumes that other nonprice domestic and trade policies of other importers and exporters are exogenous in response to the EEP. The Canadian Special Grains Program, however, was specifically enacted to offset the price-depressing effect of the EEP; thus, the modeling approach will overestimate the supply response and export reduction by Canada. The EEC wheat acreage set-aside program may also be a result of the depressing effect of the EEP on export revenues.

The modeling assumption that targeted importers receive EEP-competitive prices on all commercial imports is an extreme one, which results in an overestimate of the impact of the EEP on world trade and an underestimate of the impact on other exporters' export levels. The modeling approach does not allow for analysis of the impacts of the EEP on trade flows between countries. The main impact of the EEP would seem to be on trade flows and not on changes in net export and import volumes by each country. However, given the EEP objective of additionality, the modeling approach does capture the overall net impact of the EEP on world trade volumes, market shares, and U.S. net exports.

In summary, the analysis using the annual world wheat trade model indicates that the EEP has expanded U.S. exports and caused a decline in Canadian, Australian, and Argentine wheat exports. The export additionality of the program is estimated at 8-13 percent over the period 1986/87 to 1988/89 (Table 8). These results are generally lower than those determined in other studies. Hillberg (1988), using a quarterly, spatial equilibrium model of world wheat trade, reported EEP additionality ranging from 10 percent (October 1985-March 1986) to 17-20 percent

(April/June 1987). Bailey (1988) reported export additionality at a high of 58 percent for 1986/87 to 14 percent for 1987/88. The incorporation of a nonpassive price response by all other exporters in response to EEP subsidies is the major determinant that would explain the lower estimates of export additionality in this study relative to Bailey's estimates.

The analysis suggests that the ability of the EEP to expand U.S. exports (rather than to change the market composition of U.S. exports) is limited. The effectiveness of the EEP to increase U.S. wheat exports has been moderated by the domestic policies of most major wheat importers and exporters, which decrease the domestic price transmission elasticities with respect to import prices. U.S. export expansion since 1985/86 is attributable mainly to production conditions and domestic policies of major importing (USSR, China) and exporting (Canada) countries. Examination of the EEP with respect to its initial stated objectives suggests that the goals of additionality and cost effectiveness are not being met.

Appendix

Table A.1. Summary of estimated domestic supply and demand elasticities from the wheat trade model

Country/ Region	Elasticity with respect to							
	Wheat Price	Barley Price	Sorghum Price	Corn Price	Soybean Price	Rapeseed Price	Thai Rice Price	Income
U.S.								
Production[a]	0.28							
Food demand	-0.03							0.28
Feed demand	-1.28			0.79				
Stock demand	-0.88							
Canada								
Production	0.60	-0.40						
Food demand	-0.03					-0.20		
Feed demand	-0.60	0.22						0.32
Australia								
Production	0.18		-0.10					
Exports	0.98							
Argentina								
Production	0.48		-0.27					
Exports	0.17							
EEC								
Production	0.19							
Feed demand	-1.32			1.19				0.97
Food demand	-0.07							0.05
Other Western Europe								
Import demand	-0.43							
USSR								
Import demand	-0.79							
Eastern Europe								
Total use								0.09
China								
Production	0.01[b]							
Total use								0.24
Japan								
Total use	-0.12							0.22
India								
Production	0.25		-0.10					
Total demand	-0.38							0.76
HIEA[c]								
Import demand	-0.17							0.57

Table A.1. Continued

Country/ Region	Elasticity with respect to: Wheat Price	Barley Price	Sorghum Price	Corn Price	Soybean Price	Rapeseed Price	Thai Rice Price	Income
Other Asia								
Production	0.06						-0.04	
Total demand	-0.12						0.12	0.66
Brazil								
Production	0.72			-0.49				
Total demand	-0.50							0.59
Mexico								
Production	0.19		-0.11					
Total demand	-0.16			0.10				0.95
Other Latin America								
Production	0.35				-0.31			
Total demand	-0.11			0.15				0.61
Algeria								
Production	0.07							
Total demand	-0.29							0.55
Egypt								
Production	0.15							
Total demand								0.72
Morocco								
Production	0.06			-0.06				
Total demand	-0.44							0.81
Tunisia								
Production	0.09							
Imports	-0.17							1.63
Other Africa								
Production	0.03							
Total demand								0.46

[a]Mean elasticities.
[b]Elasticity with respect to aggregate grain and wheat price, of which wheat price is a component.
[c]High-Income East Asia.

Table A.2. Key price transmission elasticities of wheat prices of other regions with respect to U.S. Gulf port wheat price

Country/Region	Elasticity
Canada	
Wheat export price	1.06
Australia	
Wheat export price	0.98
Argentina	
Wheat farm price	0.43
EEC	
Wheat intervention price	0.02
Japan	
Wheat resale price	0.28
India	
Wheat farm price	0.29
Brazil	
Wheat farm price	0.10
Algeria	
Wheat farm price	0.57
Egypt	
Wheat farm price	0.30
Morocco	
Wheat farm price	0.28

Endnotes

1. The data for these figures come from U.S. Department of Agriculture, Foreign Agricultural Service, "Export Markets for U.S. Grain and Products," various issues.

2. Space limitations do not allow reporting the complete details of the wheat trade model. Readers interested in the modeling approach, structural coefficients, estimated equations, and model validation may refer to Devadoss, Helmar, and Meyers (1989).

3. Generic PIK certificates are presented to export merchants who have successfully completed a sale.

4. Equations 7 and 8 do not result in shifts in the domestic supply and demand curves. The effective subsidies create movements along the respective supply and demand schedules.

5. Where information was available on the relative price response of competitive exporters to the EEP in specific countries, this information was used in place of the full response conjecture.

6. The degree of overestimation cannot be evaluated because of the limitations of incorporating the EEP program details in the world wheat model.

7. Estimated using International Wheat Council statistics.

8. Roberts and Love (1989) calculate that Australian wheat production was reduced by between 0.7 and 1.0 mmt in 1987/88 because of the EEP. The Roberts and Love calculation used a point supply elasticity (0.39) borrowed from a model of Australian agriculture only, while the current study estimates an Australian wheat supply elasticity of 0.18 using a world wheat trade model. Our estimated reduction in Australian wheat production (0.13 mmt) in 1987/88 is lower than that of Roberts and Love.

9. The USDA reports a 4.0 mmt increase in China's domestic use, to 105.5 mmt in 1987/88. These figures are subject to a high degree of error, however, because of uncertainty regarding actual PRC wheat production.

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