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THE IMPACT OF THE FOOD SECURITY ACT OF 1985 ON U.S. WHEAT EXPORTS

Kenneth W. Bailey

Abstract

A major objective of the Food Security Act of 1985 was to make the United States more competitive in world markets. U.S. wheat exports in 1987/88 were 75 percent above their 1985/86 level. This paper analyzes the change in U.S. competitiveness in wheat exports by quantitatively assessing those factors responsible for this export expansion. The results indicate that about half of the increase can be attributed to the provisions of the 1985 Act. About 40 percent of the increase is due to nonprice factors in the Soviet Union and China—namely production shortfalls and domestic policies—that increased import demand. The rest is due to reduced competitor yields.

Key words: wheat exports, simulation model, farm policy, export bonus.

A major theme throughout the Congressional debate on the Food Security Act of 1985 (1985 Act) was the loss of U.S. export market share to competitor countries. U.S. wheat exports fell by almost 50 percent from a high of 1.77 billion bushels in 1981/82 to 915 million bushels in 1985/86 (USDA, 1988). The U.S. share of the world wheat export market fell from 48 to 29 percent over this same period. One hypothesis is that U.S. agricultural export embargoes in the early 1970s resulted in declines in U.S. exports and farm prices and income in the 1980s.[1] Embargoes undermined U.S. credibility as a supplier and encouraged competitor production under this hypothesis. This hypothesis, however, has been challenged by a study commissioned by the Economic Research Service which concluded that embargoes did not cause the farm crisis of the 1980s (USDA, 1986). This study and others suggest that the high value of the U.S. dollar coupled with inflexible loan rates created a "price umbrella" under which foreign countries expanded area planted and production of grains (Thompson; Salathe and Langley). This expansion, together with a world recession and an international debt crisis, resulted in declining U.S. sales and market share in a shrinking world market.

One of the major objectives of the Food Security Act of 1985 was to make the United States more competitive in world grain markets. Two important changes in this direction have been (a) greater downward flexibility in loan rates, and (b) an ability to reduce Commodity Credit Corporation (CCC) loan forfeitures and reduce Farmer-Owned Reserve (FOR) and CCC stock levels when the market price is below release levels. The 1985 Act has provided the Secretary of Agriculture greater discretion in setting loan rates and export bonus levels under the Export Enhancement Program (EEP). The more flexible loan rate formula and implementation of the Findley Amendment have substantially lowered the loan rate. The EEP, in conjunction with CCC export credit guarantees (GSM-102 and GSM-103), has lowered the U.S. export price in targeted markets.[2] These discretionary measures were implemented under the assumption that the elasticity of import demand facing the U.S. market is of such magnitude that a reduction in the U.S. export price will expand both the quantity and value of U.S. exports. The 1985 Act has also allowed for the issuance of generic certificates in lieu of cash payments to participating producers, export merchants, and commodity groups (Glauber). Exchanges of

[1] See Abbott et al. for a brief description of this hypothesis.

[2] For a detailed description of the Export Enhancement Program and CCC export credit programs, see Smith (1987, 1988).

Kenneth W. Bailey is Program Director of the Food and Agricultural Policy Research Institute (FAPRI), Department of Agricultural Economics, University of Missouri-Columbia. This paper was written while the author was an agricultural economist with the Economic Research Service, U.S. Department of Agriculture.

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these certificates have resulted in reduced CCC loan forfeitures and a drawdown of FOR and CCC stock levels.

U.S. wheat exports have increased significantly since implementation of the 1985 Act. Exports have expanded 75 percent from 1985/86 to an estimated 1.6 billion bushels in 1987/88. The purpose of this article is to quantify the degree of this expansion that can be attributed to the 1985 Act. An understanding of the major factors responsible for this export expansion will provide policymakers greater information on the response of U.S. wheat exports to changes in U.S. farm policy.

AN ECONOMETRIC MODEL OF THE WORLD WHEAT MARKET

An econometric simulation model of the world wheat economy was used to assess those factors that have expanded U.S. wheat exports. A dynamic nonspatial equilibrium model was employed. Nonspatial equilibrium models solve for the net trading position of each country and for one equilibrium world price; they do not solve for multilateral trade flows between countries. The model used in this paper focuses on the behavior of the world's major wheat exporters—the United States, Canada, the European Community, Australia, and Argentina. It also contains a Japanese submodel, a block of equations representing the rest of the world's major importing countries and regions, and world market clearing conditions.[3] An advantage of using this type of model is that it can dynamically assess the impact of changes in agricultural policies on world wheat trade. The model developed here represents an improvement to existing trade models by explicitly reflecting policy variables in the area response, ending stocks, and price transmission equations for major wheat exporters.

Structure of the world wheat trade model was patterned after the FAPRI/CARD trade model (Devadoss et al.). It consists of 78 behavioral equations and 46 identities and was estimated over the period 1960–86 using ordinary least squares.[4] Equations are mostly linear, although some variables are expressed as ratios. The complete model documentation, data, literature review, and validation statistics are presented in Bailey (1988, 1989).

Model Specification

The world wheat trade model is conceptualized below and in Figure 1. Six equations describe the behavior of major exporters and importers, and the world market clearing conditions.

$$(1)\ ES_{j,t}(P_{j,t}) = AP_{j,t}(P^e_{j,t})*YL_{j,t} + ST_{j,t-1} - DD_{j,t}(P_{j,t}) - ST_{j,t}(P_{j,t}),$$

$$(2)\ P^e_{j,t} = P_{j,t-1},$$

$$(3)\ P_{j,t} = a_{j,t} + b_{j,t}*ER_{j,t}*P_{us,t},$$

$$(4)\ ED_{i,t}(P_{i,t}) = DD_{i,t}(P_{i,t}) + ST_{i,t}(P_{i,t}) - AP_{i,t}(P^e_{i,t})*YL_{i,t} - ST_{i,t-1},$$

$$(5)\ P^e_{i,t} = P_{i,t-1},$$

$$(6)\ P_{i,t} = a_{i,t} + b_{i,t}*ER_{i,t}*P_{us,t}, \text{ and}$$

$$(7)\ P^*_{us,t} \text{ such that } \sum_j ES_{j,t}(P^*_{us,t}) - \sum_i ED_{i,t}(P^*_{us,t}) - ROW_t = 0,$$

where:

ES = wheat excess supply,
P = border price,
AP = wheat area planted,
P^e = wheat expected price,
YL = wheat yield,
ST = wheat ending stocks,
DD = wheat domestic demand,
a = trade margin,
b = exchange rate coefficient,
ER = exchange rate, currency for country i or j relative to U.S. dollars,
ED = wheat excess demand,
ROW = rest of the world net trade,
j = subscript for major exporters,
i = subscript for major importers, and
us = subscript for the United States.

Excess supply for major exporters, equation (1), is determined via an identity that equals supply (area planted times yield plus beginning stocks) less domestic demand and ending stocks. Planted area is a function of an expected price and government policy variables. In the United States, planted area is specified as a function of expected net returns per acre for program and nonprogram participants using an approach developed by Bancroft. In Canada and Australia,

[3]The equations for the rest of the world importers were provided by the Center for Agricultural and Rural Development, Iowa State University, and are part of the FAPRI/CARD model. These equations will be published in a forthcoming CARD report.

[4]The OLS estimation technique may lead to biased and inconsistent parameter estimates when applied to a system of equations where there exists an independent variable that is in fact endogenous to the system. Other estimators, such as instrumental variable and full-information techniques, were initially considered for use in estimating the model. They were not, however, judged to represent an improvement over OLS since specification error, which increases as a modeling system becomes larger, would affect all parameter estimates in the system of equations (see Bailey 1988, pp. 118–20).

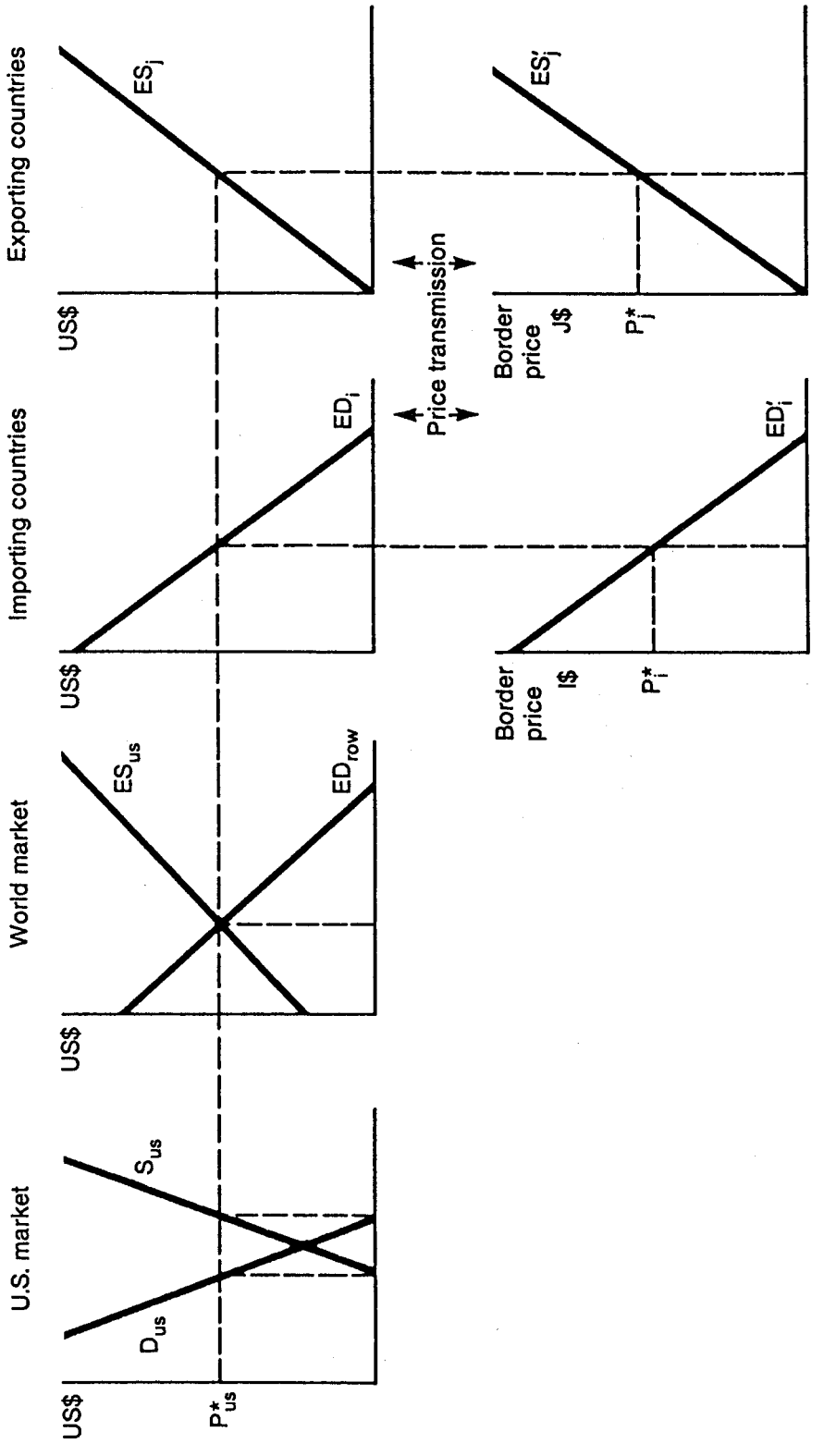

Figure 1. Solution of the World Wheat Trade Model.

planted area is specified as a function of expected pool returns from Canadian Wheat Board and Australian Wheat Board marketings (Bailey and Goodloe). In the EC, wheat planting is a function of expected gross returns from EC market prices (Meilke and de Gorter). The expected price for all major exporters, equation (2), is equal to the border price lagged one period since planting occurs well in advance of the marketing year. The border price is determined in equation (3) via a price transmission equation which is linked to a world reference price, in this case the U.S. wheat Gulf ports' price. Domestic prices are conditioned on these border prices, as well as on government policies that act to limit the influence of the variation in world prices.

Excess demand for major importers, equation (4), is determined via an identity that is equal to domestic demand plus stocks less supply. The expected price for importers in equation (5) is equal to the border price lagged one period, where the latter is determined in equation (6) via a price transmission equation.

The world market clearing condition, equation (7), is satisfied when an equilibrium price is determined that sets world supply equal to world demand.[5] Since the U.S. border price is the world reference price, the model is cleared through the U.S. market by setting U.S. excess supply equal to the world demand for U.S. exports.[6] This is diagramed in Figure 1 where ED_i and ES_i represent excess demand and supply schedules in local currencies for world importers and export competitors. Substituting the price transmission equations into these schedules then determines ED_i^* and ES_i^* which are denominated in U.S. dollars. Market clearing conditions are then met when an equilibrium world price P_{us}^* is determined that equates U.S. excess supply (ES_{us}) with the import

TABLE 1. MODEL ESTIMATES OF OWN-PRICE ELASTICITIES FOR WHEAT[a]

	Area Harvested	Feed Use	Food Use	Domestic Use	Ending Stocks
United States	.58[b]/1.23[c]	-.97	—[d]	—	-.59[e]
Canada	.33	-1.03	-.08	—	-.25
EC-10	.77	-1.92	—[d]	—	-.61
Australia	.13	-2.24	—[d]	—	-.60
Argentina	.32	—	—	—[d]	—[d]
Japan	.52	—	—	-.18	—[d]

Note: — = not available.
[a] Short-run elasticities evaluated over the period 1960–86.
[b] Acreage planted within U.S. commodity programs.
[c] Acreage planted outside U.S. commodity programs.
[d] Statistically insignificant within a 90-percent confidence interval.
[e] Commercial ending stocks.

TABLE 2. MODEL ESTIMATES OF CUMULATIVE DYNAMIC ELASTICITIES FOR WHEAT[a]

	Simulation Period[b]					
	1	2	3	4	5	40
U.S. export demand[c]	-0.69	-0.86	-0.85	-0.86	-0.86	-0.79
Excess supply						
United States	0.20	0.44	0.46	0.46	0.46	0.44
Canada	0.37	0.41	0.57	0.76	0.96	2.70
Australia	0.21	0.12	0.07	0.04	0.02	0
Argentina	0	0.19	0.46	0.49	0.49	0.49
Excess demand						
Japan	0	-0.02	-0.02	-0.02	-0.02	-0.02
Soviet Union	-0.21	-0.21	-0.21	-0.21	-0.21	-0.21
Other Western Europe[d]	0	3.54	3.54	3.54	3.54	3.54
Africa & Middle East	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34
High-income East Asia	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13
Other Asia	0	-0.24	-0.24	-0.24	-0.24	-0.24

[a] With respect to a sustained change in the U.S. wheat Gulf ports price.
[b] Period 1 = 1986/87: short-run elasticity; period 5 = 1990/91: intermediate-run elasticity; and period 40 = 2025/26: long-run elasticity.
[c] Elasticity of demand for imports facing the United States with respect to the U.S. wheat Gulf ports price.
[d] Other Western Europe was a net exporter in 1985.

[5] The model solution does not explicitly reflect the imperfect nature of the world wheat market as have other studies (McCalla and Alaouze et al.). Grennes and Johnson argued, however, that variation in world wheat prices is better explained by government policy than by changes in market structure.

[6] This demand function for U.S. wheat is defined as the excess supply from the rest of the world less world import demand.

demand facing the U.S. market (ED_{row}), where the latter is equal to the horizontal sum of the excess demand for all importers (ED_i) less the excess supply for the non-U.S. world exporters (ES_j).

Model Elasticities

The model elasticities representing the behavioral characteristics of the major exporters and Japan are presented in Table 1. These short-run elasticities were computed from the estimated behavioral equations by multiplying the estimated coefficient by the ratio of the mean of the independent variable to the mean of the dependent variable. The results indicate a low own-price elasticity for food use for the world's major wheat exporters.[7] This is not the case for Japan, a major wheat importer, which has a significant own-price elasticity for food use.

Trade elasticities were computed for the excess supply and demand functions and for the demand for U.S. wheat exports (see Table 2). The method employed earlier to compute elasticities from estimated equations could not be used to estimate trade elasticities since the world wheat model solves for net trade via identities, not estimated reduced-form equations. One approach commonly used in trade modeling is to first estimate supply, demand, and price transmission elasticities for each country, and then aggregate these via market shares to compute excess supply and demand elasticities and the U.S. export demand elasticity (Bredahl et al.). This approach, however, is most commonly used with static trade models and is not appropriate for models that have a complex dynamic structure.

Trade elasticities were therefore computed in this study by dynamically simulating the complete modelling system beyond the historical period, and then computing cumulative dynamic elasticities.[8] Pindyck and Rubinfeld defined a dynamic elasticity as follows:

$$(8)\quad E_P(r) = \frac{P_t}{Q_t}\,\frac{Q_{t+r} - Q_t}{dP_t}$$

where E is a dynamic elasticity for quantity Q with respect to price P, dP_t is a change in price occurring in period t, and $Q_{t+r} - Q_t$ is the change in quantity over r periods. Using this definition, the elasticities presented in Table 2 were computed as follows. First, all exogenous variables were fixed at their 1985/86 levels. The model was then simulated over the period 1986/87–2025/26 (40 periods) in order to determine the baseline simulation path for the endogenous variables. The model was then shocked by raising the wheat Gulf ports' price in 1986/87, sustaining this price over the 40-year simulation period, and resolving the model. The result is the shocked simulation path. The cumulative dynamic elasticities were then computed by (a) computing the percent change in net trade for each country/region from the baseline simulation path, and (b) dividing this change by the percent increase in the Gulf ports' price. The results show the period-by-period response of each country and region to a sustained change in the U.S. wheat export price.

The U.S. wheat export demand elasticity increases from -0.69 in the first period to -0.86 by the fourth period and then declines to -0.79 in the long run (Figure 2). This result is surprising in that it suggests very little change in the demand for U.S. wheat exports beyond the first period. U.S. wheat excess supply is inelastic, and the elasticity increases from 0.2 in the first period to 0.46 in the third period and then declines to 0.44 in the long run. This range is comparable to the elasticity of excess supply for Argentina. Australian wheat excess supply is highly inelastic since its only link to the world price is through the human consumption price which is statistically insignificant in the food use equation. Canadian wheat excess supply is relatively more elastic and increases from 0.37 in the first period to 2.7 in the long run. This cumulative increase is due to the timing of pool payments which occur over more than one year and therefore affect planting decisions beyond the current crop year. The excess supply of the European Community is not affected by changes in the world price due to the Common Agricultural Policy which isolates domestic prices. Japanese wheat import demand is only marginally responsive to the world price since the Japanese border price has only a marginal impact on the Japanese resale price. The rest of the import demand elasticities reported in Table 2 are stable since the specifications for these importers do not contain any lagged variables.

Model Validation

The model was dynamically simulated over the period 1968–85 in order to compare the simulated results to actual values and to com-

[7]It should be noted that Argentine and Japanese wheat food and feed use were combined for econometric estimation. Feed use, however, represents a small percent of domestic use.

[8]For a discussion of dynamic elasticities and multipliers, see Johnston (pp. 8–11) and Pindyck and Rubinfeld (pp. 391–401).

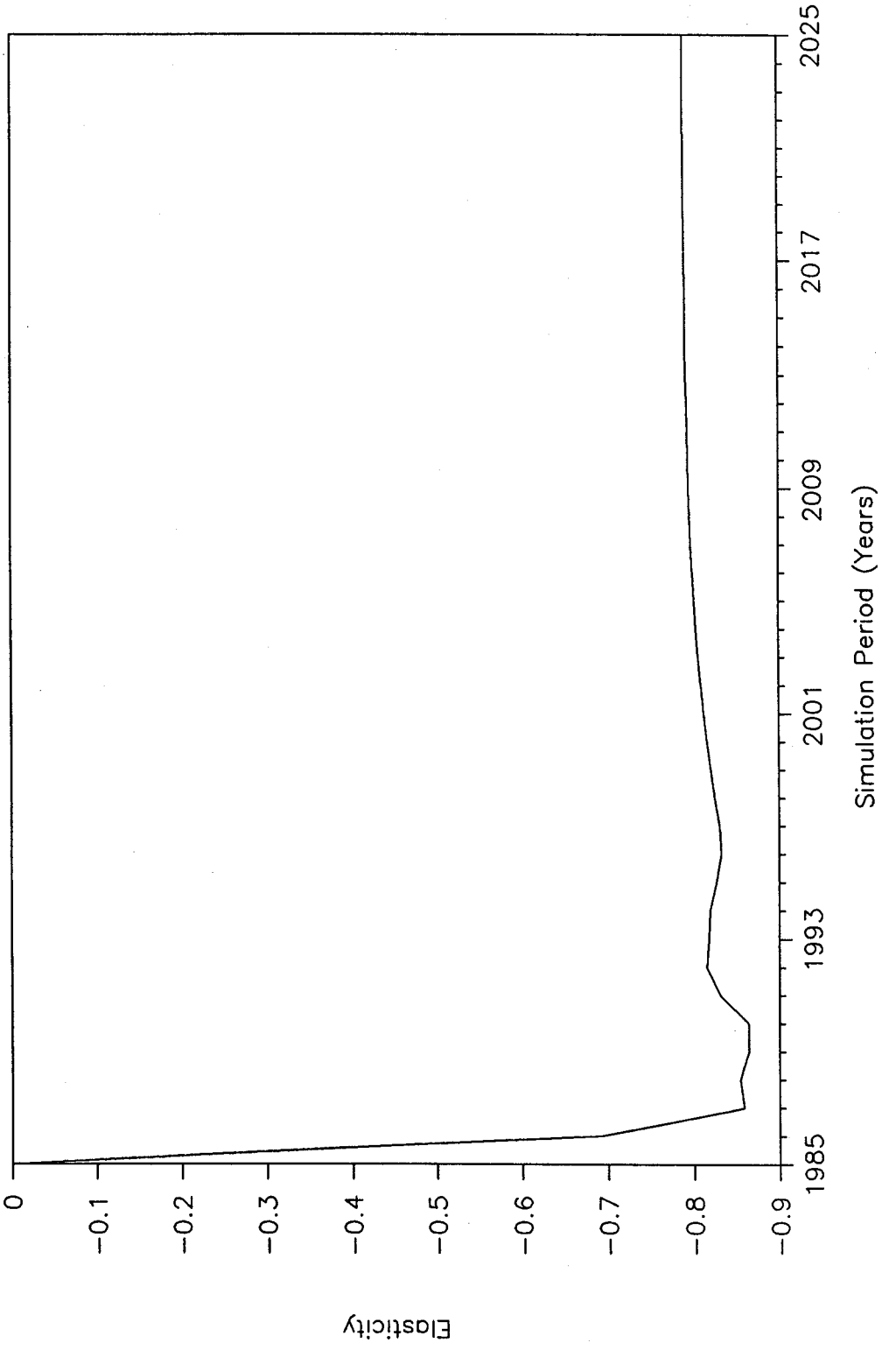

Figure 2. Dynamic Export Demand Elasticity for U.S. Wheat.

TABLE 3. SELECTED VALIDATION STATISTICS OF THE WORLD WHEAT TRADE MODEL, 1968–85[a]

	MARE[b]	PTPE[c]	Adjusted R-Squared
		---- Percent ----	
United States			
Program area	.071	17.65	90.56
Nonprogram area	.234	29.41	93.00
Food use	.012	41.18	79.93
Feed use	.335	17.65	90.81
Seed use	.075	29.41	99.40
Ending stocks[d]	.113	5.88	77.29
Net exports	.134	35.29	—
Gulf ports price	.147	29.41	—
Canada			
Area harvested	.044	17.65	94.16
Food use	.012	23.53	92.37
Feed use	.099	41.18	79.75
Seed use	.054	23.53	98.89
Ending stocks	.095	29.41	91.18
Exports	.100	41.18	—
Australia			
Area planted	.092	11.76	93.62
Food use	.032	41.18	83.58
Feed use	.428	41.18	60.55
Ending stocks	.788	23.53	86.36
Exports	.138	17.65	—
EC-10			
Area harvested	.027	29.41	40.70
Food use	.011	47.06	85.02
Feed use	.076	29.41	91.16
Ending stocks	.141	29.41	75.92
Net exports	1.502	35.29	—
Argentina			
Area planted	.071	23.53	75.05
Domestic use	.030	29.41	83.64
Ending stocks	.294	29.41	51.42
Net exports	.301	29.41	—
Japan			
Area harvested	.210	11.76	98.59
Domestic use	.011	29.41	93.20
Ending stocks	.081	41.18	85.30
Net imports	.027	41.18	—

[a] For wheat supply, use, and prices.
[b] Mean absolute relative error:

$$\text{MARE} = \frac{1}{n}\sum_{t=1}^{n}\left|\frac{y_t - \hat{y}_t}{y_t}\right|,$$

where y_t is the actual value in year t, $\hat{y}_t$ is the model estimate in year t, and n is the number of years in the historical simulation period.
[c] PTPE: percent turning point error.
[d] Commercial stocks.

pute measures of goodness of fit (see Table 3). The Mean Absolute Relative Error (MARE) for U.S. wheat exports (net of imports) and the Gulf ports price is less than 0.15, although the Percent Turning Point Errors (PTPE) are relatively high (35.3 and 29.4, respectively). The validation statistics for these two equations are important since they represent the cumulative effects of all of the other endogenous variables. The results suggest that the model tracks the historical data well. The exception is in a few years when the simulated value of the Gulf ports' price appears to be exceeding the actual value. One explanation for this is that the approach employed to convert the foreign excess supply and demand schedules to a June/May crop year does not accurately reflect the proper timing of actual export shipments.

SIMULATION PROCEDURES

The model was simulated over the ex post forecast period 1986/87–1988/89. A baseline scenario was constructed by adding Baseline Adjustment Factors (BAF's) to individual equation intercepts in order to reflect the USDA's December 1988 Interagency Baseline over this period. The BAF's were computed by taking the difference between the initial simulated values of the endogenous variables and their baseline values on a year-by-year basis. The BAF's reflect the observed variance in the error structure, as well as new information generated over the ex post simulation period.

Once the model was adjusted via the BAF's to reflect the model baseline, the analysis was accomplished using the following three-step approach. First, exogenous variables that are hypothesized to have contributed to the expansion in U.S. wheat exports were shocked one at a time under each scenario. This was accomplished by constraining each factor to its 1985/86 level and rerunning the model over the simulation period 1985/86–88/89. The year-by-year difference between the baseline value and each shocked scenario was then computed. If this change is positive, then an export expanding factor has been isolated. Second, a "low export" scenario was constructed by shocking all of the exogenous variables, or fixing them at their 1985/86 levels, and rerunning the model over the simulation period. The difference between the baseline level of U.S. wheat exports and the "low export" scenario then provided the degree of "market expansion" that can be explained by all of the exogenous factors. Third, the percent of this market expansion attributable to each exogenous factor was then computed. This was accomplished by rerunning the model for each exogenous variable by constraining all variables except the one of interest to its 1985/86 level. The difference in U.S. wheat exports between each of these scenarios and the "low

export" scenario would then provide an estimate of the direct effect of each exogenous variable on market expansion. Interactions between exogenous variables could also be isolated in this manner if the year-by-year sum of the individual changes in U.S. wheat exports due to each factor is not equal to the computed "market expansion."

Model Scenarios

Four exogenous factors have been hypothesized to have contributed to the expansion in U.S. wheat exports. Scenarios were constructed to test these factors. They are: (1) reductions in competitor yields, (2) a lower U.S. wheat loan rate, (3) the Export Enhancement Program (EEP), and (4) factors unrelated to the world wheat price that have expanded imports by the Soviet Union and China. Factors (1)–(3) above have been viewed by many in the industry as responsible for this export expansion. Factor (4) was isolated in an earlier analysis after it became apparent that factors (1)–(3) explained less than half of the U.S. wheat export expansion. The depreciation in the value of the U.S. dollar was also hypothesized to have contributed to this export expansion, but was not considered here since bilateral exchange rates are not reflected in the regional import demand equations in the world wheat simulation model.

Scenario Assumptions

A major assumption for scenarios (1)–(4) is that U.S. government-owned stocks are endogenized so as to maintain the wheat farm price at its baseline level.[9] This assumption was made since FOR and CCC stocks were not fully endogenized in the model. Generic certificate programs and the weekly CCC wheat auction program are hypothesized to have been used by the CCC to reach targeted year-end stock levels, which implicitly suggests the existence of a targeted season average farm price. Given the complexity with which the CCC stock program has been managed under the 1985 Act, it was assumed for all scenarios that CCC plus Farmer Owned Reserve (FOR) stocks are endogenized so as to maintain the wheat farm price at its baseline level.

The objective of scenario (1) is to isolate the effect of reductions in competitor yields on U.S. wheat exports. The latter has the effect of shifting a country's excess supply function to the left, thereby shifting the excess demand function facing the U.S. market to the right. Competitor yields in scenario (1) were therefore constrained from falling below their 1985/86 levels.

Scenarios (2) and (3) reflect provisions in the Food Security Act of 1985 that are hypothesized to have expanded U.S. wheat export volume. The loan rate was frozen at its 1985/86 level in scenario (2) in order to assess the impact of a more flexible loan rate on U.S. wheat exports. The U.S. wheat loan rate provides a floor for U.S. and world wheat prices in the model, and also determines minimum support prices in Canada and Australia. Loan rates and farm prices for wheat and competing crops, as well as target prices, diversion provisions, and production costs, were frozen at 1985/86 levels. CCC and FOR stocks were endogenized to support a $3.30 per bushel farm price in this scenario. EEP bonuses were unaltered in order to isolate the loan rate effects.

The impact of the EEP on U.S. wheat exports is isolated in scenario (3). The export bonus program was conceptualized in the model baseline by expanding the theory of a general export payment-in-kind scheme to the unique case of a targeted program (Houck; Bailey, 1988, pp. 273–79). The EEP bonuses were set equal to zero in this scenario in order to isolate the impact of this program on U.S. wheat export volume.

Finally, scenario (4) isolates those factors unrelated to the world wheat price that have expanded import demand in the Soviet Union and China. Based on reduced-form import demand functions for the centrally planned importers estimated using time series data from 1960 to 1985, the Soviet Union was the only centrally planned importer found to be price responsive (CARD). However, because China has exhibited price responsive behavior in recent years, an implied import demand elasticity of –0.6 was used.[10] Therefore, part of the increase in Soviet and Chinese imports was captured in scenario (2) and (3) by lower world prices. Scenario (4) then isolates those nonprice factors that expanded imports in the Soviet Union and China and analyzes their effect on U.S. wheat exports. This was accomplished by constraining the BAF's for the Soviet and Chinese import demand functions to 1985/86 levels.

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[9]The exception is scenario (3) which maintained the farm price at the 1985 loan rate level.

[10]This elasticity was provided by the Commodity Trade Analysis Branch (CED) of the Economic Research Service. This is similar to the -0.54 estimate adopted by the USDA for the Trade Embargo/Competiveness study (Abbott et al.).

TABLE 4. MODEL ESTIMATES OF FACTORS AFFECTING U.S. WHEAT EXPORTS

Crop Year [a]	1986/87	1987/88	1988/89
	--- Million Bushels ---		
U.S. wheat exports[b]	1,003	1,592	1,450
Low export scenario[c]	536	586	840
Market expansion:			
Bushels[d]	467	1,006	610
Percent change (percent)[e]	87	172	73
Export change attributable to:[f]	----- Percent -----		
EEP program	31	19	23
Lower U.S. loan rate	35	27	11
Lower competitor yields	10	10	25
Soviet and Chinese imports[g]	24	42	41
All four factors	100	100	100

[a] June/May crop year.
[b] Source: USDA (1988).
[c] Model scenario with all four factors constrained to their 1985/86 levels.
[d] The difference in U.S. wheat exports between the baseline and the low export scenario.
[e] Relative to the low export scenario.
[f] The percent of the total change in U.S. wheat exports on a year-by-year basis attributable to each factor.
[g] Nonprice factors that have expanded imports for the Soviet Union and China.

SIMULATION RESULTS

The results indicate that U.S. wheat exports have increased 467 million bushels in 1986/87, 1,006 million in 1987/88, and 610 million in 1988/89 due to the combination of the following four factors: (a) the Export Enhancement Program, (b) the lower wheat loan rate, (c) reductions in competitor yields, and (d) nonprice factors that expanded imports in the Soviet Union and China (Table 4).

The EEP program, which lowered the U.S. export price in targeted markets, accounted for about 30 percent of the export expansion in 1986/87 and about 20 percent in 1987/88–1988/89. The lower wheat loan rate, which dropped U.S. export prices to all buyers, is responsible for about a third of the market expansion in 1986/87 and 1987/88 and about 11 percent in 1988/89. Lower yields in competing countries accounted for 10 percent of the expansion in 1986/87 and 1987/88 and 25 percent in 1988/89. Most of the increase, however, was due to factors unrelated to the world price that increased imports by the Soviet Union and China. These factors accounted for about a quarter of the market expansion in 1986/87 and about 40 percent in 1987/88 and 1988/89.

Export Enhancement Program

The amount of wheat shipped under the EEP has increased from 10 percent of total U.S. exports in 1985/86 to 65 percent in 1987/88. The model results, however, indicate that some of the wheat shipped under the EEP would have been exported regardless of the program because of the other factors mentioned. They further suggest that total U.S. wheat exports increased 20 percent in 1986/87, 7 percent in 1987/88, and an estimated 6 percent in 1988/89 relative to what would have occurred without the EEP. That translates into an export expansion of 169 million bushels in 1986/87, 104 million in 1987/88, and 83 million in 1988/89.

The ability of the EEP to expand U.S. wheat exports depends critically on prevailing world market conditions. World wheat stocks were 34 percent of world consumption 1985/86—up from 25 percent in 1980/81—and competition between exporting countries for markets was very keen. Moreover, much of the U.S.'s supply was tied up in government stocks unavailable to the market. The EEP helped provide the U.S. an advantage in this environment and therefore accounted for about 30 percent of the U.S. export expansion isolated by the model in 1986/87. Market conditions, however, changed appreciably in 1987/88 as competitor production fell and Soviet and Chinese import demand grew significantly due to domestic factors. As a result, there was much less competition between exporting countries for import markets. Despite an estimated four-fold increase in estimated EEP bonuses to $1 billion, the EEP accounted for just 19 percent of the 1 billion bushel expansion in U.S. wheat exports in 1987/88 (Table 4). Market conditions further changed in 1988/89 as U.S. wheat supplies fell significantly due to generic certificates, which drew down government stocks, and the drought. The drought also resulted in a 40-percent reduction in Canadian wheat production from the year before to just 16 million metric tons. The result was continued strong competition between importers for available world supplies despite a projected 25-percent reduction in Soviet and Chinese imports (USDA baseline). As a result, the EEP was not very effective in generating additional U.S. wheat exports in 1987/88 and 1988/89 due to these market conditions.

Wheat Loan Rate

The U.S. wheat loan rate fell from $3.30 per bushel in 1985/86 to $2.28 in 1988/89 under the Food Security Act of 1985. This lower wheat

loan rate accounted for 35 percent of the market expansion in 1986/87, 27 percent in 1987/88, and 11 percent in 1988/89. The lower loan rate resulted in marginally lower competitor production and higher import demand. Harvested wheat area in export competing nations fell only 1–5 percent from what it would have been with the higher loan rate despite significantly reduced price supports. Generous agricultural support programs, particularly in the European Community (EC) and Canada, isolated producers from changes in the world price, thus leaving planted area unresponsive to lower world prices.

The lower wheat loan rate under the 1985 Act also sharply lowered U.S. wheat ending stocks. Ending stocks fell 17 percent in 1986/87, 36 percent in 1987/88, and 57 percent in 1988/89 from what they would have been under a $3.30 loan rate. Maintaining the loan rate at the 1985 level would have meant large forfeitures by producers to the CCC in order to support the wheat farm price at $3.30 per bushel. Wheat normally produced for export would have continued to fall into CCC storage under a high and rigid loan rate.

Competitor Production

Wheat yields in the EC and Australia fell below their 1985/86 levels in both 1986/87 and 1987/88 due to adverse weather. The drought of 1988 accounted for most of the drop in Canadian wheat production from 26 million metric tons in 1987/88 to just 16 million in 1988/89. This shortfall reduced the amount of wheat available for export from those countries, increasing the demand for U.S. wheat.

Given the magnitude of these yield fluctuations, lower competitor yields have had a minimal effect on U.S. wheat exports in 1986/87 and 1987/88, accounting for just 10 percent of the market expansion isolated by the model. However, the drought of 1988/89 significantly reduced Canadian wheat production while reducing U.S. wheat yields just 10 percent from the year before. Therefore, the percent of market expansion due to reductions in competitor yields increased to 25 percent in 1988/89.

Imports by the Soviet Union and China

Total imports by the Soviet Union and China increased from 22.3 million metric tons in 1985/86 to an estimated 36.5 million metric tons in 1987/88, and then fell to a projected 27.5 million metric tons in 1988/89 (USDA baseline). Some of this import expansion since 1985/86 was due to the lower wheat loan rate which lowered export prices in general and the EEP which further reduced U.S. prices in targeted markets. Most of it, however, was due to nonprice factors in the Soviet Union and China, such as poor-quality harvests and changes in domestic policies. These internal factors accounted for 24 percent of the U.S. export market expansion in 1986/87, 42 percent of the increase in 1987/88, and 41 percent in 1988/89.

Soviet imports increased from 15.7 million metric tons in 1985/86 to an estimated 22 million metric tons by 1987/88, and then fell to a projected 14 million metric tons in 1988/89 (USDA baseline). CARD estimated Soviet wheat import demand as a function of Soviet wheat production, the U.S. wheat Gulf ports price (less the EEP bonus to the Soviet Union), and hard currency earnings from crude oil exports. Some of the recent import expansion, however, was also due to a poor-quality crop in 1987/88 which increased imports of bread-quality wheat which were needed to meet domestic food needs. These non-price factors were originally unaccounted for by the model. They increased Soviet imports and were therefore reflected in this scenario. Factors that lowered the price the Soviet Union paid for imports—namely lower U.S. wheat loan rates and the EEP—were accounted for earlier.

Wheat imports by China increased from 6.6 million metric tons in 1985/86 to an estimated 15 million metric tons in 1987/88, and then fell to a projected 13.5 million metric tons in 1988/89 (USDA baseline). These higher imports since 1985/86 were due to a growing population, rising incomes, and falling stocks. Recent economic reforms in China have increased personal incomes which led in turn to increased food demand. That higher demand outstripped domestic production and sharply lowered stocks. The Chinese government opted to meet increased domestic demand and offset rapidly falling stock levels with added imports. It is these nonprice factors which were reflected in this scenario. Some of the increase in total Chinese imports, however, was due to the price effects of lower wheat loan rates and the EEP. China has become more price responsive in recent years and may have taken advantage of the EEP offers and allocated more hard currency reserves to purchase a larger volume of grain in order to rebuild their depleted stock levels. These price effects, however, were accounted for earlier.

CONCLUSIONS

The U.S. share of the world wheat market fell from a high of 48 percent in 1981/82 to 29 percent by 1985/86. This loss of market share was a major consideration in the debate for the Food Security Act of 1985. U.S. wheat exports have since increased 75 percent from 1985/86 to an estimated 1.6 billion bushels in 1987/88. The results of this analysis show that this expansion can be attributed to the following four factors: (a) the Export Enhancement Program, (b) the lower wheat loan rate, (c) reductions in competitor yields, and (d) factors unrelated to the world price that have expanded imports in the Soviet Union and China.

About 40 percent of the expansion in U.S. wheat exports since 1985/86 is directly attributable to non-price factors that have expanded imports by the Soviet Union and China. Roughly half of the expansion in U.S. wheat exports can be attributed to policy changes in the Food Security Act of 1985. These changes include lower wheat loan rates, the EEP, and generic certificates that made U.S. government wheat stocks available to the market. The balance of the market expansion is due to reductions in competitor yields, with 25 percent of the expansion in 1988/89 due to the drought in Canada.

The EEP program has been responsible for about a third of the expansion in U.S. wheat exports in 1986/87 and about 20 percent of the expansion in 1987/88 and 1988/89. Although the amount of wheat shipped under the EEP has increased from 10 percent of total U.S. exports in 1985/86 to 65 percent in 1987/88, this analysis suggests that some of the wheat shipped under the EEP would have been exported without the program because of the other factors mentioned. The effectiveness of the program in expanding U.S. wheat exports faded in 1987/88 and 1988/89 due to changing market conditions that resulted in less competition between the world's major exporters and more competition between the world's importers.

Lower U.S. wheat loan rates significantly expanded U.S. wheat exports, particularly in 1986/87 and 1987/88, and significantly lowered U.S. wheat ending stocks. Lower loan rates made the United States more competitive in world markets and lowered government stocks. Ending stocks fell 17 percent in 1986/87, 36 percent in 1987/88, and 57 percent in 1988/89 from what they would have been under a $3.30 loan rate. Lower loan rates, however, did not significantly reduce planted wheat area in export competing countries, particularly the EC and Canada, because of generous agricultural policies.

REFERENCES

Abbott, P. C., P. L. Paarlberg, and P. M. Patterson. "Supplier Substitutability by Importers: Implications for Assessing the 1980 U.S. Grain Embargo." *So. J. Agr. Econ.*, 20 (1988):1–14.

Alaouze, C. M., A. S. Watson, and N. H. Sturgess. "Oligopoly Pricing in the World Wheat Market." *Amer. J. Agr. Econ.*, 60 (1978):173–85.

Bailey, K. W. "The Impact of the Food Security Act of 1985 on U.S. Wheat Exports: An Econometric Analysis." Ph.D. Dissertation, Dept. of Agricultural and Applied Economics, University of Minnesota, September 1988.

Bailey, K. W. *A Structural Econometric Model of the World Wheat Market.* ERS, USDA, Tech. Bull. No. 1763, June 1989.

Bailey, K.W., and C. Goodloe. "An Econometric Analysis of the Effect of the Food Security Act of 1985 on the Wheat Sectors of Canada and Australia." *Wheat Situation and Outlook Report.* ERS, USDA, WS-279, September 1987.

Bancroft, R. L. "An Econometric Analysis of Aggregate Acreage Response, Program Participation and Land Retirement." Ph.D. Dissertation, Dept. of Agricultural Economics, Purdue University, 1981.

Bredahl, M., W. Meyers, and K. Collins. "The Elasticity of Foreign Demand for U.S. Agricultural Products: The Importance of the Price Transmission Elasticity." *Amer. J. Agr. Econ.*, 61 (1979):58–63.

Devadoss, S., M. Helmar, and W. Meyers. "FAPRI Trade Model for the Wheat Sector: Specification, Estimation, and Validation." Staff Report No. 86-SR3. Center for Agricultural and Rural Development, Iowa State University, January 1986.

Glauber, J. W. *Generic Certificates.* ERS, USDA, Agr. Econ. Report No. 594, August 1988.

Grennes, T., and P. Johnson. "Oligopoly Pricing in the World Wheat Market: Comment." *Amer. J. Agr. Econ.*, 61 (1979):574–77.

Houck, J. P. "The Basic Economics of an Export Bonus Scheme." *No. Cent. J. Agr. Econ.*, 8 (1986):227–35.

Johnston, J. *Econometric Methods.* New York: McGraw-Hill Book Co., 1984.

McCalla, A. F. "A Duopoly Model of World Wheat Pricing." *Amer. J. Agr. Econ.*, 48 (1966):711–27.

Meilke, K., and H. de Gorter. *An Econometric Model of the European Economic Community's Wheat Sector.* Working Paper No. 86-3. International Agricultural Trade Research Consortium, February 1986.

Pindyck, R., and D. Rubinfeld. *Econometric Models and Economic Forecasts.* New York: McGraw-Hill Book Co., 1981.

Salathe, L., and S. Langley. "An Empirical Analysis of Alternative Export Subsidy Programs for U.S. Wheat." *J. Agr. Econ.*, 38, 1 (1986):1–18.

Smith, M. *Increased Role for U.S. Farm Export Programs.* ERS, USDA, Agr. Info. Bull. No. 515, April 1987.

Smith, M. "Programs Boost U.S. Farm Exports." *Agricultural Outlook.* ERS, USDA, AO-141, May 1988.

Thompson, R. L. *Statement by Robert L. Thompson, Assistant Secretary of Agriculture for Economics before the House Appropriations Committee, Subcommittee on Agriculture, Rural Development, and Related Agencies.* U.S. Congress, House, Committee on Appropriations, 99th Cong., 1st sess., 1987.

U.S. Department of Agriculture. Economic Research Service. *Embargoes, Surplus Disposal, and U.S. Agriculture.* AER-564, December 1986.

U.S. Department of Agriculture. Economic Research Service. *Wheat Situation and Outlook Report.* WS-283, November 1988.