Volume Title: The Effects of U.S. Trade Protection and Promotion Policies

Volume Author/Editor: Robert C. Feenstra, editor

Volume Publisher: University of Chicago Press

Volume ISBN: 0-226-23951-9

Volume URL: http://www.nber.org/books/feen97-1

Conference Date: October 6-7, 1995

Publication Date: January 1997

Chapter Title: Causes and Consequences of the Export Enhancement Program for Wheat

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Chapter URL: http://www.nber.org/chapters/c0316

Chapter pages in book: (p. 273 - 296)

10 Causes and Consequences of the Export Enhancement Program for Wheat

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Trade has played a major role in U.S. agriculture throughout the twentieth century. The share of annual U.S. wheat production that was exported rose from approximately 25 percent at the beginning of the century to 60 percent by the beginning of the 1980s. The federal government has supported agricultural production in general, and exports in particular, with several programs. The export programs aim to achieve three basic goals: maintain appropriate surplus levels of agricultural commodities, increase foreign demand for U.S. products, and support humanitarian causes. Export programs have taken four basic forms: export subsidies (in kind or in cash) that have allowed domestic prices to exceed world prices and countered subsidization by U.S. competitors; export credit and credit guarantee programs that have assisted countries with foreign exchange difficulties; food aid programs, directed toward countries suffering from hunger; and nonprice promotion programs that have attempted to increase foreign demand for U.S. products. The focus of this paper is on the effects of the most recent export subsidization program, known as the Export Enhancement Program (EEP). Since the primary commodity sold under this program is wheat (wheat sales account for approximately 80 percent of total EEP sales), we concentrate our analysis on the wheat market.

The EEP was established by the secretary of agriculture in the spring of 1985 in reaction to the continuing decline in U.S. agricultural exports and the increase in government stocks of grain. The program is considered a success by the U.S. Department of Agriculture (USDA) and the majority of research-

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The authors thank Edward Allen, Steve Haley, Howard Leathers, and Jim Werden for many helpful discussions and help with the data. Rachel Levy and Amy Schneeberger provided research assistance. The responsibility for any errors is of course the authors' own.

ers. This evaluation is based on two facts. First, coincident with the implementation of EEP legislation, U.S. wheat exports have increased significantly. Second, the majority of existing studies on the effects of the EEP find positive, albeit small, effects of the program on exports, revenues, and domestic prices. The method employed in such studies is almost exclusively that of simulation.[1] The wheat market is modeled in detail, and the equilibrium conditions for the world market are derived; next, the equilibrium is computed under alternative scenarios concerning the relevant policy variables. Comparing the outcomes corresponding to scenarios with and without the EEP provides an estimate of the effects of the program. Simulation studies typically consider one year at a time; owing to the reference to different years and the sensitivity of the results to modeling assumptions and functional forms, a comparison of results across studies is often difficult. The analysis is complicated by the complexity of farm programs; the EEP was introduced in conjunction with other changes in basic farm support.

In this paper, we employ a different method to analyze the effect of a variety of factors on the world wheat market and U.S. producers. Rather than relying on simulation analysis, we explore time-series data for the period 1970–94 to investigate the relation between export performance, subsidies, and other factors. Our analysis will attempt to address the following questions: (1) How important are relative cost changes in explaining the performance of U.S. wheat producers prior to the EEP program? (2) Which was primarily responsible for the decline in U.S. production and export shares in the world wheat market in the early 1980s—relative cost changes or European subsidization? (3) Do U.S. policies toward wheat, such as price guarantees, have detectable effects on the behavior of wheat growers? (4) How important are policy changes and relative cost changes in explaining the recovery of production and exports after 1985?

The remainder of the paper is organized as follows. In section 10.1, we provide an overview of the U.S. wheat market and the EEP and summarize the results of the literature to date on the effects of the program; we conclude this section by describing our own approach. In section 10.2, we describe the data used in the empirical analysis. Section 10.3 reports and interprets the results, and section 10.4 concludes.

10.1 Overview of the Export Enhancement Program

10.1.1 The U.S. Wheat Market

Understanding the determinants of domestic supply and demand is a prerequisite for studying exports in any market. Domestic demand comprises two

1. Examples of such studies include Anania, Bohman, and Carter (1992), Brooks, Devadoss, and Myers (1990), Seitzinger and Paarlberg (1989a, 1989b, 1990), and Haley (1989).

major components: private demand and demand for stocks. Private demand is fairly stable and predictable since policy reduces price fluctuations through the holding of stocks. Stocks are held both commercially (known as "free" stocks) and by the federal government. Government stockholding is a major tool of U.S. agricultural policy. The Commodity Credit Corporation (CCC) buys wheat from farmers participating in price-support programs at a specified price called the loan rate, in whatever quantities necessary to cause the market price to rise to the loan rate. Thus, the loan rate becomes a floor on U.S. prices. In periods when market prices exceed loan rates, accumulation of government stocks is low. If private market prices would tend below the loan rate, on the other hand, farmers would have incentive to sell to the CCC until market prices equaled the loan rate, leading to rapid growth in government stocks. In addition to the loan rate, the government uses target prices to support farm income; farmers receive deficiency payments equal to the difference between the target price and the maximum of the loan rate and market price.

The domestic supply of wheat is the product of acreage planted and yield per acre. The acreage devoted to wheat will generally depend on wheat market conditions in recent years and overall farm policy variables. During the 1980s, farmers participating in agricultural support programs were subject to requirements that limited the acreage for wheat growing. While a high loan rate might encourage production, the fact that participation in the program is conditional on acreage restrictions makes the connection between loan rates and acreage uncertain. It will depend on the set-aside requirements that are associated with any particular loan rate. It is possible that high loan rates encourage participation in the program, which then imposes sufficiently stringent set-asides that acreage declines with the loan rate. Although yield is partially determined by exogenous factors such as weather conditions and soil quality, it may also be influenced by behavior; when market conditions are favorable, owing to strong export demand, farmers can partly overcome the effect of acreage restrictions on production by using resources more intensively to increase yield.

The description given above of the U.S. wheat market demonstrates the channels through which domestic policy instruments influence exports. A high loan rate, for example, increases market price, inducing an increase in domestic production, provided that acreage restrictions are not too strong. But higher loan rates, and thus domestic prices, can make exports to world markets less desirable. The excess of domestic supply over private domestic demand is more likely to be absorbed by a rise in government stocks. As a result, one would generally expect loan rates to be positively related to production volume (for a given acreage at least) and government stocks and inversely related to exports. Since the value of the dollar dictates the relative cost advantage of U.S. producers on the world market, it, too, should influence acreage, production, and export decisions. All else equal, a weak dollar implies a higher dollar price on the world wheat market and greater incentive to plant, produce, and export wheat.

Fig. 10.1 U.S. wheat, 1970–94: Production, exports, and ending stocks
Source: World Wheat Situation and Outlook Yearbook.

10.1.2 Historical Background

The EEP was enacted during a period of financial distress for farmers, characterized by declining land values, a significant loss of export markets and farm income, and a growing surplus of government stocks. Figure 10.1 depicts wheat production, exports, and government stocks for the period 1970–94; while exports were relatively stable during the early 1970s and soared during the second part of that decade, they started faltering in 1981; between crop years 1981–82 and 1985–86, the export volume fell from 1,771 to 909 million bushels. During the same period, government stocks increased steadily to reach a peak level of 1,905 million bushels in 1985.

Several factors contributed to these developments. On the domestic side, high legislated loan rate levels for wheat (fig. 10.2) increased the incentive to sell to the CCC. On the international side, the strong appreciation of the dollar in the early 1980s eroded the competitiveness of U.S. wheat exports relative to foreign-produced wheat. Figure 10.3 depicts three alternative, weighted-average real exchange rate indices for wheat markets, one against the currencies of the major importing countries (Japan, Brazil, Morocco, Nigeria, Egypt, India, etc.), one against the currencies of the major wheat competitors (Canada, Argentina, Australia, and the European Community), and a combined index that measures the value of the dollar in the overall world agricultural trade market.[2] All three indices increased sharply between 1980 and 1985. Together,

2. These trade-weighted indices are constructed as follows. First, the current exchange rate for each country (in units per dollar) is adjusted by taking the ratio of the same-period CPI in the

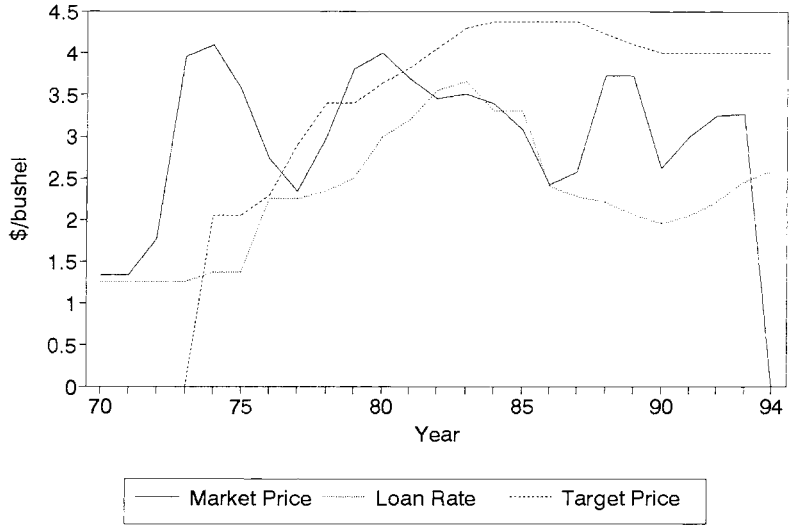

Fig. 10.2 U.S. wheat, 1970–94: Market price, loan rate, and target price
Source: World Wheat Situation and Outlook Yearbook.

the high loan rates and strong dollar shifted sales away from export markets and toward government stocks.

Other factors held responsible for the situation in the export markets were the debt problems and slow income growth in many importing countries and the extensive subsidization of wheat exports by the European Community (EC). The EC subsidies took the form of export restitutions paid to exporters to compensate for any difference between the world market price for wheat and an internal price floor. Under the Common Agricultural Policy (CAP), intervention prices—the prices guaranteed on EC sales—are set. Quantities not consumed domestically are sold in the international markets at going world prices. The difference between the world price and the EC intervention price is the export restitution. Thanks in part to the extensive subsidization, the EC switched from being a net importer of wheat until 1974 to becoming a major U.S. competitor in the world wheat markets in the 1980s. In addition, the exchange rate swings that worked against U.S. exports worked in favor of European producers.

Against this background, the Food Security Act of 1985, which outlined the farm policy for crop years 1986–90, set out to reduce government stocks and

United States to that of the country in question. Then, the percentage change from the base period (1980) is multiplied by a weight. The geometric mean of these changes constitutes the real weighted exchange rate index. The weights used in the construction of the three indices are the average dollar shares of U.S. exports from 1983 to 1985 for the customer-based index, the world less U.S. shares in wheat exports for the competitor-based index, and U.S. market shares for the combined index.

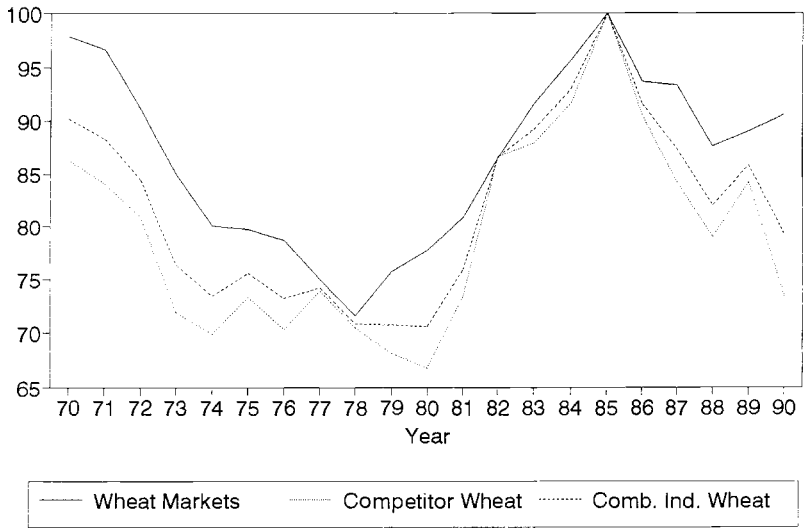

Fig. 10.3 Exchange rate indices: Weighted average, annual, 1970–90
Source: World Wheat Situation and Outlook Yearbook.

improve the situation in the export markets through a series of measures. A reduction in the loan rates was aimed at lowering U.S. prices for wheat, making the United States more competitive in the export markets while reducing the growth in government stocks. To maintain farm income support, target prices were frozen at the 1985 level for crop year 1986–87 and slowly declined afterward. To make exports more competitive, the EEP was established and designed in such a way as to simultaneously contribute to the reduction of government stocks. Under the original design of the program, government-owned surplus commodities were to be paid as bonuses to exporters to allow them to lower the prices of U.S. agricultural products in specific markets. By 1989, however, the government stocks were reduced to such a level that payment in kind was no longer feasible, and cash subsidies replaced the old system. The EEP was further designed as a targeted subsidization program; the targeted markets were ones where U.S. competitors, the European Community in particular, heavily subsidized their exports.

The EEP was initially codified as a three-year export subsidy program; during this time frame, a total of $2 billion worth of surplus commodities was to be made available to exporters as bonuses. Later, the overall amount of bonuses was limited to a maximum of $1.5 billion. In 1987, however, the USDA announced that the program would continue once the authorized $1.5 billion was exhausted. In fact, the Omnibus Trade and Competitiveness Act of 1988 authorized an additional $1 billion in commodities, raising the ceiling to $2.5 billion. By the end of 1990, approximately $2.9 billion had been allocated to

subsidize U.S. agricultural exports. The 1990 Farm Bill established minimum expenditures of $500 million per year for 1991–95. An additional $1 billion would be available if GATT negotiations failed or if no agreement were reached by 1992.

10.1.3 Criteria for the EEP

The Foreign Agricultural Service (FAS) of the USDA, which administers the program, specified four criteria for evaluating sales under the EEP. These were as follows:

1. *Additionality.* Sales under the EEP should increase agricultural exports above the level that would have occurred in the absence of the program.

2. *Targeting.* The EEP is not a global export program; subsidies are to be targeted to markets that the EC heavily subsidizes. This is an important feature of the EEP since it implies that marginal exports are unlikely to be eligible for subsidies.

3. *Budget neutrality.* Budget outlays should not increase beyond what they would have been in the absence of the program. The original design of the EEP as an in-kind subsidy program served this purpose directly as no cash payments were made to exporters; on the contrary, the government saved on the storage costs of the surplus commodities. In later years, even though cash payments replaced in-kind bonuses, the EEP can be viewed as a substitute to domestic support payments; by increasing export sales and thus supporting higher wheat market prices, the program reduces the amount of deficiency payments to farmers.

4. *Cost effectiveness.* The last criterion is rather vague as it specifies that EEP sales should result in a net gain to the overall economy. It has been a subject of intense debate in the literature under which conditions export subsidies increase national welfare (for an overview, see Anania, Bohman, and Carter 1992); but the U.S. wheat market does not fit the theoretical framework of any of the models that provide a justification for such subsidies.

In late 1989, the FAS reformulated the guidelines for approval of EEP sales to emphasize the EEP's trade policy objectives: further the U.S. negotiating strategy in the Uruguay Round by countering competitors' unfair trade practices, and develop, maintain, and expand markets for U.S. agricultural products.

10.1.4 Implementation of the EEP

The USDA uses a flexible multistage process to determine and award subsidies to exporting firms. First, the FAS receives and reviews proposals from USDA specialists, members of the U.S. agricultural community, and foreign

governments before selecting countries and commodities to target. An approved proposal is announced as an initiative, specifying the targeted country, the commodity, and the maximum quantity (e.g., 300,000 metric tons) that can be sold under the EEP.

Next, the FAS uses information based on market intelligence reports to set minimum acceptable sale prices and maximum bonuses. The minimum price is one that is competitive with the prices of alternative suppliers. The FAS also estimates the U.S. domestic price plus freight and handling to a particular destination. The difference between the minimum price and the U.S. price represents the maximum acceptable bonus. To promote competition among exporting firms, neither minimum prices nor maximum bonuses are announced publicly.

After the initiative is announced, U.S. exporting firms compete for sales in the foreign markets through an FAS-administered bidding process. In particular, exporters negotiate with the targeted country to determine the quality, quantity, and price of wheat that they will deliver. This information is submitted as a bid to the FAS. If the price specified in the bid is lower than the minimum acceptable price set by the FAS, the bid is rejected. If the price is higher, the FAS compares the bonus amount to the maximum acceptable bonus. If the exporter's bonus is higher, the bid is rejected. A rejected bid can be revised and resubmitted. If the bid passes both the price and the bonus tests, the FAS compares its bonus amount to the bonus amounts of all acceptable bids received and awards the subsidies in ascending order of bonuses until the approved quantity is filled.

Firms with successful bids export and receive EEP subsidies. Until 1989, these subsidies took the form of commodity certificates with value equal to the per-unit bonus times the amount of wheat sold to the targeted country. Exporting firms could exchange the certificates for an equivalent value of surplus commodities in government storage or sell them. After 1989, the commodity certificates were replaced by cash subsidies.

10.1.5 Activity under the EEP

As mentioned above, the main commodity sold under the EEP is wheat; other commodities include barley (7 percent of total EEP sales), wheat flour, sorghum, rice, poultry, dairy cattle, and eggs.

In the first year of the program (May–September 1985), four North African countries (Algeria, Egypt, Morocco, and Yemen) were targeted. Over the next four fiscal years, the number of countries grew to sixty-five. No additional countries have been targeted since 1988. The major recipients are the Soviet Union (27 percent of total EEP sales), China (19 percent), and Algeria, Egypt, and Morocco (a combined 28 percent). The other sixty countries account for the remaining 26 percent of EEP wheat sales. It is interesting to note that the two major recipients (the Soviet Union and China) were originally excluded from the EEP. Both countries reacted to the exclusion by refusing to buy U.S.

wheat; as a result, the U.S. market shares dropped from 34 percent in 1984 to 8 percent in 1985 and 1 percent in 1986 in China and from 22 percent in 1984 to 1 percent in 1985 and 5 percent in 1986 in the Soviet Union. The decline in market shares was reversed in 1987, when both countries became eligible for the EEP. Critics of the EEP view these particular episodes in China and the Soviet Union as evidence that the United States lacks market power in the world wheat market and that it cannot therefore act as a price-discriminating monopolist (see Anania, Bohman, and Carter 1992). The inability to price discriminate reduces the likelihood that U.S. welfare is increased by subsidizing exports.

EEP subsidy levels (average bonus as a percentage of average sales price) vary substantially by commodity, country, and year. For wheat, the average subsidy level over the entire period the EEP has been in effect is about 27 percent; the year 1987 is associated with the highest subsidies (43 percent). A comparison across countries shows that the Soviet Union and other Eastern European countries successfully negotiated the higher per-ton subsidies, followed by North Africa and China. Latin American and Middle Eastern countries received lower than average subsidies. In general, subsidy levels have been higher for the countries in which the EC has been more competitive.

Since the implementation of the EEP, U.S. wheat exports have increased significantly; the fastest growth occurred between 1985 and 1988, when exports went from twenty-five to forty-three metric tons (see also fig. 10.1 above). EEP sales during this period accounted for approximately 50 percent of total U.S. wheat exports, but, as with subsidy levels, there was substantial variation across years and countries. The maximum EEP share was reached in 1987, when the EEP accounted for approximately 74 percent of wheat exports. Of course, this does not imply that, without the EEP, U.S. exports would have been minimal; it is an open question whether, despite its stated objective of additionality, the EEP merely displaced commercial exports.

Around seventy-five firms have sold and delivered commodity certificates under the program. Many of these firms are foreign owned but have been incorporated for business in the United States. The four largest exporters (Cargill, Continental Grain, Louis Dreyfus, and Artfer) account for 65 percent of total EEP bonuses received, each receiving over $100 million in bonuses.

10.1.6 Evaluation of the EEP

As previously mentioned, policy makers consider the EEP a success. This assessment is based on the fact that, after the introduction of the EEP, U.S. wheat exports started increasing, suggesting that the additionality criterion was being met, while government stocks started dropping, suggesting that budget neutrality and cost effectiveness were being satisfied as well. By 1990, the stocks were reduced to the lowest level since the mid-1970s; the concern about how to reduce the wheat surpluses has given way to the question of optimal stock size.

The academic community, however, has been more skeptical in its evaluation of the EEP. On the theoretical side, it is not obvious that additionality will be met since subsidies will be inframarginal owing to the targeted nature of the program. Critics also point out that the wheat export increase coincides with several favorable developments in the international markets, and isolating the contribution of the EEP is therefore difficult. Some of the factors suspected of having increased wheat exports independent of the program were the low yields in export-competing countries because of the drought, the depreciation of the U.S. dollar, the low loan rate legislated in 1985, and the large increase in demand by the Soviet Union and China. To isolate the effects of the EEP, economists have constructed detailed models of the world wheat market and simulated the effects of alternative policy scenarios. As usual with this type of analysis, the results depend on the particular assumptions that the research is willing to make about the behavior of the economic agents and the functional forms.

One of the most important assumptions in this context concerns the response of the other export-competing nations, the EC in particular, to the EEP. According to the USDA Economic Research Service, EC export restitutions for wheat grew from $365 million in 1985 to $1.8 billion in 1988. This increase supports the presumption that, in conjunction with the dollar depreciation against the ECU and the lower loan rates, the EEP forced the European Community to lower its export prices. It is, however, an open question whether EC restitutions were targeted to specific countries to counter EEP bonuses or whether they were extended globally to achieve domestic EC goals (see Haley 1989).

The evaluation criteria for the EEP are closely related to the FAS guidelines for EEP sales approval. In particular, researchers have been interested in assessing whether the program successfully targeted heavily subsidized markets and in computing the program's effects on domestic prices, export volume, and export revenues. While the majority of researchers agree that the EEP successfully targeted countries where the European Community had aggressively subsidized its wheat exports, Anania, Bohman, and Carter (1992) view the Soviet Union and China episodes as evidence that the targets were partially determined by the market power of some large-purchasing countries rather than the European Community's unfair trade practices. In addition, they claim that, because of the European Community's response to U.S. subsidies, it was other exporters and not the European Community that lost market share as a result of the EEP; in China, for example, the expansion of the U.S. market share in 1987 and 1988 occurred at the expense of Australia and Canada.

The USDA has meanwhile been more concerned with the question of whether value-added products are better targets for EEP sales than bulk commodities. Most EEP sales have been targeted to basic grains; some argue that processed commodities are good candidates for the EEP since the European Community subsidizes both bulk and processed foods. The EEP effects on

domestic prices are of special interest since an explicit goal of the EEP has been budget neutrality; had domestic prices declined as a result of the EEP, higher deficiency payments to the farmers would have been necessary, increasing the cost of the program. In general, the effect on domestic prices depends on two factors. An EEP-induced increase in demand for U.S. exports tends to increase domestic prices; on the other hand, the release of EEP bonus commodities from government storage has a dampening effect on domestic prices. Most researchers found that—at least for the years 1985–87—the EEP had a positive, although modest, effect on domestic prices. The exact magnitude of the price effects depends on assumptions about how aggressively the European Community subsidized its exports in response to the EEP. Haley (1989), for example, estimates that assuming that in the absence of the EEP the European Community would have uniformly subsidized its exports at $90.00 per metric ton implies a U.S. domestic price increase of 7 percent. If, however, one assumes that the European Community had targeted specific markets independent of the EEP, the effect of the program on domestic prices is much larger: over 22 percent. These results are in sharp contrast with Anania, Bohman, and Carter (1992), who simulated price effects for the year 1988; they find that, because of the release of commodity surpluses from government stocks, domestic prices in the United States went down during that year; as a result, the budgetary cost of deficiency payments increased.

With respect to export volume and revenues, most studies find that wheat exports rose because of the EEP; the additionality of the program is estimated between 2 and 30 percent, with the highest increases concentrated in the years 1986–87. It is generally agreed that the EEP displaced to some extent unsubsidized commercial sales to certain countries; competing exporters displaced from markets subsidized through the EEP moved into other untargeted markets where the United States used to be a major supplier. Because of the simultaneous increase of U.S. market prices and export volume, gross export revenues rose as a result of the EEP; the effect on net revenues, however, is less clear. The latter are computed by subtracting the economic cost of the bonuses awarded to exporters under the EEP from the gross revenues. For the period 1985–89, this cost is equal to the value of the surplus commodities in the government stocks minus the storage cost the government would have incurred had these products not been used in the EEP. Using this cost measure, it is estimated that the EEP led to a slight increase in revenues of about 1 percent.

A current issue of special interest is whether the EEP has encouraged U.S. trading partners to negotiate. The United States has used the EEP as a negotiating tool in the GATT negotiations, offering to eliminate the program if other countries cut their export subsidies. Although the expansion of EEP sales has coincided with progress in the Uruguay Round, it is unclear precisely what role the EEP has played in the trade negotiations.

In summary, most existing studies find that the EEP had small but positive effects on exports and domestic prices. It is interesting to note that all the work

cited above refers to the period 1985–88; little is known about the EEP effects in subsequent years. But 1985–88 represents exactly the years that coincide with a sharp depreciation of the dollar and a decrease in loan rates. It is thus an interesting question to what extent the decline in U.S. exports in the early 1980s was caused by the relatively high value of the dollar as opposed to the EC subsidization and whether U.S. subsidies played a significant role in increasing U.S. exports beyond the level to which these would have risen as a result of exchange rate changes. The following sections address these questions by relating acreage, production, and export shares of U.S. wheat producers to exchange rates, loan rates, and subsidies for various time periods. Before moving to estimation, we next discuss the data used in our analysis.

10.2 Data

One attractive aspect of studying the market for wheat is that the USDA and other national and international organizations track agricultural production and marketing in great detail. Consequently, there is a wide array of data sources from which to choose.

The analyses that follow rely on two different data sources. The first is the *World Wheat Situation and Outlook Yearbook.* In particular, we used annual data from this publication to construct measures of the U.S. and other competing countries' shares of world wheat acreage, production, and exports. This publication also provides data on U.S. market prices, support prices, and ending stocks held by the federal government. We focus on the period 1970–93 for most of our work, with careful attention paid to the pre- and post-EEP subperiods. Additional information on subsidization in the United States and other competing countries was obtained from *Estimates of Producer and Consumer Subsidy Equivalents.* Subsidy data are available for only a limited number of years in different countries, usually 1983–92. These data are used to evaluate the success of the EEP and other policy instruments in influencing the level of U.S. wheat production and exports.

The second of our data sources is destination-specific data on the value and quantity of wheat exports provided by a statistical office of the USDA Economic Research Service (ERS). These are annual data from the period 1975–94. We use these data to assess the effect of the EEP on U.S. prices relative to prices in export markets.

10.3 Empirical Evidence

This section of the paper describes how we use the data to shed some light on several important questions concerning the EEP and other government support instruments, such as the loan rate. As mentioned in section 10.1, previous research on these questions has relied on simulations of models of the world

wheat market. Since it is difficult to compare and evaluate such models owing to the myriad assumptions that underlie them, these models have not produced a consensus view on the effect of the EEP. Our aim is to see what the data suggest about the effect of agricultural policies. We make no attempt to estimate a structural model of behavior since we lack sufficient information on participation and set-aside rates for the wheat programs. We will instead estimate reduced-form equations that include some key policy and market variables. We will explore the stability of these reduced forms to ensure that our results are not too fragile to draw conclusions from the data.

Our first objective is to determine how relative cost changes and policy measures affected the behavior of the U.S. share of total wheat acreage, production, and exports. We choose to focus on shares of the so-called competitor group (defined as Argentina, Australia, Canada, the European Community, and the United States) totals, as opposed to physical quantities of output. Focusing on competitor group shares allows us to abstract from the effect of world demand shocks and supply shocks emanating from producers outside the competitor group on the physical quantity measures observed for the group.

Wheat growers are probably best viewed as making sequential decisions regarding (1) how much acreage to plant, (2) how intensively to cultivate the planted acreage, and (3) how to allocate output between domestic and export markets, where domestic markets include the option of selling to the government at the loan rate if private market prices would be lower than the loan rate. Decisions should be a function of policy variables, such as loan rates and set-aside requirements, and relative costs of production. Since exchange rate fluctuations constitute shifts in relative costs of production, they will be our main proxy for market conditions faced by U.S. exporters in the international wheat market.

Timing issues complicate our analysis. At each stage, more relevant information is revealed to producers. For example, the exchange rate prevailing when the export versus domestic sales decision must be made is not known at the time of the acreage and production decisions. In fact, it is likely that wheat production decisions might respond to the previous period's relative cost and demand conditions rather than the conditions that prevail at harvest time. The conditions at harvest time will influence the export decision only. Dynamic links may also arise because policy responds to the behavior of stocks, which in turn are affected by market conditions prevailing in the previous period.

Simple OLS exploration of the acreage and production shares confirms the importance of market conditions and, to a lesser extent, government policies on outcomes. Table 10.1 reports the results of an OLS regression of U.S. acreage share on a constant, acreage in the prior period, the (log of the) lagged real exchange rate index of the U.S. dollar relative to the competitor group (using weights for group members provided by the USDA in construction of its index), and the (log of the real) loan rate. Changes in the real exchange rate have

Table 10.1 U.S. Wheat Acreage Share Regression, 1971–93

	Coefficient	SE	*t*-Statistic
Constant	8.30799	2.40536	3.45395
ACUSSHR(−1)	.507102	.144802	3.50203
RXCOMP(−1)	−5.36061	2.41292	−2.22163
LRLOANRT	−.496470	.781046	−.635647
Dependent variable		ACUSSHR	
No. of observations		23	
SD of dependent variable		1.62514	
SE of regression		1.21214	
R^2		.519547	
Durbin-Watson statistic		1.97892	

a direct effect on the common currency relative costs of the competitor group vis-à-vis the United States. An increase in the index (a real appreciation of the dollar) will increase U.S. relative costs.

The results show that acreage is indeed significantly influenced by the real exchange rate but is insensitive to the loan rate for the period 1971–93. Since the dependent variable is in share percentage points and the exchange rate is in logs, the estimated coefficient implies that a 10 percent appreciation of the dollar will lead to a reduction in U.S. acreage share of 0.5 percentage points in the following wheat year. A similar regression using the contemporaneous exchange rate produced insignificant results. This is not surprising since the relevant choices are made before the contemporaneous exchange rate is known. The lack of a significant relation between loan rates and acreage probably reflects the fact that higher loan rates coincide with larger set-aside requirements. In the absence of such a relation, one would expect high loan rates to encourage more acreage.[3]

Table 10.2 reports the analogous regression for the U.S. production share.[4] The results are very similar with respect to the effect of exchange rates on production. The estimated coefficient on the exchange rate implies that a 10 percent real dollar appreciation leads to a reduction in the U.S. share of group production of 0.8 percentage points. Production is also significantly, positively related to loan rates. The estimated model implies that a 10 percent increase in the loan rate leads to a 0.4 percentage point increase in the U.S. share of competitor group production. The fact that loan rates are positively related to production, but not to acreage, suggests that the production effect of loan rates

3. We tested to see whether lagged stocks were helpful in explaining acreage. They were highly correlated with lagged exchange rates, but neither variable was significant when both were included in the model. Since the model fit best with exchange rates instead of stocks, we report that specification.

4. Including lagged production has almost no effect on the model, so we left it out in the interest of parsimony.

Table 10.2 **U.S. Wheat Production Share Regression, 1971–93**

	Coefficient	SE	*t*-Statistic
Constant	18.6095	.410900	45.2895
RXCOMP(−1)	−7.60734	3.78993	−2.00725
LRLOANRT	4.27263	1.24511	3.43152
Dependent variable		PUSSHR	
No. of observations		23	
SD of dependent variable		2.58332	
SE of regression		1.93358	
R^2		.490697	
Durbin-Watson statistic		1.96472	

Table 10.3 **U.S. Wheat Export Share Regression, 1970–93**

	Coefficient	SE	*t*-Statistic
Constant	37.7959	.895404	42.2110
RXCOMP	−29.9157	8.32227	−3.59466
LRLOANRT	11.5216	2.71300	4.24680
Dependent variable		XUSSHR	
No. of observations		24	
SD of dependent variable		6.52075	
SE of regression		4.33095	
R^2		.597225	
Durbin-Watson statistic		1.96635	

works through yields. Farmers can apparently offset some of the acreage set-aside requirements to take advantage of higher loan rates.

Table 10.3 shows the results for the analogous equation using U.S. export share as the dependent variable. The exchange rate used here is the contemporaneous exchange rate rather than the lagged exchange rate used in the acreage and production equations. The current exchange rate determines the relative benefit of export sales versus sales to the CCC. Table 10.3 shows that exchange rates and loan rates together explain a great deal of variation in the U.S. export share over the period 1970–93, with an R^2 value of .60. Each of the regressors is statistically significant at the 1 percent level. The exchange rate coefficient implies that a 10 percent appreciation of the dollar leads to a 3 percentage point reduction in the U.S. export share. Meanwhile, a 10 percent increase in the loan rate leads to a 1.2 percentage point increase in U.S. export shares. The link between loan rates and exports is likely to be quite complex. High loan rates stimulate production, and high production periods are also likely to be high export periods, for given values of the exchange rate. Later in the paper, we explore this linkage in more detail using an instrumental variables procedure.

Table 10.4 U.S. Wheat Stocks Regression, 1970–93

	Coefficient	SE	*t*-Statistic
Constant	27,330.8	1,670.43	16.3616
RXCOMP	68,062.8	15,525.7	4.38389
LRLOANRT	14,762.4	5,061.25	2.91674
Dependent variable		ESTUSMT	
No. of observations		24	
SD of dependent variable		11,741.9	
SE of regression		8,079.62	
R^2		.567686	
Durbin-Watson statistic		.836020	

Table 10.5 U.S. Wheat Export Share Regression, 1970–85

	Coefficient	SE	*t*-Statistic
Constant	40.8789	1.69523	24.1141
RXCOMP	−35.1576	8.59186	−4.09197
LRLOANRT	−6.27077	8.35666	−.750392
Dependent variable		XUSSHR	
No. of observations		16	
SD of dependent variable		5.70066	
SE of regression		4.03979	
R^2		.564770	
Durbin-Watson statistic		2.15520	

Table 10.4 reports the behavior of U.S. government wheat stocks in relation to exchange rates and loan rates. Not surprisingly, both variables are statistically significant. Either an appreciation of the dollar or an increase in the loan rate will lead to an increase in government stocks of wheat by making sales to the CCC more attractive relative to export sales.

Tables 10.1–10.4 all report the results of estimation over the entire period 1970–93. Since the implementation of the EEP and other aspects of the 1985 Farm Bill constituted a major policy shift, it is worth examining the subperiod 1970–85 separately. The results for exports are reported in table 10.5. We find that, in this subperiod, loan rates are unrelated to export shares, with a negative point estimate. This is in sharp contrast to our results in table 10.3 above for the entire period. The effect of exchange rates is even more pronounced in this subperiod, however. A 10 percent real dollar appreciation leads to a 3.5 percentage point reduction in exports according to the estimated coefficients.

An interesting exercise is to use the reduced-form coefficients of table 10.5 to project U.S. wheat export shares for the period 1985–93, in which the EEP was put into effect. There is no reason to think that the behavioral relations that generated these reduced-form coefficients would have remained the same

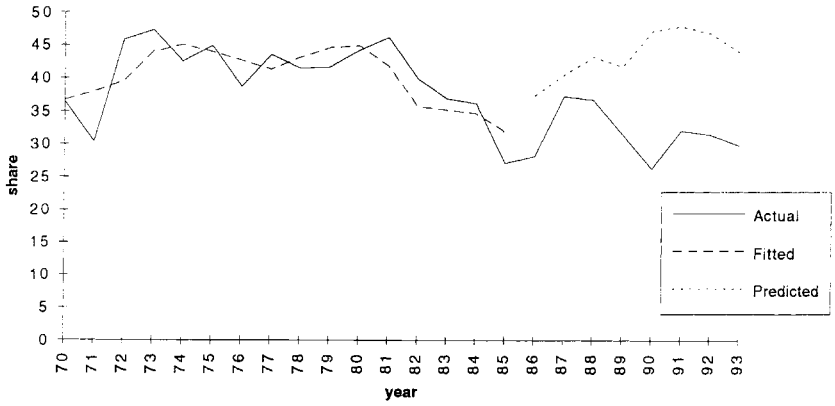

Fig. 10.4 Actual, fitted, and predicted U.S. wheat exports based on OLS over 1970–85 sample

Source: World Wheat Situation and Outlook Yearbook and authors' calculations.

with the implementation of the EEP and the other policy changes that occurred in 1985. Nonetheless, we think of this projection as one type of estimate of how U.S. wheat export shares might have evolved after 1985 as a result of the sharp fall in the value of the dollar had there been no major policy changes in the United States or in other competitor group countries.

The results of this exercise are shown in figure 10.4, which plots the actual, fitted, and predicted shares of U.S. wheat exports from 1970 to 1993. The fitted values are the within-sample estimated values of U.S. export share for the 1970–85 sample period. The predicted shares are obtained by substituting realized values of the exchange rate and the loan rate from the 1986–93 prediction period into the regression relation estimated over the sample period. The first thing to notice abut the figure is that actual shares are below predicted shares for every year of the 1986–93 prediction period. Furthermore, the shortfall of actual relative to predicted levels rises dramatically after 1989. One might have expected just the opposite: that, with the implementation of the EEP program, U.S. export shares would increase for given values of the exchange rate and loan rate relative to the pre-EEP period. Since we are projecting on the basis of the pre-EEP relation, it is rather puzzling that actual values consistently fall short of projected values. One interpretation is of course that the EEP and the policy responses of competitor countries to the EEP actually hindered U.S. exports on balance in the period 1986–93. However, it is likely that other changes in farm policy played a role in this breakdown in the relation between export shares, exchange rates, and loan rates.

The results of this regression analysis also underscore the fact that the decline in U.S. exports in the early to mid-1980s was very much in line with the historical relation between the value of the dollar and the U.S. share of competitor group exports. Indeed, inspection of the residuals, represented by the gap

Table 10.6 U.S. Wheat Export Share Regression, 1970–80

	Coefficient	SE	*t*-Statistic
Constant	41.2188	1.93237	21.3307
RXCOMP	−35.9205	15.5964	−2.30313
LRLOANRT	−13.3121	9.55981	−1.39250
Dependent variable		XUSSHR	
No. of observations		11	
SD of dependent variable		4.38326	
SE of regression		4.09306	
R^2		.427456	
Durbin-Watson statistic		2.71456	

between actual and fitted values in figure 10.4, reveals that the model's fitted values for U.S. export shares during the period 1981–84 were less than the actual level of U.S. export shares in each of those years. Only in 1985 did fitted values exceed actual. The fitted values implied a 14 percentage point decline in U.S. export shares from 1980 to 1985 owing to the changes in exchange rates and loan rates. Actual shares declined 17 percentage points over this period. It is not clear that European subsidies could have played a substantial role in the collapse of wheat export markets, above and beyond the effect of exchange rates. They may have magnified the collapse in 1985–86, according to our inspection of the residuals.

A potential criticism of this exercise is that rising European subsidies coincided with the dramatic appreciation of the dollar in the early to mid-1980s. The biggest increases in European subsidies did occur during 1985. Since no subsidy measures are included in the model, the estimated coefficients on the exchange rate may be biased upward owing to the omitted variable, which is causally related to U.S. export share and by chance correlated with the value of the dollar. To check the robustness of our results, we estimated our simple export share equation over the period 1970–80, during which European subsidies were not viewed as a big factor and U.S. wheat export shares were large by historical standards.

The results of estimating the reduced-form export share equation over the period 1970–80 are reported in table 10.6. While the standard errors on the coefficient estimates have increased relative to the results in table 10.5, the exchange rate coefficient remains of similar magnitude and is still statistically significant. Figure 10.5 uses the pre-1981 results to project export shares using realized values of the exchange rate and the loan rate. These predicted values are almost identical to the fitted values obtained when the model was estimated over the period 1970–85. In other words, the relation between exchange rates and export shares over the period 1981–85 appears no different from the relation that prevailed from 1970 to 1980. Consequently, it is hard to

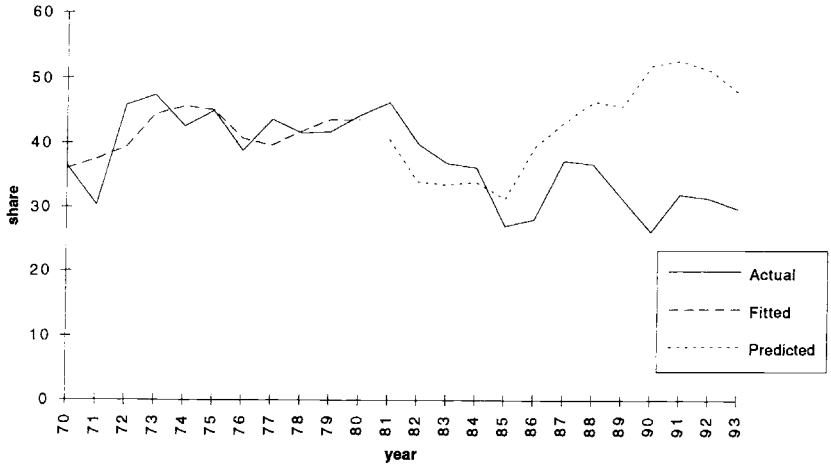

Fig. 10.5 Actual, fitted, and predicted U.S. wheat exports based on OLS over 1970–80 sample

Source: World Wheat Situation and Outlook Yearbook and authors' calculations.

believe that the omission of European subsidies is an important factor in explaining the data over the period 1981–85. Export shares behaved very much in line with what would have been expected given the evolution of common currency relative costs (proxied by the exchange rate) and U.S. government policies.

Data on EC producer subsidy equivalents for wheat were available over the period 1982–89 from the USDA Economic Research Service. This is a very short sample period, but we wanted to further investigate the relative importance of exchange rates and subsidies for this period. Table 10.7 reports the simple regression of export shares on exchange rates only for this eight year period. While this is a very short sample, there was substantial variation in both subsidies and exchange rates over the period. European subsidies rose from just over 3 percent per unit in 1984 to over 50 percent by 1986. The point estimate of the coefficient on the exchange rate remains quite close to the values obtained on the entire sample and the various subsamples considered thus far. It is no longer statistically significant at the 5 percent level owing to the smaller sample size, although the marginal significance level for a one-sided test is only .06. The results obtained when the data on European wheat subsidies are added are reported in table 10.8. Adding the subsidies does almost nothing to the estimated coefficient on the exchange rate or its t-value. Meanwhile, the coefficient on the subsidy variable has a t-value only slightly greater than one. It seems that, even over this period, exchange rates have a more substantial effect on export shares than subsidies. The huge increase in European subsidies in 1985, from 3.8 percent per unit to 31.1 percent per unit, translates

Table 10.7 U.S. Wheat Export Share Regression, 1982–89

	Coefficient	SE	*t*-Statistic
Constant	38.6034	2.79378	13.8176
RXCOMP(−1)	−39.6450	21.9647	−1.80495
Dependent variable		XUSSHR	
No. of observations		8	
SD of dependent variable		4.70255	
SE of regression		4.08910	
R^2		.351900	
Durbin-Watson statistic		1.04753	

Table 10.8 U.S. Wheat Export Share Regression with European Subsidy Variable, 1982–89

	Coefficient	SE	*t*-Statistic
Constant	40.8149	3.46508	11.7789
PSPECS	−.081783	.077197	−1.05940
RXCOMP	−38.6518	21.7643	−1.77593
Dependent variable		XUSSHR	
No. of observations		8	
SD of dependent variable		4.70255	
SE of regression		4.04804	
R^2		.470708	
Durbin-Watson statistic		1.32271	

into only a slightly more than 2 percentage point decline in the predicted U.S. export share, on the basis of the coefficients in table 10.8. As noted earlier, actual shares declined about 17 percentage points from 1980 to 1985. Thus, our regression results with both subsidies and exchange rates imply that subsidies account for very little of the erosion of U.S. export market shares. European subsidies may explain the larger than predicted drop in U.S. export shares in 1985 but none of the decline before that.

As an intermediate step toward a more structuralist approach to modeling export shares, we also investigated the behavior of export shares conditional on production shares themselves, in addition to exchange rates. If export and production shares are jointly determined, we need to use a two-stage least squares or instrumental variables (IV) procedure. Our earlier work on production shares suggests that lagged exchange rates might be an ideal instrument for this purpose. The IV estimates of the model for the period 1970–85 are reported in table 10.9, while the actual, fitted, and predicted values from the model are shown in figure 10.6. As can be verified from the table or the figure, the IV estimates are nearly identical to the OLS estimates in terms of their

Table 10.9 **U.S. Wheat Export Share Regression Using Instrumental Variables, 1971–85**

	Coefficient	SE	*t*-Statistic
Constant	28.6351	10.9552	2.61384
RXCOMP	−34.4867	7.04317	−4.89648
PUSSHR	.572087	.520660	1.09877
Dependent variable		XUSSHR	
No. of observations		15	
SD of dependent variable		5.80801	
SE of regression		4.07381	
R^2		.578308	
Durbin-Watson statistic		1.85743	

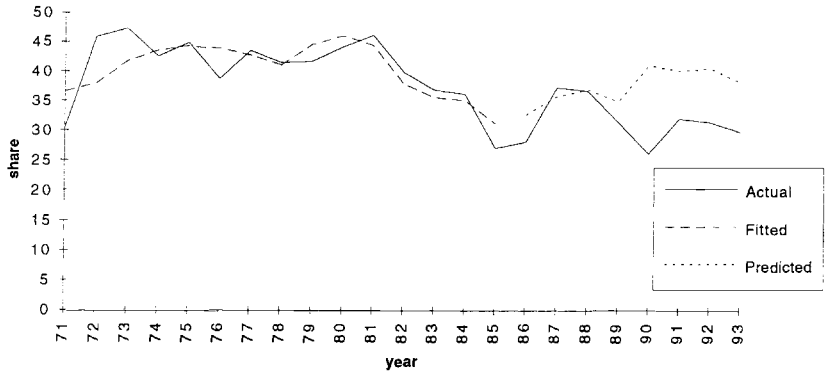

Fig. 10.6 Actual, fitted, and predicted U.S. wheat exports based on IV estimation over 1971–85 sample
Source: World Wheat Situation and Outlook Yearbook and authors' calculations.

implications for the role of exchange rates in explaining the behavior of wheat exports.

All the evidence on export shares points to the same basic conclusion: that the overvaluation of the dollar was primarily responsible for the collapse of U.S. wheat exports from 1981 to 1985. The spike in European subsidies in 1985–86 may have contributed a few percentage points to the decline in U.S. wheat export shares, but the damage had largely been done by that point in time.

What was the effect of the EEP on export shares of U.S. producers? There is nothing in the overall performance of exports to suggest that the EEP and the ensuing subsidy war with the EC left U.S. exporters with a larger share of world markets than would have been obtained without the EEP. For every

Table 10.10 **Relative Wheat Prices during the EEP**

	Coefficient	SE	*t*-Statistic
Constant	−.831739	.099076	−8.39496
EEPDUM	.206136	.212107	.971845
LRLOANRT	−.271162	.294884	−.919554
Dependent variable		PDIFF	
No. of observations		247	
SD of dependent variable		.817428	
SE of regression		.797199	
R^2		.056614	
Durbin-Watson statistic		1.78274	

model of wheat export shares estimated in this paper, the out-of-sample projections of wheat export shares conditional on realized values of the exchange rate and other factors (such as loan rates and production shares) show that actual exports began to turn down substantially relative to projections after 1988.

This breakdown in the relation between export shares, exchange rates, and loan rates may reflect other aspects of farm policy. In particular, there is some evidence that set-aside requirements became more stringent after 1985: the simple correlation between loan rates and acreage shares switched from being 0.28 over the period 1970–85 to −0.58 in the period 1986–94. This suggests that, while higher loan rates encouraged participation in farm programs, they were combined with tighter restrictions on acreage than had previously been the case. Thus, the decline in export shares may have been the result of policy-driven reductions in U.S. acreage share. Without a detailed structural model and the necessary information on target prices, loan rates, set-asides, and participation rates, we cannot be sure what is driving behavior over this period.

A final question of interest is the effect of the EEP on U.S. wheat prices. Our approach to this issue is to compare the level of U.S. domestic wheat prices with the level of U.S. export prices to different regions in the pre- and post-EEP periods. Wheat export destinations are grouped into thirteen regions, and regional export unit values per bushel are calculated for the period 1975–93 on an annual basis. We then regress a measure of the price difference (U.S. price minus export region price) on a constant, an EEP dummy (which equals one in EEP periods and zero otherwise), and the loan rate (which may influence the relative price of what in the United States). The results for the regression that pools all the export regions into a single regression are given in table 10.10. The point estimate on the EEP dummy suggests that the price differential changed such that relative prices in the United States rose by $0.21 during the EEP period, but the coefficient is not statistically significant. In estimation on a region-by-region basis, the only region where prices fell significantly relative to the United States was North Africa, a huge recipient of

EEP-subsidized wheat. These regression results suggest that the effect of the EEP on U.S. domestic prices was modest.

10.4 Conclusion

This paper has attempted to use regression analysis to study the effect of the Export Enhancement Program on U.S. wheat exports. We find that measures of change in common currency relative costs of the competitor group of exporters have important effects on production, acreage, and export shares as well as government wheat stocks. Policy variables, such as the loan rate, also have important effects on these outcomes in most of our specifications.

The main findings of our analysis are as follows. The decline of U.S. export market shares in wheat during the early and mid-1980s can be attributed primarily to the appreciation of the dollar. In fact, our simple regression model of export market shares as a function of exchange rates and loan rates does quite well at out-of-sample prediction of the evolution of export shares for the period 1981–85. This finding holds up in a number of different specifications of the export share model. Furthermore, results for a small subperiod in which European wheat subsidies per unit are available suggest that the subsidies explain only about 2 percentage points of the 17 percentage point decline in U.S. export market share from 1980 to 1985. It appears inaccurate to blame the collapse of wheat exports on the EC subsidies and, consequently, dubious to attempt to rectify the situation with countervailing subsidies, such as the EEP.

Ironically, shortly after the implementation of the EEP, the dollar underwent a drastic real depreciation. Nonetheless, the EEP program grew substantially over the period we study. This may reflect a more general phenomenon: that one of the costs of exchange rate misalignments might be the adoption of temporary import protection or export promotion programs that are difficult to remove even after the realignment of exchange rates. Had historical relations between the U.S. export share, the dollar, and loan rates prevailed after 1985, U.S. wheat export shares would have recovered almost fully to their 1980 levels by the end of the decade. However, the historical relations no longer appear to hold, which is perhaps a consequence of the EEP, other changes in farm programs, and competitor country subsidies in influencing wheat market behavior. The fact that the EEP is not a subsidy that operates at the margin implies that it is at least plausible that it would have little effect on export shares.

If the EEP was not successful in restoring U.S. exports, at least it did not appear to be very harmful to U.S. consumers. The price of wheat in the United States relative to the average export price from the United States to various regions changed very little after the EEP was implemented. On the other hand, this means that the EEP was not successful in reducing the need for other support measures for farmers.

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