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**CAUSES AND CONSEQUENCES OF
THE EXPORT ENHANCEMENT PROGRAM
FOR WHEAT**

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ABSTRACT

This paper uses regression analysis to study the causes and impacts of the Export Enhancement Program for wheat. We find that the overwhelming causes of the EEP, faltering export markets and swelling government stocks are primarily attributable to the overvaluation of the dollar in the 1980s, not the increase in EC subsidies to wheat farmers in 1985. We also find that what had been a fairly robust relationship between export shares, exchange rates, and loan rates broke down after 1985, probably due to a variety of changes in farm policy. In any case, export shares did not rebound in spite of the weaker dollar and the implementation of the EEP in the post-1985 period.

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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 20th century. The share of annual U.S. wheat production that was exported rose from approximately 25% at the beginning of the century to 60% 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 the subsidization by U.S. competitors; export credit and credit guarantee programs that have assisted countries with foreign exchange difficulties; food aid programs, directed towards countries suffering from hunger; and non-price 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% 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 United States Department of Agriculture (USDA) and the majority of researchers. 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 the one 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 EEP provides an estimate of the effects of the program. Simulation studies typically consider one year at a time; due 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 impact 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 1970-1994 to investigate the relationship 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) Were relative cost changes or European subsidization primarily responsible for the decline in U.S. production and export shares in the world wheat market in the early 1980s? (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 the next section 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 II we describe the data used in the empirical analysis. Section III reports and interprets the results and Section IV concludes.

¹ Examples of such studies include Anania et al (1992), Brooks et al (1990), Seitzinger and Paarlberg (1990 and 1989), and Haley (1989).

I. Overview of the Export Enhancement Program

The U.S. Wheat Market

Understanding the determinants of domestic supply and demand is a prerequisite for studying exports in any market. Domestic demand is comprised of two 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 1980's 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 associated with any particular loan rate. It is possible high loan rates encourage

participation in the program, which then imposes sufficiently stringent set-asides that acreage declines with the loan rate. The yield—though partially determined by exogenous factors such as weather conditions and soil quality—may also be influenced by behavior; when market conditions are favorable, due to strong export demand, farmers can partly overcome the effect of acreage restrictions on production by using resources more intensively to increase the yield.

The above description 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 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.

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 1 depicts wheat production, exports, and government stocks for the period 1970-94; while exports were relatively stable during the early 1970's 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 (Figure 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 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 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, 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

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 United States to that of the country in question. Then the percent 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 1983-85 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.

markets in the 1980's. 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 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 U.S. 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 afterwards. 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 EC 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 were 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 were 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.

Criteria for the EEP

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

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 (see Anania et al (1992) for an overview); 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.

Implementation of the EEP

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, both minimum prices and maximum bonuses are not 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 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 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.

Activity under the EEP

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

In the first year of the program (May through September 1985), four North African countries (Algeria, Egypt, Morocco and Yemen) were targeted. Over the next four fiscal years then number of countries grew to 65. No additional countries have been targeted since 1988. The major recipients are Soviet Union (27% of total EEP sales), China (19%), Algeria, Egypt and Morocco (a combined 28%). The other 60 countries account for the remaining 26% of the EEP wheat sales. It is interesting to note that the two major recipients (Soviet Union and China) were originally excluded from 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% in 1984 to 8% in 1985 and 1% in 1986 in China, and from 22% in 1984 to 1% in 1985 and 5% in 1986 in the Soviet Union. The decline in market shares was reversed in 1987 when both countries became eligible for EEP. Critics of the EEP view these particular episodes in China and the Soviet Union as evidence that the U.S. lacks market power in world wheat market so that it cannot act as a price discriminating monopolist (see Anania et al (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 percent 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%; the year 1987 is associated with the highest subsidies (43%). 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 25 to 43 Mt (see also Figure 1). EEP sales during this period accounted for approximately 50% 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 EEP accounted for approximately 74% of wheat exports. Of course, this does not imply that without EEP, U.S. exports would have been minimal; it is an open question whether EEP—despite its stated objective of additionality—merely displaced commercial exports.

Around 75 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% of total EEP bonuses received, each receiving over \$100 million in bonuses.

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 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 due 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, so that isolating the contribution of the EEP is 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 the analysis, the results depend on the particular assumptions 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 the EEP, in conjunction with the dollar depreciation against the ECU and the lower loan rates, forced the EC to lower its export prices. It is, however, an open question whether EC restitutions were targeted to specific countries to counter EEP bonuses, or 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 EEP successfully targeted countries where the EC had aggressively subsidized its wheat exports, Anania et al (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 EC's unfair trade practices. In addition, they claim that because of EC's response to U.S. subsidies, it was other exporters and not the EC 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 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 EC 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 1985-1987—the EEP had a positive, though modest, effect on domestic prices. The exact magnitude of the price effects depends on assumptions about how aggressively the EC subsidized its exports in response to the EEP. Haley (1989), for example, estimates that assuming that in the absence of the EEP, the EC would have uniformly subsidized its exports at \$90/mt implies a U.S. domestic price increase of 7%. If, however, one assumes that the EC had targeted specific markets independent of the EEP, the effect of the program on domestic prices is much larger: over 22%. These results are in sharp contrast with Anania et al (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 U.S. 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%, with the highest increases concentrated in the years 1986-87. It is generally agreed upon that the EEP displaced to some extent unsubsidized commercial sales to certain countries; competing exporters displaced from markets subsidized through EEP moved into other untargeted markets where the U.S. 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%.

A current issue of special interest is whether the EEP has encouraged the U.S. trading partners to negotiate. The U.S. has used the EEP as a negotiating tool in the GATT negotiations offering to eliminate the program if other countries cut their export subsidies. Though the expansion of EEP sales has coincided with progress in the Uruguay Round, it is unclear what role the EEP has precisely 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 of the work cited above refers to the 1985-88 period; little is known about the EEP effects in subsequent years. But 1985-88 are 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 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.

II. 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 data source is the *Wheat Situation and Outlook Yearbook*, which is published by the Economic Research Service of USDA. 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 our work on the 1970-1993 period for most of our work, with careful attention paid to the pre- and post-EEP sub periods. Additional information on subsidization in the United States and other competing countries was obtained from an ERS Statistical Bulletin entitled *Estimates of Producer and Consumer Subsidy Equivalents*. Subsidy data are only available for a limited number of years in different countries, usually 1983-1992. 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.

A second set of data employed in our work are destination-specific data on the value and quantity of wheat exports provided by a statistical office of the Economic Research Service. These are annual data from 1975-1994. We use these data to assess the impact of the EEP on U.S. prices relative to prices in export markets.

III. 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 I, 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 due to the myriad assumptions that underlie them, these models have not produced a consensus view on the impacts of EEP. Our aim is to see what the data suggest about the impact 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 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 impact 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 vs. 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 which 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 confirm the importance of market conditions and, to a lesser extent, government policies on outcomes. Table 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 their index), and the (log of the real) loan rate. Changes in the real exchange rate have a direct effect on the common currency relative costs of the competitor group vis-a-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 1971-93 period. Since the dependent variable is in share percentage points and the exchange rate is in logs, the estimated coefficient implies that a 10% 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 relationship 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 relationship, one would expect high loan rates to encourage more acreage.³

Table 2 reports the analogous regression for the U.S. production share.⁴ The results are very similar with respect to the impact of exchange rates on production. The estimated coefficient on the exchange rate implies that a 10% 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% 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 production effect of loan rates works through yields. Farmers can apparently offset some of the acreage set aside requirements to take advantage of higher loan rates.

Table 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 3 shows that exchange rates and loan rates together explain a great deal of variation in the U.S. export share over the 1970-93 period, with an R-squared value of .60. Each of the regressors is statistically significant at the 1 percent level. The exchange rate coefficient implies that a 10% appreciation of the dollar leads to a 3 percentage point reduction in the U.S. export share. Meanwhile, a 10% 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

³ We tested to see if 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.

exchange rate. Later in the paper, we explore this linkage in more detail using an instrumental variables procedure.

Table 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 1-4 all report the results of estimation over the entire 1970-93 period. Since the implementation of the EEP and other aspects of the 1985 Farm Bill constituted a major policy shift, it is worth examining the 1970-85 sub period separately. The results for exports are reported in Table 5. We find that in this sub period, loan rates are unrelated to export shares, with a negative point estimate. This is in sharp contrast to our results in Table 3 for the entire period. The impact of exchange rates is even more pronounced in this sub period, however. A 10% 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 5 to project U.S. wheat export shares for the 1985-93 period in which the EEP was put into effect. There is no reason to think that the behavioral relationships that generated these reduced form coefficients would have remained the same 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 U.S. or other competitor group countries.

The results of this exercise are shown in Figure 4, which plots the actual, fitted, and predicted shares of U.S. wheat exports from 1970-93. 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 relationship estimated over the sample period. The first thing to notice about 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. exports 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 relationship, 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 1986-93 period. However, it is likely that other changes in farm policy played a role in this breakdown in the relationship 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 relationship between the value of the dollar and the U.S. share of competitor-group exports. Indeed, inspection of the residuals, represented by the gap between actual and fitted values in Figure 4, reveals that the model's fitted values for U.S. export shares during the 1981-1984 period 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 due 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, based on 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 due 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 1970-1980 period, 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 1970-80 period are reported in Table 6. While the standard errors on the coefficient estimates have increased relative to the results in Table 5, the exchange rate coefficient remains of similar magnitude and is still statistically significant. Figure 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 1970-85 period. In other words, the relationship between exchange rates and export shares over the 1981-85 period appears no different from the relationship which prevailed from 1970-80. Consequently, it is hard to believe that the omission of European subsidies is an important factor in explaining the data over the 1981-85 period. 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 European Community producer subsidy equivalents for wheat were available over the 1982-89 period 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 7 reports the simple regression of export shares on exchange rates only for this 8-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 sub samples considered thus far. It is no longer statistically significant at the 5% level due 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 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, only translates into a slightly more than 2 percentage point decline in the predicted U.S. export share based on the coefficients in Table 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 implies 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 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 1970-85 period are reported in Table 9, while the actual, fitted, and predicted values from the model are shown in Figure 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 implications for the role of exchange rates in explaining the behavior of wheat exports.

All of 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 1981-85. 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 impact 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 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 relationship 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 1970-85 period to -0.58 in the 1986-94 period. This suggests that higher loan rates, while encouraging participation in farm programs, 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 impact of 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 1975-1993 period 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 wheat in the U.S.). The results for the regression which pools all of the export regions into a single regression are given in Table 10. The point estimate on the EEP dummy suggests that the price differential changed such that relative prices in the U.S. rose by 21 cents during the EEP period, but the coefficient is not statistically significant. In estimation on a region-by-region basis, the only region whose prices fell significantly relative to the U.S. was North Africa, a huge recipient of EEPed wheat. These regression results suggest that the impact of the EEP on U.S. domestic prices was modest.

IV. Conclusion

This paper has attempted to use regression analysis to study the impact 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 is primarily attributable 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 1981-85 period. This finding holds up in a number of different specifications of the export share model. Furthermore, results for a small sub period 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 1980-85. 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 relationships 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 relationships 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 U.S. 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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Table 1

U.S. Wheat Acreage Share Regression 1971-1993

Dependent variable:	=	ACUSSHR		
Number of observations	=	23		
Std. dev. of dependent var.	=	1.62514		
Std. error of regression	=	1.21214		
R squared	=	.519547		
Durbin-Watson statistic	=	1.97892		
		Coefficient	Std. Error	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

Table 2

U.S. Wheat Production Share Regression 1971-1993

Dependent variable:	=	PUSSHR		
Number of observations	=	23		
Std. dev. of dependent var.	=	2.58332		
Std. error of regression	=	1.93358		
R squared	=	.490697		
Durbin-Watson statistic	=	1.96472		
		Coefficient	Std. Error	t-statistic
Constant		18.6095	.410900	45.2895
RXCOMP(-1)		-7.60734	3.78993	-2.00725
LRLOANRT		4.27263	1.24511	3.43152

Table 3

U.S. Wheat Export Share Regression 1970-1993

Dependent variable:	=	XUSSHR
Number of observations	=	24
Std. dev. of dependent var.	=	6.52075
Std. error of regression	=	4.33095
R squared	=	.597225
Durbin-Watson statistic	=	1.96635

	Coefficient	Std. Error	t-statistic
Constant	37.7959	.895404	42.2110
RXCOMP	-29.9157	8.32227	-3.59466
LRLOANRT	11.5216	2.71300	4.24680

Table 4

U.S. Wheat Stocks Regression 1970-1993

Dependent variable:	=	ESTUSMT
Number of observations	=	24
Std. dev. of dependent var.	=	11741.9
Std. error of regression	=	8079.62
R squared	=	.567686
Durbin-Watson statistic	=	.836020

	Coefficient	Std. Error	t-statistic
Constant	27330.8	1670.43	16.3616
RXCOMP	68062.8	15525.7	4.38389
LRLOANRT	14762.4	5061.25	2.91674

Table 5

U.S. Wheat Export Share Regression 1970-1985

Dependent variable:	=	XUSSHR
Number of observations	=	16
Std. dev. of dependent var.	=	5.70066
Std. error of regression	=	4.03979
R squared	=	.564770
Durbin-Watson statistic	=	2.15520

	Coefficient	Std. Error	t-statistic
Constant	40.8789	1.69523	24.1141
RXCOMP	-35.1576	8.59186	-4.09197
LRLOANRT	-6.27077	8.35666	-.750392

Table 6

U.S. Wheat Export Share Regression 1970-1980

Dependent variable:	=	XUSSHR
Number of observations	=	11
Std. dev. of dependent var.	=	4.83826
Std. error of regression	=	4.09306
R squared	=	.427456
Durbin-Watson statistic	=	2.71456

	Coefficient	Std. Error	t-statistic
Constant	41.2188	1.93237	21.3307
RXCOMP	-35.9205	15.5964	-2.30313
LRLOANRT	-13.3121	9.55981	-1.39250

Table 7

U.S. Wheat Export Share Regression 1982-1989

Dependent variable:	=	XUSSHR		
Number of observations	=	8		
Std. dev. of dependent var.	=	4.70255		
Std. error of regression	=	4.08910		
R squared	=	.351900		
Durbin-Watson statistic	=	1.04753		
		Coefficient	Std. Error	t-statistic
Constant		38.6034	2.79378	13.8176
RXCOMP(-1)		-39.6450	21.9647	-1.80495

Table 8

U.S. Wheat Export Share Regression with European Subsidy Variable 1982-1989

Dependent variable:	=	XUSSHR		
Number of observations	=	8		
Std. dev. of dependent var.	=	4.70255		
Std. error of regression	=	4.04804		
R squared	=	.470708		
Durbin-Watson statistic	=	1.32271		
		Coefficient	Std. Error	t-statistic
Constant		40.8149	3.46508	11.7789
PSPECS		-.081783	.077197	-1.05940
RXCOMP		-38.6518	21.7643	-1.77593

Table 9

U.S. Wheat Export Share Regression Using instrumental Variables 1971-1985

Dependent variable:	=	XUSSHR		
Number of observations	=	15		
Std. dev. of dependent var.	=	5.80801		
Std. error of regression	=	4.07381		
R squared	=	.578308		
Durbin-Watson statistic	=	1.85743		
	Coefficient	Std. Error		t-statistic
Constant	28.6351	10.9552		2.61384
RXCOMP	-34.4867	7.04317		-4.89648
PUSSHR	.572087	.520660		1.09877

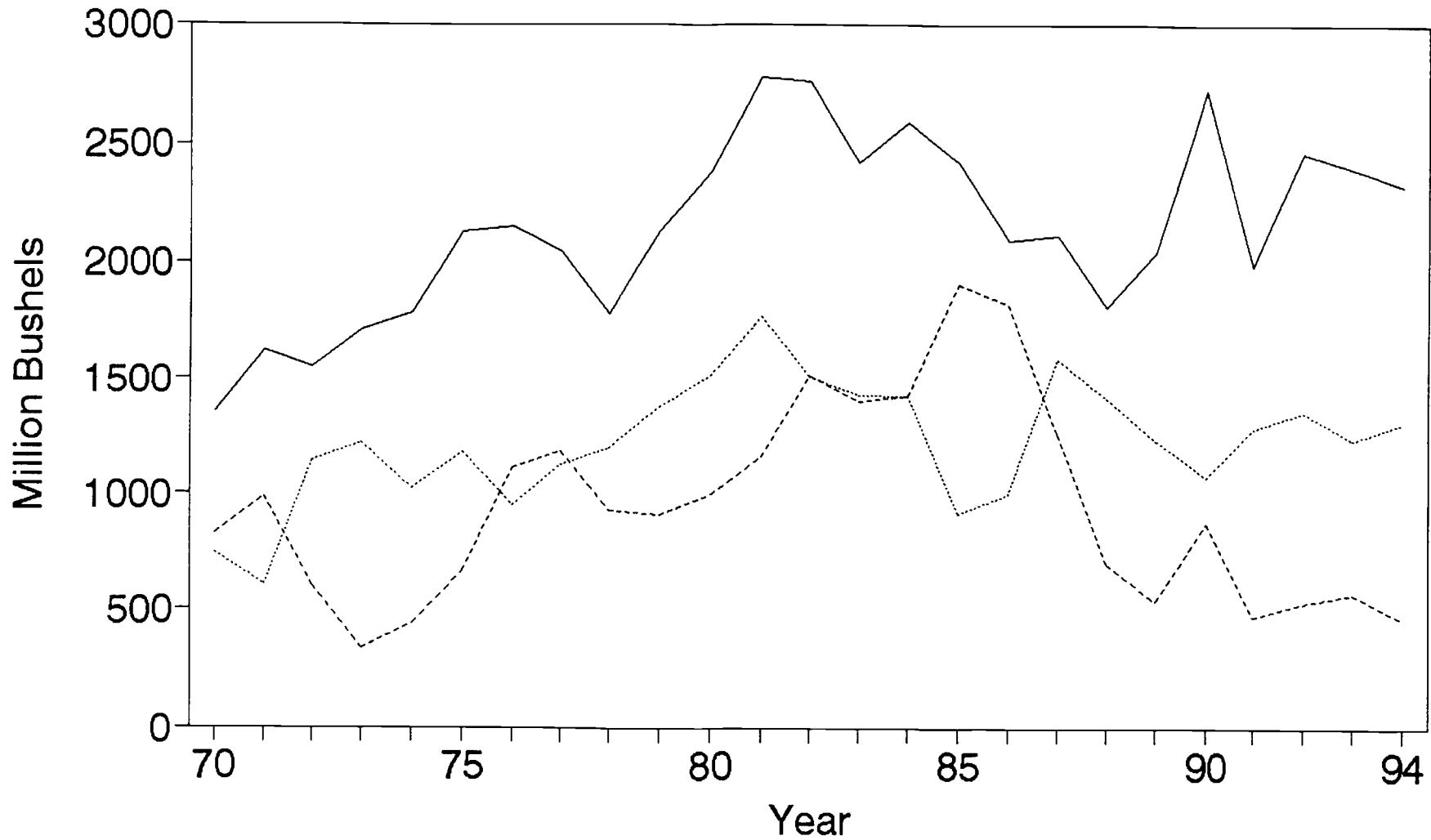
Table 10

Relative Wheat Prices During the EEP

Dependent variable:	=	PDIFF		
Number of observations	=	247		
Std. dev. of dependent var.	=	.817428		
Std. error of regression	=	.797199		
R squared	=	.056614		
Durbin-Watson statistic	=	1.78274		
	Coefficient	Std. Error		t-statistic
Constant	-.831739	.099076		-8.39496
EEPDUM	.206136	.212107		.971845
LRLOANRT	-.271162	.294884		-.919554

Figure 1: U.S. Wheat, 1970-1994

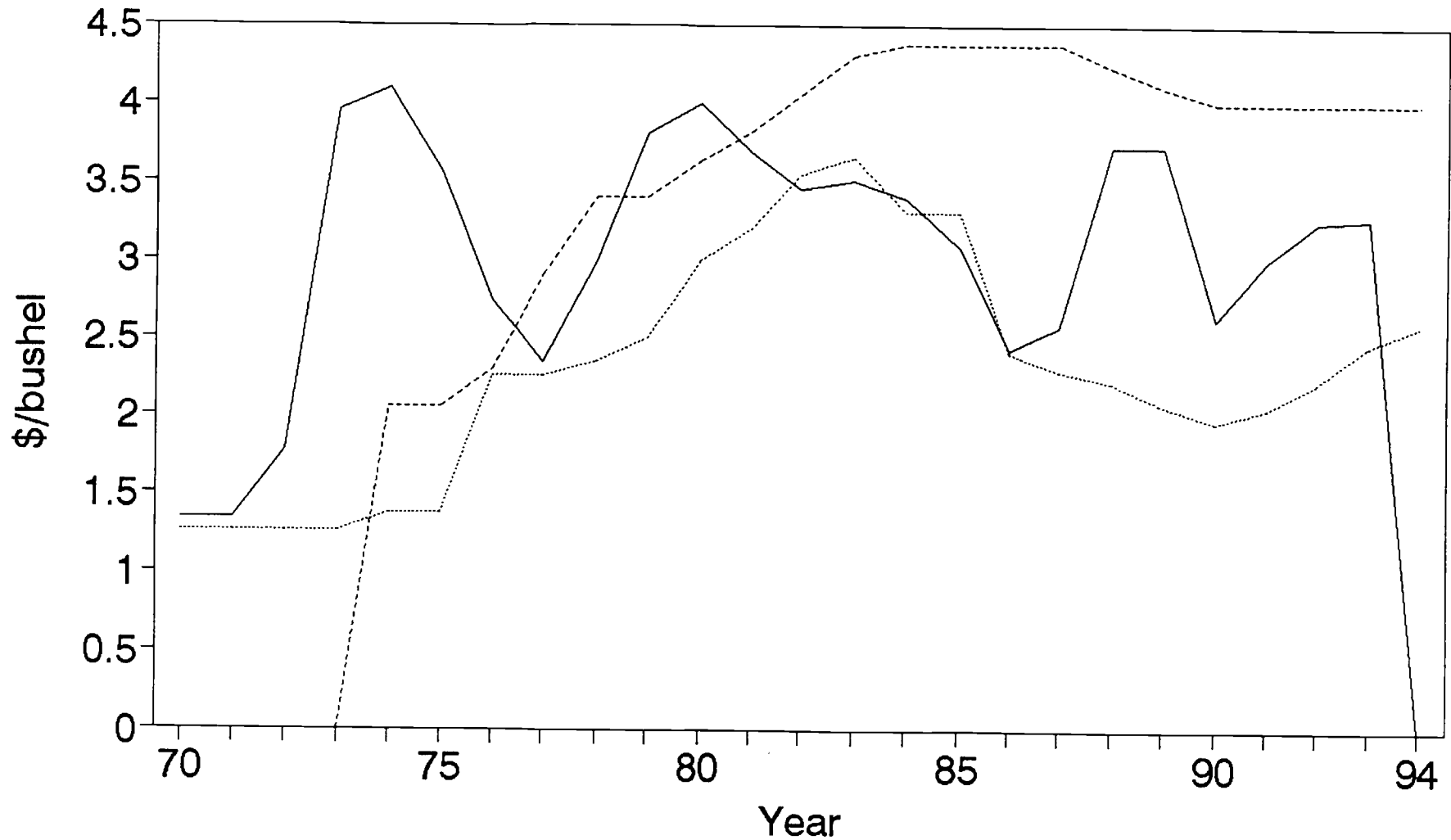
Production, Exports and Ending Stocks



— Production Exports - - - - - Ending Stocks

Figure 2: U.S. Wheat, 1970-1994

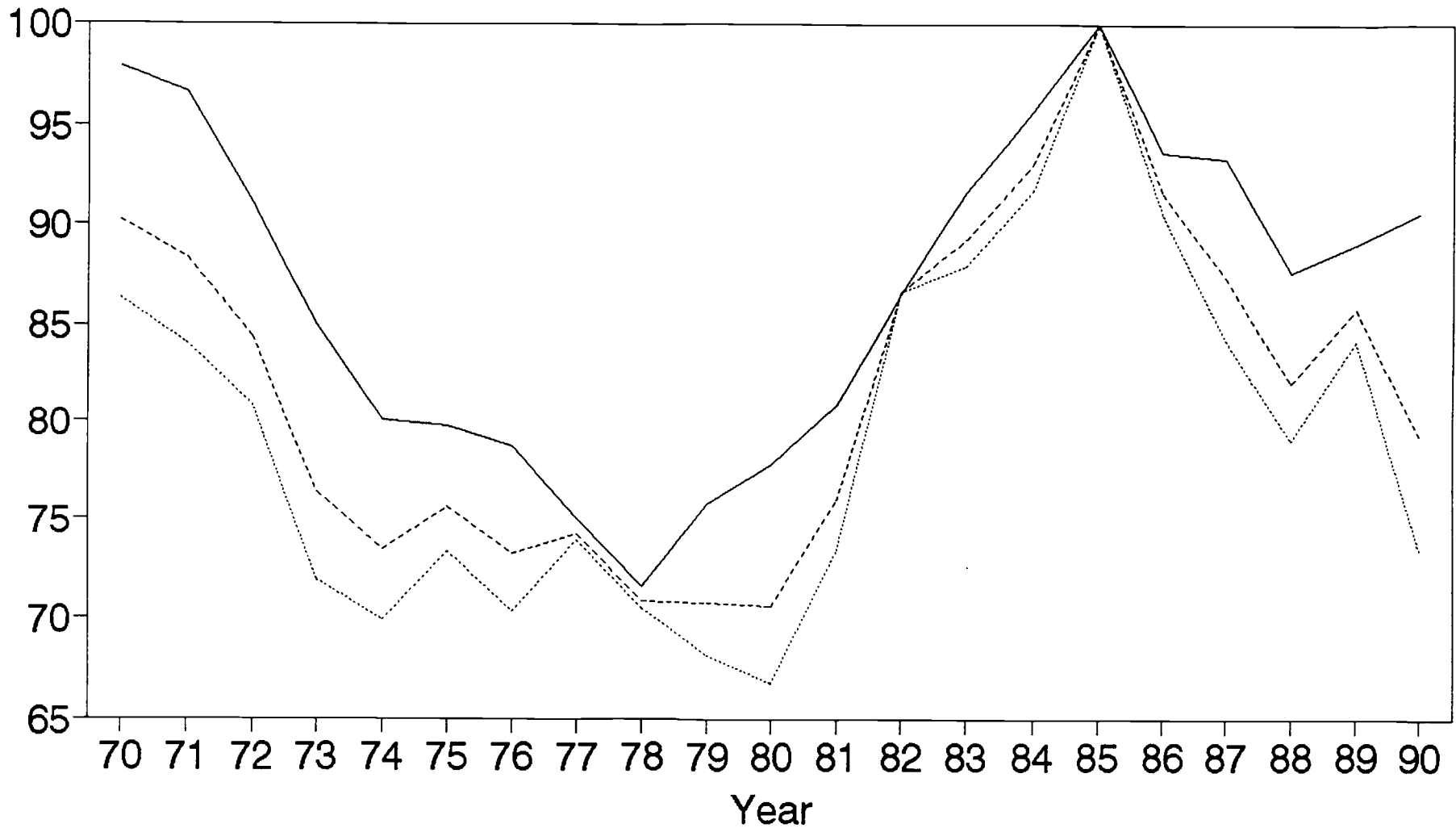
Market Price, Loan Rate and Target Price



— Market Price Loan Rate - - - - - Target Price

Figure 3: Exchange Rate Indices

Weighted-average, annual, 1970-1990



— Wheat Markets Competitor Wheat - - - - Comb. Ind. Wheat

fig 4

Figure 4. Actual, Fitted, and Predicted U.S. Wheat Exports based on OLS over 1970-85 Sample

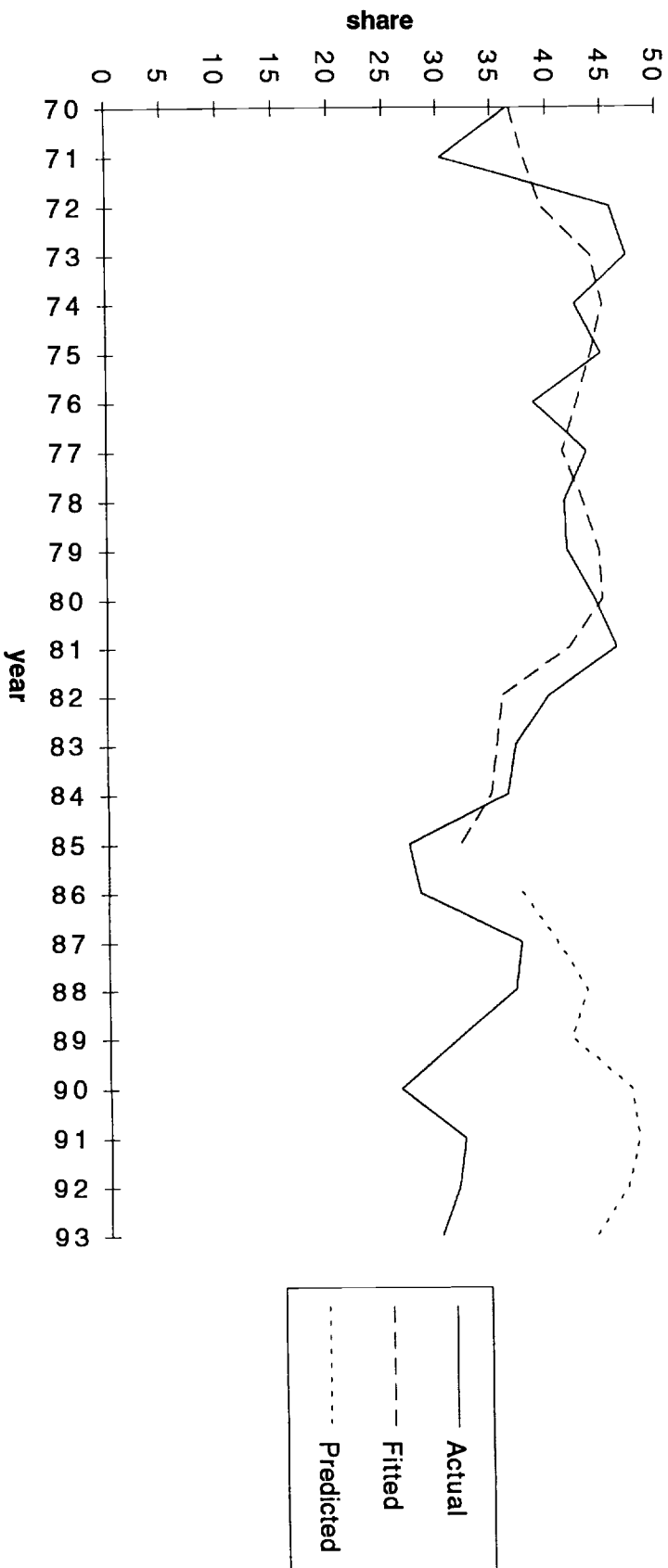


fig 5

Figure 5. Actual, Fitted, and Predicted U.S. Wheat Exports based on OLS over 1970-80 Sample

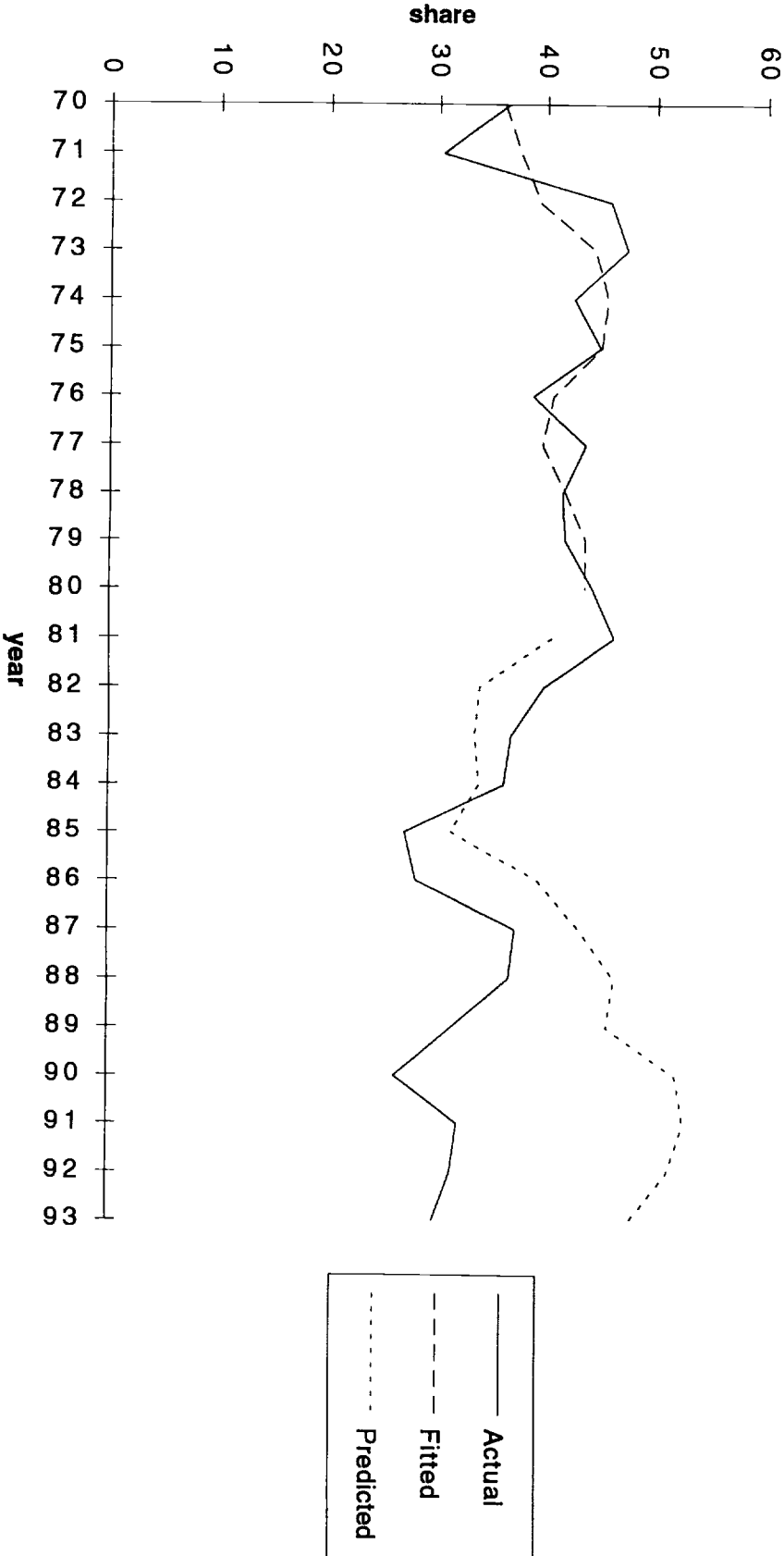


Figure 6. Actual, Fitted, and Predicted U.S. Wheat Exports based on IV Estimation over 1971-85 Sample

