STUDY BY THE STAFF OF THE U.S.

General Accounting Office

Market Structure And Pricing Efficiency Of U.S. Grain Export System

Suspicions and innuendos concerning the U.S. grain export system have oftentimes abounded with much of the concern centered on the system's high degree of market concentration. This study should promote a better understanding of the system in terms of how it is structured and how it works. The degree of competition within the system is addressed as is the degree of efficiency with which the overall marketing system transforms information about grain export sales into grain futures prices.

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FOREWORD

The U.S. grain export system provides a vehicle through which large quantities of grain valued in the billions of dollars are moved from American farmlands to customers overseas. The export system represents a major part of the overall U.S. grain-marketing system in which grain prices are determined or "discovered" based on various supply and demand information. Because a substantial share of U.S. grain exports are traded by a small number of large multinational corporations, skepticism concerning the degree of competition within the export system and the efficiency with which grain prices reflect changes in information about grain supply and demand has been evident in recent years. Some fear that the large exporting firms have the power to manipulate the market and to profit, at the expense of producers and consumers, based on "inside" information that they alone hold.

We made this study to obtain a better understanding of the U.S. grain export system. We were specifically interested in its market structure and the corresponding degree of competition within the system and the efficiency with which grain export sales information is transformed into changes in grain prices.

This study was prepared by Ralph W. Lamoreaux of our Food Coordination and Analysis Staff. It was based primarily on the efforts of Neilson C. Conklin (a University of Minnesota doctoral candidate at the time) who worked on our food staff during the period October 1980 through September 1981 and who used the results of this work to prepare his doctoral thesis on "An Economic Analysis of the Pricing Efficiency and Market Organization of the U.S. Grain Export System." The thesis was submitted to the University of Minnesota and was published in December 1981. Because of the close relationship between this study and the thesis, and because of the additional analytical detail contained in the thesis, we are issuing the thesis as a supplement to this study. Those interested in obtaining a copy of the thesis may order it from the address shown on the inside cover.

The information presented in this study and the thesis was obtained through (1) a comprehensive literature search, (2) interviews with and/or data obtained from industry representatives and officials of the Departments of Agriculture and Commerce and the Commodity Futures Trading Commission, and (3) analysis of changes in commodity futures prices based on grain export sales information.

Questions regarding this study or the thesis should be addressed to William E. Gahr, Associate Director, Food Coordination and Analysis Staff, (202) 275-5525.

Henry Eschwege

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STUDY BY THE STAFF OF THE U.S. GENERAL ACCOUNTING OFFICE

MARKET STRUCTURE AND PRICING EFFICIENCY OF U.S. GRAIN EXPORT SYSTEM

D I G E S T

As a surplus producer of grain, the United States is a major grain exporter. The increasing importance of grain exports to the U.S. agricultural sector and the entire U.S. economy make the system that markets this grain an important one. This system--involving a variety of parties, including grain-exporting firms, marketing institutions through which grain trading takes place, and Government agencies--provides a vehicle through which the proper grade and type of grain is bought/sold and delivered at the right time and place to overseas customers.

In the wake of major Soviet Union grain purchases from the United States beginning in 1972 and ensuing market instabilities and domestic price increases, grain exports and the ability of the export system to operate efficiently and competitively became the focus of considerable public attention.

Because a substantial share of U.S. grain exports is handled by a small number of large multinational corporations, there are those who perceive the grain export industry to be a cartel of just a few of these corporations which are not subject to the disciplines of market forces or effective Government regulations. This market structure, labeled as oligopolistic, has led some observers to conclude that the large exporters have the power to manipulate the market at the expense of producers and consumers alike. Such concerns have led to numerous proposals for changes in U.S. grain export policy and the system through which it works. It is important that those in the Government responsible for making policy and effecting changes to the system fully understand the system and the implications of any such changes.

GAO's study--based largely on the efforts of Dr. Neilson C. Conklin who worked for GAO on its Food Coordination and Analysis Staff during October 1980 through September 1981--examines the market structure of and corresponding degree of competition within the U.S. grain export system. It also examines the efficiency with

which the overall marketing system transforms grain export sales information into changes in grain prices.

IMPORTANCE OF U.S. GRAIN EXPORTS

Over the past several years, U.S. exports of grain and oilseeds have grown considerably. For example, export volumes of wheat, corn, and soybeans were almost three times greater in 1980 than they had been a decade earlier. During 1980 the United States exported 55 percent of its wheat production, 31 percent of its corn production, and 35 percent of its soybean production. Grain and oilseed exports are of great importance not only to the agricultural sector but also to the entire U.S. economy. During 1980 the total value of wheat, corn, and soybean exports was $20.7 billion, almost 10 percent of the value of all U.S. exports. (See p. 1.)

COMPETITIVE FORCES AT WORK IN THE U.S. GRAIN EXPORT SYSTEM

The U.S. grain export system is a relatively free market system which relies on competitive prices and limited Federal regulation to keep it running smoothly, fairly, and efficiently. GAO, in examining the system's market structure, found that although the grain export system is relatively concentrated, the level of concentration has been on the decline in recent years and is less than some people perceive it to be. GAO found that:

--In the 1980-81 marketing year about 100 firms reported grain exports to the Department of Agriculture's Export Sales Reporting Division. (See p. 14.)

--The number of firms reporting export sales of wheat from 1974 to 1980 increased by 32 percent, and those firms reporting export sales of corn and soybeans increased by 38 percent and 15 percent, respectively. (See p. 17.)

--Firms having Japanese ownership or affiliation and farmer-owned agricultural cooperatives have, in recent years, captured a slightly larger share of the U.S. grain-exporting market at the expense of other exporters, including the five largest multinational firms. (See p. 16.)

--Grain exporters must compete for grain supplies with merchandisers and processors in the domestic market, which is even less concentrated than the export market. (See p. 16.)

--Patterns of export facility ownership have been relatively stable with the percentage owned by the major exporters declining slightly. (See p. 17.)

Interviews with officials of a few selected grain exporters also disclosed a perception of increasing competition in the industry over the last decade. (See p. 18.)

An added factor which promotes increased competition in grain marketing--both in the export trade as well as domestically--is the existence of highly liquid market institutions (e.g., the Chicago and Kansas City Boards of Trade and the St. Louis Merchants and Minneapolis Grain Exchanges) in which prices are discovered, barriers to participation are low, and grain trading is conducted under rules and regulations designed to promote fairness and competitiveness. (See p. 19.)

PRICING EFFICIENCY IN THE U.S. GRAIN EXPORT SYSTEM

Grain prices serve as economic signals to grain traders, producers, and consumers and influence the decisions each makes regarding grain marketing. If each is to make the best decisions, it is important that information affecting grain prices be reflected in those prices as quickly and accurately as possible. Pricing inefficiency has been perceived by some as a major economic performance problem in the U.S. grain export system with the major grain exporters enjoying a resulting advantage because of their "inside" information. (See p. 29.)

Using Chicago Board of Trade commodity futures price data and Department of Agriculture export sales information, and applying regression and spectral and cross-spectral analysis techniques to test the relationship between these two variables, GAO found that the U.S. grain export system translates information about grain export sales into price changes with reasonable efficiency.

GAO's analysis tested the relationship between export sales information (i.e. new information) and changes in grain futures prices. In the analysis GAO assumed that other factors that influence these prices, such as worldwide crop conditions, real income at home and abroad, fiscal and monetary policy, political events, etc., are uncorrelated with the weekly reporting of export grain sales. In addition, expected export sales were assumed to be constant thoughout the period analyzed. Significant departure from either of these assumptions could seriously bias these tests.

The Department of Agriculture's Export Sales Reporting System plays an important role in providing for and maintaining informational or pricing efficiency in the system. (See p. 37.)

OBSERVATIONS

The U.S. grain export system is responsible for competitively moving large volumes of grain valued in the billions of dollars from the farm to ocean vessels. It is a system responsible for efficiently handling a tremendous flow of information which is transformed into prices which affect resource allocation and economic rewards worldwide. It is a system that is relatively concentrated, has been labeled as oligopolistic, and operates with minimal Government intervention. The system is ever-changing. Although competitive forces appear to be at work in the system and while there seems to be an efficient transformation of grain export sales information into price changes, the very significance of the system to the United States warrants continued monitoring both privately and publicly.

GAO believes this study can provide a better understanding of (1) the U.S. grain export structure, (2) export operations, and (3) the efficiency with which the overall marketing system transforms information about grain export sales into grain futures prices, subject to the above qualifications on the analysis performed. GAO is hopeful this information will be useful to policymakers as they consider, in the future, the impact on U.S. grain marketing of issues such as those mentioned above and other issues that come before them, such as proposals for a grain marketing board, a grain reserve board, export levies, etc. (See pp. 37 and 38.)

Contents

ABBREVIATIONS

CFTC	Commodity Futures Trading Commission
c.i.f.	cost, insurance, and freight
f.o.b.	free on board
GAO	General Accounting Office
USDA	Department of Agriculture

CHAPTER 1

INTRODUCTION

Grain 1/ has been a staple in man's life for thousands of years. Although most people today no longer think of it as such, grain, in one form or another, is truly the "staff of life." From flour used to bake bread and cakes, to corn and soybean meal used to feed beef and dairy cattle, the basic grains and oilseeds sustain the world's food system.

Not every part of the world has an adequate supply of grain in every year. However, the "North American granary," and in particular the United States, produces grain surpluses. Partially because of rising populations and incomes around the world, U.S. exports of grain and oilseeds have grown considerably. For example, combined volumes of U.S. exports of wheat, corn, and soybeans were 2.75 times greater in 1980 than they had been a decade earlier. During 1980 U.S. wheat exports represented over 55 percent of the country's domestic production. For corn and soybeans, 31 percent and 35 percent, respectively, of the annual harvest was exported.

Grain and oilseed exports are of great importance not only to the agricultural sector, but also to the entire U.S. economy. During 1980 the total value of wheat, corn, and soybean exports was $20.7 billion, almost 10 percent of the value of all U.S. exports.

Grain grown and harvested in the United States is either stored, processed, and/or consumed domestically or funneled into world markets through the grain export system. This system provides a vehicle through which the proper grade and type of grain is sold and delivered at the right time and place to overseas customers. Chapter 2 describes (1) the U.S. grain export system, (2) the system's market structure and corresponding level of competition, (3) the marketing institutions through which grain trading takes place, and (4) the relationship between the Federal Government and the system. Chapter 3 discusses how grain sales are made and some of the risks faced by grain-exporting firms. Chapter 4 discusses the efficiency with which grain export sales information is reflected in grain prices.

1/ The term grain includes a number of agricultural commodities, including wheat, corn, sorghum, oats, barley, rice, and rye. The two major grains, and the ones discussed in this study, are wheat and corn. Soybeans, which are an oilseed rather than a grain, are also discussed since they are handled and transported like grain. These three commodities are the major U.S. field crops and represent the bulk of agricultural exports.

GRAIN EXPORT POLICY

Grain has been traded between countries for thousands of years. Both ancient Greece and Rome imported wheat from their colonies and even Socrates recognized that "* * * no man qualifies as a statesman who is entirely ignorant of the problems of wheat."

During the past decade international grain markets have displayed increasing instability for a number of reasons, including the (1) narrowing gap between grain supply and demand, (2) lack of significant government-held reserves, and (3) emergence of large and sporadic customers in world grain markets. Resulting swings in grain prices have caused problems for producers and consumers worldwide. Governments have attempted to deal with these problems using a variety of policy tools. Most governments, other than that of the United States, insulate their domestic grain markets with levies, tariffs, quotas, or import/export agencies. The table on the following page briefly summarizes and compares types of policies used by several nations trading in wheat, corn, and soybeans. Changes in trade policies by these and other nations can have major effects on world grain markets.

U.S. grain is exported under a policy of free trade, subject to some Federal Government oversight and regulation. The United States has generally not followed a policy of insulating its grain market as do many other countries. However, the United States has imposed embargoes on grain and oilseed exports on an ad hoc basis during periods of tight supplies and for political reasons.

The free trade policy of the United States results in its producers and consumers being faced directly with adjustments in world grain markets. Producer groups often complain that prices are too low, consumer groups believe that they are too high, and both have been distressed by supply, demand, and resulting price instabilities. To bring more stability to the entire system, the traditional response of the United States has been to pursue multilateral trade agreements with major trading partners. Such agreements have not always been successful, however, and have prompted numerous proposals for changes in U.S. grain export policy. Some of them are expressed in simple terms such as "a bushel of grain for a barrel of oil." Others are much more complex. For example, legislation introduced in the 96th Congress proposed the creation of a grain-marketing board to obtain the highest export prices for American farmers. A food bank system has been proposed which would accumulate grain reserves, license grain exporters, and channel food aid abroad. A grain reserve board also has been proposed which would be based on a variable export levy, a reserve program, and a series of bilateral agreements which would help allocate U.S. grain.

Trade Policies of Various Countries in Wheat, Corn, and Soybean Markets

Nation	Trade policy		
	Wheat	Corn	Soybeans
European economic community (9 countries)	Variable levy to maintain domestic price. Export subsidies for soft wheat.	Variable levy to maintain domestic price.	Free trade.
Eastern Europe	State trading. Imports determined by domestic production and targets.	State trading. Imports determined by domestic production and targets.	State trading. Imports determined by domestic production and targets.
Soviet Union	State trading with formal bilateral agreements.	State trading with formal bilateral agreements.	State trading with formal bilateral agreements.
Japan	State trading with fixed domestic resale price.	Free trade.	Free trade.
Less developed countries	Generally use State trading agencies.	Generally use State trading agencies.	Generally use State trading agencies.
Brazil	State trading.	Not applicable.	Exporting quotas and licensing.
Canada	Wheat board controls exports.	Not applicable.	Not applicable.
Australia	Wheat board controls exports.	Not applicable.	Not applicable.
Argentina	Free trade.	Free trade.	Not applicable.

Each of these proposals to change the U.S. grain export policy would involve changes in the grain export system. Each proposal would increase direct Government involvement in the system with the Government becoming not only an overseer and regulator, but a much more active participant. As each of these proposals and others are considered, policymakers and legislators need a good understanding of the system and how it works. This understanding is essential if policy changes are to allow the grain export system to operate in a manner beneficial to all--producers, consumers, and other system participants.

OBJECTIVES, SCOPE, AND METHODOLOGY

The purposes of our study were to obtain a better understanding of the U.S. grain export system and to analyze at least some aspects of its performance. Specifically, we wanted to (1) describe the system in terms of its organization, (2) describe the way in which grain trading occurs, (3) define some performance measures, and (4) conduct an empirical analysis of these measures.

To conduct our work, we used information from almost 100 publications (see app. I for selected references) and interviewed industry representatives from such grain-exporting firms as Cargill, Continental, Louis Dreyfus, Marubeni, C. Itoh, and International Grain Management Corporation. We also interviewed and obtained information from representatives of several agencies within the U.S. Department of Agriculture (USDA), including the Foreign Agricultural Service, the Agricultural Cooperative Service, and the Federal Grain Inspection Service. We obtained futures prices for wheat, corn, and soybeans from the Commodity Futures Trading Commission (CFTC) and additional information from the U.S. Department of Commerce. The study was performed in accordance with our current "Standards for Audit of Governmental Organizations, Programs, Activities, and Functions."

The effective and efficient performance of the U.S. grain marketing system (including that of the U.S. grain export system) is important to the entire country. Although the system is very large and complex, it can be measured to some extent in terms of the efficiency with which grain is physically moved through the system (generally referred to as productive efficiency) and in terms of the efficiency with which information is transformed into grain prices (pricing efficiency). The issue of productive efficiency has been the subject of several previous studies. Although the system has generally been considered to be productively efficient, we concluded in a report entitled "U.S. Grain Transportation Network Needs System Perspective To Meet Future World Needs" (CED-81-59, Apr. 8, 1981) that the major components of the grain transportation system--railroads, waterways, roads, and ports--need to be viewed as an integrated system in which developments in one area affect all others. We also concluded that a number of problems threaten the transportation system's ability to meet future demand and that bottlenecks which impede

the movement of grain exports and increase costs presently can create even greater constraints in the future, hinder farm productivity growth, and threaten our balance of payments.

Our primary emphasis in looking at the performance of the grain export system in this study has to do with pricing efficiency. The issue of pricing efficiency has not been as fully addressed in previous research efforts as productive efficiency. Furthermore, allegations of market manipulations--arising from the perception of the grain export industry as an oligopoly--imply that information about grain exports is not efficiently translated into grain prices and that, therefore, the larger exporters with better information sources enjoy an advantage over others.

Our search of the literature suggested to us one means through which we could analyze the pricing efficiency of the export system. To do so, we used (1) the "efficient markets hypothesis" which states that prices in an efficient market reflect all available information, (2) commodity futures price data from the Chicago Board of Trade which was obtained from CFTC and export sales data obtained from USDA's Export Sales Reporting Division over the 5-year period from June 1975 to June 1980, and (3) regression, spectral, and cross-spectral analysis techniques. Our analysis tested the relationship between only two of many possible variables (i.e., grain futures price changes and export sales information) and its results may have been affected by, but we did not measure, the effects of any other variables, such as worldwide weather, crop conditions, political events, or fiscal and/or monetary policies, upon grain futures prices.

We conducted our work primarily in Washington, D.C., and at the University of Minnesota--St. Paul campus. We interviewed representatives from the above named grain exporting firms in Minneapolis/St. Paul and in New York City.

Much of the credit for this study must be given to Dr. Neilson C. Conklin who worked on our Food Coordination and Analysis Staff during the period October 1980 through September 1981. Dr. Conklin--a University of Minnesota doctoral candidate at the time--selected the topic of this study and performed much of the work which this study is based on. Dr. Conklin also used the results of this work to prepare his doctoral thesis on "An Economic Analysis of the Pricing Efficiency and Market Organization of the U.S. Grain Export System." The thesis was published in December 1981. Dr. Conklin's major professor at the University of Minnesota was Dr. Reynold P. Dahl of the Department of Agricultural and Applied Economics. Dr. Dahl reviewed and commented on a draft of this study.

CHAPTER 2

U.S. GRAIN EXPORT SYSTEM:

A DESCRIPTION

The U.S. grain export system, its organization, and its functions are generally not well understood by the public and by some academics and Government policymakers. Before 1972 there was little reason for anyone outside of the grain trade to give it much thought. World grain markets were relatively stable and U.S. food prices were low. In the wake of major Soviet Union grain purchases from the U.S. in 1972 and ensuing domestic price increases, grain exports became the focus of considerable public attention. In this politically charged atmosphere, suspicions and innuendos oftentimes abounded, generally centering on the grain export system's high degree of market concentration. A substantial share of U.S. grain exports is handled by a small number of large multinational corporations. This market structure, labeled as oligopolistic, has led some observers to conclude that the large exporters (1) manipulate grain markets based on inside information, (2) underpay grain producers (farmers) for their production, and (3) are responsible for higher domestic food prices resulting from increased export sales which they have orchestrated. The fact that the large exporters are generally privately owned and traditionally secretive in their dealings has done little to dispel the sometimes negative feelings that have built up against them.

The following quote exemplifies public perception of the grain export system as seen by the press:

> "The five companies [Cargill, Continental, Bunge, Louis Dreyfus, and Cook Industries] maintain a strangle hold over the world's grain supply and constitute a food cartel unprecendented in world history. The grain companies are not at the mercy of the free market.
>
> "On the contrary, they use their enormous size to manipulate the free marketplace and to maximize profits at the expense of farmer and consumer alike." 1/

Another writer wrote that: "Yet the [grain] companies still were rogue elephants in the international economy, as large, central, and almost as inaccountable as ever * * *." 2/

1/Roger Burbach, "The Great Grain Robbery," The Progressive, July 1976, p. 25.

2/Dan Morgan, Merchants of Grain, New York: Viking Press, 1979, p. 361.

In this chapter we examine the basis for these types of beliefs surrounding the grain export system and, at the same time, attempt to objectively describe the system.

FUNCTIONS OF THE GRAIN EXPORT SYSTEM

As discussed in chapter 1, the grain export system provides a vehicle through which the proper grade and type of grain is bought/sold and delivered at the right time and place to overseas customers. The system, as indicated, entails not only the physical movement of grain but also the flow of information among system participants. Each function is described in the following sections.

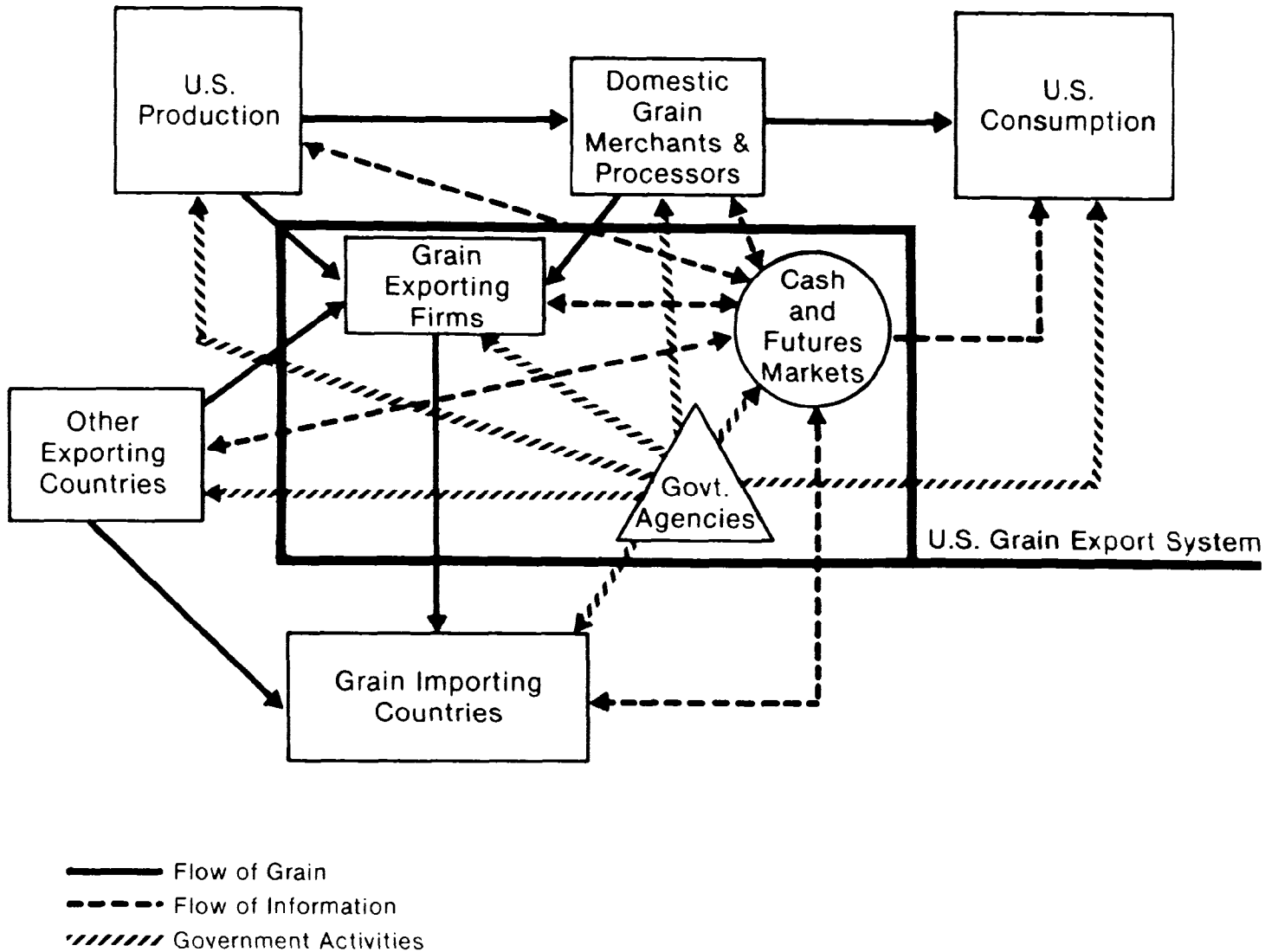
Physical movement of grain to export channels

An important function of the U.S. grain export system is to physically move grain to export position where it is generally loaded on oceangoing vessels for delivery to foreign customers. The flow chart on the following page which we developed from a variety of sources shows the relationship of the system to (1) U.S. production, (2) the domestic market, including U.S. consumption, (3) governmental agencies, (4) cash and futures market institutions, and (5) both grain-importing and -exporting countries. Grain generally flows from the farm, where it is produced, to country elevators and from there to subterminal and inland terminal elevators. From the inland terminal elevators, it moves either into domestic use or into export channels, including export elevators. Recently, increasing amounts of grain have been moving directly from large country and subterminal elevators to port facilities for export, thus bypassing the inland terminal elevators. This is in response to unit train 1/ rates now being offered by the railroads. For this study, grain enters the export system once it is beyond a position for domestic use.

During the past decade the volume of grain and oilseeds moving through the export system has increased dramatically. As shown in the table on page 9, wheat exports increased approximately 105 percent; corn, 338 percent; and soybeans, 82 percent.

1/A unit train is an entire train carrying the same commodity and moving intact from point of origin to destination and return. Unit train rates are generally lower than muliple- or single-car shipment rates.

Figure 2.1 The U.S. Grain Export System in the World Grain Market



U.S. Exports of Unprocessed Wheat, Corn, and Soybeans During 1970-80

Year	Wheat	Corn	Soybeans
	----------(1,000 metric tons)----------		
1970	17,436	14,384	11,955
1971	16,220	12,871	11,538
1972	21,317	22,357	11,996
1973	37,444	33,144	13,221
1974	25,132	29,801	13,940
1975	30,966	33,442	12,496
1976	26,527	44,264	15,332
1977	23,826	40,415	16,196
1978	34,096	50,043	20,705
1979	33,378	59,167	20,888
1980	35,750	63,042	21,779
Percentage increases from 1970 to 1980	105	338	82

Source: U.S. Foreign Agricultural Trade Statistical Report, Calendar year 1980. Washington, D.C., May 1981.

This increased grain movement has been accommodated by the grain export system although not without problems. Railcar shortages, rail line abandonments, inadequate lock and dam capacities, and rural road deterioration have plagued the grain transportation network and were the subject of our previously mentioned report on the U.S. grain transportation network.

The general pattern of grain movement from farm to various port areas responds to foreign demands and the costs of interior and overseas transportation rates. In recent years such things as development of the unit-train concept and deregulation of the transportation industry under the Staggers Act of 1980 have additionally altered grain movement patterns nationwide.

Grain flows from producing areas, mainly in the Nation's interior, to port areas at the Gulf of Mexico, the Great Lakes, and the Atlantic and Pacific coasts. Patterns of wheat, corn,

and soybean flows during 1977 are shown in the illustrations on pages 11 to 13. The illustrations reflect the heavy dependence of the export system on Gulf of Mexico ports. In 1977, for example, the gulf ports handled over 76 percent of all soybean exports and 64 and 46 percent of the corn and wheat exports, respectively.

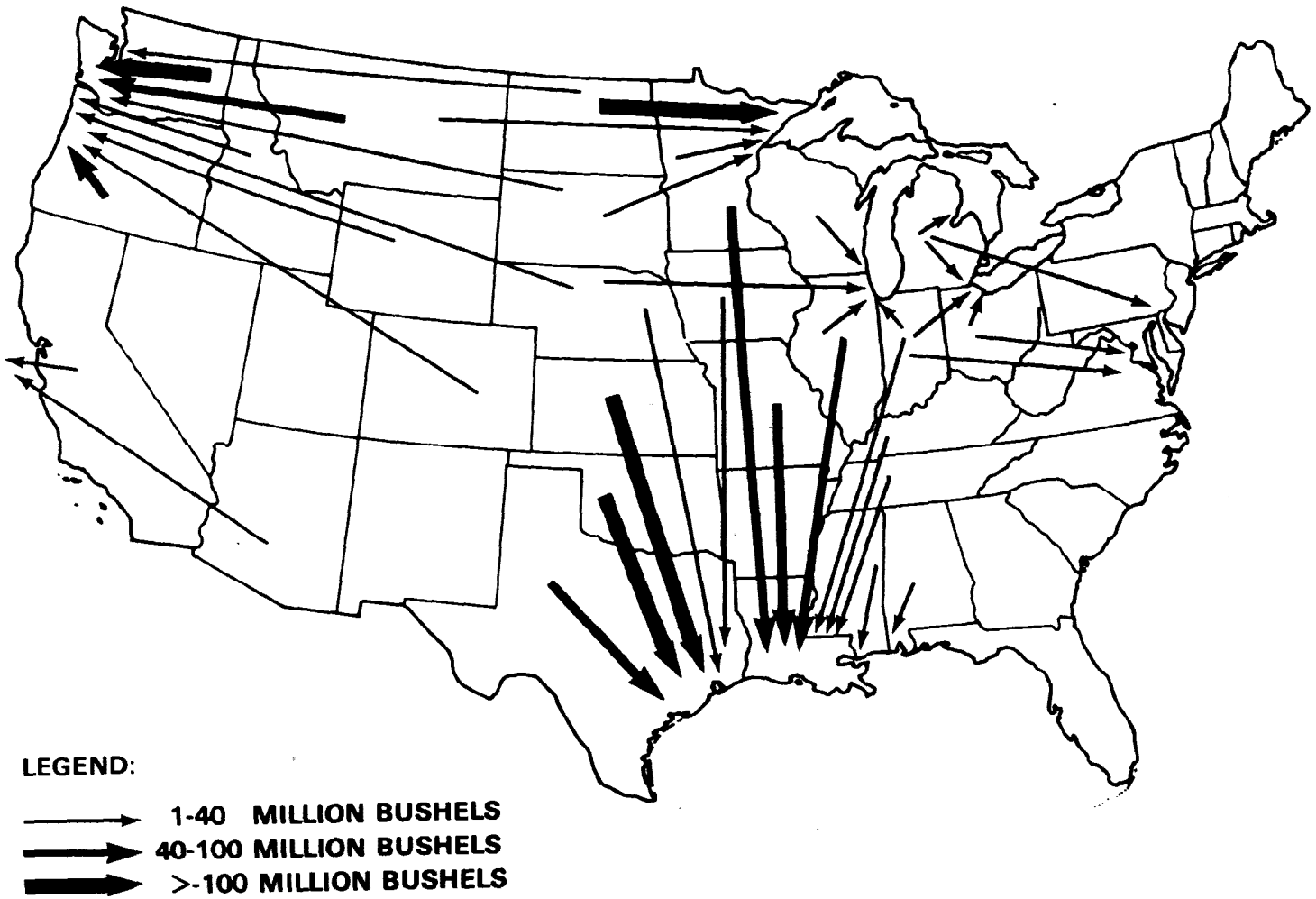
These geographic flows, as illustrated, give the grain export system a deceptively simple appearance. However, physical grain movements do not occur automatically nor are they achieved at the direction of a "grain czar." Under the U.S. grain-marketing system, grain movements are generally directed by private sector decisionmakers in response to economic fluctuations. Farmers, domestic merchandisers, processors, grain exporters, transportation companies, and other parties interact; they buy, sell, and move the grain to its ultimate destination. Since the early 1970's, public sector (Federal Government) decisionmakers have generally not been directly involved in grain-marketing activities. However, the Federal Government does have several important roles to play. In its policymaking role, for example, it attempts to define socially acceptable limits for the system. These limits result from a broad range of policies concerning such issues as food and agriculture, health, safety, environment, transportation, and foreign relations. Its regulatory function keeps the system operating within the parameters set by these policies.

Flow of information in the grain export system

Neither private nor public sector decisionmakers act in a vacuum; they require information to do their jobs. Although less visible than the physical movement of grain, the flow of information is just as important in the grain export system. Information concerning the physical state of the system, economic variables, and the political environment is important to all participants. As a result, both private and public sector entities have emerged over the years to provide this information. Wire services, newsletters, trade publications, and Government agencies regularly provide information about grain prices, inventories, exports, and crop conditions. Additionally, crop forecasts and other analyses are provided which are useful for making decisions relating to future activities.

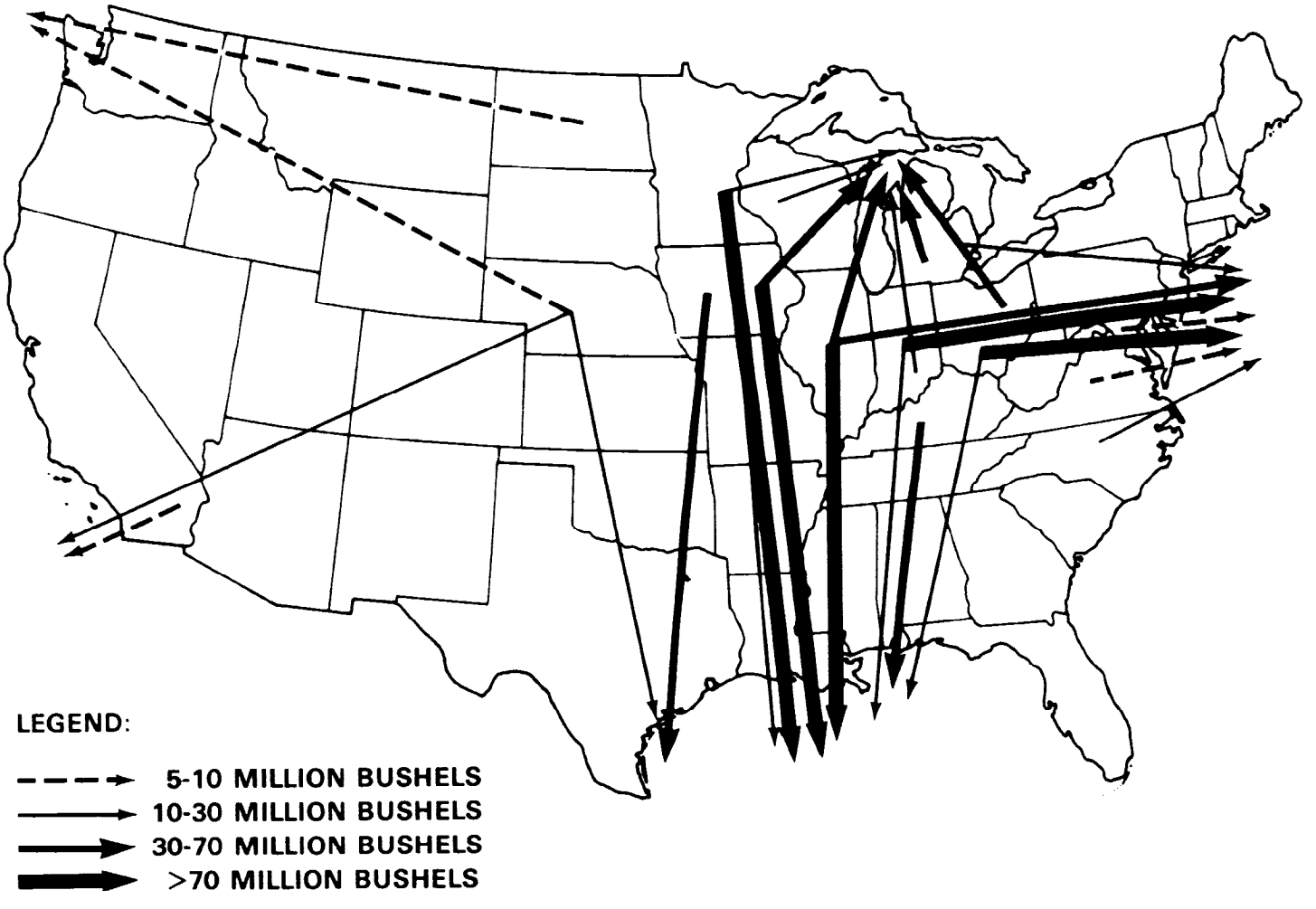
Although entities such as these above speed the flow of information throughout the system, they are not at the heart of information in the grain export system. Large volumes of information are not useful to system participants unless they have been processed into more easily interpreted signals. For the grain export system, these signals are economic ones and are in the form of grain prices which are generated by the interaction of buyers and sellers in the marketplace. Formal institutions such as grain exchanges and futures markets have emerged to enhance price signals. These institutions are discussed more fully beginning on page 19.

PATTERNS OF WHEAT FLOWS TO PORT AREAS DURING 1977



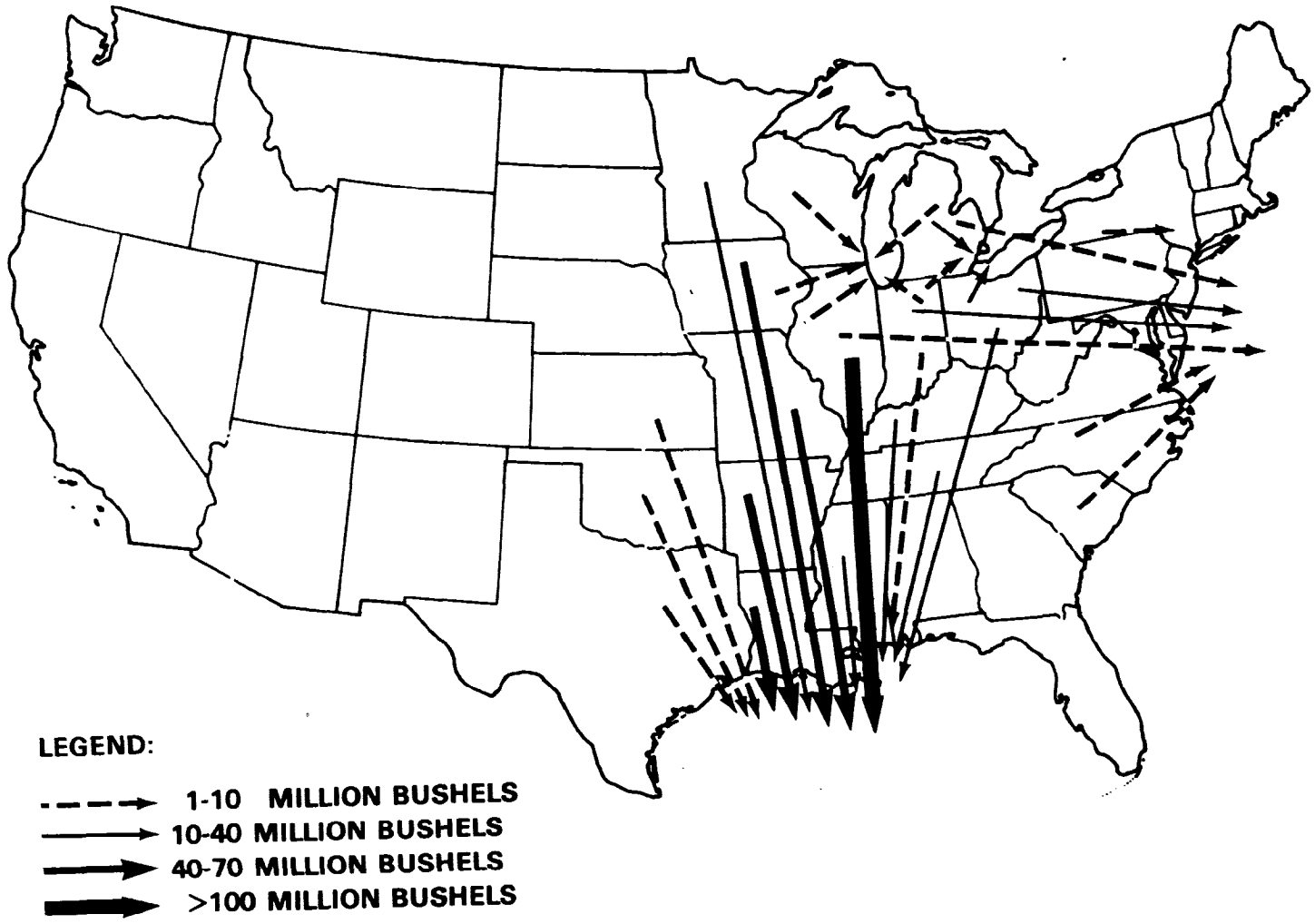
Source: Lowell D. Hill, Mack N. Leath and Stephen W. Fuller, *Wheat Movements In The United States: Interregional Flow Patterns and Transportation Requirements in 1977,* North Central Regional Research Bulletin 274, Jan. 1981.

PATTERNS OF CORN FLOWS TO PORT AREAS DURING 1977



Source: Lowell D. Hill, Mack N. Leath and Stephen W. Fuller, *Corn Movements In The United States: Interregional Flow Patterns and Transportation Requirements in 1977*, North Central Regional Research Bulletin 275, Jan. 1981.

PATTERNS OF SOYBEAN FLOWS TO PORT AREAS DURING 1977



Source: Lowell D. Hill, Mack N. Leath and Stephen W. Fuller, *Soybean Movements In The United States: Interregional Flow Patterns and Transportation Requirements in 1977*, North Central Regional Research Bulletin No. 273, Jan. 1981.

When considered in its entirety, the U.S. grain export system is highly complex. To facilitate an understanding of it, the remaining sections of this chapter are devoted to three important system components: (1) market structure, (2) market institutions through which grain trading takes place, and (3) the public sector or Government which regulates and assists the first two.

MARKET STRUCTURE OF THE GRAIN EXPORT SYSTEM

The market structure of the U.S. grain export system may be categorized into four groups: (1) farmer-owned agricultural cooperatives, (2) Japanese-owned or affiliated firms, (3) major multinational corporations other than Japanese, and (4) all other exporting firms. The major multinational corporations are large firms which operate worldwide and handle much of the grain bought and sold in the world today. The Japanese firms are likewise multinational in nature and some, at least, are large ones. For our study, we were interested in the Japanese firms, as a group, because in recent years they have become a significant force in the U.S. grain export system. Farmer-owned agricultural cooperatives, some of which are large ones, are involved in U.S. grain exporting and recently have been seeking ways to increase their share of the export market. Other exporting firms include smaller U.S. firms and other firms trading primarily in the domestic grain markets.

For this study, a grain-exporting firm is defined as one that sells grain directly to a foreign buyer. It does not necessarily have to be involved in the actual loading of the grain on an oceangoing vessel because this function is often performed by some other company. This definition is consistent with the one used by USDA's Foreign Agricultural Service, which requires export sales to be reported to it. The definition excludes firms which own port elevators but do not actually make sales to overseas customers. The definition considers as an exporter individuals who make sales to foreign buyers. By this definition, the director of the Foreign Agricultural Service's Export Sales Reporting Division estimated that in the 1980-81 marketing year, approximately 100 firms reported grain exports.

While the number of firms engaged in the grain export business is significant, not all of them export a full range of commodities and products. Although the information is somewhat dated, this fact is shown in our report entitled "Issues Surrounding the Management of Agricultural Exports" vol. II (ID-76-87, May 2, 1977) which displayed the following results based on a survey of 195 agricultural export firms.

Agricultural Export Firms Classified
by Primary Commodity,
Marketing Year 1973-74

Primary commodity	Number
Multicommodity	27
Soybeans and products	34
Wheat and products	22
Corn	17
Cotton and products	54
Rice	26
Inactive	15
Total	195

There has been concern that the larger grain exporting firms dominate the market. The availability of empirical data on the subject, however, is limited. The information we were able to obtain showed conflicting results. A 1976 report, for example, by USDA's Farmer Cooperative Service estimated that the six largest grain firms at the time controlled 90 percent of the grain exports. In a 1976 report published by the U.S. Department of Commerce, however, concentration ratios calculated by USDA Economic Research Service personnel, based on actual reports of export sales from the Foreign Agricultural Service, told a considerably different story. As shown in the following table, the eight largest firms accounted for 69 percent of the total food and feed grains and oilseeds exported for the 1974-75 marketing year. Also, it was only at the 20-firm level that concentration ratios approached or surpassed 90 percent.

Exporting Firm Concentration Ratios
Marketing Year 1974-75

Number of firms	Food grains (note a)	Feed grains (note b)	Oilseeds (note c)	Total
	(percent)			
4 largest	58	44	42	49
8 largest	78	64	63	69
20 largest	88	93	87	90

a/Wheat, rye, and rice.

b/Corn, barley, oats, and sorghum.

c/Soybeans; soybean oil, cake, and meal; cottonseed oil; linseed oil; and flaxseed.

Information recently provided to us by USDA's Export Sales Reporting Division showed a decline in the level of concentration in the U.S. grain export system. The following table lists the four categories of grain exporters as they were defined on page 14. They are listed in the table by order of importance in the 1980-81 marketing year in terms of market share. Also shown is each category's relative increase or decrease in market share from 1974-75 to 1980-81. 1/

Exporter category	Percent of market share change from 1974-75 to 1980-81
Five largest multinationals (excluding Japanese firms)	-5.3
Firms having Japanese ownership or affiliation	+4.7
All other firms	-0.5
Agricultural cooperatives	+1.1

1/A more descriptive presentation of the information we obtained from the Export Sales Reporting Division was precluded by USDA's strict interpretation of the confidentiality requirements of section 812 of the Agricultural Act of 1970, as amended (7 U.S.C. 612c-3). This provision requires that contracts for export sales be reported to the Secretary of Agriculture and that "individual reports shall remain confidential * * *."

As shown, agricultural cooperatives and Japanese-owned or -affiliated firms increased their shares of the combined wheat, corn, and soybeans market during the two periods. Their increases came at the expense of the multinationals and all other firms.

Concentration ratios for export firms as shown above do not alone adequately reflect the total degree of competition in the grain export industry. Grain exporters must also compete with domestic merchandisers and processors for supplies of grain. The U.S. domestic grain industry is much less concentrated than the export industry with only 55 percent of total 1977 sales being controlled by the 20 largest firms.

Control of physical facilities provides another indication of the degree of competition in an industry. Although there are firms owning export facilities which do not make grain sales to foreign customers as well as export firms which do not own any physical facilities, the control of export facilities does undoubtedly increase the flexibility and power of some firms in the export system.

Since 1968, trends in the control of elevator storage capacity at ports have shown no increase in market concentration, according to data compiled by USDA's Federal Grain Inspection Service. In 1968, for example, major exporters controlled 56 percent of port elevator storage capacity; this share shrank to 54 percent in 1976 and to 50 percent in 1981. On the other hand, during this same time period, farmer-owned cooperatives increased their share of port elevator capacity from 9.7 percent to 21.4 percent. This growth was especially apparent in the gulf ports where cooperative elevators increased from none in 1968 to six in 1981. The share of elevator capacity controlled by firms other than major exporters and cooperatives has declined during the last decade. Thus, it appears that cooperative increases in elevator capacities have come at the expense of both the major exporters and the smaller firms.

Economic theory suggests that ease of entry and exit is an important indicator of an industry's competitiveness. Although relatively large economies of scale have been hypothesized as a barrier to entry in grain exporting, firms have entered and left the industry since 1968. Members of the grain trade have also pointed out the widely varying sizes at which a grain export firm may do business. Smaller firms often find a niche by providing a special service, product, or quality of grain.

The number of firms reporting grain export sales has been on the increase in recent years. The following information, for example, comes from the Foreign Agricultural Service's Export Sales Reporting Division. It shows that the number of firms reporting export sales of wheat from 1974 to 1980 increased by about 32 percent; those firms reporting export sales of corn and soybean increased by 38 and 15 percent, respectively.

Firms Reporting Export Sales of Wheat, Corn and Soybeans During Marketing Years 1974-75 to 1979-80 (note a)

Year	Wheat	Corn	Soybeans
1974-75	41	56	39
1975-76	44	55	42
1976-77	39	61	37
1977-78	44	56	41
1978-79	50	61	44
1979-80	54	77	45
Percentage increases from 1974-75 to 1979-80	32	38	15

a/Many grain exporting firms export more than one commodity. Therefore, for any given year, the total number of firms exporting wheat, corn, and soybeans cannot be obtained by simply adding the number of firms shown above for each commodity.

A series of interviews with officials of both large and small grain exporters disclosed a perception of increasing competition in the industry over the last decade. This perception seems consistent with the information presented above. These interviews also revealed that the industry is undergoing some other changes as well. For example, Japanese trading houses such as Marubeni, Mitsui, Mitsubishi, and C. Itoh have established U.S. subsidiaries which export U.S. grain to Japan and other countries. Some of these firms have acquired U.S. facilities, including country, terminal, and port elevators. As discussed earlier, farmer-owned cooperatives have gained an increased role in the export system. Recently, cooperatives have become increasingly interested in selling their grain directly to foreign customers.

Thus, although market concentration is substantial in the grain export system, the level of concentration has been on the decline in recent years. Patterns of export facility ownership are relatively stable with concentration in the hands of major exporters declining slightly. Increases in the number of firms reporting export sales indicate freedom of entry into the industry and at least imply increased competition. Japanese firms and agricultural cooperatives have increased their shares of the U.S. grain-exporting market at the expense of other exporters, including the multinationals. Further, exporters must compete for grain supplies with merchandisers and processors in the domestic market that is even less concentrated.

An additional factor which may promote increased competitiveness in the grain-marketing system is the existence of highly liquid market institutions in which prices are discovered, barriers to participation are low, and grain trading is conducted under rules and regulations designed to promote fairness and competitiveness. The next section of this chapter is devoted to the crucial role of these institutions in the U.S. grain export system.

MARKET INSTITUTIONS THROUGH WHICH GRAIN TRADING TAKES PLACE

A market may be defined as a sphere of economic activity in which firms or individuals, acting as buyers and sellers, interact with each other and price discovery takes place. Although prices are determined by the basic forces of supply and demand in grain marketing, the actual discovery of specific prices results from the interaction of buyers and sellers. In this study, we are concerned with the efficiency of price discovery in grain markets, or, in other words, with the efficiency with which grain prices reflect changes in information about grain supply and demand.

Over the years, numerous institutions have developed to facilitate the operations of a given market. Medieval fairs and the village marketplace are examples of such institutions. Institutions such as the Chicago and the Kansas City Boards of Trade and the St. Louis Merchants and the Minneapolis Grain Exchanges have played an important role in developing the U.S. grain-marketing system, both domestic and export. These institutions, governed by specific rules and regulations, bring together buyers and sellers in a central marketplace. They serve as clearinghouses for grain supply and demand information for the United States and the rest of the world. From this information, grain prices are discovered.

Two types of grain trading take place. First, cash trading involves the sale and receipt of grain for immediate or forward delivery at a specified time and place. Delivery of grain is always involved in transactions on the "cash market." Cash trading takes place in such institutions as the St. Louis and Minneapolis Exchanges, but not in the Chicago and Kansas City Boards of Trade. Second, futures trading is done through the use of standardized futures contracts. Delivery of grain may or may not be involved--usually it is not. Futures contracts are traded in the "futures market," generally not for the purpose of merchandising grain, but rather for the purpose of pricing grain for forward delivery, which facilitates hedging. Hedging allows those buying and selling on the futures market to transfer price risks associated with future commitments to others who are willing to bear them. Futures trading takes place in such institutions as the Chicago and Kansas City Boards of Trade and the Minneapolis Grain Exchange. No futures trading is done in the St. Louis Merchants Exchange.

One of the more significant economic developments in the United States in recent years has been the sizable increase in futures trading of grain and grain products. Such trading is increasingly being used not only by U.S. traders, but by the rest of the world for both hedging and price reference purposes. Importers of U.S. grain, private firms, Government agencies, and even grain-exporting nations make use of U.S. futures market prices. Many observers feel that the Canadian Wheat Board keeps a close watch on U.S. futures markets. Thailand has used U.S. futures market prices as part of the export price formulas set in its bilateral corn export agreements with Japan and Taiwan.

Futures trading volumes in grain and grain products have grown from 2.6 million contracts in 1960 to 39.6 million contracts in 1980. This growth is shown in the following table which was calculated from information we obtained from the Futures Industry Association.

Futures Trading Volumes
Grain and Grain Products

Calendar year	Number of contracts traded
	(000 omitted)
1960	2,619
1970	7,883
1974	15,038
1975	16,084
1976	18,544
1977	22,202
1978	25,277
1979	30,343
1980	39,556

The network of market institutions in the U.S. grain-marketing system (including cash and futures markets) is as vital to the flow of grain as trucks, railcars, barges, and elevators. It is through these institutions that information about supply and demand is transformed into prices. The U.S. grain export system--unlike the centralized marketing systems of the Soviet Union, Canada, and other nations--accomplishes this feat without

the direct involvement of the Government. However, the Government does play an important role in regulating and assisting the entire system.

THE FEDERAL GOVERNMENT'S ROLE IN THE U.S. GRAIN EXPORT SYSTEM

This study has thus far dealt mainly with the role of private sector decisionmakers in the U.S. grain export system and with market institutions through which they interact. The Federal Government also plays several important roles. In chapter 1, for example, we discussed the Government's role in setting grain export policy. General policies established by the Government pertaining to health and safety, the environment, transportation, and the economy affect the overall grain-marketing system. Some of the policies have had the effect of increasing marketing costs. Others, such as those related to recent transportation deregulation, have stimulated innovations in ratemaking and in transportation modes and movements which may well result in increased efficiencies within the system. The number of Government programs affecting grain marketing (including exporting) in one way or another is difficult to determine. However, using an inventory of Federal food, nutrition, and agricultural programs which was assembled by USDA, we identified over 50 programs possibly affecting the U.S. grain export system.

The day-to-day impact of the Government on the grain export system is not as evident in its policymaking as it is through its role of assisting or providing information or in its regulatory role. For example, in this latter role, legislation in 1976 created USDA's Federal Grain Inspection Service to ensure that U.S. grain being exported met certain quality and weight criteria. Although much of the cost of this inspection service is borne by the industry, and ultimately the farmer and the consumer, the fact that it is being done by an independent agency has benefited the industry and has added credibility to the entire U.S. export system. CFTC is another example of Government regulation in the grain export system. This agency is charged with overseeing and regulating commodity futures trading in the various market institutions which were discussed earlier.

Perhaps the most controversial attempt by the Federal Government to regulate the grain export system has been the requirement that all export sales of certain agricultural commodities, including the major grains and oilseeds, be reported to USDA. This requirement was the direct result of the supply and demand imbalances of the early 1970's and was instituted under the Agriculture and Consumer Protection Act of 1973, which added section 812 of the Agricultural Act of 1970. The evolution of this requirement and the ensuing reporting system is described in our May 1977 report on "Issues Surrounding the Management of Agricultural Exports" (ID-76-87). The objectives of the reporting system are to:

--Provide information for the Government to use in developing export policies and programs.

--Provide producers with information to help in their marketing decisions.

--Improve performance of U.S. commodity markets by making available to the public timely information on export sales transactions.

OBSERVATIONS

The U.S. grain export system is complex and involves the flow of large volumes of grains as well as much information. Because of its complexity, the system is sometimes misunderstood by the general public, academics, and policymakers. Some observers believe that (1) the export system is controlled by just a few major multinational corporations, (2) these firms can manipulate markets and their prices, and (3) the Government has little control over the system.

Our examination of the export system's market structure disclosed that although the system is relatively concentrated, the level of concentration has been on the decline in recent years and is less than some people perceive it to be. We found that (1) a substantial number of firms are engaged in grain exporting, (2) the number of firms reporting grain exports has been increasing in recent years, (3) the major exporters have lost some control over elevator storage capacity at ports during the past 10 years or so, and (4) the composition of grain exporters is changing somewhat as farmer-owned cooperatives, Japanese trading houses, and other firms strive for increased roles in the U.S. grain export system.

Highly liquid market institutions within the U.S. grain-marketing system aid in price discovery, facilitate participation by many parties, and are operated under rules and regulations which encourage competition. The Government, in addition to its regulatory role, sets policy and helps system participants by providing them with useful information.

CHAPTER 3

HOW GRAIN EXPORTERS MAKE SALES AND MANAGE RISKS

Chapter 2 provided a general description of the U.S. grain export system. In this chapter we will attempt to further expand the reader's understanding of the system by providing (1) more detail on how grain sales are made and (2) a discussion of some of the risks faced by grain exporters in conducting their business.

HOW GRAIN EXPORT SALES ARE MADE 1/

Grain export sales are initiated when exporting firms make contact with importers either on the open market or through public or private tenders. On open markets, such as those found in London and Rotterdam, bids and offers are constantly being made by buyers and sellers. Public tenders are made when importers (especially foreign governments) issue open requests for bids prior to a final offering date. Such tenders are formal and their terms are specific. Private tenders are less formal. They involve an importer inviting bids from a few selected exporters. Both private importers and government entities make use of private tenders.

The terms of grain export sales, whether made on the open market or through tender, are specified in individual contracts. Several standard contract forms have been developed over the years to meet the needs of the export trade. Within the general framework of these contract forms, specific terms are set by the buyer and seller for each sale. Such terms would include those having to do with the quantity and quality of the grain, shipping period, origin, destination, delivery, price, and payment. Two common delivery terms are "free on board" (f.o.b.) and "cost, insurance, and freight" (c.i.f.). When grain is sold with f.o.b. delivery terms, the grain is simply assembled and loaded onto a ship provided by the importer. Under c.i.f. delivery terms, the exporter provides the ship, delivers it loaded with grain to the importer, and insures the grain en route.

1/Much of the information under this section was based on a paper written by Neilson Conklin, Gerhard Wilbert, and Reynold Dahl entitled "Pricing of Grain Exports and the Role of Future Markets," Minnesota Agricultural Economist, no. 614, Agricultural Extension Service, University of Minnesota, Dec. 1979. At the time, Messrs. Conklin and Wilbert were research assistants and Dr. Dahl was a professor in the Department of Agricultural and Applied Economics, University of Minnesota.

Grain export pricing

Nearly all export grain sales are made on what are called forward cash contracts calling for delivery at some future point in time. If export contracts fix the price of grain, they are called flat price contracts. Exporters are able to quote such prices even on grain not owned because futures markets are available for pricing and hedging. Hedging allows exporters to avoid certain risks/consequences associated with adverse price changes. It is discussed further on page 25.

Other contracts stipulate only the basis price, which is the relationship of the cash price to a designated futures price. These contracts are called basis or unpriced contracts, and under them, the final price of the grain is fixed at the request of the importer at any time prior to the delivery date. The following example of a grain export sale, purposely simplistic in nature, may clarify how flat price and basis price contracts work. It should be noted that grain exporters do not generally operate on the basis of individual sales (as is implied in the example), but rather on a "net" position resulting from all their purchases and sales. Exporters seldom link a specific export sale with a specific purchase of cash grain. They are continuously buying and selling cash grain and buying and selling futures for hedging. It is a flow process similar to that of a pipeline in which individual transactions tend to lose their identity.

Flat price contract example

On June 1 a wheat-importing country calls several grain exporting firms requesting flat price offers for delivery of soft red wheat. On this same date the price of Chicago wheat for September delivery is $4.41. One exporter responds with an offer to supply 30,000 metric tons (1,102,300 bushels) of soft red wheat f.o.b. the Gulf of Mexico, for delivery in August, at $4.68 per bushel. Of course, other terms such as grain quality and the payment terms are stipulated.

Calculating the per bushel price is crucial to the exporter. If the price is a cent per bushel too high, the business may be lost to a competitor, and if it is too low, the exporter may take a loss on the sale. In a competitive business like grain exporting, profit margins are not guaranteed. How did the exporter, in this example, arrive at the flat price of $4.68 at the Gulf of Mexico in August? The table on page 25 shows the calculations.

Starting at the country elevator the exporter finds the grain price today is $4.08. To this must be added truck freight cost to the river terminal elevator and the cost of elevation at the river terminal (including conditioning, shrinkage, interest, weighing and inspection, and a profit for the owner of the river terminal elevator).

The exporter now finds the price of the wheat f.o.b. barge at the river terminal elevator to be $4.23 per bushel. After barge freight of 31 cents from the river terminal elevator to an export elevator at the Gulf of Mexico and the export terminal elevator cost of 12 cents are added, the price of wheat has climbed to $4.66. Adding an estimated profit margin of 2 cents per bushel yields the $4.68 per bushel quoted to the importer. Although there is an estimated profit margin of 2 cents per bushel at June 1, many things can reduce or perhaps increase this margin between June 1 and the August delivery date.

Example of Wheat Price Calculations on June 1 for August Delivery at the Gulf of Mexico

Costs and prices	Cost	Flat price	Basis (note a)
	----------per bushel----------		
Country price	-	$4.08	$-0.33
Truck freight to river terminal	$0.05	-	-
Delivered price at river terminal	-	4.13	-0.28
River terminal elevation cost	0.10	-	-
F.o.b. barge price		4.23	-0.18
Barge freight	0.31	-	-
Export terminal elevation cost	0.12	-	-
Estimated profit margin	0.02	-	-
F.o.b. vessel price	-	4.68	+0.27
September wheat futures Chicago	-	4.41	-

a/The basis is the difference between the first four cash prices shown in the second column and the September futures price shown at the bottom of the column.

One major risk is that the price of wheat can change. The exporter has made a forward cash contract at a fixed sales price 3 months before delivery. If the exporter does not own this wheat, the risk is that the price of wheat already sold will rise before

it can be purchased, thus reducing the exporter's profit margin. Hedging in futures markets can reduce the risk involved in a fixed-price sale.

The exporter hedges a forward cash contract by purchasing futures contracts as a temporary substitute for the cash grain which must be purchased later for delivery. When the cash grain is bought for delivery, futures are sold to lift the hedge. Grain merchants can use futures markets for hedging because of the close relationship between cash and futures prices. As mentioned above, this relationship is known as the basis. Although hedging eliminates the largest part of the exporter's price risk, the risk of change in the basis is still present. If the cash price the exporter must pay for the wheat increases relative to the futures price, the exporter's profit margin will be reduced.

Flat-priced contracts are commonly used by importers who are also final users of grain. These buyers are likely to be more concerned with locking in a supply of grain at a known price and less concerned with flat price risks. These buyers may be either private or government agencies. The centrally planned economies of Eastern Europe tend to use flat-priced contracts as do many government agencies of less developed countries.

Basis price contracts

Some of the risks inherent in flat price contracts may be avoided by using basis price contracts. A basis price contract does not specify the flat price but only the relationship of the cash price to a designated futures price. If the contract for the grain export sale just discussed was basis priced rather than flat priced, the designated futures price would be Chicago September wheat with the agreed basis being 27 cents over that price.

This basis price sale does not initiate any flat price risk for the exporter. A basis price contract leaves the exporter open only to the risk that the basis (the difference between cash and futures prices) will shift against him. This risk is much lower than the risk of a flat price change since cash and futures prices tend to move together.

RISK AND RISK MANAGEMENT

Superficially, the situation facing the exporter as described above seems simple enough. The exporter must find a buyer (importer), make the sale and set contract terms including price, assemble the grain, and deliver it. In a static world this would, in fact, be the case and the grain exporter would be little more than a merchant operating on a fixed markup. However, in a world with many variables, this is not the case. Grain prices are constantly changing in relative as well as absolute terms. Export market conditions are always shifting as a result of worldwide weather, natural disasters, disruptions in transportation systems, government political and policy changes, etc. Each of these

circumstances translates into risk that grain exporters face in conducting their business. While this risk is often viewed as a burden on the grain exporter, it is not totally one-sided and does in fact create the possibility of profit as well as loss. The grain exporter's challenge is to manage risk in such a way that the firm earns a return on its investment equal to or exceeding its opportunity cost. The very essence of grain exporting is risk management.

Types of risk

Officials from one of the major multinational corporations trading in grain provided us with the following list of major risks which grain exporters must face and manage:

1. Quality risk--grain deteriorating while being stored, handled, or transported.

2. Logistical risk--transportation and handling facilities will not be available when needed.

3. Foreign exchange risk--changes in exchange rates.

4. Financial risk--defaulted contracts.

5. Political risk--governmental policy changes, both domestic and foreign.

6. Price risk--changes in flat prices.

7. Basis risk--changes in price relationships.

These risks are not all of equal importance, and obviously the extent of each risk varies with individual transactions. Officials from five grain-exporting firms--Continental, Louis Dreyfus, Marubeni, C. Itoh, and International Grain Management Corporation--were asked to rank these risks as "very great," "great," "some," "little," or "none." The perceptions thus obtained yield some idea of the relative importance of each of the risks. Reasons given for selecting a level of risk also offer some clues as to risk management strategies.

Regarding quality risk, the five firms felt there was only a little. The existence of well-defined grades and standards, the ability to blend grains of various qualities, and the specification of quality in contracts seems to keep this risk at a minimum level.

Some to little risk was attributed to logistics. Even the grain exporters interviewed who owned no handling or transportation facilities did not perceive higher levels of logistical risk than did the firms that owned such facilities. This may reflect, at least in part, the fact that concentration in the ownership of port facilities is not a serious problem.

Foreign exchange was not generally considered much of a risk since most grain sales by at least the major grain traders are priced in U.S. dollars.

Perceptions of the five firms toward financial and political risks ranged from some to very great. These two risks were considered to be somewhat interrelated since contract defaults and the resulting financial losses have in the past often been related to political actions. While some changes in government programs and policies are fairly predictable and easy to manage, other actions such as the recent Soviet Union grain embargo are much less predictable and may be of serious consequence to grain traders.

Managing price and basis risks is the very essence of grain trading. Although officials of the firms we interviewed felt they represented some to very great risk, the officials also pointed out that price and basis risks are manageable and that they do offer opportunities for profits as well as losses. This is facilitated through market institutions such as futures markets which provide opportunities for hedging and forward pricing.

Astute management of all kinds of risk is required if a firm is to be successful in grain exporting. The large size of most transactions in the grain export trade increases the consequences of the risks that must be taken. Also, because of the competitiveness of the business, the margin for error on any given bushel of grain that is traded is small. The exporting firm's goal in managing risks is not necessarily directed toward one individual transaction but rather toward what is best for its entire operation. The fact that grain exporting is a risky business helps to explain the diversification of many exporters into areas that are not directly grain related.

CHAPTER 4

PRICING EFFICIENCY IN THE U.S. GRAIN EXPORT SYSTEM

Grain prices serve as economic signals to grain traders, producers, and consumers alike, enabling them to make decisions such as when to buy and sell; how much corn, wheat, or other type of grain to plant; or what kinds of and how many boxes of cereal to buy for breakfast. If grain traders, producers, and consumers are to make the best decisions, it is important that information affecting grain prices be reflected in these prices as quickly and accurately as possible.

Pricing inefficiency has been perceived as a major economic performance problem in the U.S. grain-marketing system. For example, in export grain sales hearings before the Subcommittee on Small Business Administration and Small Business Investment Companies Authority and General Small Business Problems--No. 1, House Committee on Small Business (96th Congress, 1st session), in June 1979, the following statement was provided by Chairman Neal Smith:

> "Once again we see the following scenario repeated: Grain companies make substantial fixed price sales, they then purchase more than enough in the cash and futures markets before U.S. sellers of grain know of the new demand; the grain exporters then wait for the news to come out for the market to move up. They then take profits on excess long futures after the market moves up on news of the sales."

In this chapter we examine the U.S. grain export system's performance in terms of the efficiency by which grain export sales information is transformed into grain prices. Our analysis centers on only two of many variables, namely export sales information and grain futures prices, and its results should thus be interpreted.

PRICING EFFICIENCY: THE ECONOMIC CONCEPT

Economists have developed pricing efficiency criteria for a variety of market systems based on the concept of a perfectly competitive market. These criteria require that prices for a commodity vary over time, space, and form only by the costs of storage, transportation, and processing. To detect pricing inefficiencies in an actual market system, observed price behavior may be compared to these criteria.

There are a number of reasons for pricing inefficiencies in the marketplace. In a monopolistic market, for example, pricing

inefficiency often abounds and the cause/effect relationship in such a situation has frequently been examined. General uncertainty and imperfections in the flow of information also contribute to pricing inefficiencies in some markets. In the real world, variables affecting commodity supply and demand (export sales information is one such variable in grain markets) are constantly changing and information about them is often less than perfect. Such uncertainties and/or lack of information necessitate the use of more dynamic pricing criteria. It has been suggested that prices are simply aggregates of information and that this is the very essence of price discovery. The performance of a market in price discovery depends on its ability to transform information into prices. A market in which prices always fully reflect available information is called "efficient."

The above concept of pricing efficiency is referred to as the efficient markets hypothesis. Under this hypothesis, three levels of efficiency are defined with each having its own set of hypothesized price behaviors:

1. Weak form efficiency--present prices accurately reflect information contained in past prices.

2. Semistrong form efficiency--present prices accurately reflect all publicly available information.

3. Strong form efficiency--present prices accurately reflect all information, including that held by "insiders."

PRICING EFFICIENCY AND INFORMATION FLOW

To better understand these levels of efficiency and how they relate to the performance of the U.S. grain export system, we must first consider the flow of information within the system. Each day large amounts of information about grain production, inventories, exports, and other world events become known to traders in the grain markets. These traders make decisions to buy and sell grain based on their individual needs and on their expectations of how these events will affect grain supply and demand. If this information emerges at random and is freely available to all, price changes in an efficient market will occur randomly.

Now let us consider further the flow of information concerning specific grain exports. At the time an export sale is made, the company making the sale may be the only exporter to know about it. Each week these sales are reported to the Export Sales

Reporting Division of USDA's Foreign Agricultural Service. 1/ Before June 1980, reports were required to be submitted each Thursday by exporting companies regarding their export sales for the preceding Monday through Sunday. The Export Sales Reporting Division's report for a given week's activity was subsequently released a week later after the close of the commodity markets as shown in the first time-frame illustration below.

Sales made		Sales reported	Weekly report released after market closes	Market reopens
Day 1 Monday	- Day 7 Sunday	Day 11 Thursday	Day 18 Thursday	Day 19 Friday

Under this time frame, there was a lag of 11 to 18 days from the time a sale occurred and the time the weekly report of sales activity was publicly released.

In June 1980 there were some changes in the reporting week and a shortening of the reporting time frames. The reporting week was changed to Friday through Thursday (as opposed to the previously used export sales week of Monday through Sunday) and reports from exporters became due to the Export Sales Reporting Division the following Monday. The Export Sales Reporting Division now releases its overall report on Thursday, cutting the lag to 7 to 14 days from the time a sale occurs to the time it is publicly released as shown in the illustration on the following page.

1/Large sales involving more than 100,000 tons must be reported to the Export Sales Reporting Division by 3 p.m. the following business day. The Export Sales Reporting Division, on the same day, makes a daily report of these sales. These daily sales reports are included in the weekly reports published by the Export Sales Reporting Division. For our study, we were interested in all export sales, both large and small. We therefore used the weekly sales reports to measure changes in futures market prices.

Sales made		Sales reported	Weekly report released after market closes	Market reopens
Day 1 - Friday	Day 7 Thursday	Day 11 Monday	Day 14 Thursday	Day 15 Friday

HOW EFFICIENTLY DOES THE U.S. GRAIN EXPORT SYSTEM TRANSFORM INFORMATION INTO PRICES?

To answer this question, we tested the hypothesized price behaviors of each of three levels of efficiency (weak, semistrong, and strong) introduced above. In doing this, we analyzed the flow of information under the Export Sales Reporting Division's system as described during the 5-year period from June 1975 to June 1980. We were particularly interested in the behavior of actual futures market prices and their responses to information about export sales. Complete and accurate grain export sales data was not available pre-June 1975. Post-June 1980 data was not used in the analysis because the export sales reporting week and time frames were changed in June 1980 and because the data generated subsequently was not yet sufficient for the statistical analysis techniques we used. Data used in our analysis consisted of wheat, corn, and soybean future prices from the Chicago Board of Trade which we obtained from CFTC. We also used net new export sales data as reported by the Foreign Agricultural Service in its publication "U.S. Export Sales." In conducting our analysis, we assumed that

--all export sales were, in fact, being reported under USDA's Export Sales Reporting System;

--there was little delay between the time export sales were made and the time they were reported; and

--there was no leakage of export sales data from USDA before the export sales reports were released.

Under the information system in effect from 1975 to 1980, each firm had knowledge of its own export sales from day 1 of the reporting cycle through day 10 and, under some circumstances, may have been able to deduce the sales of some of its competitors. On day 11, the Export Sales Reporting Division received reports of these sales and, assuming there was no leakage, made this information publicly available after market closing on day 18. On day 19, market participants might be expected to react on the basis of the new information.

Our testing for the weak form level of efficiency disclosed very little about actual responses of grain prices to information about grain export sales. This is because, as described above, grain export sales information does not become publicly available on a daily basis and the weak form efficiency formula is most valid when applied to short-term responses. The fact that such information becomes available on a weekly basis, and only then after more than a week has transpired from the dates of the sales, renders the results of testing for weak form efficiency in the U.S. grain export system rather meaningless.

More meaningful results, however, can be obtained in testing the hypothesized behaviors associated with the semistrong and strong forms of pricing or informational efficiency.

Given the pattern of information flow that existed from June 1975 to June 1980, if the U.S. grain export system displayed the strong form of informational efficiency, grain prices would fully adjust each time grain export sales were made (days 1 to 7). On the other hand, if prices did not respond immediately, and perhaps not until release of the export sales report (day 18), then the informational efficiency of the export system would be labeled as semistrong.

Test methodology and results

To test the hypothesized behaviors of semistrong and strong form levels of efficiency, and thereby determine price responsiveness to information about grain export sales, we needed answers to two important questions:

--Is there a relationship between changes in grain futures prices and export sales information?

--Are there time lags in the responses of grain futures prices to export sales information?

To obtain these answers, we used regression, spectral, and crossspectral analytical techniques. These techniques were used to detect the relationship between price changes and export sales information--the only two variables in our models. In the analysis we assumed that other factors that influence these prices, such as worldwide crop conditions, real income at home and abroad, fiscal and monetary policy, political events, etc., are uncorrelated with the weekly reporting of export grain sales. In addition, expected export sales were assumed to be constant throughout the period analyzed. Significant departure from either of these assumptions could seriously bias these tests. Semistrong and strong forms of efficiency were tested in different models. Our analysis involved the application of a series of rather complex mathematical manipulations against the basic data that was being examined to test the degree to which the two variables were related. Two useful statistics generated by the

cross-spectral portion of our analysis involved what are known as the coherence and the phase.

The coherence statistic is a measure of the strength of the relationship between two variables. It provides an indication of the degree to which the two variables "move together" at each frequency or time interval. The coherence statistic is always greater than or equal to zero, but less than or equal to one. The larger the coherence statistic, the stronger the relationship between the two variables. Coherences are calculated over a range of frequencies which represent time periods. In our analysis, 129 frequencies were observed during the period from June 1975 to June 1980 and were used in determining the average coherences reflected in the following table.

Average Coherences Between Price Changes and Export Sales Information for Wheat, Corn, and Soybeans

	Level of efficiency	
Commodity	Semistrong	Strong
Wheat	0.10	0.13
Corn	0.15	0.09
Soybeans	0.15	0.17

We analytically determined 1/ that the above coherences show a statistically significant relationship between export sales during a given week and price changes during the same week (this relates to the coherences shown in the table under the strong level of efficiency). We also determined analytically 1/ that there is a statistically significant relationship between USDA's export sales reports and changes in price the following market day (this relates to the coherences shown in the table under the semistrong level of efficiency). The fact that these relationships exist implies that futures markets for wheat, corn, and soybeans respond to both private and public information about grain export sales. The wheat and soybeans markets showed slightly larger coherence values for the strong form efficiency model than for the semistrong form efficiency model. In the corn market, the coherence value is larger for the semistrong model.

Overall, the relationship between export sales information and grain prices--while statistically significant--is relatively low, with variation in export sales information explaining only

1/The analytical test for determining the statistical significance of coherences was obtained from L. H. Koopman's Spectral Analysis of Time Series, New York Academic Press, 1974, p. 285.

from 9 percent to 17 percent of the variation in price changes. This is not surprising, however, if we consider the tremendous amounts of other information which affects futures markets every day. Such information would include worldwide production and consumption information, domestic needs, weather conditions, and economic and political events.

Like the coherence statistic, the phase statistic is another useful piece of information generated by cross-spectral analysis. The phase statistic gives us an indication of the time lag between two variables at each frequency or time interval. Although there are no value parameters for the phase statistic as there were for the coherence statistic (see the preceding page), in the context of our analysis, a negative phase value determined to be significantly different from zero would indicate a lag of futures price changes behind information about export sales. A positive phase value determined to be significantly different from zero would indicate the opposite--that grain export sales information lags behind price changes. A phase value of zero indicates no lead or lag between the two variables.

For the hypothesis of semistrong form efficiency to hold relative to the grain export system, there must be no lag between the release of USDA's export sales report and the price changes that occur. For the hypothesis of strong form efficiency to hold, there must be no lag between export sales during a given week and price changes during the same week. The following table shows the average phase statistics we generated through our analysis for both the semistrong and strong form levels of efficiency.

Average Phases Between Price Changes and Export Sales Information for Wheat, Corn, and Soybeans

	Level of efficiency	
Commodity	Semistrong	Strong
Wheat	-0.24	-0.26
Corn	-0.59	-0.09
Soybeans	+0.18	-0.11

For each of the two levels of efficiency, the average phases were determined 1/ to be not significantly different from zero

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1/The analytical test for determining significant lag between two variables was obtained from C. W. J. Granger and M. Hatanaka's Spectral Analysis of Economic Time Series, Princeton, New Jersey, Princeton University Press, 1964, pp. 103-104.

for each of the three commodities. From this determination, we can infer that there is no significant lag between export sales information and price changes.

The results of our cross-spectral analysis show that the efficiency with which the U.S. grain export system transforms export sales information into grain prices, at least with regard to the wheat, corn, and soybeans future markets, is between the semistrong and strong form levels of efficiency. We determined that prices do respond to information about export sales prior to its public release. A further price adjustment was also found to occur following the public release of USDA's weekly export sales report.

OBSERVATIONS

Our analysis of the behavior of actual futures market prices in response to information about export sales showed that prices of wheat, corn, and soybeans

--responded to knowledge of grain export sales before release of the Export Sales Reporting Division's report and

--responded more fully upon release of the report.

In terms of the efficient markets hypothesis, our analysis indicated that the efficiency of the U.S. grain export system is between semistrong and strong. These results imply that grain prices do respond as export sales are made and as export companies buy futures contracts to hedge these transactions (see ch. 3). However, the prices do not adjust fully until after the export sales report is released. Once the report is released, traders in the futures markets reevaluate their positions, buy and sell grain based on this reevaluation, and, in effect, an adjustment of grain prices takes place on the basis of the new information.

The Export Sales Reporting System plays an important role in providing for and maintaining informational efficiency in the U.S. grain export system. It facilitates the flow of information to the grain markets. Reductions in the lag between the time information about export sales are made, reported, and released publicly--such as the changes taking place in the reporting system in June 1980--should further improve the informational efficiency of the system even over the generally high level of efficiency disclosed by our analysis.

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The above results, along with those in chapter 2 regarding market structure, indicate that competitive forces are at work moving grain and information through the export system. It is important to keep in mind, however, that economic, political, and other forces within the U.S. grain export systems are

ever changing. The system moves large volumes of grain valued in the billions of dollars from the farm to ocean vessels. The system also handles a tremendous flow of information. It transforms this information into prices which, in turn, result in the allocation of resources and the distribution of economic rewards not only domestically, but also worldwide. The impact of this system overall and in terms of its efficiency and corresponding competitiveness is tremendous on the U.S. agricultural sector as well as the entire economy. It is a system that warrants constant monitoring both privately and publicly.

As we recommended in our earlier work regarding the grain transportation network, there is a need for expanded monitoring of the network and cooperation between industry, labor, and Government in resolving present bottlenecks and preventing future ones. Other areas important to the U.S. grain export system but not considered in this study have to do with technological and institutional innovations now taking place in the grain export system. The level of research and development in grain handling and transportation, and the effects of transportation deregulation on ratemaking are two such examples.

We believe this study can provide a better understanding of (1) how the U.S. grain export system is structured, (2) how it works, and (3) subject to the limitations of the tests, the degree of efficiency with which the overall marketing system transforms information about grain export sales into grain futures prices. We are hopeful this information will be useful to policymakers as they consider, in the future, the impact on U.S. grain marketing of issues such as those just discussed and other issues that come before them, such as proposals for a grain-marketing board, a grain reserve board, export levies, etc.

APPENDIX I

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