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**PROCEEDINGS OF A SYMPOSIUM  
ON  
GLOBAL GRAIN DISTRIBUTION  
SYSTEMS: IMPEDIMENTS TO  
INCREASED EXPORTS**



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## TRANSOCEANIC IMPEDIMENTS TO INCREASED U.S. GRAIN EXPORTS

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This paper examines five general types of actual potential, and/or perceived impediments to exporting U.S. grain via ocean vessels. The following sections discuss impediments and research issues involving (1) price or rate risk, (2) grain quality, (3) port capacity, (4) cargo preference, and (5) the Panama Canal. Concluding remarks, focusing on the relative importance of research issues, are then offered.

### Price Risk

Findings from a survey of grain merchandisers conducted by the USDA indicated that the largest "exporting" risk perceived by the respondents results from changes in the flat price of grain (Caron, p. 5). The largest "logistical" risk was associated with ocean charters.

Much of the domestic grain price risk can be hedged away through trades in the futures market. The hedging effectiveness of a particular market can be estimated by regressing the change in cash price on the change in futures price (e.g., Ederington). The coefficient of determination ( $R^2$ ) of this regression indicates the proportion of cash price variability which can be hedged away. The general regression specification can be expressed as:

$$\Delta C = a + b \Delta F + e$$

where  $\Delta C$  is the change in cash price;  $\Delta F$  is the respective change in futures price;  $a$  and  $b$  are estimated coefficients using ordinary least squares; and  $e$  is the error term under classical assumptions.

To illustrate, the effectiveness measures of hedging soybean price are presented in Table 1. The results from two regressions are shown -- one using Gulf cash prices,

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and the other using Rotterdam cash prices. Weekly price changes during 1979-87 are used, and the hedge is always against the nearby futures price.<sup>6</sup>

Table 1. Hedging Effectiveness Regressions for Gulf and Rotterdam Soybean Prices, 1979-87.

Dependent Variable*	Intercept	Slope	R <sup>2</sup>
Gulf Price	-0.09	0.93	0.83
Rotterdam Price	0.52	0.75	0.53

\*Dependent and independent variables are weekly price changes. Only those observations for which data were available for all variables included in an expanded study were used, resulting in 163 observations.

The Gulf price regression has a slope coefficient of .93 and an R<sup>2</sup> of .83, indicating that 83% of the Gulf flat price variability could have been eliminated through hedging by maintaining a cash-to-futures hedge ratio of .94. The results of the Rotterdam regression suggest that only 53% of the variability in Rotterdam soybean price could have been hedged away through the futures market. Thus, the share of Rotterdam price variability which can be systematically hedged is approximately 30% less than the share of Gulf price variability. When the Rotterdam price is adjusted by the Deutsche Mark exchange rate, the effectiveness declines by an additional 10%.

It is not surprising that the effectiveness of hedging overseas prices is less than that for U.S. prices. However, little work has been done to help identify and measure the factors causing this decrease. Some of these factors may include: (a) differences in local supply/demand conditions, (b) the degree of market integration between U.S. ports and importing areas, (c) the effect of government programs and policies on prices, and (d) ocean freight rates. Regressions of the Rotterdam/Gulf basis on ocean freight rates suggest that about 50% of the basis variability is explained by the ocean rate.<sup>7</sup>

<sup>6</sup>Gulf cash prices were collected from various issues of USDA's Grain Market News; futures prices are from a tape provided by the Chicago Board of Trade; and Rotterdam prices were obtained from Oil World.

<sup>7</sup>Ocean rates were provided by Professor Stephen Fuller, Texas A&M University, and Dr. T.Q. Hutchinson, USDA. Only rates for 40,000-60,000 ton grain shipments under foreign flags were used.

This preliminary and simple look at hedging effectiveness and basis variability indicates that the foreign price risk facing U.S. exporters is quite high, and that ocean rates may explain a considerable amount of this risk. Further study is needed on the risk components (e.g., exchange rate, ocean rate, government policy, and others), explanatory and predictive models for ocean freight rates (e.g., Binkley and Harrer; Klindworth), and the use and effectiveness of ocean freight futures, exchange rate futures, commodity markets, and forward markets to manage this risk.

Figure 1 illustrates the cargo rate uncertainty which transoceanic shippers face. The graph is of the Baltic Freight Index from 1978-90. In February 1981, the index was \$22 per ton, and in July 1986 it was only \$4 per ton. The rate basis between routes is also erratic. For example, freight differential between Gulf/ Europe and Gulf/Japan was \$16 in February 1981; it was \$5 in July 1986.

In contrast to industrial commodities such as coal and iron ore which experience steady production and demand streams, grain trading and freight contracting is on a relatively short term basis. Pricing grain freight is done in one of three general forms. First, the "spot" or "cash" rate can be obtained for immediate shipments. Second, forward contracts between the shipper or receiver and carrier can be formed. Third, the freight futures market can be used to directly hedge freight rate or in offering a forward rate contract.

Both spot and forward agreements are often done on a confidential basis. "Spot" rates usually apply to shipments which will occur within one month. Forward contracts - usually involving only very large shippers and carriers -- are often on an annual basis with, for example, shipments scheduled monthly or quarterly.

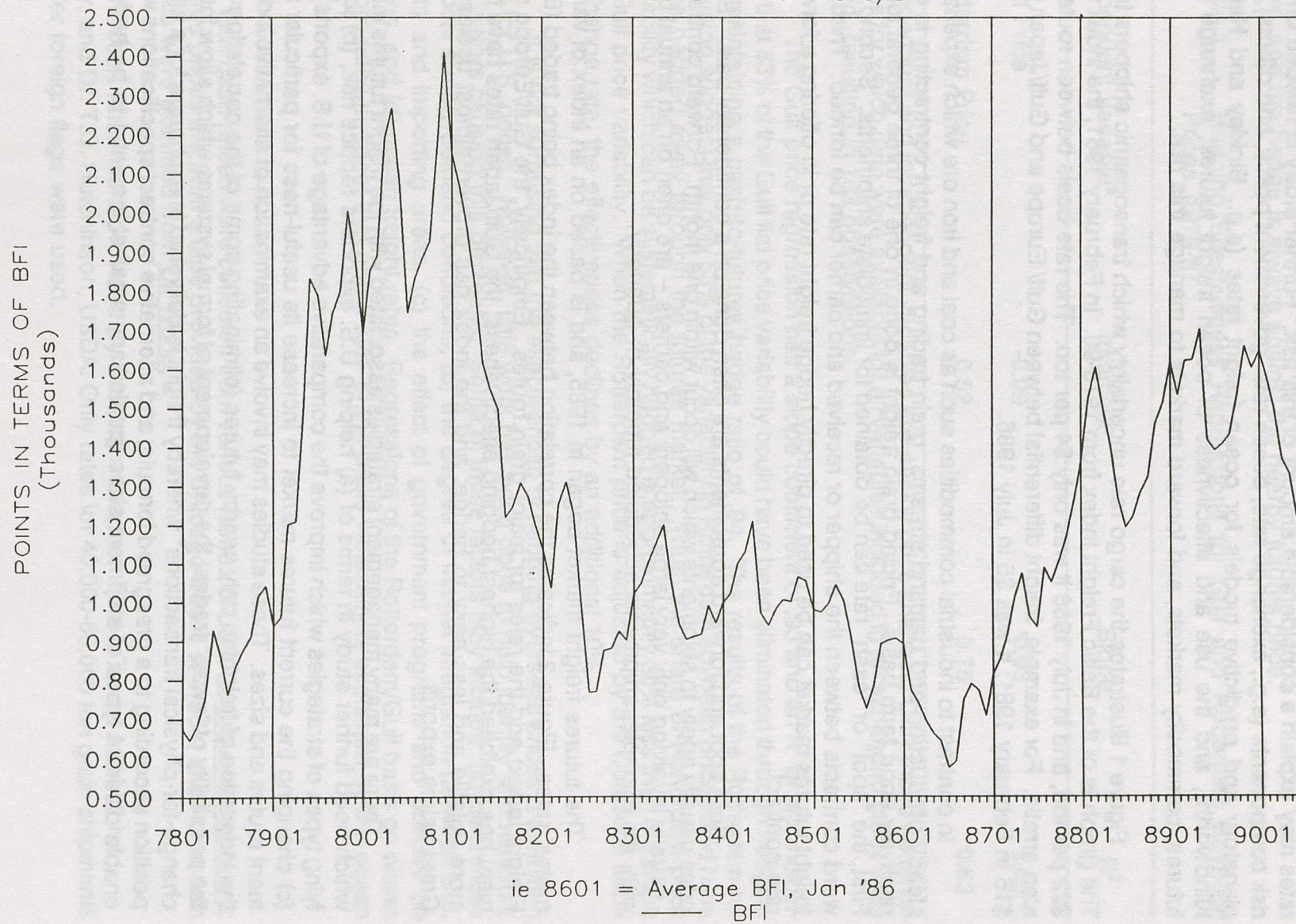
The futures freight market began in 1985, and is based on an index of various routes' rates. Figure 2 indicates the correlation between the index being traded (Baltic Freight Index) and the rates for major grain routes. Empirically, the Gulf/Europe shipment has exhibited the highest hedging effectiveness; the Gulf/Japan rates have been more volatile and less easy to hedge; and the index has proven almost useless for Great Lakes exports.

There are many management strategies associated with the freight futures market which need further study in terms of (a) helping U.S. exporters reduce risk, (b) identifying types of strategies which improve the comparative advantage of U.S. exports, and (c) changing the current futures market to increase its usefulness for particular shipment routes and sizes. These studies may involve an examination of alternative indices; the indexation of freight to only nearby futures (eliminating some of the correlation risk), the possibility of "swap" trades; the development of formal systems which allow for "exchange-for-physical transactions" whereby freight is delivered in exchange for a futures position according to a preagreed formula; and alternative contract specifications which enable different types of shipment sizes (particularly small shipments) to be hedged.

Figure 1.

# BALTIC FREIGHT INDEX, JAN. 78 – JULY 90

RECONSTRUCTED BFI PRIOR TO 6/84

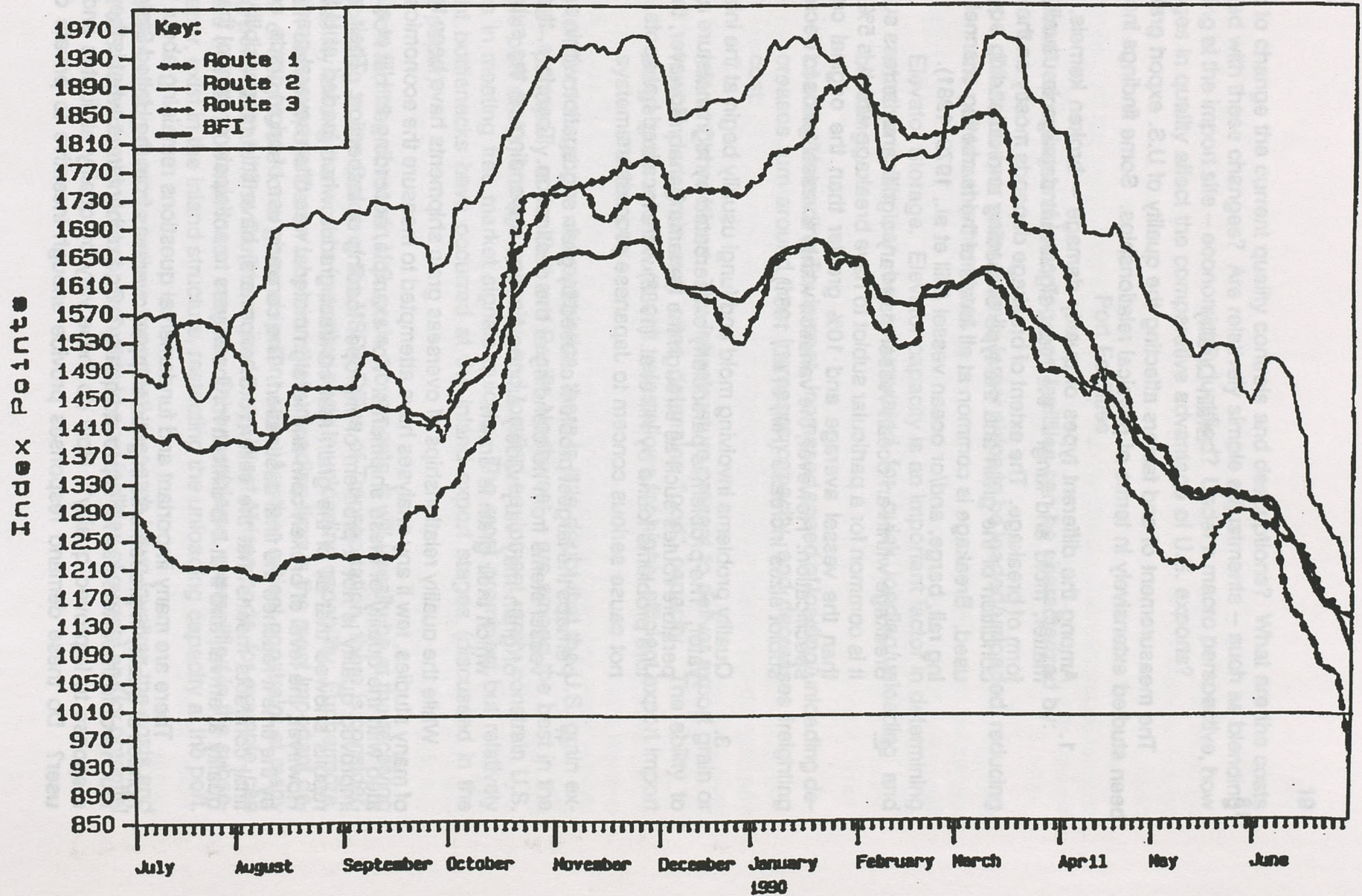


SOURCE: E D F MAN INTERNATIONAL FUTURES

Figure 2.

# Daily Route Indices 1, 2 & 3

3rd July 1989 - 29th June 1990



source: Baltic Exchange Ltd.

## Grain Quality

The measurement of and factors affecting the quality of U.S. export grain have been studied extensively in terms of physical relationships. Some findings include:

1. Among the different types of quality damage -- broken kernels, foreign matter, mold and fungi -- the most significant damage is usually in the form of breakage. The extent of breakage depends mostly on the original condition of the grain and the type of loading and unloading equipment used. Breakage is common at all levels of the marketing channel, involving rail, barge, and/or ocean vessel (Hill et al., 1979, 1981).
2. Breakage within an ocean vessel may vary significantly across sublots. It is common for a particular subplot to have breakage which is 5% greater than the vessel average and 10% greater than the original certificate specification. However, the variation within a vessel tends to decrease as subplot sizes increase (Hill, et al., 1981).
3. Quality problems involving mold and fungi usually begin at the inland elevator. The problem is particularly exacerbated by high moisture and temperature routes such as through the Panama Canal. However, the moisture problems found by Hill et al. (1988) were localized hot spots, and did not cause serious concern to Japanese processors.
4. Perhaps the largest problem caused by grain segregation within an ocean vessel stems from no blending at the destination. Therefore, the quality of grain may vary widely among buyers, depending on the subplot from which their grain is drawn.

While the quality relationships of overseas grain shipments have been the focus of many studies, few if any analyses have attempted to measure the economics associated with the quality of these shipments. For example, according to Hill et al. (1988), improved quality is not a problem of improper loading or inspection. Their sampling results showed that all of the grain met contract grades when loaded at U.S. ports. However, the level of broken corn and foreign material was often several grades lower by the time it reached the final destination. The common use of origin grade, certificate final contracts means that the seller (U.S. exporters) have little responsibility for the quality at arrival, and that it is difficult for the buyers to anticipate or control the quality.

There are many important and fundamental questions remaining about the economics of quality improvements in grain shipped overseas from the United States. How much would importers pay for improved quality? Or, in other terms, what is the demand response to improved quality? How do these vary by quality attributes and type of user? Do these demand responses provide enough incentive to private or public



interests to change the current quality controls and descriptions? What are the costs associated with these changes? Are relatively simple adjustments -- such as blending or cleaning at the import site -- economically justified? Under a macro perspective, how do changes in quality affect the comparative advantage of U.S. exports?

### Port Facilities

"Good" exporting and importing port facilities can be characterized by:

1. **Draft.** Deeper water permits larger ships to be loaded/unloaded, reducing the per ton shipment cost.
2. **Elevator Storage.** Elevator capacity is an important factor in determining whether grain can be accumulated for quick loading/unloading and blending.
3. **Loading/Unloading Equipment.** Increased speed of loading/unloading decreases turn around time, increases capacity, and decreases freighting cost.
4. **Inland Connections.** The infrastructure present to deliver export grain or haul import grain may often determine "port" capacity. The ability to barge grain and/or use unit trains allows for highly efficient export import systems at the port.

In terms of the above characteristics, there is little doubt that the U.S. grain export ports -- principally at the Gulf and Pacific Northwest -- are among the best in the world. The port drafts, storage capacity, and loading equipment rarely constrain U.S. exporters in meeting free market signals quickly. The most prominent but relatively infrequent bottlenecks have occurred at the inland export stages (discussed in the previous paper).

If port facilities constrain U.S. grain movements, it will usually be at the receiving end. According to Jim Caron of the USDA Office of Transportation, there is considerable variability among the world's importing ports in unloading capability. Furthermore, other than distance, it is Caron's opinion that unloading time is the most important determinant of freight rate for a given shipment size. Another critical constraint at many importing ports is draft. The Caribbean and many West African ports, for example, can not handle over 20,000 metric ton vessels. Other problems, exemplified in the subsequent paper, exist in the inland structure, restricting the unloading capacity at the port.

An interesting (and we believe important) research issue involves the costs and merits of U.S. subsidization for improvements to port facilities of current and/or potential

importers of U.S. grain. For example, what are the economic benefits of increasing receiving capacities in West Africa? Would economic support from the United States for these improvements lead to increased U.S. exports, or would it simply benefit French exporters? What are the current constraints (equipment, draft, inland infrastructure, etc.) at ports throughout the world? Where would the United States get the biggest bang for its buck, and are these cases cost effective?

Little work has been done in a systematic way on measuring port capacities throughout the world and identifying effective bottlenecks. Even less work, if any, has addressed the issue of likely payoffs to improving port capacities of importers. We view this type of identification and benefit/cost research as having large potential impacts on the competitiveness of the U.S. export trade.

### Cargo Preference

The Cargo Preference Act of 1954 requires that at least half of all cargo generated by the government be transported on privately owned, U.S. flag vessels. For grain, most of the shipments qualifying under Cargo Preference is associated with the PL 480 program.

The cargo preference issue reflects primarily the tradeoff between the national-defense need of having a U.S. flag merchant marine versus using U.S. vessels which charge rates appreciably above the free market. Existing U.S. flag shipowners and national defense interests often argue in favor of cargo preference, while large industrial shippers and grain exporters lead lobbying efforts against it. Recent trade negotiations -- e.g., the 1988 U.S./China trade agreement and the Spring 1990 U.S./U.S.S.R. agreement -- have taken the free-market approach. In spite of strenuous lobbying by U.S. flag interests, neither agreement mandated that a share of the cargo be transported on U.S. flag ships.

Grain exporters have contended that they are bearing a large portion of the cost of maintaining an uncompetitive U.S. merchant marine. This contention raises questions (perhaps research issues) regarding the merits of other subsidy systems. An alternative system, for example, might involve direct transfers to the merchant marine industry.

Perhaps, however, it is important to simply gain perspective on the importance or magnitude of the problem. In 1987, for example, 3.7 million tons were carried under Titles I and III of P.L. 480, while 1.4 million tons was carried under Title II (EK). The ocean freight differential (OFD), reflecting the increased cost of using U.S. flag ships for these shipments, is approximately \$140 million. While this OFD represents an increase in cost of about 33%, the cargo to which it applies is only about 12% of the total 1987 shipments. The proportional increase in total cost ( $33 \times .12$ ) is roughly 4%. Therefore,

regardless of the qualitative implications of cargo preference in terms of equity and economic efficiency, there may be a question of overall importance of this issue.

### Panama Canal

Many issues related to the Panama Canal are political, and will not be addressed here. However, the most prominent political issue -- Canal ownership -- raises questions about how U.S. trade would be affected should the Canal be closed to U.S. shipments or should the Canal toll rate be increased significantly.

A Canal closure would likely cause grain loadings at the U.S. Gulf and East Coast to decrease, while an increase in loadings would be expected at the West and Pacific Northwest ports. Most of the grain shipments affected are bound for the Far East and Southeast Asia markets. For example, according to Klindworth, approximately 30 million metric tons of U.S. grain moved from the Gulf and through the Panama Canal to Pacific importers during 1987.

A rough estimate of the increase in cost of shipping grain from the Gulf to Japan without using the Panama Canal was provided by clients of E.D. and F. Man International Futures, Inc. through a procedure known in the industry as "voyage calculation". Under a low hire rate for trip out in a 50-55,000 MT vessel, this increase is \$2.75 per ton. Assuming a stronger time charter market, the estimate is \$6.00 - \$7.00 per ton. From a regression model of vessel rates, Klindworth estimates the increase in cost to be about \$10.00 per ton. Thus, under various assumptions and methods, the rate increase from the Gulf to Japan caused by a closure varies from about \$3.00 to \$10.00 per ton -- a range which indicates considerable uncertainty about the effect a closure would have on rates and consequently on U.S. competitiveness. An additional uncertainty is the rate spread adjustment which would occur between the Gulf and PNW in response to a closure. Figure 3 shows past spreads. Given the variability in the spread without closure, the effect of a Canal closure is difficult to estimate. E.D.F. Man estimates that the service capability (ton-miles) of the current shipping fleet would be reduced by 15-20% from a Canal closure. This is equivalent to reducing available tonnage supply by approximately one million deadweight per month. The economic and efficiency effects of these changes in supply and demand factors have received little attention.

Fuller, Makus, and Gallimore estimate revenue-maximizing toll rates for the Canal under various assumptions about cargo rate levels and spreads. They conclude that, because of the relatively inelastic relationship between toll rates and U.S. grain traversing the Canal, there is opportunity for a revenue-maximizing management to increase tolls substantially above historic levels. Furthermore, the optimal discriminatory rate structure has tolls which are much higher for soybeans than for corn and sorghum.

The Fuller et al. study focused on the effects of toll rates on grain flows through the Gulf and PNW ports given that the total quantity demanded for U.S. exports is constant. Though outside the scope of their study, a remaining question involves the effect of Canal toll rates on U.S. exports versus other countries' exports. For example, what would be the substitution effect between the United States and, say, Argentina grain as toll rates increase? It is not clear in this case which country would gain export share, and the magnitude of this gain is certainly unclear. Other effects involving Canada, Australia, Brazil, and other exporting countries are feasible, but there is little information about the probability and magnitude of these types of impacts.

### Concluding Remarks

We have focused on five general areas of transoceanic impediments to increased U.S. grain exports, and have offered thoughts on research issues which might be addressed to reduce these impediments. We did not, however, explicitly rank these issues by importance. Our closing remarks focus on the relative (and subjective) importance of research topics.

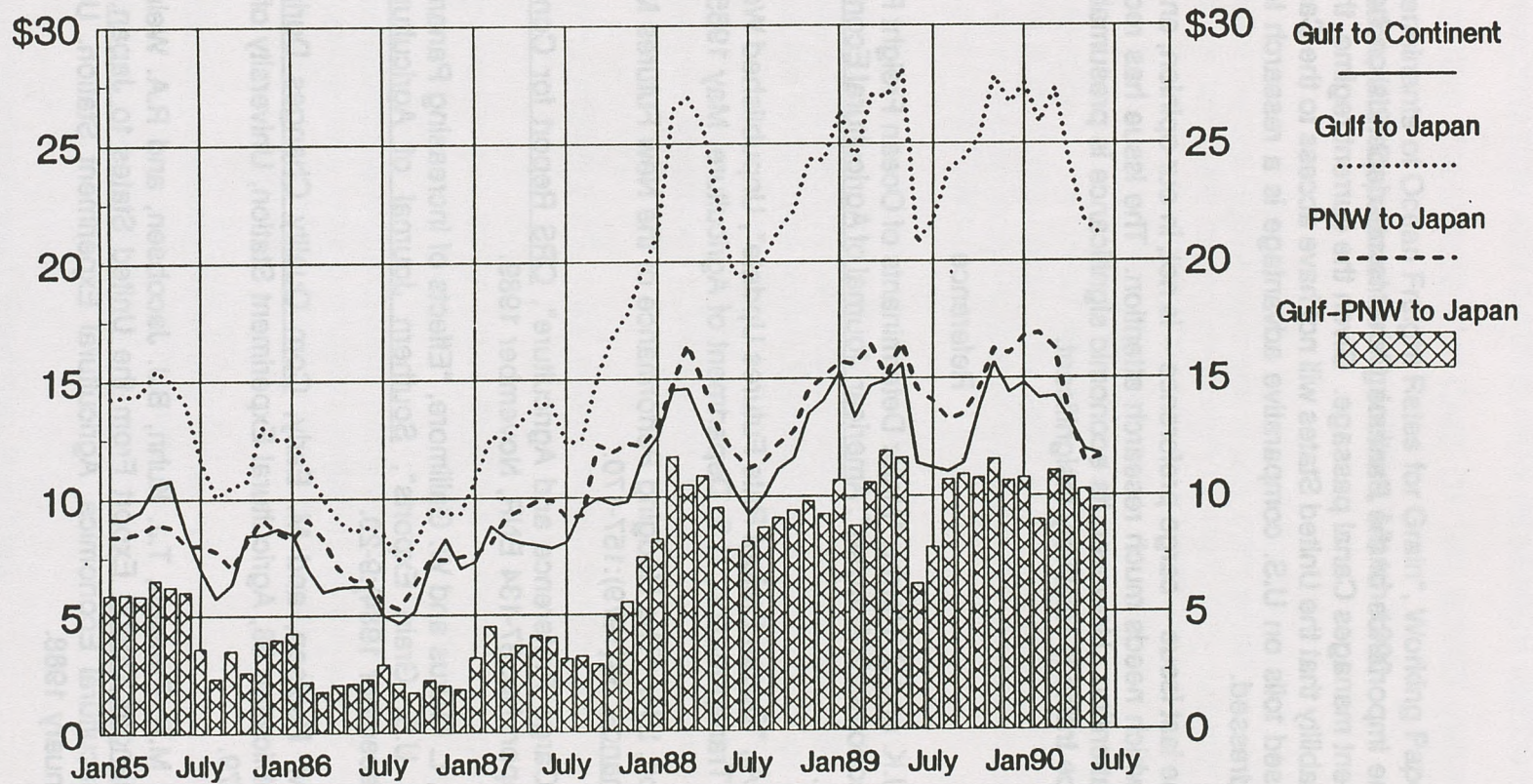
From a public-sector standpoint, we believe that the issue of subsidizing import port development is far and away the most important research issue. This belief is based on the following premises: (a) the current data base for this type of work is poor, (b) many of the benefits will be in macroeconomic and perhaps political form, discouraging private interests from investigating the problem, (c) the potential increase in U.S. exports (an estimate which would be one focus of study) may be quite high, and (d) positive externalities or peripheral results of this type of research may lend useful insights into other problems involving international trade.

Management of price risk associated with transoceanic shipments is another area in which large research payoffs may exist. From the shipper's or carrier's standpoint, there are many marketing strategies which could be investigated under the current market structure, or possibly, under new marketing systems. The freight futures market is the risk management institution which is probably most conducive to change because of its infancy and because of its formal structure. Alternative contract specifications in this market might be examined in an attempt to increase speculative trading (thus increasing needed liquidity), and to increase the hedging activity for small shipments and for different origin/destination routes.

There is room for more study in the grain-quality area; however, we believe that it should focus primarily on the costs of and demands for developing alternative standards and procedures. Particular attention might be given to whether these demand/supply factors vary by importing region, allowing U.S. exporters to gain market shares in countries with the highest demand for change.

Figure 3.

# Selected Ocean Freight Rates



source: Sparks Commodities

TRO-OF

The importance of the Panama Canal issue depends on how the Panamanian government manages Canal passage. Given the current regime, there is an extremely low probability that the United States will not have access to the Canal. The probability of increased tolls on U.S. comparative advantage is a research topic which has not been addressed.

The last issue -- cargo preference -- is not, in our opinion, an impediment to U.S. exports which needs much research attention. The issue has received considerable political attention. However, its economic significance is presumably minimal if Cargo Preference traffic is relatively insignificant.

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In the last twenty years, there has been a major shift in the pattern of U.S. grain exports. Table 1 shows the five largest importers of U.S. corn, wheat and soybeans in selected years. Before the grain export revolution of 1972, U.S. exports centered around Western Europe and PL 480 shipments to the developing countries. Since then, Japan, Korea and the Soviet Union have emerged as the major buyers of U.S. grain. Except for soybeans, Western Europe has become largely self-sufficient and, in fact, presents major competition to the United States for corn and wheat sales in much of the world, particularly in the Middle East. The battle of subsidies to grain producers has been a major preoccupation for governments; but the fact of life is that Europe will not be a market for the United States.

It is impossible to look at the changed patterns without considering the political and economic underpinnings. The distribution of food is vital to any nation's health and stability. To the extent possible, the distribution of food should be separated from politics but we do not live in a perfect world. Politics, in fact, play almost as important a part in market growth or decline, as does weather. Later, we will discuss the Soviet Union at some length, but the news of the last few weeks from the Soviet Union dramatically underlines the importance of food distribution in a country that has for far too long had a different set of priorities.

The major events affecting U.S. grain exports during the last two decades can be summarized as follows:

1. The decision of the Soviet Union in 1971 to provide feedgrains for its animal industry and to spend hard currency to import grain.
2. The continuing rise of the Chinese population together with the desire of producers to raise more profitable vegetables on the scarce arable land and the gradual change in eating habits to more bread, more western fast foods, and more proteins.
3. The prosperity of Japan, Korea and Taiwan has led to the desire for more meat and poultry -- at the relative expense of rice and fish. Since the prosperity is due in substantial part to the open U.S. market for their

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The last issue - cargo preference - is not, in our opinion, an impediment to U.S. exports which needs much research attention. The issue has received considerable political attention. However, its economic significance is presumably minimal if Cargo Preference traffic is relatively insignificant.

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