Agricultural Commodity Export Data: Sales and Shipments Contrasted

Fred J. Ruppel

Abstract. *Past research has used export shipments as the dependent variable in econometric modeling of international agricultural trade This article describes export sales data, contrasting sales to shipments, and it provides numerical and statistical measures of the similarity of sales to shipments data Forward sales are analyzed, together with econometric estimations of the lead/lag relationship between current shipments and current and past values of sales The two variables are quite different graphically, numerically, and statistically Thus, one should exercise caution in using shipments data as an economic variable*

Keywords. *Exports, export sales, international trade*

The U S Department of Agriculture (USDA), under Congressional mandate, began to collect data on export sales and export shipments of major U S agricultural commodities in late 1973 The motivation for the legislation was the huge, unanticipated Soviet wheat and corn purchases of 1972 and dramatic price increases in U S food and feed markets in the months following these Soviet purchases Exporters of designated agricultural commodities were required to report weekly to USDA's Foreign Agricultural Service, detailing all sales contracted and shipments sent of these commodities, including destinations and intended delivery dates Large sales (100,000 metric tons or more in 1 day or 200,000 or more metric tons in 1 week) were to be reported by 3 p m the next working day The purpose of the legislation was to provide agricultural commodity markets with more up-to-date information on worldwide demand

An unintended benefit was the generation of data on commodity export sales Export sales data allow researchers to model U S commodity export transactions more exactly The decision to buy or sell a commodity generally depends on current economic conditions and on expectations about future needs and conditions In this context, sales is the *economic* variable, responding to commodity prices, exchange rates, and world income levels Shipments reflect physical movement of previously sold grain and products (plus small amounts shipped on consignment for further resale) and can be viewed as a *logistical* variable, responding to transportation rates and capacities, weather constraints, and desired delivery dates In this article, my objectives are (1) to describe the sales data, with special reference to the contrasts between sales and shipments, (2) to provide numerical and statistical measures of the degree of similarity between sales and shipments data, and (3) to generate econometric estimates of the lead/lag relationships between sales and shipments for corn, soybeans, and wheat

Researchers have argued for the use of sales data in place of shipments data Tryfos has asked "whether it is possible to estimate an export demand function using the recorded (historical) exports or imports and price differences because the recorded price difference does not reveal the actual difference which gave rise to observed exports or imports" (*16*, p 689)[1] Machlup observed that "the statistics of foreign trade record shipments contracted for in the past, while the theory of trade adjustment is concerned with new contracts influenced by new exchange rates to be carried out in the future" (*9*, p 107) Studies utilizing sales data include work by Heifner, Kahl, and Deaton (*7*), Conklin (*6*), Ruppel (*14*), Ayuk (*1*), Paggi (*13*), and Bessler and Babula (*3*) The first two studies were concerned with pricing efficiency in U S grain and soybean markets, the latter two with the impacts of prices and exchange rates on U S exports Heifner, Kahl, and Deaton studied the relationship between large export sales of corn, wheat, and soybeans and futures trading in these commodities, questioning whether insider information of the large trading firms gave them the opportunity to make capital gains before the

The author is an assistant professor in the Department of Agricultural Economics, Texas A&M University This work was funded partly by a cooperative agreement with the Commodity Economics Division, ERS, while the author was a graduate research assistant at the University of Maryland The author thanks Bruce Gardner, Christopher Clague, David Bessler, Wes Peterson, and John Penson for their helpful comments

[1]Italicized numbers in parentheses refer to items in the References at the end of this article

sales were announced (*7*) Conklin used regression analysis and spectral and cross-spectral analysis techniques to test the relationship between Chicago Board of Trade commodity futures prices and export sales data (*6*) Ruppel estimated export demand and stock demand parameters for corn, soybeans, and wheat in two econometric systems, one using shipments data and the other using sales data (*14*) Ayuk performed a similar analysis for cotton (*1*) Using vector autoregression techniques Paggi (*13*) and Bessler and Babula (*3*) used sales data to assess the impacts of the money supply and exchange rates on U S exports

One can make strong arguments for preferring sales data to shipments data in econometric analyses of commodity demand The economic, political, and institutional variables at the time of the sale may differ significantly from those at the time of shipment Results from studies that estimate export parameters using shipments data can be misleading, especially if there is a long lag between sale of the commodity and its actual shipment

Data Issues in International Agricultural Trade Modeling

Much research in international trade has focused on the impacts of exchange rates and prices on U S export demand These impacts have either been calculated based on a derived expression (Johnson, Grennes, and Thursby (*8*) and Collins, Meyers, and Bredahl (*5*)) or estimated econometrically (Chambers and Just (*4*), Batten and Belongia (2), and Orden (*11*)) Using either method requires data on U S exports or export values The point at issue here is the distinction between export sales and export shipments data Studies calculating international economic parameters based on a derived expression typically use annual data or an average of a few years' data for export quantity values However, sales and shipments data differ less drastically over longer periods, so using shipments data in these studies is not problematic

Studies that use econometric estimation methods to generate international trade parameters generally use either annual or quarterly data Annual models are rarely able to make use of commodity export sales data because sales data were not available until late 1973 and thus yield too few observations for most econometric work Models that use quarterly data on U S international agricultural trade, however, are not bound by this constraint It is this group of studies with which I take issue here

Two frequently cited studies that use quarterly data are Chambers and Just (*4*) and Batten and Belongia (*2*) Chambers and Just "attempt to develop a model which reflects exchange rate effects on the domestic sector as well as the foreign sector of U S agriculture" (*4*, p 33) In the context of a system of equations, Chambers and Just estimate per-capita wheat, corn, and soybean exports (shipments) as functions of lagged dependent variables, current real commodity prices, the Standard Drawing Rights (SDR) to dollar exchange rate, vectors of commodity-specific exogenous shifters, and quarterly dummy variables Using three-stage least squares estimators over quarterly data from 1969-I to 1977-II, they conclude that "the estimated structural exchange rate elasticities for exports (all larger than unity) indicate that the level of U S grain exports has been very sensitive to fluctuation in the exchange rate" (*4*, p 38) Chambers and Just have summarized empirical regularities, but have not modeled causal structures They conclude that, for the period considered, exchange rate changes in a given quarter gave rise to commodity export shipments in the same quarter (because they were regressing current export shipments on current exchange rates) Given the tightness of world grain and soybean markets in 1972-77, it is unlikely that commodity purchases (motivated by exchange rate movements) and commodity shipments could have followed one another so closely It is more likely that the relationship Chambers and Just find results from equation misspecification and not from economic causality

Batten and Belongia's declared objective was "to assess the relative impacts of foreign economic activity and real exchange rates on export volume" (*2*, p 13) They estimated a double-log agricultural export equation in which the real volume of U S agricultural exports was estimated as a function of current real foreign gross national product (GNP), a real price index of U S agricultural exports lagged twice, and a real trade-weighted index of the foreign exchange value of the U S dollar lagged five periods Batten and Belongia conclude (based on standardized regression coefficients) that "changes in foreign income have been primarily responsible for the changes in foreign demand for U S agricultural exports from I/1971 to I/1984" (*2*, p 13) They implicitly acknowledge a difference between sales and shipments in their attempt to capture the economic component of export transactions by relating values of current shipments to past values of prices and exchange rates They credit foreign GNP as the primary source of increases and decreases in commodity movements Their failure to include past foreign GNP values is puzzling, however, because lagged values of other economic variables were included Even if one accepts their equation specification, their conclusion is questionable because foreign GNP changes do not typically lead to commodity purchases and ensuing shipments in the same quarter The use of lagged values as right-hand-side economic variables is a step in the right direction However, a distributed lag of past export sales would probably predict commodity export values better This article provides preliminary work toward that end

Both studies use data on export shipments to construct the dependent variable (*2, 4*) The parameter estimates necessarily reflect changes in the export shipments variables for given changes in right-hand-side economic variables I maintain that export demand parameter estimates are biased in these representative studies and may be incorrect in other studies that use quarterly export shipments data The distinction between export sales and export shipments is not trivial, unless sales and shipments are so highly correlated that one variable can be used in empirical estimation as a proxy for the other If these variables are not highly correlated, incorrect parameter estimates result through econometric misspecification Ruppel found substantial differences in price and exchange rate impacts on corn exports between systems that included export sales as a dependent variable and systems that used export shipments (*14*) Ayuk found similar results for cotton, with insignificant own-price and exchange rate coefficients, but large differences in foreign GNP and relative price impacts between the models (*1*) When policymakers use incorrect parameter estimates, their policies may be misdirected

Origin of Export Sales Data

The unanticipated purchase of large amounts of grain by the Soviet Union in 1972 was the catalyst for the generation of data on export sales Reaction to the "Great Grain Robbery" was dramatic, as food prices rose quickly and reserve grain stocks were depleted Concern mounted over the unfair advantage of the large grain companies with respect to inside information on future prices and grain trade trends Therefore, Congress instituted the export sales reporting requirement in the Agriculture and Consumer Protection Act of 1973 The act required the Secretary of Agriculture to set up an export reporting system for agricultural commodities, and it provided for fines up to $25,000 or imprisonment up to 1 year for exporters who knowingly failed to report export sales as required

The reporting requirement of 1973 continues to generate data on export sales and export shipments The form that each exporter must submit categorizes new sales for 32 separate commodity classifications plus destination and crop-marketing year of intended delivery [2] The report includes changes, adjustments, and cancellations of previous sales, purchases of U S grain from foreign sellers, and current export shipments Specific items such as name of buyer, date of sale, exact delivery dates, and selling price and terms, are not requested Individual reports are confidential These data are summarized by the Export Sales Reporting Division of the Foreign Agricultural Service The summary data are published weekly as *U S Export Sales (17)* and are available to the public

Each weekly report provides two sets of summary data The first lists new sales, purchases of U S grain from foreign sellers, buybacks and cancellations, and beginning and ending levels of outstanding export sales (sales that have been contracted but not yet delivered) for the current and next marketing years in addition to current weekly export levels These summary data are provided for 13 commodities and include two for wheat, five for feed grains, and three for soybeans, as well as aggregate data on rice, cotton, and whole cattle hides The second set of summary data includes accumulated exports and outstanding export sales for the current and next marketing years, by country of destination These summary data are provided for 28 commodities and include seven categories of wheat, six of feed grains, three of soybeans, three of cotton, eight of hides, and one of rice

Nearly all sales of grain and soybeans for export are made by forward contract The commodity is sold today for delivery sometime in the future The importer, which may be a private firm or a public agency, first contacts U S exporters or multinational grain-trading firms with notice of the intent to purchase a certain quantity of a commodity These intents are usually advertised publicly, so as to encourage competition among exporters for business and to ensure the most favorable price However, if the intent to purchase could increase the price of the commodity, business may be conducted in secret, as apparently occurred with the Soviet purchases in 1972 (*10*)

Once details are agreed upon, a contract is drawn up The sales price may be fixed at some specified amount (flat price contract) or quoted relative to a designated futures price (basis price contract) This futures price changes daily until the associated futures contract is removed from trading Importers are free to establish the final price at any time prior to delivery date based

[2]The marketing year for each crop begins with the harvest The marketing year for corn is from September 1 through the following August, for wheat is from June 1 through May, and for soybeans is from September 1 through August Prior to September 1986 the marketing year for corn was October 1 through the following September The corn data in this study use the October September marketing year rather than the September August marketing year

on the then-current futures price, and exporters can hedge their own position via futures trading Contracts also specify quality, shipping arrangements, payment methods, and numerous other details, including penalties for contract cancellation by either party Shipment may be within the month or may be a year or more away Seldom is there immediate delivery, except for small amounts that an exporter already owns In addition to routine buying and selling by major exporters, an export sale usually triggers buying and selling from the farmgate to the loading docks Although individual transactions become entangled with mass movements of grain, aggregate lags can be detected econometrically

Relationship Between Export Sales and Shipments

The distinction between export sales and shipments needs to be elaborated Over a long period, we would presume that export sales and export shipments would be equal In fact, if we define "net export sales" as gross sales less cancellations, buybacks, and purchases of U S grain from foreign sellers, net sales and actual shipments are separated only by the net change in outstanding export sales

Negative Adjustments to Gross Sales

Contract cancellations and buybacks and purchases of U S grain and soybeans from foreign sellers (repurchases) are negative adjustments to gross sales and contribute to the divergence between gross export sales and export shipments A cancellation is a unilateral action In contrast, a contract buyback can be initiated by either party and is by mutual consent Gross sales obviously decrease with contract buybacks and repurchases Cancellations can be more complex Some cancellations are simply a matter of how the data are managed If an importer requests a shipment delay from the current marketing year to the next, this fact appears as both a cancellation for this marketing year and a sale for the next Net sales are not affected Loading tolerances on ships have similar effects A contract quantity is generally stipulated with a plus or-minus 5-percent margin for different hold capacities and loading techniques If the ship is underloaded, a cancellation is reported An overloaded ship likewise increases sales These situations increase either cancellations or sales when in fact neither was intended to increase or decrease the final amount delivered Overloading and underloading ships alter net sales, but they would presumbly average out to a zero net effect

Other cancellations are more genuine Such cancellations can be caused by political, economic, or institutional factors and can be initiated by the buyer, by the seller, or by parties outside the transaction The simplest case is crop-switching, where an importer requests replacement of one commodity with another The first crop shows a real cancellation and the second a real sale The parties adjust prices to cover the new transaction A second type of real cancellation involves current and expected supplies of a commodity Buyers may cancel a contract if world supplies of a crop suddenly become more abundant, especially when production of their own country's crop exceeds expected levels Exporters might cancel if supplies are short or if price goes too high before they have a chance to hedge their orders in existing futures markets It may be more economical to pay the penalty for contract cancellation than to suffer a severe loss For the sample period, the largest cancellation was clearly political The U S Government placed an embargo on corn, wheat, and soybeans to the USSR in January 1980 following the Soviet invasion of Afghanistan, 13 8 million metric tons (MMT) of grain were embargoed This amount exceeded the 8 MMT already committed as part of a 1976 grain trade agreement

These last types of cancellations create real differences over time between the volume of sales and shipments However, because of the way the data are compiled, it is impossible to separate out the real cancellations It is likewise impossible to tell what percentage of the total level of sales constitutes real sales (that is, excluding sales increases from loading tolerances and marketing year switches) If a period were chosen such that beginning and ending outstanding export sales were equal, the difference between total sales and total shipments would be the amount of total cancellations The figure for real cancellations would be much smaller, as would be the figure for real sales Because isolating real cancellations and sales from their total amounts is impossible, I will use the level of "net export sales " As already explained, net export sales equals total export sales minus cancellations, buybacks, and purchases of U S grain from foreign sellers The volume of net export sales over time will differ from the volume of export shipments only by the difference between beginning and ending levels of outstanding sales

Outstanding Export Sales

Outstanding export sales represent sales that have been contracted, but not yet delivered The level increases as new sales are made, and it decreases as exports are shipped These levels fluctuate with market conditions and importers' expectations In a tight market with further expectations of short supply, buyers tend to increase their purchases for later export to ensure availability of grain for later consumption When grain is readily available, buyers are far less concerned with contracts for future delivery, and the level of outstanding sales is low Over a given period, the data may show large or small differences between total sales and total shipments, depending on beginning and ending levels of outstanding sales

One might question the importance of outstanding sales in terms of quantity magnitudes In figure 1, panel A, beginning levels of quarterly outstanding export sales of corn, soybeans, and wheat are plotted over time, by marketing quarters from 1974 through 1985 The circled observations represent the first quarter of the marketing year for each crop We would generally expect high levels of outstanding export sales going into each new marketing year Corn and soybean levels are consistent with this expectation, with outstanding sales levels generally highest in the first quarter of the crop-marketing year Outstanding wheat sales, however, are typically *lower* in the first quarter of the marketing year (June-August) than in any other quarter These figures are more revealing when they are compared with actual shipment levels From 1974 to 1985, quarterly beginning levels of outstanding export sales of corn averaged 13 9 MMT, with a minimum of 5 4 MMT and a maximum of 27 8 MMT Actual shipments during this time period averaged only 11 9 MMT Outstanding sales of soybeans averaged 5 8 MMT (ranging from 1 4 to 17 2 MMT), with actual shipments averaging 4 9 MMT Outstanding sales of wheat averaged 8 9 MMT (ranging from 3 5 to 15 0 MMT), with actual shipments averaging 8 3 MMT The average beginning level of outstanding sales was greater for each commodity than the average quantity shipped per quarter

Figure 1, panel B, illustrates the link between beginning levels of outstanding sales and actual shipments, where the ratios of beginning (quarterly) outstanding sales levels to actual quantities shipped during the ensuing quarter are plotted over time The circled observations again reflect the first quarter of the marketing year Note the number of ratio values greater than unity A ratio value greater than 1 0 indicates that forward sales had to have been contracted for delivery durations longer than one quarter Increasingly greater ratio values necessarily indicate longer and longer lag lengths between commodity sale and shipment The mean ratio value was 1 22 for corn, 1 33 for soybeans, and 1 11 for wheat Furthermore, the ratio values for each crop seldom drop below 0 75, and on only one occasion for all three crops does the ratio drop below 0 50 That is, in almost every crop quarter, at least 50-75 percent of crop shipments that quarter had been sold prior to the beginning of the quarter This result demonstrates the potential significance of lead/lag relationships between sales and shipments

Finally, figure 1, panel B, demonstrates both the positive serial correlation in corn and soybean ratio values from quarter to quarter and the positive first-order and negative second-order serial correlation for wheat These corn and soybean results are not unexpected, as the numerator is a stock variable that would be expected to exhibit positive serial correlation The wheat result, however, is surprising and highlights the tremendous seasonality in outstanding export sales levels of wheat The consistently low levels of outstanding export sales at the beginning of the marketing year relative to other quarters (fig 1, panel A) lead to these low ratio values at the beginning of the wheat marketing year There are two possible explanations for this phenomenon The first involves wheat production in the Southern Hemisphere The May-July harvest of North American wheat overlaps the Southern Hemisphere's wheat marketing year, where wheat is typically harvested in November-January At the time of the U S harvest, other wheat is still available for purchase, and importers have a choice of old-crop Southern Hemisphere wheat or new-crop Northern Hemisphere wheat They can easily buy on cash markets for delivery in the near future, leaving outstanding export sales of wheat low during this period The second possible explanation involves wheat's competition with corn and soybeans for vessel space That is, importers of U S wheat find it unnecessary to contract ahead for delivery during the Northern Hemisphere summer months, but must compete for vessel space following corn and soybean harvests Corn and soybean ratio values exhibit far less seasonality

Numerical Comparisons from Annual Data

Net export sales for any chosen period can be calculated from data on outstanding export sales and accumulated export shipments The ending level of outstanding export sales (OS) is equal to the beginning level plus the (positive or negative) excess of net new sales (SA) over current shipments (SH)

$$OS_t = OS_{t-1} + (SA_t - SH_t) \quad (1)$$

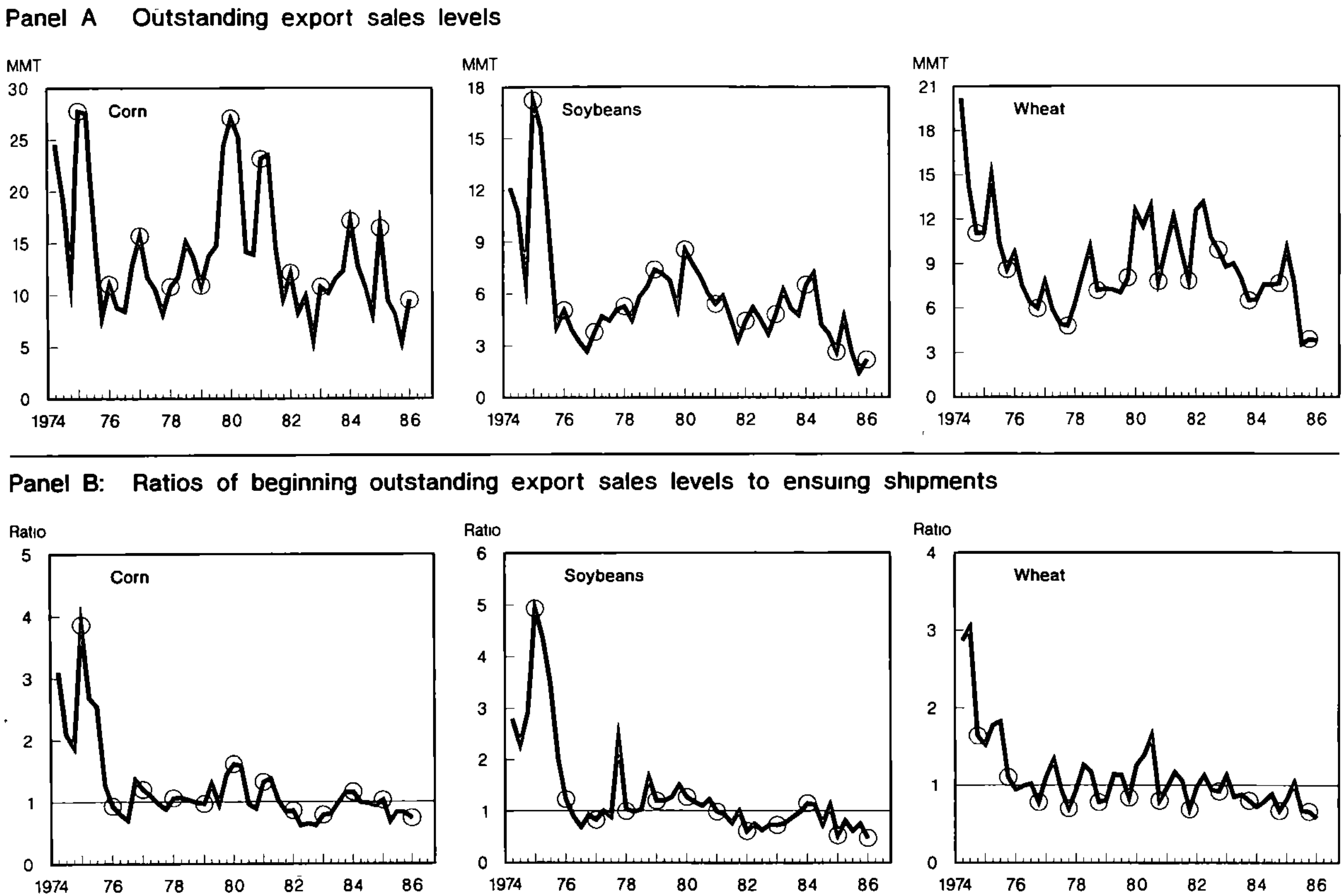
Net new sales for a given period can thus be calculated as the increase or decrease in outstanding export sales during the period, plus current shipments

$$SA_t = (OS_t - OS_{t-1}) + SH_t \quad (2)$$

Sales can be stipulated for delivery in either the current marketing year (OSC) or the next year (OSN), and

Figure 1

Outstanding export sales of corn, soybeans, and wheat



MMT = million metric tons

outstanding sales records are kept for both Shipments are calculated as the difference between two levels of accumulated export shipments (AE) Hence

$$SA_t = [(OSC_t + OSN_t) - (OSC_{t-1} + OSN_{t-1})] + (AE_t - AE_{t-1}) \quad (3)$$

where SA_t refers to overall net new export sales regardless of marketing year of intended delivery [3]

The shorter the time frame, the greater the relative divergence between export shipments and net export sales will be Since most grain is generally shipped within 4-6 months from the time it is purchased, it might seem that annual data on export sales and shipments would be approximately equal Table 1 shows calendar-year and marketing-year annual shipment and net sales data for corn, soybeans, and wheat for 1974-85 Although the mean values of sales and shipments in both calendar-year and marketing-year calculations are approximately equal for each crop, the individual data values for each year differ greatly In only 5 of 69 separate pairs of data points is the deviation between sales shipments less than 1 percent (table 1) In 40 cases (58 percent), the deviation between the two pairs of points is greater than 5 percent More than 50 percent of the cases where the pairs of points differ by less than 5 percent occurred after 1981, a period when large grain and soybean stocks presumably made forward sales less necessary

The correlation coefficients for each of the six sets of annual data are positive and reasonably large, pointing to strong relationships between the variables, but that relationship is greater than 0 90 only for wheat One would hope to see values closer to unity to qualify one variable as a "proxy variable" for the other or to argue for small amounts of "measurement error" It is interesting that the correlation coefficient between the two wheat variables is larger with marketing-year data than with calendar-year data Marketing-year data for sales and shipments should differ if there are significant lag relationships between the two variables The strong relationship in wheat marketing-year sales and shipment data again indicates less forward sales activity for wheat between marketing years The low figures for calendar-year 1975 and marketing-year 1974/75 soybean sales were the result of extremely high importer purchases just prior to the 1974 U S soybean harvest Worldwide soybean supplies were anticipated to be extremely tight because of a Brazilian ban on soybean and soymeal exports The lifting of the ban in November led to the cancellation of many prior purchases of U S soybeans in later quarters (*12*, pp 7-8)

Table 1 reflects annual data, where we would have expected large divergences between the two variables to have been smoothed out A shorter period shows far weaker relationships between sales and shipments If one uses quarterly data over the same period, the correlation coefficients between corn and soybean export sales and export shipments are 0 36 and 0 59, respectively Wheat sales and shipments are more highly correlated, at 0 71 Even if one could argue from the annual data that the sales and shipment data do not differ significantly, one cannot draw the same conclusion from quarterly data

Graphic Analysis from Quarterly Data

Simple graphs of sales and shipments over time reveal important aspects of the sales/shipments relationship Figure 2 plots quarterly export sales and export shipments of corn, soybeans, and wheat from 1974-85 Two points emerge First, the sales data are much more variable than the export data The export data for all three commodities track relatively smoothly over time, but the sales data are much more spiked The coefficients of variation for quarterly corn, soybean, and wheat sales are 0 47, 0 40, and 0 53, whereas the coefficients of variation of their shipments are 0 26, 0 25, and 0 30, respectively Second, a pattern of seasonal variation emerges The circled observations represent end-of-marketing-year (fourth-quarter) data Export shipments for all three commodities are consistently and substantially lower in the fourth marketing quarter than in the earlier three, with corn and soybean export sales generally higher in the fourth quarter This fourth-quarter-sales/first-quarter-shipments observation again points to the potential importance of lags between sales and shipments

Econometric Analysis of the Lag Relationship

The total amount of exports shipped must over time equal the sum of all past net sales Thus, current export shipments can be represented as a distributed lag of past values of net export sales Tables 2 and 3 show the results of an econometric investigation into the lag relationships between export sales and export shipments of corn, soybeans, wheat, and hard red winter (HRW) wheat [4] The columns of table 2 are in two categories The first two columns are corn equations,

[3]There are problems inherent in converting weekly data to monthly, quarterly, or annual figures Please contact the author for specific procedures used to generate quarterly and annual sales and shipments data from weekly publications

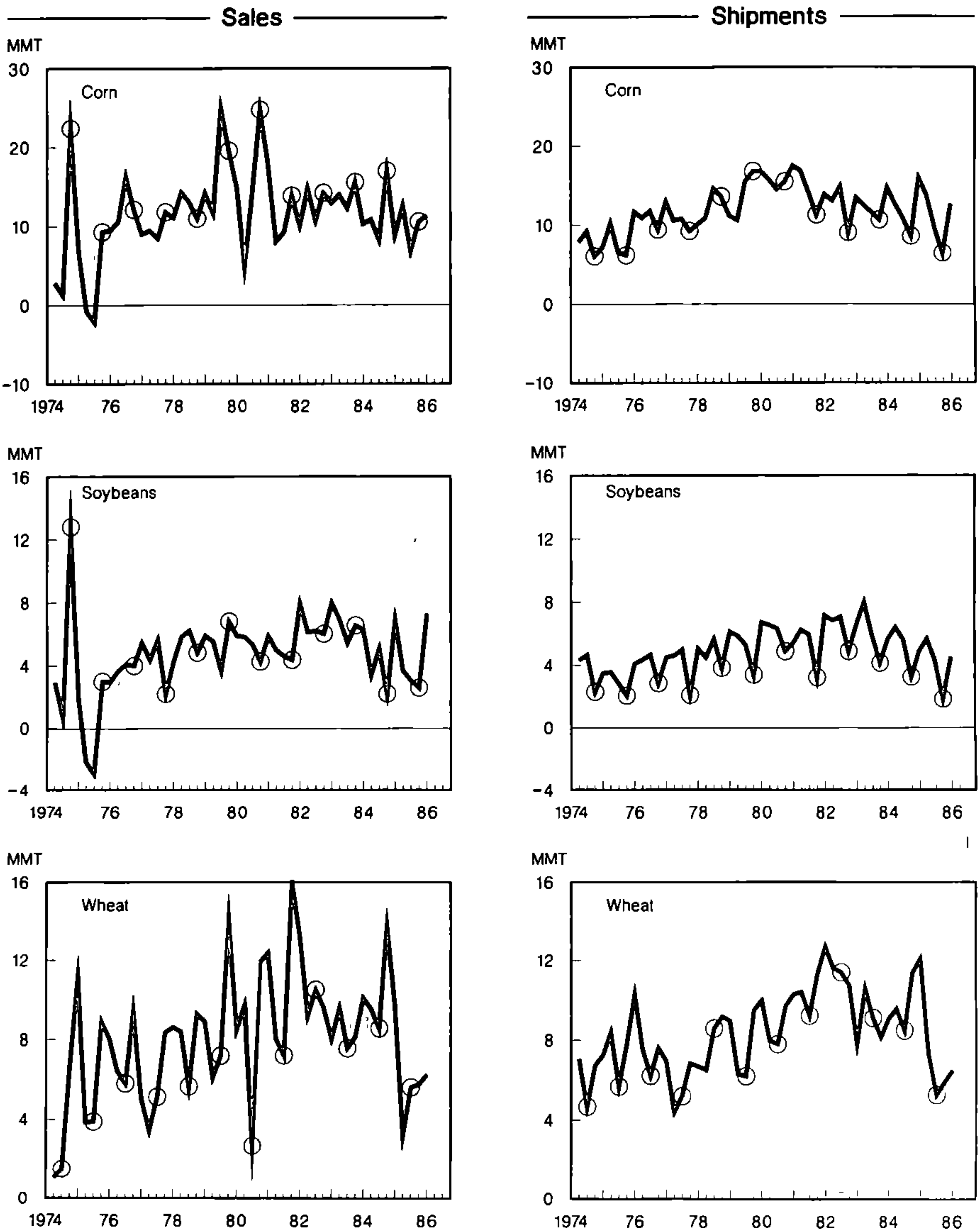
[4]Because HRW wheat accounts for approximately 50 percent of all U S wheat grown and exported, where regression results are reported, separate equations are reported for HRW wheat as well as for aggregate wheat

Table 1—Export sales and export shipments of corn, soybeans, and wheat: Annual data by calendar and marketing years

Item	Corn			Soybeans			Wheat		
	Sales		Shipments	Sales		Shipments	Sales		Shipments
					1,000 metric tons				
Calendar year									
1974	33,454		30,419	18,320		14,792	20,425		25,674
1975	15,880		34,695	854		12,551	24,711		32,173
1976	48,089		45,210	17,209	*	16,413	26,751		28,366
1977	40,848	**	40,787	16,569	*	16,809	25,563		23,203
1978	52,573	*	50,398	22,812		20,124	32,291	*	33,305
1979	71,196		59,852	21,919	*	21,376	35,940		32,027
1980	61,787	*	63,481	21,315		23,148	36,845	*	35,799
1981	41,303		56,561	21,919	*	22,594	44,586	*	43,621
1982	52,699	*	50,804	26,367	*	25,349	37,391		41,558
1983	52,116	*	49,625	25,255	*	24,293	35,446	*	36,846
1984	44,976		48,247	17,642		20,185	41,583	**	41,516
1985	41,309	*	42,550	16,618	*	16,338	20,917		24,999
Mean	46,353		47,719	18,900		19,498	31,871		33,257
Standard deviation	13,976		9,744	6,582		4,064	8,028		6,857
					Ratio				
Coefficient of variation	0 302		0 204	0 348		0 208	0 252		0 206
					Statistical measure				
Correlation coefficient		0 82			0 84			0 91	
					1,000 metric tons				
Marketing year									
1974/75	13,355		30,140	-238		11,957	25,627		28,046
1975/76	48,595		43,942	14,729		15,980	29,231		31,882
1976/77	38,788		43,669	17,765		16,275	23,069	*	24,222
1977/78	49,450	**	49,289	21,162		19,054	31,039		28,690
1978/79	70,451		54,283	21,936		20,789	31,529		30,707
1979/80	58,837		62,768	21,314		24,457	35,058	**	35,283
1980/81	49,070		60,109	19,855	*	20,844	39,684	**	39,631
1981/82	49,896	*	51,253	26,330	*	25,935	49,049	*	46,976
1982/83	54,764		48,369	26,937		25,244	34,851		38,251
1983/84	46,362	*	47,047	17,039		20,900	36,373	*	35,223
1984/85	38,877		45,886	16,270	*	16,730	32,363		36,110
Mean	47,131		48,796	18,464		19,833	33,443		34,093
Standard deviation	14,273		8,770	7,308		4,367	7,019		6,326
					Ratio				
Coefficient of variation	0 303		0 180	0 396		0 220	0 210		0 186
					Statistical measure				
Correlation coefficient		0 81			0 87			0 95	

Note Double asterisks (**) denote less than 1-percent differences, and asterisks (*) denote less than 5 percent differences between pairs of numbers

Figure 2
Export sales and export shipments of corn, soybeans, and wheat



MMT = million metric tons

Table 2—Corn, soybeans, wheat, and hard red winter (HRW) wheat· Lagged export sales as predictors of export shipment levels

Equation	Corn (1)	Corn (2)	Soybeans (3)	Wheat (4)	HRW wheat (5)
			Coefficient		
nXS	0 18 (2 26)	0 14 (2 03)	0 21 (3 22)	0 35 (5 08)	0 29 (4 45)
nXS1	41 (5 04)	31 (4 44)	23 (3 49)	41 (5 98)	41 (6 21)
nXS2	20 (2 99)	09 (1 45)	05 (1 10)	10 (1 39)	10 (1 42)
nXS3	16 (2 48)	06 (1 05)	06 (1 38)	05 (74)	04 (61)
nXS4	06 (92)	06 (1 08)	08 (1 75)	03 (40)	11 (1 64)
[LAG SUM]	[1 01]	[66]	[63]	[94]	[95]
CROP QTR1	—	2,698 (3 33)	1,789 (6 06)	365 (55)	–477 (1 14)
CROP QTR2	—	2,444 (2 76)	2,101 (7 18)	–292 (43)	-1,226 (2 99)
CROP QTR3	—	2,408 (2 84)	1,962 (6 97)	–441 (76)	-177 (46)
INTERCEPT	—	2,533 (1 95)	620 (1 63)	853 (1 04)	705 (1 31)
R-SQUARE	—	71	84	81	73
ADJ-R-SQ	—	65	81	77	66
Durbin-Watson statistic	1 45	1 51	1 60	1 56	1 73
Degrees of freedom	39	35	35	35	31

Note The variables denoted by "nXSi" are current and lagged values of export sales, where n indicates the commodity (C, S, W, H) and i indicates the lag length (0-4) For each equation, the dependent variable is export shipments per quarter, and the summation of the coefficients on current and lagged sales and outstanding sales is reported in brackets Absolute values of t-statistics are reported in parentheses The R^2 statistic is invalid in the first equation
— = Not applicable

with different equation structures in each column The last three columns are soybean, wheat, and HRW wheat equations, with structures identical to the second corn equation The dependent variable in all five equations is export shipments per quarter measured in 1,000 metric tons All the equations were estimated by ordinary-least-squares over crop-marketing quarter data from 1974 through 1985 Because the first year of data provides lag values for 1975, there were 44 observations over each of the commodities, except for HRW wheat, where 1974 data were not available Summary statistics (where appropriate) are provided in the last rows of each column

The first equation shows export shipments of corn (nXD interpreted as CXD) as a function of current (nXS) and four quarterly lagged values of export sales (nXS1-nXS4) The intercept is suppressed so that the coefficients on the right-hand-side variables can be interpreted as percentages That is, export shipments in any given quarter are made up of the sum of percentages of sales from current and previous quarters Because the average magnitude of each variable on the right side of the equation is approximately equal to the mean of the dependent variable, if the lag structure encompasses the entire realm of forward sales activity (or the greater portion thereof), the

Table 3—Corn, soybeans, wheat, and hard red winter (HRW) wheat: Current and lagged export sales and lagged beginning outstanding sales as predictors of export shipment levels

Equation	Corn (1)	Corn (2)	Soybeans (1)	Soybeans (2)	Wheat (1)	Wheat (2)	HRW wheat (1)	HRW wheat (2)
	Coefficient							
nXS0	0 21 (3 91)	0 18 (3 36)	0 34 (5 55)	0 32 (6 16)	0 36 (6 38)	0 35 (5 77)	0 28 (4 66)	027 (4 23)
nXS1	35 (6 78)	34 (5 65)	31 (5 70)	31 (5 73)	40 (7 11)	40 (6 45)	42 (6 90)	42 (6 26)
nXS2	—	13 (2 48)	—	13 (3 38)	—	11 (1 81)	—	11 (1 64)
nOS1/nOS2	20 (4 88)	17 (3 87)	17 (4 02)	20 (5 11)	23 (4 08)	16 (2 81)	20 (3 12)	12 (1 70)
[LAG SUM]	[76]	[82]	[82]	[96]	[99]	[1 02]	[90]	[92]
CROP QTR1	2,745 (4 08)	2,771 (3 95)	1,693 (6 40)	1,830 (7 64)	426 (96)	421 (85)	-64 (20)	-177 (51)
CROP QTR2	1,889 (2 83)	2,495 (3 36)	1,659 (6 26)	2,146 (9 20)	-142 (32)	-132 (26)	-810 (2 45)	-961 (2 71)
CROP QTR3	2,235 (3 53)	2,159 (3 26)	1,679 (6 64)	1,782 (7 92)	-508 (1 34)	-380 (91)	-5 (02)	-7 (02)
INTERCEPT	1,234 (1 12)	376 (29)	-261 (55)	-1,185 (2 27)	273 (42)	-8 (01)	552 (1 19)	589 (1 04)
R-SQUARE	79	78	86	89	86	84	75	72
ADJ-R-SQ	75	73	84	87	83	81	70	66
Durbin-Watson statistic	1 84	1 97	2 15	2 33	1 94	2 01	1 73	1 84
Degrees of freedom	37	36	37	36	37	36	33	32

Note The variables denoted by "nXSi" are current and lagged values of export sales, where n indicates the commodity (C, S, W, H) and i indicates the lag length (0-4) The variables denoted by "nOS1/nOS2' are lagged beginning outstanding sales levels by commodity (n) and by lag length (1 or 2 as appropriate) For each equation, the dependent variable is export shipments per quarter, and the summation of the coefficients on current and lagged sales and outstanding sales is reported in brackets Absolute values of t-statistics are reported in parentheses

— = Not applicable

coefficients should sum to approximately 1 0 The coefficient on each current and lagged sales variable reflects the percentage of current export shipments that was sold i periods ago, with i taking on a value from zero to 4 The first equation reveals that, on average, 18 percent of current export shipments of corn were sold during the current quarter, 41 percent during the previous quarter, 20 percent two quarters ago, and 22 percent three or four quarters ago For each equation in tables 2 and 3, the number in brackets following the four-lag coefficient and associated t-statistic is the sum of the coefficients on the current and lagged sales variables for that equation In this first corn equation, the sum of the lag coefficients of 1 01 yields the expected result The comparable soybean, wheat, and HRW wheat equations (not shown) have coefficients summing to 1 01, 1 02, and 1 00 with associated coefficients of 0 35, 0 30, 0 19, 0 08, 0 10, 0 39, 0 38, 0 10, 0 10, 0 05, and 0 27, 0 36, 0 23, 0 08, and 0 06, respectively The suppression of the intercept means that the R^2 statistic (the coefficient of multiple determination) is not valid

Quarterly dummy variables for the first three quarters of the marketing year and an intercept term are added in the second corn equation and in the soybean, wheat, and HRW wheat equations of columns 3, 4, and 5 (table 2) With the intercept and dummy variables added, the coefficients on current and lagged sales can no longer be interpreted as percentages summing to 1 0 The literal values on the lag coefficients are no longer meaningful Rather, the *positive* magnitudes of these (within-equation) coefficients relative to one another become important, with significance on the coefficients interpreted only in a one-tail sense The sum of the coefficients drops to 0 66 in the corn equation, and it drops to 0 63, 0 94, and 0 95 in the soybean, wheat, and HRW equations, respectively

A problem with the equations of table 2 lies in the general insignificance of coefficients beyond the first lag quarter Dropping the more distant lags from the estimation is not the proper way to handle this problem, because the lag structure for all the commodities clearly reaches further back than one quarter An alternative method of assessing the lag relationship is to replace sales in the more distant quarters with the level of beginning outstanding sales for a more recent quarter [5] That is, if one lagged sales variable is to be included in the equation, the two-, three-, and four-lag sales variables are replaced by the level of beginning outstanding sales in the previous period Thus, the lagged beginning outstanding sales variable reflects sales contracted in two or more earlier periods, but not yet shipped at the beginning of the previous quarter Table 3 shows the results of this equation specification for lag lengths of one and two sales quarters and for beginning outstanding sales levels lagged one and two periods, respectively

The equations in table 3 differ noticeably from those in columns 2-5 of table 2 The adjusted R^2 improves an average of 0 06 in the one-lag specification and 0 045 in the two-lag specification The sums of the significant coefficients move closer to 1 0, and the Durbin-Watson statistics move closer to 2 0 The quarterly dummy variables remain positive and significant in the corn and soybean equations, but are generally insignificant in the wheat equations Nearly all the coefficients on the current and lagged sales and outstanding sales variables are significant at the 5-percent level, and the remainder are significant at the 10-percent level For each commodity, the coefficients on both the current sales variable and the one lag sales variable are larger than each of the corresponding coefficients on the two-lag sales variable and the lagged beginning outstanding sales variable, indicating the greater impact of more recent sales on current shipments None of the intercepts is significant, except for the two-lag specification of the soybean equation

[5]Thanks for this alternative specification are due to an insightful anonymous reviewer who looked unfavorably on the practice of summing coefficients not significantly different from zero

Analysis of Marketing-Quarter-Specific Lead/Lag Relationships

The equations in tables 2 and 3 are limited in revealing the lead/lag relationships between export sales and export shipments of corn, soybeans, wheat, and HRW wheat Simply lagging the sales data falls short for two reasons First, the lead/lag relationship is likely to differ for each marketing quarter Shipments made in the first quarter of the marketing year are not likely to have had the same sales lag structure as shipments made in the third quarter Both the beginning outstanding sales levels and the ratios of beginning outstanding sales to ensuing shipments vary by marketing quarter for each commodity

Second, the sales means are different for each quarter When equations are estimated econometrically, deviations from the means of the right-hand-side variables are plotted against deviations from the means of the dependent variable The estimated equations in tables 2 and 3 use aggregate means for the sales variables for all quarters, when these values actually differ for each quarter Quarter-specific, right-hand-side variables are more desirable, as deviations from the mean during the first marketing quarter, for example, would be deviated from a mean associated with that quarter

Table 4 presents an alternative econometric analysis of the lead/lag relationship between export sales and export shipments The right-hand-side variables used in the estimation are [0,x] interactive dummy variables, obtained by multiplying a [0,1] value for each of four quarters by the appropriate lagged value of sales or beginning outstanding sales The column headings represent the shipment quarter, and the row designations reflect the lag length The sales quarter can be inferred from these two components That is, cell QTR1/CLAG1 (denoted C-Q1L1) represents corn sales contracted in the fourth marketing quarter, one lag period prior to the first shipment quarter This variable receives a value only once four observations, when the CROP QTR1 value of 1 (from tables 2 and 3) is multiplied by the lagged sales value In similar fashion, cell QTR2/WLAG0 (W-Q2L0) represents wheat sales contracted in the second marketing

Table 4—Export shipments as a function of quarter-specific current and lagged export sales and lagged beginning outstanding sales

Item	Unit	QTR1	QTR2	QTR3	QTR4	Function
Corn						
CLAGO	Coefficients	0 32 (1 75) [08]	0 36 (3 35) [07]	0 25 (2 88) [06]	0 14 (1 08) [04]	— — —
	Quarters	(1)	(2)	(3)	(4)	—
CLAG1	Coefficients	63 (4 31) [19]	29 (1 70) [07]	51 (5 29) [10]	35 (3 85) [08]	— —
	Quarters	(4)	(1)	(2)	(3)	—
CBOS1	Coefficients	03 (29) [01]	34 (4 61) [12]	30 (7 23) [09]	40 (3 43) [10]	— — —
	Quarters	(3,2,1)	(4,3,2)	(1,4,3)	(2,1,4)	—
Statistics						
"R-Square"	—	—	—	—	—	79
Durbin Watson	—	—	—	—	—	2 12
Degrees of freedom	—	—	—	—	—	32
Soybeans						
SLAGO	Coefficients	51 (6 39) [16]	21 (1 83) [05]	54 (3 16) [11]	29 (2 32) [06]	— — —
	Quarters	(1)	(2)	(3)	(4)	—
SLAG1	Coefficients	21 (1 62) [04]	66 (5 74) [18]	22 (1 23) [05]	27 (3 79) [06]	— — —
	Quarters	(4)	(1)	(2)	(3)	—
SBOS1	Coefficients	36 (3 44) [08]	17 (4 59) [05]	31 (10 09) [10]	19 (2 64) [05]	— — —
	Quarters	(3,2,1)	(4,3,2)	(1,4,3)	(2,1,4)	—
Statistics						
"R-Square"	—	—	—	—	—	0 89
Durbin-Watson	—	—	—	—	—	2 39
Degrees of freedom	—	—	—	—	—	32

See notes at end of table

—Continued

Table 4—Export shipments as a function of quarter-specific current and lagged export sales and lagged beginning outstanding sales (Continued)

Item	Unit	QTR1	QTR2	QTR3	QTR4	Function
Wheat.						
WLAGO	Coefficients	35 (3 67) [11]	37 (2 70) [10]	36 (3 41) [07]	36 (2 98) [07]	— — —
	Quarters	(1)	(2)	(3)	(4)	—
WLAG1	Coefficients	0 39 (3 57) [07]	0 35 (2 75) [11]	0 50 (3 76) [14]	0 49 (4 17) [10]	— — —
	Quarters	(4)	(1)	(2)	(3)	—
WBOS1	Coefficients	32 (3 38) [08]	30 (1 87) [06]	11 (88) [03]	19 (2 64) [05]	— — —
	Quarters	(3,2,1)	(4,3,2)	(1,4,3)	(2,1,4)	—
Statistics						
"R-Square"	—	—	—	—	—	0 86
Durbin-Watson	—	—	—	—	—	1 98
Degrees of freedom	—	—	—	—	—	32
HRW Wheat.						
HLAG0	Coefficients	33 (3 92) [11]	23 (1 92) [06]	27 (2 52) [06]	26 (2 61) [04]	— — —
	Quarters	(1)	(2)	(3)	(4)	—
HLAG1	Coefficients	34 (3 01) [06]	32 (3 22) [11]	78 (7 03) [22]	44 (3 72) [09]	— — —
	Quarters	(4)	(1)	(2)	(3)	—
HBOS1	Coefficients	29 (3 91) [08]	38 (1 57) [07]	- 02 (18) [00]	31 (4 20) [10]	— — —
	Quarters	(3,2,1)	(4,3,2)	(1,4,3)	(2,1,4)	—
Statistics						
"R Square"	—	—	—	—	—	84
Durbin-Watson	—	—	—	—	—	1 72
Degrees of freedom	—	—	—	—	—	28

Note The blocks denoted by "nLAGi" represent current and lagged values of export sales, where n indicates the commodity (C, S, W, H) and i indicates the lag length (0 1) The blocks denoted by "nBOS1" are lagged beginning outstanding sales levels by commodity (n) For each equation, the dependent variable is export shipments per quarter Absolute values of t statistics are in parentheses, means-adjusted coefficients (elasticities) are in brackets, and sales quarters are in parentheses "R-Square" is the square of the correlation coef ficient between the actual and predicted value of the dependent variable

— = Not applicable

quarter, zero lag periods prior to the second (shipment) quarter, and QTR4/SBOS1 (S-Q4B1) represents beginning outstanding soybean sales in the third crop quarter, one lag period prior to the fourth shipment quarter Again, the level of beginning outstanding sales in a given marketing quarter reflects sales contracted either in a prior quarter of the current marketing year or in the previous marketing year, but not yet shipped as of the beginning of the quarter

Corn, soybean, wheat, and HRW wheat export shipments were regressed on the interactive variables already described, with the results presented in table 4 Each equation contains 12 regressors (4 quarters by 3 lagged sales variables current sales, lagged sales, and lagged beginning outstanding sales), with the intercept suppressed for each commodity For each regressor, the estimated coefficent is given, with the absolute value of the t-statistic in parentheses, the means-adjusted coefficient (elasticity) in brackets, and the crop-marketing quarter in which the sale was made in parentheses For the nBOS1 variables,this last line lists the three most recent quarters for which sales contracted in one of those quarters would likely have been included in beginning outstanding sales Summary statistics are reported for each commodity As noted earlier, the R^2 statistic is invalid Instead, what is reported as "R^2" is the correlation coefficient between the actual and predicted values of the dependent variable This statistic is identical to R^2 in ordinary-least-squares (OLS) equation estimation The "R^2" values in the equations in table 4 are similar to the R^2 statistics of table 3, except for HRW wheat where the explanatory power improves substantially

Of the 48 current and lagged coefficients for the four commodities, 41 are significant at the 5-percent level (one-tail), and three others are significant at the 10-percent level The estimated coefficients for each commodity sum to approximately 4 0, and the means-adjusted coefficients sum to approximately 1 0 Because of large differences in quarterly sales means, the literal coefficients are less meaningful than are the means-adjusted coefficients, these latter coefficients measure the percentage of total shipments attributable to a given lag structure The commodities can be analyzed vertically by shipment quarter, horizontally by lag length, and diagonally by sales quarter

The largest means-adjusted coefficients in the corn equation are C-Q1L1, a fourth-quarter-sales/first-quarter-shipments lag structure, and C-Q2B1, beginning outstanding sales in the first marketing quarter reflecting sales in the fourth, third, and second marketing quarters We see nearly a third of total shipments explained by these two lag structures When means-adjusted coefficients are added horizontally, 44 percent of total shipments have a one-quarter lag, and another 32 percent have lags extending beyond one quarter Three of the five largest means-adjusted coefficients are in the CBOS1 row, indicating the importance of these longer lags to second-, third-, and fourth-quarter corn shipments First-quarter shipments typically reflect only first-quarter and fourth-quarter sales

Whereas fourth-quarter sales are important in corn export marketing, first-quarter sales are important for soybeans Three of the four largest means-adjusted coefficients in the soybean block are S-Q1L0, S-Q2L1, and S-Q3B1, all reflecting (either exclusively or principally) sales contracted in the first marketing quarter These three lag structures comprise 44 percent of total shipments Concurrent sales and shipments are more common for soybeans than for corn, with 38 percent of total soybean shipments having a zero lag length compared with 25 percent for corn Finally, adding vertically, we see fourth-quarter shipments to be low relative to the other three quarters, confirming the regularities we noted in soybean shipments (fig 2)

The two wheat equations need to be examined jointly because the all-wheat results are largely determined by HRW wheat The most significant finding is the short lag structure for wheat shipments Nearly 50 percent of total HRW wheat shipments have a one-quarter lag structure, with H-Q3L1 and H-Q2L1 having the two largest means-adjusted coefficients Only 25 percent of HRW shipments are associated with sales contracted two or more quarters past The all-wheat numbers are slightly smaller in each of these categories, with a greater number of concurrent sales and shipments when other wheat varieties are included Shipments on average are relatively constant across all quarters in both wheat equations First- and second-quarter sales are important to HRW shipments, whereas sales are spread more evenly across all quarters in the all-wheat block

Conclusions

Table 4 gives a clearer understanding of the temporal relationships between export sales and export shipments of corn, soybeans, wheat, and HRW wheat than does the simple lagged-variables equation structure of tables 2 and 3 A better understanding of lead/lag structures is important to export merchants and shippers, to transportation economists, and to those individuals (in both the public and private sectors) who need to predict season-ending export shipment levels at any point in the marketing year Moreover, the information is important to anyone concerned with commodity prices or grain and soybean marketing, both domestic and foreign because deviations from quarter-specific trends could affect prices

A natural extension of this work is a comparison of estimating equations for export shipments It is entirely plausible that shipments, especially in the short run, can be better predicted from a lag relationship on sales than from an econometric specification of shipments on economic variables Reversing the estimating equations in the text, thereby expressing sales as a function of current and future shipments rather than shipments as a function of lagged sales, is also possible The empirical question becomes "When will the commodity be shipped?" rather than "When was the commodity sold?"

The major contribution of this study is to show that export sales and export shipments of agricultural commodities differ dramatically, especially in the short run Furthermore, simple econometric specifications do not explain enough of the variation between the two variables to allow one to predict shipment levels based on past sales Researchers estimating economic parameters of the agricultural export sector cannot interchange these variables and obtain meaningful results Past research has used export shipments as the export variable in modeling international agricultural trade, when the use of export sales would have been more correct Thompson maintains that one of the two major problems with empirical work in international agricultural trade is specification error that biases estimates of the elasticity of export demand (*15*, p 10) This elasticity was of crucial importance in discussions leading to the Food Security Act of 1985, with estimates ranging from highly inelastic to highly elastic Knowledge of institutional structures in the export sector would help researchers better formulate the econometric models that generate the parameters used not only by policymakers but also by industry and private analysts who forecast prices and export quantities

References

(1) Ayuk, Elias T "An Economic Analysis of Export Sales and Export Shipments The Case for Cotton," M S thesis, Texas A&M Univ , Dec 1986

(2) Batten, Dallas S , and Michael T Belongia "The Recent Decline in Agricultural Exports Is the Exchange Rate the Culprit?" *Federal Reserve Bank of St Louis Review,* Vol 66, No 8, Oct 1984, pp 5-14

(3) Bessler, David A , and Ronald A Babula "Forecasting Wheat Exports Do Exchange Rates Matter?" *Journal of Business and Economic Statistics,* Vol 5, No 3, July 1987

(4) Chambers, Robert G , and Richard E Just "Effects of Exchange Rate Changes on U S Agriculture A Dynamic Analysis," *American Journal of Agricutural Economics,* Vol 61, No 2, May 1979, pp 249-57

(5) Collins, Keith J , William H Meyers, and Maury E Bredahl "Multiple Exchange Rate Changes and U S Agricultural Trade Models," *American Journal of Agricultural Economics,* Vol 62, No 4, Nov 1980, pp 656-65

(6) Conklin, Neilson C *An Economic Analysis of the Pricing Efficiency and Market Organization of the U S Grain Export System* U S General Accounting Office Study Supplement June 1982

(7) Heifner, Richard, Kandice Kahl, and Larry Deaton "A Study of Relationships Between Large Export Sales and Futures Trading," Appendix to *Export Grain Sales* Hearing before the Subcommittee on Small Business Administration and Small Business Investment Corporation Authority and General Small Business Problems of the Committee on Small Business U S House of Representatives, 96th Congress, 1st session, June 11, 1979

(8) Johnson, Paul R , Thomas Grennes, and Marie Thursby "Devaluation, Foreign Trade Controls, and Domestic Wheat Prices," *American Journal of Agricutural Economics,* Vol 59, No 4, Nov 1977, pp 620-27

(9) Machlup, Fritz "Explaining Changes in Balances of Payments and Foreign Exchange Rates A Polemic without Graphs, Algebra, and Citations," in *Flexible Exchange Rates and the Balance of Payments* (ed J S Chipman and C P Kindleberger) New York North-Holland Publishing Co , 1980

(10) Morgan, Dan *Merchants of Grain* New York Viking Press, 1979

(11) Orden, David "Money and Agriculture The Dynamics of Money-Financial Market-Agricultural Trade Linkages," *Agricultural Economics Research,* Vol 38, No 3, Summer 1986, pp 14-28

(12) Paarlberg, Philip L "Causes and Consequences of Restrictions on U S Agricultural Exports, 1973 to 1975 " IED Staff Report U S Dept of Agr , Econ Res Serv , 1980

(13) Paggi, Mechel "Macroeconomic Policy Implications from Empirical Analysis A Study of U S Rice Exports " Paper presented to the annual meeting of the American Agricultural Economics Association, Reno, NV, July 1986

(14) Ruppel, Fred J "Export Sales and Export Shipments of Corn, Wheat and Soybeans Institutional Relationships and Empirical Estimation " Ph D dissertation, Univ of Maryland, Dec 1984

(15) Thompson, Robert L *A Survey of Recent U S Developments in International Agricultural Trade Models* BLA-21 U S Dept of Agr , Econ Res Serv , 1981

(16) Tryfos, Peter "The Measurement of Price Elasticities in International Trade," *American Journal of Agricultural Economics,* Vol 57, No 4, Nov 1975, pp 689-91

(17) U S Department of Agriculture, Foreign Agricultural Service *U S Export Sales* 1973-85, various issues

In Earlier Issues

The application of a formal model to policy research is often accompanied by skepticism on the part of some and by the belief on the part of others that what comes out of a computer is automatically right Both reactions are incomplete No formal model has yet predicted aggregate response with consistent accuracy Neither has any informal model But all too often, formal models are reported in the literature as though their purpose is to replace informal methods A really effective tool kit must include both types

W Neill Schaller
Vol 20, No 2, April 1968