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OUTSTANDING EXPORT SALES AND THE DEMAND FOR ENDING STOCKS: AN EMPIRICAL CONNECTION

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ABSTRACT

Outstanding export sales (export sales which have been contracted but not yet delivered) are recognized as "encumbered" stocks and netted out of total ending stocks prior to estimating price elasticities of stock demand. Results from several specifications indicate much greater price responsiveness by inventory holders than previously believed.

INTRODUCTION

There has been an increasing amount of interest in the past few years in the use of export sales data in empirical estimation within agricultural economics. Two studies have used sales data to assess pricing efficiency in grain markets. Heifner, Kahl and Deaton analyzed the relationship between large export sales and futures trading and price movement in order to examine whether large trading companies possessed insider information which allowed them to take advantageous positions in cash and futures markets. Conklin examined weekly sales data and grain price movements[1] in order to analyze pricing efficiency in the U.S. grain export system. Both of these studies pointed to the further use of sales data in grain pricing analyses.

Ruppel examined institutional and empirical relationship between export sales and export shipments of corn, wheat and soybeans. Regressing export shipments on lagged values of export sales yielded significant lag lengths of one to four months in soybeans, up to six months in wheat, and lag lengths of nearly a year in corn. He also estimated systems of equations for the three commodities. He first structured a "traditional" system with behavioral equations for production, domestic disappearance, stock demand and export demand. The export demand equation in this traditional system used export <u>shipments</u> as the dependent variable. He then set forth an alternative model using export <u>sales</u> as the dependent variable in the export demand equation, defining a new behavioral equation for export shipments based on logistical reasoning. Not only were the estimated coefficients in the export demand equations dramatically different between the two

systems specifications (especially the corn equations), but also the stock demand equations generated surprisingly different outcomes between the two systems. The alternative model specification required netting out outstanding sales (discussed later) from ending stock levels, with much higher price elasticities of stock demand in the alternative model.

The current paper flows from the stock demand portion of this previous work. Those earlier results are reported, together with an econometric extension of that work. The intent is to point out the importance of taking export sales into consideration in commodity-specific modelling.

THE INSTITUTIONAL FRAMEWORK

Nearly all sales of grain and soybeans for export are made via forward contract. The commodity is sold today for delivery sometime in the future. Shipment may be within the month, or may be a year or more down the road. Seldom is there immediate delivery, except for small amounts which the exporter may already own. Over a long time span, we would presume that sales and shipment volume data would be equal. In fact they are separated only by cancellations and the net change in "outstanding export sales". Cancellations are not important in the present context. We simply net out contract cancellations from gross export sales and concern ourselves with net sales. That is, export shipments and net export sales are separated only by the net change in outstanding export sales.

Outstanding export sales is the measure of those sales which have been made but which have not yet been delivered. The level

increases as new export sales are made and decreases as exports are shipped. These levels fluctuate with market conditions and expectations on the part of importers. In a tight market with further expectations of short supply, buyers tend to increase their purchases for later shipment in order to insure availability of grain for later consumption. When grain is readily available, there is much less concern for having contracts made for future delivery, and the level of outstanding sales is low. Over a given time period, the data may show large or small differences between (net) export sales and export shipments, depending on the beginning and ending levels of outstanding sales.

The level of outstanding sales is important in stock demand and supply analysis because outstanding sales which are held and counted as stocks are in fact "encumbered", i.e., not available to potential buyers. In this sense, outstanding sales are much like PL480 committments which the government has made (out of CCC stocks) or Farmer Owned Reserve (FOR) stocks when the market price is below the release price. If one is interested in estimating price elasticities of (speculative) stock demand, these encumbered stocks need to be excluded from the calculation.

One might question the importance of outstanding sales in terms of quantity magnitudes. For the time period under analysis (quarterly, 1974-82 inclusive) outstanding sales of corn averaged 14.4 million metric tons (MMT), with a minimum of 5.6 MMT and a maximum of 27.8 MMT. During this same time period USDA total ending stocks of corn averaged 83.8 MMT, so that outstanding sales averaged 17% of ending stocks. Since outstanding sales are

highest and ending stocks lowest in the fourth crop quarter, negative net stocks are possible, with sellers anticipating new quantities available from the harvest. There were three quarters when net stocks of corn (total stocks less outstanding sales) were negative. Outstanding sales of wheat averaged 9.1 MMT (ranging from 4.8 to 15.0 MMT). Ending stocks averaged 46.9 MMT, such that outstanding sales of wheat averaged 19% of ending stock levels. There was only one quarter when outstanding sales exceeded ending stocks. There were four negative net stocks quarters in soybeans. Ending stocks averaged 23.1 MMT with outstanding sales averaging 26% of this figure at 6.0 MMT, ranging from 2.7 to 17.2 MMT.

There are a number of different reasons why an economic agent would desire to hold ending stocks in any given period. The government holds some stocks as a result of various farm programs. Farmers keep stocks on hand for feed. Seed companies hold some for the next planting. Speculators hold stocks in anticipation of higher prices in the next period. A true picture of the demand for ending stocks would divide the demand into its several categories. For comparative purposes this study uses the USDA gross stock count (net of outstanding sales) with the recognition that further stock classification would be desireable. It turns out that stock breakdown is not an important issue in the present context. The focus in this study is on the comparison between "traditional" stock demand and stock demand net of outstanding sales. It is presumed that the results obtained would be even stronger if stocks were treated more selectively.

THE ANALYTICAL MODEL

Total commodity demand is composed of domestic disappearance (DD), purchase for export (XD), and the demand for carryover stocks (SD). Beginning supply is the sum of production (PR) plus carry-in stocks from the previous time period (SD_{-1}). At equilibrium, total demand for the commodity equals the level of beginning supply:

$$PR^i + SD^i_{-1} = DD^i + XD^i + SD^i, \qquad (1)$$

where the "i" superscript denotes the commodity (1=corn, 2=wheat, 3=soybeans). This equilibrium condition together with behavioral equations for each of the separate components allows for determination of commodity price as the fifth endogenous variable in the system. Variants on this model are employed depending on the nature of the commodities being studied and the research questions being asked.

In the process of estimating the above system, a behavioral equation for the estimation of export demand is solved using export shipments as the dependent variable. This is the traditional manner in which systems which include export demand equations have been estimated. Recognition of a distinction between purchase demand (export sales, XS) and delivery demand (export shipments, SH) requires an alternative system which incorporates that distinction. The identity which defines outstanding sales (OS) links these two variables:

$$OS^i = OS^i_{-1} + XS^i - SH^i. \qquad (2)$$

The ending level of outstanding sales (sales which have been

contracted but not yet delivered) increases when current (net) export sales exceeds export shipments. With the distinction between export sales and shipments, the equilibrium condition stated earlier as Equation (1) no longer holds. It is not necessary that beginning stocks be consumed domestically, shipped as exports or held as ending stocks. Part of those beginning stocks can be held at the end of the period as outstanding sales. With no distinction drawn between sales and shipments, these outstanding sales simply show up as end-of-period stocks. That is, when we incorporate the distinction between sales and shipments, we define a new variable, $\tilde{SD}$, which is net stock demand. This is the demand by speculators, farmers, elevator operators and government officials for stocks to be held into the next period. Net stock demand is the old value (SD) less outstanding sales, defined over both the current period and the previous period:

$$\tilde{SD}^i = SD^i - OS^i; \qquad (3.1)$$

$$\tilde{SD}^i_{-1} = SD^i_{-1} - OS^i_{-1}. \qquad (3.2)$$

These two equations can be rearranged and inserted into Equation (1) to yield

$$PR^i + \tilde{SD}^i_{-1} + OS^i_{-1} = DD^i + XD^i + \tilde{SD}^i + OS^i. \qquad (4)$$

Since XD^i in the tradition model and SH^i in the alternative model are numerically equal, substituting Equation (2) into (4) and cancelling leaves a new equilibrium condition:

$$PR^i + \tilde{SD}^i_{-1} = DD^i + \tilde{SD}^i + XS^i. \qquad (5)$$

This condition is identical to (1) except that SD has been replaced with $\tilde{SD}$, and export sales has replaced export shipments. Estimating four behavioral equations as before for production, domestic disappearance, net ending stocks and export sales leaves price once again determined by the equilibrium condition. Finally, by estimating a behavioral equation for export shipments, the identity in (2) will solve for the level of outstanding sales as the last endogenous variable in the system.

The equation used to estimate stock demand includes as right-hand side variables the beginning stock level (production plus lagged stock demand), current real (CPI-adjusted) price, the interest rate and crop quarter dummy variables. The beginning stock level is expected to be highly positively related to the ending level. The price and the interest rate both reflect opportunity costs, and are inversely related to the demand for ending stocks. The higher the price, the greater is the opportunity cost of holding the commodity and the less probability that the price will be higher in the next period. A higher interest rate means greater interest income foregone on the cash that would have been received had the commodity been sold in the current period. Since the fourth crop quarter is dummied out, the crop quarter dummy variables are expected to enter positively, reflecting decreasing ending stock levels through the crop year.

Two econometric specifications are offered. The first leaves all the variables in their absolute quantity units. Beginning and ending stock levels are in thousand metric ton units, prices are in cents per bushel, and the interest rates are the current quarter's three-month-average Treasury Bill rate

quoted in percentage points. Elasticities are calculated by multiplying the regression coefficients by the ratios of the means of the right-hand-side variables to the dependent variable. A second specification expresses the critical variables (ending stock demand, price and interest rate) as percentage changes. This specification allows the regression coefficients on those modified variables to be interpreted as elasticities (Chavas). Beginning stock levels in this latter specification are in million metric ton units.

RESULTS AND DISCUSSION

Stock demand equations were estimated for each specification (level and percentage change) and for each model (the traditional and the alternative) using two stage least squares estimators. The quantity level specification results are reported in Table 1. One pair of equations is given for each commodity, with the letter preceding the variables in the equation denoting the commodity (C=corn, W=wheat, S=soybeans). The first equation of each pair (the "a" form) presents the traditional model, with ending stock levels (_SD) and beginning stock levels (_BEG) as gross measures with no adjustment for outstanding sales. The second equation (the "b" form) reports the alternative model, where the stock levels are net of outstanding sales (_SD* and _BEG*).

In presenting the results, the focus will be primarily on contrasting the "a" and "b" forms for each commodity. Three observations can be made with respect to each set of equations. As expected, the most important variable in explaining the ending level of stocks is the beginning level. However, that importance

TABLE 1. STOCK DEMAND EQUATIONS IN LEVEL FORM

(1a) CSD = − 9920 + 0.819 CBEG − 25.33 CPRI − 527.4 TBIL
(−1.54) (21.16) (−1.35) (−3.03)
[−0.07] [−0.05]
+ 5411 CQ1 + 2432 CQ2 + 544 CQ3
(0.98) (0.72) (0.29)

D.W. = 0.87 Durbin's h = 3.18 R-Square = 0.99

(1b) CSD* = 13636 + 0.637 CBEG* − 121.9 CPRI − 357.2 TBIL
(1.10) (8.91) (−3.24) (−1.15)
[−0.42] [−0.04]
+ 34447 CQ1 + 23544 CQ2 + 12139 CQ3
(3.49) (3.91) (3.49)

D.W. = 1.03 Durbin's h = 3.08 R-Square = 0.99

(2a) WSD = −2150.1 + 0.848 WBEG − 7.37 WPRI − 298.6 TBIL
(−0.56) (16.83) (−0.97) (−4.32)
[−0.05] [−0.06]
+ 3716 WQ1 + 3197 WQ2 + 1805 WQ3
(1.50) (1.84) (1.93)

D.W. = 1.27 Durbin's h = 1.81 R-Square = 0.99

(2b) WSD* = 18052 + 0.589 WBEG* − 49.2 WPRI − 261.7 TBIL
(2.90) (7.04) (−3.65) (−2.60)
[−0.42] [−0.06]
+ 13444 WQ1 + 9772 WQ2 + 5163 WQ3
(3.20) (3.41) (3.35)

D.W. = 1.95 Durbin's h = 0.27 R-Square = 0.99

(3a) SSD = −5611 + 0.792 SBEG − 1.12 SPRI − 97.1 TBIL
(−2.87) (18.74) (−0.45) (−1.58)
[−0.03] [−0.04]
+ 5251 SQ1 + 1937 SQ2 − 1597 SQ3
(3.13) (1.71) (−2.30)

D.W. = 0.83 Durbin's h = 3.53 R-Square = 0.99

(3b) SSD* = 10185 + 0.480 SBEG* − 25.5 SPRI − 199.5 TBIL
(2.27) (5.75) (−4.15) (−1.41)
[−0.82] [−0.10]
+ 18138 SQ1 + 11728 SQ2 + 5410 SQ3
(5.69) (5.39) (3.69)

D.W. = 1.33 Durbin's h = 1.71 R-Square = 0.98

NOTE: See text for variable definitions. "Asymptotic" t-statistics are reported in parentheses, elasticities at variable means in brackets where appropriate.

declines for each commodity as we move from the traditional model to the alternative model. Second, the coefficients on the crop quarter dummies make more sense in the alternative model. We expect ending stock levels to decline relatively consistently from the first crop quarter (the harvest) to the last. That decrease is more consistent, more steady when outstanding sales are netted out. Finally, the price elasticities of stock demand are much larger for the alternative model. For each commodity, the price elasticity increases from near zero (and insignificant) in the traditional model to -0.42 for corn and wheat and -0.82 for soybeans (all highly significant) when outstanding sales are netted out.

The corn and soybean equations in Table 1 have high serial correlation, as shown by the high Durbin's h-statistics. The equations in Table 2 are an attempt to correct for this serial correlation by expressing critical variables as percentage changes. Again the results change dramatically between the "a" and "b" equations. Price elasticities of stock demand increase (in absolute value) from near zero in the traditional model to -0.92 for corn and -1.43 for soybeans when outstanding sales are netted out. The interest rate elasticities have the opposite result, with significant results in the traditional model becoming insignificant in the alternative specification. This tendency for the price to increase in importance in the alternative model while the interest rate decreased in importance was also present for all three commodities in Table 1.

These results can be compared to other studies. Using a traditional five-equation model with export shipments as the

TABLE 2. STOCK DEMAND EQUATIONS IN PERCENTAGE FORM

(1a) CSD = −0.656 + 0.00149 CBEG − 0.076 CPRI − 0.110 TBIL
(−28.19) (5.19) (−0.60) (−1.80)

+ 0.098 CQ1 + 0.128 CQ2 + 0.112 CQ3
(2.08) (3.77) (4.21)

D.W. = 2.05 R-Square = 0.87

(1b) CSD* = −1.003 + 0.00239 CBEG* − 0.921 CPRI − 0.055 TBIL
(−17.31) (3.11) (−2.91) (−0.33)

+ 0.248 CQ1 + 0.362 CQ2 + 0.342 CQ3
(1.98) (4.00) (4.65)

D.W. = 1.86 R-Square = 0.79

(2a) WSD = −0.386 + 0.00167 WBEG + 0.457 WPRI − 0.034 TBIL
(−13.02) (2.72) (2.42) (−0.62)

+ 0.066 WQ1 + 0.048 WQ2 + 0.050 WQ3
(1.92) (1.59) (2.27)

D.W.= 1.04 R-Square = 0.72

(2b) WSD* = −0.533 + 0.00361 WBEG* − 0.138 WPRI + 0.078 TBIL
(−13.28) (3.59) (−0.61) (0.91)

+ 0.022 WQ1 + 0.061 WQ2 + 0.073 WQ3
(0.39) (1.29) (1.99)

D.W.= 2.00 R-Square = 0.60

(3a) SSD = −0.638 + 0.00206 SBEG + 0.093 SPRI − 0.070 TBIL
(−33.80) (2.18) (0.87) (−1.57)

+ 0.314 SQ1 + 0.252 SQ2 + 0.103 SQ3
(7.85) (8.46) (4.53)

D.W. = 0.99 R-Square = 0.94

(3b) SSD* = −1.341 + 0.00567 SBEG* − 1.428 SPRI − 0.299 TBIL
(−8.82) (0.73) (−1.94) (−0.66)

+ 0.775 SQ1 + 0.771 SQ2 + 0.708 SQ3
(2.28) (2.92) (3.30)

D.W. = 1.66 R-Square = 0.57

NOTE: See text for variable definitions. "Asymptotic" t-statistics are reported in parentheses. Coefficients on "_PRI" and "TBIL" variables can be interpreted as elasticities.

dependent variable in the export demand equation and no adjustment for outstanding sales in their stock demand equations, Chambers and Just found price elasticities of stock demand of -0.17 for corn, -0.25 for wheat and -0.03 for soybeans over quarterly data from 1969(I) to 1977(II). The current model is closer in form and methodology to their work than to any other. Subotnik and Houck calculated elasticities at the variable means for corn over quarterly data from 1957(IV) to 1975(III). Their largest (short run) elasticity calculation of -0.60 was for off-farm stocks during the first crop quarter. These numbers declined through the crop year to -0.51, -0.20, and -0.11 in CQ2-CQ4 respectively. The largest on-farm elasticity was -0.18 during the third crop quarter.

Clearly the current calculations are much larger than any reported above. Stockholders are much more responsive to the price level in the current period than heretofore imagined. A price elasticity of stock demand near zero implies that stockholders have a fixed amount they desire to hold into the next period, with very little willingness to veer from that amount. A zero elasticity in fact eliminates or discounts very highly speculation as a motive for holding stocks. The current results pointing to higher (possibly even elastic) responsiveness is based not on theoretical or econometric manipulation, but on the statistical recognition that encumbered stocks should not be treated in the same fashion as free stocks. Though the present study suffers in failing to disaggregate ending stocks into their many separate components, it does contribute by showing the econometric gains that can be made by recognizing outstanding sales as encumbered stocks.

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