PRICE EFFICIENCY OF MARKETING BOARDS: THE CASE OF GRAIN SORGHUM

Volume II

A Dissertation

by

CLAUDE PARR ROSSON, III

Submitted to the Graduate College of
Texas A&M University
in partial fulfillment of the requirement for the degree of

DOCTOR OF PHILOSOPHY

December 1982

Major Subject: Agricultural Economics

PRICE EFFICIENCY OF MARKETING BOARDS: THE CASE OF GRAIN SORGHUM

Volume II

A Dissertation

by

CLAUDE PARR ROSSON, III

Approved as to style and content by:

Thomas L. Sporleder
(Chairman of Committee)

Stephen Fuller
(Member)

Carl C. Shafer
(Member)

Ray T. Gilbert
(Member)

Carl C. Shafer
for (Head of Department)

December 1982

TABLE OF CONTENTS

Page

Page

Page

LIST OF TABLES

Table | Page

Volume I

List of Figures

Volume I

Volume II

CHAPTER IX

RESULTS OF PRICE ANALYSIS

Introduction

The results of the analyses outlined in Chapter V are presented in three main sections of this chapter. The first section presents results of the analysis of price efficiency from port to farm level. The next section contains results of price efficiency from Japan to exporting country port level. The relationship of marketing boards to price levels and variability are examined in the third section.

Each section presents the main hypothesis to be examined, then outlines the model specification used, presents the results of the price efficiency analysis, and discusses tentative conclusions drawn from the analysis.

The Argentine grain marketing system was controlled by the National Grain Board(NGB) from August 1973 to March 1976. Therefore, it was necessary to separate the price efficiency analysis into two periods: the first from 1973-1976, the second from 1977-1980. This division allowed Argentine prices to be analyzed under a market-managed and a market-oriented system. To allow valid comparisons to be made across countries, this time separation was maintained in each country at both levels.

South Africa was not included in the analysis of price efficiency from the port to farm level because the Maize Board merely implements the floor price scheme for sorghum. The Maize Board, in fact, encourages producer sales to the private trade, thereby minimizing the effect of the board. Australia was under a board system during both periods and was analyzed as such. The Texas grain marketing system reflects the least degree of intervention of any system examined. It provides the market-oriented perspective during both periods and is used for comparison purposes.

The first analysis examined price efficiency between port and farm levels. Prices were analyzed for Argentina, Australia, and Texas allowing for the time separations above. Rates of price adjustment were compared across countries to determine if farm prices in any system responded more rapidly than the others to changes at the port level.

The second section analyzed price efficiency between Japan and the exporting country port level. All four exporting countries were included in this analysis with the same time separations as above. Price adjustment coefficients were used to determine which prices responded most rapidly to the Japanese price.

The effect of marketing boards on price level and variability were examined in the third section. The Argentine and Australian systems were analyzed from 1969-1980 to determine if their respective boards had raised and stabilized prices.

Price Efficiency Analysis from Port to Farm Level

Hypothesis 1 - Marketing board systems respond less rapidly to changes in world price level than nonboard systems.

A system of partial adjustment distributed lag equations was specified to evaluate the rate at which price information is transmitted between levels within the four marketing systems. Simple regression equations estimated jointly were used to examine the accuracy with which price information was passed between levels. Monthly average grain sorghum price data to test these relationships. The specific purpose of this analysis was to compare adjustment coefficients across countries to determine if the relative speeds of adjustment were different.

The test for the difference between two regression coefficients was used to determine whether or not rates of adjustment, intercepts, and slopes were significantly greater in a particular country. The test was:

$$t= bi-bj/\sqrt{Var(bi)+Var(bj)-2Cov(bi,bj)} \quad \text{(Kmenta, p.372),}$$

where Var(bi) represents the variance of the respective estimated coefficients and Cov(bi) is the covariance between these coefficients. This is evaluated as a t test statistic and determines if the coefficients from the two equations are significantly different under the null hypothesis Ho: bi=bj.

Japan is included as the main source of demand for grain sorghum because it accounts for about one-half of world sorghum imports and is the major market for each of the aforementioned exporting countries (table 7,p.23). Monthly corn prices at Rotterdam were included since corn is a substitute for sorghum in many end uses.

Model Specification

The following distributed lag models were used in this analysis.

Distributed Lag Models

Argentina

10.1 $P^f_{1t} = a_1\lambda_1 + \lambda_1 b_{11} P^p_{1t-1} + \lambda_1 b_{12} T_{1t} + \lambda_1 b_{13} C_{1t} + (1-\lambda_1) P^f_{1t-1} + \lambda_1 b_{14} P^f_{t-2} + e_{1t}$

Australia

10.2 $P^f_{2t} = a_2\lambda_2 b_{21} P^p_{2t-1} + \lambda_2 b_{22} T_{2t} + \lambda_2 b_{23} C_{2t} + \lambda_2 b_{24} W_{2t} + (1-\lambda_2) P^f_{2t-1} + P^f_{t-2} + e_{2t}$

Texas

10.3 $P^f_{3t} = \lambda_3 a_3 + \lambda_3 b_{31} P^p_{3t-1} + \lambda_3 b_{32} T_{3t} + \lambda_3 b_{33} C_{3t} + (1-\lambda_3) P^f_{3t-1} + \lambda_3 b_{34} P^f_{t-2} + e_{3t}$

where:

P^f_{it} = monthly average farm price for grain sorghum at time t in ith country

P^p_{it} = monthly average port level (f.o.b.) price for grain sorghum at time t in ith country

T_{it} = monthly average transport charges for heavy grains at time t in country i

C_{it} = monthly average price of corn at time t in Rotterdam

W_{2t} = monthly average price of stockfeed wheat at time t in Australia

P^f_{it-j} = monthly farm price for grain sorghum in country i lagged j periods

λ_i = rate of adjustment in ith country

E_t = error term in ith country $= \lambda e_{t1} + e_{t2}$ (see equation 5.4).

The farm price was lagged two periods to allow testing model specification. If the second lag was not significant and the first lag was, the model was correctly specified and fit the one period lag structure. The basic concept for this application of causality under the distributed lag hypothesis is found in Pindyck and Rubinfeld. The analysis provided an empirical test of the relationship between variables in different time periods. It allows an explicit test of the hypothesis that prices at time t at a given level in a particular country are a function of prices in t-1 and t-2. If the coefficient on the second lag(t-2) is not significant, while the first lag was significant, one may conclude that the price in t-1 lead the price in t and the first lag specification was correct.

The speed of price adjustment was based on the following criteria: the coefficient of adjustment (λ) was evaluated for each country at the port and farm levels to determine if it was significantly different from unity, since unity implies instantaneous adjustment. Conversely, this hypothesis may be evaluated directly from the model as Ho: $(1-\lambda) = 0$. If one fails to reject Ho, instantaneous adjustment was occurring. The coefficient of adjustment was then compared across equations (countries) to determine if adjustment was occurring at a greater rate at different levels in a particular country.

Initial estimates of the parameters were made in common log form, percent change of logs, and linear form. Insignificant variables were removed and the equations were reestimated. Because of mixed performance of the log linear models, it was apparent that they were not superior to hte linear models. Therefore, in the interest of simplicity all estimates were made in linear form.

were made in linear form.

Regression Models

To evaluate the second aspect of price efficiency, accuracy, regression models were specified for the grain marketing system in each country. The perfect market concept suggested by Bressler and King (p. 413) was used, which closely follows the Thompson and Dahl analysis.

The efficiency criteria used to evaluate accuracy tested for the strength of the relationship between prices at different levels in the marketing channel and determined how closely price differentials approximate transport costs. Monthly average grain sorghum prices at the farm, port elevator, and c and f prices in Japan were used to examine pricing accuracy within each country. Slope and intercept terms were compared across countries to determine relative accuracy.

The destination price can be expressed as:

10.4 $Pd = Po + C + E$

where Po is origin price, C is transfer cost (including transport) and E is a random error term. If Pd is adjusted for freight, 10.4 becomes: 10.5 $Pd - Cf = Po + Ct + E$ where Cf is freight between destination and origin and Ct represents costs of transfer other than freight. Now 10.5 can be estimated as a single equation with the intercept term reflecting the cost (other than freight) of moving grain between origin and destination.

Simple regression models were specified for each country as:

Argentina

10.6 $P_t^{p*} = a + BP_t^f + e_t$

Australia

10.7 $P_t^{p*} = a + BP_t^f + e_t$

South Africa

10.8 $P_t^{p*} = a + BP_t^f + e_t$

Texas

10.9 $P_t^{p*} = a + BP_t^f + e_t$

where the following refer to data within each country:

P_t^f = monthly average farm price for grain sorghum,

P_t^{p*} = monthly average port price (f.o.b.) for grain sorghum in period t, adjusted for transportation between farm and port level.

The B value from each equation was tested to determine its significance level which reflects the strength of the relationship between prices, therefore the accuracy of the price adjustments. B also was tested for unity which would indicate a less than perfect one-to-one relationship between prices. The B's were compared at the same marketing level among the countries to determine if the marketing system in a particular country more accurately reflected world price conditions.

The intercepts from each equation were compared to determine which countries had lower transfer costs exclusive of transport.

Seasonal quarterly dummy variables were placed in each model and tested for significance.

Results of Price Efficiency Analysis from Port to Farm Level - Period 1973-76

The three distributed lag models were tested for fit by including the second lag of farm price as an independent variable. This coefficient was not significant in any of the equations, while the farm price lagged one period was significant in each equation (table 98). Therefore, the partial adjustment distributed lag model was the correct specification. The distributed lag estimates were made in real domestic currency, thereby eliminating the effects of changes in the general price level. Because the intercepts and slopes of the simple regression models had to be compared across countries, estimates were made in real U.S. dollars. The seasonal dummy variables were not significant in any model. Initial parameter estimates were made in linear form; all coefficients not significant at 90 percent were dropped from the model and the model was reestimated. Log estimates of the simple regression models were attempted, but resulted in less significant estimates than linear models. Therefore Tables 98 and 99 are final linear estimates of the distributed lag and regression models. Comparisons among the countries are made in Table 99.

The Argentine farm price was found to be a function of only the c and f price for sorghum in Japan and the lagged farm price (table 98).

Table 98. Results of Distributed Lag Analysis of Farm Level Grain Sorghum Prices, 1973-76

Variables	Parameter Estimates[a]		
DEP VAR: Farm Price Mean Value	Argentina P1,058.16	Australia $A75.73	Texas $96.73
Intercept	648.82 (3.56)	-1.15 (-.21)	33.76 (15.51)
Trend Var.		-.0011 (-1.17)	
c and f Sorghum Japan	-.038 (2.85)		
f.o.b. Sorghum		.553 (3.35)	.265 (1.80)
f.o.b. Sorghum lagged one month		-.589 (-3.06)	
cif Corn - Rotterdam		-.685 (-2.93)	.322 (2.73)
cif Corn - Rotterdam lagged one month		.069 (2.32)	-.335 (-3.24)
Transport rate farm to port		6.83 (7.09)	.945 (2.10)
Transport rate lagged one month		-3.68 (-2.50)	
Farm Price - Sorghum lagged one month	.630 (5.99)	.750 (4.91)	.321 (2.37)
Coefficient of adjustment	.370 (11.1)	.250 (.980)	.679 (3.19)
R-Square	.762	.976	.619
Significance of Overall Model	.0001	.0001	.0001

[a]All estimates are in domestic real currencies per MT. Numbers in parentheses are t-values; any value greater in absolute value than 2.03 indicates statistical significance at .05 level.

Table 99. Results of Simple Regression Model Analysis of Adjusted Port Level Price and Farm Price of Grain Sorghum, 1973-76

DEP VAR: ADJFOB[a] Variables	Argentina	Australia	S. Africa	Texas
		Parameter Estimates[b]		
Intercept	90.39 (22.37)	7.31 (4.32)	62.14 (5.01)	73.27 (6.16)
Farm Price for Sorghum (slope)	.132 (1.15)	.776 (26.35)	.428 (2.77)	.344 (2.82)
R-Square	.0019	.943	.252	.316
Correlation	.0000	.890	.063	.10
Slope Significantly Different from One	Yes	Yes	Yes	Yes
Significance of Overall Model	.804	.0001	.0021	.0004

[a]All estimates in real U.S. dollars per MT; ADJFOB is port price minus transport charges from farm level to port.

[b]t-values are in parentheses; a number greater in absolute value than 2.03 indicates significance at .05 level.

The first estimates were made in nominal pesos, but resulted in a lagged farm price with a negative coefficient.
Deflating the prices resulted in a positive coefficient estimate. Although the Japanese price was significant, it had a negative sign indicating that a one peso increase in Japan resulted in a P.04 decline in Argentina. This may seem counter intuitive at first, but reflects the relationship between the Argetine peso and Japanese yen during this period. As the yen was increasing in value, the peso was declining.

The R-square of this equation was .762 indicating that the variables were explaining about three-fourths of the variation in farm price. The coefficient of adjustment was .37 suggesting that about one-third of the adjustment in farm price occurred during the first month. Approximately 6.5 months were required for full adjustment to occur.

The coefficient of determination for the Australian model was 0.976. The lagged farm price was significant at the .05 level and had a positive coefficient as expected. The coefficient of adjustment was .250, indicating that one-fourth of the adjustment in farm price occurred during the first month,however it was not significant. About ten months (10.4) were required for 95 percent of the adjustment in farm price to occur. The prices of f.o.b. sorghum and lagged f.o.b. sorghum at the port were significant and indicated that a one $A increase in sorghum during the present month resulted in a $A.53 increase at the farm during the same month, other variables constant. The lagged f.o.b. price was negative indicating that high prices in the previous month resulted in lower prices the following month.

A time trend variable was added to this model in an attempt to explain the positive transport coefficient. Although the coefficient remained positive, the lagged value became negative and highly significant. The lagged transport coefficient indicated that a $A3.68 increase in transport rates during hte current month reduced farm price by $A1.00 the following month.

The Texas model had a coefficient of determination of .619. The lagged farm price coefficient was positive and indicated significance at the .05 level. Over two-thirds of the adjustment in farm price occurred during the first month (.68) and 2.6 months were required for 95 percent of the adjustment to occur. The f.o.b. port price for sorghum was significant at the .10 level indicating that a one dollar per MT increase at the port resulted in a $.27 increase at the farm level. The coefficient for c.i.f. corn at Rotterdam revealed that a $.32 increase in the farm price resulted from a one dollar increase in corn.

The transport coefficient was positive, implying that a one dollar increase in rates resulted in a $.95 increase in the farm price. However, this result runs counter to the theory of derived demand which requires that an increase in margin reduce demand, hence price, at the farm level.

Time trend variables up to the third power were placed in the model in an attempt to determine if the positive sign was the result of unexplained trend in the data. However, these variables were not effective because when significant, other coefficients(c.i.f. corn and lagged farm price)became nonsignificant indicating multicollinearity between the trend variable and the nonsignificant variable. The transport rate was lagged up to five months in the presence of trend variables, but the lagged coefficients were not significant.

Several factors may partially explain the poor performance of the transport rate proxy. First, the rate was a proxy and estimated as the difference between prices paid to farmers in central Texas and theGulf. Gulf prices are subject to extreme fluctuation due to the close proximity of the port. Prices in Central Texas may not reflect all of the shocks affecting the Gulf price, resulting in wide disparity, hence a poor proxy. Second, the use of price differentials as transport may be confounded by the fact that storage costs were assumed zero. This would result in an underestimation of the rate. Third , close examination of the proxy revealed that month to month changes were more extreme than normally expected of transport rates.

To answer the question of how closely farm prices follow the f.o.b. port price adjusted for transport, simple regressions were applied to the price series of each region.

Generally, a poor correlation was found between adjusted f.o.b. price and farm price in each country except Australia (table 99). The R-square was .94 with a correlation of .89 indicating a close relationship between prices at the two levels. Although the intercept was significant, it was the smallest of the four countries, $7.31. The farm price coefficient was significant and revealed a slope of .76 indicating a close relationship between prices. This evidence suggests farm price and f.o.b. price were closely correlated.

Argentine prices reflected the least correlation with an R-square of .0019 and an intercept of $90.39. The Texas model had an intercept term of $73.27 and an R-square of .316. Although South Africa was not analyzed with the distributed lag model to determine speed of adjustment, it was analyzed to determine how accurately price movements at the port were reflected by farm prices. An R-square of .25 resulted, with an intercept of $62.14.

Figures 19-22 show these relationships clearly. Notice as the Argentine f.o.b. port price increased between August 1974 and November 1975, the farm price declined, reflecting poor correlation between the prices. The Texas and South African farm prices followed their respective port prices fairly close, but not as closely as the Australian farm price. The price received by members of the board was slightly above the adjusted port price. Two factors may partially explain this relationship: a) the transport rates used in this analysis are average rates and may not be representative estimates at any point in time, overestimating the actual rates for hauling grain and b) it is probable that the board received a premium above the average port price due to quality standards that are strictly enforced. As the regression models indicate, the Australian system most accurately reflected changes at the port level.

In comparing the results across countries it is important to note that the slope and intercept terms were estimated in real U.S. dollars, while the adjustment coefficients reflect the time dimension. The speed of price adjustment in Texas was significantly greater than

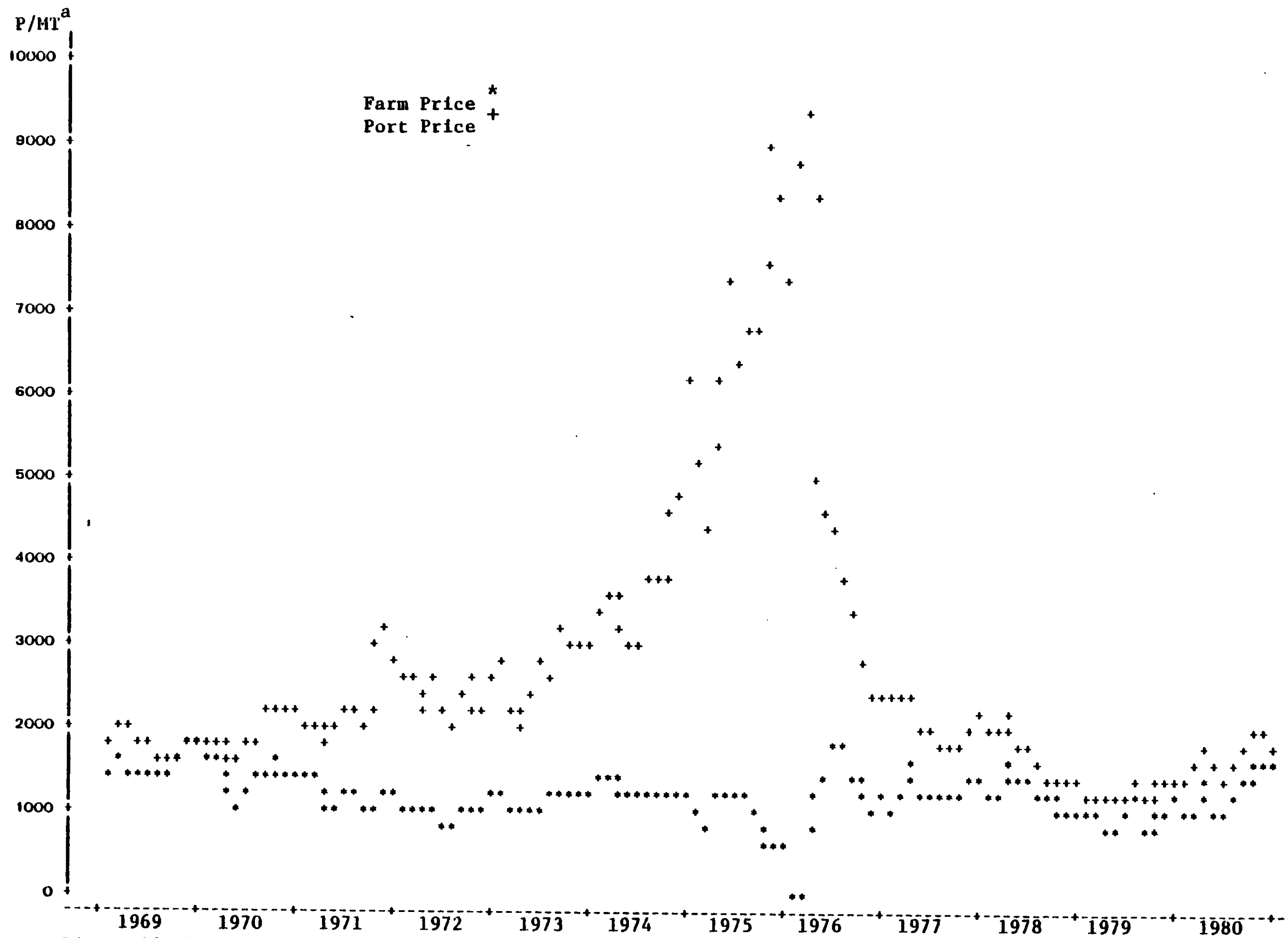

Figure 19. Argentina: Monthly Average Sorghum Prices at the Farm and Port Levels, 1969-80

[a]Real Pesos per metric ton.

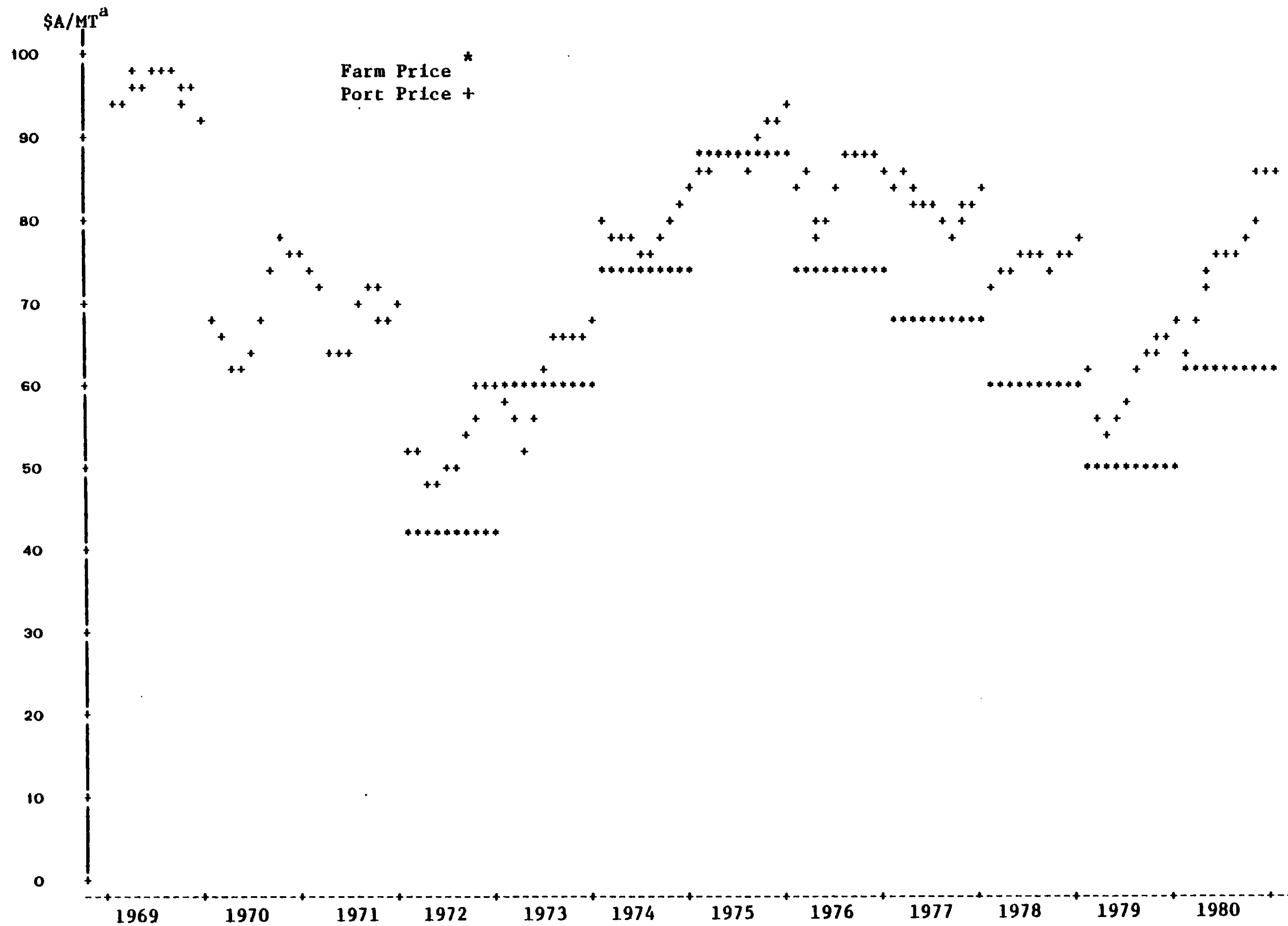

Figure 20. Australia: Monthly Average Sorghum Prices at the Farm and Port Levels, 1969-80

[a]Real Australian dollars per metric ton.

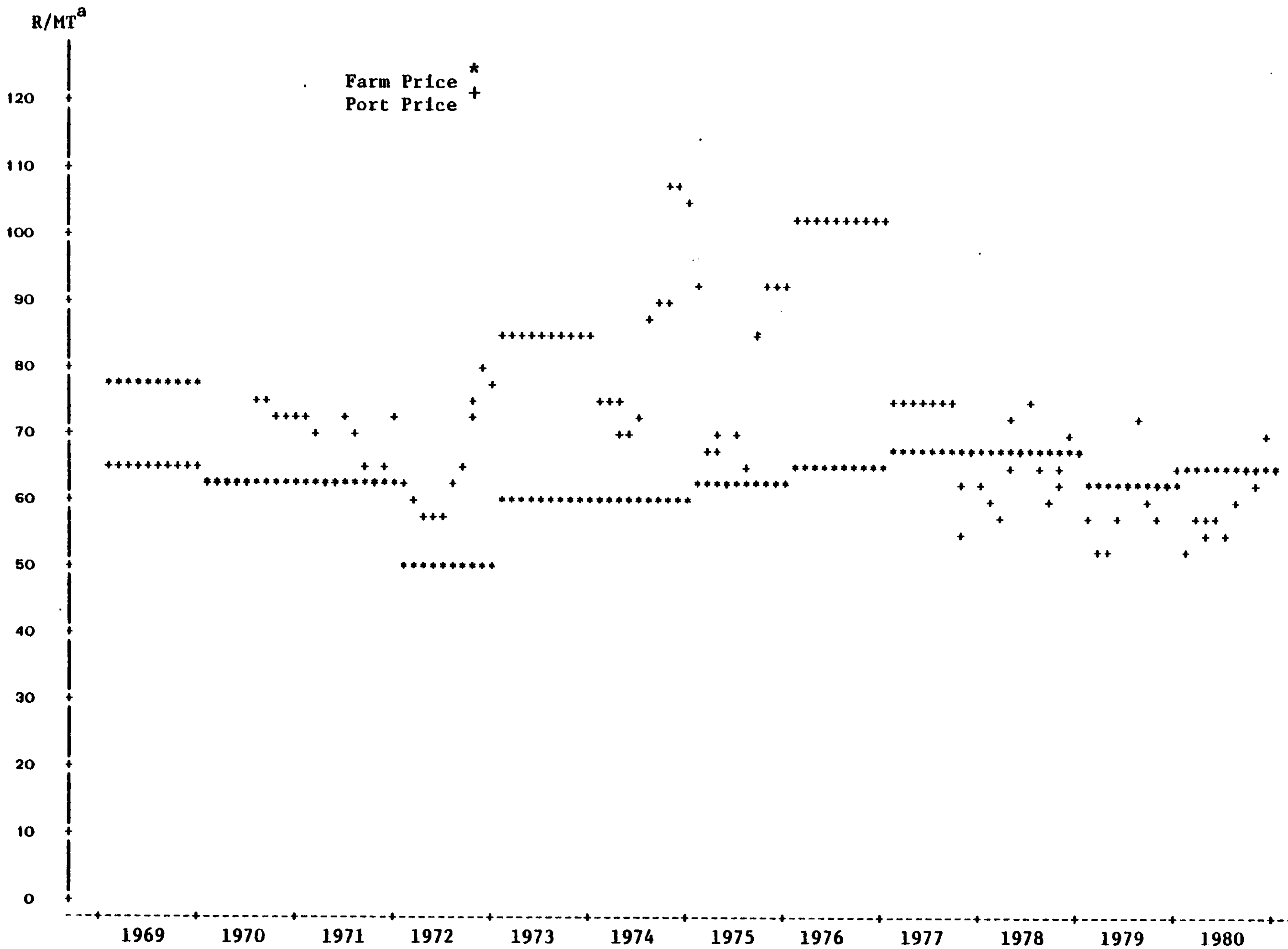

Figure 21. South Africa: Monthly Average Sorghum Prices at the Farm and Port Levels, 1969-80

[a]Real Rand per metric ton.

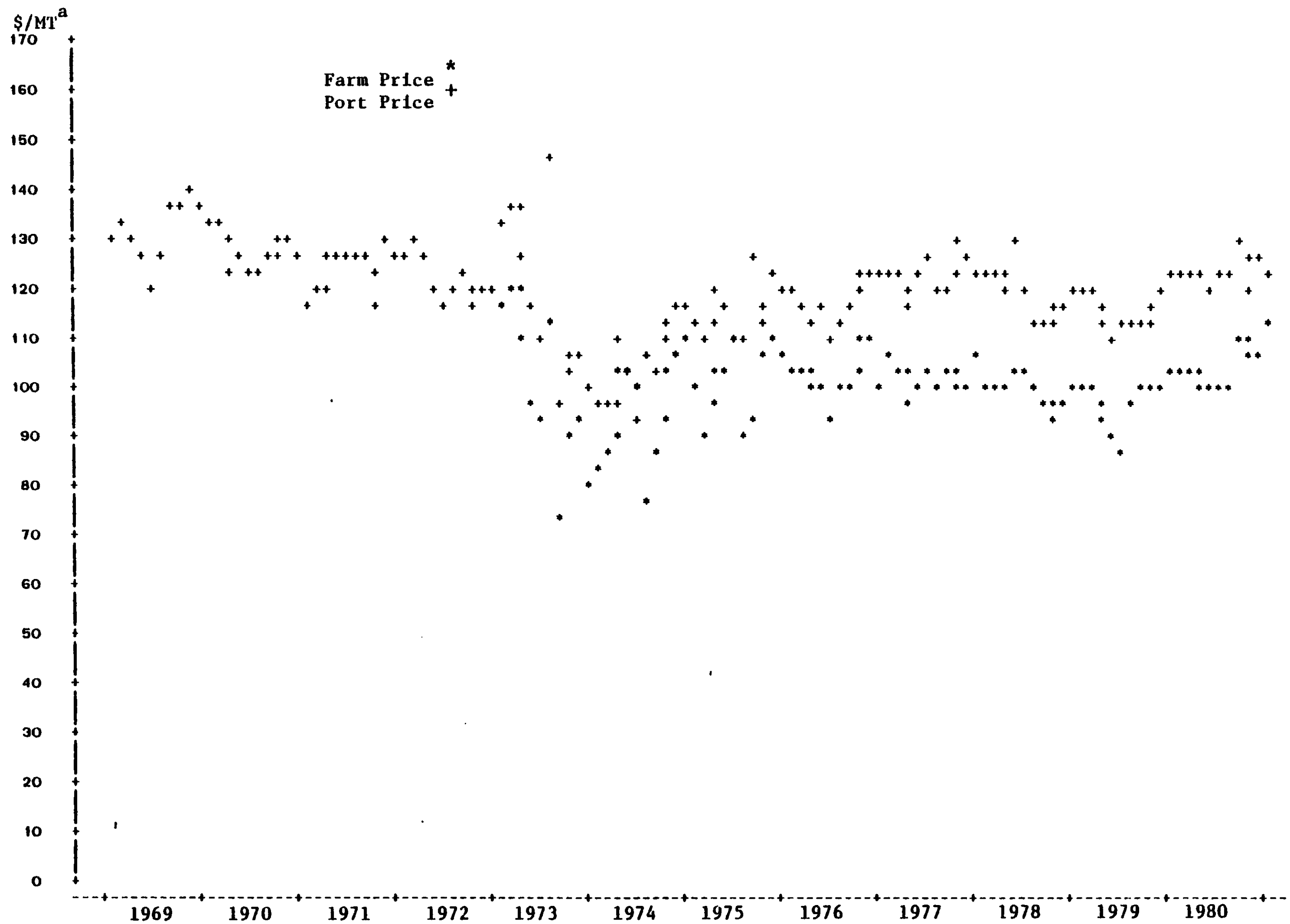

Figure 22. Texas: Monthly Average Sorghum Prices at the Farm and Port Levels, 1969-80

[a]Real dollars per metric ton.

in Argentina or Australia (table 100). No significant differences were found between the speed of price adjustment in the other systems.

The slope coefficients reveal that the Australian system more accurately reflected price changes than any other system. No significant differences existed between Texas and the other systems. Comparison of intercept terms revealed that the Australian system had significantly lower unexplained transfer costs than any of the other systems. The South African system exhibited significantly lower transfer costs than Argentina.

These results suggest that between 1973 and 1976 the marketing board system in Australia reflected price changes at the port level with less speed and greater accuracy than the Argentine or Texas systems. The Australian port price also reflected less unexplained transfer cost than the other systems.

Period 1977-80

During this period the overall fit of the models was inferior to the 1973-76 period. R-square ranged from .62 for Texas to .94 for Australia. The Argentine model had an R-square of .66, indicating that c and f sorghum in Japan, the f.o.b. port price, lagged port price, and lagged farm price explained about two-thirds of the variation in farm price (table 101). As before, the c and f price in Japan was negative indicating that an increase would result in a .18 real peso decline in the farm price. The coefficient of adjustment was .214, but was not significant, indicating very little adjustment occurred in the first month.

Table 100. Farm Level Country Comparisons of Adjustment Coefficients from Distributed Lag Models and Slope Intercept Terms from Simple Regression Models, 1973-76

Adjustment Coefficient Comparison[a]	Slope Coefficients	Intercept Comparison
TX > ARG[b] (1.80)	AUS > ARG (5.36)	AUS < ARG (18.95)
AUS = ARG (.50)	ARG = SA (1.52)	SA < ARG (2.21)
TX > AUS* (1.37)	TX = ARG (1.22)	TX > ARG (1.37)
	AUS > SA (2.45)	AUS < SA (4.76)
	AUS > TX (3.45)	AUS < TX (5.57)
	TX = SA (.46)	TX = SA (.70)

[a] Texas = TX, Argentina = ARG, Australia = AUS, South Africa = SA.
[b] t values are in parentheses; a value greater than 1.69 indicates significance at .05 level.
* significant at .10 level.

Table 101. Results of Distributed Lag Analysis of Farm Level Grain Sorghum Prices, 1977-80

Variables	Parameter Estimates[a]		
DEP VAR: Farm Price	Argentina	Australia	Texas
Mean Value	P1,191.16	$A63.17	$100.90
Intercept	254.12	2.77	17.32
	(2.32)	(1.20)	(1.29)
c and f Sorghum - Japan	-.179		
	(-1.69)		
f.o.b. Sorghum	.161	.391	.208
	(1.27)	(4.21)	(1.55)
f.o.b. Sorghum lagged one month	.069	-.339	
	(1.53)	(-3.32)	
cif Corn - Rotterdam		-.066	.149
		(-1.46)	(1.28)
cif Corn - Rotterdam lagged one month		.083	-.155
		(1.87)	(-1.64)
Transport farm to port			.658
			(2.51)
Farm Price Sorghum lagged one month	.786	.863	.559
	(10.28)	(10.90)	(5.31)
Coefficient of adjustment	.214	.137	.441
	(.476)	(.205)	(2.59)
R-Square	.658	.939	.618
Significance of Overall Model	.0001	.0001	.0001

[a]All estimates are in domestic real currencies per MT. Numbers in parentheses are t-values; any value greater in absolute value than 2.00 indicates statistical significance at .05 level.

The Australian model indicated that the f.o.b. port price for sorghum and the lagged f.o.b. price were significant factors in explaining the farm price. A one dollar A increase at the port resulted in a $A.39 increase at the farm that same month. The c.i.f. corn price at Rotterdam was negatively correlated with the farm price, but was not significant. The adjustment coefficient was not significant indicating very little adjustment occurred during the first month.

The Texas model indicated that the f.o.b. port price was an important factor in explaining farm price as was the lagged price of corn at Rotterdam. However, the most significant variables in explaining farm price were transportation and lagged farm price. The results indicate that a one dollar increase in transport rates result in a $.66 increase in the farm price. The coefficient of adjustment was significant indicating that almost half (.44) of the adjustment in farm price occurred during the first month. Five months were required for full adjustment to occur, which is more than required in the 1973-76 period.

The results of the regression of adjusted port price on farm price indicate that Australian prices had the strongest relationship (table 102). The R-square for the Australian model was .752 and the correlation between adjusted port price and farm price was .566. The slope of this model was not significantly different from one at the .05 level. The intercept was significant and indicated $8.49/MT unexplained transfer cost between port and farm level.

Table 102. Results of Simple Regression Model Analysis of Adjusted Port Level Price and Farm Price of Grain Sorghum, 1977-80

DEP VAR: ADJFOB[a] Variables	Argentina	Australia	S. Africa	Texas
		Parameter Estimates[b]		
Intercept	77.58	8.49	128.42	72.98
	(16.76)	(1.41)	(11.84)	(7.42)
Farm Price for Sorghum (slope)	.294	.940	-.211	.421
	(5.52)	(13.84)	(-2.36)	(4.32)
R-Square	.266	.752	.111	.272
Correlation	.070	.566	.012	.074
Slope Significantly Different from One	Yes	No	Yes	Yes
Significance of Overall Model	.0001	.0001	.010	.0001

[a] All estimates in real U.S. dollars per MT; ADJFOB is port price minus transport chages from farm level to port.

[b] t-values are in parentheses; a number greater in absolute value than 2.00 indicates significance at .05 level.

The Texas model exhibited a .07 correlation between adjusted port and farm prices. However, the slope was significantly different from one and a significant intercept was encountered, which indicated $73/MT in unexplained transfer cost.

The Argentine model had an R-square of .266 and exhibited a .07 correlation between adjusted port and farm prices. The slope did not equal one and $78 in unexplained transfer costs were reflected in the intercept.

The South African model showed a very weak relationship between port and farm prices as indicated by a .012 correlation. However, this result may not be surprising when one considers that in many seasons sorghum is exported at a loss and the port price may not be the significant factor in setting the farm price. This model also had the highest unexplained transfer cost, $128/MT.

In comparing the models to determine price efficiency, it should be noted that the Texas system responded the quickest to changes in the port price (table 103). However, the Australian model generated the only slope that was not different from one and also exhibited the highest correlation between adjusted port price and farm price. Australia also had the smallest unexplained transfer cost. Therefore, it was not possible to draw definite conclusions. It would appear that the Texas system responded the quickest, while Australian farm prices reflected changes in the port price more accurately than the others.

It is not possible to arrive at a general conclusion concerning

Table 103. Farm Level Country Comparisons of Adjustment Coefficients from Distributed Lag Models and Slope and Intercept Terms from Simple Regression Models, 1977-80

Adjustment Coefficient Comparison[a]	Slope Coefficients	Intercept Comparison
TX > ARG[b] (1.70)	AUS > ARG (7.72)	AUS < ARG (9.42)
AUS = ARG (.69)	ARG > SA (6.09)	ARG < SA (5.16)
TX > AUS (2.31)	TX > ARG (1.27)*	TX = ARG (.41)
	AUS > SA (9.29)	AUS < SA (8.87)
	AUS > TX (4.41)	AUS < TX (5.63)
	TX > SA (4.76)	TX < SA (3.77)

[a] Texas = TX, Argentina = ARG, Australia = AUS, South Africa = SA.
[b] t values are in parentheses; a value greater than 1.65 indicates significance at .05 level.
* indicates significance at .10 level.

hypothesis one based on this evidence. During the first period (1973-76) the Australian system reflected changes in the f.o.b. port price more accurately than the market-oriented Texas system. There was no significant difference in the speed of price adjustment in the two systems. Therefore, with specific reference to the Australian system, hypothesis one can be rejected and it may be concluded that the market-managed grain marketing system responded more accurately and as quickly as the market-oriented Texas system. The Texas system responded more quickly than the Argentine, but no significant differences were found regarding accuracy within the two systems. Therefore, one must fail to reject hypothesis one in the Argentine case and conclude that the farm price responded slower, but as accurately as the Texas farm price.

Price Efficiency Analysis Between Japan and Exporting Country Port Level

Model Specification

As before, partial adjustment distributed lag equations were specified for each country analyzed.

Distributed lag models

Argentina

10.10 $$P^p_{1t} = a_1\lambda_1 + \lambda_1 b_{11} P^j_{1t} + P^f_{t-1}\lambda_1 + \lambda_1 b_{12} C_{1t} + \lambda_1 b_{13} F_{1t} + \lambda_1 b_{14} X_{1t} + (1-\lambda_1) P^p_{1,t-1} + e_{1t}$$

Australia

10.11 $$P^p_{2t} = \lambda_2 a_2 + \lambda_2 b_{21} P^j_{2t} + P^f_{t-1} + \lambda_2 b_{22} F_{2t} + \lambda_2 b_{23} C_{2t} + \lambda_2 b_{24} XC_{2t} + (1-\lambda_3) P_3{}^p_{,t-1} + e_{2t}$$

South Africa

10.12 $P^{p}_{3t} = a_3 \lambda_3 + b_{31}\lambda_3 P^{j}_{3t} + P^{f}_{t-1}\lambda_3 + \lambda_3 b_{32} F_{3t} + \lambda_3 b_{33} C_{3t} + \lambda_3 b_{34} XC_{3t} + (1-\lambda_3) P^{p}_{3,t-1} + e_{3t}$

Texas

10.13 $P^{p}_{4t} = \lambda_4 a_4 + \lambda_4 b_{41} P^{j}_{4t} + P^{f}_{t-1}\lambda_4 + \lambda_4 b_{42} F_{4t}$
$\lambda_4 b_{43} C_{4t} + (1-\lambda_4) P^{p}_{4,t-1} + e_{4t}$

where:

P^{f}_{t-1} is as before

P^{p}_{it} is as before

λ_i is as before

e_{it} is as before

P^{j}_{it} = monthly average c and f price for No. 2 yellow sorghum in Japan, a proxy for world demand

F_{it} = monthly average ocean freight rate for heavy grains between ith exporting country and Japan

Cit = cif corn at Rotterdam,

XC_{it} = rate of exchange between foreign currency and U.S. dollar.

To examine the accuracy between the importing c and f price and the export f.o.b. price, simple regression models were used.

Argentina

10.14 $P^{j*}_{t} = a + BP^{p}_{t} + e_t$

Australia

10.15 $P^{j*}_{t} = a + BP^{p}_{t} + e_t$

South Africa

10.16 $P^{j*}_{t} = a + BP^{p}_{t} + e_t$

Texas

10.17 $P_t^{j*} = a + BP_t^p + e_t$

where the following refer to data within each country:

P_t^p = average monthly price for grain sorghum at port level (f.o.b.)

P_t^{j*} = monthly average c and f price for grain sorghum in Japan in period t, adjusted for ocean freight between exporting country and Japan.

<u>Results of Price Efficiency Analysis Between Japan and Exporting Country Port Level Period 1973-76</u>

Distributed lag estimates were generated for all four major exporting countries. The initial estimates were examined for coefficients not significant at .90 level and then reestimated without those variables in the model. The results are presented in Table 104. Seasonal dummy variables were included, but were not significant. All estimates are in domestic real currencies.

The results of the Aregetine model indicate the current c and f price in Japan was a significant factor in establishing the port price in Buenos Aires. A one peso increase in the c and f price resulted in a .56 increase in the f.o.b. price the same month. The lagged c and f coefficient indicated that a one peso increase in Japan resulted in a P.34 decline in Argentina the following month. The coefficient of adjustment indicated that one-fourth of the adjustment of the port price occurred in the first month, but was not significant.

Stockfeed wheat prices and the lagged f.o.b. port price were found to be the most important variables affecting the Australian port

Table 104. Results of Distributed Lag Analysis of Port Level Grain Sorghum Prices, 1973-76

Variables	Parameter Estimates[a]			
DEP VAR: FOB	Argentina	Australia	S. Africa	Texas
Port Price - Mean Value	P5,075.15	$A79.43	R84.37	$111.11
Intercept	-188.95 (-.91)	10.47 (2.97)	2.46 (.310)	22.70 (1.24)
c and f Sorghum - Japan	.562 (7.28)	.012 (1.24)	.461 (4.66)	.143 (1.06)
c and f Sorghum lagged one month	-.339 (-2.95)		-.274 (-2.54)	
Stockfeed Wheat		.394 (4.98)		
cif Corn - Rotterdam				.448 (3.92)
cif Corn - lagged one month				-2.56 (-2.22)
fob Sorghum - lagged one month	.755 (7.50)	.412 (4.32)	.742 (6.85)	.398 (2.84)
Coefficient of adjustment	.245 (.509)	.589 (10.94)	.258 (.301)	.602 (2.54)
R-Square	.966	.949	.763	.571
Significance of Overall Model	.0001	.0001	.0001	.0001

[a]All estimates are in domestic real currencies per MT. Numbers in parentheses are t-values; any value greater in absolute value than 2.03 indicates statistical significance at .05 level.

price. The stockfeed wheat coefficient indicates that a one dollar A increase results in a $A.39 in the port price. The adjustment coefficient indicated that about 60 percent of the adjustment in f.o.b. price occurred during the first month. Three months were required for 95 percent of the price adjustment to occur. Therefore, the port price in any month reflects a large portion of available price information.

The most significant factors affecting the South African port price were the c and f price, lagged c and f price, and lagged port price. The lagged c and f price (Japan) was significant and negative indicating an inverse relationship between port and import prices. A one Rand increase in the c and f price resulted in a R.46 increase in the South African port price. The coefficient of adjustment was .26 indicating very slow response to chanes in explanatory factors, but was not significant.

The Texas model indicated that lagged f.o.b. price and c.i.f. corn in Rotterdam were the most significant factors affecting port prices at the Gulf. A one dollar increase in the c.i.f. price resulted in a $.45 increase in the Gulf port price. A one dollar increase in lagged c.i.f. yielded a $.26 decline in Gulf prices. The coefficient of adjustment indicated that almost two-thirds of the price adjustment was occurring in the initial month. About three and one-quarter months were required for 95 percent of price adjustment to occur.

The simple regression results indicate a relatively strong relationship between the adjusted c and f price in Japan and port prices in Texas (table 105). The slope was significantly different from zero, but not equal to one. Texas had the smallest unexplained transfer cost reflected by an intercept term of $53.24/MT. Australia had the highest unexplained transfer cost at $106.57/MT.

A poor correlation was found between c and f Japan prices and port prices in the other countries. South Africa had a correlation of .12, Argentina had .34, and Australia had .006. Australia did not have a slope different from zero reconfirming the weak relationship between the port price and c and f Japan.

In comparing the countries, it was found that the Texas system had a coefficient of adjustment significantly greater than the other systems except Australia where the coefficients were not significanly different (table 106). The slope in the Texas model was significantly greater than any other slope implying that the Texas port price followed c and f import prices more closely. The Texas model also reflected a significantly smaller intercept term than any other model indicating less unexplained transfer cost. Based on these results it seems reasonable to conclude that the Texas system was relatively more efficient than the others in transmitting price information from the importing country to the port level. The Argentine and South African systems were very slow in transmitting price signals and exhibited a weak relationsip between c and f prices and port prices. Although the Australian system transmitted price information at the same rate as the Texas system, the signals were not accurate, reflecting some distortion in the system.

Table 105. Results of Simple Regression Model Analysis of Adjusted c and f Sorghum Price in Japan and Port Level Price, 1973-76

DEP VAR: ADJC&F[a] Variables	Argentina	Australia	S. Africa	Texas
		Parameter Estimates[b]		
Intercept	82.58 (11.59)	106.57 (22.77)	96.72 (13.66)	53.24 (7.06)
fob Port Price for Sorghum (slope)	.209 (2.92)	.060 (.805)	.144 (2.23)	.488 (7.25)
R-Square	.366	.079	.347	.645
Correlation	.134	.006	.120	.416
Slope Significantly Different from One	Yes	Yes	Yes	Yes
Significance of Overall Model	.0001	.1001	.0002	.0001

[a]ADJC&F is c and f price for sorghum in Japan minus ocean freight from country of origin.
[b]t values are in parentheses; a number greater in absolute value than 2.03 indicates significance at .05 level.

Table 106. Port Level Country Comparison of Adjustment Coefficients, Slope, and Intercept Terms, 1973-76

Adjustment Coefficients[a]	Slope Coefficients	Intercept Comparison
AUS > ARG[b]	ARG > AUS	ARG < AUS
(2.47)	(2.13)	(4.13)
ARG = SA	ARG = SA	ARG < SA
(.08)	(.86)	(1.81)
TX > ARG	TX > ARG	TX < ARG
(2.12)	(3.51)	(3.52)
AUS > SA	AUS = SA	SA < AUS*
(2.36)	(1.20)	(1.65)
TX = AUS	TX > AUS	TX < AUS
(.03)	(6.52)	(8.94)
TX > SA	TX > SA	TX < SA
(2.40)	(5.21)	(5.97)

[a] ARG = Argentina, AUS = Australia, SA = South Africa, TX = Texas.
[b] t values are in parentheses; value greater than 1.69 indicates significance at .05 level.
* significant at .10 level.

Period 1977-80

During this period the Argetine grain marketing system was returned to the private trade, while Australia and South Africa maintained marketing boards. A dummy variable for the grain embargo was included in each model, but was significant only for Argenina and Australia (table 107).

The Argentine model reflected the best fit with an R-square of .997. The lagged price of sorghum in Japan, exchange rates, the dummy variable, and lagged port price were all significant factors in explaining the port price. The results indicate that the U.S. grain embargo of the USSR yielded higher sorghum prices in Argentina. A real price increase of P223 ($.20)/MT can be attributed to the embargo. A one peso increase in c and f Japan sorghum price resulted in a P.84 increase in the Argentine f.o.b. price the same month. The coefficient of adjustment indicated that about half (.49) of the price adjustment was occurring in the first month after a price change. Four and one-half months were required for 95 percent adjustment to occur.

The c and f price Japan was found to be a significant factor in establishing the Australian port price. A one $A increase in the c and f price resulted in a $A.31 increase in the Australian port price. The dummy variable for the embargo was significant and indicated that the Australian f.o.b. price was $A2.77 higher due to the embargo. The adjustment coefficient was .22 resulting in very slow adjustment to price changes abroad. About 12 months were required for 95 percent of the price adjustment to occur. The R-square for this model was .942

Table 107. Results of Distributed Lag Analysis of Port Level Grain Sorghum Prices, 1977-80

Variables	Parameter Estimates[a]			
DEP VAR: FOB	Argentina	Australia	S. Africa	Texas
Port Price - Mean Value	P2224.09	$A75.78	R71.37	$120.02
Intercept	-222.77 (-4.06)	-7.32 (-1.96)	-9.72 (-1.65)	12.03 (1.09)
c and f Sorghum - Japan	.836 (23.45)	.309 (6.13)	.739 (5.57)	.137 (3.24)
c and f Sorghum lagged one month	-.400 (-4.31)	-.247 (-4.60)	-.419 (-2.69)	
Stockfeed Wheat		.201 (2.80)		
cif Corn - Rotterdam Exchange Rates[b]	2.11 (2.64)			.243 (3.44)
Exchange Rates - lagged one month	-2.14 (-2.59)			
DEMB[c]	223.41 (3.62)	2.77 (2.61)		
fob Sorghum - lagged one month	.515 (5.22)	.781 (11.93)	.778 (10.78)	.456 (4.72)
Coefficient of adjustment	.485 (1.35)	.219 (.422)	.222 (.372)	.544 (7.53)
R-Square	.997	.942	.914	.650
Significance of Overall Model	.0001	.0001	.0001	.0001

[a]All estimates are in domestic real currencies per MT. Numbers in parentheses are t-values; any value greater in absolute value than 2.00 indicates statistical significance at .05 level.
[b]Exchange rate between Argentine Peso and U.S. Dollar.
[c]Dummy variable for period of U.S. grain embargo, Jan-Dec 1980.

indicating that the explanatory variables were explaining almost all of the variation in the Australian port price.

The South African model and an R-square of .914 reflecting a relatively good fit of the model. However, the lag of the Japanese price was negative indicating an inverse relationship between port price and c and f price the previous month. A one Rand increase in the Japanese price resulted in a R.25 decline in the South African port price, reflecting the higher inventories the preceding month. The adjustment coefficient was low revealing that less than one-fourth of the adjustment occurred in the first month. Twelve months were required for 95 percent of price adjustment to occur.

The Texas model revealed that c and f Japan and c.i.f. corn at Rotterdam were important factors. The current month price in Japan was significant and implied that a one dollar increase in Japanese prices results in a $.14 increase in the Texas port price. The adjustment coefficient revealed that about one-half of the price adjustment occurred during the initial month and that four months were required for 95 percent adjustment. The c.i.f. Rotterdam corn price coefficient indicated that a one dollar increase overseas resulted in a $.24 increase in sorghum at the Texas Gulf.

The results of the simple regression analysis suggest that Texas had the strongest relationship between adjusted c and f Japan and port prices as indicated by a correlation of .29 (table 108). The slope of this model was not significantly different from one and the intercept was not significant, implying a relatively strong relationship between the prices.

Table 108. Results of Simple Regression Model Analysis of Adjusted c and f Sorghum Price in Japan and Port Level Prices, 1977-80

DEP VAR: ADJC&F[a] Variables	Argentina	Australia	S. Africa	Texas
		Parameter Estimates[b]		
Intercept	96.72 (20.00)	103.36 (32.56)	127.97 (24.78)	19.17 (1.33)
fob Port Price for Sorghum (slope)	.105 (2.46)	.136 (4.61)	-.066 (-1.62)	.809 (6.75)
R-Square	.222	.463	.007	.541
Correlation	.049	.214	.000	.293
Slope Significantly Different from One	Yes	Yes	Yes	No
Significance of Overall Model	.0002	.0001	.518	.0001

[a]ADJ c and f is c and f price for sorghum in Japan minus ocean freight from country of origin.
[b]t values are in parentnesis; a value greater in absolute value than 2.00 indicates significance at .05 level.

The Australian model reflected a correlation of .214 between the prices, but had a slope coefficient of .14. The Argentine model had .05 correlation and a slope different from one indicating a poor relationship between the two price series. The South African model also reflected a relatively poor relationship between the series indicated by correlation of 0 and a slope of -.066 (table 108).

The significantly different adjustment coefficients were those of Australia and Argetina, Texas and South Africa, and Texas and Australia. Texas had a slope coefficient significantly greater than all the others (table 108). It is also important to note that the Texas system had significantly less unexplained transfer costs than any of the other systems(table 109).

As before, it is not possible to make a general statement regarding hypothesis one. Concerning the speed of price adjustment during the first period, it appears that two of the board systems, Australia and South Africa, adjusted to changes in world price at about the same rate. The Texas system responded at a significantly greater rate than either of the previously mentioned board systems. There was no difference in the rate of adjustment between Texas and Argentina. However, the Texas system reflected price changes more accurately than any other system during this period. It is possible to conclude that the Texas system was relatively more efficient in reflecting price changes than Australia or South Africa. Therefore hypothesis one cannot be rejected in relation to those two board systems.

Table 109. Port Level Country Comparison of Adjustment Coefficients, Slope, and Intercept Terms, 1977-80

Adjustment Coefficients[a]	Slope Coefficients	Intercept Comparison
ARG > AUS[b]	AUS = ARG	AUS = ARG
(2.32)	(.71)	(1.39)
ARG = SA	SA < ARG	SA > ARG
(2.22)	(3.45)	(5.30)
ARG = TX	TX > ARG	TX < ARG
(.42)	(6.19)	(5.73)
AUS = SA	AUS > SA	AUS < SA
(.03)	(4.73)	(4.8)
TX > AUS	TX > AUS	TX < AUS
(2.77)	(6.56)	(6.84)
TX > SA	TX > SA	TX < SA
(2.66)	(8.16)	(8.41)

[a] ARG = Argentina, AUS = Australia, SA = South Africa, TX = Texas.
[b] t values are in parentheses; value greater than 1.65 indicates significance at .05 level.

During the second period (1977-80) hypothesis one may not be rejected when comparing the Texas system to Australia and South Africa. It can be concluded that the board systems reflected price changes in Japan with less speed and accuracy than the market-oriented system in Texas. However, since Argentina also operated under minimal government control during this time, its system must also be compared to the board systems. Argentina adjusted quicker than Australia, but slower than South Africa. However, the Argetine system reflected price changes more accurately than South Africa, but to about the same degree as Australia. Therefore, the results are inconclusive and suggest that the Argetine system was relatively more efficient than the South African system, but not more efficient than the Australian system.

Results of Farm Price Adjustment During Periods of Increasing and Decreasing World Prices

One of the main objectives of producer marketing boards is to raise and stabilize the price paid to farmer members. The implication of this objective suggests that the prices paid to members should adjust quickly when world price level is increasing, but should adjust at a slower rate when prices are declining. The purpose of this analysis was to determine if the prices paid to board members in Australia adjusted at different rates when world prices trended up and down. The Argentine system was not analyzed because only increasing prices were experienced during the board period (figure 19 p. 352).

Australia was analyzed from 1972-1977 to determine the response to increasing and declining prices. Analysis of covariance was used to determine the effect of price changes on the farm price. Dummy variables were employed; a 1 was used for the increasing period of world prices (February 1972-October 1974), while a -1 was used during the declining price period (December 1974-August 1977). Results are presented in Table 110.

The fob sorghum price indicated that a one dollar increase at the port resulted in a $A .17 increase at the farm during the same month. The lagged fob coefficient was negative indicating an inverse relationship between the farm price and fob price the preceeding month. Although transport had a positive sign, the lagged coefficient was negative implying a $A 7.89 decline in farm price occurred from a one dollar increase in rates the previous month. The coefficient of adjustment was .05 indicating that five percent of the adjustment in farm price occurred during the first month.

The interaction terms for fob and lagged fob prices indicated that a net response of $A .03 could be expected in farm price. However, the interaction term between the lagged farm price and the dummy variable was not significant indicating the price paid by the Board did not adjust at a faster rate wnen prices on the world market were increasing than when world prices were falling.

Table 110. Results of Distributed Lag Analysis for Australia During Periods of Increasing and Decreasing Prices

DEPVAR: Farm Price Mean Value: $A68.48	Parameter Estimates[a]
Variables	
Intercept	.35 (.20)[b]
fob sorghum price	.17 (2.15)
fob sorghum- lagged one month	-.21 (-2.39)
Transport	8.42 (14.60)
Transport lagged one month	-7.89 (-11.45)
Interaction Term-Dummy and fob sorghum	-.38 (-5.22)
Interaction Term-Dummy and lagged fob	.41 (5.18)
Interaction Term-Dummy and lagged farm price	-.02 (-.46)
Farm price lagged one month	.95 (23.19)
Adjustment Coefficient	.05 (1.29)
R-Square	.99

[a]Real Australian dollars per metric ton.

[b]t values are in parentheses; number greater in absolute value than 1.99 indicates significance at .05 level.

Analysis of Marketing Board Price Level and Variability

To evaluate the impact of marketing boards on price level and variability at the port, the following analyses were conducted.

Hypothesis 2: Prices were higher and more stable in the Argentine and Australian systems during their marketing board periods than in the market-oriented periods.

Formally, these hypotheses are:

Ho : $P_B > P_{NB}$ and Ho: $\sigma^2_B < \sigma^2_{NB}$

where:

P_B = mean board price

P_{NB} = mean price under market oriented system

σ^2_B = price variability under board system

σ^2_{NB} = price variability under market oriented system.

The basis for this analysis lies in the objectives of the marketing boards and the agricultural policy environment in which they function. Marketing boards may attempt to:

(1) raise farm income, (2) stabilize prices received by producers, or (3) earn foreign exchange. The NSW Grain Sorghum Board has attempted to accomplish the first two objectives. The NGB of Argentina used the board to raise the port price and generate foreign exchange for use in the industrial sector. Therefore, hypothesis two was evaluated entirely within the constructs of these objectives.

Since price series with little variation have a relatively slow adjustment rate, it is important to identify the variability examined in this study. Comparing variability in prices not adjusted for common factors would yield the same results as analyzing the adjustment coefficients. Therefore, it was necessary to analyze the variability net of the effects of the local market environment. The fob port prices were adjusted for the general rise in the price level, exchange rate changes, and seasonal factors. The unexplained variation, or net variation, was analyzed as the variance of the residuals and compared between countries.

Due to the qualitative, dichotomous nature of the marketing board, a regression model employing dummy variables was deemed appropriate for this analysis. The analysis of the level of board prices is explained first, followed by a discussion of the test of board price stability.

Model Specification

1. Analysis of Price Level Under A Marketing Board System

A single equation was specified for each of the systems in Argentina and Australia to analyze the impact of the marketing boards on price level. The Argentine grain marketing system was examined from 1969-80, the board period ranging between August 1973 and March 1976. Australia was evaluated from 1969-80 and the board period from 1972-80. This analysis was not performed on the South African system because the Maize Board merely implements the floor price scheme and therefore does not attempt to enhance sorghum price within the country or at the port. Formally,

10.18 $P_b = a + B_1P_j + B_2P_c + B_3F + B_4XC + D1X_t + D2Z_t + E_t$

where

P_b = monthly average f.o.b. price for grain sorghum,

P_j = monthly average price for sorghum in Japan,

P_c = monthly average price of corn in Rotterdam,

F = monthly average ocean freight between exporting board country and Japan,

XC = rate of exchange between foreign currency and U.S. dollar,

E_t = random error term,

Di = dummy coefficient,

Xt = 1 during board years, 0 otherwise (intercept dummy),

$Z_t = X_t P_j$, an interaction term between marketing board and Japanese c and f price (slope dummy).

The following hypotheses were tested:

Ho1 : D1 = 0 which implies there is no significant difference in mean f.o.b. port price during board and nonboard periods. If Ho is rejected one could conclude that the marketing board system had a significant effect on price level.

Ho2 : D2 = 0 which accounts for the interaction between the Japanese price and board periods.

2. Analysis of Price Stability Under Marketing Board System

In order to effectively test if board prices have been less variable than free market prices it was necessary to compare equations specified for Argentina and Australia to those of a proxy for world price. The Argentine system was analyzed from August 1973 to March 1976, while Australia was examined from 1972 to 1980. Therefore, two separate comparisons were necessary.

a. Argentina vs World Price

10.19 $P_b = a_1 + B_1WPI + B_2XC + B_3D2 + B_4D3 + B_5D_4 + e_{1t}$

10.20 $P_{nb} = a_2 + B_1WPI + B_2XC + B_3D2 + B_4D3 + B_5D4 + e_{2t}$

where

P_b = monthly average price for grain sorghum f.o.b. Argentina,

P_{nb} = monthly average sorghum price, c and f, Japan,

XC = monthly average exchange rate between Argentine peso and U.S. dollar and Japanese Yen and U.S. dollar,

WPI = wholesale price indices,

D_i = seasonal dummy variables,

e_{1t} = random error term.

The formal hypothesis test was Ho : $V(e_1) - V(e_2) = 0$.

The F test was used where $F = S_1^2/S_2^2$ and S_i^2 is the sample variance of the residuals.

b. Australia vs World Price

10.21 $P_b = a_1 + B_1WPI + B_2XC + B_3D2 + B_4D3 + B_5D_4 + e_{1t}$

10.22 $P_{nb} = a_2 + B_1WPI + B_2XC + B_3D2 + B_4D3 + B_5D4 + e_{2t}$

where the variables are as before except

P_b = monthly average f.o.b. price in Australia,

XC = monthly average exchange rate between Australian dollar and U.S. dollar and Japanese Yen and U.S. dollar.

Test Ho : $V(e_1) - V(e_2) = 0$

This analysis allows a direct comparison of board and nonboard systems to determine the impact of boards on price stability. If prices under the board system have been more stable than the variations on the world market, the variance of e1 should be less than e2. In both analyses the seasonal dummy variables were tested to determine the price variation explained by seasonal effects.

The National Grain Board (NGB) of Argentina controlled all sales of sorghum from August 1973 to March 1976. The analysis of price level included the period 1969-80, while the variability analysis included only the period during which the NGB controlled grain marketing. It was necessary to include the longer period in the dummy variable analysis of price level to allow for periods of board and non-board marketing. The variability analysis included only the marketing board period to allow for comparisons in variability of Argentine and Japanese sorghum prices.

Although no stated objectives of the board's policy are available in the literature, Wainio indicates that support prices for sorghum were in effect during this period. Wilson indicates that farmers were paid subsidies above the domestic price level to encourage production, alleviate social unrest, and generate foreign exchange. Recent evidence suggests that the latter objective prevailed.

As the world price level for grains increased between 1973 and 1975, the Argentine f.o.b. price followed (figure 19). However, after August 1974 when the f.o.b. price increased rapidly, the Argentine farm price leveled off and even declined. This provides superficial evidence that the NGB was using grain sales as a foreign exchange earning mechanism. The following analysis further supports this contention.

The equation of board price level contained two dummy variables: one to determine only the price effect in board years and the other to determine the interaction effect of the price of sorghum in Japan on port price level. As with the other models, variables not significant at .10 level were removed and the equation reestimated.

The F statistic was used to determine the significance of the dummy variables in each equation (Kmenta p. 370).

$$F = \frac{R_F^2 - R_R^2}{1 - R_F^2} \left(\frac{n-q}{q-k} \right),$$

where R_F^2 = R-square of the model containing the dummy variables,
R_R^2 = R-square of the model with dummy variables removed,
n = number of observations,
q = number of independent variables in full model,
k = number of independent variables in reduced model.

<u>Results of Price Level and Variability Analysis Under A Marketing Board System - Argentina</u>

Results of the Argentine model indicate that the c and f price of sorghum in Japan, c.i.f. corn in Rotterdam, ocean freight to Japan, and the f.o.b. sorghum lagged one month were significant explanatory factors (table 111).

A one peso increase in sorghum prices in Japan resulted in a P.34 increase at the port in Argentina. A one peso increase in corn at Rotterdam yielded a .41 increase in port sorghum prices in Argentina. The coefficient for ocean freight indicated a one peso increase would reduce the f.o.b. price by P.39. The coefficient of adjustment was .35

Table 111. Results of Marketing Board Level Analysis for Argentina and Australia, 1969-80

DEP VAR: f.o.b. Sorghum Price Mean Value[a]	Argentina P2,786.89	Australia 74.52
Intercept	113.51[b] (1.62)	-3.01 (-1.35)
c and f Sorghum Japan	.344 (5.42)	
cif Corn - Rotterdam	.407 (6.47)	.152 (4.39)
cif Corn - Rotterdam - lagged one month	-.448 (-7.60)	-.150 (-4.26)
Ocean freight	-.391 (-3.31)	
Stockfeed wheat		.172 (3.65)
Dummy for board years	43.26 (.489)	-3.83 (-2.04)
Interaction dummy between board years and sorghum in Japan	.015 (2.41)	.033 (2.31)
f.o.b. Sorghum - lagged one month	.655 (11.89)	.843 (21.53)
Coefficient of adjustment	.345	.157
R-square Full Model	.9867	.9285
R-square Reduced Model	.9861	.9257

[a]All estimates are in real domestic currency per metric ton.

indicating that one-third of the port price adjustment occurred during the first month.

In testing for the significance of the dummy variables, F was calculated to be

$$F = \frac{.9867-.9861}{1-.9867} \; X \; \frac{143-8}{8-6} = 3.022.$$

When compared to the tabular F = 3.00, the dummy variables were significant at the .05 level. The null hypothesis can be rejected and it may be concluded that the NGB in Argentina was a significant factor in raising the f.o.b. port price for sorghum between 1973 and 1976.

The analysis of price variability compared fluctuations in the Argentine port price during the board period to Japanese price movements during the same period. Prices in both locations were adjusted for general price rise, exchange rates, and seasonal effects. The resulting prices in the two locations were then compared for variability (table 111).

The R-square for the Argentine model was .9987. The wholesale price index was significant as were exchange rates. Second and third quarter seasonal dummies were also significant and negative implying that sorghum prices are generally lower during these seasons. The Japanese model had an R-square of .6772 and indicated that exchange rates and second and third quarter seasonality were significant factors in establishing the c and f price. The wholesale price index appeared to have no significant effect on prices.

To determine the variability of the two price series, the residuals from the models above were analyzed to determine their unexplained variability. The analysis compared the unexplained variability, or random error, in the two series. The variances in the residuals of the two equations were tested using the F ratio (Kmenta, Steele and Torrie). Variance of the residuals from the Argentine model was 81,008.8, while that from the Japanese model was 27,478,218 (table 112). The calculated F value was:

$$F = \frac{27,478,218}{81,008.8} = 339.2.$$

The calculated F value was greater than the tabular value of 2.39 and allowed rejection of the null hypothesis at the .01 level that the two variances were equal.

With respect to Argentina, hypothesis two may not be rejected. It may be concluded that port prices for sorghum were significantly higher and more stable during the marketing board period than during the nonboard period.

Australia

The New South Wales Marketing Board has been in operation since 1972. Therefore, the Australian f.o.b. port price level was analyzed from 1969-80 and price variability from 1972-80.

Australia responded positively to increases in the c.i.f. corn price as the f.o.b. port price increased by $A.15 (table 113). Stockfeed wheat was also a significant factor indicating that a one dollar A increase resulted in a $A.17 increase in sorghum at the port.

Table 112. Results of Marketing Board Price Variability Analysis for Argentina, 1973-76

Variables	Parameter Estimates[a]	
DEP VAR: Argentina: Port Price Japan: c and f Japan	Argentina	Japan
Intercept	-687.34 (-3.98)	17,080.53 (2.73)
Wholesale price index	1,261.34 (1.86)	10,359.86 (1.14)
Lagged wholesale price index		13,910.50 (-1.62)
Exchange rate	27,008.04 (12.02)	-715.35 (-5.44)
Dummy 2d quarter	-244.14 (-2.99)	-3,794.28 (-2.65)
Dummy 3d quarter	-240.05 (-3.14)	-2,862.56 (-2.05)
Dummy 4th quarter	12.30 (.17)	-2,052.53 (-1.45)
R-square	.9987	.6772
Variance of Residuals	81,008.8	27,478,218

[a]Estimates are in Argentine pesos per metric ton. Numbers in parentheses are t-values; any value greater in absolute value than 2.03 indicates statistical significance at .05 level.

Table 113. Results of Marketing Board Price Variability Analysis for Australia, 1972-80

Variables	Parameter Estimates[a]	
DEP VAR: Australia: Port Price Japan: c and f Japan	Australia	Japan
Intercept	151.25 (9.32)	52.25 (2.92)
Wholesale price index	28.22 (5.37)	91.70 (8.49)
Exchange rate	-80.33 (-9.25)	-.0929 (-1.77)
Dummy 2d quarter	-.4898 (-.33)	-4.43 (-1.66)
Dummy 3d quarter	1.1191 (.76)	1.05 (.39)
Dummy 4th quarter	2.6443 (1.80)	3.67 (1.36)
Dummy embargo	12.4445 (5.72)	13.22 (3.92)
R-square	.8285	.6139
Variance of Residuals	105.062	348.786

[a]Estimates are in real Australian dollars per metric ton. Numbers in parentheses are t-values; any value greater in absolute value than 1.99 indicates statistical significance at .05 level.

The coefficient of adjustment indicates that .16 of the price adjustment occurred during the first month.

The calculated F statistic for the significance of the dummy variables was:

$$F = \frac{.9285-.9257}{1-.9285} \times \left(\frac{143-9}{7-5} \right) = 2.64.$$

The F statistic was not significant when compared to the tabular value of 3.00. Therefore, the board did not significantly affect port price level between 1972-80.

In analyzing board and world price variability both series were adjusted for wholesale price changes, exchange rate changes, seasonal effects and changes caused by the 1980 grain embargo. Wholesale price and exchange rates both had significant effects on the model. The embargo resulted in a $A2.44/MT increase in prices in the Australian market. R-square for this model was .8285.

Wholesale prices and exchange rates were also significant in the Japanese model. Second quarter seasonal effects were significant and negative indicating that Japanese prices have declined $A4.43/MT due to seasonality. The U.S. grain embargo resulted in significantly higher prices in Japan by about $A13.22/MT.

Variance of the Australian price residuals was 105.062 compared to 348.786 for the Japanese residuals. The calculated F value was:

$$F = \frac{348.786}{105.062} = 3.32.$$

The tabular value of F was 1.80 resulting in rejection of the null hypothesis at the .01 level. It can be concluded that prices were more stable under the board than on the world market.

With respect to hypothesis two, it may not be concluded that prices were higher under the board system. However, it may be concluded that port prices in Australia were more stable than world market prices.

CHAPTER X

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

Summary and Conclusions

The role and importance of agricultural prices are well documented (Bressler and King, Tomek and Robinson). Agricultural production and marketing decision makers rely heavily on price signals for timely and accurate information regarding supply and demand conditions worldwide.

The efficiency with which price information was passed back to producers under varying degrees of government intervention was the focus of this study. Sporleder and Chavas identified two main aspects of price efficiency: a) macro - the role of prices in the marketing system, and b) micro - intrafirm efficiency on profit maximization. Only the concept of macro price efficiency was addressed here.

Price efficiency was defined as the timeliness and accuracy with which price information is transmitted between levels in a marketing channel (Griffith, Sporleder and Chavas). This study examined the prevailing world price for grain sorghum between 1973 and 1980 to determine how efficiently price changes were transmitted from the source of demand in Japan to the port and farm level in Argentina, Australia, South Africa, and Texas.

Australia and South Africa presently have producer marketing boards which determine the producer price for grain sorghum and have been in operation since 1972 and 1956, respectively. Although Argentina presently functions in a relatively free or open market, periods of total government control of grain pricing occurred between August 1973 and March 1976.

Therefore, Argentina provided a unique setting in which to examine the effect of a government marketing board on price efficiency. The United States, having never experienced a marketing board, provided the environment for analyzing price efficiency under minimal government intervetion.

Because of increasing government-to-government sales on the export grain market, it has been hypothesized that the market-oriented grain marketing system in the U.S. may not serve the best interests of producers and consumers (McCalla and Schmitz). Recent public debate in the U.S. has centered on redirecting the market-oriented grain marketing system to a more market-managed network. Bale and Lutz hypothesize that the move toward a more market-managed system in the U.S. could result in severe distortion of the true world supply/demand situation, thereby reducing the speed with which price signals are transmitted to producers.

The main purpose of this study was to determine the effect of varying degrees of government intervetion on the efficiency with which sorghum prices were transmitted from Japan to the four major exporting countries. The major objectives of the study were to:

1. Measure the ability of world and port prices to quickly and accurately transmit price information from the source of demand in an importing country to producers in the grain exporting countries of the U.S., Argentina, Australia, and South Africa.

2. Analyze the imact of marketing boards on the level and stability of grain sorghum prices at the port level in Argentina and Australia.

3. Describe the factors affecting pricing efficiency of the major U.S. competitors in the international grain sorghum market.

4. Develop a taxonomy for marketing boards which allows behavioral implications to be established.

5. Identify emerging issues relevant to Texas and U.S. grain sorghum and substitute grain crops.

Seemingly unrelated regression (SUR) was used to estimate a system of distributed lag equations to evaluate the effect of marketing boards on price efficiency. Dummy variables were used to assess the impact of marketing boards on price level, while board price stability was compared to world price stability using regression analysis.

The description of the world coarse grain trade focused on concentration among the major trading nations. Trends in market share for importers and exporters were identified as were trends in government involvement. The four country descriptions examined the role of government in each marketing system and assessed its impact on concentration among firms operating at the port level. The production and marketing system for sorghum was described for each country and key issues and policies relating to pricing, transportation, and storage were identified.

Conclusions from Descriptive Analysis

Private exporters dominate the trade of coarse grains, handling 83 percent of foreign sales in 1981. State trading exporters handled 7 percent of the export trade, while agricultural cooperatives handled 10 percent (table 13, p. 35). Among sorghum exporters, it was found that the U.S. dominates with 58 percent of the market, followed by Argentina with 32 percent, Australia with 4 percent, and South Africa with 1.5 percent.

State trading among importers almost doubled between 1977 and 1981, going to 42 percent. Private traders' share of the import market declined from 63 percent to 49 percent during this same period, while cooperatives maintained 9 percent of the market. Japan is the leading sorghum importer, accounting for over 50 percent of world purchases. Mexico was second with 14 percent, followed by Israel and Venezuela with about six percent each (table 7, p. 23).

It was found also that barter agreements between grain importers and exporters were becoming more prevalent. Argentina has recently announced an agreement with Iraq under which wheat and rice will be supplied for oil. South Africa has a similar arrangement with Romania whereby 500,000 MT of corn will be exchanged for 200,000 MT of manufactured fertilizer.

Bilateral grain sales agreements among countries were found to be increasing. Argentina intends to ship 360,000 MT of corn and 180,000 MT of sorghum to Iran under bilateral terms in 1982/83. Since 1981 Argentina has exported 80 percent of its total coarse grain crop to the Soviet Union under bilateral terms. Australia has major bilateral agreements with China, USSR, Egypt, and Iraq for wheat sales through 1984. As world supplies remain high, it appears that major coarse grain exporters may be turning to bilateral terms to ensure markets for their crops.

Japan

This section outlines the results of the Japanese description.

Results of the Japanese description indicate that tremendous growth has occurred in per capita income since 1954. A fifty fold increase has resulted from the level of income rising from $163 in 1954 to $8,233 in 1978. Recent government estimates indicated that meat demand should increase to 3.2 MMT by 1985. A 4.2 percent increase was projected for beef consumption, a 3.2 percent increase for pork, and a 2.4 percent increase for chicken.

Domestic feed grain production has been declining, primarily due to an enticing program for rice production. As a result of expanded livestock production and reduced domestic feed grain output, feed grain imports have expanded 72 percent since 1970 (table 25 p.94). Grain sorghum imports increased 12 percent during this period to 4.3 MMT.

Feed grain imports enter the Japanese market relatively free of government control. However, agricultural cooperatives and trading firms control almost all of the imports.

The formula feed industry was moderately concentrated as 11 firms controlled 80 percent of the market. Zennoh, the largest cooperative, controlled 40 percent of the market. The next ten firms had 40 percent, while the remaining 73 firms had 20 percent.
Half of the formula feed produced since 1960 has been for poultry, 30 percent for swine, and nine percent for each of dairy and beef cattle. Zennoh completely controls pricing and meets quarterly to set the price of all formula feeds in Japan.

The U.S. relative position in the Japanese sorghum market declined steadily after 1972, but recovered in 1980 as Argentina increased sales to the Soviet Union. By 1981 the U.S. had 91 percent of the market, followed by Australia with 7 percent and South Africa with 1 percent.

It was found also that Japan began a rice disposal program in 1982 aimed at reducing the surplus. Although this had displaced some feed grain imports, the total extent is as yet unmeasurable.

Argentina

Government's role in the Argentine grain marketing system became evident in 1933 with the creation of the GRB. This action was followed by support prices for grains, a fixed exchange rate for exports, and passage of the elevator and grain laws giving the government a definitive role in the grain marketing system.

Juan Peron's rise to power brought greater government intervention with the formation of IAPI to act as the state trading monopoly. The trend in government direction of the system continued until 1956 when Peron was overthrown and IAPI abolished. The marketing of grains was returned to the private sector and the NGB was created to implement grain pricing policy. However, the return to market orientation was overshadowed by the introduction of export retention taxes.

With Peron's reemergence to power in 1973, the NGB assumed monopoly control of the grain marketing system. The government's role was more pervasive than before as all aspects of the system were regulated including: buying and selling for domestic and export use, transport, and marketing. In March 1976, control of the marketing system returned to the private sector with only port elevators remaining under control of the NGB. Since then, the grain marketing system has functioned relatively free of government intervention.

The Ley de Granos 1979 dominates the agricultural policy environment of Argentina. Four new private export elevators have recently been constructed and cooperatives are in the process of renovating two older NGB port facilities. These actions signal the return of the functions performed at the export level to the private sector. Because of capital constraints, cooperatives have been slower to react to the Ley than private firms.

The export marketing system is becoming increasingly more efficient as indicated by reduced congestion, increased throughput, more storage at the port level, and a general trend toward a more market oriented network. The primary implicaton of this increased capacity is that with reduced marketing costs, Argentina could become an even greater competitor of the U.S. in coarse grain markets worldwide.

There were about 140 firms in the Argentine grain and oilseed export industry in 1981 (NGB). The industry was composed of five multinational export firms, five cooperatives, the NGB, and approximately 129 domestic export firms.

Industry concentration was moderate in 1978 with 20 firms controlling 97.3 percent of the market. By 1979 the 20 firm concentration ratio had declined to 91.3 percent but was at 95 percent in 1981, reflecting an increase in concentration. The top eight firms, which had 72.3 percent of the market in 1978, had only 68.4 percent in 1981 reflecting a decrease in concentration. However, in 1980 the top eight firms had 58.8 percent of the market which suggests an increase in concentration between 1980 and

Among the top four firms, concentration has been fairly stable. Between 1978 and 1980 their market share declined steadily from 43.4 percent to 34.3 percent. However, in 1981 the top four firms controlled 41 percent of the grain export market. No one firm has controlled more than 12.5 percent of the market and that firm went out of business after the 1980 season (NGB). In fact, only one firm has been among the top four consistently since 1978, while one other has ranked first or second in three of the four years examined.

While these data suggest some degree of concentration among the top eight and top four firms, it is the author's contention that hasty conclusions not be drawn regarding the competitiveness of the grain export industry. Without further investigation of the regional power of these groups of firms, initial conclusions may prove faulty. Unfortunately, these data are not available so conclusions regarding competitiveness cannot be drawn. Much of the increase in competition among the exporting firms can be attributed to the Ley de Granos 1979 which allowed private firms to build and operate port storage facilities.

The degree of vertical integration exhibited by firms at the export level is not well documented. However, recent developments in Argentina indicate that the private exporting firms may be beginning to integrate backward toward the production level. Several of the private export firms have agreements with acopiadores to deliver grain directly to export facilities, bypassing the correador (broker) (Wainio). If this signals the beginning of a trend, one could expect the partial elimination of the correador. There is no evidence to suggest that private firms are moving into processing of grains for feed.

However, the two major second level (regional) cooperatives, ACA and FACA, do have processing facilities and ACA has recently acquired export facilities. FACA has 252 first level (local) cooperative members and a total farmer membership of 150,000. It is important to realize that FACA has its foundational roots in the Peronist movement of the mid 1940's and consequently many of its member farmers are from the non-landed class and represent the results of modified agrarian reform. The Peron ideals, while not deep rooted, do have an influence on management through the farmer members. A new soybean crushing plant with 1,000 MT per day capacity was recently built by FACA and represents its first attempt at vertical integration.

ACA has 255 member locals and 230,000 producers and is not integrated backward into production. However, ACA has had a feed compounding facility at San Nicolas since 1977 with 400 MT per day capacity. This co-op also has four oilseed crushihg plants constructed in 1958. Recent forward integration attempts by ACA were made at Nicochea and Ramallo. In December 1981, the agreement was sealed for the purchase of NGB port facility number two at Nicochea. This facility has a 1,000 MT per hour outload and 12,000 MT storage capacity. The Ramallo facility has 12,000 MT storage capacity and an inload/outload rate of 600 MT per hour.

The NGB now coordinates ship arrival with grain arrival at the port and has reduced the long lines waiting to unload. Grain cannot be unloaded at the port until the date specified on the certificate issued to the first-handler by the NGB. This date corresponds to scheduled ship arrival which is usually known 15 days in advance.

Although these improvements have increased throughput considerably, recent government estimates indicate that handling and other transfer costs at the port level are higher than those experienced at U.S. ports. Zemborain estimates that handling and port charges in Argentina are 15 percent of the Rotterdam cif corn price, while those in the U.S. are four percent. He also indicates that Argentine ocean freight and demurrage are 26 percent of cif, while U.S. charges are 11 percent of cif price. Argentine port charges are overall 26 percent higher than U.S. charges.

Two main factors appear to be responsible for these higher charges. The Argentine rail rate structure is such that a higher per unit rate is charged as distance carried increases as opposed to a decreasing per unit rate in the U.S. Shallow drafts along the Parana River necessitate topping off at Buenos Aires or Bahia Blanca, thereby increasing costs.

The latter factor is probably the most significant in causing higher marketing costs because of the demurrage charges that may occur at both river and ocean ports. Shallow drafts at some river bends (less than 27 feet) require that large ships load only partially full; they must then move to an ocean port to complete loading and may have to wait to load in both locations. Therefore, charges are considerably higher than they would be if ships could load to capacity at the port level. It facilities were available to accommodate unit trains from the heart of the wheat belt, ships could load to capacity at the ocean ports.

Argentina is experiencing greater private investment at all levels in the export marketing system in spite of uncertainties due to inflation, high capital costs, and an unstable political environment. Argentina is a country of great agricultural potential, much of which is still unrecognized because of constraints on the grain export marketing system.

South Africa

Although the Maize Board dominates corn and sorghum marketing, agricultural cooperatives are a powerful force in the system. Ninety percent of the corn and 70 prcent of the sorghum is presently originated by cooperatives, while they own or control about 90 percent of the first-handler facilities. It is hypothesized that the cooperative movement is a potentially dominant force capable of altering the existing agricultural policy environment.

The Maize Board has assumed a more aggressive posture regarding exports, due mainly to producer group efforts. More direct sales of corn to foreign traders and governments are anticipated since NAMPO has gained control of the Board's leadership positions. The previous policy of weekly export tenders appears to have been modified by NAMPO leaders.

The Maize Board and private grain trading companies dominate the export of corn and sorghum from South Africa. It has been the Board's policy to sell 20-25 percent of the expportable surplus of corn under government-to-government contract and to allow the private trade to handle 70-75 percent.

In 1980 four major multinational grain trading companies were represented in South Africa, including Cargill (General Overseas Holding), Continental, Louis Dreyfus, and Philip Bros. The South African offices of these large companies serve primarily as bidding agents for making tender offers. The decision to buy grain from the Board is not made in South Africa, but at the head offices of these major traders.

Several smaller domestic grain trading companies such as Leo Rapnaely & Sons, Kann & Kann, and Agrimin also compete on export tenders. These are generally relatively small operations with all major decisions being made in Johannesbourg (Kansteiner).

Cooperatives generally do not export grain because of limited expertise regarding the international market and its functions. However, there is no regulation which prevents cooperatives from competing on export tenders once they have been approved by the Board.

Three main ports, Durban, East London, and Cape Town, handle virtually all of South Africa's grain exports. Normally two-thirds of the corn exported moves through East London, while Durban handles one-third of the corn and all of the grain sorghum (Kansteiner). Cape Town is usually not used for corn or sorghum because of its distance from the growing areas. The port elevators are owned and operated by the South African Railways and Harbors Administration (SARH).

The physical efficiency with which South Africa's major grain ports are operating supports Kansteiner's argument that the port facilities are a bottleneck in the grain exporting system. The turnover of 40.95 indicates that the overall system has limited port storage. East London has a turnover ratio of 39, while Durban has a turnover of 44.65. The main implication of these high ratios is that the port system is operating very near maximum capacity and there is great potential for the development of congestion at the harbors.

These results support Kansteiner's contention that any delay in ship arrival results in congestion at the port, especially with the use of unit trains. He also indicates that Durban is the most congested harbor which is supported by its relatively small storage capacity and high turnover ratio. One can conclude that there is a need for increased storage space at the ports to reduce congestion and the rate at which the facilities are operating during peak periods.

South Africa has recently entered several barter agreements with foreign countries. These arrangemets call for the trade of corn and sorghum for phosphate fertilizer. This has had the effect of reducing the amount of grain available to private export firms.

The combination of more barter agreements and increased direct exports could have serious implications for private trading firms. It may become increasingly difficult to meet export commitments using South African grains if this trend continues.

Although lack of port storage was cited as a potential bottleneck during peak harvest, South African corn and sorghum have been displacing U.S. grains in the Japanese market. This may be the result of the Maize Board's more aggressive stance on exports and favorable ocean freight between the two countries. However, it does appear that South Africa has the potential to be a major force in the Asian market.

Australia

The Australian Wheat Board (AWB) dominates the agriculural policy environment and grain marketing system. Due to the substitutability between sorghum and stockfeed wheat, sorghum prices set by the sorghum boards must be sensitive to changes in wheat prices. Sub-terminal and port storage facilities are controlled by the AWB, reflecting its domination of the system.

Australia's sub-terminal system has developed only in recent years, but by 1980 had two MMT of storage. These facilities were built mainly for the purpose of transferring grain from the older rail lines to the new ANR system. Grain can be quickly put through the new elevators and reach the port in less time. Sub-terminal storage is about evenly split among N.S.W., Victoria, and Western Australia, each with about 30 percent of total capacity. South Australia has three percent, while Queensland has none.

In 1980 Australia had 18 major port terminals located throughout the grain producing area. Twelve of the terminals, 67 percent, are in South and Western Australia making farmer cooperatives the single largest owner. The remaining six facilities are owned by respective state BHA's. Port terminal storage capacity ranges from 111,000 MT in Queensland to 1,916,000 MT in Western Australia.

Port storage capacity is estimated at 5,251,000 MT or 23 percent of total capacity. Port storage in Western Australia represents 36 percent of port terminal capacity, while South Australia and Victoria have 33 percent and 20 percent of total port storage capacity; N.S.W. and Queensland together represent 10 percent of port terminal storage capacity.

Handling and storage facilities have been expanded at several ports in recent years to accommodate larger ships and greater grain volume. However, inload/outload rates vary from 120 tons per hour at Gladstone, Queensland, to 4,000 tons per hour at Kwinana, Western Australia, which became operational in 1977. Seven of the ports have outload rates of 800 tons per hour, while Kwinana can ship out 5,000 tons per hour. Western Australia has the largest export capability measured at 5.5 million metric tons (MMT) (International Wheat Council Report). South Australia has an export capacity of 2.5 MMT, while Queensland can ship out 2.0 MMT. Australia's sustainable monthly export capacity is now placed at 1.5 MMT which implies an annual flow of 18 MMT.

Farmer cooperatives and state owned elevators dominate the first-handler level in the Australian grain export marketing system. In 1960 Australia had 658 country elevators; by 1978 that number had increased to 930, a 41 percent expansion in 18 years (Commonwealth Bureau of Statistics). The average country elevator, which serves as first receival point for grain deliveried, separates grain into major classes and is located on or near rail services to facilitate grain movement to the port.

The country elevator system developed separately in each state. Individual states now have a Bulk Handling Authority (BHA) which is the licensed representative of the AWB and owns and operates the country facilities. The BHA in the respective states are:

New South Wales - Grain Handling Authority

Victoria - Grain Elevators Board of Victoria

South Australia - South Australia Cooperative Bulk Handling Ltd.

Western Australia - Cooperative Bulk Handling Ltd. of Western Aus.

Queensland - The State Wheat Board of Queensland.

The BHA's in New South Wales, Victoria, and Queensland are statutory bodies, while the BHA's in Western and South Australia are privately owned farmer cooperatives.

Since 1915 major Australian agricultural cooperatives have effectively demonstrated efficiency in marketing agricultural products. In 1920, eight major producer cooperatives, representing all Australian States, formally established the Cooperative Federation of Australia. They opened a selling office in London and associated with national agricultural cooperative associations from New Zealand, South Africa and Rhodesia. In addition to handling commodities directed sold to it by its members, this London office renders marketing services to a number of commodity boards from member countries.

In recent years sixteen Australian agricultural cooperatives have become shareholders in the international cooperative trading organization established in Singapore by the International Cooperative Alliance. The Australian Director of the trading organization is the President of the Cooperative Federation of Australia.

In 1973 Australian cooperatives had a total membership of 3.4 million. Of this total, 12 percent or 408,000 were farmers who accounted for 80 percent of the total business done by all cooperatives.

The most significant recent development regarding Australian cooperatives is a proposal at the Federal level to form a central bank for cooperatives. Although not yet approved, it is believed the proposal has much support and therefore an excellent chance for success. The centralized cooperative banking system would be similar to the U.S. cooperative system with one federal bank and several regional offices.

Trade policy has been influenced by increasing government intervention. There appears to be growing use of bilateral trade agreements between Australia and importing countries. Recent long-term agreements with Mid and Far Eastern nations verify this contention. Export credit has recently been extended to some developing countries in South East Asia for wheat purchases.

Three major constraints to the grain marketing system limit Australia's potential to compete with the U.S. for Asian markets. First, the country is frequently hit by severe drought in the major production regions, making exportable surplus highly variable and unpredictable.

Second, the rail network has two problems which limit its operation Three major gauges of rail have developed among the states, making interstate shipment costly and time consuming. The small size of grain cars has been cited as another problem with the rail system. Although most hauls are short, many require movement over steep terrain with the small cars resulting in greater costs.

The third constraint is the frequency and length of labor disputes in the port areas and other parts of the country. Trade and labor unions represent well over half of the work force and can completely halt movement of commodities.

Even though the grain export marketing system has several bottlenecks, there is reason to believe that Australia has the potential to become a force in the Asian market. This has already occurred to some extent in wheat. Given the new facilities on line and recognition of the rail problems to be overcome, recent efforts have attempted to increase car size and streamline the system by allowing interstate grain shipments. If these efforts prove successful, it is probable that Australia could increase its share of the Asian market, becoming even more competitive with the United States.

Conclusions from Price Analysis

The purpose of this analysis was twofold: a) to compare the coefficient of adjustment from a distributed lag model specified for each country to determine which interior prices adjusted most rapidly to changes at the export level and import level, and b) to determine the effect of marketing boards in Argentina and Australia on price level and variability at the port level. Since the Argentine system was under marketing board control from 1973-76, it was necessary to separate the analysis into two periods: one from 1973-76, the second from 1977-80. The South African Maize Board merely implements a floor price scheme for sorghum and does not attempt to alter price at the farm, therefore, only the speed at the port level was examined. All final estimates of the models were made in real domestic currency per metric ton.

Between 1973-76 it was found that the Texas farm price for sorghum adjusted to the port price at a significantly greater rate than the Australian farm price paid to board members or the Argentine price. Over two-thirds of the farm price adjustment occurred in the Texas system during the first month, one-third occurred in the

Argentine system, and one-fourth occurred in the Australian system. Based on these results it was possible to conclude that farm sorghum prices in the market-oriented grain marketing system of Texas responded quicker to price signals on the world market than the two market-managed systems.

The port price for sorghum in each country was analyzed to determine relative responsiveness to the cif price in Japan and cif corn at Rotterdam. The Texas port price adjusted at a significantly greater rate than port prices in Argentina and South Africa. However, no significant difference existed between rates of adjustment in Australian and Texas port prices. It can be concluded that the market-oriented system in Texas was relatively more price efficient than the marketing board systems in Argentina or South Africa, but that the Australian board system was equally as efficient as the Texas system.

It was determined that Texas port prices accounted for 60 percent of total adjustment during the first month, while Australian port prices adjusted 59 percent. About one-fourth of the adjustment in port prices occurred during the first month in Argentina and South Africa.

The main conclusion drawn from the distributed lag analysis during this period was that farm prices in market-oriented systems responded relatively more efficiently than farm prices in the marketing board systems. Port prices in the market-oriented system responded equally as fast as the Australian board system, but more rapidly than the Argentine or South African board systems.

<u>During the second period of analysis (1977-80)</u> it was determined that Texas farm prices again responded at a significantly greater rate

than farm prices in Argentina or Australia. However, it must be noted that the Argentine grain marketing system was essentially free of board control during this period. No significant difference existed in the rates of adjustment between Argentina and Australia. Texas farm prices adjusted by 44 percent during the first month while Argentine and Australian prices adjusted by 21 percent and 14 percent, respectively.

Analysis of the adjustment in port prices revealed that the Texas price responded at a significantly greater rate than port prices in Australia and South Africa. There was no significant difference between the port price adjustment rates in Texas and Argentina. The rate of adjustment for the Texas model indicated that 54 percent of the adjustment in port prices occurred in the first month, compared to 49 percent for Argentina, and 22 percent for Australia and South Africa.

A dummy variable for the period of the U.S. grain embargo of the Soviet Union was included in each model to determine the effect, if any. While the dummy was not significant in the Texas or South African models, it was in the Argentine and Australian models. The results suggest that the Argentine port price was 223 pesos higher during the embargo. The Australian port price was $A2.77 higher during the embargo. This evidence provides partial support for the hypothesis that U.S. competitors gained as a result of the January 1980 embargo.

The marketing board system in Australia was examined to determine if a significant difference in rates of adjustment in farm prices existed during periods of increasing world prices compared to declining world prices. It was hypothesized that the board would respond more quickly as prices increased and at a slower rate as prices fell. This analysis could not be included for the Argentine system because prices only increased between 1973 and 1976. The period of increasing world prices was 1972-74, while prices fell from 1975-77.

The coefficient of adjustment was .05 during this period, but was not significant at the .05 level. The interaction dummy variable was -.02 and insignificant. Therefore, it may be concluded that the Australian system responded at about the same rate whether prices were increasing or decreasing.

Board Price Level and Variability Analysis

Prices at the port level in Argentina and Australia were analyzed to determine if they were higher and more stable during their respective marketing board periods.

Argentine price level and variability were examined from 1969-80. The dummy variable in the model indicated that the Argentine port price was significantly higher during the marketing board period. When port price variability was compared to world price variability it was concluded that board prices were more stable than world prices.

Together, these results suggest that the National Grain Board (NGB) of Argentina was a significant factor in raising and stabilizing port prices from 1973-76.

Australian price level and variability were analyzed from 1969-80. Results of the price level analysis indicated that no significant difference existed between port prices in Australia during the board and nonboard periods. However, the price variability analysis indicated that the port price had been significantly less variable than the world price since 1972. It was concluded that although the New South Wales Grain Sorghum Board did not significantly raise port prices, it did significantly reduce the variability in those prices.

Implications

The most significant implication of these conclusions is that the market-oriented system appears to exhibit superior performance to the market-managed system. Although many have espoused contrary claims, few have empirical support of their contentions.

In both periods of analysis, prices in the market-oriented grain marketing system in Texas responded more quickly to world price conditions than the market-managed systems. Significant improvements resulted in Argentine price response after the marketing board reduced control in 1976. Therefore, this study found no evidence of price distortion in the market-oriented systems. To the contrary, price signals were significantly more distorted in the market-managed systems.

Although this study did not examine the extent of the price distortion or the welfare implications, these seem to be areas where future research efforts could focus.

Research efforts should also be directed toward determining the welfare implications of marketing board systems. Although recent research has examined the welfare implications of a grain cartel, little work has been done with regard to marketing boards.

REFERENCES

Abel, M. E. and Michele M. Veeman. "Marketing Boards." Marketing Alternatives for Agriculture, Cornell Univeristy Cooperative Extension Service Leaflet No. 7-10.

ACAECER S. A. Buenos Aires, selected issues.

Alaouze, Chris., A. S. Watson, and N. H. Sturgess. "Oligopoly Pricing in the World Wheat Market." Amer. J. Agr. Econ. 60(1978)

Alejandro, Carlos. Essays on the Economic History of the Argentine Republic. New Haven: Yale University Press, 1970.

Austin, Lynn. "Australian Feed Grain Demand." USDA, ESCS, For. Agr. Econ. Res. Washington, D.C., Nov. 1977.

Australian Wheat Board. Annual Report. Melbourne, Victoria, selected years.

Baker, Noel R. "Australia's Role In the International Grain Market." International Cereal and Bread Congress, Winnipeg, Canada, September 1978.

Bale, Malcolm and E. Lutz. "The Effects of Trade Intervention on International Price Instability." Amer. J. Agr. Econ. 61(1979): 512.

Ben-David, S. and W. G. Tomek. "Allowing For Slope and Intercept Changes in Regression Analysis." Ag. Econ. Res. 179. Cornell Univ., Nov. 1965.

Bieri, Jurg and A. Schmitz. "Export Instability, Monopoly Power, and Welfare." Jnl. Intl. Econ. 3(1973): 389-96.

Binkley, James and Bruce Harrer. "Determinants of Ocean Freight Rates for Grain: An Econometric Analysis." working paper, Purdue University.

Bolsa De Cereales. Revista Institucional. Buenos Aires, Argentina, selected issues.

Braidot, Nestor. "Grain Exports: Evaluation and Power Structure in Handling." ACAECER, S.A. Buenos Aires, August, 1981.

Bredahl, Maury, W. Meyers, and K. Collins. "The Elasticity of Foreign Demand for U.S. Agricultural Products." Amer. J. Agr. Econ. 61(1979): 58-63.

Bressler, R. G. and R. A. King. Markets, Prices and Interregional Trade. New York: John Wiley & Sons, 1970.

Bureau of Agricultural Economics. BAE Trends in Australian Agricultural Commodities. Canberra, December 1977.

_____. Coarse Grains Situation and Outlook. Canberra, 1975-80.

_____. Rural Industry in Australia. Canberra, 1975.

_____. Summary for Press. Canberra, 1978.

_____. Survey of the Australian Wheatgrowing Industry. Canberra, various issues.

_____. Wheat Stabilization. Canberra, August 1977.

Centro de Acopiadores de Cereales. Memoria 1980/81. Buenos Aires, Sept. 29, 1981.

Chambers, R.G., John M. Letiche, and A. Schmitz. "The Gains From International Trade." International Trade and Agriculture. Westview Press, Boulder, Colorado, 1979.

Cook, Michael and C. Parr Rosson, III. "Methodological Issues in Examining Export Market Performance: The Australian Case." SP-5, DIR 80-1, Texas A&M University, September 1980.

Coscia, A. A. Comercialization de Granos, Buenos Aires, Editorial Hemisferio Sur, 1980.

Dept. of Administrative Services. Australia Handbook 1979/80. Canberra, Australia 1979.

Department of Agriculture and Fisheries. 1982 Abstract of Agricultural Statistics. Division of Agricultural Marketing Research, Pretoria, South Africa.

Doggett, H., D. L. Curtis, F. X. Laubscher, and O. J. Webster. Sorghum Production and Utilization. Westport, Connecticut: AVI Publishing Co., Inc., 1970.

Dravo Van Houten, Inc. Bahia Blanca and River Ports Terminal Study. Buenos Aires, June 1979.

Ethridge, Dean M. "Estimating the Structure of Time Lags Between Wholesale and Farm Prices for Cottonseed," SJAE. 7(1975):169-75.

Fama, Eugene F. "Efficient Capital Markets: A Review of Theory and Empirical Work." Journal of Finance. 25(1970): 383-417.

Ferguson, C.E., and S.C. Maurice. Economic Analysis. Richard D. Irwin, Inc. Homewood, Illinois, 1974.

Foote, Richard J. Analytical Tools for Studying Demand and Price Structures. USDA, AMS, H.B. 146, August 1958.

Forker, O. D. Price Determination Processes: Issues and Evaluation. FCS Info. 102, Farm Coop. Serv., USDA, Sept. 1975.

Fuller, Wayne A. and James E. Martin. "The Effects of Autocorrelated Errors on the Statistical Estimation of Distributed Lag Models." J. Farm Economics 43(1961):71-82.

General Agreement on Tariffs and Trade. International Trade 1980/81. Geneva, Switzerland, 1981.

Gibson, Anthony. Argentina: A Description of the Grain Export Marketing System, Unpublished M.S. paper, Texas A&M Univ., August 1981.

Goodwin, John W. and H. E. Drummond. Agricultural Economics. 2d ed., Reston, VA: Reston Publishing Co., 1982.

"Grain Sorghum News." Grain Sorghum Producers Association. Abernathy, Texas, March, 1982.

Griffith, G. R. "Sydney Marketing Margins - An Econometric Analysis." Rev. of Mktg. and Agr. Econ. 42(1974): 223-37.

Griliches, Z. "Distributed Lags: A Survey." Econometrica 35(1967): 65-73.

Harberger, Arnold C. "The Welfare Loss from Monopoly." American Economics Review. 2(1954): 77-78.

Hassler, J. B. "Measuring Dynamic Performance." Ch. 6, Farmers in a Market Economy. Ames, Iowa: Iowa State Univ. Press, 1964.

Hillman, Jimmye and A. Schmitz. International Trade and Agriculture. Boulder, Colorado: Westview Press, 1979.

Hoos, Sydney. Agricultural Marketing Boards--An International Perspective Cambridge, Mass.: Ballinger Pub. Co., 1979.

Industries Assistance Commission Report (IACR). Wheat Stabilization. Report No. 175, Canberra, June 30, 1978.

International Wheat Council (IWC). "Problems in Grain Handling and Transportation." Secretariat Paper No. 11. London, February 1980.

_____. World Wheat Statistics. London, selected issues, 1965-81.

Jackson, D.M., Warren R. Grant, and Carl E. Shafer. "U.S. Sorghum Industry." USDA, ESS, Agr. Econ. Rpt. No. 457, June 1980.

Jean, C. V. The Australian Wheat Marketing System. FAS, USDA, December 1965.

Jesse, Edward V. Measuring Market Performance: Quantifying the Non-Quantifiable. University of California-Davis WP-15, March 1978.

Jones, Bob F. and R.L. Thompson. "Interrelationships of Domestic Agricultural Policies and Trade Policies." Speaking of Trade: Its Effect on Agriculture. Agricultural Extension Service, Univ. of Minnesota, Special Report No. 72, 1978.

Junta Nacional De Granos. Anuario. Buenos Aires, Argentina, selected issues.

Just, R. E., Ernst Lutz, Andrew Schmitz, and Stephen Turnovsky. "The Distribution of Welfare Gains from International Price Stabilization Under Distortions." Amer. J. Agr. Econ. 59(1977): 652-61.

Kalmbach, Paul M., J. W. Sharp, and F. E. Walker. "The Japanese Food and Feed Grain Economy." Ohio Agricultural Research and Development Center, Wooster, Ohio, RB 1126, June 1981.

Kansteiner, W. H. South African Maize Exports: Marketing Techniques, Export Trends, and Future Developments. Unpublished Paper, South African University, Pretoria, South Africa, June 1, 1981.

Kaplan, Irving, J. L. McLaughlin, B. J. Marvin, H. D. Nelson, E. E. Rowland, and D. P. Whitaker. Area Handbook for the Republic of South Africa. D A Pam 550-93, U.S. Government Printing Office, Washington, D. C. 1971.

Kmenta, Jan. Elements of Econometrics. New York: Macmillan & Co., 1971.

Knutson, R. L., M. L. Cook, and T. L. Sporleder. "Assessment of International Cooperative Coordination in World Grain Trade." Texas A&M University and USDA, 1978.

Koh, T. H. "A Comparative Study of Agricultural Marketing Legislation In Canada, Australia, United Kingdom, and the United States." Dept. of Ag. Econ., Univ. of Guelph, Ontario, Canada, No. A.E. 164-165/11, November, 1964.

Konandreas, P. A. and A. Schmitz. "Welfare Implications of Grain Price Stabilization: Some Empirical Evidence for the U.S." Amer. J. Agr. Econ. 60(1978): 74-84.

Kramer, N. W. and W. M. Ross. "Cultivation of Grain Sorghum in the U.S." Sorghum Production and Utilization. Westport, Connecticut: AVI Publishing Co., 1970.

Lang, Mahlon G. "Economic Efficiency and Policy Comparisons." Amer. J. Agr. Econ. 62(1980): 772-77.

Maize Board. Report On Maize, 1980. Maize Board, Pretoria, South Africa, November 1979.

Marion, B. W. and C. R. Handy. Market Performance: Concepts and Measures. USDA, ERS, Agr. Econ. Rpt. No. 244, September 1973.

Martin, L. J. and T. K. Warley. "The Role of Marketing Boards in Stabilizing Commodity Markets." Amer. J. Agr. Econ. 60(1978): 878-84.

Martin, Larry. "Comparing Performance of Alternative Market Systems - A Suggested Approach with Special Reference to the Grain Markets of Canada and the United States." Univ. of Illinois working paper, November 1979.

Massell, Benton F. "Price Stabilization and Welfare." Quar. J. Econ. 83(1969): 284-97.

Maurer, Alan B. The Relationship Between Wheat Self-Sufficiency and National Wheat Trade Policy. unpublished M.S. thesis, Texas A&M University, August 1980.

McCalla, Alex and T. Josling. Imperfect Markets in Agricultural Trade. Allenheld, Osmun and Co., Inc., Montclair, New Jersey, 1981.

McCalla, Alex F. and Andrew Schmitz. "Grain Marketing Systems: The Case of the United States versus Canada." Amer. J. Agr. Econ. 61(1979): 199-212.

McCalla, Alex F., Andrew Schmitz and Gary S. Storey. "Australia, Canada, and the U.S.: Trade Partners or Competitors?" Amer. J. Agr. Econ. 61(1979): 1022-29.

Millimet, Scott A. "The Export Responsiveness of the Argentine Grain Export Marketing System: A Constant Market Share Analysis." Unpublished M.S. Thesis, Texas A&M University, May 1982.

Ministry of Agriculture. Agriculture In South Africa. Chrsis Van Rensburg Pubs., Johannesburg, South Africa.

Mori, Horoshi and W. D. Gorman. "Empirical Investigation into the Relationship Between Market Structure and Performance as Measured by Prices." J. Farm Econ. 48(1966): 162-71.

Nelson, Harold D. South Africa, A Country Study. D A Pam 550-93, U.S. Government Printing Office, Washington, D.C., 1981.

Nerlove, Marc. "Distributed Lags and Demand Analysis." Agriculture Handbook No. 141, USDA, Washington, D.C. 1958.

Nerlove, Marc. "Distributed Lags and Estimation of Long-Run Supply and Demand Elasticities: Theoretical Considerations." J. Farm Econ. 40(1958): 301-14.

Newbery, D. G. and J. E. Stiglitz. Theory of Commodity Price Stabilization. Clarendon Press, Oxford, 1981.

Obrien, Patrick M. "Global Prospects for Agriculture." Agricultural Food Policy Review. USDA, ESCS, AFPR-4, Washington, D.C. April 1981.

Ott, Lyman. An Introduction to Statistical Methods and Data Analysis. Belmont, California: Duxbury Press, 1977.

Peltier, K. and D. Anderson."The Canadian Grain Marketing System." Dep. Ag. Econ. Agr. Econ. Rpt. No. 130. North Dakota State University, December 1978.

Philips, Louis. Applied Consumption Analysis. North-Holland Publishing Co., Amsterdam 1974.

Pindyck, Robert S. and D. L. Rubinfeld. Econometric Models and Economic Forecasts. New York: McGraw-Hill, Inc. 1981.

Plan Nacional de Transporte. Buenos Aires: Secretario de Estada de Transporte y Obras Publicas, 1980.

Rand Daily Mail. Pretoria, South Africa, Nov. 3, 1981.

Randall, Laura. An Economic History of Argentina in the Twentieth Century. New York: Columbia Univ. Press, 1978.

Raphaely, Jeremy. "An Analysis of South African Maize Export Industry with Projections of Exports for 1970 and 1975." Harvard Business School, 1967.

Rawlinson, W.W. "Agricultural Cooperation in Australia." Cooperative Federation of Australia. Melbourne, 1977.

Reca, Lucio G. Argentina: Country Case Study of Agricultural Prices and Subsidies, World Bank Staff Working Paper No. 386, Washington D.C., April, 1980.

Reed, M. R. and G. W. Ladd. "Linkage Between Policy Formation and Import Demand." Iowa Agriculture and Home Economics Experiment Station, J P No. J-10455, Iowa State University, 1981.

Report of Comptroller General. Grain Marketing Systems in Argentina, Australia, Canada, and the EEC; Soybean Marketing in Brazil. U.S. General Accounting Office, Washington D.C., May 1976.

Richards, Dean. The Australian Grain Industry. USDA, FAS, FASM-298, October 1980.

Rogers, G. B. "Pricing Systems and Agricultural Marketing Research." Agricultural Economics Research. USDA, ERS, January 1970.

Rosson, III, C. Parr and Michael Cook. "The Australian Wheat Export Marketing System: A Description and Conceptual Framework For Performance Analysis." North Dakota Agricultural Experiment Station, Fargo, North Dakota, October 1980.

Samuelson, Paul A. "Proof That Properly Anticipated Prices Fluctuate Randomly." Industrial Mgmt. Rev. v. 6 #2(1965): 41-49.

Sargent, R. L. "Australian and U.S. Wheat Marketing Systems." University of Idaho, Ext. Bulletin No. 596, August 1980.

Scherer, F. M. Industrial Market Structure and Economic Performance. Chicago: Rand McNally & Co., 1980.

Schmitz, A., Alex McCalla, D. Mitchell, and Colin Carter. Grain Export Cartels. Cambridge, Mass.: Ballinger Publishing Co., 1981.

Secretaria de Estado de Transporte y Obras Publicas. Plan Nacional de Transporte. Buenes Aires, 1980.

Shafer, Carl. "Partial Adjustment and Expectation Models as Geometric Lags with Koyck Transformation." unpublished course notes Ag. Econ. 627, Texas A&M University, November 1980.

Shei, Shun-Yi and R. L. Thompson. "The Impact of Trade Restrictions on Price Stability in the World Wheat Market." Amer. J. Agr. Econ. 59(1977): 628-38.

Sporleder, T. L. and Jean-Paul Chavas. "Aspects of Pricing Efficiency and the Value of Information." Texas A&M University working paper, May 1979.

Spriggs, John. "Econometric Analysis of Export Supply of Grains in Australia." Foreign Ag. Econ. Report No. 150, Washington, D.C., June 1978.

Thompson, S. R. and Reynold P. Dahl. "The Economic Performance of the U.S. Grain Export Industry." Agr. Exp. Sta. T. B. 325, University of Minnesota, 1979.

Tomek, W. G. and K. L. Robinson. Agricultural Product Prices. Ithica: Cornell Univ. Press, 1981.

Townsend, Terry P. and M. V. Martin. "The Elasticity of Price Transmission in the Pacific Northwest and Japanese White Wheat Marketing Systems." Oregon State Univ. working paper, April 1980.

Trierweiler, John E. and J. B. Hassler. "Measuring Efficiency in the Beef-Pork Sector by Price Analysis." Agri. Econ. Res. USDA, ERS, January 1971.

U.S. Department of Agriculture. FAS, Agricultural Attache Report, selected issues.

_____. FAS, Argentina: Prospects for Increased Exports of Wheat, Corn, and Sorghum. Grain and Feed Division, Washington, D.C., August 1969.

_____. Foreign Agriculture. Washington, D.C., Feb.and Aug., 1979.

U.S. Department of Commerce, International Trade Administration, Foreign Economic Trends, South Africa., U.S. Government Printing Office, Washington, D. C., August 1981.

_____. International Trade Administration, Foreign Economic Trends, Argentina., U.S. Government Printing Office, Washington, D.C., November 1981.

_____. International Trade Administration, Foreign Economic Trends, Australia, U.S. Government Printing Office, Washington, D.C., November 1981.

_____. International Trade Administration, Overseas Business Report. Washington, D.C. March 1981; May 1981 - Australia.

_____. FAS, ESCS, Foreign Agriculture Circular, U.S. Government Printing Office, Washington D.C., selected issues.

_____. "Improving the Export Capability of Grain Cooperatives." FCS Research Report 34,Washington,D.C., June 1976.

Vicenzotti, Antonio. "Costos De Commercialization De Maiz, Trigo y Soja. Working paper, Junta Nacional de Granos, Buenos Aires, November 1981.

Wainio, John. Supply Response in the Argentine Grain Sector Under Varying Degrees of Government Intervention. unpublished M.S. thesis, Texas A&M University, August 1982.

Wall Street Journal. Dow Jones and Company, Inc. May 26, 1982.

Waugh, Frederick V. "Does the Consumer Gain from Price Instability?" Quar. J. Econ. 58(1944): 602-14.

Whitaker, D. P., P. Just, J. E. MacDonald, K. W. Martindale, J. Record, R. S. Shinn, C. Townsend, and N. Vreeland. Area Handbook For Japan. Dept.of the Army Pam. 550-30, Washington, D.C., 1974a.

_____.Area Handbook for Australia. Dept. of the Army Pam. 550-169, Washington, D.C., 1974b.

Williams, John. "The Republic of South Africa's Agricultural Commodity Control Board System." Unpublished paper, American Embassy, Pretoria, South Africa, October 1981.

Wilson, Shasi. "A Preliminary Study on Analyzing Technical Efficiency in A Grain Export Marketing System: The Argentine Case." Unpublished Master's Thesis, Texas A&M University, May 1982.

World Bank. World Development Report 1980, Washington, D.C., August 1980.

Wyser-Pratt, G. P. "Risk Arbitrage." The Bulletin. No. 74-75, New York University, May 1971.

Zemborain, Luis. "Maiz: los que ganan mas con menos." La Nacion, Buenos Aires, Sept. 4, 1981.