Exchange Rates and Commodity Markets: Global Exports of Corn, Cotton, Poultry, and Soybeans

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Abstract
The effects of exchange rates and risk on major commodity exporters are examined in markets constructed from the top five importers and top three exporters from 1961 to 2000. Depreciation typically stimulates exports but the impacts vary considerably. Exchange risk has virtually no negative impacts. Importer incomes raise exports for about half the exporters, and major competitor market shares affect about half the exporters.

Key Words: *Exchange rates, commodity exports, market shares*

Introduction

Exchange rates have been noted to affect US agricultural export revenue. The USDA Economic Research Service (2001) estimates exchange rates account for a quarter of the change in US agricultural export revenue with effects varying by commodity and country. Importer income, foreign productivity, and weather also play roles.

The present paper takes a look at four separate global commodity markets, examining major exporters in four markets from 1961 to 2000. The present analysis estimates commodity exports from each of the three top exporters using weighted exchange rates, relevant relative prices, and importer incomes for the top five importers. The effects of exchange rates and risk, as well as relative prices and importer incomes, vary considerably across these global commodity markets.

A Brief Look at the Commodities

Corn, cotton, poultry, and soybeans account for almost one third of US agricultural export revenue. US corn exports are about about one tenth of the world total (ERS, 2002) and Chambers (2002) projects increased world demand. Corn shipments for industrial processing are largely limited to Japan, South Korea, and Canada with food shipments to Sub-Saharan Africa and Latin America. Defining the market as the five largest importers in 2001, Argentina (global export market share 9%) and Europe (4%) are competitors with the US (70%).

In cotton production, the US ranks second after China and US cotton market shares have declined recently as described by Hudson and Ethridge (2000). Still, the US accounts for about one fifth of world exports as described by Jolly, Jefferson-Moore, and

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Traxler (2005). Depressed cotton prices are the result of the continued strong world production described by Meyer (2002). Due to data limitations, Australia (11%) and Argentina at (1%) are chosen as the major competitors of the US (38%) in the present model.

Soybean trade has expanded rapidly with the US projected to remain the leading soybean exporter through the 2010s. The US, Brazil, and Argentina account almost all world exports as documented by Larson (2000). In the present model, Brazil (31%) and Argentina (14%) are major competitors with the US (47%).

The US is the largest producer of poultry products with almost one third of expanding world output. Major importers are Canada, Hong Kong, Japan, Mexico, and Russia, and competitors are Brazil, Thailand, China, France, and the Netherlands. Only 7% of global production is traded due to local consumption and trade barriers according to Colyer (2000). Brazil (21%) and Europe (3%) are the major competitors for the US (44%).

A Brief Review of Exchange Rates and Trade

Chambers and Just (1987) contend exchange market intervention to stimulate exports is common. Klitgaard and Orr (1998) evaluate the role of the dollar on price competitiveness of US exports. Jabara and Schwartz (1987) attribute US trade deficits to dollar overvaluation and Roe (2000) sees the strong dollar during the 1990s as a reason for high US commodity prices on world markets. Orden (2002) agrees that exchange rate movements are influential in agriculture. A variety of commodity market effects are uncovered by Cushman (1983), Grigsby and Arnade (1986), Chambers and Just (1986), Anderson and Garcia (1989), Penson, Capps, and Rosson (1995), and Hudson and Ethridge (2000).

Goldberg and Knetter (1999) find different market reactions to exchange rates in a model of excess supply of German beer exports to the US and US linerboard exports to Germany. Hooper and Kohlhagen (1978) analyze multilateral trade flows between the US and West Germany from 1965 to 1975 and find exchange rate effects but no risk effects. Cushman (1983) extends their study to 1977 and uncovers a lagged risk effect. Krugman (1987) finds German exporters to the US price to market absorbing a portion of exchange rate effects. Thompson and Upadhyaya (1998) find export depreciation elasticities of exchange rates on chemicals and primary metals close to 3% in Alabama.

Estimated risk effects in the literature vary widely, for instance in Cushman (1986, 1988), Kenen and Rodrik (1986), and Chowdhury (1993). Asseery and Peel (1986) find positive risk effects for most trade flows between five industrial countries. Gotur (1985) finds risk has an impact on the US/German trade balance with larger effects on German exports. Fang, Li, and Thompson (2005) show exports from five Asian countries react differently to exchange rates and risk, concluding that higher risk stimulates effort to avoid its impact.

Commodity Market Model and Data

Balassa (1965, 1977) defines revealed comparative advantage as

$$S^{nk} = ((X_{nk}/X_{nw})/X_k/X_w))$$

where X_{nk} ≡ export revenue of commodity n in country k
X_{nw} ≡ export revenue of commodity n in the world
X_n ≡ export revenue of country n
X_w ≡ world export revenue.

A better name for S^{nk} is standardized export market share since comparative advantage refers to a relative efficiency advantage while factor endowments and demand contribute to determining exports. If $S^{nk} > 1$ country k is a relative exporter commodity n. The present model treats major competitor market shares XS^c as exogenous for each exporter. Abbott, Bredahl, and Reed (1994) and Goldberg and Knetter (1999) develop the theoretical background of market shares.

Total exports XS_T is the sum of the major exporter XS, the two major competitors XS^c, and exporters in the rest of the world XS^e, that is $XS_T = XS + XS^c + XS^e$. Houck (1986) examines exchange rate effects in a similar model. Export supply from the rest of the world XS^e is assumed to be a function of the relative price of exports from the major exporting countries.

Arbitrage is assumed to ensure $P = eP^e$ where the exchange rate e is the price of foreign currency and P^e is the global commodity price. The present model isolates the effects of e by separating it from the domestic relative price defined as $P^r = P/P^e$. The present model assumes these two independent variables determine exports from the rest of the world in the function $XS^e(e, P^r)$ thus affecting exports of the major competitor XS.

Importer excess demand is specified as a decreasing function of the importer price and an increasing function of income in the importing countries, $XD^m(P^m, Y^m)$. The importer price P^m effect is separated into exchange rate and relative price effects resulting in $XD^m(e, P^r, Y^m)$. Importer incomes and exchange rates are constructed for each commodity from the top five importers.

Deriving the expression for home exports or excess supply X,

$$X = XS(e, P^r) = XD^m(e, P^r, Y^m) - XS^e(e, P^r) - XS^c = X(e, P^r, Y^m, XS^c) \quad (1)$$

The relative price, major importer income, and major competitor market share are then exogenous isolating exchange rate effects.

The specified linear export equation is

$$\ln X_t = \alpha_0 + \alpha_1 \ln E_t - \alpha_3 \ln P^r_t + \alpha_4 \ln Y^m_t - \alpha_2 \ln S^c_t \quad (2)$$

where t represents year and X_t ≡ exports
E_t ≡ exchange rate level e_t or variance V_t
P^r_t ≡ relative home price
Y^m_t ≡ importer real income
S^c_t ≡ export share of the two major competitors.

The dependent variable exports X_t is metric tons. The exchange rate variable E_t is either the relevant home currency price of foreign currency e_t or its historical volatility $V_t = T(\mathrm{var}(\ln(e_t/e_{t-1})))^{1/2}$ where T is 40 years.

The exchange rate is the price of foreign currency that should increase the quantity of exports. Exchange risk could lower export revenue due to profit risk as developed by Ethier (1973) but De Grauwe (1988) suggests exporters might increase volume to offset revenue loss. Broll and Eckwert (1999) note the return on an option to export should increase with risk. Importers might seek other sources facing idiosyncratic exchange risk. The effects of exchange risk would depend on foresight, risk aversion, financing mechanisms, currency inventory practices, and so on.

The relative home price $P^r{}_t$ is expected to have a negative effect on exports with higher home prices discouraging exports. Importing country income $Y^m{}_t$ would have a positive effect for normal goods as developed by Klitgaard and Orr (1998). The standardized competitor market share $S^c{}_t$ for each commodity based on the three major exporters would have a negative effect on exports except in expanding markets.

Annual export data from 1961 to 2000 are from the USDA (2002) in the *Production, Supply, and Distribution* (PSD) database. Prices and market shares are derived from this ERS data and exchange rates are from the ERS *Agricultural Exchange Rate* database. The GDP of importing countries is from *World Economic Indicators*.

Statistical analysis ensures zero means of residuals, no autocorrelation, homoskedasticity, and low covariance between errors and explanatory variables. Each time series variable is tested for unit roots with Augmented Dickey Fuller (ADF) and Phillips-Perron tests. The variables are all difference stationary according to MacKinnon critical values for the ADF and Philips-Perron unit root tests. Multicollinearity does not seem to be an issue with all variables less than 0.4 correlated.

The autoregressive conditional heteroscedastic ARCH model of Engle and Rotheschild (1992) includes variance to the influence of risk. Greene (2000) describes the usefulness of ARCH and generalized autoregressive conditional hetroscedasticity (GARCH) models. Zakoian (1990) introduces the threshold ARCH or TARCH model based on symmetric distributions of residuals to forecast conditional variance of the dependent variable as a function of lagged values of dependent and exogenous variables. The present exchange risk model applies the TARCH model. Squared errors follow a heteroscedastic ARMA(1,1) process. Akiake's Information Criterion suggests one lag is sufficient for the present TARCH model supporting its efficiency for the present data.

Commodity Export Estimation

Estimated coefficients of the log linear model (2) in Tables 1-4 are *ceteris paribus* partial elasticities. Market shares for 2001 are listed in parentheses with each major competitor. The three major competitors account for varying shares of the three global markets: 83% in corn, 50% cotton, 68% poultry, and 92% soybeans.

All regressions indicate significant F-statistics at the 1% level. The Z-GARCH statistic provides a test of the null hypothesis that ARCH slope coefficients are simultaneously zero and all are rejected at the 1% level. The Akaike information criterion AIC and Schwarz criteria both improve with R^2. Predictive R^2 powers for the regressions range from 0.46 to 0.96 and average 0.73. About half of the Durbin-Watson d-statistics reject the null hypothesis of serial correlation and the following discussion is limited to these results.

The consistently positive importer income elasticities indicate normal or super normal commodities for 7 of the 12 exporters in the exchange rate models. The positive income elasticities are less than one as might be expected for 3 of the exporters, and for 4 others the elasticities are greater than one, indicating sensitivity to importer income. The income sensitive exports are US corn, Australian cotton, and Brazilian and Argentine soybeans. Every 1% decrease in importer income lowers exports of soybeans from Brazil by 1.66% and Argentina by 5.93%.

Table 1. Corn Exports (*5% and **1%)

	α_0	lne	lnV	lnP	lnY	$\ln S^c$	R^2	d stat	F-stat	Z-GAR
US 70%	-6.68 (-1.64)	0.83** (3.82)		0.17 (0.65)	1.28** (17.8)	-0.65** (-7.54)	.910	1.74*	14.2**	11.2*
	7.66** (26.2)		0.09** (5.60)	0.73** (6.28)	0.49** (29.0)	-0.72** (-17.5)	.848	1.44	9.76**	21.6**
AR 9%	7.62 (1.78)	0.15 (0.70)		0.42 (0.92)	0.54 (2.15)	0.39 (0.20)	.798	1.84*	31.8**	2.18*
	7.79** (6.34)		-0.10** (-5.31)	0.49 (1.35)	0.39** (4.22)	-0.69 (0.05)	.550	1.84*	72.5**	3.53**
EU 4%	6.99 (8.40)**	0.30 (5.06)		0.08 (1.23)	0.61** (14.4)	-0.29 (-1.93)	.670	1.32	28.3**	7.89**
	4.45** (2.61)		0.04 (1.03)	0.13 (1.10)	0.59** (7.07)	-2.08** (-2.69)	.605	1.30	27.2**	5.95**

Table 2. Cotton Exports

	constant	lne	lnV	lnP	lnY	$\ln S^c$	R^2	d stat	F stat	Z-GAR
US 38%	7.86 (4.80)	0.23 (1.40)		0.86 (1.36)	0.457 (3.91)	-0.11 (-1.30)	.405	1.30	14.5**	3.67**
	7.79** (3.36)		-0.07 (-0.67)	0.92 (0.94)	0.41** (2.43)	-0.10 (-0.95)	.452	1.50	14.8**	2.34*
AU 11%	-28.6** (-54.1)	0.34* (2.40)		-0.47* (-2.29)	2.55** (44.0)	-0.06 (-0.77)	.956	2.26*	71.1**	3.05**
	-28.6** (-37.6)		-0.02 (-0.71)	-0.34 (-1.01)	2.44** (46.30)	-0.16 (-0.84)	.955	2.39*	72.1**	2.93*
AR 1%	-4.50 (-0.69)	0.63** (1.32)		0.84 (1.28)	0.77 (1.40)	-0.78 (-1.17)	.460	1.57*	37.2**	2.90**
	-15.2** (-5.97)		0.09 (1.00)	0.40 (0.56)	1.63** (9.57)	-1.96** (-4.19)	.580	1.48	78.1**	2.58*

Depreciation increases exports for 8 of the 12 exporters with most elasticities less than one. The depreciation elasticity of US corn exports is 0.83 but Argentine and EU exports are not affected. For cotton the opposite holds with US exports insensitive to the exchange rate but positive Australian (0.34) and Argentine (0.63) depreciation elasticities. Poultry exports have depreciation elasticities of 0.30 for the US, 0.63 for Brazil and 0.59 for the EU. Depreciation elasticities are the highest for Argentina (3.14) and Brazil (1.23) in soybeans but US exports are not affected. Every 1% peso appreciation would lower Argentine soybean exports an amazing 3.14%, a reflection of peso instability.

Table 3. Poultry Exports

	constant	lne	lnV	lnP	lnY	lnS^c	R^2	d stat	F stat	Z-GAR
US 44%	-1.58 (-1.15)	0.30* (2.36)		3.37** (8.55)	0.71** (7.30)	-0.18 (-1.91)	.944	1.66*	54.0**	2.15*
	-1.78 (-1.21)		-0.05 (-1.17)	3.45** (9.23)	0.84** (8.27)	-0.15* (-2.22)	.926	1.52*	63.2**	2.06*
BR 21%	-4.50 (-0.69)	0.63** (1.32)		0.84 (1.28)	0.77 (1.40)	-0.78 (-1.17)	.460	1.57*	37.2**	2.90**
	-15.2** (-5.97)		0.09 (1.00)	0.40 (0.56)	1.63** (9.57)	-1.96** (-4.19)	.580	1.48	78.1**	2.58*
EU 3%	0.27 (0.28)	0.59** (4.29)		-0.99** (-4.63)	0.82** (14.7)**	-.092* (-2.71)	.960	1.30	52.3**	2.44**
	-4.04** (-10.2)		0.04** (2.92)	-0.16 (-0.90)	1.06** (41.5)	-0.04** (-4.36)	.939	1.16	43.4**	2.49**

Table 4. Soybean Exports

	constant	lne	lnV	lnP	lnY	lnS^c	R^2	d stat	F stat	Z-GAR
US 47%	13.66** (11.0)	0.02 (0.08)		1.78** (3.06)	0.23 (1.91)	-0.06 (-1.00)	.847	1.56*	18.2**	2.26*
	12.81** (16.6)		0.13** (5.17)	0.78** (2.30)	0.20* (4.80)	-0.11** (-2.77)	.896	1.94*	16.3**	8.49**
BR 31%	-4.90* (-2.53)	1.23** (7.34)**		2.97** (4.53)	1.66** (14.8)**	-0.87** (-5.09)**	.854	1.61*	37.5**	6.32**
	-4.09 (-1.29)		-0.08 (-1.38)	2.99** (3.01)	1.25** (6.80)	-0.66** (-4.66)	.789	1.10	56.3**	6.21**
AR 14%	-71.6** (-16.5)	3.14** (6.24)		3.63** (12.8)	5.93** (28.7)	-0.70 (-1.11)	.786	1.50	49.3**	2.67**
	-63.6** (-10.7)		0.08 (0.48)	3.26** (7.06)	4.34** (11.5)	2.47 (3.10)	.757	1.39	41.4**	2.09

Exchange risk generally has no negative impact on exports, lowering only Argentine corn. For 8 of the 12 markets, exchange risk has no effect on exports. For US corn and soybeans and EU poultry, exchange risk increases exports. Fang, Lai, and Thompson (2005) find similar results for some Asian exporters concluding these exporters must actively manage exchange risk. Exports may increase as a buffer against exchange rate uncertainty.

The relative home price has the expected negative impact for only 2 of the 12 exporters, Australian cotton and EU poultry. In 5 of the exchange rate models there are no relative home price effects suggesting exporters must price to market or contract for export ahead of price news. In the other 4 exchange rate models, exports increase with a higher domestic relative price. US corn, poultry, and soybean exports all increase when there is a higher domestic relative price suggesting US markets are satiated. There are very high domestic price elasticites for Brazilian (2.97) and Argentine (3.63) soybean exports suggesting soybeans are grown for only export with no options for domestic sales.

Turning to each commodity, US corn exports in Table 1 increase with depreciation and are sensitive to major competitor market shares. Argentine corn exporters are insulated from the exchange rate perhaps trading in dollars, but suffer a small negative risk effect, and are insensitive to competitor market share. EU exporters are sensitive to importer income.

Cotton exports in Table 2 from Australia and Argentina increase with depreciation but competitor market shares have no effect. Risk has no effects on any exporter perhaps due to increased world production and the high price variance motivating long term contracts. Meyer (2002) points out that increasing cotton competition from Uzbekistan and Turkmenistan is inducing long term contracts.

Depreciation raises poultry exports from the US, Brazil, and the EU in Table 3, the most consistent exchange rate effects for any commodity. Poultry contracts and value added exports may increase sensitivity to the exchange rate as developed by Colyer (2000). Exchange risk affects only the EU. Relative poultry prices have a positive effect on US exports, perhaps evidence of a low cost producer responding to rising world prices. Domestic markets may not absorb surplus poultry products according to Kim and Marion (1997). US and EU exports are sensitive to importer income.

Depreciation especially stimulates soybean exports from Brazil and Argentina in Table 4 but has no effect on US exports. Exchange risk raises US soybean exports but has no effect on the other two exporters. Brazil is sensitive to competitor market share but the other two exporters are not. A higher domestic relative soybean price raises exports for each country, perhaps evidence production is aimed primarily at export. Brazil and Argentina are sensitive to exporter income but the US is not.

Table 5. Exchange Rate Effects

	e	P	Y	S^c
Corn				
US	+	0	+	–
AR	0	0	0	0
Cotton				
AU	+	–	+	–
AR	+	0	0	0
Poultry				
US	+	+	+	0
BR	+	0	0	0
Soybeans				
US	0	+	0	0
BR	+	+	+	–

Table 5 summarizes the exchange rate effects. There are positive depreciation effects for 6 of the 8 exporters with no effects for Argentine corn or US soybeans. US corn and poultry exports increase with depreciation but soybean exports do not. A higher domestic relative price lowers exports for only Australian cotton, again evidence that commodity production is aimed at exports. Exports are sensitive to importer income for half the exporters. Exports are sensitive to competitor market shares for only 3 of the 8 exporters, indicating the global markets are expanding.

Conclusion

Commodity exports of corn, cotton, poultry, and soybeans have varying sensitivity to exchange rates with the strongest effects for poultry. Depreciation raises US exports of corn and poultry but not soybeans in contrast to the positive effects for soybeans and cotton reported during an earlier period by Anderson and Garcia (1989). Consistent with present results, Jabara and Schwartz (1987) find during an earlier period that soybean exporters passed through exchange rate changes but their similar conclusion for corn is inconsistent with the present results.

Exchange risk has virtually no negative impacts on commodity exports. Positive risk effects for US corn and soybeans, Argentine corn, and European poultry exports may indicate that the presence of exchange risk stimulates effort to avoid it. Producers may cushion exchange risk with extra production to maintain revenue. The exchange rate acts as a “shock absorber” for export markets as developed by Saghaian, Reid, and Marchant (2002) with some exporters evidently taking steps to expand exports when there is exchange risk.

Importer income raises US corn, cotton, and poultry exports. Importer income also raises exports of Australian cotton and Brazilian soybeans. Importer income does not raise exports of Argentine corn or cotton, Brazilian poultry, or US soybeans, but these exporters may sell outside the constructed commodity markets.

Major competitor market shares have limited impacts, lowering US corn, Australian cotton, and Brazilian soybean exports. The major exporters account for 83% of global corn exports and the US accounts for 70% but US exports are sensitive to competitor market shares. Brazilian soybeans are similar in their large share of global trade. The three major soybean exporters supply 92% of global exports, the US 47%, and Brazil 31%, and it may be a surprise that US exports are insensitive to the Brazilian market share. A similar result arises in poultry where the three major exporters account for 68% of global trade suggesting Brazil must sell to different importers. Australian cotton accounts for only 11% of global trade and the three major competitors for only 50% making it perhaps surprising that Australian cotton is sensitive to competitor market shares but Australia may export to the same countries as the US and Argentina.

In conclusion, it is safe to say that some commodity exports respond to exchange rates while all seem insulated from exchange risk. The four commodity export markets behave differently and it is unlikely that any exchange rate strategy would benefit all exporters.

References

Abbott, P., M. Bredahl, and M. Reed (1994) "Competitiveness: Definitions, Useful Concepts, and Issues," in *Competitiveness in International Food Markets*, edited by M. Bredahl, P. Abbott, and M. Reed, Boulder: Westview Press.

Anderson, M. and P. Garcia (1989) "Exchange Rate Uncertainty and the Demand for US Soybean," *American Journal of Agricultural Economics* 71, 721-29.

Asseery, A. and D. Peel (1991) "The Effects of Exchange Rate Volatility on Exports," *Economic Letters* 37, 173-7.

Balassa, B. (1965) "Trade Liberalization and Revealed Comparative Advantage," *Manchester School of Economic and Social Studies* 33, 99-123.

Balassa, B. (1977) "Revealed Comparative Advantage Revisited: An Analysis of Relative Export Shares of the Industrial Countries, 1953-1971," *Manchester School of Economic and Social Studies* 45, 327-44.

Broll, U. and B. Eckwert (1999) "Exchange Rate Volatility and International Trade," *Southern Economic Journal* 66, 178-185.

Chambers, R. and R. Just (1986) "A Critique of Exchange Rate Treatment in Agricultural Trade Models: Reply," *American Journal of Agricultural Economics* 68, 994-7.

Chambers, R. and R. Just (1987) "Effects of Exchange Rate Changes on US Agriculture: A Dynamic Analysis," *American Journal of Agricultural Economics* 63, 297-319.

Chowdhury, A. (1993) "Does Exchange Rate Volatility Depress Trade Flows? Evidence from Error-Correction Models," *Review of Economics and Statistics* 75, 700-6.

Colyer, D. (2000) "Poultry," in *Competition in Agriculture, The United States in the World Market*, edited by D. Colyer, P. Kennedy, W. Amponash, S. Fletcher, and C. Jolly, New York: Haworth Press.

Cushman, D. (1983) "The Effects of Real Exchange Rate Risk on International Trade," *Journal of International Economics* 15, 45-63.

Cushman, D. (1985) "Has Exchange Risk Depressed International Trade? The Impact of Third-Country Exchange Risk," *Review of Economics and Statistics* 5, 361-79.

Cushman, D. (1988) "US Bilateral Trade Flows and Exchange Risk during the Floating Period," *Journal of International Economics* 24, 317-30.

De Grauwe, P. (1988) "Exchange Rate Variability and the Slowdown in Growth of International Trade," *IMF Staff Papers* 35, 63-84.

Economic Research Service (2002) *Agricultural Exchange Rates, Production Supply and Distribution*, USDA website.

Ethier, W. (1973) "International Trade and the Forward Exchange Market," *American Economic Review* 63, 494-503.

Fang, W., Y. Lai, and H. Thompson (2005) "Exchange Rates, Exchange Risk, and Asian Export Revenue," *International Review of Economics and Finance*.

Goldberg, P. and M. Knetter (1999) "Measuring the Intensity of Competition in Export," *Journal of International Economics* 47, 27-60.

Gotur, P. (1985) "Effects of Exchange Rate Volatility on Trade: Some Further Evidence," *IMF Staff Papers* 32, 475-512.

Greene, W. (2000) *Econometric Analysis,* Upper Saddle: Prentice Hall.

Grigsby, S. and C. Arnade (1986) "The Effect of Exchange Rate Distortions on Grain Export Markets: The Case of Argentina," *American Journal of Agricultural Economics* 68, 434-40.

Hooper, P. and S. Kohlhagen (1978) "The Effect of Exchange Rate Uncertainty on the Prices and Volume of International Trade," *Journal of International Economics* 8, 483-511.

Houck, J. (1986) *Elements of Agricultural Trade Policies*, Prospect Heights: Waveland Press.

Hudson, D. and D. Ethridge (2000) "Cotton," in *Competition in Agriculture, The United States in the World Market*, edited by D. Colyer, P. Kennedy, W. Amponash, S. Fletcher, and C. Jolly, New York: Haworth Press.

Hudson, D. and D. Ethridge (2000) "Competitiveness of Agricultural Commodities in the United States: Expanding Our View," *American Journal of Agricultural Economics* 82, 1219-23.

Jabara, C. and N. Schwartz (1987) "Flexible Exchange Rates and Commodity Price Changes: The Case of Japan," *American Journal of Agricultural Economics* 69, 580-90.

Jolly, C. K. Y. Jefferson-Moore, and G. Traxler (2005) "Consequences of Biotechnology Policy for Competitiveness and Trade of Southern U.S. Agriculture," *Journal of Agricultural and Applied Economics* 37, 393-407.

Kenen, P. and D. Rodrik (1986) "Measuring and Analyzing the Effects of Short-Term Volatility in Real Exchange Rates," *Review of Economics and Statistics* 68, 311-5.

Kim, D. and B. Marion (1997) "Domestic Market Structure and Performance in Global Markets: Theory and Empirical Evidence from US Food Manufacturing Industries," *Review of Industrial Organizatio*n 12, 335-54.

Klitgaard, T. and J. Orr (1988) "Evaluating Price Competitiveness of US Exports," *Current Issues in Economics ad Finance* 4, 1-6.

Krugman, P. (1987) "Pricing to Market When the Exchange Rate Changes," in *Real Financial Linkages Among Open Economies*, edited by S.W. Arndt and J.D. Richardson, Cambridge: MIT Press.

Larson, D. (2000) "Soybeans," in *Competition in Agriculture, The United States in the World Market*, edited by D. Colyer, P. Kennedy, W. Amponash, S. Fletcher, and C. Jolly, New York: Haworth Press.

Meyer, L. and S. MacDonald (2002) "Cotton," Staff of Economic Research Service, USDA website.

Orden, D. (2002) "Exchange Rate Effects on Agricultural Trade," *Journal of Agricultural and Applied Economics* 34, 303-12.

Roe, T. (2000) "Competitiveness on US Agriculture: Concepts, Issues, and Policy: Discussion," *American Journal of Agricultural Economics* 82, 1234-7.

Saghain, S. H., M. R. Reid, and M. A,. Marchant (2002) "Monetary Impacts and Overshooting of Agricultural Prices in an Open Economy," *American Journal of Agricultural Economics* 84, 90-103.

Thompson, H. and K. Upadhyaya (1998) "The Impact of the Exchange Rate on Local Industry," *Economia Internazionale* 11, 103-13.

USDA/ERS (2001) "Exchange Rate Indexes and US Agricultural Trade," *Agricultural Outlook: Agricultural Economy*, January/February, 4-6.

World Development Indicators (2002) Development Data Group and Development Economics, International Bank for Reconstruction and Development, World Bank.

Zakoian, J. (1990) *Threshold Heteroskedastic Models*, Paris: CREST, INSEE.