WP 94-09
August 1994

Working Paper

Department of Agricultural, Resource, and Managerial Economics
Cornell University, Ithaca, New York 14853-7801 USA

STRUCTURAL ADJUSTMENT AND AGRICULTURAL EXPORT RESPONSE IN LATIN AMERICA

Kristin A. Markussen
and
David R. Lee

It is the policy of Cornell University actively to support equality of educational and employment opportunity. No person shall be denied admission to any educational program or activity or be denied employment on the basis of any legally prohibited discrimination involving, but not limited to, such factors as race, color, creed, religion, national or ethnic origin, sex, age or handicap. The University is committed to the maintenance of affirmative action programs which will assure the continuation of such equality of opportunity.

Structural Adjustment and Agricultural Export Response in Latin America

Kristin A. Markussen and David R. Lee

This paper was prepared for presentation at the XXII Conference of the International Association of Agricultural Economists, Harare, Zimbabwe, August 22-29, 1994.

Kristin Markussen is an economist at the National Bank of Alaska and was formerly a graduate research assistant in the Department of Agricultural Economics, Cornell University. David Lee is an associate professor in the same department.

Abstract

Expanding exports has been one of the principal goals of structural adjustment programs aimed at restoring external balance of payments equilibria in many developing countries. This paper analyzes the changing responsiveness of agricultural exports to price and exchange rate variation for selected crops in eight Latin American countries over the period 1961-1990. The results show that: (1) commodity and country disaggregation in estimation generates much higher export response elasticities than previously estimated; (2) real exchange rate changes dominate price changes in stimulating export response; and (3) statistical tests confirm structural change in export response elasticities in over half of the equations estimated. Overall, the evidence suggests that price and exchange rate changes accompanying stabilization and adjustment reforms have had significant though non-uniform effects in stimulating agricultural export expansion in Latin America.

Structural Adjustment and Agricultural Export Response in Latin America

Increasing exports as an intermediate step toward restoring external balance of payments equilibrium has been a central component of most economic stabilization and structural adjustment programs initiated in the 1980's and '90's. Export-promoting policies and programs have been particularly extensive in Latin America, where the largest proportion of adjustment lending has occurred (44% of adjustment lending in 1989, for example). Though agriculture's relative contribution to GDP declined in most Latin America countries prior to the 1980's, agriculture has maintained an important role in terms of export and employment generation and in providing "the lead to the rest of the economy in the process of adjustment and economic recovery" (Chhibber 1988, p. 44).

This paper assesses agricultural export performance in response to changes in two key determinants of export supply--exchange rates and producer prices--which were influenced by structural adjustment programs of the 1980's. Export responsiveness is estimated for selected export crops in eight Latin American countries in the period through 1980. In each case, export response is estimated prior to the initiation of structural adjustment programs and for a longer time series incorporating the post-adjustment period. Changes in export responsiveness to price and exchange rate variation under both regimes are tested statistically. The results demonstrate the key role played especially by exchange rate policy in determining export responsiveness, as well as differing country and commodity experiences.

Structural Adjustment and Agriculture in Latin America

Though experiences differed from country to country, the economic developments of the 1970's and early 1980's which precipitated the economic stabilization and structural adjustment programs of the 1980's are depressingly familiar: the collapse of the Bretton Woods Agreement and increased exchange rate variability; OPEC's formation and subsequent oil price shocks in the early and late 1970's; the flood of petro-dollars and increasing debt burdens assumed by

many countries in the late 1970's; and finally, increases in real interest rates and threats of default in the late 1970's and early 1980's. The results of these developments are equally familiar: chronic inflation stimulated by oil and commodity price shocks and reinforced by lax or ineffective monetary and fiscal policy; depletion of international currency reserves; increases in debt service payments; and low or negative real economic growth caused by the above factors and exacerbated by the worldwide recession of the early 1980's.

In response to these developments, 13 Latin American countries engaged in economic stabilization programs with the IMF and structural adjustment programs with the World Bank in the period through 1990. Due largely to data constraints (discussed below), eight of these countries are included in this analysis: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, and Mexico. In these eight countries, IMF loans amounting to 21.6 billion SDR's and structural adjustment loans totalling $9.0 billion were approved in the 1980-90 period (World Bank 1990). These loans supported a wide variety of macroeconomic and sectoral reforms, including stricter monetary and fiscal policies, public sector reforms, privatization of public enterprises, tax reforms, subsidy reduction and elimination, and, perhaps most importantly, devaluation of domestic currencies.

The effects of these reforms have varied widely from country to country. In spite of the goal of generating overall economic growth, real per capita GDP increased from 1980 to 1990 in only two of the eight countries, Chile (3.8%) and Colombia (6.3%) (Table 1). Inflation abated in several countries (Bolivia, Costa Rica, Mexico), but remained at excessive levels in others (Argentina and Brazil, most notably). The terms of trade declined sharply in all eight countries over the 1980's. Yet, in many countries, the macroeconomic preconditions for improved economic performance were created. Except for Brazil, each of the countries experienced a real devaluation over the late 1980's, making their exports more globally competitive. Export growth, in most cases, responded to these and other economic incentives by expanding at rates well above early 1980's levels (Table 1). Current account balances, in turn, responded in seven of the

eight countries, registering improved performance by the end of the decade. Other details are provided in Markussen (1993).

Because of the importance of the agricultural sector in employment and GDP in many of these countries and the prominence of agricultural exports among tradable goods, macroeconomic and structural reforms such as currency devaluation have particularly important implications for this sector. In six of the eight adjusting countries, agriculture's proportion of GDP increased over the 1980's. In four countries, agriculture's share of total country exports increased, while in the other four countries, the proportion of agricultural exports remained high, ranging from 15-20% (Brazil) to nearly 60% (Costa Rica). Real annual growth in agricultural exports between 1980-82 and 1990-92 averaged 9.1% across the eight countries, ranging from 3.6% in Brazil to 18.9% in Chile (Table 2). Clearly, the performance of agriculture has remained crucial in determining the outcomes of adjustment in both the tradable sector and the overall economy.

Recent Literature on Agricultural Export Response

A number of studies over the past decade have examined export behavior as it relates to the structural adjustment policies of the 1980's. Hazell, Jaramillo and Williamson (1990) estimate price variability for 15 commodities and 22 countries and find that real exchange rates, domestic marketing arrangements and other government interventions have played a major role in buffering variability of price transmission to producers. They foresee increased export price variability arising from structural adjustment programs impeding the expansion of agricultural exports in many countries. Gersovitz and Paxson (1990) specify the conditions under which export response may differ from production response to output price changes.

Several papers analyze export response under structural adjustment using variations of traditional supply response methodologies, though each of these studies is characterized by significant limitations. Bond (1985) estimates primary commodity export supply as a function of prices, exchange rates, and supply shifters. Results for Western Hemisphere food crops and

agricultural raw materials demonstrate negative current period price elasticities of supply and very low one-period lagged supply elasticities (0.07 and 0.03, respectively). The empirical results provide weak support for the author's claim that "export supply in developing countries does indeed respond to improved price incentives", though rather more support for the conclusion that "this evidence lends support to a developing country's use of the exchange rate as a policy tool to improve the trade balance" (p. 227). Bond's analysis, though, omits the structural adjustment years of the 1980's.

Balassa (1988) estimates the response of agricultural export/output ratios in 16 Sub-Saharan African countries though 1982. Like Bond, he finds that real exchange rates were a significant determinant of export response, particularly so for agricultural exports compared to exports of goods and services. Countries with "market-oriented economies" are shown to have performed especially well. Belassa's analysis extends only through 1982, however, early in the structural adjustment process, and is confined only to African countries.

Wattleworth (1988) examines the collective effects of simultaneous export expansion among developing countries on selected export markets. He confirms the importance of the real exchange rate in accounting for export response, but uses output supply elasticities as a proxy for export supply elasticities, which he notes are often unavailable.

Finally, Islam and Subramanian (1989) estimate developing country agricultural export response as a function of a number of supply and demand-side variables influencing export behavior. Their empirical results are mixed, with only variables representing a time trend and a dummy variable for oil price shocks consistently significant. In addition, the mixture of demand and supply-side explanatory variables raises questions as to whether the estimation equations are properly identified, while the time series used (1962-1983) yields few insights relevant to export behavior under structural adjustment.

Estimating Agricultural Export Response for Latin America

This paper analyzes agricultural export response in eight Latin American countries in the period through 1990. The central question that is addressed and tested statistically is whether price and exchange rate changes accompanying structural adjustment have resulted in changes

country), and then, for complete time series extending through 1990. Chow tests are employed in each case to formally test for structural change in the estimated coefficients between the pre-adjustment and entire time series following the standard methodology outlined in Kennedy (pp. 87-88).

The countries and commodities used in this analysis were chosen based on three criteria: first, data availability; second, that the export crops represented major exports of the country in question; and third, on enough time having elapsed since the initiation of structural adjustment for potential effects on exports to be realized. The result was the set of 22 country-commodity combinations given in Table 3. For 17 of these cases, crop exports increased between 1980 and 1990 (Table 2). Five other Latin American countries which had initiated stabilization and adjustment programs in the 1980's (Honduras, Jamaica, Panama, Uruguay, and Venezuela) were excluded.

Data on the dependent variables--annual export volumes--in each estimation equation were from FAO (1992). Data on annual producer prices were obtained from the SIAPA database of the International Institute for Cooperation in Agriculture (IICA), and were used in current and one-period lagged forms. Exchange rates for each country were calculated using data from the International Monetary Fund (1990, 1992), based on Edward's (1989) standard definition of the real exchange rate. This calculation adjusts the nominal dollar exchange rate by the ratio of the wholesale price index in the U.S. to the consumer price index in the domestic economy to

account for relative rates of inflation. In the results reported here, price and exchange rate variables were used in composite form as regressors; in other estimates (not shown), they were used singly. Both formats have been employed in the literature. A linear time trend, intercept dummy variables, and slope interaction variables were included as regressors in preliminary estimation equations but did not prove consistently significant. Further details regarding the variables, data, and tests for structural change are contained in Markussen (1993).

The present analysis addresses a number of the limitations of previous research. First, by estimating the responsiveness of individual export crops in specific countries, the aggregation problem faced by Bond is overcome. Aggregation of crops in estimating export response not only obscures the effects on specific commodities, but can be expected a priori to generate a low aggregate elasticity of supply, given the substitution relationships commonly existing among agricultural commodities. (Conversely, as Lele (1992) argues, examining export response gives only one part of the story with respect to adjustment, given the substitution relationships that exist with crops for domestic consumption.) Second, the time series used in each country-commodity combination analyzed here ends in 1990, thus incorporating up to a decade's experience with structural adjustment, depending on the country. Finally, the analysis generates estimates of export supply response to changes in solely supply-side variables (prices and exchange rates), thus addressing the need for export supply elasticities identified by Wattleworth and avoiding the potential identification problems raised in the study of Islam and Subramanian.

Empirical Results

Export response equations were estimated for each commodity-country combination and, in each case, for two time periods: 1961 (or another proximate initial year) through the year prior to the initiation of stabilization and or adjustment programs, and then for the entire time series through 1990. Equations were estimated by OLS, adjusted for autocorrelation wherever necessary. A seemingly unrelated regression (SUR) approach was not followed due to the

different years in which adjustment programs were initiated across countries, and thus the different time series estimated.

Due to the number of equations estimated, the full set of regression estimates is not reported here, but is discussed in detail in Markussen, 1993. Table 4 summarizes the estimated coefficients, standard errors, and elasticities derived using the composite price and exchange rate variable specification, similar to Bond and Wattleworth. The estimates, however, are generally much stronger. Several negatively-signed elasticities are estimated, though these are mostly for perennials, whose price response behavior is considerably complicated than that for annual crops. However, it is clear that disaggregation of agricultural exports at the individual crop level generally results in export supply elasticities which are higher, in some cases much higher, than the low elasticities reported by Bond. In addition, in 15 of 22 cases, the export elasticity increases in the sample period including adjustment years, compared to the pre-adjustment period. In eleven of those cases, the change is statistically significant using a Chow test.

When variables representing exchange rates and prices are included separately as regressors (not shown), the econometric results are somewhat weaker and include more negatively signed coefficients (particularly for the price variables for perennials). Two conclusions are evident, however. First, the responsiveness of exports to changes in the real exchange rate, particularly for the longer sample period incorporating the post-adjustment years, tends to dominate responsiveness to price changes. Second, Chow tests confirm structural change in fewer cases, in part reflecting the more limited explanatory ability of this specification compared to use of the composite price-exchange rate variable.

Conclusions

This analysis builds on previous research by estimating agricultural export response under structural adjustment for eight Latin American countries, disaggregated at individual country and commodity levels, for years extending through 1990. The results permit several conclusions. First, disaggregation at the country/commodity level results in much higher export

response elasticities--with respect to both price and exchange rates--than those previously estimated (e.g., Bond). Second, real exchange rate variation is shown to dominate variations in commodity prices in determining export supply response. There appear to be significant returns to macroeconomic reforms which include currency devaluation and increase economic incentives for producers and exporters. Third, structural change in export responsiveness after the initiation of adjustment is confirmed in well over half the cases in which a composite variable (incorporating price and real exchange rate effects) is the primary explanatory variable.

These results suggest that exchange rate and price reforms under structural adjustment are, in many cases, having their intended effects in stimulating agricultural exports. One qualification to this conclusion is that since many countries had previously experienced seriously overvalued exchange rates, the effects of initial large-scale currency devaluations in stimulating exports may overstate the effects to be expected from subsequent or continuing devaluations.

References

Balassa, B. "Incentive Policies and Agricultural Performance in Sub-Saharan Africa." PPR Working Paper Series. The World Bank, 1988.

Bond, M. E. "An Econometric Study of Primary Commodity Exports from Developing Country Regions to the World." IMF Staff Papers 34 (1985): 191-227.

Chhibber, A. "Raising Agricultural Output: Price and Nonprice Factors." Finance and Development June 1988: 44-47.

Edwards, S. Exchange Rate Misalignment in Developing Countries. 1988. The World Bank Occasional Paper No. 2, New Series. Baltimore, Maryland: The Johns Hopkins University Press, 1989.

Food and Agricultural Organization of the United Nations. Trade Yearbook. Rome, Italy, various years.

Gersovitz, M., and C.H. Paxson. The Economies of Africa and the Prices of Their Exports. Princeton Studies in International Finance No. 68. Princeton, New Jersey: International Finance Section, Department of Economics, Princeton University, 1990.

Hazell, P.B.R., M. Jaramillo, and A. Williamson. "The Relationship Between World Price Instability and the Prices Farmers Receive in Developing Countries." Jo. of Agr. Economics 42 (1990): 227-241.

International Monetary Fund. International Financial Statistics Yearbook. Washington, D.C.: International Monetary Fund, various years.

Islam, N., and A. Subramanian. "Agricultural Exports of Developing Countries: Estimates of Income and Price Elasticities of Demand and Supply." Jo. of Agr. Economics 40 (1989): 221-231.

Kennedy, P. A Guide to Econometrics. 2nd ed. Cambridge, Massachusetts: MIT Press, 1985.

Lele, U. "Structural Adjustment and Agriculture: A Comparative Perspective on Performance in Africa, Asia, and Latin America." International Working Paper Series IW92-30r, Food and Resource Economics Department, University of Florida, November 1992.

Markussen, K. "An Econometric Analysis of Agricultural Export Supply Response and Structural Adjustment in Latin America," unpublished M.S. Thesis, Department of Agricultural Economics, Cornell University, 1993.

Wattleworth, M. "The Effects of Collective Devaluation on Commodity Prices and Exports." IMF Staff Papers 35 (1988): 166-180.

World Bank. "Adjustment Lending Policies for Sustainable Growth," Country Economics Department, PRS14, 1990.

Table 1. Macroeconomic Indicators for Selected Latin American Countries

	GDP per capita (1987 US$)		Ave. annual inflation (%)		Real Eff. Exch. Rate (Index: 1985=100)
	1980	1990	1980-82	1989-91	1990
Argentina	2,990	2,170	142.5	2,117.2	134
Bolivia	850	600	115.2	16.4	191
Brazil	2,000	1,820	94.8	1,307.3	70
Chile	1,580	1,640	20.5	22.5	142
Colombia	1,110	1,180	26.0	28.4	160
Costa Rica	1,740	1,660	54.9	20.9	126
Ecuador	1,310	1,080	18.9	50.9	159
Mexico	1,920	1,750	52.4	22.8	107
	Terms of Trade (Index:1980=100)	Ave. Ann. Growth in Exports (volume)		Current Acct. Balance (mill. US$)	
	1990	1979-81	1989-91	1980	1990
Argentina	67	1.0	25.0	-4,774	1,789
Bolivia	74	-1.5	13.0	-6	-194
Brazil	82	19.8	11.1	-12,806	-2,983
Chile	84	9.0	11.1	-1,971	-790
Colombia	80	0.5	-3.9	-206	391
Costa Rica	70	4.5	4.2	-664	-514
Ecuador	66	-2.1	7.6	-642	-136
Mexico	70	18.1	21.2	-10,750	-5,255

Source: ECLAC, Economic Survey of Latin America, various years; World Bank, World Tables, 1992.

Table 2. Exports of Selected Latin American Countries, 1980-82 and 1990-92

Country	Total Exports (ann. ave.) 1980-82	Total Exports (ann. ave.) 1990-92	Total Agricultural Exports (ann. ave.) 1980-82	Total Agricultural Exports (ann. ave.) 1990-92
Argentina (Mill. $)	5,489	12,188	3,771	7,054
Maize (1,000 MT)			5,957	4,329
Soybeans (1,000 MT)			2,268	3,588
Wheat (1,000 MT)			4,021	5,807
Bolivia (Mill. $)	594	828	54	155
Coffee (MT)			5,777	6,069
Brazil (Mill. $)	14,093	32,841	6,027	8,553
Cocoa (MT)			130,763	95,566
Coffee (MT)			832,644	989,994
Soybeans (1,000 MT)			1,167	3,265
Chile (Mill. $)	2,715	9,251	253	1,431
Apples (MT)			191,719	374,711
Grapes (MT)			89,665	439,715
Peaches (MT)			10,587	73,279
Pears (MT)			26,402	112,147
Colombia (Mill. $)	2,407	7,022	1,608	2,439
Bananas (1,000 MT)			766	1,374
Coffee (MT)			573,734	827,197
Costa Rica (Mill. $)	637	1,625	438	962
Bananas (1,000 MT)			1,022	1,587
Cocoa (MT)			2,068	519
Coffee (MT)			87,983	143,276
Ecuador (Mill. $)	1,647	2,858	374	891
Bananas (1,000 MT)			1,261	2,494
Cocoa (MT)			26,217	51,410
Coffee (MT)			61,914	85,731
Mexico (Mill. $)	12,725	27,219	1,014	2,996
Coffee (MT)			159,308	208,378
Cotton (lint; MT)			160,037	45,792
Tomatoes (MT)			472,101	336,007

Note: Export values are real 1990-92 $.

Table 3. Countries, Crops, and Years Analyzed		
Argentina	Bolivia	Brazil
Maize (1961-1990)	Coffee (1970-1990)	Cocoa (1966-1990)
Soybeans (1965-1990)		Coffee (1966-1989)
Wheat (1961-1990)		Soybeans (1970-1989)
Chile	Colombia	Costa Rica
Apples (1969-1990)	Bananas (1968-1990)	Bananas (1968-1990)
Grapes (1969-1990)	Coffee (1968-1990)	Cocoa (1968-1990)
Peaches (1968-1990)		Coffee (1968-1990)
Pears (1968-1990)		
Ecuador	Mexico	
Bananas (1968-1990)	Coffee (1968-1990)	
Cocoa (1968-1990)	Cotton (lint) (1968-1990)	
Coffee (1968-1990)	Tomatoes (1968-1990)	

Table 4. Regression Results Using Composite Variable (Price and Exchange Rate)

Country, Crop and Initial Year of Adjustment	Pre-Adjustment			Whole Period		F-Statistic
	$\hat{\beta}$	s	ε	$\hat{\beta}$	s	
Argentina (1983)						
Maize	0.203	0.299	0.203	0.059	0.186	1.198
Soybeans	3.176	2.038	3.176	3.015**	1.376	0.930
Wheat[1]	-148.077	1803.930	-0.017	2249.440	1970.980	4.221***
Bolivia (1980)						
Coffee[1]	229.480	182.663	0.276	309.186	192.082	2.834
Brazil (1983)						
Cocoa	0.198***	0.068	0.198	0.201***	0.051	0.362
Coffee	-0.289***	0.045	0.289	-0.192***	0.048	4.360***
Soybeans	1.796***	0.561	1.796	1.734***	0.444	0.814
Chile (1985)						
Apples[1]	6.724***	1.716	0.780	10.854***	1.443	6.108***
Grapes[1]	2.044***	0.645	0.840	4.115***	0.818	19.999***
Peaches[1]	0.317***	0.062	0.815	0.802***	0.147	23.071***
Pears[1]	1.102***	0.128	0.900	1.626***	0.285	29.807***
Colombia (1985)						
Bananas[1]	104.746***	11.014	1.153	45.823***	8.219	6.359***
Coffee[1]	4.122	4.128	0.086	8.602**	3.282	3.378**
Costa Rica (1985)						
Bananas[1]	80.463	176.629	0.092	57.173	51.651	1.814
Cocoa[1]	-0.120	0.100	-0.161	-0.169**	0.079	0.573
Coffee[1]	3.810	3.456	0.073	7.017*	3.536	6.769***
Ecuador (1986)						
Bananas[1]	-20.943	39.289	-0.044	88.345***	22.836	3.823***
Cocoa	-0.412**	0.419	-0.412	-0.116	0.190	4.759***
Coffee[1]	6.121***	1.607	0.394	7.306	1.158	1.534
Mexico (1983)						
Coffee[1]	3.560	2.390	0.127	4.568	2.757	5.360***
Cotton	-0.583***	0.153	-0.583	-0.888***	0.200	4.877***
Tomatoes[1]	29.973***	7.783	0.749	9.481**	3.501	1.595

Note: *, **, *** denote statistical significance at 10%, 5% and 1% levels, respectively. [1] linear regression; all others in doub form.

Source: Markussen, 1993.

OTHER A.R.M.E. WORKING PAPERS
(Formerly A.E. Working Papers)

No. 93-12	Urban Influences on Farmland Use in New York State	Thomas A. Hirschl Nelson L. Bills
No. 93-13	An Empirical Evaluation of Incremental Conditional Damages and Benefits	Gregory L. Poe Richard Bishop
No. 94-01	Income and Dietary Change: International Comparisons Using Purchasing-Power-Parity Conversions	Thomas T. Poleman Lillian Thomas
No. 94-02	Meeting Clean Air Standards for Acid Rain and Urban Ozone: Implications for Electric Utilities in New York State	Martha Czerwinski Brian Minsker Timothy Mount
No. 94-03	Economic Evaluation of Residential Solar Electricity in Developing Countries	Duane Chapman
No. 94-04	Fishing in Stochastic Waters	Gunter Schamell John M. Conrad
No. 94-05	Implementing the Convolutions Approach: A Companion to "Measuring the Difference (X-Y) in Simulated Distributions: A Convolutions Approach"	Greg Poe
No. 94-06	Can Price Supports Negate the Social Gains from Public Research Expenditures in Agriculture?	Harry de Gorter Johan F.M. Swinnen
No. 94-07	Bioeconomics of Regulating Nitrates in Groundwater: Taxes, Quantity Restrictions, and Pollution Permits	Arthur C. Thomas Richard N. Boisvert
No. 94-08	Rethinking Contracts for Purchasing Power: The Economic Advantages of Dispatchability	Gary W. Dorris Timothy Mount