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Foreign Borrowing and Agricultural Trade of Major Latin American Debtors

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ABSTRACT

This report describes the debt situation among eight Latin American countries and analyzes the link between debt and imports of agricultural goods. An econometric model helps test whether an unexpected change in debt-service payments affects imports more than would an expected change in debt-service payments.

Introduction

The 1970's saw a worldwide increase in foreign borrowing, followed by sudden changes in the world economy in the early 1980's. The tight U.S. monetary policy in 1979 influenced these economic changes. This policy reversed the worldwide inflationary climate of the 1970's and increased real interest rates, and reduced prices for many commodity traded worldwide. World trade declined in volume and value in 1981 and 1982 for the first time since the late 1940's (9). These events particularly hurt Latin American debtor nations which had assumed a high percentage of variable interest rate loans and which exported primarly resource and agricultural commodities whose prices were vulnerable to deflation.

This paper discusses the effects the debt crisis for eight major Latin American debtors has had on their agricultural imports. [1] It highlights the relationships among foreign borrowing, the cost of borrowing, unexpected shocks to the cost of borrowing, and trade.

Latin American Debt

Encouraged by favorable terms of trade, Latin America increased imports from 1975 to 1980. Exports did not increase enough to finance all the increase in imports which were partially financed by inflows of external capital.(9). For example, the value of Brazil's imports rose from $13.5 billion in 1975 to $25 billion in 1980, while its exports rose from $8.6 billion in 1975 to $20 billion in 1980. Eaton and Gersowitz claim that borrowing generally was used for transactions similar to credit card use at the household level. (4).

1/ Argentina, Brazil, Chile, Colombia, Ecuador, Peru, Mexico, and Venezuela.

The sudden changed economic enviroment in 1979 altered the role of debt and increased debt and debt-service payments in 1980's. Borrowing for short-term debt to serve other debt increased in the 1980's. For example Argentina's and Mexico's short term debt increased by more than 50% between 1980 and 1982 (23).

Total debt for Latin America rose from $242 billion in 1980 to $383.9 billion in 1985. Most of the increase in debt occurred between 1980 and 1982. For example, debt of Brazil rose more than 25 percent, and that of Mexico and Argentina rose more than 50 percent. By 1985, outstanding debt was over $10 billion for each of seven Latin American countries and greater than 50 percent of gross national product (GNP) for each of the eight Latin American countries in this paper.

Debt service payments also reflect the increased debt burden for Latin American countries in the 1980's. Rising interest rates for short-term or variable-term credit, depreciating exchange rates, and increased short term borrowing to compensate for foreign exchange lost to falling export revenues or capital flight led to increases Latin American debt service payments. By 1985 debt-service payments for long-term debt were 33.6 percent of exports of goods and services for the region in 1985.

Effect of Unexpected Increases in Debt Service

Other things being equal, increases in debt-service payments reduce foreign exchange available for importing. Borrowing countries may not have expected sudden changes in the factors influencing debt-service payments in 1979-82, such as the rise in real interest rates. Therefore it is important to determine if expected changes in debt service payments (income) have a different effect on imports than do unexpected changes in debt-service payments (income). Using a two-period graph, we show that consumption in the second period falls more if the increase in debt service occurs unexpectedly and then estimate agricultural

import functions for eight Latin American countries and test if such a claim can be empirically validated.

The original budget line in figure 1, which includes foreign borrowing, is b. Any factor that influences income available for importing can shift the budget line b. The factors that can shift the budget line outward are: increases in the level of foreign exchange reserves at the beginning of a period, increases in export earnings, and newly acquired debt. A rise in debt-service payments can shift the budget line inward. A relative increase in debt-service payments is comparable with a decrease in real income available to pay for imported goods. 2/ This can be represented as an an inward shift in the intertemporal budget line for imported goods.

The slope of the intertemporal budget line represents the relative prices of the good in time 1 and time 2: ie $P_{t1}(1+i)/P_{t2}$, where P_{t1}, and P_{t2} are prices in the first and second periods respectively; the i refers to interest earned on income between the first and second period. Interest rates are included as part of the price of the good in the first period because when countries spend in the first period they either must borrow from the second period or forgo the opportunity to earn interest on the income spent in the first period.

Given the slope, the budget line in figure 1 is tangent to the intertemporal utility (or choice) function at A. At point A, $\underline{X}_1$ is imported in time 1 and $\underline{X}_2$ is imported in time 2. Suppose, due to the rise in debt-service payments and fall in export prices which reduce income, the budget line shifts inward to

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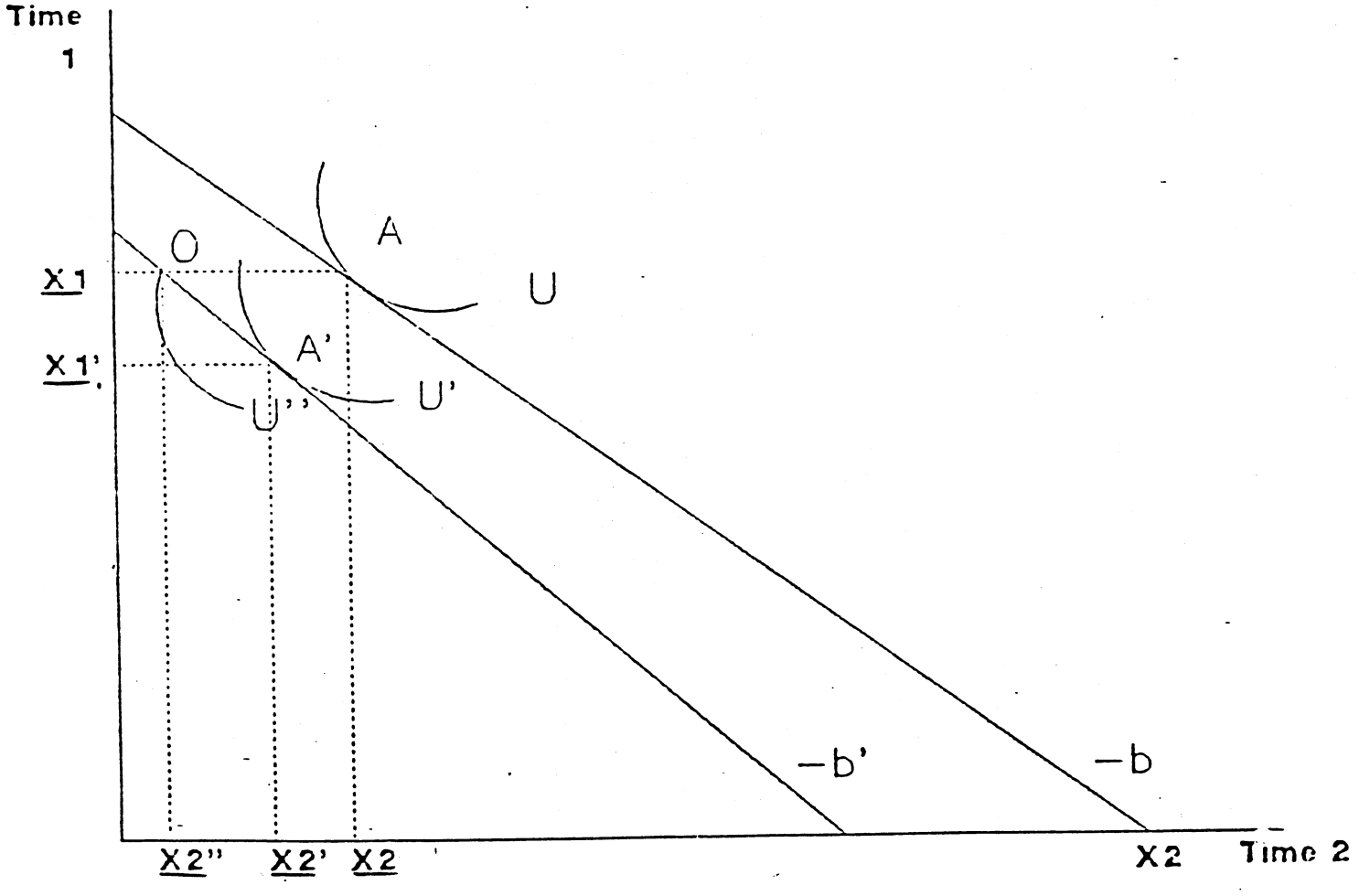
2/ Debt service payments can increase if short-term borrowing is used to finance imports. In this cause debt service may appear positively related to imports. Unexpected increases in debt service would partially offset a positive relationship between expected debt service and imports. Above we illustrate the case where unexpected increases in debt service enhance an already negative relationship between debt service and imports. Either case serves our point.

budget line b'. Budget line b' is tangent to a utility function at A'. At A', $\underline{X}'_1$ is imported in time 1, and $\underline{X}_2'$ is imported in time 2. Therefore, lower levels of imports of a good occur when income available for imports is lowered.

However, far more drastic reductions in imports in the second period arise from an unexpected fall in budgets. Suppose a country's agents believe they are on budget line b. They consume $\underline{X}_1$ in the first period. They then find themselves at b' rather than b in the second period. With the surprise fall in income agents cannot consume at point A' or the amount $\underline{X}'_2$ in the second period, because $\underline{X}_1$ has already been consumed in the first period. In this case, agents must import the amount in the second period where the inner budget line b' intersects the first periods consumption point $\underline{X}_1$ or point 0 on the graph. This amount of imports for period two is represented as $\underline{X}''_2$ in figure 1 and represents a reduction in imports that would not have occurred had the decline in foreign-exchange reserves been expected. The fall in imports due to a fall in income is represented by $\underline{X}_2$ to $\underline{X}_2'$, while the fall in imports due to the surprise element of the income change is $\underline{X}_2'$ to $\underline{X}_2''$.

Figure 1 illustates the decline in U.S. exports to the debtor Latin American countries. The years 1975-80 can represent the first period. The years 1980-85 can represent the second period, which witnessed a surprise increase in debt relative to export earnings (sudden income shortfall). Data on Latin American trade generally show a sudden reduction in imports in the years 1982-83, with partial recovery of previous import levels in the following years.

Figure 1. How income shortfalls influence imports



Capital Flows and Agricultural Imports

We derived an importing equation as a reduced form of two equations to examine the relationship between agricultural imports of Latin American countries and capital flows. The first equation follows Eaton and Gersovitz in specifying demand for capital for reserves or for transactions as:

$$B = (XV, M/GNP, R) \qquad (1)$$

where: B is demand for foreign borrowing, XV is variability of exports, M is imports, GNP is domestic income, R is foreign reserves. Export variability (XV) in our model is the square of first differences of the (annual) value of total exports. The ratio of total imports to GNP is the total value of all imports to real GNP. Reserves (R) are foreign exchange reserves reported in dollars minus gold.

The specification in equation (1) reflects that borrowing can smooth foreign-exchange expenditures (XV) for a constant level of imports, increase imported consumables [either consumer or investment goods (M/GNP)], or increase reserves (R). Although Eaton and Gersovitz also included public debt as an argument in the borrowing equation, we did not. In Latin America, the distinction between public and private debt has been lost as the governments have assumed much of the private debt in Latin America. We also specified import demand for agricultural goods together with the demand for borrowing, specified as equation (1). The agricultural import equation is:

$$M_a = (P_Q, GNP, B, XR, DS) \qquad (2)$$

where: M_a is the quantity of agricultural imports, P_Q is the import price, XR is the real exchange rate, B is borrowing, and DS is debt-service paid. We

represented the endogenous variable M_a as an index of agricultural imports, and price, P_Q, as import unit value (both calculated from data in 17). The rest of the data for the above variables was from (8). Exchange rates (XR) are divided by relative Consumer Price Indexes (CPI's) obtained from (8). Debt service was obtained from World Bank debt tables and is debt-service paid (23).

Price and income are standard arguments in an import demand function and are expected to have negative and positive signs, respectively (12). Exchange rates expressed as local currency per dollar are expected to have a negative sign. As the number of units of local currency increases per dollar, the currency depreciates and imports become more expensive. Borrowing and debt service could have positive or negative signs. If borrowing finances imports, the sign is positive. An increase in borrowing increases imports. If the country is overextended, the signs could be negative. However, borrowing will not necessarily be reduced if a country is in financial trouble. Many countries increase borrowing to cover debt-service payments. The change in debt service may better indicate how being overextended affects the level of imports.

To test the hypothesis that unexpected changes in debt service significantly reduce agricultural imports (in reference to the earlier argument highlighted in figure 1) we substituted equation (1) into equation (2), and obtained the reduced form equation (3). The equation was estimated for eight debtor countries in Latin America that are major agricultural importers.

$$M_a = (P_Q, GNP, XV, M/GNP, R, XR, DS_e, DS_u) \qquad (3)$$

In order to test hypotheses concerning expected and unexpected debt service, the debt-service variable in equation (2) was broken down into two variables,

expected debt service, DS_e, and unexpected debt service, DS_u. Expected debt service was obtained by taking the current year's debt and the previous year's interest rate, and deriving the payment due from a 20-year repayment schedule. The formula to derive the expected payment for year t is:

$$DSE_t = Debt_t * i_{t-1}/1 - (1 + i_{t-1})^{-20} \qquad (4)$$

where: i_{t-1} represents the 1-year Libor interest rate in the previous period. The Libor rate represents the rate European banks charge each other on international loans and serves a good proxy for the international rate. Unexpected debt service was obtained by subtracting DSE from the actual debt service paid. Other formulations of unexpected debt service are available. 3/

Results

Equation (3) was specified as a linear equation. The M/GNP variable was dropped due to collinearity problems and concern about simultaneous equation bias. Table 1 reports the results of estimating equation (3) for eight Latin American countries. We pooled seven equations--for Argentina, Brazil, Colombia, Ecuador, Peru, Mexico, and Venezuela--using annual data from 1971 to 1984 and estimatedthem using seemingly unrelated regressions (SUR). The SUR estimators are efficient relative to ordinary least squares (OLS) when there exists contemporaneous relationships in errors among equations. These error relationships may arise when each equation has a common omitted variable. The

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3/ We used an autoregressive model to estimate expected debt service. Except for Peru, the results for each country did not appear radically different than the formulation above. See Wallis for a discussion of modeling with expectations (20).

equation for Chile indicated serial correlation, and was estimated alone rather than incorporating a corrected Chile equation in the SUR system and losing one observation for all countries.

With the exception of Chile, overall fit statistics for individual equations are good. Dollar reserves, or real GNP, are positive and significant at the 5-percent level in Brazil, Chile, Colombia, Ecuador, Mexico, and Venezuela. The price of agricultural imports, the import unit value, is negative and significant at the 5-percent level in Argentina, Colombia, Ecuador, and Mexico. Since prices represent import unit values of all agricultural goods, such a broad index of prices may give wrong signs. However, only in the Venezuela equation is it the wrong sign and significant. The real exchange rate variable also performs well across equations. It is the right sign in every equation but for Ecuador and Venezuela, both oil-exporting countries. 4/

The performance of the two components of the debt-service variable is interesting. In all countries but Chile, a rise in the expected debt-service variable has a positive effect on imports, giving limited credence to the claim of Eaton and Gersovitz that borrowing is used to finance trade. The expected increase in debt service may reflect increased borrowing, which increases short-term budgets for consuming. This variable is not significant only in the Brazil equation. We hypothesized that unexpected rises in debt service will decrease agricultural imports. The unexpected debt-service variable is negative and significant at the 5-percent level in

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4/Short-term debt may be taken on to finance imports and lead to higher service payments. By choosing to report OLS and SUR estimators, we are assuming that all right-hand side variables, including expected debt-service payments, are exogenous. We therefore assume that if short term debt is assumed it precedes the decision to finance agricultural imports.

Table 1--Agricultural import demand equations for selected Latin American countries 1/

Items	Argentina		Brazil	
	Coefficient	T-statistic	Coefficient	T-statistic
Constant	1528346	7.60	2139103	2.70
Price	-1039968	-7.98	-4336239	-1.47
Real GNP	-663.86	-2.72	-11236.3	-.89
Dollar reserves	9.05	.78	299.8	3.19
Export variability	.0000043	2.12	.000156	5.23
Exchange rate	-121.9	-4.54	-4466.3	-4.27
Expected debt service	82940.02	2.72	102178	.61
Unexpected debt-service	49780.82	.86	67965.8	1.88
Rbar square	.59		.84	
D-W	2.65		2.45	
Estimation technique	SUR		SUR	

Items	Colombia		Chile	
	Coefficient	T-statistic	Coefficient	T-statistic
Constant	-44678.5	-.30	371622.7	.50
Price	-199803.6	-2.17	-3371426	-1.26
Real GNP	28413.1	3.93	270496.9	2.38
Dollar reserves	34.62	2.84	-166.5	-.73
Export variability	-.0000165	.52	.0000038	.32
Exchange rate	-2070.2	-.99	-28890.75	-1.71
Expected debt service	166767.2	4.67	-373632.8	-.63
Unexpected debt service	-144280.1	-1.90	240332.1	1.17
Rbar square	.93		.31	
D-W	2.51		3.40	
Estimation technique	SUR		OLS	

See footnotes at end of table.

Continued--

Table 1--Agricultural import demand equations for selected Latin American countries 1/--Continued

Items	Ecuador		Peru	
	Coefficient	T-statistic	Coefficient	T-statistic
Constant	-160678.7	-.94	953653.1	1.49
Price	-881122.9	-6.13	1407177	1.15
Real GNP	288185.6	5.94	-181.6	-.86
Dollar reserves	3.42	.07	-109.8	-1.06
Export variability	.000197	2.94	.0000114	.22
Exchange rate	3286.4	.88	-200631.5	-2.71
Expected debt service	171943.8	3.48	863070.8	4.24
Unexpected debt service	-220603.1	-6.40	57210.3	1.16
Rbar square	.92		.67	
D-W	2.24		2.19	
Estimation technique	SUR		SUR	

Items	Mexico		Venezuela	
	Coefficient	T-statistic	Coefficient	T-statistic
Constant	-612013.7	-.16	-1084290	-2.54
Price	-26430000	-4.76	3040652	2.56
Real GNP	2977.8	1.91	1503963	4.94
Dollar reserves	1143.8	3.63	-100.79	-3.76
Export variability	67051.6	3.53	-.0000162	-4.97
Exchange rate	-47712.4	-2.78	94710.5	1.56
Expected debt service	391746	1.19	645226	10.53
Unexpected debt service	-350204	-1.95	-195930	-2.60
Rbar square	.88		.96	
D-W	2.07		2.58	
Estimation technique	SUR		SUR	

1/ Models estimated from yearly data for 1971-84. Note interpretation of goodness of fit measures for a single equation (Rbar) in an SUR system is not clear.

Colombia, Ecuador, Mexico, and Venezuela and is insignificant in most other equations. Only in Brazil is it positive and significant.

These results give limited support to the hypothesis that unexpected rises in debt service should reduce imports if countries spend within their budget constraints. As of this writing, Brazil has put ceilings on its debt-service payments, tied it to export earnings, rather than reduce imports beyond their capacity to earn foreign exchange. Brazil's increases in agricultural imports, even when its budget unexpectedly falls, is consistent with that country's insistence on limiting its debt-service payments.

The above empirical approach is a step in the direction of including effects of capital flows on trade in empirical analysis. Extensions would be to include a larger number of countries. We would also like to extend the formulation of the model and devise a more sophisticated method of modeling expectations, perhaps by devising an expectations scheme that is derived from, and consistent with, our econometric model. However, modeling results often are not robust across expectations schemes. On the other hand, to ignore expectations is to leave out a critical component of economic behavior.

Table 2--Import demand elasticities from estimated Latin American debt models

Country	Variables					
	Price	Real GNP	Dollar reserves	Export variability	Exchange rates	Expected debt service
	Elasticities					
Argentina	-0.95 1/	-0.74 1/	0.004	0.0012 2/	-1.31 1/	0.44 1/
Brazil	-.21	-.18	.33 1/	.0005 1/	-.17 1/	.125
Chile	-.062	1.28	-.11	.01	-.54 2/	-.27
Colombia	-.005 2/	1.15	.17 1/	.32	-.035	.34 1/
Ecuador	-.78 1/	1.77 2/	.004	-.47	.27	.22 1/
Mexico	-1.48 1/	1.92 2/	.43 1/	.07 1/	-.32 1/	.35
Peru	.26	-.65	-.07	.002	-.07 1/	.60 1/
Venezuela	.27	1.97	-.15 1/	-.0001 1/	.17 3/	.25 1/

1/ Significant at the 1-percent level. 2/ Significant at the 5 percent level. 3/ Significant at the 10 percent level.

CONCLUSION

Stability of macroeconomic conditions may be a major factor in determining annual changes in agricultural exports to developing nations. The rapid and unexpected emergence of the debt problems in the early 1980's may have heightened the effects on agricultural exports to Latin America. The relationship between borrowing and trade may be influenced by the borrower's expectations of debt-service payments. Smooth transition periods between payment schedules of debtors may reduce the variability of trade if unanticipated changes to debt-payment schedules have a greater effect on imports than do anticipated changes. Policymakers in both developed and developing nations should be aware that macroeconomic policy should be predictable if agricultural exporters are not to be subject to major shifts in the export market.

The years 1985-90 represent a period where declines (or rises) in foreign exchange reserves of Latin American countries, if they occur, will not come unexpectedly. It seems reasonable to conclude that future declines in Latin American imports of agricultural products due to rising debt-service payments will not be as steep as in 1980-85.

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