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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 presents underlying reasons why their debt levels dramatically rose in the early 1980's. This report also 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.

Keywords: Debt, debt service, econometric model, income, imports, Latin America

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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 by lowering inflation in the United States, increasing real interest rates, and reducing world commodity prices. 1/ These events initially lowered incomes, increased the relative debt burden of debtor nations, and slowed economic growth. World trade declined in volume and value in 1981 and 1982 for the first time since the late 1940's (9). This report highlights the relationships among foreign borrowing, the cost of borrowing, unexpected shocks to the cost of borrowing, and trade.

Many Latin American countries are currently among the largest debtors in the world's less developed countries (LDC's). Twelve of the 17 countries the World Bank classified as highly indebted are in Latin America (9). Inflows of foreign savings spurred economic growth and increases in trade in Latin America in the late 1970's (9). But the debt crisis in 1982 reduced the growth and trade which has had strong consequences for Latin America and for countries they trade with.

This report discusses the debt crisis for eight major Latin American debtors: Argentina, Brazil, Chile, Colombia, Ecuador, Peru, Mexico, and Venezuela.

LATIN AMERICAN DEBT

International borrowing increased dramatically in the 1970's. Public and publicly guaranteed (PPG) debt for the 107 less developed countries that report to the World Bank increased from $50 billion in 1970 to $354 billion in 1980. 2/ Total debt (includes private and nonguaranteed and short-term debts) for these countries rose from $573.54 billion in 1980 to $892.4 billion in 1985. Total debt for Latin America rose from $242 billion in 1980 to $383.9

1/ Shane and Stallings argue that this period witnessed more of a shift in U.S. money demand than U.S. money supply (17). Underscored numbers in parentheses refer to items cited in the References section.

2/ Disbursed and outstanding as defined by the World Bank debt tables; private nonguaranteed and short-term debt are not available for the early 1970's. Less developed countries are the 107 low- and middle-income countries that report to the World Bank.

billion in 1985. In both years, Latin American debt accounted for approximately 43 percent of the total debt for the countries reporting to the World Bank (table 1).

In 1985, outstanding debt was over $10 billion for each of seven Latin American countries (table 1). Outstanding debt was greater than 50 percent of gross national product (GNP) for each Latin American country shown in table 2.

Table 1--Outstanding debt for Latin American debtor countries 1/

Country	Outstanding debt								
	Total			Long term			Short term		
	1980	1982	1985	1980	1982	1985	1980	1982	1985
	Billion US dollars								
Brazil	70.2	90.7	103.7	56.7	73.3	92.0	13.5	17.4	11.0
Mexico	57.3	85.8	94.4	41.2	59.7	89.0	16.1	26.1	5.4
Argentina	27.0	43.6	46.0	16.7	27.1	40.1	10.3	16.5	5.9
Venezuela	29.5	31.8	32.0	14.0	17.1	21.8	15.5	14.7	10.2
Chile	11.9	17.3	19.0	9.4	14.0	17.4	2.5	3.3	1.6
Colombia	6.8	10.2	14.8	4.5	7.1	10.9	2.3	3.1	3.9
Peru	9.4	11.6	13.6	7.4	8.6	11.8	2.0	3.0	1.8
Ecuador	5.9	7.5	8.7	4.4	5.5	7.1	1.5	2.0	1.6
Latin America	240.8	328.9	374.0	172.4	237.5	326.0	68.4	91.4	47.0
World total	606.9	709.4	853.4	472.4	551.7	730.9	134.5	167.7	123.9

1/ Public and publicly guaranteed debt.
Source: (23).

Table 2--Outstanding debt for major Latin American debtor countries, 1985

Country	Outstanding debt	
	Public and publicly guaranteed (debt/GNP)	Principal and interest due (debt service/exports)
	Percent	
Brazil	51.3	26.6
Mexico	58.3	36.9
Argentina	79.9	41.7
Venezuela	66.0	12.9
Chile	142.2	26.2
Colombia	42.6	29.2
Peru	88.2	7.9
Ecuador	79.0	28.8
Latin America 1/	62.3	26.2
All developing countries 2/:	45.0	18.9

1/ Includes Caribbean countries. 2/ Refers to the 107 low- and middle-income countries that report to the World Bank.
Source: (23).

Most of the increase in debt occurred between 1980 and 1982. Debt of Brazil rose more than 25 percent, and debt of Mexico and Argentina rose more than 50 percent. Short-term debt (debt with an original maturity of less than 1 year) also contributed to the increase. For example, Argentina's and Mexico's short-term debt rose more than 50 percent from 1980 to 1982. A rise in short-term debt is important because it may be used to pay past debt and could be viewed as an early indicator of debt-payment problems.

Debt service payments also reflect the increased debt burden for Latin American countries in the 1980's. Debt-service payments for long-term debt were 33.6 percent of exports of goods and services for the region in 1985. Borrowing, particularly for short-term debt to service other debt, increased until 1982, when Mexico suspended payments.

BORROWING AND TRADE

The effects of borrowing on trade are complex and can operate through several channels. Given full employment (or fixed levels of output), borrowing must result in either imports of goods and services or in domestic inflation as aggregate demand rises. If domestic money supplies do not offset (sterilize) this capital inflow, then there must be net imports. Capital inflows are the other side of current account deficits. Two types of goods can be purchased overseas. Borrowers can import capital goods for production that increase domestic economic growth, or borrowers can import goods that are directly consumed. Foreign borrowing can be used to build reserves or finance capital flight.

Encouraged by favorable terms of trade, Latin America increased imports from 1975 to 1980. Yet, exports did not increase enough to finance all of the increase in imports. For example, the value of Argentina's imports increased from $3.6 billion in 1975 to $10.5 billion in 1980. Meanwhile, Argentina's exports rose from $2.9 billion in 1975 to $8.02 billion in 1980. 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.

Imports were financed by inflows of external capital (9). Eaton and Gersovitz claim that borrowing generally was used for transactions similar to credit-card use at the household level (4). Dornbusch claims borrowing also helped finance current account deficits for Chile, Brazil, and Mexico (2). Borrowing also financed capital flight for other countries. Table 3 lists the trade balance and capital accounts for eight Latin American countries.

When the changing economic environment reduced incomes and increased debt and debt-service payments in the 1980's, indebted countries in Latin America were required to make economic adjustments to alter the balance of payments. They used five channels: reducing imports, increasing exports, using international reserves, delaying some of the principal and interest payments, and getting new loans.

Import restrictions were widely implemented over Latin America as attempts to reduce imports. Tariffs, surcharges, or licensing requirements have been imposed by at least six countries since 1982 (Brazil, Chile, Colombia, Mexico, Peru, and Venezuela). Even countries that liberalized trade earlier, such as Argentina and Mexico, re-imposed restrictions.

The dollar value of exports from Latin American countries increased 7 percent since 1982. However, falling prices for export goods limited the effectiveness of this second channel in improving balance-of-payments deficits. For example,

Table 3--Current account and trade balance for major Latin American debtor countries

Country	1979	1980	1981	1982	1983	1984	1985
			Billion US dollars				
Argentina:							
Current account 1/	-0.513	-4.77	-4.71	-2.48	-2.44	-2.5	-0.900
Trade balance	1.782	-1.37	.71	2.73	3.72	3.98	4.877
Brazil:							
Current account 1/	-10.48	-12.81	-11.75	-16.31	-6.84	.042	-.270
Trade balance	2.717	-2.823	1.185	.778	6.469	13.086	12.466
Chile:							
Current 1/ account	-1.189	-1.971	-4.733	-2.304	-1.073	-2.060	-1.30
Trade balance	-.355	-.764	-2.677	.063	.986	.293	.78
Colombia:							
Current account 1/	.438	-.206	-1.961	-3.054	-3.003	-1.401	-1.390
Trade balance	.463	-.297	-1.572	-2.244	-1.494	-.246	-.021
Ecuador:							
Current account 1/	-.625	-.642	-1.002	-1.195	-.104	-.248	.085
Trade balance	-.054	-.302	-.183	.162	.957	1.055	1.147
Mexico:							
Current account 1/	-5.459	-8.162	-13.899	-6.218	5.419	4.240	.540
Trade balance	-2.830	-2.830	-4.099	6.795	13.762	12.941	8.407
Peru:							
Current account 1/	.729	.062	-1.728	-1.613	-.875	-.223	.53
Trade balance	1.540	.837	-.553	-.428	.293	1.007	1.098
Venezuela:							
Current account 1/	.350	4.728	4.0	-4.246	4.247	5.418	3.086
Trade balance	4.155	8.174	7.840	2.748	8.162	8.705	6.790

1/ Net exports of goods and services and unilateral payments. If unilateral payments were zero, a positive current account indicates that exports of goods and services are greater than imports of goods and services.

Source: (8).

world soybean prices (crucial to Argentina and Brazil) fell 15 percent between 1980 and 1981. Oil prices, critical to Venezuela and Mexico, rose by 16 percent from 1980 to 1981 but then fell back to 1980 levels by 1983.

Most Latin American countries improved their balance of payments by using their reserves in 1978-82. Argentina's total reserves fell approximately 30 percent, Brazil's fell approximately 65 percent, Chile's reserves rose 100 percent, Colombia's reserves rose 100 percent, Ecuador's reserves fell 50 percent, Peru's reserves rose 200 percent, Mexico's reserves fell by 50 percent, and Venezuela's reserves rose approximately 20 percent. However, it is not clear whether each country used its reserves to finance imports or to maintain strong currencies at quasi-fixed exchange rates. It is clear that by 1983-84, 2 years after the debt problems became evident, Latin American countries explicitly attempted to build their reserves.

Latin American countries also attempted to improve the balance of payments by rescheduling debt and interest payments on past debt. These restructuring agreements represent short-term income relief and allow countries to hold foreign exchange reserves that otherwise would be payed to creditors. Commercial banks concluded multiyear agreements to restructure payments on over $20 billion of debt for Argentina and Mexico in 1982 and for Brazil in 1983. Further agreements continued for Mexico and Brazil in 1984, 1985, and 1986. Multiyear restructuring agreements were also concluded with Chile, Ecuador, Peru, and Venezuela in 1983 and 1984 (18). However, the multiyear agreements provided stability relative to earlier yearly reschedulings.

The fifth channel to improve the balance of payments is to acquire new loans. Since 1982, new loans of up to $6 billion have been provided to Brazil and Mexico. Smaller amounts have been assumed by Argentina, Chile, and Ecuador since 1982 (23). Much of the new debt acquired since 1982 has been through explicit agreements that may alleviate the financial crisis.

CAUSES OF THE DEBT PROBLEM

Countries may fall short of foreign exchange if debt that was planned to be used for investment in foreign-exchange earning industries is used to purchase items for consumption. This could precipitate a debt crisis. Other factors contributing to the unexpected foreign exchange shortfalls of Latin American debtors are adverse changes in the terms of trade (falling export prices relative to import prices), rising real interest rates, falling real exchange rates, and rising inflation. These influences may have contributed to general economic uncertainty in Latin America and encouraged capital flight that magnified the unanticipated declines in foreign exchange reserves.

Investment

It is often assumed that agents or firms acquire long-term debt in order to invest. Money is invested such that the present value of all returns is greater than the cost of borrowing (or the interest rate). Sachs believes that similar rules hold for countries (15). He states "capital-scarce developing countries can profitably borrow over the longer term only if the borrowed resources are invested sufficiently in traded goods" (15). Arnade, Shane, and Stallings illustrate this concept by deriving an export revenue function and writing it as a function of investment rather than as a fixed input (1). Borrowers determine the level of investment loans needed by setting the marginal revenue of investment equal to the interest rate.

Investment can either develop export industries that earn foreign exchange, develop domestic industries that produce goods that substitute for imported goods, or produce nontradable goods and services. Such notions are well established. Keynes noted that investment in export-earning industries would be necessary for Germany to make World War I reparations payments (10). Critics responded that investment in domestic industries would allow a country to allocate more of its foreign-exchange reserves to repaying debts by reducing imports. Argentina, Brazil, and Mexico relied heavily on import substitution industries in the period following the Second World War (18). Sachs and Arnade, Shane, and Stallings claimed that Latin American countries may not have used their loans to develop export industries (1, 15). Sachs wrote "Foreign borrowing by Latin American governments often went to increase private sector accumulation of foreign assets rather than increase export capacity" (8). He contrasted this with Asian countries and noted that while the share of exports to GDP were similar between Latin America and Asia in 1965, the ratio of exports to GDP was far higher for Asia by 1985.

Arnade, Shane, and Stallings illustrated how shortfalls in investment can compound a country's debt problem (1). They assumed lenders will increase loans to a country if expected future incomes increase. Loans have two uses: consumption and investment. Government-backed lenders and borrowers misperceive the nature of the intertemporal utility function; so consumption levels by borrowers are higher than lenders expected. The increased consumption comes at the expense of investment and results in lower than expected levels of income in the repaying period.

Chile may represent an example of the above scenario. Dornbusch showed that in 1982 capital formation dropped and there was a flight into consumer durables (2). This increase in demand for consumer goods reduced investment and perhaps income in later periods. The ensuing income shortfall hampered Chile's ability to repay or service its debt.

Terms of Trade

Terms of trade played a role in debt accumulation during the 1970's. Since it is difficult for countries to foreclose on foreign assets, Winters assumed countries borrowed against future incomes rather than using current assets as collateral (22). The debt increased during a period of sustained increase in export values, and added to expectations of increases in future revenue. Unexpected downward shocks in export prices have reduced foreign-exchange earnings, which are used to service debt and repay the principal, for debtor exporters.

Terms of trade can also adversely affect a developing country's income if export prices fall and import prices fail to decrease. Shane and Stallings claim that other countries followed the United States in tightening monetary policy in 1979 (16). This policy shifted world demand inward and reduced prices for many primary commodities, such as minerals, that borrowing countries exported. For example, Brazil's export price of iron ore fell by 12 percent between 1980 and 1981, coffee fell 42 percent, and sugar fell 32 percent (8). However, the decline in world demand failed to greatly reduce the more fixed-price industrial products that developing countries import. The terms of trade index for Latin America changed from 95 in 1978 to 100 in 1980, to 93 in 1982, and to 92 in 1983.

Sachs, a partial dissenter from this argument, claimed changes in terms of trade do not explain the situation of all problem debtors (15). He noted that many of the "crisis" countries were oil exporters such as Mexico, and that Venezuela enjoyed terms of trade gains between 1979 and 1983. He also noted, however, that in the same period Brazil, Chile, and Peru "suffered serious income losses from terms of trade declines" (15). Table 4 lists the terms of trade index for eight Latin American countries.

Table 4--Terms of trade for Latin American debtor countries

Country	Export unit value/import unit value				
	1975	1978	1980	1982	1983
			1975 = 100		
Argentina	100	77	73	70	51
Brazil	100	108	72	60	43
Chile	100	85	71	53	37
Colombia	100	145	129	119	154
Ecuador	100	107	144	142	205
Mexico	100	92	94	99	93
Peru	100	89	78	69	54
Venezuela					

Source: (18).

Interest Rates

As discussed earlier, borrowers gain if investment returns are greater than the cost of borrowing or if interest rates are less than inflation (negative real rates). Real interest rates (whether measured as the U.S. prime minus an index of traded goods or in the U.S. prime minus the price index of borrowers' exports) on U.S. loans were were low (typically below 1 percent) or even negative in the 1970's. This rate was lower than that available in many countries, so foreign borrowing made economic sense.

A high percentage of loans made to Latin America in the late 1970's were variable-rate loans that had short-term maturities. Brazil's share of loans with variable interest rates doubled to over 33 percent between 1968 and 1973, and Mexico had 75 percent of debt in variable interest rate loans in 1982 (18). A United States International Trade Commission report stated that as much as three-fourths of foreign commercial debt had been contracted at variable interest rates (18). After the United States began tightening the money supply in 1979, nominal interest rates rose, and U.S. and world inflation fell. Both of these effects significantly raised real interest rates to foreign borrowers (5). Nominal interest rates on Eurodollar deposits rose from 8.1 percent (1974-78 average) to 14 percent (1979-82 average), peaking at 19.5 percent in 1980. Real rates increased from 0.7 percent to 5.3 percent (9). Latin American countries assumed a large percentage of variable-rate loans and were the first to feel the shock. By 1982, Argentina's debt-service payments increased 66 percent over 1979 levels. Brazil's payments increased by 49 percent, Chile's by 68 percent, Colombia's by 53 percent, Ecuador's by 65 percent, Mexico's by 8 percent, Peru's by 36 percent, and Venezuela's by 41 percent (23).

Exchange Rates

Dornbusch has claimed that "overvalued currencies" in several Latin American countries, particularly Chile, may have played a major role in reducing incomes of borrowing countries below what lenders expected (2). Sachs noted that in 1979-81, the real value of the currency appreciated 36.9 percent in Argentina, 13.3 percent in Chile, and 7.5 percent in Venezuela over 1976-78 levels (15). An overvalued currency leads to increased spending on imports and reduced earnings from exports. The rise in imports and fall in exports resulting from a strong currency lowers foreign exchange available for debt repayment. A strong currency, however, also insures that the prices of imported investment goods are cheaper. But increased investment in export-earning industries is unlikely if world demand for traded commodities is falling.

Latin American countries have traditionally used fixed exchange rates which they overvalued (in the sense that sustained trade deficits rose) forcing them to periodically conduct major devaluations to achieve external balance (9). To back such devaluations, countries intervene in foreign currency markets, with signficant domestic implications. An increase in foreign reserves that is not sterilized expands the domestic money supply and can lead to domestic inflation.

Exchange rate devaluations have been a major part of the adjustment policies implemented in Latin America in the 1980's. 3/ In 1982 or 1983, Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela devalued their currencies. As of January 1987, exchange rates for four countries were pegged to the U.S. dollar (Panama, Paraguay, Peru, Venezuela), while exchange rates for six countries were flexible rates. Rates for three countries (Brazil, Chile, and Colombia) adjust to a set of indicators. Rates for Argentina, Ecuador, and Mexico are managed floating rates (7).

Even before debt-motivated adjustments, currencies in South America changed frequently. Fluctuating exchange rates increase risk and lead to hedging of goods and foreign exchange. Further compounding trading problems is the widespread use of multiple exchange rates and strong black-market premiums prevalent in Latin America (15).

Devaluation can benefit a country through increasing the revenues earned from exports. But devaluation can also hurt. Depreciation increases debt-service payments (in local currency) for existing debt denominated in dollars. In Chile, for example, debt increased from 50 percent to 78 percent of gross domestic product (GDP) after currency devaluations in 1982.

Argentina

Argentina changed its currency (then the peso) in 1977 that had been managed by the central bank. Preannounced tablita or devaluations were used from December 1978 until 1981. A dual rate was used in the early 1980's. A

3/ For price-taking countries, devaluation reduces the prices of exported goods in foreign currency and increases the prices of imported goods in home currency. Restrictions on import-demand and export-supply elasticities that are required to improve balance of payments when devaluations occur can be summed up by the Marshall-Lerner or Bickerdicke-Robinson-Metzler conditions (see 12 for further discussion).

financial rate floated, and a commercial rate was adjusted periodically. The commercial peso was devalued twice by 30 percent in 1981. A new currency, the austral (A), was introduced as a part of a broader economic plan in June 1985. The new currency was pegged to the U.S. dollar at 0.8A/$ but was devalued at the end of 1986 (to 1.4A/$). Capital flows were also liberalized in 1987.

Brazil

Brazil tied its cruzeiro to a crawling peg in 1968. Later, this quasi-fixed rate was tied to the dollar. A 30-percent devaluation occurred in 1979. It was pegged to the dollar at Cr 13.84/$. Brazil again devalued the cruzeiro 23 percent in 1983, and had a series of smaller depreciations. Brazil initiated a new currency, the cruzado, as a part of its economic plan in 1986.

Chile

Chile tied its currency to the dollar in 1978. Chile's currency rose along with the dollar. The Chilean peso was devalued in 1982 and the country switched from a fixed exchange rate (1979-82) to a crawling peg tied to a basket of currencies. They tried a float for several months, but the currency depreciated very sharply. At the end of 1982, Chile's currency was adjusted daily. Chile also indexed its exchange rate to domestic inflation in 1983.

Colombia

Colombia began appreciating its currency as early as 1975. Colombia used a crawling peg in 1983 after a minor devaluation.

Mexico

Mexico's currency was fixed from 1977 to 1980. Mexico has used multiple rates since 1982, when foreign debt payments were suspended and foreign exchange markets closed. The peso (p) was devalued (from 26.6P/$ to 44.6P/$) in February 1982. A three-tiered system was initiated: a controlled rate, a free rate for goods, and a free rate for services. In June 1985, Mexico devalued the controlled rate 17 percent and let the market rate float.

Peru

Peru abandoned a prearranged rate of devaluation and assumed periodic devaluations in 1980. Peru devalued its currency against the dollar by approximately 100 percent annually from 1981 to 1985.

Venezuela

Venezuela started using multiple rates in 1983: a floating rate for financial exchanges and two preferential controlled rates for exports (4.3 and 6 Bolivares(b)/$), debt service, government purchases, and some imports. Venezuela devalued all rates in 1984. In 1984, they also added a third controlled rate at 7b/$ but merged all controlled rates in 1985 at 7.2b/$. Meanwhile, the free rate was 17b/$. Venezuela devalued the Bolivar in 1986.

Capital Flight

Capital flight heavily contributed to problems of countries such as Argentina, Venezuela, Chile, and Mexico. Capital flight in 1984 was calculated to be

$42.8 billion for Mexico, $31 billion for Argentina, and $20 billion for Venezuela (17). Argentina liberalized capital flows in 1978, contributing to capital flight estimated at $9 billion in 1981 (17). Capital flight has had less of an overt influence on countries such as Brazil, which attempt to restrict capital flows.

Empirical studies of capital flight are difficult. First, capital flight is difficult to define. Does one distinguish between capital that is only seeking highest returns from capital that is invested overseas only to get beyond the reach of the government? Capital flight is also difficult to measure. For example, over-invoicing is often used to get around capital controls.

A number of factors contributed to perceived increases in risk and to capital flight in the late 1970's and 1980's. These include currency instability, perceived lack of stable investment opportunities, changes in capital regulations without offsetting changes in other areas of the economy, and domestic inflation. Sachs claims overvalued currencies encouraged Latin Americans to buy foreign assets (15). A further discussion of capital flight is contained in the appendix.

DEBT SERVICE AND INCOME EFFECTS

Changes in the economic environment in the 1980's are reflected in debt service and debt levels. Debt-service payments in own currency terms reflect many of the causes of the debt crisis. For example, debt-service payments increase if interest rates rise for short-term or variable-term credit. Loans denominated in dollars become more costly to service if the debtor countries' real exchange rates depreciate. Finally, debt-service payments increase if borrowing increases to compensate for foreign exchange lost to falling export revenues or capital flight. The cumulative effects of all these factors can substantially increase debt-service payments.

Effect of Unexpected Increases in Debt Service

It is well established that income is a critical factor influencing a country's level of imports (12, 14). Other things being equal, increases in debt-service payments reduce income 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. We will show how expected changes in debt-service payments (income) have a different effect on imports than do unexpected changes in debt-service payments (income). We then estimate agricultural import functions for eight Latin American countries and test if such a distinction can be empirically validated.

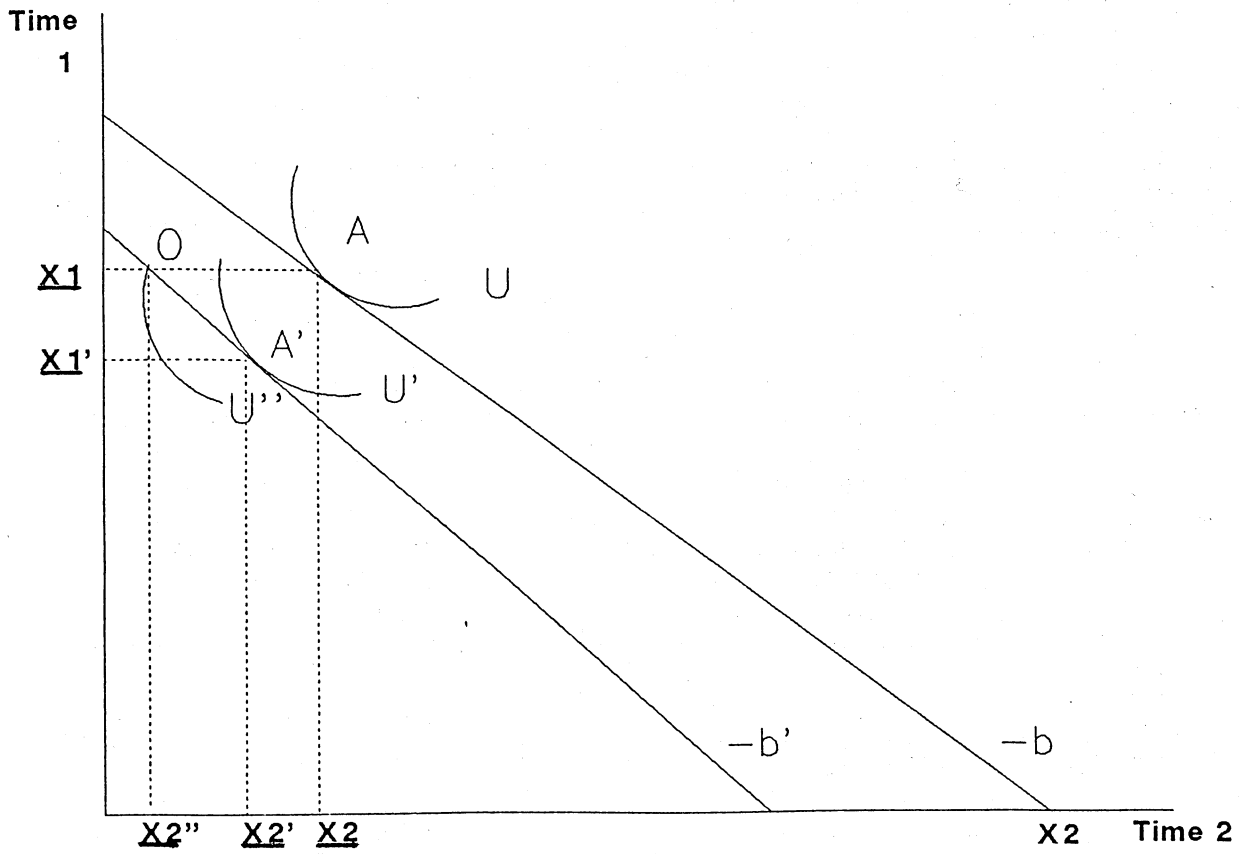
Using a two-period graphical analysis, we show that consumption in the second period falls more if the increase in debt service occurs unexpectedly. A relative increase in debt-service payments is comparable with a decrease in real income available to pay for imported goods. 4/ This can be represented as an an inward shift in the intertemporal budget line for imported goods.

4/ Debt service can increase if short-term borrowing is used to finance imports and, thus, may appear positively related to imports. The unexpected increases in debt service would partially offset a positive relationship between expected debt service and imports rather than enhance an already negative relationship between debt service and imports.

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.

The slope of the intertemporal budget line represents the relative prices of the good in time 1 and time 2: that is, $P_{t1}(1+i)/P_{t2}$. P_{t1},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

Figure 1. How income shortfalls influence imports



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 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. Suppose agents suddenly 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 period's 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). The years 1985-90 represent a third period where future declines (or rises) in foreign exchange reserves do not come unexpectedly. It seems reasonable to argue that future declines in Latin American imports of U.S. products due to rising debt-service payments will not be as steep as they were in 1980-85. Data on Latin American trade generally support the conclusion that there was a sudden reduction in imports in the shock years 1980-82, with partial recovery of previous import levels in the following years.

CAPITAL FLOWS AND AGRICULTURAL TRADE

Agriculture plays a significant role in Latin American trade. Table 5 lists agricultural imports and exports as a share of the total imports and exports for eight Latin American countries. Agricultural exports are critical to several countries and agricultural imports are important in all countries. For example, agriculture accounted for more than 60 percent of Argentina's and Colombia's (legal) exports throughout the early 1980's. It also accounted for 10 to 25 percent of imports for all countries in Latin America except Argentina and Brazil. We focus on the influence of debt on agricultural imports. The income elasticity of import demand for agricultural goods determines the shortrun effects of debt on agricultural trade. If the income elasticity is less elastic than that for other goods, demand for farm products may not be reduced as much as for other goods.

Estimating the Effect of Borrowing on Agricultural Imports

We turn to an empirical analysis of the influence of debt on agricultural trade. In the 1970's and 1980's, there has been an increased interest in the empirical relationship between capital flows and trade (11), which previously had been ignored (12, 22). Hemphill presented one of the first efforts to measure the relationship between capital flows and trade (6). He developed a

Table 5--Agriculture's share of total trade

Item and country	1980	1981	1982	1983	1984
			Percent		
Agricultural imports' share of total imports:					
Argentina	6.5	5.8	5.3	5.5	6.3
Brazil	9.9	9.1	8.5	8.7	9.8
Chile	15.9	12.6	14.4	17.2	13.4
Colombia	11.5	9.5	10.3	10.9	10.4
Ecuador	8.1	7.8	9.1	14.9	12.1
Mexico	16.1	13.5	12.8	26.3	20.9
Peru	20.4	20.4	18.0	17.5	18.6
Venezuela	16.2	17.0	15.2	11.6	13.8
Agricultural exports' share of total exports:					
Argentina	68.8	69.1	64.0	75.3	74.7
Brazil	46.8	41.8	40.3	41.2	38.7
Chile	8.5	10.5	10.3	9.3	11.7
Colombia	77.2	71.1	69.6	68.0	75.8
Ecuador	25.1	22.1	24.1	17.0	19.8
Mexico	11.2	8.1	6.6	7.3	7.0
Peru	9.7	9.3	9.4	6.0	6.7
Venezuela	.4	.4	.6	.8	.8

Source: (17).

theoretical case for the relationship between import demand and foreign exchange. Eaton and Gersovitz provided a more direct discussion of the effect of borrowing on trade (4). They tried to determine the extent that borrowing serves a transaction role (importing) or a reserve role.

We derived an importing equation as a reduced form of two equations to examine the relationship between agricultural imports 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. Eaton and Gersovitz also included wealth. Income growth partially substitutes here for wealth accumulation. 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.

The Estimating Equation

We used the above equations to test the hypothesis that unexpected changes in debt service significantly reduce agricultural imports (in reference to the earlier argument highlighted in figure 1). By substituting equation (1) into equation (2), we arrived at 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 as 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. 5/ However, the unexpected debt service was distributed above and below zero. It seems reasonable that rational planners would come to forecast DSE in a similar manner to equation (4).

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 6 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 estimated them using seemingly unrelated regressions (SUR). The SUR estimators are efficient relative to ordinary least squares (OLS) when there exist contemporaneous relationships in errors among equations. These error relationships may arise when each equation has a common omitted variable. The 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.

Short-term debt may be taken on to finance imports. The expected debt-service variable may rise because imports are rising. In this case, the expected debt-service variable would not be exogenous but would be a function of the level of imports. OLS and SUR estimators would be inconsistent.

By choosing to report OLS and SUR estimators, we are assuming that all right-hand side variables, including expected debt-service payments, are exogenous. Therefore, we need to assume that determination of the level of debt-service payments precedes the decision to finance agricultural imports. In other words, if countries borrow to finance imports, this borrowing occurs prior to the decision to import agricultural products. We are assuming a two-stage budgeting process. Countries may borrow to finance imports and thereby increase debt-service payments. Having obtained the additional reserves, they then decide what to import.

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.

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

5/ 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).

Table 6--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	

See footnote at end of table.

Continued--

Table 6--Agricultural import demand equations for selected Latin American countries 1/--Continued

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 footnote at end of table.

Continued--

Table 6--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	

See footnote at end of table.

Continued--

Table 6--Agricultural import demand equations for selected Latin American countries 1/--Continued

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. We dropped the import value to GNP ratio specified in the text after noting strong influence of this variable in countries that primarily import agricultural products. Note interpretation of goodness of fit measures for a single equation (Rbar) in an SUR system is not clear.

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 Colombia, Ecuador, Mexico, and Venezuela and is insignificant in most other equations. 6/ 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 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.

6/ Though the unexpected debt-service variable varies over the period of estimation, this number is largest in 1982-83. Concessional sales rose in this period but are not represented in our model.

Table 7--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

Falling commodity prices, high real interest rates, overvalued exchange rates, lower than anticipated investment levels, and capital flight contributed to the debt problems in 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. The rapid and unexpected emergence of the debt problems in the early 1980's may have heightened the effects on U.S. agricultural exports to Latin America.

Stability of macroeconomic conditions is a major factor in determining annual changes in agricultural exports. Macroeconomic policy should be predictable if U.S. agricultural exporters are not to be subject to major shifts in the export market.

We have not discussed the effect on agricultural production or imports as our model is developed from finance literature. However, some countries import the same crops they grow. For example, Brazil and Mexico grow and import wheat. The longer run effects of Latin America's debts on U.S. agricultural exports may depend on the degree these countries shift resources in or out of production of agricultural goods. A growing debt burden may limit imported inputs, such as seed and fertilizer, and slow agricultural productivity growth.

Debtors may reduce food imports to save foreign exchange. This may provide an incentive to produce food domestically. Quotas and tariffs on imported food may raise the domestic food price high enough to induce domestic producers to significantly increase food supply. Indebted governments also may encourage their agricultural sectors to expand and increase agricultural exports to earn foreign exchange. It would not be surprising to find that the severity of the current debt crisis would force policy changes in Latin American countries that would favor the export sectors and, in the long run, lead to increases in domestic agricultural production in these countries.

Economic growth, in general, is viewed as being the predominant way out of the current debt crisis. Countries must continue to grow to increase their income faster than their levels of expenditures. They need investment funds to do this. However, this strategy is somewhat responsible for the current situation.

General economic conditions were quite different in 1978-82 than they have been in recent years. World growth has risen; interest rates and inflation have fallen. Future income shortfalls, if they arise, are unlikely to occur as unexpectedly and rapidly as those in 1980-82. However, short-term remedies recently used in Latin America (such as import licensing, capital controls, tariffs, import substitution) may lead to long-term enhancement of underlying economic difficulties. In sum, Latin American countries are facing the consequences of the cutback in resources to their domestic economies at a time when possibilities for growth are emerging. The result is prolonged uncertainty with respect to the economies of these nations and U.S. agricultural exports to this region.

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APPENDIX

We found little work that formally provides an economic rationale for capital flight. We digress to illustrate a method of viewing the phenomenon of capital flight. Capital may leave a country if agents perceive that investment in domestic industry contains a high risk. To depict this, we write a revenue function as:

$$R(P,Z) = MAX_X\ P*X \quad \text{Subject TO: } H(X) = Z \tag{1}$$

where: P is a vector of prices of export goods, X is a vector of exports, Z represents the levels of a fixed factor. (such as irrigated land) and H(X) represents a transformation function which is typically called the production possibilities frontier. Arnade, Shane, and Stallings write levels of the fixed input as a function of investment so the revenue function becomes r(P, I), where I represents the amount of the investment loan (1).

Arnade, Shane, and Stallings then derive a demand for investment loans by optimally choosing the levels of investment so that the marginal revenue of investment equals the interest rate, represented by i. Arnade, Shane, and Stallings say borrowers:

$$Max_I\ r(P,I) - iI \tag{2}$$

and derive the loan demand from the first order condition: $dr(P,I)/dI = i$.

Now suppose agents view investment in a country as a risky venture and demand a risk premium. In this case, agents may see a revenue function as:

$$r'(P, I) - pI \tag{3}$$

where: p represents a premium required to invest to offset risk. Investors will then seek to maximize this revenue function, or:

$$MAX_I\ r'(P, I) - (p + i)I \tag{4}$$

Agents seeking the optimal level of returns will invest, at a level I', to where the marginal revenue of investment equals the interest rate plus the risk premium or $dr(P,I)/dI = i + p$. If I* represents the optimal investment levels without a risk premium obtained by solving equation (2), then investors will put the difference from what the government borrowed for investment and their investment levels, I* - I', into foreign assets and earn payments equal to i + p.

Holders of foreign assets are not explicitly earning the amount i + p but, since there is no perceived risk of investing in foreign assets, such investment can be thought of as earning the interest rate plus the risk premium. The level of investment in domestic industries when agents perceive domestic investment to be risky, I', is less than the level of investment when agents do not perceive domestic investment to be risky, I*. Since the revenue function is increasing in the level of investment, when investment is lower, future revenues (or incomes) will be lower.

It is reasonable to claim that lenders did not perceive the risk of investing in domestic industry to be as high as those that took borrowed capital out of the country. With lower than expected levels of investment in domestic industries, income projections of borrowing countries (made at the time of assuming a loan) would be overstated. This would be particularly true if foreign assets are beyond the reach of repaying governments. Without the expected levels of earnings from investment, debtor countries could face a crisis in repaying their loans.

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