THE IMPACT OF EXTERNAL DEBT VARIABLES ON THE DEMAND FOR IMPORTS BY LESSER DEVELOPED COUNTRIES

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PREFACE

Three models for testing the significance of external debt variables in the demand for total imports, agricultural imports, and wheat imports by 24 lesser developed countries were developed and estimated. Parks' method for estimating a system of regression equations in the presence of both serially and contemporaneously correlated disturbances was used. The models include a theoretically complete specification of external debt variables.

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has made my life as a graduate student not just tolerable, but delightful.

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CHAPTER I

MACROECONOMIC INFLUENCES ON INTERNATIONAL TRADE

In recent years agricultural economists have become increasingly aware of the relationships between macroeconomic forces and international trade flows. Schuh (1974) was among the first to recognize the influence of currency exchange rates on agricultural commodity trade. Chambers and Just (1979 and 1981) further developed the linkages between international macroeconomic variables and agricultural trade. The monetary and fiscal policies of large industrialized countries are recognized to influence trade flows; however, the impact of the macroeconomic policies of lesser developed countries (LDCs) have received less attention.

The conversion from fixed to flexible currency exchange rates and the growth of highly liquid international capital markets have increased the economic interdependence of the sovereign nations of the world. The domestic monetary and fiscal policies of large industrialized countries influence international financial and commodity markets through interest rates, currency exchange rates, and other price levels. Many economists believe, for example, that the tight monetary policies pursued by the United States and Great Britain in the early 1980s forced real interest rates on international capital markets to rise and dampened world demand for goods and services.

High interest rates and weak export earnings, in turn, contributed to the severe external debt payment problems which affected many LDCs (Barth and Pelzman, 1984). Some agricultural economists predict that external debt problems, in turn, will further reduce LDC demand for agricultural imports throughout the 1980s (Shane and Stallings, 1984).

Among the most striking changes in the global economy over the last fifteen years have been the rapid growth of international commodity and financial markets and the increasing participation of LDCs in these markets. Between 1970 and 1981 total world merchandise trade expanded from $300 billion to $1,907 billion in current dollars, while the share of world imports purchased by LDCs increased from 23.6 to 30.7 percent (IMF, International Financial Statistics, 1985 Yearbook). During the same time period, the value of world wheat trade increased from $3.94 billion to $22.13 billion while the LDC share grew from 43 percent to 57 percent (FAO, International Trade Yearbook, 1972 and 1984).

Many LDCs entered international capital markets during this time period, some OPEC nations as net creditors, but most other LDCs as net debtors. The external public and publicly guaranteed debt of LDCs grew from $54.35 billion to $495.84 billion between 1970 and 1981 (World Bank, World Debt Tables, 1975 and 1985). Rapid accumulation of external debt combined with rising interest rates and declining world-wide demand for their exports created serious foreign exchange problems for many developing countries in the early 1980s. Many countries had trouble meeting their debt repayment schedules. Between 1975 and 1980, fewer than three countries per year had to negotiate formal rescheduling of their outstanding external debt, but from 1981

to 1984 an average of seventeen countries per year negotiated new repayment schedules (World Debt Tables, 1985).

The value of total international merchandise and wheat trade declined sharply after 1981. By 1983 merchandise trade had fallen by $200 billion, and the LDC share dropped to 29.6 percent (IFS). World wheat trade decreased by $2.4 billion, and U.S. wheat exports alone fell by $1.6 billion (FAO, International Trade Yearbook). Some researchers have suggested that the debt repayment problems experienced by many LDCs in the early 1980s contributed to the sharp decline in wheat exports, particularly from the United States (Shane and Stallings, 1984; Abbott, 1984; and Smith, et. al., 1986). Nevertheless, few attempts have been made to empirically measure the impact of external debt on international trade (Winters, 1985; Wilde, et. al., 1986).

The Problem

The structure of import demand by developing countries is not well understood. Standard import demand models are highly aggregated and focus on domestic income and relative prices as the major determining variables (Houthakker and Magee, 1969; Leamer and Stern, 1970; and Magee, 1975). The theoretical and empirical linkages between external debt and wheat imports are particularly unclear. Given the large number of developing countries which face external debt repayment problems and the importance of LDCs in international wheat markets, a clearer understanding of these links is imperative.

Objectives

The primary objectives of this research are to develop the theoretical linkages between external debt and import demand by developing countries, and to test the relationship empirically. Total imports, total agricultural imports, and total wheat imports of 24 developing countries from Latin America, Africa, and Asia will be analyzed. The models will be constructed to facilitate testing the hypothesis that the effect of external debt constraints on imports will differ between countries and across commodity classifications. Specific objectives include the following:

1) To outline the history of international lending and repayment crises, with emphasis on the development of the current debt crisis. Additionally, the terminology used to describe international lending will be clarified.

2) To integrate the economic theory of external borrowing and debt repayment into an international trade framework. The reasons why LDCs borrow and the theoretical linkages between debt, debt repayment, and imports will be emphasized.

3) Three groups of empirical models for total imports, agricultural imports, and wheat imports for the 24 countries in the study group will be derived and tested to compare the effect of external debt constraints on alternative classes of import goods and on countries of different size and economic strength. This process will include a review of the existing import demand literature in order to clarify the choice of appropriate model specifications and functional

forms. Estimation techniques suitable for the model specifications and study group will be chosen.

Organization of the Study

The remainder of this research is organized into chapters as follows. Chapter II consists of a discussion of external debt, including the history of international lending, external debt terminology, and the current status of the external debt of LDCs. The third chapter includes a discussion of external debt theory, international trade theory, and the linkages between imports and external debt. Structural models and testable hypotheses are developed in Chapter III. Chapter IV contains the models to be estimated, and the empirical methodology appropriate to the study group and hypothesized relationships. Specific null hypotheses are developed in Chapter IV. Chapters II through IV also include reviews of the relevant literature with particular emphasis throughout on the macroeconomic determinants of import demand by LDCs. Results of the empirical estimation are discussed in the fifth chapter. Conclusions as well as shortcomings of the study and suggestions for further research are included in Chapter VI.

CHAPTER II

EXTERNAL DEBT OF DEVELOPING COUNTRIES

The analysis of external debt in an international trade framework requires an understanding of the historical antecedents of the current debt crisis, and the terminology used to describe the characteristics of the international lending environment. This chapter includes three sections with the goals of developing this understanding. The first section is a history of international capital markets, which places the current debt crisis in historical perspective. The second section introduces the debt-related terminology used by international lenders and analysts. Section three is a discussion of debt distribution among developing countries based on the definitions and statistical measurements used by the World Bank. Most of the following discussion is based on geographic aggregates of the study group to be used in later analysis. The use of geographic aggregates, while obscuring some of the variation among countries, is valid both to illustrate the concepts being discussed and to indicate regional trends. More information on individual countries is contained in Chapter IV.

Debt Crisis in Historical Perspective

The Beginnings of International Banking

The international debt crisis of the early 1980s was not the first time the world banking system approached collapse. The history

of international sovereign lending and debt repudiation began in Europe more that six centuries ago. Late in the thirteenth century the leading banks of Europe, the Bardi and the Peruzzi of Florence, Italy, made large loans to Edward I, the King of England. Like earlier loans to monarchs, these were backed by the promise of tax revenues. Edward I guaranteed that export taxes on the English wool trade would be used to repay the debt. Unlike previous sovereign loans, however, these were made to a monarch other than that of the lender. The Bardi and the Peruzzi had no control over the collection or disposition of the English wool tax. Therefore, when Edward III ascended to the English throne in the 1330s and chose to repudiate his predecessor's debts, the Bardi and the Peruzzi had no legal recourse. Both banks collapsed, a calamity which "[set] back Italian banking for a generation" (Makin, 1984, p. 37).

Medieval Banking Practices.

The 650 years between the collapse of the Bardi and the Peruzzi in Florence and the current international debt crisis makes up a long history of international lending, profit taking, and default. Since the thirteenth century, bankers have looked abroad for lending opportunities which often offered high returns; but the risks were enormous. Indeed, according to Makin (1984),

> The most remarkable thing about government debts is the consistency with which they are repudiated by war, inflation, simple fiat, or the disappearance or reconstitution of the government that issued them (p. 36).

Until the nineteenth century, international lending practices followed essentially the same pattern as that initiated by the Bardi and the Peruzzi. International loans were usually made by merchant

banks to individual rulers. Legally, these loans were the personal obligations of the sovereign rather than of the nation he ruled (Makin, 1984). Sovereign loans made by merchant banks were often extended for the purpose of encouraging international trade in the luxury items marketed by the lending banking family (de Roover, 1948). Banks required the borrower to surrender jewels, a crown, or other personal property, or to pledge future tax revenues as collateral for the loan. Because sovereign loans to foreign rulers are relatively risky, lenders were able to charge higher interest rates than could be earned on domestic loans. Sophisticated techniques such as risk premiums on loans to less stable monarchs were used as early as the fifteenth century (Seiber, 1982). Despite such practices, individual banks lacked the ability to enforce international agreements, and debt repudiation was common.

Raymond de Roover, historian of medieval European banking, argued that despite the risks associated with sovereign lending, merchant banks were "...unable to avoid dealing with the courts which were markets for the luxury goods in which they dealt" (de Roover, 1948, p. 27). Edward III, having caused the collapse of the Bardi and the Peruzzi a few years earlier, had only to offer his physical crown as collateral in order to receive new loans from Brussels in 1340. According to Makin (1984), bankers intended the physical surrender of the English crown to symbolize the sovereign nature of the loan and to imply that the debt was the liability of the English government rather than a personal obligation of Edward III. Nevertheless, the bankers had no legal recourse in the event of sovereign repudiation, other

than seizure of the collateral. In cases in which the collateral consisted of future tax revenues, the lender had no recourse.

Early Modern Europe

The fifteenth century Medici banking empire collapsed as a result of external political and economic instability and poor management practices (Seiber, 1982). According to Raymond de Roover,

> Rather than refuse deposits, the Medicis succumed to the temptation of seeking an outlet for surplus cash in making dangerous loans to princes (The Medici Bank, 1948, cited in Makin, 1984, p. 28).

For example, loans to Charles the Bold of Burgundy amounting to four times the capital base of the Bruge branch "contributed to the bank's ultimate demise" (Seiber, 1984, p. 20). Two centuries later, unsecured loans to the Hapsburgs, rulers of the Austrian Empire, resulted in the demise of the leading sixteenth and seventeenth century banking power, the Fuggers of Southern Germany (Seiber, 1984). The leading banking powers of medieval and early modern Europe, the Bardi, Peruzzi, Medici, and Fuggers, all failed at least in part because of unsafe loans to foreign sovereigns.

The political art of international finance was refined in 1792 when the revolutionary government of France repudiated royalist debts with the resounding words, "The sovereignty of peoples is not bound by the treaties of tyrants" (Makin, 1984, p. 36). The French were less pleased with those words when, in 1918, the Bolsheviks quoted them in repudiating czarist debts to French bond-holders (Makin, 1984). Debt repudiation was no longer merely politically expedient; it had gained philosophical legitimacy.

The Nineteenth Century

By the nineteenth century, international finance was no longer dominated by commercial banks. International trade was financed much as it had been for centuries through bills of exchange issued by commercial banks. Long term investment capital, however, was supplied through investment bankers such as the Rothschild Bank of London and Credit Mobilier of Paris (Seiber, 1982).

Bond Financing. Investment banks sold foreign government bonds to individual investors primarily in London, Paris, and New York. In this way, the burden of international debt was spread among many small investors, rather than being concentrated in a few privately owned banks. This diffusion of risk throughout the economy of the creditor country reduced the impact of repudiation on the central financial system (Seiber, 1982). Individual investors suffered large losses and some banks failed, but debt repudiation in the nineteenth century did not threaten the stability of the international financial system (Makin, 1984).

The ability of debtors to collect taxes was implied as collateral on the bonds, but as before, neither individual investors nor investment banks had any control over the collection or distribution of foreign taxes (Makin, 1984). Nineteenth century investment bankers expected occasional defaults on international debts because of unforeseen recessions, wars, and inflation; accordingly, bonds issued by governments perceived to be less reliable carried risk premiums in the form of higher interest rates (Sachs, 1982). Despite using this nascent form of country risk analysis, nineteenth century investment

bankers have been criticized for following improper lending practices. Seiber quotes L.H.Jenks, who wrote in 1927,

> Any government which claimed sovereignty over a bit of the earth's surface and a fraction of its inhabitants could find a financial agent in London and purchasers for bonds (Seiber, 1982, p. 21).

The largest nineteenth century borrowers were the developing countries of that time, notably the United States, Russia, Spain, Turkey, Egypt, and many of the newly independent Latin American countries including Peru, Bolivia, Uruguay, Brazil and Argentina (Seiber, 1982). The major early nineteenth century creditors, France and Great Britain, based their lending policies as much on political considerations as on potential profits. For example, during the Latin American wars of independence, France allied itself the Spanish colonial rulers. Britain extended large loans to the new Latin American republics in order to counter-balance French influence in Spain and to thwart Spanish attempts to regain control of its former colonies (Jenks, 1927). Most lending in Latin America during the early nineteenth century was used to finance military expansion. Lending in Latin America became so excessive that Jenks describes as "burlesque" British loans to the nonexistent Kingdom of Poyais on the Mosquito coast (p. 47).

Most long term lending to the United States, in contrast, was used to finance development of physical infrastructure such as railroads and canals. Nevertheless, default and repudiation were common in the nineteenth century both in Latin America and the United States. In spite of charging risk premiums, many banks and individual investors were financially ruined. In the 1840s a collapse of international cotton prices created a severe decline in United States

export revenues, resulting in the suspension of interest payments on foreign bonds by nine separate states (Seiber, 1982). Almost half of the U.S. railroads financed by foreign bonds during this period went into receivorship (Makin, 1984). Like many of the current debt problems facing LDCs, the U.S. defaults were primarily caused by falling export commodity prices and a resulting foreign exchange shortage (Seiber, 1982).

Implications of Default Under Bond Financing. The system of bond financing introduced in the nineteenth century had two major implications for default. As discussed earlier, it had the effect of diffusing the impact of default throughout the economy of the creditor country thus reducing the risk of financial collapse. At the same time, decentralized bond holding meant that creditors were less able to press foreign governments for payment. Because the bond holders were individual citizens, they lacked the political or military power necessary to enforce their claims. Bond holders occasionally formed coalitions to press their claims against defaulting debtors. The most frequent action taken by bond holders was to organize boycotts of bonds issued by governments which had defaulted in the past. Credit boycotts sometimes forced debtors to renegotiate existing debts to regain access to international capital markets, but they were difficult to organize and often failed (Dale and Mattione, 1983).

International Crisis. Some authors identify the panic of 1873 as the first international financial crisis because it was transmitted throughout world financial markets (Kindleberger, 1978). The panic began in Austria and Germany with the economic recession which followed the Franco-Prussian war, and spread throughout Europe, the

United States, and Latin America. Defaults occurred in twelve countries, including Honduras, Peru, Egypt, and Spain (Seiber, 1982). The withdrawal of German investments from the United States apparently initiated the spread of the crisis by inducing American investors to withdraw credits from Latin America. Attempts by lenders to call in outstanding loans contributed to default in many countries and caused the crisis to spread (Kindleberger, 1978).

The Growth of International Lending. Despite the frequency with which defaults occurred, the volume of international lending grew very rapidly in the nineteenth century, especially in the fifty years preceeding the First World War. Between 1864 and 1913, foreign investments by the largest creditors increased from less than $4 billion to $44 billion, or from $44 to $480 billion in 1984 dollars, an annual growth rate of 5 percent (Makin, 1984). Britain, France, and Germany were the largest net creditors. British lending was allocated largely according to market forces except in Latin America, where political rivalry with France was an important impetous to lending. Other British lending was concentrated within the British empire and the United States. France and Germany, to a greater extent than Britain, used international lending as a foreign policy tool to expand their political influence in Eastern Europe and North Africa; as a result French and German investments carried a higher degree of risk (Abbott, 1979).

World War I. The First World War had a profound effect on the international financial system. The largest pre-war lenders, Britain, France, and Germany all suffered severe losses as a result of the war. All three liquidated large percentages of their overseas investments

in order to finance the war effort. Britain lost approximately 15 percent of its pre-war foreign loans and investments, or equivalently, six percent of its pre-war gross capital holdings (Makin, 1984). France and Germany, whose international lending was more politically motivated, lost even more than Britain. France lost approximately two-thirds of its foreign bonds as a result of the war: French-held Russian bonds worth $4.5 billion alone were repudiated following the Russian Revolution (Abbott, 1979). Germany lost "virtually all of its foreign holdings," either liquidated to finance the war or confiscated after the war as reparations (Makin, 1984, p. 43).

The Early Twentieth Century

The huge losses incurred by European financial powers during the war, and the physical devastation they suffered created a void in the international financial system. The United States, which in 1860 had been one of the world s largest net debtors, filled that void and emerged from World War I as a major world financial power. The United States government assumed much of the responsibility for financing the Allied war effort and the post-war reconstruction of Europe (Makin, 1984). Abbott (1979) argues that U.S. lending during and after the war provided a strong stimulous to domestic export earnings and contributed to the growth of the U.S. as a major twentieth century economic power.

The United States rapidly expanded its private foreign lending during the 1920s. Following the war-time devastation of Germany and the assessment of punitive reparation payments, Germany required large infusions of foreign capital. American bond-holders provided private

capital for German reconstruction, but according to Abbott (1979), much of the U.S. capital was used for reparation payments. He further argues that rapid infusions of capital in the early 1920s initiated the hyper-inflation that weakened the post-war German economy. The 1924 Dawes Loan from the United States government and suspension of reparation payments helped restore the German economy to stability.

Private capital flows resumed after 1924 and German industry quickly recovered. Abbott (1979) contends, however, that lending to Germany in the post-1924 period was excessive. He quotes the President of the Reichsbank, who stated in 1927 that the

> ... expenditure upon the construction of stadia, swimming baths, pleasure gardens, and ornamental buildings, upon land and estates, amusement halls, banqueting halls, hotels, offices, planetaria, aerodromes, theatres, and museums, upon credit concession to, and participation in, private business, amounts to a total sum not much below the total of foreign loans raised by the cities (p. 22).

Certainly, not all of the expenditures described above were unproductive, but it is unlikely that the rate of return on investments such as swimming baths and pleasure gardens made them economically viable. The German long-term foreign debt burden reached 9,545 milliard marks by 1931. An additional 11,969 milliard marks in short-term obligations, and 10,315 milliard marks in annual reparation payments precipitated the collapse of the German economy in 1931, and the outright repudition of foreign debts (Abbott, 1979).

In addition to large German loans, the United States also made extensive loans to Latin American and other European countries. Great Britain also recovered to the degree that it again became a large net creditor in the late 1920s. During the prosperous 1920s, foreign bonds were popular among investors and highly profitable; however, the

international financial climate changed radically during the 1930s. The American stock market boom in 1928 made foreign lending relatively less attractive as an investment, causing the supply of long-term credit available to debtor countries to decrease sharply. Many debtor countries were forced to rely on short-term loans at higher interest rates to meet service requirements on existing debt (Kindleberger, 1978). Kindleberger further argues that the resulting liquidity crisis depressed international commodity prices and contributed to the Great Depression. The Great Depression in turn spurred further defaults which culminated in the collapse of the international financial system (Seiber, 1982).

The Great Depression

Rapidly declining world trade and falling commodity prices caused sharp reductions in export earnings and foreign exchange reserves among many Latin American and Eastern European countries (Seiber, 1984). According to Abbott (1979), "The supply of overseas investment funds virtually ceased after 1932" (p. 23). Widespread defaults began in Bolivia in 1930 and, "By the end of 1933, practically all Latin American loans were in default" (Abbott, 1979, p. 24). Abbott further argues that Latin American defaults were caused primarily by the inability of the borrowers to collect enough tax revenue to meet service requirements. The European defaults which followed, were induced by governmental foreign exchange controls which made it impossible for private borrowers to convert enough currency to service their foreign debts. Defaults in Germany, in contrast, stemmed largely from political motives as resurgent nationalist sentiments

increased the perception that war debts and reparation payments were unjust (Abbott, 1979).

As a result of defaults on foreign loans, interest dividends received by the United States fell by an estimated 56 percent between 1929 and 1935. Great Britain suffered a 35 percent decline in interest revenues during the same period. These defaults had a devastating effect on the world economy. Cleona Lewis wrote in 1938:

> At the present time the World War debt situation is at a stalemate. The debtors refuse to repudiate, refuse to propose new terms, and refuse to pay. The United States waits on their decision, merely reminding them semi-annually that instalment payments are due, but takes no steps towards a readjustment of existing agreements. Meantime, lack of a permanent settlement stands as one of the obstacles hindering the full and speedy recovery of World Trade (Cleona Lewis, America's Stake in International Investment, Washington: Brookings Institute, 1938, p. 423, cited in Abbott, 1979, p. 25).

Post World War II.

Immediately following World War II, private sources of capital for international lending were insignificant. The United States government and internationally funded agencies assumed responsibility for the rebuilding of Europe and Japan following the war. Private foreign investment consisted almost entirely of direct foreign investment by corporations in countries in which the creditor had commercial interests.

Resurgence of International Lending. Most external borrowing by LDCs in the 1950s and 1960s was in the form of concessionary development and commercial loans made on a bilateral basis from individual industrialized countries (Abbott, 1979). Public and private lending to foreign governments began to increase in the 1960s

as world attention focused on the need for capital infusions to promote economic growth in the developing countries.

Very rapid growth in LDC external debt began after the quadrupling of petroleum prices induced by the Organization of Petroleum Exporting Countries (OPEC) in 1973-74. The external debt of LDCs grew rapidly during this period for two reasons. First, the abrupt oil price increase caused serious trade imbalances in oil importing countries and created an immediate need for short-term trade deficit financing (Shane and Stallings, 1984). The second, more complicated reason involved the recycling of OPEC dollar deposits in Western banks. Banks in the United States, Europe, and Japan were flooded with excess reserves as OPEC surplus revenues were deposited with them. Banks holding large interest-bearing deposits were under competitve pressure to find productive uses for the excess reserves. The process of lending the OPEC surpluses to LDCs came to be called recycling, because it returned huge amounts of capital to the oil deficit countries (Seiber, 1982).

During the early 1970s, the large industrial countries maintained liberal monetary policies. The world money supply grew at average rates of over ten percent per year between 1970 and 1973, and again from 1975 to 1979 (Shane and Stallings, 1984). Sparked by liberal money supply growth, and the additional liquidity generated by OPEC surpluses and the conversion to flexible exchange rates, the level of world economic activity increased rapidly (Shane and Stallings, 1984). The period was also characterized by high inflation and low real interest rates. LDCs had unprecedented access to international capital markets and perceived borrowing to be very inexpensive. Not

only were real interest rates low, but high U.S. inflation rates continuously eroded the current dollar value of existing debt. The rapid economic growth of LDCs during the 1970s (real GDP of all LDCs grew at an average rate of five percent per year between 1975 and 1980) led debtors and creditors alike to believe that developing countries could grow their way out any potential future debt repayment problems (Shane and Stallings, 1984).

The International Debt Crisis. The world economic environment changed abruptly in the late 1970s. OPEC again raised oil prices in 1979-80, creating additional trade imbalances for oil-importing LDCs. Rather than responding with another round of petrodollar recycling and rapid liquidity growth, industrialized countries initiated severe anti-inflationary policies (Shane and Stallings, 1984). Great Britain and the United States both pursued sharply contractionary monetary policies. As a result, inflation rates fell and real interest rates rose sharply. The real cost to LDCs of servicing existing debt and acquiring new loans increased. According to Shane and Stallings (1984), real interest rates increased from an average of a negative 3 percent in 1975-80 to over 17 percent in 1981-83. Another macroeconomic factor which affected the external debt position of LDCs was the rising value of the U.S. dollar. Over 75 percent of all LDC external debt was denominated in dollars in 1983 (World Debt Tables, 1985). As the dollar appreciated against the currencies of the debtor countries and other industrialized countries the real value of LDC existing debt increased (McKinnon, 1984).

The third factor which contributed to the severe debt repayment problems faced by many LDCs after 1981 was the sharp downturn in world

economic activity and world trade. The volume of world trade fell 10.5 percent between 1981 and 1983. The recession in the industrialized countries reduced the demand for LDC exports. Not only was the real cost of new and existing debt increasing, but the ability of LDCs to earn foreign exhange to service debt fell sharply. After 1981, many LDCs suffered severe trade imbalances, foreign exchange shortages, and debt service problems.

Mexico 1982. In August, 1982 Jesus Silva-Herzog, the Finance Minister of Mexico, requested assistance from the United States Treasury Department in renegotiating Mexico's external debt (Makin, 1984). Bankers and official lenders in the industrialized world were shocked to discover the magnitude of Mexico's total external debt and the possibility that much of the debt might never be repaid (Kvasnicka, 1986). After a decade of booming lender confidence, highly liquid international capital markets, and rapid debt accumulation in LDCs, the bubble burst (Makin, 1984).

The Risk of Default. The rapid growth of external borrowing by LDCs during the 1970s and the repayment problems experienced by many countries in the early 1980s have engendered concern for the stability of the international financial system. By 1983 more than 40 countries were engaged in renegotiations on debt amounting to $480 billion, or approximately half of the estimated $797 billion in total LDC external debt (Kvasnicka, 1986). The nine largest banks in the United States had loans outstanding to LDCs equivalent to 246 percent of their primary capital base (Laver and Huhne, 1985). Thus, repudiation of less than half the outstanding LDC debt in 1983 could have rendered the nine largest banks in the U.S. insolvent. Many economists

believed that the international financial system was on the brink of collapse (Dale and Mattione, 1983).

Parallels to Earlier Debt Crises

The international credit crisis of the 1980s shares some similarities with earlier crises. Bacha and Alejandro (1982) argue that while serious, the current debt crisis is not unique. They contend that the decreasing willingness of lenders to extend further credit to countries having repayment problems is part of a cyclical pattern of growth and decline in international lending. Like the international financial crises in 1873 and the 1930s, sources of foreign capital contracted sharply in 1981. Bacha and Alejandro further argue that relative to the growth in gross domestic product (GDP) over the past twenty years, the growth of LDC debt is not as extreme as many authors suggest, nor as potentially catastrophic as earlier crises.

In contrast with Bacha and Alejandro, Barth and Pelzman (1984) predict that a major debt repudiation could occur which would threaten the integrity of the international banking system. They argue that a default could also have serious implications for international trade by limiting the willingness of banks to extend further credit to finance imports by LDCs. Credit crises and trade crises are historically related phenomena. In the 1930s falling commodity prices created severe trade imbalances in many debtor countries and reduced their ability to service external debt. The resulting credit crisis reduced the credit available to finance international trade and exacerbated the international trade recession. A downward spiral of

falling trade volume and contracting international credit availability led to the collapse of the international financial system.

Another parallel with earlier crises is the perception among debtor countries that they have been unfairly exploited by international bankers. In the 1820s, many Latin American countries were encouraged to accept loans in the geopolitical struggle between France and Britain. In the 1930s Germany declared that it had been forced to accept loans to meet reparation payments assessed by the Allies. Again, in the 1980s, many analysts and debtors argue that the LDCs were manipulated into accepting unnecessary loans in order to rescue the international banking system from the excess liquidity crisis created by OPEC surpluses (Makin, 1984). In order to clarify some of the discussion of the current debt crisis, the following section will define debt-related terminology and review the magnitude of the external debt of developing countries.

Debt Terminology

Default, Rescheduling, and Repudiation

Discussion of the international debt problem is frequently clouded by the use of imprecise terminology. Although the terms repudiation, rescheduling, and default are frequently used interchangeably in the international debt literature, they are not perfect synonymns. Repudiation refers to the outright refusal by a debtor to meet current or future debt service requirements. Repudiation implies that the borrower has denied responsibility for the debt, and is either unable or unwilling to repay it. Further, repudiation requires that the creditor no longer treat the loan as an

asset. Rescheduling is the process whereby the debtor and creditor arrive at a new repayment schedule which usually involves reduced interest rates and extended maturities. Creditors and debtors usually prefer rescheduling to repudiation, because it maintains the value of the lenders asset and it allows borrowers to retain access to international capital markets. Default technically refers to any interruption of scheduled principal or interest payments on outstanding debt, and thus includes both repudiation and rescheduling. Some authors incorrectly use the term default as a synonymn for repudiation, and rescheduling as an euphemism for default. Once a loan is in default it may be either repudiated or rescheduled, depending on the willingness of both borrower and lender to negotiate new terms.

Debt Classifications

Domestic versus External Debt. Debt can be defined and measured in many ways, but the 'international debt crisis' usually refers to long-term external sovereign debt. Long-term debt is debt which has a maturity of greater than one year, as opposed to short-term debt which has maturites of one year or less. External debt includes the liabilities of all borrowers within a country that are owed to nonresidents and are payble in a currency other than that of the debtor. In contrast, domestic debt is owed by public or private borrowers to residents of the same country and payable in the domestic currency.

Sovereign versus Private Debt. Sovereign debt refers to the liabilities owed or guaranteed by a sovereign power. In 1983, public

and publicly guaranteed debt made up 83 percent of all LDC external debt. Unlike private debt, sovereign debt is usually extended without tangible collateral. The integrity and stability of the sovereign power alone guarantees the worth of the loan. In the 1960s and 1970s, lenders believed that a default on sovereign debt would only occur under catastrophic circumstances, such as a major war or revolution. This belief is justified only if the debt is repayable in the debtor country's currency (Barth and Pelzman, 1984). A sovereign nation has the power to raise revenue through taxation and money creation; therefore, it will always be able to repay debt denominated in its own currency.

Debt Repayment Capacity. Because external debt, by definition, cannot be repaid in the borrowing country's currency, repayment obligations cannot be met directly through taxation and money creation. The capacity to repay external debt depends on the ability of the debtor to acquire the necessary foreign exchange (Barth and Pelzman, 1984). Most LDC currencies are not traded on international currency exchanges and may remain fixed at official exchange rates which do not accurately reflect their true market value (Henneberry, 1985). As a result, most LDC currencies are not freely convertible to the so-called "hard" currencies, such as the U.S. dollar, in which their external debt is denominated. Because revenue raised domestically through taxation or money creation cannot be readily converted to hard currencies, the primary sources of foreign exchange for developing countries are export earnings and new borrowing. The ability of LDCs to earn export revenue and to aquire new debt depends on economic and political conditions in the rest of the world. There is no assurance

that a sovereign nation will always be able to repay external debt, because its ability to earn foreign exchange is partially dependent on international conditiitons which the LDC may be unable to infuence.

External Debt Measurement and Distribution

Debt Outstanding Disbursed Only

Statistical measures of external debt commonly used by The World Bank and researchers are described below. Debt Outstanding Disbursed Only (DOD) measures the nation's stock of long-term public and publicly guaranteed external debt owed to both public and private lenders. The largest debtor countries in terms of DOD are frequently grouped together for analysis. A large DOD, however, does not necessarily imply the existence of 'problem' debt. South Korea, and Indonesia, for example, are among the largest debtors in the world, but neither is currently experiencing debt repayment difficulties. Other debtors such as Peru and Chile have smaller DOD, but serious repayment problems. This seeming contradiction exists because DOD measures only the absolute level of debt. It does not give any indication of the term structure of the debt, the magnitude of the debt relative to the size of the economy, or of the ability of the debtor to meet debt service requirements.

Figure 1 illustrates the growth of DOD in real dollars for the 24 LDCs in the study group and three geographic subsets: Latin America, Asia, and Africa. As shown in Figure 1, DOD for all LDCs in the study group increased from $66 to $273 billion between 1970 and 1983. Over the 1970 to 1983 time period, Latin American DOD increased from $23 to

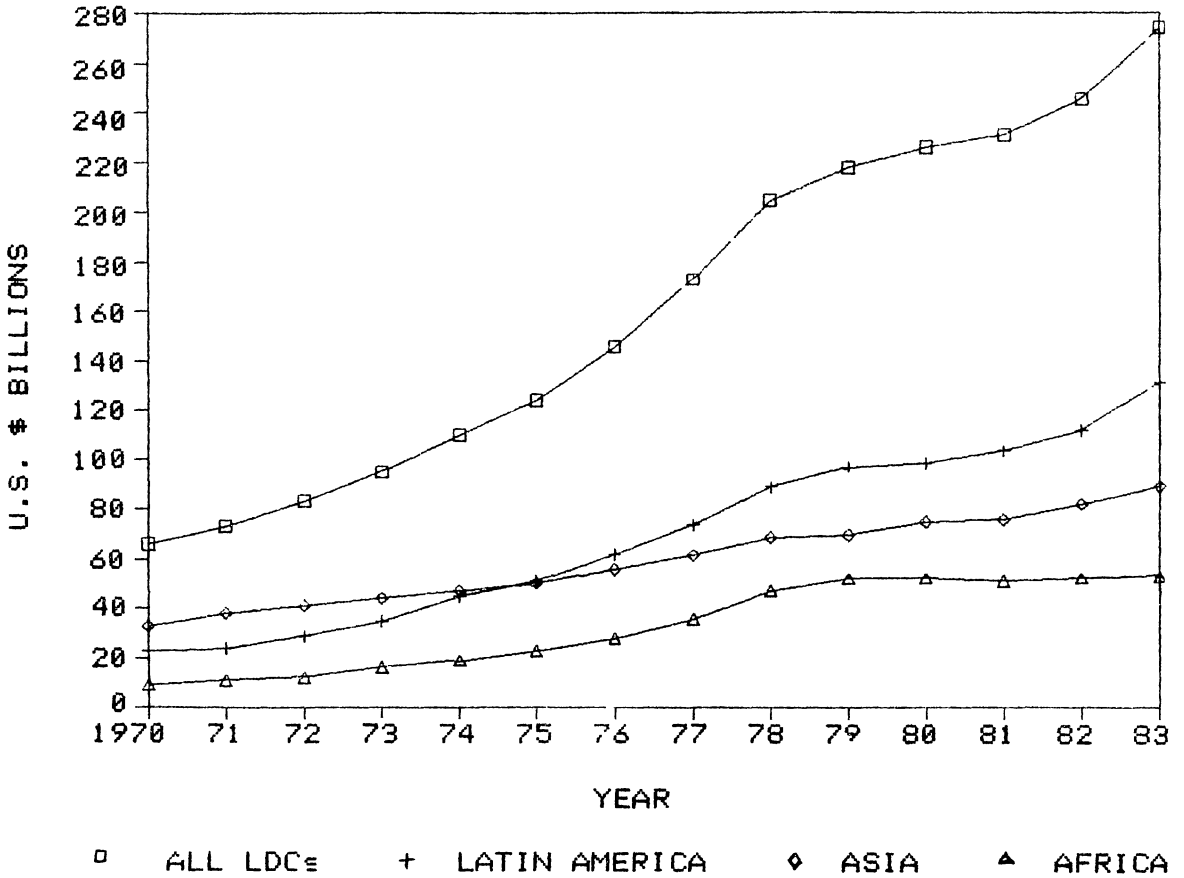

Figure 1: Real Total Debt Outstanding Disbursed, 1970-1983

$132 billion, Asian from $33 to $89 billion, and African from $10 to $53 billion over the same time period.

Total Debt Service

Total Debt Service (TDS) measures the flow of interest and principal payments made by a country in a given year. TDS may be a more revealing measure of the country's debt situation than DOD. According to Dhonte (1975), TDS is an important measure of debt because, "...debt service payments are contractual obligations, and the higher their level the greater the potential impact on import capacity of a downturn in foreign exchange earnings" (p. 163). TDS may also be preferable to DOD as an indicator of debt burden because it incorporates the term structure of the debt. As interest rates on floating rate loans rise, TDS also increases. Kvasnika (1986) estimates that the rise in United States interest rates in 1980-1982 caused TDS requirements for all developing countries to increase by $40 billion.

A weakness of TDS as a measurement of debt is that it includes only current payments and gives no indication of obligations due in the near future (Dhonte, 1975). As Figure 2 shows, TDS varies from year to year and across countries. In general TDS has grown faster and fluctuated more from year to year in Latin America than in either Africa or Asia. Figure 2 illustrates the rapid increase in TDS for all LDCs. Between 1970 and 1983, annual real TDS increased from $7 billion to $39 billion.

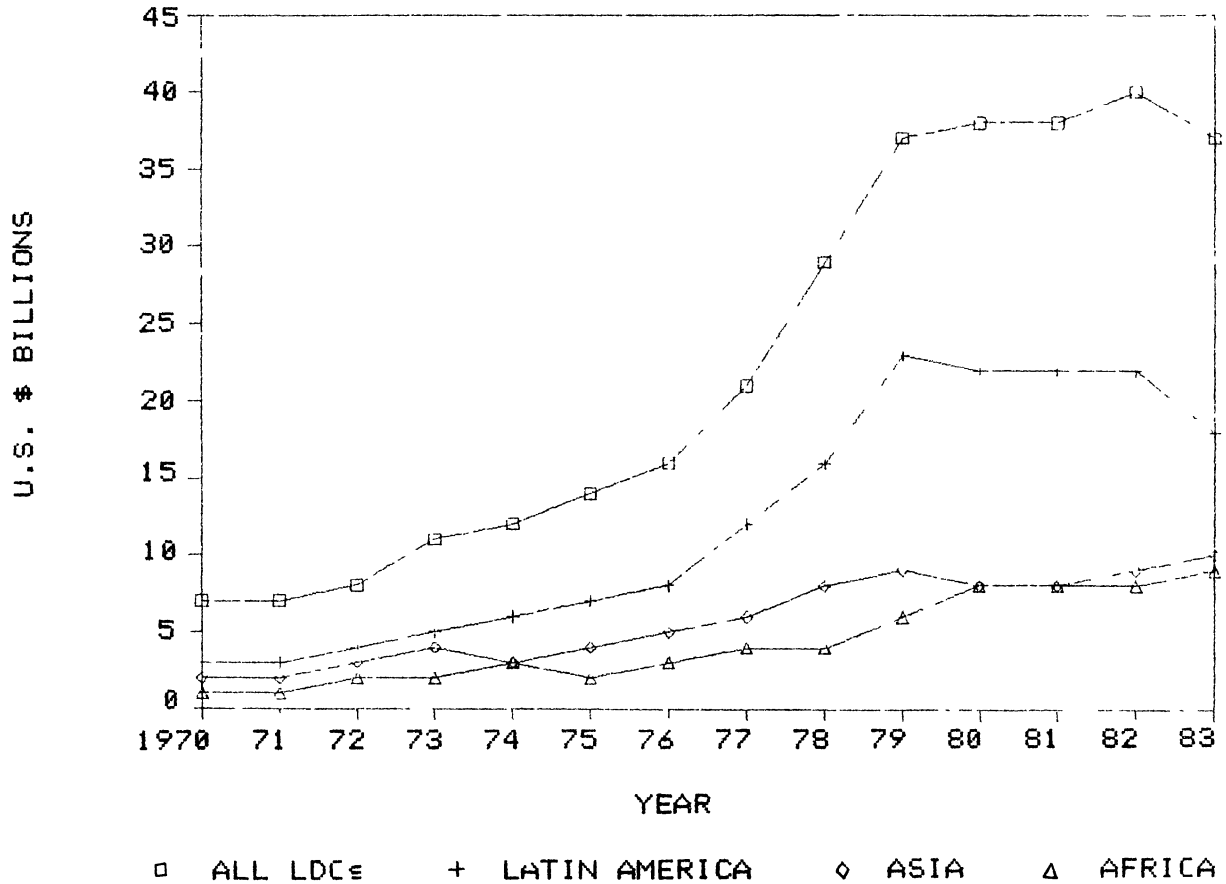

Figure 2: Real Total Debt Service, 1970-1983

Disbursements and Net Transfers

Disbursements measure the flow of new lending to the country in a given year. As such it represents an addition to the foreign exchange available to finance imports. Net transfers measure the flow of new lending minus total debt service payments in a given year. It is the net annual flow of new credit available to finance imports (Dhonte, 1975). Negative net transfers mean that a country spends more on debt service than it receives in new borrowing. While no immediate conclusion can be drawn from the existence of negative net transfers (indeed it is an essential phase of debt repayment) negative net transfers will exacerbate any repayment problems affecting a debtor.

Figure 3 shows net transfers to all LDCs and the three geographic aggregates for the period 1970 to 1983. Net transfers to all LDCs increased more than six-fold between 1970 and 1978, but plummeted to one third of the 1978 peak by 1983. Most of this instability was absorbed by Latin American borrowers. Net transfers to Latin America were erratic throughout the 1970-1983 period, and negative in 1983. Asian and African borrowers, in contrast, received relatively small, stable, positive net transfers throughout the period.

Debt Ratios

Debt Outstanding/Gross Domestic Product. Statistics which measure debt relative to some index of the debtor's economic strength may be the most revealing indicators of repayment capacity. DOD as a percentage of the borrower's gross domestic product (DOD/GDP) measures the level of indebtedness relative to the size of the economy. Dhonte

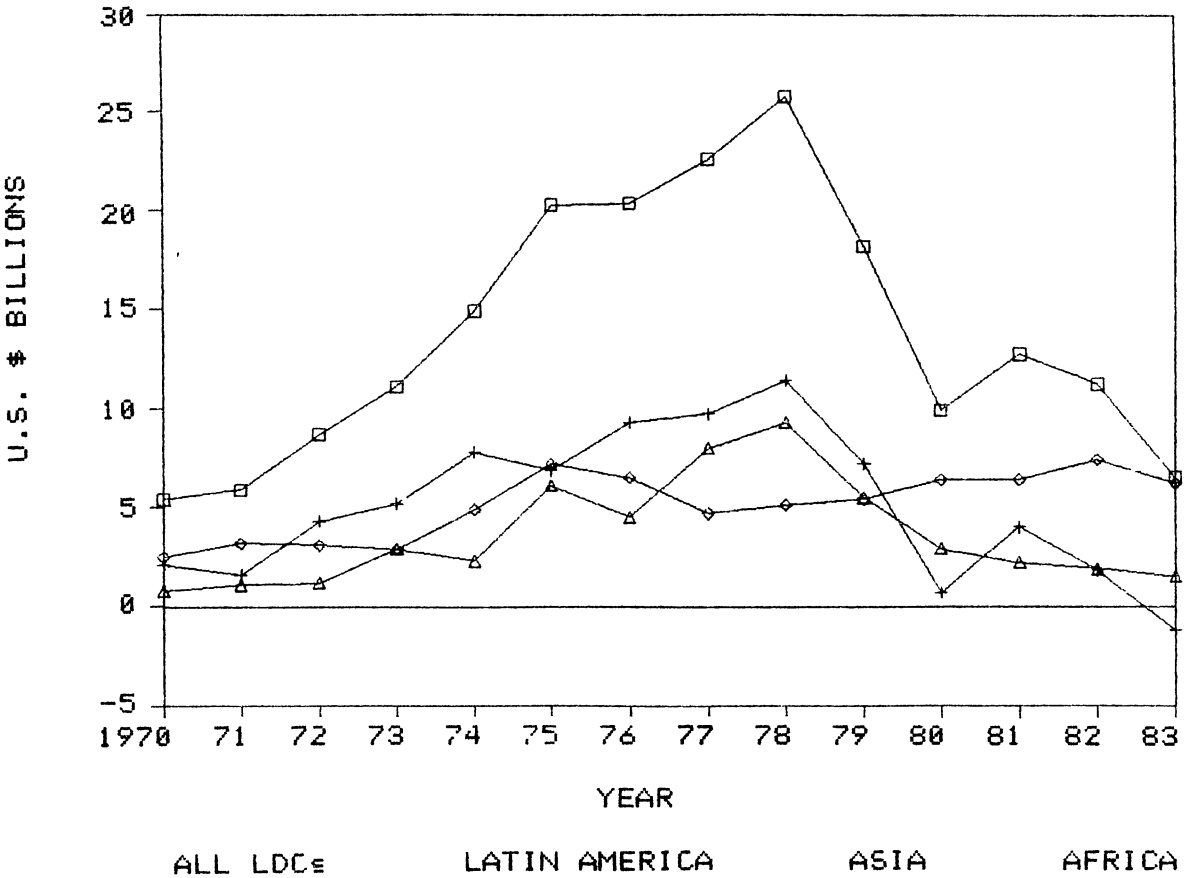

Figure 3: Real Net Transfers, 1970-1983

(1975) found that DOD/GDP, while a good theoretical measure of debt, was not successful as a predictor of debt repayment problems.

Total Debt Service/Exports of Goods and Services. The ratio of total debt service to export earnings (TDS/XGS) is a measure of the current debt burden facing a country. TDS/XGS is the percentage of current foreign exchange earnings which is required to service debt and is therefore unavailable to finance imports of goods and services. Because many LDCs are dependent on imports for basic foods, fuels, and intermediate capital goods, rising TDS relative to XGS may portend serious economic and political problems. Dhonte (1975) found that 8 of 13 countries requiring debt renegotiation between 1959 and 1971 had TDS/XGS ratios of more than 15 percent in the year preceeding renegotiation. In contrast, only 3 of the 13 countries had TDS/XGS greater than 15 percent four years prior to renegotiation. Thus he concluded that high and rising TDS/XGS is characteristic of countries requiring debt rescheduling.

The ratio TDS/XGS varies sharply across countries and across time. This variation is apparent even at geographically aggregated levels. As a group, the Latin American countries experienced a high and unstable relationship between TDS and XGS. Between 1970 and 1978 the ratio increased rapidly, from 21 percent to over 41 percent. In 1981 the ratio dropped to 32 percent but has since rebounded to 40 percent. In the African countries TDS/XGS remained very stable at below 15 percent through the early 1970s, but since 1977 the TDS/XGS has soared to over 30 per cent. The Asian countries, in contrast, have maintained a stable TDS/XGS ratio of between 15 and 19 percent throughout the 1970 to 1983 time period. According to Dhonte's

criteria, the Latin American and African countries are far more likely to experience debt repayment problems than are the Asian countries.

Currency Composition. Debt can be classified by the currency of denomination. Almost all LDC debt is repayable in the currencies of large industrial countries such as Great Britain, France, and the United States. By far the largest share of LDC debt is denominated in U.S. dollars. The value of the dollar may be the most significant variable influencing both the debt repayment burden in the LDCs and the recent decline in U.S. agricultural exports (Schuh, 1974). As the dollar appreciates against the currencies of a debtor and its major trading partners, the cost to the debtor country of dollar denominated imports and debt service increases (McKinnon, 1984). Those countries whose debt is predominantly repayable in dollars are disad- vantaged by a strengthening dollar. Latin America had the highest percentage of dollar denominated debt in 1983 at almost 90 percent, followed by Asia and Africa with 68 and 54 percent, respectively (World Debt Tables, 1985).

Future Prospects

While no outright repudiations have yet occurred, the threat of default and the need for rescheduling continues. According to the World Bank, the numbers of countries engaged in formal rescheduling negotiations each year from 1981 to 1984 were thirteen, nine, twenty-two, and twenty-three, respectively, up from an average of less than three per year in 1975-80 (World Debt Tables, 1985). With the exception of five countries, all of the 36 LDCs which required debt renogiations during this period were Latin American or African.

The debt crisis is not over, and the implications of further debt repayment problems for the international financial system and international trade are not well understood. Some economists predict that a worsening debt crisis may threaten the ability of LDCs to continue participation in the international economy. LDCs are important members of the international trading community. The United States relies on LDCs to purchase a large share of its exports. In 1983 LDCs purchased 34 percent of total exports, 39 percent of agricultural exports, and 60 percent of the wheat exports of the United States (FATUS). The value of all three classes of U.S. exports to LDCs declined after 1981, with wheat exports alone falling 10 percent by 1983. The following chapter will develop the theoretical relationships between external debt and international trade flows. An empirical framework for testing hypothesized linkages between debt and imports will be proposed.

CHAPTER III

ECONOMIC THEORY OF EXTERNAL BORROWING AND INTERNATIONAL TRADE

The primary purpose of this research is to investigate the theoretical and empirical relationships between external debt and three classes of imports for developing countries. Some agricultural economists have postulated a negative relationship between the increasing debt repayment problems experienced by many LDCs in the early 1980s and the declining agricultural exports from the United States (Shane and Stallings, 1984; Abbott, 1984; Wilde, et.al., 1986; and Dutton, Grennes, and Johnson, 1986). Thus far, however, empirical support for this hypothesis is weak (Winters, 1985; Wilde, et.al., 1986; and Dutton, Grennes, and Johnson, 1986).

The more general hypothesis that foreign exchange constraints may limit imports by LDCs is very common in both agricultural economics and international trade literature (Abbott, 1979; Hemphill, 1974; and Leamer and Stern, 1970). The basic rationale for this hypothesis rests on the inconvertibility of LDC currencies into the hard currencies in which most international trade is denominated. As discussed in the previous chapter, LDCs acquire foreign exchange through export earnings or external borrowing. A reduction in available foreign exchange due to falling export earnings, rising external debt service payments, or restrictions on further external

borrowing is expected to exert a constraint on imports analogous to a reduction in income. Again, empirical support for this hypothesis is rather weak. Hemphill (1974) found that foreign exchange earnings and reserves were significant determinants of total import demand for most countries studied. However, Wilde, et.al. (1986) found no support for the hypothesis that foreign exchange reserves exerted a constraint on wheat imports by developing countries.

The lack of strong empirical support for the hypothesized relationship between external debt and import demand may be the result of theoretical and statistical inadequacies of the tested models. This chapter includes a discussion of the theory of external borrowing and international trade in order to clarify the theoretical linkages between debt and import demand. A theoretically sound import demand model amenable to statistical estimation and capable of testing external debt hypotheses is developed.

Open Economy Macroeconomics and External Borrowing

Why Developing Countries Borrow

The relationship between debt and imports may be clarified by a discussion of LDC borrowing behavior. While the primary purpose of this dissertation is neither to model optimal external borrowing by an LDC nor to predict debt default, the theory of external borrowing is useful in illustrating the linkages between borrowing, debt repayment, and imports.

LDCs accumulate external debt for two basic purposes. The first is to increase current consumption. This type of borrowing involves a

transfer of wealth from future time periods to finance present consumption. According to Sachs (1984), LDCs will "use loans to equate the marginal utility of consumption at various points in time" (p. 1). This argument is derived from Friedman's permanent income hypothesis of macroeconomic consumption which holds that consumers base their expenditures on present and expected future income streams (Edgmand, 1979).

The second type of LDC borrowing is for investment. Unlike a simple transfer of consumption from the future to the present, borrowing to invest in long-run development projects is expected to increase long-run income growth above levels required to service the debt. Sachs (1984) states that according to economic theory and in the absence of market failures, LDCs will borrow on international capital markets "to finance all investment projects with positive present value at the prevailing interest rate" (p. 1). Both types of borrowing will be explored further, following the theory of open economy macroeconomic equilibrium discussed below.

External Borrowing and International Trade

Much of the following discussion draws on the work of Sachs (1984), who presented the standard model of international borrowing for a small open economy. The Sachs model incorporated external debt variables into an intertemporal macroeconomic equilibrium condition; however, it did not explicitly include the external trade account. The following model extends the Sachs model to incorporate the external trade balance.

For simplicity, Sachs assumed that the economy produces a single traded good, Q_t, in time period t. The domestic production function is given by

$$Q_t = F(K_t, L_t) \tag{1}$$

where the labor supply, L_t, is exogenous or perfectly elastic at a fixed wage rate. The capital stock, K_{t+1}, follows the adjustment function

$$K_{t+1} = K_t(1-d) + I_t \tag{2}$$

where d is the rate of depreciation and I_t is gross investment in period t.

In a simple closed-economy model, the macroeconomic equilibrium condition requires only that domestic absorption equals domestic output. In an open economy, the equilibrium condition for macroeconomic stability must account for international commodity and capital flows. The external balance account can be written as

$$M_t - X_t = (D_{t+1} - D_t - rD_t) \tag{3}$$

In equation (3), $(M_t - X_t)$ is the net merchandise trade imbalance. D_{t+1} is the flow of debt acquired in period t and repayable in period t+1. D_t and rD_t are the required principal and interest payments, respectively, on existing debt due in period t.

The simple external balance identity in equation (3) states that the net trade deficit must be financed by new external borrowing in excess of the amount required to service existing debt. In reality, other means exist to finance external trade imbalance, including

+icial aid, foreign direct investment, and changes in foreign exchange reserves (Dornbusch, 1980). The model is simplified by ignoring these additional sources of external finance. From equation

(3), increases in interest or principal payments must be balanced by increased borrowing, increased exports, and/or decreased imports. The simplification is justified on two counts. According to Dornbusch (1980), changes in foreign exchange reserves are often unrelated to trade and debt flows. He reports that many LDCs continued to add to their foreign exchange reserves in the late 1970s even as debt service payments rose and imports had to be curtailed. Further, according to Hemphill (1974), flows such as foreign investment and foreign aid are not easily controlled by domestic policy makers. He argues that

> ... imports play a relatively important role in attaining short-run balance, because this flow is responsive to the policy tools that the authorities use, while flows other than imports [export earnings, foreign aid, foreign direct investment] tend to be exogenous in relation to these policies (p. 641).

A frequent assumption of external borrowing models is that the country can make loans for only one year. Loans received in period t-1 must be repaid in period t, and so forth (Sachs, 1984, p. 6). It is relatively easy to extend the model to allow for long-term lending, however, the notation becomes rather complicated. Conceptually, D_t represents the amount of lending received in all previous years and repayable in year t. Similarly, D_{t+1} is the amount of new loans to the country in time t, repayable in all future time periods. In terms of the statistical measures discussed in the previous chapter, D_t corresponds to principle payments and rD_t to interest payments due in period t. The sum (D_t+rD_t) equals period t total debt service (TDS) as defined in Chapter II. D_{t+1} corresponds to disbursements (DSB) in period t. The parenthetical term on the right hand side of equation (3) is the difference between DSB and TDS in period t, which corresponds to the World Bank definition of net transfers.

The open economy macroeconomic equilibrium condition can be derived from the preceeding system of structural equations:

$$C_t+I_t+(X_t-M_t) = Q_t+(D_{t+1}-D_t-rD_t) \quad (4)$$

Unlike a simple closed economy equilibrium condition which requires only that the sum of consumption and investment equal output, the open economy equilibrium condition must account for external borrowing and trade. In equation (4), new lending disbursed in period t, D_{t+1}, is treated as an addition to domestic output, Q_t. Similarly, principal and interest payments, D_t and rD_t, and exports, X_t, are all treated as absorptions of domestic output. Imports in period t, M_t, are subtracted from the left hand side to leave absorptions of domestic output (Dornbusch, 1980).

The external borrowing constraint implied by the model represented in equations (1) through (4) will add further insight into the role of external debt in an international trade framework. To derive the external borrowing constraint facing the economy, equation (4) can be written as

$$D_{t+1} = (1+r)D_t+C_t+I_t+(X_t-M_t)-Q_t \quad (5)$$

In the standard model of external borrowing, the country is assumed to have access to any loan that can be repaid under the budget constraint in equation (4). A second assumption is that in a finite horizon model, last-period debt is less than or equal to zero. Under these assumptions, the borrowing constraint can be expressed as the following set of equations:

$$
\begin{aligned}
D_2 &= (1+r)D_1+C_1+I_1+(X_1-M_1)-Q_1,\\
D_3 &= (1+r)D_2+C_2+I_2+(X_2-M_2)-Q_2,\\
&\ \ \vdots\\
D_{T+1} &= (1+r)D_T+C_T+I_T+(X_T-M_T)-Q_T,\\
D_{T+1} &< 0.
\end{aligned}
\tag{6}
$$

Following the procedure used by Sachs, it can be shown that by substituting each D_t equation into D_{t+1} for all t=1...T, the borrowing constraint for the first period can be written as

$$
\begin{aligned}
&\sum_{i=1}^{T} (1+r)^{-(i-1)}C_i \le\\
&\qquad \sum_{i=1}^{T} (1+r)^{-(i-1)}(Q_i-I_i) +\\
&\qquad\qquad \sum_{i=1}^{T}(1+r)^{-(i-1)}(M_i-X_i)-(1+r)D_1
\end{aligned}
\tag{7}
$$

The left hand side of equation (7) is nonnegative because consumption in each period is greater than zero. Therefore the $(1+r)D_1$ term can be carried to the left-hand side to yield the first period borrowing constraint.

$$
\begin{aligned}
(1+r)D_1 \le \max_{I_i} &\sum_{i=1}^{T} (1+r)^{-(i-1)}(Q_i-I_i) +\\
&\max_{X_i} \sum_{i=1}^{T} (1+r)^{-(i-1)}(M_i-X_i)
\end{aligned}
\tag{8}
$$

The borrowing constraint for any time period can be calculated from equation (8) as below:

$$(1+r)D_t \leq \max_{I_i} \sum_{i=1}^{T} (1+r)^{-(i-1)}(Q_i - I_i) + \max_{X_i} \sum_{i=1}^{T} (1+r)^{-(i-1)}(M_i - X_i) \tag{9}$$

The implication of the borrrowing constraint in (9) is that for debt repayment to be successful, debt during any period must be less than or equal to national wealth (Sachs, 1984). In this model, national wealth is defined as the maximum discounted value of gross domestic output net of investment, plus the net trade balance.

The complete macroeconomic equilibrium model can be represented by the following set of equations:

$$\begin{aligned}
&\max\ U(C_1, C_2, \ldots, C_T) \\
&\text{subject to} \\
&\quad Q_t = F(K_t, L_t), \\
&\quad K_{t+1} = K_t(1-d) + I_t, \\
&\quad M_t - X_t = D_{t+1} - D_t - rD_t \\
&\quad C_t = (Q_t - rD_t) - I_t + (D_{t+1} - D_t) + (M_t - X_t) \\
&\quad D_t \leq \max \sum_{i=1}^{T} (1+r)^{(t-i-1)}[(Q_i - I_i) + (M_t - X_t)] \\
&\quad K_1, D_1 \text{ are given; } L_t \text{ is given for all } t.
\end{aligned} \tag{10}$$

The optimal level of borrowing with a finite time horizon is found by maximizing the utility function in (10) subject to the necessary constraints. Following Sachs, the solution consists of a series of sequences, $(C_1, C_2, \ldots, C_T)$, $(I_1, I_2, \ldots I_T)$, $(M_1, M_2, \ldots, M_T)$, $(X_1, X_2, \ldots, X_t)$, $(D_1, D_2, \ldots D_T)$, such that the constraints in (10) are met along with the following set of marginal conditions:

$$U_t = \delta U/\delta C_t = \lambda(1+r)^{-(t-1)} \tag{11a}$$

$$\delta F/\delta K_t = r+d \text{ for } t=2,\ldots,T-1$$
$$\delta F/\delta K_T = 1+r, \tag{11b}$$

$$\sum_{t=1}^{T} (1+r)^{-(t-1)} C_t = \tag{11c}$$
$$\sum_{t=1}^{T} (1+r)^{-(t-1)} (Q_t - I_t + M_t - X_t) - (1+r)D_1$$

Interpretation of the External Debt Model

Marginal Utility of Wealth Over Time. The interpretation of the marginal conditions (11a), (11b), and (11c) is directly related to the two types of borrowing identified above. Equation (11c) is simply a restatement of the debt constraint discussed above, which requires that indebtedness during any period be less than the total wealth of the country. If indebtedness exceeds wealth, the country is insolvent. Sachs defines λ in (11a) as the marginal utility of wealth, which is equivalent to the increase in utility derived from additional consumption made possible by decreased indebtedness. The condition (11a) states that the LDC should borrow externally to equate the marginal utility of consumption in each period with the discounted marginal utility of wealth.

An example of this type of borrowing, discussed by Lessard (1986), is to finance short-run balance of payments disequilibria in order to maintain a stable level of consumption during periods of fluctuating export revenues or import expenditures. Figure 4 illustrates a situation of fluctuating export revenues, X, and stable desired import expenditures, M. During periods of low export

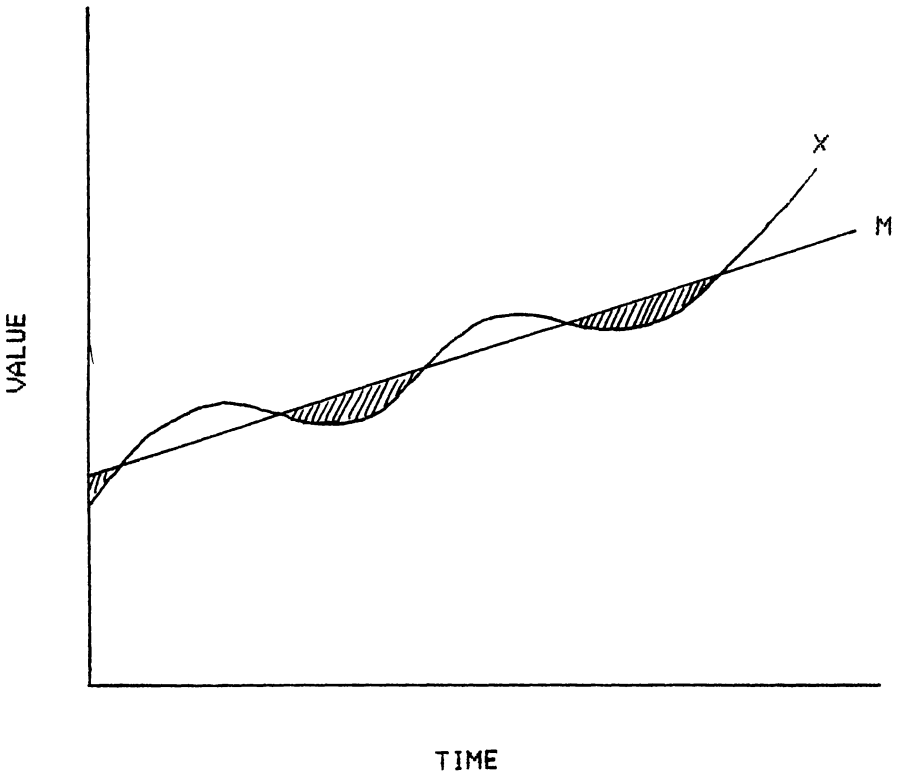

Figure 4. External Borrowing to Maintain Balance of Payments Equilibrium when Export Revenues are Unstable

earnings, the LDC can borrow amounts equal to the shaded areas in order to maintain the desired level of imports. The debt is repaid during periods of high export earnings, and the long-run capital account remains in balance. A similar type of borrowing occurs when large price changes for basic imports, such as oil, cause import expenditures to increase unexpectedly. Figure 5 shows a situation of fluctuating import expenditures, M, and stable export revenues, X. Such borrowing is in accordance with IMF recommendations that LDCs attempt to accomodate temporary price changes but adjust to permanent price changes.

This scenario is valid for many LDCs, because large price changes for their primary export commodities frequently produce wide fluctuations in export earnings. Additionally, many LDCs are dependent on food and energy imports. Because demand for these products is relatively inelastic, LDCs desire to maintain a stable level of imports. As discussed in Chapter II, many LDCs engaged in this type of borrowing following the quadrupling of oil prices in 1973 and their doubling again in 1979. This type of external borrowing may create repayment problems for the LDC if it misinterprets as temporary a permanent decline in export revenues or increase in import prices. In such a case, future consumption and imports must be constrained below desired levels in order to service the debt.

Marginal Utility and Marginal Cost of Capital. The second condition for optimal external indebtedness, (11b), states that borrowing should occur as necessary to equate the marginal product of capital, $\delta F/\delta K_t$, with the marginal cost of capital, (r+d), (Sachs, 1984). This condition defines the limitation on external borrowing to

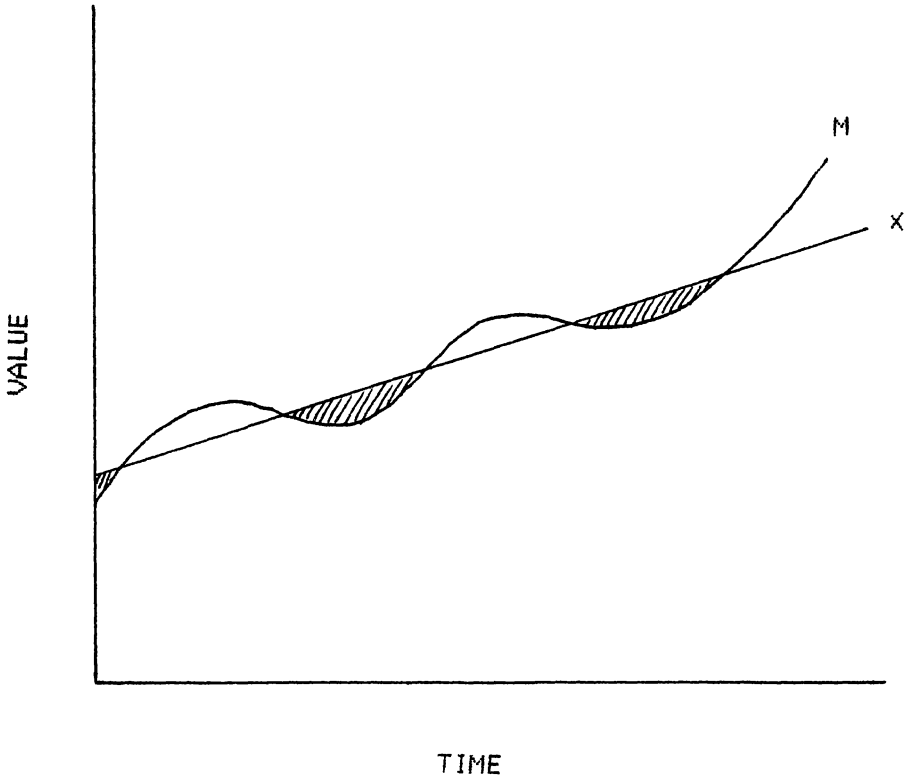

Figure 5. External Borrowing to Maintain Balance of Payments Equilibrium when Import Expenditures are Unstable

finance development projects. Lessard (1986) illustrated this type of borrowing as in the scenario in Figure 6. Line A represents the pattern of income growth generated in the absence of externally borrowed capital. C and B measure expected gross and net income, respectively, with externally financed development. The shaded area between B and C measures debt service. The difference between A and B is the increase in net income made possible by external borrowing. In reality, whether net income with external borrowing exceeds the level of income that would have prevailed with only domestic capital depends on the success with which the borrowed capital is invested. If the LDC incorrectly assesses the expected marginal utility of capital by overestimating the return from a given investment project, it may find that the actual marginal utility of capital is less than the marginal cost. Similarly, if the marginal cost of capital increases unexpectedly, as in the case of increasing real interest rates on variable rate loans, previously approved investment projects may become infeasible.

The Current Debt Crisis

The debt repayment problems experienced by many LDCs in the early 1980s may be attributable to miscalculations of the marginal utility of externally borrowed capital and the marginal cost of that capital. The rapid rise in real interest rates in 1981 raised the real marginal cost of external capital from a negative 3 percent to over 17 percent. It is clear that many investment projects which were economically sound at low or negative real interest rates would not be viable at higher rates. The expected marginal utility of externally borrowed

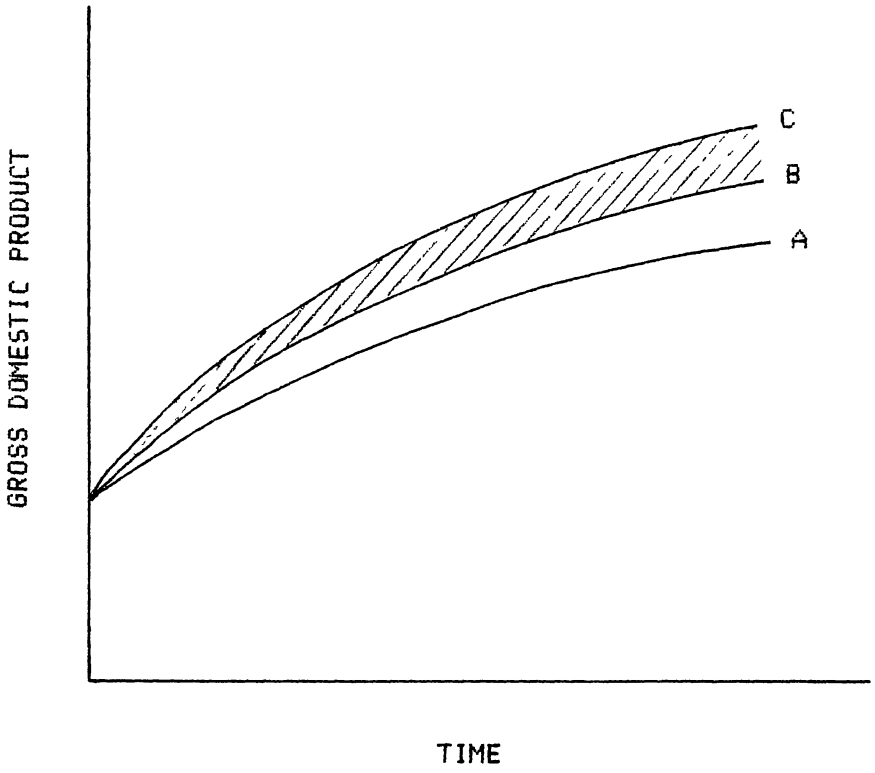

Figure 6. Gross Domestic Product Growth Above the Level Required to Service External Debt

capital may also have been overestimated by many LDCs. Some analysts argue that borrowed capital was not always invested efficiently. Wallich states that in some LDCs, as much as 50 to 90 percent of external borrowing in 1974-1982 left the country in the form of capital flight (Wallich, 1986). In these countries, the actual marginal utility of capital may have been far less that the estimated rate. Another source of repayment problems in some LDCs resulted from the type of investment projects undertaken. Due to the inconvertibility of many LDC currencies, increasing domestic incomes does not necessarily imply an increasing ability to meet foreign debt repayment obligations. Externally financed development projects which generate domestic growth without adding to foreign exchange earnings may meet the requirement that the marginal cost of capital be less than or equal to the marginal return and still result in repayment problems if the LDC cannot convert its currency.

In some developing countries, a large percentage of external borrowing went to finance current consumption rather than long-term development. In others, the borrowed capital may have been invested in unproductive activities or in projects which did not generate foreign exchange revenue. For these countries, borrowed capital intended for long-term investment may actually represent a real transfer of wealth from the future to the present. In such a case, the marginal cost of capital would exceed the marginal utility. In addition, the equilibrium condition that intertemporal mariginal utilities of wealth be equated, may have been violated. The income growth path would resemble Figure 7 rather than Figure 6. In Figure 7, the entire area between B and C is debt service requirement. Net

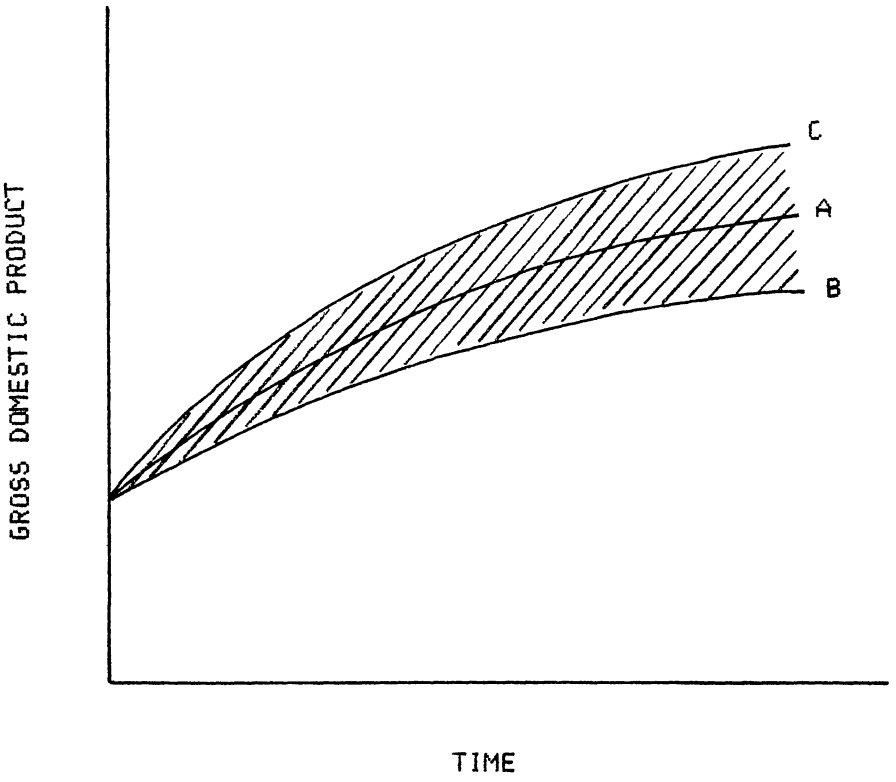

Figure 7. Gross Domestic Product Growth Below the Level Required to Service External Debt

income after external borrowing, B, is below the level that would have prevailed in the absence of borrowing, A; thus the LDC may experience severe economic problems as future consumption must be reduced in order to service existing debt.

The preceeding discussion of debt theory indicates that external borrowing and international trade are interrelated. Imbalance in the trade account may induce a country to borrow in international capital markets to compensate for temporary price changes. Another linkage is the possibility that debt service payments may exert a constraint on foreign exchange reserves and hence on imports. A more subtle linkage is the relationship between external debt, income growth, and imports. These relationships will be developed more fully with a discussion of international trade theory. These results rest on the inclusion of external borrowing in the macroeconomic equilibrium condition. This point will be useful in the discussion of international trade theory below.

International Trade Theory

The relationship between debt and imports can be illustrated through import demand theory. The theory of international trade states that import demand, M_d, is a residual of domestic supply and demand, and can be derived graphically as in Figure 8. The left-hand panel of Figure 8 illustrates hypothetical closed-economy demand and supply functions for a single commodity in a small country. At the domestic equilibrium price, P_1, domestic demand equals domestic supply and import demand is zero. At prices below P_1, domestic demand exceeds domestic supply. Import demand, M_d, equals the horizontal

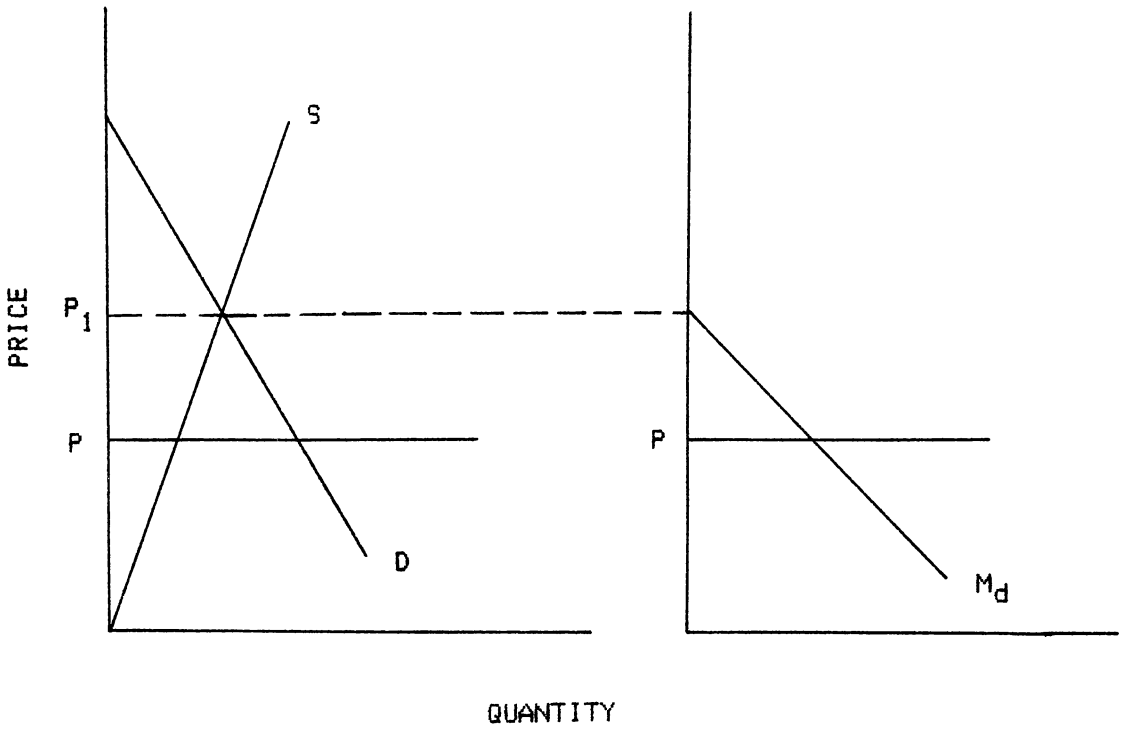

Figure 8. Derivation of Import Demand for a Homogeneous Product by a Small Country

distance between domestic supply and demand at alternative prices. The small-country assumption in international trade theory implies that the importer faces a perfectly elastic supply curve at given prices. Actions taken by the importer will not affect given world prices.

The import demand function is affected by any factors which change domestic demand or supply. Consumer theory identifies income, own price, substitute prices, population, and consumer tastes and preferences as the primary determinants of demand. The proper specification of these variables has been reviewed at length in Leamer and Stern (1970), Houthakker and Magee (1969), and Coffin (1970). The theoretical impact of external debt on import demand has been discussed above. One of the major ways external debt can influence import demand is through its effect on income growth. A decrease in net income, or Gross Domestic Product, due debt service requirements in excess of GDP growth, as would occur if the marginal cost exceeded the marginal utility of borrowed capital, will cause the domestic demand function to shift to the left, to D′ as in Figure 9. As a result, import demand will also shift to the left, to $M_{d'}$, and the quantity of imports demanded will decrease at every price level. Conversely, if borrowed capital results in increased GNP growth above levels required for debt service, both domestic demand and import demand will shift to the right, to D" and $M_{d"}$ respectively, and the quatitiy of imports demanded will increase.

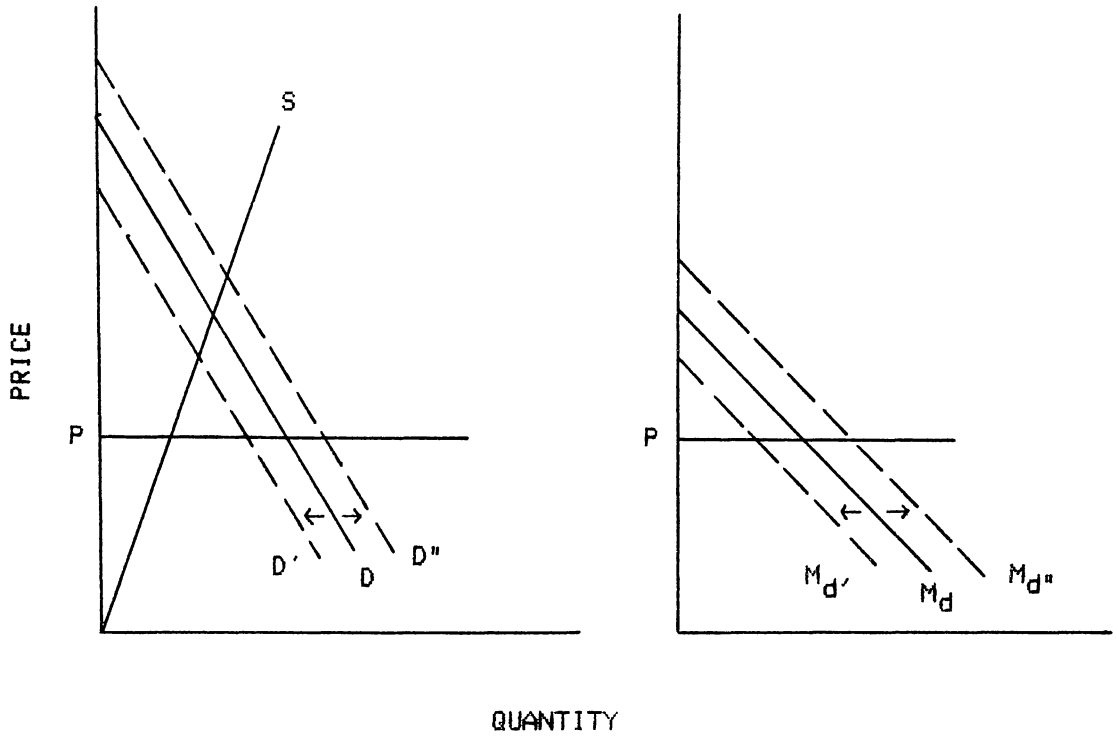

Figure 9. Impact of External Borrowing on Import Demand due to Changes in GDP

A Structural Model of Import Demand

The primary goal of this research is to investigate the possible linkages between external debt and international trade by lesser developed countries. Separate models of total imports, agricultural imports, and wheat imports for 24 developing countries will be developed to test the hypothesis that debt may affect these classes of imports differently. The relationship between the level and structure of external debt and wheat imports will be explored in detail. The models to be estimated draw heavily on the standard single equation import demand models suggested by Leamer and Stern (1970) and reviewed extensively by Magee (1975). The wheat import demand model will draw on the work of Gallagher, Lancaster, Bredahl, and Ryan (1981) and Chambers and Just (1979 and 1981). The major theoretical innovation of these models will be in the treatment of external debt variables.

Previous Research

Despite the theoretical link between external debt and import demand, derivable from either external debt theory or international trade theory, few studies have attempted to model the relationship empirically. The theoretical relationship is not easily amenable to empirical estimation. Theory leaves many questions about the appropriate model specification and estimation techniques unanswered. For example, the appropriate measurement of debt variables is not clear. Wilde, et. al. (1986) used foreign exchange reserves as a proxy for external debt constraints in a study of net wheat import demand by selected lesser developed countries. They failed to find a

significant statistical relationship between foreign exchange reserves and wheat imports, and concluded that debt constraints were unlikely to affect wheat imports. The result that foreign exchange reserves are unrelated to wheat import demand is meaningful in itself, but it does not necessarily imply that debt and imports are unrelated. Researchers have found that foreign exchange reserves and external debt constraints are not highly correlated; in fact, many LDCs borrowed to add to their foreign exchange reserves in the late 1970s as debt service payments rose and imports fell (Dornbusch, 1980). Theory also suggests that foreign exchange reserves and debt variables enter the balance of payments identity and the import demand function separately. It appears that the use of foreign exchange reserves as a proxy for external debt constraints is inappropriate.

In an earlier study by Winters (1985), alternative measures of debt were incorporated into a model of aggregate import demand by developing countries. Winters developed an intertemporal import demand model in which wealth was used as the primary independent variable. Wealth was defined to increase with concessionary loans and to decrease with increases in repayments. Winters also considered total debt outstanding (DOD) as a potential factor in reducing wealth by constraining the country's willingness and ability to borrow. He found that while the grant element of foreign loans did increase wealth and imports, repayments did not consistently have the expected negative effect on imports. Additionally, DOD had no statistically significant effect on imports. The specification of the debt variables used by Winters clarifies the complex relationships between the capital and trade accounts of LDCs.

Dutton, Grennes, and Johnson (1986) incorporated external debt variables into an export demand model for the United States. They used per capita net transfers, or disbursements minus total debt service, as an explanatory variable in a model of total demand for U.S. exports. Other variables included exchange rates of the dollar against currencies of the importing countries and competing exporters, lagged exports, prices, and lagged prices. They found a positive but statistically insignificant relationship between net transfers and U.S. exports.

Two problems with the Dutton, Grennes, and Johnson study involve unnecessary aggregation. Modeling total U.S. exports to a number of countries, with only intercepts allowed to vary across countries imposes uniformity on the study group that may be inappropriate. There is no theoretical reason to believe that the slope parameter on net transfers for Brazil should be the same as that for Malaysia, for example. To the contrary, the results of Winters' study suggest that the effect of debt constraints may vary considerably across countries. The second source of unnecessary and potentially inappropriate aggregation lies in the definition of the debt variable used by Dutton, Grennes, and Johnson. Net transfers is a composite variable which simultaneously measures new disbursements and total debt service. Using net transfers as the independent variable implies that disburesments and total debt service have parameters of opposite signs and equal magnitude. While this may be true, it is preferable to test the hypothesis that the parameters are equal.

Modeling Import Demand

Single-Equation Import Demand Models. According to Thursby and Thursby (1984), it is valid to estimate a single equation import demand model as long as the international supply of imports is infinitely elastic. If the importing country is large, relative to the size of the market for the imported good, trade theory states that actions taken by the importer can affect the market price of the good. In such a case, the import supply is not perfectly elastic. Import prices and the quantity of imports supplied depend on the level of imports; therefore, if the importer is a large country, demand and supply must be estimated simultaneously. On the other hand, if the importing country is small relative to the world market, its actions do not significantly affect world prices or supply. Small importers face perfectly elastic supply curves at given world prices. The countries in this study cannot be reasonably assumed to exert market power in the demand for total imports, total agricultural imports, or wheat imports. They can buy as much or as little as they want at given prices. Therefore, it is appropriate to estimate single equation import demand models for the separate countries in the study group.

Total Imports. A standard quantitative model of import demand includes any variables which influence the domestic demand or domestic supply of the imported good. Precise specification of the model depends, of course, on the definition of the dependent variable. Leamer and Stern (1970) suggested the following specification as a basic model for total imports:

$$M_d = f(Y, p_d / p_m) \qquad (12)$$

where M_d is the total quantity of imports, Y is a measure of domestic income, and p_d and p_m are the domestic and import price levels respectively. The expected sign of the relative price parameter is negative. Leamer and Stern point out, and Warner and Kreinin (1983) emphasize that the specification of relative prices as a ratio constrains the price elasticities to be of equal magnitudes and opposite signs. The implicit homogeneity assumption, while valid in theory, may be inappropriate in empirical estimation because of biases in the statistical price series available to the researcher. For this reason, the price variables will be specified separately where possible, to avoid constraining prices to satisfy the homogeneity assumption. As in consumer theory, the income elasticity of demand for imports is expected to be positive, unless the import is an inferior good. This is unlikely in the case of total imports and total agricultural imports, which are broad aggregates. Again, in accordance with standard demand theory, quantity of imports demanded and the price of domestic substitutes are expected to be positively related, while the own price elasticity is expected to be negative.

The models to be estimated in the later analysis will be of the general form suggested by Leamer and Stern. Additional variables will be included as appropriate. The model of total imports will take the general form

$$M_{it} = f(Y_{it}, P_{dit}, P_{mit}, ER_{it}, DOD_{it}, TDS_{it}, DSB_{it}) \qquad (13)$$

where M_{it} is the per capita quantity of total imports demanded by country i in period t, Y_{it} is per capita income, P_{dit} and P_{mit} are domestic and import price levels, respectively, and ER_{it} is the

exchange rate between the currency of country i and the U.S. dollar. The debt variables, DOD_{it}, TDS_{it}, DSB_{it}, are also measured in per capita terms. The inclusion of the exchange rate as a separate variable permits differential impacts of price and exchange rate changes to be observed. According to Warner and Kreinin, prices and exchange rates may have different effects for three reasons. First, exchange rate changes may be more visible than price changes. Second, exchange rate changes may be measured more accurately than other price changes; and third, exchange rate changes may be considered more transitory than other price changes. For LDCs, many of which have pegged exchange rates, the arguments put forth by Warner and Kreinin may be reversed. Pegged exchange rates are changed at discrete intervals, so real exchange rate movements may be hidden for long periods of time. In this case, price changes might be more visible, more accurately measured, and more transitory than exchange rate changes. Nonetheless, the effects of price and exchange rate changes may differ, and it is appropriate to include the exchange rate as a separate variable to maintain as much flexibility in the estimation of parameters as possible.

Leamer and Stern point out that the basic model of import demand in equation (12) is appropriate for import goods which are not perfect substitutes for the domestically produced good. If the domestic and imported good are perfect substitutes, international trade theory holds that domestic supply directly affects import demand as a shift variable rather than indirectly through the domestic price. In this case the appropriate model is of the form

$$M_d = f(S, Y, p, p_s) \qquad (14)$$

where S is a shift variable for domestic supply of the traded good, p is its common world price, and p_s is the domestic price of an alternative product which is not a perfect substitute for the traded good. This implies that the proper choice of independent variables depends of the definition of the dependent variable. Narrowly defined import goods, such as wheat, are more likely to be considered perfect substitutes for a domestically produced good than are broadly defined aggregates. For this reason, the wheat demand models to be estimated below will include domestic wheat and rice production as a shift variable, and the import price of rice as the substitute good. This specification is particularly appropriate for Asian, Latin American, and North African countries in which wheat and rice are close but imperfect substitutes in consumption.

The model for total agricultural imports will include the same independent variables as in the total import demand model. Total agricultural imports includes a wide variety of consumption and capital goods. All food imports as well as agricultural equipment, fertilizers, and pesticides are included in the total agricultural imports classification. Because agricultural imports are not homogeneous with domestically produced substitutes, no domestic supply shift variable is included.

The wheat demand models will include a measure of domestic production as a supply shift variable, and the trade price of rice as a substitute good. The general form of the wheat import model is

$$QWM_{it} = f(Y_{it}, ER_{it}, WPR_{it}, PWM_{it}, PRS_{it} \quad (15)$$
$$DOD_{it}, TDS_{it}, DSB_{it})$$

where the income, exchange rate, and debt variables are as discussed above. WPR is domestic wheat production, PWM is the import price of wheat, and PRS is the trade price of rice. Parameter signs are more difficult to predict in the wheat demand models than in the aggregate total imports and agricultural imports models. If consumers favor diets richer in animal products than grains, wheat could be considered an inferior good, in which case the income elasticity of demand for wheat would be negative. Coffin found that the income elasticity of demand for wheat was positive for low per capita income countries but negative for countries at higher per capita income levels (1970). Precise definitions of these variables will be discussed in Chapter IV.

Hypothesized Relationships

Real Exchange Rates. The dollar exchange rate is included in the import demand models to test the hypothesis that the high value of the dollar in the early 1980s depressed the level of developing country imports. The dollar exchange rate has been widely postulated to affect the level of agricultural exports by the United States (Schuh), yet empirical evidence is weak. As the dollar appreciates against the currency of an importing country and against the currencies of competing exporters, the effective cost of U.S. goods and services rises relative to the price level of alternatives. An appreciating dollar may cause importers to reduce total imports if alternative sources of supply are not readily available or if a large percentage

of their imports is denominated in dollars. Otherwise, the volume of imports is expected to remain unchanged, but the source of supply may change. The models used in this study will not distinguish between sources of supply, therefore the dollar exchange rate is not expected to have a strong statistical relationship with total imports.

The dollar exchange rate may have a more complex linkage to import demand than the simple price effect described above. The real dollar exchange rate affects the real national currency denominated value of external debt. As mentioned in Chapter II, over 50 percent of the total external debt of all LDCs is denominated in U.S. dollars. In Latin American this share approaches 90 percent. A dollar appreciation may increase the level of non-dollar denominated export earnings required to service debt and thus exacerbate any external debt constraints affecting the importer. Of course, a model which includes data expressed in real U.S. dollars, includes the impact of the dollar exchange rate directly in the data. A model capable of measuring changes in market shares of competing importers may be required to fully assess the price effects of foreign currency exchange rates on import demand.

Debt Outstanding Disbursed. The key variables to be tested in the following analysis are those related to the level and structure of external debt. The primary descriptive factors concerning external debt are the level of total external debt (DOD), annual total debt service (TDS) on the debt, and inflows of new disbursements (DSB). DOD measures the total level of indebtedness of the importing country. Some analysts have argued that high levels of DOD may exert a constraint on the willingness and ability of countries to acquire

additional external debt (Winters); therefore, the ability of the debtor to finance balance of payments disequilibria or long-term investment projects could be impeded. Such restrictions could adversely affect the income growth pattern of the developing country and induce a reduction in imports.

The expected impact of rising DOD on LDC imports is ambiguous. Debt can be incurred specifically to finance increased levels of imports, thus in the short run, rising DOD may directly increase rather than decrease imports. Further, high levels of DOD may be associated with imports of capital goods used to increase the rate of economic development. The resultant income growth is expected to induce rising import demand in both the short-run and the long-run. DOD may be either positively or negatively related to imports, depending upon the short-term uses of borrowed funds and on the long-term success of the development projects undertaken with borrowed capital. The significance of DOD as a determinant of import demand is largely an empirical question. The theoretical relationship permits either a positive or a negative sign.

Total Debt Service. TDS is expected to be negatively related to imports under most circumstances. TDS is the total interest and principal payments required to service the existing level of DOD. It is a contractural obligation which has priority claim on the foreign exchange earnings of the debtor country. As such, increases in TDS directly reduce the level of foreign exchange available to finance imports. In the balance of payments identity above, equation (3), TDS competes directly with imports for the availabe export earnings; rising TDS is therefore analogous to a reduction in income. The

relationship between TDS and imports could be positive, however, if high TDS represents high levels of past borrowing which have been used to increase incomes very rapidly. It is possibe for GDP and export earnings to increase rapidly enough to offset the negative effect of higher TDS. In this case TDS alone would exert a negative effect, but could be statistically outweighed by the positive income effect. A second situation in which TDS might appear to exert a positive influence on import demand would occur if TDS were highly correlated with new disbursements. In a roll-over scenario, the LDC borrows new monies with which to repay existing debt. If the country has full access to new credit, TDS and DSB could increase at the same rate, and rising TDS would leave import growth unhindered.

Disbursements. Newly disbursed lending (DSB) is expected to have a positive impact on imports. Disbursements enter the balance of payments identity in equation (3) as an addition to export earnings, thereby increasing the foreign exchange available to finance imports. Unless the new disbursement is used exclusively to service existing debt, it should stimulate import demand. Even if it were used entirely for debt service, increased disbursements would not have a negative impact on imports. In this case, disbursements might not increase imports, but it would at least prevent the country from reducing its level of imports.

Cross-Country Comparisons. The magnitude of the estimated parameters on DOD, TDS, and DSB are expected to differ across countries and across classes of imports. The countries included in this study vary widely in terms of per capita incomes, economic growth rates, economic systems, political organization, and debt levels. It

is expected that countries which have experienced rapid growth rates and successful export development programs will be less affected by debt repayment problems than countries with slower growth rates. In general it is expected that all three debt variables will have a stronger effect on total imports than on agricultural imports or wheat imports. Basic food imports, such as wheat, are essential to the political stability and economic survival of many LDCs; therefore, wheat imports are expected to be relatively debt inelastic.

CHAPTER IV

THE EMPIRICAL ESTIMATION OF THE MODELS

The estimation of an econometric import demand model requires that several questions, unanswered by theory, be addressed. These include the precise definition of the dependent and independent variables within the model, the correct functional form of the import demand equation, and the appropriate statistical technique for the model. Underlying the empirical estimation of an import demand function is a qualitative analysis of the countries to be modeled. Some of the economic characteristics of the 24 countries in the study group will be examined in order to illuminate discussion of these empirical questions. After a brief analysis of the study group, the reduced form import demand equations for total imports, agricultural imports, and wheat imports will be derived. Specific methodological questions and testable hypotheses will then be addressed.

The Study Group

The 24 countries included in the study group represent a broad cross-section of LDCs. They include from Latin America: Brazil, Chile, Colombia, Mexico, Peru, and Venezuela; from Asia: Indonesia, Korea, Malaysia, The Philippines, Thailand, Burma, India, Pakistan, Nepal, and Sri Lanka. Also included from Africa are: Algeria, Egypt, Morocco, Kenya, Nigeria, Sudan, Tanzania, and Zaire.

Decision Criteria

The study group was chosen from the World Bank Debtor Reporting System (DRS); therefore, each has some level of outstanding external debt. Beyond the requirement that they be included in the DRS data base, no restrictions were imposed on the level or structure of external debt. The only other requirements were that consistent data on the necessary variables be available, that the countries be net wheat importers, that they have a minimum population of 10 million in 1983, and that they not be members of the Communist Block. Because the impact of debt on wheat imports is of primary interest in the following analysis, net wheat exporters in 10 or more of the 14 years covered were excluded. In addition, countries with less than 10 million inhabitants account for a very small percentage of LDC wheat imports. The 24 countries in the study group purchased 63.5 percent of total LDC wheat imports in 1983. Under an alternative decision rule of 5 million population, the study group would have included an additional 28 countries, but the share of total LDC imports would have increased only slightly, to 71 percent. The exclusion of very small countries may limit the generality of the results of the following analysis, but restrictions were necessary to produce a study group of manageable size. Further, the theoretical problems associated with modeling trade by centrally planned economies (CPEs), and the difficulties in obtaining adequate data required the exclusion of Communist Block countries.

The study group includes 8 of the world's 12 largest net external debtors (World Debt Tables, 1985). Of the debtors reported by the World Bank to have DOD in excess of $15 billion in 1983, the

study group includes all but Argentina, Israel, Turkey, and Yugoslavia. Argentina and Turkey were classified as net wheat exporters; therefore, while they could have been included in the models for total imports and agricultural imports, they could not be modeled in the wheat import demand study. Israel was omitted from the study group because it had less that 10 million inhabitants in 1983, and Yugoslavia was excluded because it is a centrally planned economy.

Characteristics of the Study Group

Per Capita Incomes. The 24 countries included in the analysis are very diverse in terms of income, debt, population, economic growth, and geographic characteristics. Table I includes per capita real incomes and DOD levels for the individual countries for the years 1970 and 1983 measured in 1980 U.S. dollars. Also included is the percentage change in these indicators over the time period. Per capita real dollar incomes ranged from a 1983 low of $122 in both Nepal and Zaire, to a high of $3416 in Venezuela. Other very low income countries are Burma, India, Pakistan, and Sri Lanka, all with per capita incomes of less than $300. Kenya, Sudan, and Tanzania also had per capita incomes under $300 in 1983. Peru is the lowest income Latin American country in the study group with per capita income of $720. All other Latin American countries had per capita incomes of over $1000 in 1983, as did Korea, Malaysia, and Algeria.

Income Growth Rates. Per capita income growth rates also differ widely among the study group. Indonesia, Korea, Malaysia, Algeria, and Nigeria all experienced real per capita income increases of over 100 percent between 1970 and 1983. Korean and Algerian per capita

TABLE I

REAL PER CAPITA INCOME AND TOTAL DEBT -
1970, 1983, AND CHANGE -
BY COUNTRY

Region / Country	Per Capita Income 1970	Per Capita Income 1983	Per Capita Income Change	Per Capita DOD 1970	Per Capita DOD 1983	Per Capita DOD Change
	--dollars--		- % -	--dollars--		- % -
Latin America						
Brazil	904	1340	+ 48	39	447	+ 1123
Chile	1684	1401	- 17	429	484	+13
Colombia	684	1159	+ 69	119	208	+ 75
Mexico	1368	1574	+ 15	124	736	+ 494
Peru	901	720	- 20	130	351	+ 170
Venezuela	2232	3416	+ 53	138	653	+ 360
Asia						
Burma	158	139	- 12	4	50	+ 1150
India	194	219	+ 13	29	24	- 17
Indonesia	150	415	+ 177	39	114	+ 192
Korea	529	1593	+ 201	111	445	+ 301
Malaysia	745	1633	+ 119	68	595	+ 775
Nepal	148	122	- 18	1	18	+ 1700
Pakistan	171	256	+ 50	52	90	+ 73
Philippines	380	551	+ 45	34	165	+ 385
Sri Lanka	358	278	- 22	48	118	+ 146
Thailand	351	673	+ 92	9	118	+ 1211
Africa						
Algeria	641	1957	+ 205	127	523	+ 312
Egypt	412	635	+ 54	96	275	- 186
Kenya	279	256	- 8	49	105	+ 114
Morocco	489	498	+ 2	91	354	+ 289
Nigeria	273	602	+ 120	17	109	+ 541
Sudan	279	261	- 6	41	233	+ 468
Tanzania	189	240	+ 27	35	105	+ 200
Zaire	169	122	- 28	28	107	+ 282

incomes grew by 201 and 205 percent respectively. With the exception of Korea, the countries having the highest per capita income growth were petroleum exporters throughout most of the study period. In constrast, several countries had declining per capita incomes. Chile and Peru experienced per capita income declines of 17 and 20 percent over the study period. Incomes in Burma, Nepal, and Sri Lanka fell by 12, 18, and 22 percent respectively. Kenya and Sudan suffered declines of 8 and 6 percent each. The sharpest decline in real per capita income occurred in Zaire where incomes fell by 28 percent. Not shown in Table I is the general trend of rapid income growth in the 1970s followed by declining or negative growth rates in the 1980s experienced by many of the countries in the study group.

Debt Levels. The per capita external debt characteristics of the study group also vary widely. The lowest income countries tend to have low per capita DOD, because their low incomes constrain the amount of lending they are able to acquire and service. Nepal, Burma, and India had per capita DOD levels of $18, $50, and $24, respectively, in 1983. The largest per capita debtors are Venezuela and Mexico which had per capita DOD of $653 and $736, respectively. Other high per capita DOD countries include Brazil ($447), Chile ($484), Korea ($445), Malaysia ($595), and Algeria ($523).

Debt Ratios. Perhaps indicative of the potential for external debt difficulties are measures which relate debt levels to the economic strength of the debtor. Such measures were discussed in Chapter II on the basis of geographical aggregates. Here they are briefly reviewed for the individual countries in the study group. Table II includes two debt ratios, DOD/GDP and TDS/XGS, which measure

total debt outstanding as a percentage of gross domestic product and total debt service as a percentage of earnings from the export of goods and services. Table II includes these debt ratios for 1970, 1976, and 1983 to illustrate the general trends over the study period.

Increasing DOD/GDP ratios indicate that indebtedness as a percentage of the country's productive wealth is growing. Very high DOD/GDP ratios may indicate impending insolvency, that is, a long-term inability to repay external debt. Most countries in the study group had increasing DOD/GDP ratios throughout the time period, with the notable exceptions of India, Indonesia, Pakistan, and Algeria. The highest debt to income ratios were in Sudan, and Zaire. In each of these countries DOD/GDP increased from less than 20 percent in 1970 to almost 90 percent in 1983. Several countries had 1983 DOD/GDP ratios in excess of 40 percent, including Mexico, Peru, Sri Lanka, Egypt, Kenya, Sudan, and Tanzania. With the exception of Mexico, all of the highest DOD/GDP countries were net oil importers throughout most of the study period. DOD and GDP are included in the empirical models as separate variables rather than as a ratio. Inclusion as a ratio would impose a homogeneity constraint on the estimated parameters, forcing the signs on DOD and GDP be of equal magnitude and opposite signs. Separating them in a double-log form allows hypothesis tests of their individual and joint significance.

The ratio of total debt service to export earnings indicates the availability of foreign exchange to finance imports. Because TDS is a contractual obligation, it has first claim on export earnings. Thus, a high TDS/XGS ratio may indicate an inability to maintain import expenditures at the desired level. In 1983, Egypt, Algeria, Morocco,

TABLE II

DEBT RATIOS[1] - 1970, 1976, 1983 -
BY COUNTRY

Region / Country	DOD/GDP			TDS/XGS		
	1970	1976	1983	1970	1976	1983
	Percent					
Latin America						
Brazil	8.6	11.6	27.7	16.0	20.2	31.9
Chile	25.5	36.5	34.6	19.2	34.2	23.1
Colombia	17.3	16.1	17.9	16.1	15.4	29.4
Mexico	9.1	17.8	46.8	53.9	68.2	44.6
Peru	14.4	26.7	48.8	16.0	35.1	23.1
Venezuela	6.2	9.4	19.1	2.6	4.3	17.3
Asia						
Burma	4.6	7.6	35.9	19.5	17.4	39.4
India	14.8	14.9	10.9	26.9	13.6	15.6
Indonesia	26.2	26.8	27.7	6.6	8.9	12.1
Korea	20.9	23.7	27.9	34.9	11.8	15.3
Malaysia	9.2	14.5	36.4	3.0	4.6	6.8
Nepal	0.3	3.2	14.9	5.3	1.7	9.0
Pakistan	30.5	44.9	35.2	28.1	24.6	39.3
Philippines	8.8	11.8	30.0	8.9	9.3	21.5
Sri Lanka	13.5	19.2	42.7	10.7	22.4	15.4
Thailand	4.9	4.9	17.6	5.5	2.9	14.9
Africa						
Algeria	19.9	36.1	26.7	4.2	15.6	40.3
Egypt	23.3	33.4	43.2	37.4	42.1	62.1
Kenya	17.6	21.9	40.9	6.2	8.2	31.0
Morocco	18.6	25.2	71.0	12.1	12.9	53.7
Nigeria	6.3	2.1	18.2	4.5	3.6	18.0
Sudan	14.6	30.8	89.4	11.1	17.8	16.9
Tanzania	18.4	33.3	43.6	6.2	6.1	18.5
Zaire	16.5	63.7	87.7	4.7	9.7	11.2

[1] DOD/GDP is the ratio of total debt outstanding to Gross Domestic Product expressed in percentage terms. TDS/XGS is the ratio of Total Debt Service to earnings from the export of goods and services.

and Mexico all had TDS/XGS ratios in excess of 40 percent. In addition, Brazil, Burma, Pakistan, and Kenya had TDS/XGS ratios over 30 percent. The TDS/XGS ratio was not included in the empirical models. Total export earnings (XGS) and total import expenditures (TM) are simultaneously determined, therefore it is inappropriate to use XGS as an expalnatory variable for TM in a single equation framework. Also, inclusion of XGS, TM, TDS, and DSB in the same equation approximates the balance of payments identity for developing countries presented in Chapter III. Thus, while some qualitative judgments based on the TDS/XGS ratio may be possible, an empirical assessment of its importance cannot be made in the present framework.

Methodology

Combining Time Series and Cross-Sectional Data

The data for this study consists of 24 cross-section units with 14 years of time series observations on each country. The time period for which consistent external debt data could be found is relatively short, however, 1970-1983 encompasses the period of rapid LDC external debt growth. Seemingly Unrelated Regression (SUR), pioneered by Zellner (1962), is appropriate in the estimation of time series data for two or more cross section units which may be related in ways which are unknown or immeasurable. In an international trade setting these factors may be internal to the group of countries, such as geographic, political, cultural, or economic characteristics which cause them to respond similarly. External factors include global macroeconomic conditions, world market supply shocks, and economies of scale gained

from trading with or lending to several countries in the region. In the following analysis, the 24 countries are grouped according to geographic location to produce three sets of seemingly unrelated cross-section units. One advantage of SUR is that including a truly unrelated country in a system of seemingly unrelated equations does not bias the estimated parameters or standard errors for any of the included countries. Therefore, all African countries are combined in a single group as are all Asian countries and all Latin American countries.

The separate equations for each country are assumed to be related only through the error terms which incorporate the unknown cross correlations among countries. The estimator used in the following analysis is the method suggested by Parks (1967), which combines Zellner's SUR with a technique for correcting the time series data for autocorrelation. The Parks method involves first correcting the individual country models for the first order autoregressive error process often found in annual economic time series data, using the Prais-Winstin estimator. SUR is then used to estimate the complete set of models based on the corrected data. The resultant parameter estimates are corrected for both autocorrelation and correlation across countries.

The Functional Form

The double-logarithmic functional form was chosen for the import demand models because of its flexibility. The most common functional forms used in empirical import demand studies are the linear and double-log. Unlike the linear form, the double-log form permits ready

comparison of models because the parameters are interpreted directly as elasticities. The double-log form is particulary helpful in dealing with the exchange rate variable. As long as the exchange rate is included as a separate variable, it does not matter whether income and other value data are denominated in dollars or in units of the national currency. The exchange rate elasticity is invariant with respect to the denomination of the other variables in the double-log form. In the linear form, however, the estimated exchange rate elasticity is very difficult to interpret because it differs depending on the specification of the other variables. In addition, the double-log transformation reduced the degree of pairwise correlation between the independent variables, and permitted the estimation of larger models than possible with the linear form.

Estimation Equations

A high degree of multicollinearity exists among some of the independent variables suggested by theory. The three debt variables are highly correlated in many countries, as are total debt and income. Further, the wheat and rice price varibles in the wheat model are almost perfectly correlated in some countries. One consequence of multicollinearity is that the estimated standard errors tend to be large, producing wide confidence intervals and low test statistics. However, parameters estimated in the presence of multicollinearity remain unbiased. In preliminary tests of partial models it was found that dropping the DOD variable did not improve the significance levels of the remaining variables. Dropping a variable from the true model violates the assumption that the model is correctly specified and

produces biased parameter estimates. Therefore, the full theoretical models were estimated in spite of the multicollinearity problem.

The only required compromise was in the specification of the wheat model price variables. Because the wheat and rice prices were too closely correlated to permit estimation as separate variables, they were redefined in ratio form. Using relative prices imposes homogeneity assumptions on the estimated wheat and rice price elasticities, requiring them to be of equal magnitude but opposite sign. This restriction may not be desirable, but, because the debt variables rather than prices are the primary focus of this research, it is acceptable to incorporate prices as a ratio.

The estimating equations are of the form suggested by theory, with the exceptions noted above. The three models are given below.

$$TM=b_1\ Y^{b2}\ RER^{b3}\ DOD^{b4}\ TDS^{b5}\ DSB^{b6} \tag{16}$$

$$AGM=g_1\ Y^{g2}\ RER^{g3}\ DOD^{g4}\ TDS^{g5}\ DSB^{g6} \tag{17}$$

$$QWM=w_1\ Y^{w2}\ RER^{w3}\ DOD^{w4}\ TDS^{w5}\ DSB^{w6}\ P^{w7}\ WPR^{w8} \tag{18}$$

where TM and AGM are total imports and total agricultural imports, respectively, each measured in real per capita U.S. dollars. QWM is total per capita quantity of wheat imports. Y is real national currency denominated Gross Domestic Product in per capia terms, and RER is the real exchange rate measured in units of the national currency per U.S. dollar. DOD, TDS, and DSB are real per capita dollar denominated debt outstanding, total debt service, and disbursements, respectively. In the wheat model, P is the relative price of wheat and rice, and WPR is domestic wheat production. More complete definitions of the variables are provided below and in Appendix A.

Data Sources and Definitions

The data used in the following empirical estimation all came from published sources and are measured on an annual basis. Information on the level and structure of external debt came from various issues of the World Bank World Debt Tables. Income, exchange rate, and inflation data are from the International Monetary Fund International Financial Statistics. Trade quantity and price data and domestic agricultural production data were taken from the Food and Agriculture Organization of the United Nations Trade Yearbook, and Production Yearbook. In all cases, the most recent published figures were used. Definitions of the variables are given below.

Dependent Variables

Total imports (TM) is the total annual value of merchandise imports, measured in real 1980 U.S. dollars. The U.S. GNP deflator from IFS was used to deflate the current dollar data series published by FAO. Agricultural imports (AGM) is the value of total agricultural imports purchased by the country. AGM includes agricultural inputs such as fertilizers and pesticides, as well as food products. As such, AGM should be viewed as a composite of investment and consumption goods. Wheat imports (QWM) is the quantity of wheat and flour in wheat equivalents imported annually. All trade variables are in per capita terms.

Independent Variables

Income and Exchange Rates. Income (Y) is per capita gross domestic product measured in real national currency units. Where

possible, real GDP figures were taken directly from IFS. In some cases it was necessary to deflate the given nominal GDP series using the domestic GDP deflator. The real exchange rate, RER, was calculated from the nominal national currency/U.S. dollar exchange rates, the national GDP deflators, and the U.S. GNP deflator published by IFS. Thus the variable RER incorporates changes in both the nominal exchange rate and relative price levels.

Debt Variables. The external debt variables are as defined in Chapter II. DOD is debt outstanding disbursed, as reported by the World Bank. TDS is total debt service, and DSB is newly disbursed lending. All World Bank data are reported in current U.S. dollars; therefore, the debt variables were adjusted using the U.S. GNP deflator to retain consistency with the other data. All debt variables are in per capita terms. The debt variables were left in U.S. dollars to simplify interpretation of the RER variable. Of course, converting the data to national currency units does not change the estimated elasticities on either the debt or the exchange rate variable in the double-log form.

Relative Prices. The wheat and rice prices were calculated from FAO trade value and volume data. The value of wheat imports, deflated by the U.S. GNP deflator, divided by the quantity of imports, yielded the unit value of wheat imports (PWM). The rice price was slighly more complicated to derive. Some countries are rice exporters rather than importers, others import in some years and export in others, and still other countries neither imported nor exported rice in some years. The rice price (PRS) was taken as the lesser of the import unit value and the export unit value, calculated for each country in

the same manner as PWM. PRS so defined represents the opportunity cost of importing wheat. It measures the minimum cost of acquiring additional rice for domestic consumption, either through increased imports or decreased exports, thus PRS will be referred to as the trade price of rice. Over the 14 years of data and the 24 countries studied, there were 7 times in which a country neither imported nor exported rice. In these cases the world rice price, taken as the annual average of PRS for all countries, was used as the rice trade price. The use of unit values for the wheat and rice price provide a consistent price series for each country. While unit values do not measure internal prices exactly, they do measure border prices with some accuracy. Unit values also account for concessionary sales and other price related trade policies. As discussed above, multicollinearity between the wheat and rice prices required that they be incorporated as a ratio.

Domestic Production. The domestic production of wheat (WPR) is annual domestic wheat production taken from the FAO Production Yearbook. WPR is incorporated in the wheat demand model to account for domestic supply shifts not captured by the relative trade prices. Of the 24 countries in the study group, 18 produced wheat domestically in every year covered. The six countries which did not produce wheat every year contain no supply shift variable, because for them, imported wheat is not a substitute for a domestically produced good. Five countries produced no wheat: Indonesia, Malaysia, The Philippines, Sri Lanka, and Thailand. Venezuelan wheat production is reported from 1970 to 1979, but none is reported from 1980 to 1983. It is unknown whether Venezuelan wheat production actually dropped to

zero or was simply below the minimum level recorded by FAO. It is not possible to include observations of zero in a logarithmic form, and estimating some non-zero level of production for Venezuela for the 1980-1983 period could bias the results of the model. Therefore, no wheat production variable was included for Venezuela.

Testable Hypotheses

Because of the large number of countries included in the study group and the widely divergent economic characteristics of those countries, it is not a simple matter to determine the correct or even the expected signs of some of the parameters to be estimated. The parameters on the debt variables are particularly hard to predict. As discussed in the previous chapter, either positive or negative signs on some parameters are both theoretically acceptable and meaningful. The basic questions to be addressed are whether these parameters are positive or negative, and how significant they are in an import demand framework. Nevertheless, some testable hypotheses can be developed and are discussed below. Table III includes a chart of expected parameter signs for the three classes of imports to be modeled.

The hypothesized relationships in the models for total imports are fairly straightforward. The parameter on the income variable, Y, is expected to be positive. Total imports are expected to be a normal good and hence to increase with increases in income. Total Debt Service is expected to be negatively related to total imports in most circumstances. Rising TDS may exert a constraint on total imports. The parameter on DSB is expected to be positive. Additional new

TABLE III

HYPOTHESIZED PARAMETER SIGNS FOR THREE CLASSES OF IMPORTS

Import Class	Independent Variables[1]						
	Y	RER	TDS	DSB	DOD	P	WPR
Total Imports	>0	<0	<0	>0	<,>0		
Agric. Imports	>0	<0	<0	>0	<,>0		
Wheat Imports	<,>0	<,>0	<,>0	<,>0	<,>0	<0	<0

[1] Y is real per capita national currency denominated Gross Domestic Product; RER is the real exchange rate vis a vis the U.S. dollar; DOD, TDS, and DSB are per capita real total debt outstanding, total debt service, and newly disbursed lending, respectively; P is the ratio of the wheat import price to the trade price of rice; and WPR is domestic wheat production.

disbursals are expected to be analogous to an increase in income. The sign of the parameter on DOD is ambiguous. Especially at low levels of debt and income, DOD and total imports may be positively related as borrowing permits the country to increase its current consumption and investment expenditures. At higher debt levels, however, DOD may exert a negative wealth effect and constrain the ability of the country to finance further imports. Thus, the parameter on DOD in the total import model is expected to be positve for low debt countries but negative for high debt countries.

The models for agricultural imports are expected to yield similar results to those for total imports because agricultural imports are a broad composite of consumption and capital goods. The parameters on income, TDS, DSB, and DOD all have the same expected signs as in the total imports models; that is positve for income and DSB, negative for TDS, and either positive or negative for DOD as discussed above. The magnitudes of these parameters may be smaller, however, as agricultural imports are expected to be less income and debt elastic than are total imports.

The parameter signs are much more difficult to predict in the wheat import model, because for some countries, wheat may be an inferior good as argued by Coffin (1970). If such is the case, the income elasticity will be negative rather than positive. Wheat may be an inferior good in some higher income LDCs in which diets richer in meat products are preferred. It is also possible that wheat may be considered an inferior good in the Asian countries where rice is the traditional food grain. However, for most countries, the parameter on Y is expected to be positive. Similar ambiguity exists in prediction

of parameter signs on the debt variables in a wheat import setting. For a normal good, the TDS parameter should be negative, the DSB parameter should be positive, and the DOD elasticity could be either positive or negative. It is expected that wheat imports will be less income and debt elastic than either total or agricultural imports. The relative price variable is expected to have a negative sign. Increases in the wheat price or decreases in the rice price would increase the relative price of wheat and decrease the quantity of wheat imports. The expected parameter on domestic production, WPR, is negative. Increases in WPR are expected to reduce the demand for imported wheat.

The three models for total imports, agricultural imports, and wheat imports were estimated for each of the 24 countries in the study group. The Parks method for correcting for both autocorrelation and correlation across countries was used. Results and interpretation of the statistical estimation are presented in the following chapter. Conclusions based on the empirical evidence and suggestions for further research are developed in Chapter VI.

CHAPTER V

EMPIRICAL RESULTS

The total imports, agricultural imports, and wheat imports models described in Chapter IV were estimated for the 24 countries in the study group. The data for each country was first corrected for first order autoregressive error process. The countries were then grouped according to geographic location, and the resulting systems of equations were estimated using seemingly unrelated regression (SUR) to account for correlated error terms among the countries. The results of the models are discussed below.

Total Import Demand Model

Table IV contains the estimated parameters, standard errors, and t-statistics from the total imports model for each country. Degrees of freedom for the three geographic groups are also given in Table IV. As discussed in the previous chapter, the expected parameter signs in the total import model were positive for income (Y) and newly disbursed external borrowing (DSB), negative for the real exchange rate (RER) and total annual debt service payments (TDS), and either positive or negative for total debt outstanding (DOD).

TABLE IV

TOTAL IMPORTS - SUR PARAMETER ESTIMATES[1] -
BY GEOGRAPHIC REGION

Region / Country	Intercept	Y	RER	DOD	TDS	DSB
Latin America[3]						
Brazil	-40.1486	4.3029	-0.4384	-0.1631	-0.6506	0.1906
		(0.7815)	(0.5492)	(0.4244)	(0.2165)	(0.1865)
		[5.507]	[-0.798]	[-0.384]	[-3.004]	[1.022]
Chile	9.0233	-0.3502	-1.3523	0.6213	0.4304	0.0328
		(0.9359)	(0.5770)	(0.4338)	(0.1075)	(0.1086)
		[-0.374]	[-2.344]	[1.432]	[4.005]	[0.302]
Colombia	-10.6946	1.7251	-0.9837	0.0754	0.0703	0.0065
		(0.7969)	(0.3796)	(0.2622)	(0.1628)	(0.0735)
		[2.165]	[-2.592]	[0.288]	[0.432]	[0.089]
Mexico	-21.0034	2.8528	-1.1778	-0.3421	0.0500	0.1384
		(0.3294)	(0.1262)	(0.0859)	(0.0491)	(0.0561)
		[8.661]	[-9.335]	[-3.984]	[1.019]	[2.468]
Peru	13.8073	-0.0404	-1.8605	0.3312	0.0007	0.0711
		(0.8315)	(0.4317)	(0.1525)	(0.0863)	(0.1070)
		[-0.049]	[-4.310]	[2.172]	[0.008]	[0.664]
Venezuela	-13.5993	2.3738	-1.6757	-0.1793	-0.0047	0.1620
		(0.9502)	(0.6418)	(0.3142)	(0.1526)	(0.1785)
		[2.498]	[-2.611]	[-0.571]	[-0.031]	[0.908]

TABLE IV (Continued)

Region / Country	Independent Variables[2]				
	Intercept	Y	RER	DOD	TDS	DSB
Asia[4]						
Burma	-17.5713	3.3073	-0.8271	-0.5590	-0.5754	0.3732
		(1.8862)	(0.4244)	(0.3695)	(0.1390)	(0.1463)
		[1.753]	[-1.949]	[-1.513]	[-4.138]	[2.551]
India	-14.1047	2.6939	-2.2477	0.6574	-2.2074	0.2156
		(0.9433)	(0.7029)	(1.0878)	(0.9524)	(0.1969)
		[2.856]	[-3.197]	[0.604]	[-2.318]	[1.095]
Indonesia	-21.6549	2.1568	-0.6573	0.7184	-0.4115	0.2353
		(0.1148)	(0.0638)	(0.0847)	(0.0347)	(0.0316)
		[18.785]	[-10.309]	[8.482]	[-11.872]	[7.433]
Korea	1.9964	0.5219	-0.9449	0.5755	-0.0638	0.0019
		(0.8893)	(0.4221)	(0.5420)	(0.2384)	(0.2065)
		[0.587]	[-2.239]	[1.062]	[-0.268]	[0.009]
Malaysia	-13.7041	2.7035	-0.3156	-0.3350	0.0056	0.0329
		(0.9826)	(0.4085)	(0.3158)	(0.0582)	(0.0651)
		[2.751]	[-0.773]	[-1.061]	[0.097]	[0.505]
Nepal	11.7065	-1.0589	-0.4469	0.1691	0.0805	0.0284
		(0.9448)	(0.2562)	(0.0739)	(0.0371)	(0.0684)
		[-1.121]	[-1.744]	[2.288]	[2.172]	[0.415]
Pakistan	-9.2507	2.1838	-1.4040	-0.4089	0.1305	0.3004
		(0.0576)	(0.0383)	(0.0426)	(0.0289)	(0.0215)
		[37.904]	[-36.746]	[-9.596]	[4.505]	[13.994]

TABLE IV (Continued)

Region / Country	Independent Variables[2]				
	Intercept	Y	RER	DOD	TDS	DSB
Philippines	-12.6842	2.3038	-0.7633	-0.2005	-0.1239	0.2001
		(0.8439)	(0.3111)	(0.1338)	(0.0804)	(0.0712)
		[2.730]	[-2.454]	[-1.499]	[-1.542]	[2.810]
Sri Lanka	-22.5427	3.7832	-0.2885	-0.7189	-0.3556	0.0181
		(1.4962)	(0.3874)	(0.7373)	(0.1845)	(0.2495)
		[2.529]	[-0.745]	[-0.975]	[-1.927]	[0.073]
Thailand	4.8555	0.5709	-1.8303	0.0169	0.1109	0.0504
		(0.3397)	(0.1703)	(0.2583)	(0.2169)	(0.0594)
		[1.681]	[-10.752]	[0.066]	[0.512]	[0.847]
Africa[5]						
Algeria	14.5263	-0.4212	-2.6079	-0.0329	-0.2473	0.1176
		(0.3079)	(0.4003)	(0.2419)	(0.0861)	(0.0997)
		[-1.368]	[-6.515]	[-0.136]	[-2.872]	[1.180]
Egypt	-22.1206	5.4947	-1.2807	-1.4031	-0.6162	1.0129
		(0.8488)	(0.2883)	(0.3636)	(0.1988)	(0.1387)
		[6.474]	[-4.443]	[-3.859]	[-3.100]	[7.302]
Kenya	-3.7175	1.6616	-1.8718	-0.1829	0.1735	-0.1606
		(0.4378)	(0.1906)	(0.2534)	(0.1174)	(0.0744)
		[3.795]	[-9.818]	[-0.722]	[1.477]	[-2.159]
Morocco	-38.3224	5.7533	-0.1571	-0.6540	0.1123	0.0941
		(1.2081)	(0.2872)	(0.3123)	(0.1458)	(0.1014)
		[4.762]	[-0.547]	[-2.094]	[0.770]	[0.928]

TABLE IV (Continued)

Region / Country	Independent Variables[2]				
	Intercept	Y	RER	DOD	TDS	DSB
Nigeria	-2.5009	1.4202	-1.1894	-0.8824	0.2697	0.4493
		(1.1166)	(0.1755)	(0.3425)	(0.1614)	(0.1454)
		[1.272]	[-6.777]	[-2.576]	[1.671]	[3.089]
Sudan	2.0138	0.1791	-0.5090	0.0303	0.1606	0.1685
		(0.2382)	(0.1994)	(0.0712)	(0.1096)	(0.0583)
		[0.752]	[-2.553]	[0.426]	[1.466]	[2.890]
Tanzania	-3.8099	1.4856	-0.7795	-0.7556	-0.2421	0.6411
		(0.8696)	(0.7400)	(0.2054)	(0.1336)	(0.1446)
		[1.708]	[-1.053]	[-3.679]	[-1.812]	[4.435]
Zaire	-15.0433	2.9653	-0.1541	-0.2717	0.2911	0.0083
		(0.2476)	(0.0942)	(0.0561)	(0.0408)	(0.0354)
		[11.974]	[-1.636]	[-4.847]	[7.141]	[0.234]

[1] Standard errors are in parentheses, t-statistics are in brackets.

[2] Y is per capita real national currency denominated Gross Domestic Product; RER is the real currency exchange rate vis a vis the U.S. dollar; DOD, TDS, and DSB are real U.S. dollar denominated per capita total debt outstanding, total debt service, and newly disbursed lending, respectively. All variables are in natural logarithms.

[3] The system weighted MSE for Latin America is 0.85218 with 48 degrees of freedom.

[4] The system weighted MSE for Asia is 0.862013 with 80 degrees of freedom.

[5] The system weighted MSE for Africa is 0.907155 with 64 degrees of freedom.

Income and Exchange Rates in the Total Imports Model

Of the 24 countries in the study group, 17 had positive statistically significant estimated income parameters at the five percent level of confidence. The remaining seven countries include four with negative but insignificant income parameters, and three with positve but insignificant parameters on income. These results suggest strong support for the hypothesis that income and total imports are positively related. Income growth appears to be a very important determinant of total imports by most LDCs.

The real national currency/U.S. dollar exchange rate also exhibited strong support for the hypothesized negative relationship. Despite the fact that RER represents only the bilateral exchange rate between the national currency and the U.S. dollar, eighteen of the countries studied had negative and significant RER parameters at the five percent level of confidence. The six remaining countries exhibited negative but statistically insignificant RER parameters. This suggests that real depreciation of the national currency against the U.S. dollar exerts a strong negative impact on the ability of LDCs to maintain or increase total imports.

Debt Outstanding in the Total Imports Model

The hypothesized relationships between debt and total imports discussed in Chapter IV argue that DOD may be positively related to total imports in some countries and negatively related in others (thus a two-way significance test is appropriate for the DOD parameter). The expected DOD parameter sign is ambiguous because total debt may

have a different impact depending on the level and structure of the debt. If existing DOD is very large relative to the ability of the debtor to repay, it may exert a negative wealth effect. That is, it may reduce the credit-worthiness of the debtor and reduce its ability to acquire new loans to service the existing debt. On the other hand, DOD used to expand the gross domestic product and foreign exchange earnings of the debtor above the levels required to service the loans may stimulate total import demand.

Of the 24 countries studied, the estimated DOD parameters in the total imports model were negative and statistically significant in seven, and positive and significant in three. The countries for which DOD had a significant negative effect include Mexico, Pakistan, Egypt, Morocco, Nigeria, Tanzania, and Zaire. Thus five of the seven countries negatively affected by their total oustanding debt are in Africa. Somewhat unexpectedly, only one Latin American country had a negative and significant DOD parameter, despite the generally high debt levels in those countries. Peru, which had the second highest DOD/GDP ratio and the worst GDP growth in Latin America, had a significant positive DOD parameter, suggesting that Peru borrowed heavily to finance imports during a period of income deterioration. Indonesia and Nepal, both with low DOD/GDP ratios, also had significant positive DOD parameters. Of the remaining 14 countries, six had positive and eight had negative but statistically insignificant DOD parameters in the total imports model. The weight of the evidence suggests that DOD has a negative effect on total imports in many countries, but some countries have used DOD to maintain or increase their ability to import.

Total Debt Service and Disbursements in the Total Imports Model

The expected parameter signs on TDS and DSB were negative and positive, respectively, as TDS is an absorption of and DSB an addition to foreign exchange available to finance imports. A frequency table showing the parameter estimates for TDS and DSB was constructed to facilitate discussion of those variable. Table V is organized into four cells depending on the signs of the estimated TDS and DSB parameters. The countries for which both TDS and DBS have the expected sign are in the upper right hand cell of Table V. The superscripts identify statistically significant parameters at the five percent confidence level. Eleven countries had the expected negative TDS and positive DSB parameters. Of those eleven countries, the TDS parameter was statistically significant in eight and the DSB parameter in five. Twelve countries had positive parameters on both TDS and DSB, each statistically significant only four times. The DSB parameter was positve for 23 countries, and statistically significant for 9 of those. TDS was negative eleven times and significant for eight of those countries. The four statistically significant positive TDS parameters were for Chile, Nepal, Pakistan, and Zaire. With the exception of Nepal these countries all have high TDS/XGS and DOD/GDP ratios, implying that debt may have been used to maintain imports during periods of declining GDP and export earnings. Nepal has a very high correlation coefficient between TDS and DSB (0.95). It is possible that the estimated standard errors on TDS and DSB are spurious for Nepal due to the multicollinearity between those two variables. In general, the hypothesis that TDS is negatively

TABLE V

ESTIMATED PARAMETER SIGNS ON TOTAL DEBT SERVICE AND DISBURSEMENTS IN THE TOTAL IMPORTS MODEL

Disbursements	Total Debt Service: Positive	Total Debt Service: Negative
Positive	Chile [1] Colombia Mexico [2] Peru Malaysia Nepal [1] Pakistan [1,2] Thailand Morocco Nigeria [2] Sudan [2] Zaire [1]	Brazil [1] Venezuela Burma [1,2] India [1] Indonesia [1,2] Korea Philippines [2] Sri Lanka [1] Algeria [1] Egypt [1,2] Tanzania [1,2]
Negative	Kenya [2]	

[1] Total Debt Service parameter statistically significant at the five percent confidence level.

[2] Disbursements parameter statistically significant at the five percent confidence level.

associated with total imports is supported by the empirical evidence. The hypothesis that DSB and total imports are positively related is strongly supported by the 23 positive parameters on DSB of which 9 were significant.

Agricultural Import Demand Model

The estimated parameters, standard errors, t-statistics, and degrees of freedom for the agricultural imports model are reported in Table VI. The expected signs are the same as in the total imports model: positive on Y and DSB, negative on RER and TDS, and either positive or negative on DOD. It was further hypothesized that the magnitude of all parameters would be smaller in the agricultural imports case that in the total imports case. The implication of smaller parameters in the agricultural imports model is that imports of agricultural products are less elastic with respect to changes in income, price, and debt variables than are total imports.

Income and Exchange Rates in the Agricultural Imports Model

The income parameter was positive and statistically significant in 11 countries compared with 17 in the total imports model. Of the remaining 13 countries, three had negative and significant income parameters, six were positive but insignificant, and four were negative and insignificant. Thus the hypothesis that income growth is positively related to agricultural imports is supported by the evidence, though less strongly so than for total imports. The three significant negative parameters and the ten insignificant parameters

TABLE VI

AGRICULTURAL IMPORTS - SUR PARAMETER ESTIMATES[1] -
BY GEOGRAPHIC REGION

Region / Country	Independent Variables[2]				
	Intercept	Y	RER	DOD	TDS	DSB
Latin America[3]						
Brazil	-26.1950	2.6929	0.0808	-0.9709	0.3089	0.4442
		(1.3534)	(0.8218)	(0.6518)	(0.3338)	(0.3338)
		[1.990]	[0.098]	[-1.490]	[0.926]	[1.331]
Chile	18.2495	-1.4466	-2.1689	1.6449	0.1584	-0.0469
		(1.1399)	(0.6596)	(0.5281)	(0.1094)	(0.1411)
		[-1.269]	[-3.288]	[3.115]	[1.448]	[-0.332]
Colombia	-12.5516	1.5691	-0.7886	0.2964	-0.0094	-0.0811
		(1.5325)	(0.7254)	(0.5085)	(0.3194)	(0.1352)
		[1.024]	[-1.087]	[0.583]	[-0.029]	[-0.600]
Mexico	-32.3844	3.4623	-1.0532	0.6455	-0.5176	-0.0986
		(2.1945)	(0.7992)	(0.4773)	(0.3222)	(0.3038)
		[1.578]	[-1.318]	[1.352]	[-1.606]	[-0.325]
Peru	31.6894	-1.4048	-2.3269	0.3691	0.2544	-0.1758
		(0.7476)	(0.3859)	(0.1271)	(0.0856)	(0.0970)
		[-1.879]	[-6.030]	[2.904]	[2.973]	[-1.812]
Venezuela	-32.7476	3.9376	-1.4147	0.2371	0.0053	-0.0654
		(0.7542)	(0.5195)	(0.2912)	(0.1796)	(0.1530)
		[5.221]	[-2.723]	[0.814]	[0.029]	[-0.428]

TABLE VI (Continued)

Region / Country	Independent Variables[2]					
	Intercept	Y	RER	DOD	TDS	DSB
Asia[4]						
Burma	-66.2950	10.9078	-3.1855	-1.3829	-0.3083	0.5035
		(3.1774)	(0.7075)	(0.5909)	(0.2375)	(0.2189)
		[3.433]	[-4.503]	[-2.340]	[-1.298]	[2.300]
India	-17.2888	0.7643	0.1799	3.7748	-2.1272	0.5382
		(1.3413)	(0.9536)	(1.3309)	(1.1860)	(0.3086)
		[0.570]	[0.189]	[2.836]	[-1.794]	[1.744]
Indonesia	6.1247	-0.0844	-0.7607	0.4765	0.0082	-0.0358
		(0.4858)	(0.2856)	(0.4532)	(0.1875)	(0.1479)
		[-0.174]	[-2.663]	[1.051]	[0.044]	[-0.242]
Korea	4.6076	-0.3206	-0.2125	1.0845	-0.2021	-0.0301
		(1.1612)	(0.5166)	(0.7478)	(0.2972)	(0.2639)
		[-0.276]	[-0.411]	[1.450]	[-0.680]	[-0.114]
Malaysia	-7.9252	1.8612	-0.3849	-0.4798	-0.0068	0.0549
		(0.8056)	(0.3217)	(0.2509)	(0.0439)	(0.0512)
		[2.310]	[-1.196]	[-1.912]	[-0.154]	[1.071]
Nepal	-1.7258	0.2639	0.1869	0.2336	-0.1266	-0.2078
		(2.3425)	(0.4625)	(0.1757)	(0.0918)	(0.1734)
		[0.113]	[0.404]	[1.329]	[-1.379]	[-1.198]
Pakistan	-9.0153	1.0475	-0.2095	0.3942	0.1022	0.5233
		(0.4038)	(0.2741)	(0.3466)	(0.2265)	(0.1669)
		[2.594]	[-0.764]	[1.137]	[0.451]	[3.134]

TABLE VI (Continued)

Region / Country	Independent Variables[2]				
	Intercept	Y	RER	DOD	TDS	DSB
Philippines	-33.4412	4.4938	0.3166	-0.6298	-0.1428	0.0007
		(0.8155)	(0.2958)	(0.1312)	(0.0861)	(0.0734)
		[5.510]	[1.070]	[-4.801]	[-1.659]	[0.010]
Thailand	-14.6329	1.8158	-1.5474	2.2373	-1.9216	-0.3646
		(0.4438)	(0.2287)	(0.3692)	(0.3069)	(0.0806)
		[4.091]	[-6.765]	[6.060]	[-6.260]	[-4.526]
Sri Lanka	-0.0811	0.6692	-0.3022	-0.2086	0.2461	-0.3990
		(2.3721)	(0.6234)	(1.1979)	(0.3164)	(0.4036)
		[0.282]	[-0.485]	[-0.174]	[0.778]	[-0.989]
Africa[5]						
Algeria	15.7534	-0.9754	-2.2207	0.2434	-0.0252	-0.1411
		(0.5656)	(0.7232)	(0.4065)	(0.1382)	(0.1594)
		[-1.725]	[-3.071]	[0.599]	[-0.182]	[-0.885]
Egypt	-17.2469	4.0806	0.0228	-1.2024	-0.3707	1.2882
		(0.9893)	(0.3843)	(0.3858)	(0.2080)	(0.1578)
		[4.125]	[0.059]	[-3.117]	[1.782]	[8.165]
Kenya	-7.5955	2.4982	-1.7271	-1.7098	0.7152	-0.1077
		(1.2030)	(0.4984)	(0.7318)	(0.3469)	(0.1906)
		[2.077]	[-3.466]	[-2.336]	[2.062]	[-0.565]
Morocco	-52.1648	7.7892	-0.1426	-1.6552	0.5032	0.1108
		(1.6250)	(0.3709)	(0.4190)	(0.1975)	(0.1458)
		[4.793]	[-0.385]	[-3.950]	[2.548]	[0.760]

TABLE VI (Continued)

Region / Country	Independent Variables[2]				
	Intercept	Y	RER	DOD	TDS	DSB
Nigeria	-3.2349	1.0188	-1.2770	-0.3880	0.0338	0.3289
		(1.0316)	(0.1652)	(0.3363)	(0.1539)	(0.1413)
		[0.988]	[-7.728]	[-1.154]	[0.220]	[2.328]
Sudan	10.6596	-1.5353	-0.6146	-0.1936	0.1827	0.1600
		(0.3053)	(0.2732)	(0.0974)	(0.1385)	(0.0772)
		[-5.029]	[-2.249]	[-1.987]	[1.319]	[2.073]
Tanzania	7.3636	-0.7579	0.2808	-0.6359	-0.7453	1.2259
		(2.3995)	(1.6866)	(0.5492)	(0.3656)	(0.3813)
		[-0.316]	[0.166]	[-1.158]	[-2.038]	[3.215]
Zaire	-17.2560	2.6118	0.2742	0.4051	-0.0565	0.0058
		(0.6266)	(0.2319)	(0.1426)	(0.1128)	(0.0898)
		[4.168]	[1.182]	[2.840]	[-0.501]	[0.065]

[1] Standard errors are in parentheses; t-statistics are in brackets.

[2] Y is per capita national currency denominated real Gross Domestic Product; RER is the real exchange rate vis a vis the U.S. dollar; DOD, TDS, and DSB are real U.S. dollar denominated per capita total debt outstanding, total debt service, and newly disbursed lending, respectively. All variables are in natural logarithms.

[3] The system weighted MSE for Latin America is 0.929993 with 48 degrees of freedom.

[4] The system weighted MSE for Asia is 0.899007 with 80 degrees of freedom.

[5] The system weighted MSE for Africa is 0.924627 with 64 degrees of freedom.

support the hypothesis that agricultural imports are relatively income inelastic.

The RER parameter is negative and significant at the five percent confidence level in ten countries, and negative but insignificant in another seven. In the remaining seven countries the RER parameter was positive but not signicantly different from zero. Thus the weight of the evidence supports the hypothesis that a real currency devaluation exerts a negative influence on LDC agricultural imports. Compared with the total imports case, in which 23 countries had negative RER parameters, agricultural imports appear to be less elastic with respect to exchange rate changes.

Debt Outstanding Disbursed in the Agricultural Imports Model

Six countries had significant negative DOD parameters, while five had significant positive DOD parameters in the agricultural imports model. Of the remaining 13 countries, for which the estimated DOD parameters were not statistically significant at the five percent confidence level, eight had positive and five had negative DOD parameters. As hypothesized, the impact of DOD on agricultural imports differs sharply across countries. Interestingly, the estimated DOD parameter was positive for five of the six Latin American countries but negative for six of the eight African countries, suggesting regional differences in the impact of total debt on agricultural imports. Compared to the total imports case, DOD is slightly more likely to have a positive sign, and almost equally likely to have an insignificant parameter estimate. Thus it appears

in the aggregate that the effect of DOD on agricultural imports does not differ from its effect on total imports. On an individual basis, only six countries had different DOD parameter signs between the total imports and agricultural imports models; and of those six countries, the DOD parameter was statistically significant in both models only in Zaire.

Total Debt Service and Disbursements in the Agricultural Imports Model

As in the total imports model, the expected parameter signs on TDS and DSB in the agricultural imports model are negative and positive, respectively. In addition, agricultural imports are hypothesized to be less elastic with respect to TDS and DSB than are total imports. Table VII is a frequency table showing the distribution of TDS and DSB parameter signs. Superscripts refer to significant parameters.

In the agricultural imports model, six countries had the expected negative TDS and positive DSB parameter estimates. The TDS parameter was negative and significant in a total of three countries, suggesting weak support for the hypothesis that TDS and agricultural imports are negatively related. The DSB parameter was positive and significant in seven countries, lending stronger support for the hypothesized positive relationship between DSB and agricultural imports. In exactly half of the countries studied, however, the estimated TDS parameter was positive and the DSB parameter was negative, suggesting the seemingly perverse conclusion that rising TDS payments and falling DSB may increase the level of aricultural imports in many countries.

TABLE VII

ESTIMATED PARAMETER SIGNS ON TOTAL DEBT SERVICE AND DISBURSEMENTS IN THE AGRICULTURAL IMPORTS MODEL

Disbursements	Total Debt Service: Positive	Total Debt Service: Negative
Positive	Brazil	Burma [2]
	Pakistan [2]	India [1,2]
	Egypt [2]	Malaysia
	Morocco [1]	Philippines
	Nigeria [2]	Tanzania [1,2]
	Sudan [2]	Zaire
Negative	Chile	Colombia
	Peru [1,2]	Mexico
	Venezuela	Korea
	Indonesia	Nepal
	Sri Lanka	Thailand [1,2]
	Kenya [1]	Algeria

[1] Total Debt Service parameter statistically significant at the five percent confidence level.

[2] Disbursements parameter statistically significant at the five percent confidence level.

However, only three of the positive TDS parameters and two of the negative DSB parameters were statistically significant at the five percent level. In 13 countries, neither TDS nor DSB was significantly different from zero. The weight of the evidence strongly supports the hypothesis that TDS and DSB are less important in the agricultural imports case than for total imports. This result indicates that LDCs are more likely to constrain nonagricultural imports than agricultural imports during a period of increasing debt service payments or decreasing access to new borrowing.

Wheat Import Demand Model

Table VIII contains the estimated parameters, standard errors, t-statistics, and degrees of freedom for the wheat imports model. As discussed in the previous chapter, the expected parameter signs are difficult to predict in the wheat import demand model. If wheat is a normal good, as is expected for most countries, Y and DSB are expected to have positive parameters. Similarly, the TDS parameter is expected to be negative. The DOD parameter may be either positive or negative as in the total and agricultural import demand models depending on the level and structure of the existing debt relative to the wealth of the country. Because of the ambiguity in predicting parameter signs for these variables in the wheat models, a two-way test of significance is appropriate. Domestic wheat production (WPR) and the relative trade price of wheat and rice (P) are expected to be negative. Additionally, wheat imports are expected to be less elastic with respect to both income and debt variables than are either total or agricultural imports.

TABLE VIII

WHEAT IMPORTS - SUR PARAMETER ESTIMATES[1] -
BY GEOGRAPHIC REGION

Region / Country	Independent Variables[2]							
	Intercept	Y	RER	WPR	P	DOD	TDS	DSB
Latin America[3]								
Brazil	14.7921	-1.1455	-0.2477	0.1969	0.4648	-0.1441	0.6347	0.1924
		(1.2219)	(0.9703)	(0.2039)	(0.2379)	(0.3686)	(0.1965)	(0.2979)
		[-0.938]	[-0.255]	[0.966]	[1.953]	[-0.391]	[3.230]	[0.646]
Chile	4.7247	-0.1903	-0.7933	-1.2789	0.1273	1.7565	0.4028	-0.4473
		(1.0908)	(0.6576)	(0.1515)	(0.1528)	(0.3652)	(0.0620)	(0.1255)
		[-0.174]	[-1.206]	[-8.442]	[0.833]	[4.810]	[6.496]	[-3.564]
Colombia	-25.3586	3.3094	-0.8870	0.7305	-0.0671	-0.4219	-0.8996	-0.0703
		(4.3286)	(2.0039)	(0.4848)	(0.2937)	(1.4412)	(0.8883)	(0.4659)
		[0.765]	[-0.443]	[1.507]	[-0.228]	[-0.293]	[-1.013]	[-0.151]
Mexico	-600.0024	57.7836	16.3184	-12.3953	-0.9138	-6.4441	-5.4416	5.0894
		(25.7754)	(9.2142)	(3.8231)	(1.9670)	(5.8322)	(2.8016)	(2.8848)
		[2.242]	[1.771]	[-3.242]	[-0.465]	[-1.105]	[-1.942]	[1.764]
Peru	2.6045	0.1809	-0.1841	0.0530	-0.1382	-0.0712	0.1141	-0.0585
		(0.9648)	(0.3019)	(0.2077)	(0.1610)	(0.1066)	(0.0829)	(0.0996)
		[0.188]	[-0.610]	[0.255]	[-0.859]	[-0.668]	[1.376]	[-0.587]
Venezuela	22.0495	-1.6454	-0.4963	na[4]	-0.1109	-0.3369	-0.0231	0.1800
		(0.3484)	(0.2292)		(0.0376)	(0.1354)	(0.0842)	(0.0716)
		[-4.722]	[-2.166]		[-2.949]	[-2.489]	[-0.274]	[2.514]

TABLE VIII (Continued)

Region / Country	Intercept	Y	RER	WPR	P	DOD	TDS	DSB
Independent Variables[2]								
Asia[5]								
Burma	-175.9051	27.9141	-1.8841	-1.5844	-1.5832	-5.8006	0.5401	1.5795
		(3.8184)	(0.9276)	(0.2411)	(0.0937)	(0.6290)	(0.2893)	(0.2636)
		[7.310]	[-2.031]	[-6.572]	[-16.903]	[-9.221]	[1.866]	[5.991]
India	47.4515	-8.9330	6.5203	-0.8095	-0.4751	2.3866	-5.3439	3.9170
		(5.3894)	(3.4409)	(2.7647)	(0.7526)	(4.9305)	(3.8718)	(1.2728)
		[-1.658]	[1.895]	[-0.293]	[-0.631]	[0.484]	[-1.380]	[3.078]
Indonesia	-37.0673	2.9723	0.0278	na[4]	-0.1553	0.7178	-0.6060	-0.1636
		(0.3057)	(0.2727)		(0.1261)	(0.5504)	(0.1707)	(0.1656)
		[9.722]	[0.102]		[-1.232]	[1.304]	[-3.551]	[-0.988]
Korea	4.1705	-0.6851	0.7263	0.0626	0.0444	0.4255	-0.0027	0.4301
		(1.1671)	(0.5444)	(0.1289)	(0.2008)	(0.6706)	(0.3077)	(0.2874)
		[-0.587]	[1.334]	[0.486]	[0.221]	[0.635]	[-0.009]	[1.496]
Malaysia	-3.5945	0.9153	0.4469	na[4]	0.0228	-0.1167	0.1333	-0.1106
		(1.2218)	(0.5121)		(0.0459)	(0.3705)	(0.0729)	(0.0738)
		[0.749]	[0.873]		[0.496]	[-0.315]	[1.826]	[-1.499]
Nepal	-183.1454	18.1069	15.1225	-0.2840	-7.7750	4.2674	-0.2842	-4.1405
		(8.2613)	(2.8452)	(2.1139)	(1.4328)	(0.9323)	(0.4388)	(0.7235)
		[2.192]	[5.315]	[-0.134]	[-5.427]	[4.577]	[-0.648]	[-5.750]
Pakistan	5.0797	-3.4352	1.6549	-1.4811	-0.3784	4.9939	1.5293	0.5357
		(2.3802)	(0.8646)	(2.5505)	(0.5192)	(1.0455)	(0.7856)	(0.4492)
		[-1.443]	[1.914]	[-0.581]	[-0.729]	[4.777]	[1.947]	[1.192]

TABLE VIII (Continued)

Region / Country	Independent Variables[2] Intercept	Y	RER	WPR	P	DOD	TDS	DSB
Philippines	11.4581	-1.2981	0.2749	na[4]	0.0031	0.4076	-0.0934	0.0539
		(1.6778)	(0.6103)		(0.1085)	(0.2667)	(0.1717)	(0.1346)
		[-0.774]	[0.450]		[0.029]	[1.528]	[-0.544]	[0.400]
Sri Lanka	19.5319	-2.3344	1.1559	na[4]	-0.3949	0.1282	0.5225	-0.3620
		(1.7186)	(0.4774)		(0.2044)	(0.8424)	(0.2242)	(0.2615)
		[-1.358]	[2.421]		[-1.932]	[0.152]	[2.331]	[-1.384]
Thailand	23.3111	-2.6848	-1.3373	na[4]	0.1643	2.7433	-1.3984	-0.2899
		(1.2623)	(0.9172)		(0.2663)	(1.0183)	(0.8254)	(0.2413)
		[-2.127]	[-1.458]		[0.617]	[2.694]	[-1.694]	[-1.201]
Africa[6]								
Algeria	18.0074	-2.3177	0.9855	-0.0113	0.1454	0.5087	0.8123	-0.1896
		(0.5724)	(0.6014)	(0.1415)	(0.1872)	(0.3732)	(0.1222)	(0.1676)
		[-4.049]	[1.639]	[-0.080]	[0.777]	[1.363]	[6.644]	[-1.131]
Egypt	-13.7948	1.0942	0.01962	2.3437	0.7197	0.6230	-0.0583	0.1111
		(0.5105)	(0.1887)	(0.5203)	(0.1729)	(0.2425)	(0.1541)	(0.1178)
		[2.143]	[0.104]	[4.504]	[4.162]	[2.569]	[-0.378]	[0.943]
Kenya	-165.9594	24.8723	-3.3252	-1.7069	-2.2636	-5.5454	3.7464	-1.8974
		(8.8837)	(1.9543)	(2.1429)	(0.5908)	(3.2662)	(1.4634)	(0.7749)
		[2.800]	[-1.701]	[-0.797]	[-3.832]	[-1.698]	[2.560]	[-2.448]
Morocco	-30.9185	4.7708	0.5605	-0.3039	-0.1857	-0.9146	0.4326	0.1265
		(0.8393)	(0.1807)	(0.0927)	(0.0715)	(0.2907)	(0.1422)	(0.0793)
		[5.684]	[3.101]	[-3.276]	[-2.598]	[-3.146]	[3.041]	[1.595]

TABLE VIII (Continued)

Region / Country	Independent Variables[2]						
	Intercept	Y	RER	WPR	P	DOD	TDS	DSB
Nigeria	-8.5512	1.6687	-0.1151	0.5332	-0.0373	0.3302	-0.1699	0.1387
		(1.7946)	(0.2786)	(0.2821)	(0.4747)	(0.4845)	(0.1880)	(0.2411)
		[0.930]	[-0.413]	[1.890]	[-0.079]	[0.682]	[-0.904]	[0.575]
Sudan	3.1380	0.2106	-0.6036	-1.6724	-0.1103	0.2297	0.8889	-0.2237
		(0.6766)	(0.2706)	(0.4035)	(0.1088)	(0.1042)	(0.2591)	(0.1058)
		[0.311]	[-2.231]	[-4.145]	[-1.014]	[2.204]	[3.431]	[-2.114]
Tanzania	2.8112	-0.1928	-0.4749	0.3952	-0.0298	-0.1801	-1.3498	0.9053
		(3.8661)	(3.3061)	(1.3603)	(0.4384)	(0.8848)	(1.0356)	(0.9044)
		[-0.050]	[-0.144]	[0.291]	[-0.068]	[-0.204]	[-1.303]	[1.001]
Zaire	18.4281	-1.9951	-0.8679	0.1589	0.0177	-0.6334	0.1333	0.1580
		(0.6241)	(0.2326)	(0.0808)	(0.1608)	(0.1643)	(0.0796)	(0.0730)
		[-3.197]	[-3.731]	[1.967]	[0.110]	[-3.856]	[1.674]	[2.165]

[1] Standard errors are in parentheses; t-statistics are in brackets.

[2] Y is per capita national currency denominated real Gross Domestic Product; RER is the real exchange rate vis a vis the U.S. dollar; DOD, TDS, and DSB are real U.S. dollar denominated per capita total debt outstanding, total debt service, and newly disbursed lending, respectively; P is the relative trade price of wheat and rice; and QWM is per capita domestic wheat production. All variables are in natural logarithms.

[3] The system weighted MSE for Latin America is 0.787186 with 37 degrees of freedom.

[4] Not applicable; variable not included in model.

[5] The system weighted MSE for Asia is 0.734393 with 65 degrees of freedom.

[6] The system weighted MSE for Africa is 0.732047 with 48 degrees of freedom.

Income and Exchange Rates in the

Wheat Import Demand Model

Twelve of the 24 countries had the expected positive income parameters, of which seven were statistically significant at the five percent confidence level with a two-way test of significance. Another three would be considered statistically significant at the ten percent confidence level. The remaining 12 countries had negative parameters on the income varible, but only four of those were significantly different from zero at either the five or ten percent level. The weight of the evidence suggests that income growth and wheat imports are positively related in most countries. In Venezuela, Thailand, Algeria, and Zaire, however, income and wheat imports are negatively related, suggesting that wheat may be considered an inferior good in some countries.

Results for the real exchange rate variable in the wheat import demand model were mixed. Only three countries had significant negative RER parameters, while four had significant positive parameters. For seventeen countries the estimated RER parameters were not significantly different from zero. Of the statistically insignificant RER parameters, ten were positive and seven were negative. Compared to the total imports case, in which 23 countries had negative estimated RER parameters, 18 significant, real exchange rates do not appear to be important determinants of total wheat import demand in most countries. In countries where RER is statistically significant, the parameter is positive slightly more often than negative. These results suggest that the real national currency exchange rate vis a vis the U.S. dollar is not a significant

determinant of total wheat demand by LDCs. This model specification does not distinguish between sources of supply, however, and cannot be used to draw conclusions about the role of exchange rates in determining the market shares of various wheat exporters.

Domestic Wheat Production and Relative Prices in the Wheat Import Demand Model

Domestic wheat production was hypothesized to be negatively related to wheat imports, but because the relationship could be positive if domestic production reflects a more general wealth increase, a two-way test of significance is appropriate. Of the seventeen countries which produce wheat, five had significant negative estimated parameters on WPR. Another five countries had negative but insignificant WPR parameters. Of the seven countries having positive WPR parameters, it was statistically significant at the five percent level only for Egypt. At the ten percent confidence level, Nigeria and Zaire also had positive and significant WPR parameters. In general, it appears that increased domestic wheat production tends to reduce wheat import demand in most LDCs, but the relationship is weak. There is some evidence that domestic production advances may even increase wheat imports at least in a few countries.

The price variable in the wheat import demand model is the ratio of the import unit value of wheat and the lesser of the unit value of rice imports and rice exports. As such it is expected to have a negative sign. Because the estimated parameters in a double-log model can be interpreted directly as elasticities, the P parameter is the own-price elasticity of demand for wheat, and its negative is the

cross-price elasiticity of demand for wheat with respect to the price of rice. Fourteen of the 24 countries in the study group had negative signs on the estimated price parameter. Of those, six were statistically significant at the five percent confidence level. The remaining ten countries had positive estimated parameters on P, but only one of those, for Egypt, was significantly different from zero. There is support for the hypothesis that the relative price of wheat and rice is negatively associated with wheat imports, but the relationship is weak.

Debt Outstanding in the Wheat Import Demand Model

As discussed previously, the relationship between DOD and wheat import demand could be either positive or negative depending on the level and structure of the debt. At lower levels of debt, wheat and DOD are expected to be positively related, but at higher debt levels it is possible that negative wealth effects could reduce the ability of the debtor to maintain the desired level of wheat imports. Therefore, it is appropriate to test hypotheses concerning DOD using a two-way test of significance. The estimated DOD parameter in the wheat import case was positive for thirteen countries and significant for six of those. Nine countries had negative DOD parameters of which four were significant. In general, DOD had a positive effect on wheat imports to Asian countries. Eight of the ten Asian countries had positive DOD parameters, whereas DOD had a positive sign in only one Latin American country, Chile. This distribution of estimated parameters supports the hypothesis that DOD and wheat import demand

are positively related at low levels of DOD, but negatively related at higher DOD levels. The number of countries for which the estimated DOD parameter was statistically different from zero in the wheat import demand model is the same as in the total imports model, suggesting that there may be no difference in the effect of DOD across classes of imports. Interestingly, two countries which had negative and significant DOD parameters in the total imports model, had significant positive DOD parameters in the wheat imports model. This result indicates that at least two countries, Egypt and Pakistan, may increase wheat imports even as their aggregate imports are constrained due to rising DOD.

Total Debt Service and Disbursements in the Wheat Import Demand Model

In the wheat import demand model, the expected parameter signs on TDS and DSB are somewhat ambiguous. If wheat is a normal good it is expected that TDS and DSB would be negatively and positively related to wheat imports, respectively, as in the total and agricultural import demand models. However, the possibility exists that wheat is considered an inferior good in some of the countries studied. If this is the case, an import constraint induced either by rising TDS or falling DSB would lead to increased wheat import demand. For this reason it is appropriate to test hypotheses concerning TDS and DSB using a two-way test of significance. Countries for which the estimated TDS and DSB parameters are negative and positive, respectively, in the total imports model but positive and negative,

respectively, in the wheat demand model would suggest that wheat is considered an inferior good.

Table IX is a frequency table of estimated TDS and DSB parameter signs. The upper right-hand cell includes countries for which TDS and DSB have the "normal" negative and positive parameter signs, respectively. The lower left-hand cell contains countries for which TDS and DSB have the "inferior" positive/negative pattern. Eight countries are in the upper right-hand cell, but of those cases, the DSB parameter is statistically significant at the five percent level only twice, and the TDS parameter is statistically insignificant for all of them. Seven countries have the "inferior" pattern of a positive TDS and negative DSB parameter. Of those seven, the TDS estimate is significant four times and the DSB estimate three times.

Taking the variables individually, TDS had a total of twelve negative and twelve positive parameter estimates. The TDS parameter was negative and statistically significant in only one country, while it was positive and significant in six. The DSB parameter was positive in thirteen countries and negative in eleven. Four of the positive DSB parameter estimates were statistically significant at the five percent level, as were four of the negative DSB estimates. Only two countries, Sri Lanka and Algeria, switched from the "normal" upper right-hand cell to the "inferior" lower left-hand cell between the total import and wheat import models. Of the twelve countries with positive TDS parameters in the wheat model, only four had negative TDS parameters in the total imports case. In constrast, ten of the eleven countries having negative DSB parameters in the wheat model had positive DSB parameters in the total imports model.

TABLE IX

ESTIMATED PARAMETER SIGNS ON TOTAL DEBT SERVICE AND DISBURSEMENTS IN THE WHEAT IMPORTS MODEL

Disbursements	Total Debt Service	
	Positive	Negative
Positive	Brazil [1] Burma [2] Pakistan Morocco [1] Zaire [2]	Mexico Venezuela [2] India [2] Korea Philippines Egypt Nigeria Tanzania
Negative	Chile [1,2] Peru Malaysia Sri Lanka Algeria [1] Kenya [1,2] Sudan [1,2]	Colombia Indonesia [1] Nepal [2] Thailand

[1] Total Debt Service parameter statistically significant at the five percent confidence level.

[2] Disbursements parameter statistically significant at the five percent confidence level.

The weight of the evidence suggests that TDS and DSB are significant variables for many LDCs in the wheat import demand model. However, rising TDS requirements more often serve to stimulate rather than constrain wheat imports. Similarly, increased access to new borrowing frequently leads to decreased wheat imports. This evidence is not strong enough to support the conclusion that wheat is widely considered an inferior good, although it may be in some countries. The large number of countries for which neither TDS nor DSB was statistically significant (ten) supports the hypothesis that wheat import demand is less elastic with respect to external debt variables than are either total or agricultural imports. The relative insensitivity of wheat imports to external debt flows suggests that the current debt crisis is not responsible for declining wheat imports to LDCs.

CHAPTER VI

CONCLUSIONS

Interpretation of the Empirical Evidence

The results of the empirical estimation of the three import demand models support the hypothesis that external debt variables are significant determinants of import demand by lesser developed countries. The degree to which external debt influences import demand varies across countries and classes of import goods. In general all debt variables are more influential in the total import case than in either the agricultural import model or the wheat import model. Agricultural imports are an intermediate case in which total debt outstanding was no more or less important than in the total imports model, but in which total debt service payments and disbursements were less significant than in the total imports model.

External debt problems due to rising TDS or falling DSB are far more likely to constrain total imports than either agricultural or wheat imports. The weight of the evidence does not support the widely held opinion that the international debt crisis of the early 1980s was responsible for declining wheat imports by LDCs. In most countries increasing TDS and decreasing DSB had no appreciable effect on demand for wheat imports. In the countries for which TDS and DSB had statistically significant impacts on wheat imports, TDS was more often positively related to wheat imports and DSB was negatively related,

suggesting the possibility that wheat may be considered an inferior good in some LDCs. The generally weak relationship between debt and wheat imports, however, suggests that the import demand for wheat is relatively debt inelastic.

Further, in constrast with the generally held opinion that high levels of total debt (DOD) have reduced total LDC imports, DOD was found to positively affect the imports of some countries and to negatively affect the imports of others. The DOD results for Latin America were particulary surprising. Despite the high levels of DOD in those countries, most were not negatively affected. In general, the African countries were more likely to be negatively affected by DOD than were the Latin American countries. Some Asian countries were positively affected by external debt, suggesting that they have been more successful in translating borrowed capital into domestic economic growth than were either the African or Latin American countries.

In addition, it was found that real domestic incomes had the expected positive effect on total imports and agricultural imports in almost all countries in the study group. Income was not as significant in the wheat model, supporting the hypothesis that wheat import demand is relatively income inelastic. As expected, the elasticity of total imports with respect to real income was more strongly positive in the total imports case than in either agricultural or wheat imports. A lower degree of substitutability exists within the category of agricultural imports than in the broader total imports classification. It can be argued that LDCs are more dependent on imported agricultural products than on non-agricultural goods. The large share of agriculture in the total economy of many

LDCs and their reliance on imported agricultural inputs and food products are consistent with the conclusion that agricultural imports are less likely to be constrained due to weak domestic growth than are total imports.

The real bilateral exchange rate between the national currency and the U.S. dollar is a very important determinant of total import demand in LDCs. The real exchange rate actually measures the combined effect of changes in the relative price level and the nominal exchange rate between the two countries. The combined price and exchange rate effect was strongly negative in the total imports case, indicating that LDCs do respond to price changes at least at the aggregate level.

Real exchange rates were much less significant in the wheat import model, as hypothesized, because there are few domestic substitutes for imported wheat in those countries which are dependent on wheat imports for domestic food supplies. The bilateral exchange rate between the national currency and the U.S. dollar does not account for multilateral currency exchange rates among other wheat exporters, the United States, and the importing country. Therefore the lack of significance of the exchange rate variable in the demand for total wheat imports says nothing about the role of exchange rates in determining the relative market shares of competing wheat exporters. Thus while a dollar appreciation does not appear to dampen total LDC wheat imports, it may affect the source of supply.

Weaknesses of the Models

The most serious weakeness of the models estimated in this research lies in the single-equation specification used. The question

of possible simultaneities among the independent variables was ignored. It is possible that the three debt variables are jointly determined, as well as incomes and real exchange rates. If in fact these variables are simultaneously determined, including them in a single equation model would produce biased parameter estimates. However, the results of the empirical estimation were consistent with theory, and the tradional income and price variables had the expected signs and significance in most cases.

The single equation approach was chosen, despite its limitations, for three reasons. It allows a simple determination of the effects of the separate external debt flows without the complexities involved in full scale macroeconomic modeling of LDCs. Thus the single equation models are a first step toward determining the interrelationships between external debt variables and international trade flows. The second reason for using single equation models is that doing so permitted the use of seemingly unrelated regression to account for correlations of the error terms across the 24 countries in the study. The third rationale for using the single equation models was that it made possible the examination of a large number of very diverse developing countries. Thus it was possible to conclude that the impact of external debt variables differs greatly among debtor countries.

Suggestions for Further Research

Few generalizations regarding the impact of debt on LDC imports can be made. Perhaps the most striking conclusion based on the empirical evidence is the wide divergence of estimated debt parameters

across countries and commodity classifications. This divergence immediately points out the need for more detailed research on the individual countries to identify the circumstances underwhich debt may negativley affect import demand. General equilibrium modeling of the individual countries including equations for exchange rate determination, demand for external borrowing, and domestic economic growth would further this effort. Of particular concern are the linkages between external debt and domestic growth. Short of full scale macroeconomic modeling, the use of instrumental variables should be explored to reduce the degree of simultaneous equations bias in the models.

A second avenue for research lies in the appropriate definition and interpretation of the real exchange rate variable. It is clear that real exchange rates have three components: the nominal currency exchange rate, and the domestic and foreign price level deflators. Efforts to separate the real exchange rate into its component parts could clarify the possible differential impacts of changes in the different components of the variable as well as the linkages between various components of RER and the other variables in the model.

A third extension of this research involves using the estimated income, price, and debt elasticities to simulate the effect of changing economic conditions on the import demands of the various LDCs in the study group. In particular, the effect of alternative debt reduction schemes on the volume of total, agricultural, and wheat imports by the 24 countries can be examined.

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