IMF WORKING PAPER

WP/90/55

INTERNATIONAL MONETARY FUND

Research Department

The Sensitivity of Secondary Sovereign Loan Market Returns to Macroeconomic Fundamentals

Prepared by Mark Stone*

Authorized for Distribution by Michael P. Dooley

June 1990

Abstract

The sensitivity of secondary sovereign loan market returns to three classes of economic news is estimated in the arbitrage pricing theory framework. Returns are characterized by a limited response to unexpected changes in procyclical U.S. aggregates. Shocks to country-specific balance of payment indicators do not impact debt prices. Announcements of policy changes by creditors and third parties that presage changes in future lending induce large debt price changes. The failure of the data to meet the empirical arbitrage pricing theory restrictions and the large proportion of return variance unexplained by macroeconomic fundamentals highlight the differences between corporate and sovereign securities.

JEL Classification Numbers:
313, 433

---

*I would like to thank Bankim Chadha, Michael Dooley, Przemyslaw Gajdeczka and Steve Symansky for helpful comments and discussion.

Contents

		Page
I.	Introduction	1
II.	The Secondary Market for LDC Debt	2
	1. The structure of the market	2
	2. Sample market prices and returns	4
III.	External Shocks and Sovereign Debt Returns	4
	1. Arbitrage pricing theory	6
	2. Pervasive macroeconomic factors	7
	3. Are LDC debt returns impacted by external macroeconomic shocks?	8
IV.	Country-Specific Shocks and Sovereign Debt Returns	10
	1. The model with an observable idiosyncratic risk component	11
	2. Country-specific determinants of debt returns	11
	3. The impact of country-specific aggregates on sovereign debt returns	12
V.	Policy Announcements and LDC Debt Returns	14
	1. Are debt prices sensitive to bank reserving announcements?	14
	2. Did announcement of the Brady Plan enhance debt values?	16
	3. Are sovereign debt prices sensitive to announcements of debt payment interruptions or resumptions?	17
VI.	Conclusion	20
Table 1.	Volume of Secondary Market Sovereign Debt Transactions	3
2.	Secondary Sovereign Debt Market Prices and Returns	5
3.	Debt Returns and External Macroeconomic Shocks	9
4.	Debt Returns and Country Specific Shocks I	13
5.	Debt Returns and Country Specific Shocks II	15
6.	Debt Returns and External Policy Announcements	18
7.	Debt Returns and Discrete Changes in Debt Payments	19
8.	Descriptive Statistics for Pervasive Macroeconomic	24
Appendix I.	Sources and Estimation of Pervasive Macroeconomic Factors	23
Appendix II.	Sources and Estimation of Country-Specific Shocks	25
Appendix III	External Debt Repayment Interruptions and Resumptions	26
References		27

Summary

The widespread use of secondary market sovereign loan prices in debt restructurings implies that participants should be aware of what moves debt market valuations. This paper gauges the sensitivity of loan market returns (defined as monthly price changes) to three classes of economic news: unexpected changes in key macroeconomic aggregates external to debtor countries, unexpected changes in debtor balance of payment indicators, and policy announcements by individual agents.

The responsiveness of sovereign loan returns to innovations in external aggregates is tested under the assumption that market returns are a function of a small number of pervasive macroeconomic aggregates, each associated with a risk premium. Debt returns exhibit a limited response to U.S. equity returns and industrial production, but they are not sensitive to other key external aggregates, such as worldwide interest rates and inflation. The failure of the sovereign loan market to support empirically a framework that is consistent with the U.S. equity return market highlights the difference between claims on corporations and claims on countries.

Since debt repayments are financed by trade revenues or reserve depletion, the hypothesis that loan returns are moved by unexpected changes in country-specific balance of payment indicators is tested. The results indicate that innovations in debtor country trade flows and reserves are not priced by the market.

Debt prices are affected by policy announcements associated with changes in future lending. The 1987 decisions by U.S. and U.K. commercial banks to increase their loan loss reserves had an adverse and prolonged impact on debt prices. The market valuation of several countries (including the Philippines, Mexico, and Venezuela) rose significantly after the announcement of the Brady Plan and multilateral funding.

I. Introduction

Secondary sovereign loan market prices are being used to evaluate the costs and benefits of sovereign external debt restructurings. The cost of schemes proposed by Sachs (1990) and Robinson (1988) are based on secondary market valuations, as are buybacks in several of the debt restructurings now being implemented under the umbrella of the Brady Plan. 1/ The importance of market-valued debt restructuring schemes for borrower economies implies that decision makers should be aware of the economic news that moves secondary loan market prices. If shocks to macroeconomic aggregates induce extreme short term price changes, then slight changes in the timing of the term agreement may alter the value of debt restructuring menu items. Given the unique nature of sovereign contracts 2/ and the small number of market participants, as well as the key roles played by third parties, loan prices may be impacted significantly by announcements of policy changes by individual agents. If market values do not respond to economic news, then, assuming that market prices accurately reflect investor information, prices are primarily determined by unmeasurable non-economic events such as the domestic political climate in borrowing countries or changes in the substitutability of loans for other assets.

This study identifies empirically the measurable indicators that move secondary market sovereign loan prices. A panel of secondary market price changes encompassing 21 sovereign borrowers over a 43-month interval is used in the analysis. 3/ The responsiveness of debt price changes to three classes of economic news is estimated.

The hypothesis that debt prices are impacted by unexpected changes in external macroeconomic aggregates is tested within the framework of the arbitrage pricing theory model. Identification of such external influences, if any, on debt market values may alert the architects of debt restructurings to the source of price changes beyond debtor control, and could assist in the development of theoretical models that provide structural explanations of developed country-LDC links.

1/ Terms for the Costa Rica debt restructuring, agreed upon in November 1989 when the secondary loan market price averaged 17.8 percent, included buybacks at 16 percent (LDC Debt Report, February 5, 1990). Morocco will be able to buy back external debt at market prices (LDC Debt Report, April 2, 1990).

2/ See Bulow and Rogoff (1989) and Eaton and Gersovitz (1981) for two views of sovereign debt contract enforcement.

3/ The debt Laffer curve was examined by Froot and Krugman (1990), who used a cross-section of 35 countries, and by Cohen (1989), who used prices for 32 countries for two months. Berg and Sachs (1988) regressed July 1987 secondary market discounts for 24 or 35 countries on 1-year to 13-year averages of country-specific macroeconomic aggregates and various dummies.

External debt repayment depends on the availability of foreign exchange earnings, implying that market returns may respond to debtor country balance of payment shocks. Confirmation of such a relationship would imply that sovereign borrowers are able to manipulate the market value of their external debt by inducing unexpected changes in trade flows and reserves.

The sovereign debt market is different from other security markets in that the number of potential buyers and sellers is small, and there are important non-trading agents, such as creditor governments and multilateral institutions, whose decisions may influence debt values. The responsiveness of debt prices to a third class of news, announcements of changes in the policies of individual agents, is tested. Because the methodology controls for the influence of external and domestic macroeconomic aggregates, the independent impact of these new policy announcements can be better gauged. The model is used to estimate the degree to which debt market valuations were altered by increases in commercial bank loan loss reserves in mid 1987. The hypothesis that the announcement of the Brady Plan in March 1989 was widely perceived to lead to debt relief for particular borrowers is tested. Finally, the impact of discrete changes in debt payment streams on market values is estimated.

The secondary sovereign loan market and the price data set are briefly reviewed in the next section. Section III of the paper describes the arbitrage pricing theory model, sketches the specification and construction of hypothesized debt return determinants external to the debtor economy, and discusses the impact of these aggregates on debt prices. The next section presents a modification of the empirical arbitrage pricing theory model that allows for country-specific return determinants, and reviews the impact of balance of payment innovations on prices, controlling for the influence of the important external aggregates identified in the previous section. section IV discusses estimates of the responsiveness of debt returns to policy announcements, controlling for the external and country-specific shocks. The paper ends with a summary of the results.

II. The Secondary Market for LDC Debt

1. The structure of the market

An active secondary LDC loan market developed in 1983 as commercial banks began to concentrate portfolios in those countries in which they were better prepared to take on risk (Vatnick, 1987; Alexander and Kawash, 1988). For example, European banks were reported to have traded Latin American paper for claims on Eastern European debtors. According to World Bank estimates (Table 1), trading volume doubled from 1984 to 1986 as debt conversion schemes introduced by the major debtors attracted non-bank market participants (World Bank Quarterly Review, various issues). The number of countries actively converting external debt increased from five in 1986 to

nine in 1987, which induced a growth in volume that year to $12 billion, more then two thirds related to debt conversions.

Table 1. Volume of Secondary Market Sovereign Debt Transactions

(In millions of U.S. dollars)

	1984	1985	1986	1987	1988
Debt-equity swaps	773	1,843	1,522	3,335	9,205
Exit bonds	0	0	0	15	4,725
Buybacks	0	0	0	0	648
Informal	0	0	0	3,500	5,414
Other	0	245	714	1,337	2,366
Total conversions	773	2,088	2,236	8,187	22,358
Total volume	2,000	4,000	7,000	12,000	50,000

Source: World Bank Quarterly Review, 1989

The value of total transactions more than quadrupled to $50 billion in 1988 as large U.S. commercial banks, who had built up loan-loss reserves beginning in mid-1987, began to sell off loans. Trading in the obligations of Argentina, Brazil, Chile, and Colombia accounted for most of the volume. Most transactions were in the form of informal conversions, debt repurchases and prepayments at a discount (World Bank Quarterly Review, various issues). Volume for 1989 appears to have been slightly higher than that of the previous year.

In addition to portfolio realignment and debt conversion, trades are motivated by tax considerations; for example, a profitable commercial bank can reduce tax liabilities by writing down LDC debt. Recently, the secondary market has been used by debtor countries to buy back debt. Trading is dominated by a small number of New York and London brokers, who both match buyers and sellers and trade for their own accounts.

2. Sample market prices and returns

The 21 price series used in this study include all but three of the countries whose prices were reported continuously over the March 1986 through October 1989 interval. 1/ 2/ Price is defined as the midpoint of the bid-ask spread. Monthly series were obtained by first converting the irregularly dated price series to a daily frequency (based on the midpoints of actual reporting intervals), then averaging the daily series. Because of the difficulty in constructing complete and precise interest and maturity profiles for the external obligations of each debtor, the continued renegotiation of the debt terms, and the long terms of these debts, returns are calculated as simple monthly price changes. 3/ The different price behavior for the obligations of debtor countries is shown in Table 2; the prices ranged from $3.70 to $21.00 for Peru and from $50.50 to $86.50 for Colombia. Central American paper is traded at the deepest discount, while the returns on South American obligations are the most volatile. Most of the unconditional returns are characterized by positive first-order autocorrelation.

Regional average correlations indicate positive co-movement between changes in the market price of the external debt of different sovereigns. The degree to which these intercorrelations are accounted for by unexpected changes in external aggregates that impact all debtors is examined in the arbitrage pricing theory framework, which is presented next.

III. External Shocks and Sovereign Debt Returns

Arbitrage pricing theory has been used extensively to test whether returns on groups of securities, usually U.S. equities, are sensitive to innovations in a small number of macroeconomic fundamentals. A brief review of arbitrage pricing theory is presented in this section, which is followed by description of the macroeconomic aggregates and discussion of arbitrage pricing theory model estimates.

1/ The most complete set of secondary market prices, for 35 countries, is reported by Salomon Brothers. Their reporting of bid-ask quotes began in March 1986, which was followed by reports for early May of that year, and monthly thereafter for 11 months. The biweekly reporting sheet was first released in April 1987.

2/ Debt for Côte d'Ivoire, Nicaragua, and Senegal were not included in the data set because of the limited number of transactions and the lack of available macroeconomic data.

3/ According to Lessard "Debt rescheduling has effectively transformed the obligations of most LDCs into perpetuities." (Lessard, 1988, p.7). This paper follows Vatnick (1987) and others in not controlling for average maturities or interest rates per country, and assumes that sovereign debt contracts can be modelled as equity claims.

Summary Statistics

Table 2. Secondary Sovereign Debt Market Prices and Returns

March 1986 to October 1989

	Prices			Monthly Returns 1/				
	Average	Minimum	Maximum	Standard Deviation	Minimum	Maximum	Auto 1/ 2/	Auto 2/
				(--------In percent--------)				
Africa 1/	37.5	7.3	51.2	2.8	-10.3	2.8	0.43	-0.07
Morocco	57.5	42.3	71.5	2.5	-8.7	2.8	0.40	0.14
Nigeria	32.1	21.0	7.5	6.8	-27.3	12.3	0.44	-0.10
Zaire	22.8	18.6	28.5	5.2	-13.2	17.4	0.19	-0.31
Philippines	57.5	38.2	73.5	5.2	-12.5	20.2	0.25	0.04
Central America	36.8	23.7	53.3	2.6	-8.3	5.3	0.54	0.31
Costa Rica	25.3	12.0	54.0	7.1	-22.9	11.9	0.48	0.28
Dominican Republic	31.9	16.5	46.0	6.1	-25.1	11.2	0.45	0.24
Honduras	29.7	10.5	41.5	12.8	-38.6	61.5	0.11	-0.30
Jamaica	41.9	34.5	47.5	3.9	-12.8	12.7	0.07	0.35
Mexico	50.4	36.0	60.6	4.6	-10.3	11.5	0.15	-0.32
Panama	41.5	10.4	71.3	8.4	-24.8	18.5	0.33	0.12
South America	45.0	29.7	59.3	3.5	-9.7	7.3	0.29	-0.02
Argentina	39.0	13.6	67.0	8.6	-16.1	31.8	-0.21	0.01
Bolivia	10.1	6.9	13.0	6.8	-15.6	25.4	0.20	-0.31
Brazil	52.3	26.3	76.0	7.8	-18.6	23.2	0.15	-0.27
Chile	62.9	52.1	70.8	3.8	-10.5	9.2	0.35	-0.27
Colombia	72.1	50.5	86.5	3.4	-11.5	8.8	0.34	0.09
Ecuador	37.5	11.1	66.3	7.9	-20.4	15.9	0.52	0.24
Peru	10.8	3.7	21.0	10.8	-39.2	25.3	0.31	-0.22
Uruguay	63.0	55.3	74.6	2.0	-5.9	4.9	0.46	0.34
Venezuela	57.5	32.2	77.7	5.5	-13.0	16.3	0.23	-0.09
Europe	51.0	38.5	67.9	2.8	-10.8	6.5	0.40	0.38
Poland	41.2	33.0	52.1	3.8	-11.0	14.1	0.23	-0.02
Yugoslavia	60.8	43.9	83.7	3.8	-15.7	6.8	0.41	0.53

Regional Average Return Correlations

	Africa	Central America	South America	Europe
Africa	1.00			
Central America	0.57	1.00		
South America	0.43	0.49	1.00	
Europe	0.29	0.58	0.55	1.00

1/ Return interval in April 1986 to October 1989. Returns are calculated as $(P_t-P_{t-1})P_t$ where P_t denotes average price in month z.

2/ First- and second-order autocorrelation coefficients.

3/ Unweighted regional averages.

1. Arbitrage pricing theory

Arbitrage pricing theory 1/ begins with the assumption that investors agree the asset return generating process obeys

$$r_{it} = E_i + b_i F_t + \epsilon_{it} \qquad (1)$$
$$i = 1,\ldots,n \quad t = 1,\ldots,T$$

where r_{it} is the return on asset i, E_i is expected asset return, b_i is a k row vector of return factor sensitivity parameters, F is a k element column vector of mean zero factors, ϵ_{it} is a disturbance term, and n and T are the numbers of assets and time periods. 2/ The factors are the source of systematic risk while ϵ_{it} captures non-systematic risk, and b_i measures the sensitivity of the return on asset i to the factors. Factors are defined here as innovations in important macroeconomic aggregates that impact all returns to some degree. Thus returns, or changes in the expected present discounted value of payment streams, are determined by innovations in a small number (k) of underlying fundamentals. The theory does not provide a structural explanation for the return generating process (1).

According to arbitrage pricing theory, if risk-averse investors maximize utility in a frictionless market, security-specific risk will be diversified away and the expected security returns will be an approximate linear function of the riskless rate p 3/ and a k-dimensional vector of factor risk premia τ

$$E_{it} = p_t + b_i \tau. \qquad (2)$$

The risk premium τ_j is the excess return (over p) per unit of factor j risk. 4/

Substitute (2) into (1) to derive the empirically testable relationship

---

1/ The arbitrage pricing theory was developed in Ross (1977). See also Connors (1984).

2/ The distributional assumptions are that the elements of ϵ and F have zero expected value (all expectations are conditional on information at the beginning of the period) and are contemporaneously correlated but independent over time, and the expectation of ϵ conditional on F is zero.

3/ The riskless rate is defined as the one-month holding period return for a one-bill portfolio that is the shortest-term bill not less than 31 days in maturity. The source is Ibbotson Associates (1990).

4/ Suppose an investor formed a portfolio that has unit sensitivity to factor j and zero sensitivity to all other factors. The return on such a portfolio is

$$p_t + \tau_j + f_{jt}$$

with expected value $p + \tau_j$. The parameter τ_j is the expected value net of p of assuming a unit of factor j risk. Note that elements of τ can be negative.

$$R_{it} = b_i r + b_i F_t + \epsilon_{it} \quad (3)$$

where R_{it} is defined as $r_{it}-p_t$. Each of these n equations includes the factor matrix F_t, and each is nonlinear in r. The disturbances terms are assumed to be serially independent and correlated between securities within the same time period. Given this theoretical and distributional structure, equation (3) can be estimated as a non-linear seemingly unrelated regression (NLSUR) system with cross-equation restrictions. The restrictions are that the k r_j's have the same value in each of the n equations. This approach was first used by McElroy and Burmeister (1988).

A large number of significant factor sensitivity parameter (b_{it}) estimates is evidence that innovations in a small number of pervasive macroeconomic indicators move secondary market sovereign debt returns.

2. Pervasive macroeconomic factors

The factors that determine returns are assumed to impact all security returns to some degree, have zero expected value at the beginning of each period, and span return space. Factors are defined as innovations in key macroeconomic aggregates. Most of the studies using observed macroeconomic factors (cf. Chen, Roll, and Ross, 1986; McElroy and Burmeister, 1988) define factors as contemporaneous or one-period-ahead forecast errors of univariate random walk, Kalman filter or ARIMA models. This study exploits the relationships between the macroeconomic aggregates by defining factors as VAR model in-sample residual errors. Estimation of equation (3) involved first estimating a VAR model of the k pre-specified macroeconomic factors, then using the sample errors from these regressions as exogenous variables in the arbitrage pricing theory framework.

Much has been written on the impact of external macroeconomic aggregates on the debt payment capacity of sovereigns. Dornbusch (1988) argued that the impact of the world economy on borrowers operates through inflation, interest rates, aggregate demand, and trade policies, while Sachs (1987) emphasized interest rates and the dollar value of world trade. However, there has been very little empirical work that has attempted to identify these aggregates.

Given the lack of agreement concerning the transmission of developed country activity to LDC debt payment capacity--and to secondary market prices--this study tests which aggregates that have been proposed in the literature move LDC debt prices. The first task is to determine the level of aggregation: should worldwide, developing country, or U.S. indicators be used? Estimates of equation (3) using the same set of factors for each level of aggregation indicated that LDC debt prices are most responsive to innovations in U.S. aggregates. (Appendix I describes the data sources, specification, and residual correlations of the VAR models.) Next, U.S. equity returns, industrial production, inflation, government bond yields,

and corporate risk premium 1/ were chosen based on equation by equation fit, the minimized objective function value and the number of significant factor sensitivity coefficients. 2/ The responsiveness of sovereign debt returns to the estimated factors are discussed next.

3. Are LDC debt returns impacted by external macroeconomic shocks?

The following equation was estimated in the NLSUR framework

$$R_{it} = r_1 b_1 + r_2 b_2 + r_3 b_3 + r_4 b_4 + r_5 b_5$$
$$+ b_1 \text{ EUSEQt} + b_2 \text{ EINDPRODt} + b_3 \text{ ECPIt} + b_4 \text{ EGOVBONDt}$$
$$+ b_5 \text{ ECORPPREMt} + \epsilon_{it}. \qquad (4)$$
$$i = 1,\ldots,21 \quad t = 1,\ldots,43$$

EUSEQ = innovations in Standard and Poor's equity return index
EINDPROD = innovations in U.S. industrial production
ECPI = innovations in U.S. consumer price index
EGOVBOND = innovations in U.S. government bond yield
ECORPPREM = innovations in the spread of Moody's average corporate yield over the average U.S. Treasury bond yield

McElroy and Burmeister (1988) regressed a random sample of 70 equity returns on univariate innovations in five factors and found that four of the five risk premia (r_j) and 215 of the 350 factor sensitivity estimates (b_{ij}) are significant. The five factors, which included univariate innovations in four macroeconomic indicators and the S&P 500 index (which may have included some of the dependent variables as components) explained between 30 percent and 50 percent of return variance.

As shown in Table 3, two of the five risk premia estimates, those for U.S. industrial production and U.S. government bond yields, are negative and significant at the 5 percent level.

Only 1 of the 21 factor sensitivity estimates corresponding to innovations in bond yields and the corporate risk premium is significant at the 5 percent level. The positive and significant response of debt returns for

---

1/ The empirical arbitrage pricing theory literature, which began with the use of factor analysis, has typically used five factors, although the appropriate number of factors has not been settled. See Conway and Reinganum (1988).

2/ Innovations in U.S. money supply, trade plans, resources, exchange rate had nominal import on bond returns were also tested.

Table 3. Debt Returns and External Macroeconomic Shocks 1/

	U.S. Equity Returns	U.S. Industrial Production	Consumer Price Index	U.S. Government Bond Yield	Corporate Risk Premium	R^2 2/
Risk premium	-0.0017 (0.19)	-0.0115* (2.41)	0.0003 (0.80)	-0.0215* (2.10)	-0.0702 (1.53)	
Africa						
Morocco	0.2812* (2.42)	0.7629 (1.58)	3.6991 (1.21)	0.2324 (1.25)	0.0535 (1.36)	30%
Nigeria	0.0644 (0.22)	1.7764 (1.56)	-0.1704 (0.02)	-0.1945 (0.47)	0.0017 (0.02)	7%
Zaire	0.5025* (2.43)	0.4449 (0.55)	4.6290 (0.84)	0.3221 (1.09)	-0.0530 (0.78)	19%
Asia						
Philippines	0.3229 (1.63)	2.0380* (2.58)	7.7807 (1.47)	-0.4233 (1.45)	-0.0225 (0.34)	23%
Central America						
Costa Rica	1.0486* (3.61)	0.6899 (0.60)	-0.2761 (0.04)	0.3235 (0.75)	0.0195 (0.20)	18%
Dominican Republic	0.8001* (3.01)	-0.0672 (0.06)	-2.8794 (0.41)	0.6540 (1.67)	0.0750 (0.85)	14%
Honduras	1.0565* (2.04)	-1.8454 (0.91)	3.1522 (-0.23)	0.6501 (0.88)	0.3469* (2.03)	16%
Jamaica	-0.0580 (0.34)	0.3999 (0.60)	3.4844 (0.75)	0.0385 (0.16)	0.0346 (0.61)	2%
Mexico	-0.1567 (0.87)	2.4434* (3.30)	14.1306* (2.96)	-0.1779 (0.63)	-0.0585 (0.96)	30%
Panama	0.1247 (0.30)	0.8807 (0.55)	-2.1791 (0.20)	0.8859 (1.49)	0.1289 (0.95)	1%
South America						
Argentina	-0.0806 (0.21)	3.3742* (2.24)	21.0678* (2.12)	-0.0257 (0.05)	0.0386 (0.31)	17%
Bolivia	-0.0719 (0.26)	2.0766 (1.93)	16.7564* (2.29)	-0.9240* (2.34)	-0.1254 (1.39)	18%
Brazil	-0.5243 (1.77)	5.2410* (4.28)	15.9335* (2.03)	-0.8602 (1.85)	-0.1925 (1.92)	35%
Chile	-0.0451 (0.28)	1.3290* (2.15)	2.4262 (0.57)	-0.2458 (1.09)	-0.0502 (0.96)	9%
Colombia	0.3335* (2.51)	1.4214* (2.63)	10.6290* (3.03)	-0.1516 (0.74)	0.0156 (0.35)	34%
Ecuador	-0.1356 (0.38)	1.5957 (1.11)	10.2469 (1.08)	0.2051 (0.38)	0.2111 (1.77)	15%
Peru	0.8149 (1.74)	1.7773 (0.98)	12.7292 (1.02)	0.3268 (0.49)	0.0442 (0.29)	8%
Uruguay	0.1907* (2.14)	0.3003 (0.85)	3.1299 (1.32)	0.1488 (1.14)	0.0239 (0.81)	10%
Venezuela	0.0044 (0.02)	2.7656* (2.96)	11.2354 (1.81)	-0.2762 (0.79)	-0.0545 (0.70)	18%
Europe						
Poland	0.0966 (0.58)	1.4113* (2.13)	0.8207 (0.18)	0.0591 (0.24)	-0.0403 (0.73)	10%
Yugoslavia	0.2503 (1.53)	1.3005* (2.00)	4.9592 (1.14)	-0.0906 (0.37)	0.0175 (0.32)	14%

Estimation Interval: April 1986 to October 1989

1/ Absolute values of t-statistics are in parentheses, * denotes parameter estimate significant at the 5 percent level.

2/ Ratio of explained variance to total variance.

five countries to U.S. inflation is another unforeseen result, given that inflation increases debt payments and erodes the real value of the debt. 1/

Seven and nine of the U.S. equity return and industrial production factor sensitivity estimates, respectively, are positive and significant, indicating that changes in investor valuation of sovereign debt prices exhibit some response to procyclical indicators of the U.S. economy. Returns on the obligations of larger Latin American economies and of the two European debtors are impacted by innovations in output of the U.S. manufacturing sector.

The five factors account for between 1 percent (Panama) and 35 percent (Brazil) of secondary market debt return variance, with an average of 17.4 percent. The equation fits do not exhibit any regional pattern. The next section examines whether the large proportion of unexplained return variance can be accounted for by another class of aggregates observed by investors: country-specific shocks.

IV. Country-Specific Shocks and Sovereign Debt Returns

According to balance of payment accounting, given a constant level of external borrowing, debt repayments are equal to non-interest current account revenues, which, for the sovereign borrowers considered here, consists primarily of net exports. 2/ Since market prices are the expected discounted value of loan payment streams, and since investors can easily observe the components of the dollar-denominated trade balance, the large share of return variance not explained by pervasive factors may be correlated with unexpected changes in exports, imports, and the exchange rate.

In addition to the non-interest current account balance there is another, albeit temporary, source of external debt funding: the stock of foreign exchange. Even with a trade deficit external debt payments can be financed by drawing down international reserves, implying that investors may associate positive reserve shocks with increases in loan market prices. This section describes specification and testing of the hypothesis that loan market returns are sensitive to innovations in the components of the external trade balance and international reserves.

1/ McElroy and Burmeister found that 24 of the 70 factor sensitivity estimates corresponding to unexpected inflation were positive and significant, while none were less than zero and significant.

2/ Simonsen (1985) develops "solvency tests" as a function of the debtor's dollar-denominated trade balance.

1. The model with an observable idiosyncratic risk component

Virtually all estimates of arbitrage pricing theory models have been based on weekly or monthly U.S. stock returns. 1/ Since U.S. equity investor information sets do not include firm-specific indicators, the hypothesis that company returns are sensitive to unexpected changes in company-specific indicators cannot be tested. However, investors in sovereign loans can easily observe country-specific measures, which suggests a modification of the arbitrage pricing theory model to allow testing of the hypothesis that returns are moved by these aggregates.

Connor and Korajczyk (1986, 1987) showed that if the idiosyncratic risk component consists of a random element and a signal observed by a group of informed investors, then equation (3) becomes

$$R_{it} = b_i r + b_i F_t + a_i + u_{it} \qquad (5)$$

where a non-zero a_i indicates that informed investors exploit private asset-specific information when forming portfolios.

This paper extends the empirical literature by testing whether idiosyncratic risk for a set of securities can be decomposed into observable and unobservable components

$$R_{it} = b_i r + b_i F_t + \alpha_i x_{it} + v_{it} \quad 2/ \qquad (6)$$

where x_i is an M-vector of shocks to observable country-specific determinants of debt returns, α_i is an M-element row vector of parameters, and v_{it} represents non-observable idiosyncratic risk. Since each x_i impacts the returns on one asset only, idiosyncratic risk can still be diversified away as n increases.

2. Country-specific determinants of debt returns

Different combinations of balance of payment measures are modelled in the VAR framework estimated for each country, with the residuals used as x in estimation of equation (6). 3/ Estimates of equation (6) using two sets of balance of payment measures are reported in the next section.

1/ Gultekin and Rogalski (1985) and Elton and Gruber (1988) estimated financial asset pricing models with government security returns.

2/ The distributional assumptions are that v is independent of x_i, x_i is independent of F and v_j, v_i has zero expectation, and the expectation of v and x conditional on F is zero.

3/ Appendix II describes the data sources, specification, and residual correlations of the VAR models.

3. The impact of country-specific aggregates on sovereign debt returns

The reduced degrees of freedom resulting from the addition of one country-specific time series to the five factors would likely reduce the efficiency of parameter estimates. 1/ 2/ Consequently, three factors were dropped from the equation (3) specification (based on the criteria of the number of significant factor sensitivity parameter estimates), leaving innovations in U.S. equity returns and industrial production. The results for the following equation are reported in Table 4

$$R_{it} = r_1 b_1 + r_2 b_2 + b_1\ EUSEQ_t + b_2\ EINDPROD_t +$$
$$\alpha_1\ ERESERVES_{it} + \alpha_2\ EXRATE_{it} + \alpha_3\ EEXPORTS_{it}$$
$$\alpha_4\ EIMPORTS_{it} + v_{it}. \qquad (7)$$
$$i = 1,\ldots,21 \quad t = 1,\ldots,43$$

EUSEQ = innovations in Standard and Poor's equity return index
EINDPROD = innovations in U.S. industrial production
ERESERVES = innovations in foreign exchange and gold reserves valued in U.S. dollars.
EXRATE = innovations in local currency to U.S. dollar exchange rate
EEXPORTS = innovations in exports valued in U.S. dollars 3/
EIMPORTS = innovations in imports valued in U.S. dollars

The risk premium for U.S. industrial production is negative and significant at the 5 percent level, while 12 of the associated factor sensitivity estimates are positive and significant at the 5 percent level. Five of the U.S. equity return coefficient estimates are positive and significant.

Seven of the foreign reserve coefficients are positive and significant, while there does not appear to be a systematic relationship between debt returns and export or import shocks. Six exchange rate shocks coefficients are significant with, assuming that a stronger borrower currency enhances debt value, the expected negative sign;

1/ Regressing equation (3) residuals on country-specific shocks is an alternative to joint estimation of the pervasive factors and the country-specific shocks. However, estimates might be biased as a result of correlation between the two sets of potential return determinants.

2/ However, in the SUR framework efficiency is enhanced by some exogenous variables are different for each equation (conditional on the true matrix of disturbance term covariances), since the Jacobians of different equations will have lower correlation, allowing more precise estimates of the off-diagonal elements of the covariance matrix.

3/ Current trade data for Nigeria are not available, and monthly export series for Honduras and Panama are not reported in a timely fashion.

Table 4. Debt Returns and Country Specific Shocks I 1/

	U.S. Equity Returns	U.S. Industrial Production	Reserves	Exchange Rate	Exports	Imports	R^2 2/
Risk premium	0.0000 (0.00)	-0.0046* (3.09)					
Africa							
Morocco	0.2920* (2.57)	1.4830* (3.69)	-0.0000 (0.58)	-0.0819* (3.36)	-0.0001 (0.67)	-0.0000 (0.26)	15%
Nigeria	0.0447 (0.17)	2.8442* (2.99)	0.0000* (2.67)	-0.0284* (2.14)			26%
Zaire	0.4558* (2.22)	-0.3965 (0.54)	0.0003* (2.13)	-0.0010* (2.01)	-0.0000 (0.05)	-0.0015 (1.86)	22%
Asia							
Philippines	0.3773 (1.92)	1.9434* (2.79)	0.0000 (0.03)	-0.0048 (0.33)	0.0003 (1.52)	0.0001 (0.88)	23%
Central America							
Costa Rica	0.9226* (-3.30)	0.5404 (-0.56)	-0.0004 (-1.11)	-0.0512* (-2.22)	-0.0000 (-0.01)	-0.0021* (-2.32)	18%
Dominican Republic	0.7374* (2.83)	0.8129 (0.89)	-0.0002 (1.13)	0.0386 (1.12)	0.0008 (1.58)	-0.0002 (0.45)	1%
Honduras	0.9391 (1.81)	-0.2235 (0.12)	-0.0009 (0.75)	-0.0003 (0.27)	-0.0005 (0.61)		10%
Jamaica	-0.1083 (0.66)	0.5133 (0.92)	-0.0009* (4.21)	-0.0065 (0.13)	-0.0000 (0.03)	0.0004 (1.21)	10%
Mexico	-0.1942 (1.02)	1.5161* (2.27)	-0.0000 (0.17)	-0.0001* (2.22)	-0.0000 (0.76)	-0.0000 (0.09)	9%
Panama	0.2485 (0.69)	2.6192* (2.11)	0.0009* (3.41)	-0.0004 (0.21)	0.0029* (5.38)		9%
South America							
Argentina	-0.4071 (1.15)	3.5057* (2.91)	0.0001* (3.25)	0.0006* (4.39)	-0.0003* (2.36)	-0.0007* (3.19)	24%
Bolivia	-0.0097 (0.03)	-0.1319 (0.12)	-0.0001 (0.34)	-0.2197 (0.74)	0.0003 (0.25)	0.0006 (0.76)	-3%
Brazil	-0.4359 (1.47)	3.2687* (3.10)	-0.0000 (0.42)	-0.0572* (2.83)	-0.0000* (2.04)	-0.0000 (0.38)	26%
Chile	-0.0500 (0.38)	0.8907 (1.96)	0.0001* (5.38)	0.0062* (6.26)	-0.0000 (0.85)	0.0001 (1.39)	34%
Colombia	0.3323* (2.36)	1.2662* (2.58)	-0.0000 (1.23)	-0.0009 (0.14)	0.0000 (0.41)	-0.0002 (1.92)	17%
Ecuador	-0.0106 (0.03)	3.0446* (2.38)	0.0004* (2.82)	-0.0005 (1.37)	0.0004 (1.77)	-0.0000 (0.06)	1%
Peru	0.6188 (1.32)	2.4286 (1.47)	0.0001 (0.58)	0.0000 (0.93)	0.0002 (0.48)	-0.0004 (1.94)	0%
Uruguay	0.1249 (1.38)	0.3399 (1.12)	-0.0000 (0.42)	-0.0001 (0.09)	-0.0000 (0.23)	-0.0004* (2.06)	-5%
Venezuela	-0.0135 (0.06)	2.2131* (2.68)	-0.0000 (0.56)	-0.0014 (1.36)	0.0000 (0.49)	-0.0000 (1.30)	7%
Europe							
Poland	0.1275 (0.75)	1.6136* (2.78)	0.0000 (0.27)	-0.0004 (1.18)	0.0000 (0.37)	-0.0001 (1.72)	2%
Yugoslavia	0.2287 (1.53)	1.7813* (3.23)	0.0000 (0.65)	0.0000* (2.79)	-0.0001 (1.37)	0.0001 (1.51)	23%

Estimation Interval: April 1986 to October 1989.

1/ Absolute values of t-statistics are in parentheses. * denotes parameter estimate significant at the 5 percent level.

2/ Ratio of explained variance to total variance.

however, three exchange rate coefficient estimates are positive with a p-value less than 0.05.

Equation (7) was reestimated after dropping the export and import series. The results, not reported here, were virtually unchanged for the two pervasive factors and reserves, while four and two of the exchange rate parameters were significantly negative and positive respectively.

The reserve-import ratio is a widely used indicator of sovereign credit-worthiness. 1/ A parsimonious version of the model was tested by including only the two factors and reserve-import ratio shocks for each country. 2/ As reported in Table 5 the pervasive factor results are similar to those from previous models, and eight of the reserve-import coefficients are positive and significant.

By the criteria of reliably estimated coefficients and equation fits, secondary market debt returns do not appear to respond consistently to innovations in important country-specific balance of payment indicators. There is limited evidence that prices are sensitive to debtor reserve-import shocks. The equation fits reported in Table 5, which range from 10 to 20 percent, imply that the analysis has not accounted for important elements of the investor information set.

V. Policy Announcements and LDC Debt Returns

The secondary sovereign debt market is distinguished from other important markets, such as those for bond and equities, by the relatively small number of decision makers operating in an environment where contracts are not legally enforceable. Given this setting, unexpected announcements of decisions by single creditors, debtors, or third parties may impact debt returns. This section tests whether sovereign debt returns are sensitive to three classes of such announcements: bank reserving decisions, third party funding, and discrete changes in debt payment streams. The methodology used in this paper differs from other event studies in that the sensitivity of returns to important external and domestic shocks is controlled for, implying more reliable tests of the impact of discrete events on price changes.

1. Are debt prices sensitive to bank reserving announcements?

On May 20, 1987 Citibank unexpectedly added $3 billion to its loan loss provisions (New York Times, 1987). Six days later, Chase Manhattan Bank increased its loan loss reserves by $1.6 billion. During June, six

---

1/ See, for example, McFadden et. al (1985) and Stone (1988).

2/ These innovations are based on ARIMA model residuals, as discussed in Appendix II.

Table 5. Debt Returns and Country Specific Shocks II 1/

	U.S. Equity Returns	Industrial Production	Reserve/ Imports	R^2 2/
Risk premium	-0.0047 (0.83)	-0.0084* (3.12)		
Africa				
Morocco	0.2684* (2.31)	1.1948* (3.08)	-0.0039 (0.45)	16%
Nigeria	0.1249 (0.43)	1.9151* (2.23)	-0.0012 (0.85)	6%
Zaire	0.4534* (2.15)	0.1245 (0.20)	0.0019 (0.42)	7%
Asia				
Philippines	0.3632 (1.83)	1.3956* (2.29)	0.0094 (1.06)	18%
Central America				
Costa Rica	1.1292* (3.93)	1.0031 (1.12)	0.0250* (2.46)	19%
Dominican Republic	0.7926* (3.15)	0.7954 (1.04)	0.0415* (2.27)	12%
Honduras	1.0947* (2.07)	0.1492 (0.10)	-0.0967 (1.04)	6%
Jamaica	-0.0530 (0.30)	0.5078 (1.06)	-0.0014 (0.08)	-0%
Mexico	-0.2040 (1.08)	1.6185* (2.82)	0.0080* (3.25)	15%
Panama	0.1188 (0.29)	2.7573* (2.30)	-0.0256 (0.98)	-8%
South America				
Argentina	-0.1117 (0.30)	2.8319* (2.51)	0.0142* (2.70)	3%
Bolivia	-0.1903 (0.66)	-0.0079 (0.01)	-0.0098* (2.39)	4%
Brazil	-0.4737 (1.48)	3.2625* (3.26)	0.0016 (0.36)	20%
Chile	-0.0223 (0.15)	0.8370 (1.87)	0.0029 (0.90)	8%
Colombia	0.3356* (2.40)	0.9407* (2.15)	-0.0004 (0.23)	17%
Ecuador	-0.0658 (0.19)	2.5416* (2.40)	0.0181* (2.08)	2%
Peru	0.6228 (1.38)	2.3583 (1.76)	0.0165* (5.61)	8%
Uruguay	0.1677 (1.93)	0.3747 (1.46)	0.0017* (3.02)	1%
Venezuela	0.0116 (0.05)	1.9858* (2.75)	-0.0003 (0.25)	9%
Europe				
Poland	0.0848 (0.52)	1.3391* (2.65)	-0.0057 (0.79)	7%
Yugoslavia	0.2634 (1.62)	1.1929* (2.38)	-0.0011 (0.20)	10%

Estimation Interval: April 1986 to October 1989.

1/ Absolute values of t-statistics are in parentheses, * denotes parameter estimate significant at the 5 percent level.
2/ Ratio of explained variance to total variance.

other of the largest U.S. banks 1/ added a total of $5.9 billion to LDC loan reserves, while U.K. banks began to provision during the middle of the month (Bird, 1989). Bird (1989) postulates three channels through which bank provisioning may impact debtor countries: 1) relative bargaining positions may be altered; 2) banks are less likely to provide new money; 3) debt-equity conversions may be more likely to occur.

The hypothesis that the Citicorp provisioning action had an immediate impact on debt returns is tested by adding a dummy variable which equals one in May 1987 to the model reported in Table 5. None of the dummy variable coefficients (the results are not reported here) are significant at the 10 percent level. The hypothesis that the market responded with a lag to the reserve changes was tested by replacing the May 1987 dummy with a new variable equaling one in June through October inclusive and zero elsewhere. Sixteen of the dummy variable coefficient estimates (the results are not reported here) are significant at the 5 percent level, while the only change in the other estimates is a decrease in the number of significant reserve-import ratio coefficients to four.

These results imply that bank reserving decisions sharply reduce the market value of LDC debts, even after controlling for other macroeconomic surprises. Possible reasons for this regularity include investor perceptions of a weaker debtor bargaining position and the consequences of expected decreases in loan flows. The delayed response of returns is striking. One observer noted that "As some [LDC debt] traders indicate, during the summer months last year there was no real change in the demand for developing country loans, but decisions to dispose of these assets taken by several institutions drove the prices down." (World Bank, September 1988, p. 8). The prolonged price response may be a result of slow decision making, or a consequence of potential sellers not wanting to unload loans in the still illiquid market, thus bringing prices down and reducing the market values of their LDC debt portfolios.

2. Did announcement of the Brady Plan enhance debt values?

The long awaited Brady Plan was expected to lead to an injection of external funds into the LDC debt situation. The plan, which was not fully articulated during the March 10, 1989 speech of U.S. Treasury Secretary Nicholas Brady, entailed using third party funding to sponsor debt reductions. The hypothesis that the Brady Plan announcement impacted LDC debt market valuations is tested by including a dummy variable equalling one in March 1989 to the basic pricing model. Four of the dummy variable coefficients (for Morocco, Zaire, Honduras, and Uruguay) were negative and

---

1/ The amount and date of LDC loan provisioning in 1987 was publicly reported in the New York Times for nine of the 13 U.S. banks with the largest LDC exposure. Reserving information for Bank of Boston and Mellon Bank were not reported, nor were the timing of reserve increases by J.P. Morgan and Wells Fargo.

significant at the 5 percent level (the results are not reported here), while the only positive and significant coefficient was for Mexico. Mexico was the first country to restructure debt under the Brady Plan in late 1989.

The first confirmation that the multilaterals would concur with the Brady Plan's suggestion of new funds for debt reduction came in early April. The hypothesis that this subsequent event had a stronger impact on debt prices then announcement of the Brady plan was tested by including a dummy variable for April 1989. The associated coefficients for seven countries (Philippines, Honduras, Mexico, Brazil, Colombia, Venezuela, and Poland) were positive and significant (the results are not reported here), while no coefficients were negative.

Table 6 reports testing of the joint hypothesis that secondary market prices were positively impacted by the Brady Plan and subsequent developments by including a dummy variable which equals one for March, April, and May 1989. Seven of the dummy coefficient (the same seven as for the April dummy) estimates are positive and significant, while the t-statistic for the Panama dummy was -1.99. Mexico, the Philippines, and Venezuela have completed or are in the process of debt transformations based on the Brady Plan.

3. Are sovereign debt prices sensitive to announcements of debt payment interruptions or resumptions?

An important difference between claims on sovereigns and corporate obligations is that the former can interrupt--and later resume--debt payments without the threat of bankruptcy. The hypothesis that the announcement of discrete changes in debt payment streams alter market prices is tested by including dummy variables in the model for the five cases of payment interruption and the four payment resumptions 1/ that occurred during the sample period.

The results, reported in Table 7, are inconclusive: two of the five coefficients associated with payment cessation are negative and significant, while three of the four payment resumption parameter estimates are positive and significant.

The ambiguity of this result may be a consequence of the event study methodology, which does not account for market anticipation of payment changes and cannot distinguish between payment interruptions and other events.

1/ Ozler (1989) tested the hypothesis that LDC debt reschedulings impacted creditor bank stock prices by regressing bank equity returns on aggregate stock market and bank industry indices and rescheduling dummies. Reschedulings were found to increase bank values from 1978 to 1980, while from 1981 to 1983 bank stock returns were adversely effected by reschedulings.

Table 6. Debt Returns and External Policy Announcements 1/

	U.S. Equity Returns	U.S. Industrial Prod.	Consumer Price Index	U.S. Government Bond Yield	Corporate Risk Premium	R^2 2/
Risk premium	0.0001 (0.03)	-0.0029* (2.37)				
Africa						
Morocco	0.2563* (2.44)	1.2414* (3.22)	0.0004 (0.04)	-0.0330* (3.08)	-0.0071 (0.41)	20%
Nigeria	0.1152 (0.41)	2.2169* (2.15)	-0.0013 (0.95)	-0.0565 (1.98)	0.0072 (0.15)	12%
Zaire	0.4467* (2.15)	-0.4008 (0.52)	0.0014 (0.33)	-0.0362 (1.72)	-0.0291 (0.85)	13%
Asia						
Philippines	0.2453 (1.65)	2.4784* (4.49)	0.0005 (0.06)	-0.0553* (3.58)	0.1172* (4.77)	57%
Central America						
Costa Rica	1.1127* (4.33)	0.2618 (0.28)	0.0164 (1.49)	-0.0825* (3.12)	-0.0667 (1.59)	32%
Dominican Republic	0.7391* (3.07)	0.1060 (0.12)	0.0067 (0.36)	-0.0711* (2.78)	-0.0334 (0.84)	17%
Honduras	0.7963 (1.60)	0.5353 (0.29)	-0.0273 (0.33)	-0.0586 (1.16)	0.2053* (2.48)	21%
Jamaica	-0.0820 (0.56)	0.3826 (0.72)	-0.0135 (0.76)	-0.0630* (4.28)	0.0270 (1.13)	30%
Mexico	-0.2794 (1.59)	2.0929* (3.22)	0.0085* (3.37)	-0.0334 (1.86)	0.0663* (2.28)	28%
Panama	0.1764 (0.48)	1.7099 (1.27)	-0.0342 (1.41)	-0.0903* (2.41)	-0.1209* (1.99)	3%
South America						
Argentina	-0.0550 (0.16)	2.7368* (2.15)	0.0153* (3.14)	-0.0911* (2.58)	-0.0725 (1.26)	14%
Bolivia	-0.2003 (0.70)	0.6947 (0.67)	-0.0087* (2.16)	-0.0258 (0.90)	0.0612 (1.31)	10%
Brazil	-0.6046* (2.24)	4.2278* (4.20)	0.0059 (1.42)	-0.0868* (3.11)	0.1257* (2.81)	43%
Chile	-0.0529 (0.42)	1.1024* (2.39)	0.0011 (0.39)	-0.0613* (4.77)	0.0252 (1.22)	40%
Colombia	0.2680* (2.23)	1.3378* (3.01)	-0.0015 (0.83)	-0.0347* (2.81)	0.0612* (3.06)	40%
Ecuador	-0.2086 (0.66)	2.7898* (2.40)	0.0173* (2.01)	-0.0990* (3.07)	0.0929 (1.78)	21%
Peru	0.6843 (1.81)	2.2360 (1.60)	0.0168* (5.14)	-0.1626* (4.21)	-0.0820 (1.27)	34%
Uruguay	0.1598* (2.06)	0.2107 (0.74)	0.0006 (1.00)	-0.0288* (3.58)	-0.0043 (0.33)	19%
Venezuela	-0.1022 (0.52)	2.5470* (3.54)	0.0001 (0.06)	-0.0713* (3.57)	0.0968* (3.00)	38%
Europe						
Poland	-0.0278 (0.19)	1.8036* (3.40)	-0.0059 (0.85)	-0.0194 (1.31)	0.0949* (4.00)	32%
Yugoslavia	0.2209 (1.57)	1.3959* (2.70)	-0.0001 (0.01)	-0.0530* (3.69)	0.0283 (1.22)	30%

Estimation Interval: April 1986 to October 1989.

1/ Absolute values of t-statistics are in parentheses, * denotes parameter estimate significant at the 5 percent level.

2/ Ratio of explained variance to total variance.

Table 7. Debt Returns and Discrete Changes in Debt Payments 1/

	U.S. Equity Returns	U.S. Industrial Production	Reserves Imports	Dummy CITCRP-2	Dummy Brady-IMF	Resume Payment	Stop Payment	R^2 2/
Risk premium	-0.0008 (0.15)	-0.0051* (3.23)						
Africa								
Morocco	0.2533* (2.42)	1.2401* (3.41)	0.0014 (0.17)	-0.0302* (2.80)	-0.0040 (0.23)			26%
Nigeria	0.1124 (0.40)	2.0880* (2.20)	-0.0015 (1.06)	-0.0521 (1.81)	0.0111 (0.24)			12%
Zaire	0.4583* (2.21)	-0.1540 (0.22)	0.0046 (1.00)	-0.0357 (1.68)	-0.0273 (0.79)			14%
Asia								
Philippines	0.2419 (1.63)	2.1788* (4.16)	0.0048 (0.60)	-0.0497* (3.20)	0.1208* (4.89)			56%
Central America								
Costa Rica	1.1130 (4.34)	0.4334 (0.48)	0.0151 (1.38)	-0.0808* (3.03)	-0.0638 (1.51)			33%
Dominican Republic	0.8035* (3.94)	-0.3606 (0.50)	0.0118 (0.63)	-0.0699* (3.15)	-0.0379 (1.11)		-0.0899* (4.31)	38%
Honduras	0.8094 (1.63)	0.7588 (0.45)	-0.0402 (0.53)	-0.0557 (1.10)	0.2076* (2.51)			21%
Jamaica	-0.0879 (0.60)	0.3596 (0.74)	-0.0110 (0.62)	-0.0621* (4.20)	0.0278 (1.16)			30%
Mexico	-0.2842 (1.62)	2.0112* (3.32)	0.0086* (3.20)	-0.0293 (1.62)	0.0701* (2.40)			29%
Panama	0.1849 (0.50)	1.9780 (1.60)	-0.0351 (1.41)	-0.0855* (2.27)	-0.1148 (1.88)			5%
South America								
Argentina	-0.1178 (0.38)	3.0997* (2.93)	0.0110* (2.28)	-0.0860* (2.71)	-0.0577 (1.12)	0.1593* (4.80)		37%
Bolivia	-0.2087 (0.73)	0.3497 (0.37)	-0.0085* (2.04)	-0.0256 (0.89)	0.0598 (1.27)			9%
Brazil	-0.5986* (2.36)	3.5504* (3.94)	0.0064 (1.44)	-0.0806* (3.05)	0.1279* (3.02)	-0.0373 (1.89)	-0.0220 (1.41)	47%
Chile	-0.0560 (0.45)	0.9107* (2.15)	0.0024 (0.97)	-0.0589* (4.57)	0.0261 (1.25)			39%
Colombia	0.2637* (2.19)	1.2871* (3.08)	-0.0009 (0.42)	-0.0314* (2.51)	0.0645* (3.21)			41%
Ecuador	-0.2781 (0.89)	3.7282* (3.39)	0.0182* (2.31)	-0.0897* (2.81)	0.1099* (2.13)	0.0548* (2.09)	0.0789* (2.37)	30%
Peru	0.6735 (1.78)	1.8790 (1.46)	0.0162* (4.24)	-0.1590* (4.08)	-0.0760 (1.16)			34%
Uruguay	0.1612* (2.08)	0.2622 (1.00)	0.0006 (1.00)	-0.0279* (3.46)	-0.0032 (0.25)			21%
Venezuela	-0.1061 (0.60)	2.0108* (3.23)	0.0009 (1.01)	-0.0672* (3.69)	0.0992* (3.37)	0.1141* (5.76)	-0.0633* (6.24)	48%
Europe								
Poland	-0.0203 (0.14)	1.8031* (3.62)	-0.0048 (0.66)	-0.0158 (1.06)	0.1068* (4.20)	-0.0163 (0.82)		38%
Yugoslavia	0.2178 (1.55)	1.3298* (2.75)	0.0001 (0.01)	-0.0500* (3.46)	0.0311 (1.33)			31%

Estimation Interval: April 1986 to October 1989.

1/ Absolute values of t-statistics are in parentheses, * denotes parameter estimate significant at the 5 percent level.

2/ Ratio of explained variance to total variance.

V. Conclusion

This study estimates the sensitivity of secondary sovereign loan market returns to three classes of economic news in the framework of the arbitrage pricing theory model.

Sovereign loan market returns do not meet the empirical restrictions of the arbitrage pricing theory model. Unlike U.S. equity returns price charges for the obligations of a national governments are not moved by a small number of observable macroeconomic fundamentals each associated with a risk premia.

Debt prices are characterized by a limited response to unexpected changes in procyclical indicators of the U.S. economy. The parameter estimates associated with either or both of U.S. equity returns and industrial production were estimated significantly for 16 out of 21 countries. This result is puzzling in that there is no direct link between these indicators and the debtor countries, whereas debt prices were found not to be sensitive to innovations in aggregates that are directly linked to borrower current account balances, such as U.S. imports. Unexpected changes in U.S. equity values and industrial production could be capturing expectations regarding the world economy, a point that may merit consideration by theoreticians modelling the impact of world events on external debt servicing potential.

In several cases external shocks do appear to meaningfully alter debt values. The countries with the largest complete model (Table 6) reliably estimated factor sensitivity estimates are Costa Rica and Ecuador. Positive two standard deviation innovations in U.S. equity returns would raise Costa Rican debt values by 8.2 percent, while an industrial production shock of identical magnitude would lift the price of Ecuador debt by 6.0 percent 1/. These examples, although based on the largest factor sensitivity estimates, suggest that architects of debt restructuring schemes should be aware of the potential impact of changes in the U.S. economy on debt values.

Country-specific balance of payment shocks have a limited impact on external debt price changes, even though debt repayments are funded by foreign exchange earnings. This result suggests that countries cannot use trade or

---

1/ The parameter point estimates are fairly robust to changes in the sample interval. The model reported in Table 6 (the payment interruption dummies are excluded to allow comparison over sub intervals) includes equity return sensitivity estimate of 1.11 for Costa Rica and 2.78 for Ecuador. Omitting the 1986 observations alters these values to 1.02 and 3.03 respectively, while estimating over the April 1986 to May 1989 interval generates estimates of 0.97 and 2.96.

reserve policies to exercise short term 1/ control over the market value of their foreign debt.

Given that unexpected changes in external and country-specific macroeconomic aggregates together do not explain a large proportion of loan market return variance--the equation fits for Table 4 average 17 percent, what does move market returns?

Policy announcements by important individual agents have a significant impact on debt values. The decision by commercial banks to increase loan loss reserves in mid-1987 significantly reduced debt prices. The announcement of the Brady Plan and the subsequent decisions of the multilaterals to become more involved in debt restructurings increased prices of one-third of the sample countries. Each of these announcements is associated with a discrete change in the availability of future lending. 2/ The results imply that investors believe sovereign debt values for a large group of countries are enhanced by increased prospects of future lending to sovereigns, which is presaged by announcements of lending institutions.

Even after controlling for these key announcements a large share of return variance remains unexplained. The relative illiquidity of the market coupled with the lack of publicly available transactional prices suggests that market imperfections may drive a wedge between investor information sets and reported prices. However, Stone (1990) compared the impact of the three classes of economic news on returns from the contemporary market with the interwar sovereign bond market, which was highly liquid with weekly reported transactional prices. The consistency of the results for two markets 50 years apart suggests that the insensitivity of sovereign loan market returns to macroeconomic fundamentals is an inherent trait of sovereign debt, rather then an artifact of market imperfections.

Given the ambiguous nature of sovereign debt contract enforcement, the low proportion of explained return variance is likely caused by the omission of important information from this study. Modifications in the substitutability of foreign debt for other assets via country debt conversion schemes almost surely alter debt values. Other important omitted variables include developments in the domestic political scene, such as changes in government, or changes in the portion of national wealth claimed by different groups.

1/ Of course structural changes in the domestic economy induced by new policies are likely to have long-term effect on debt-servicing potential and on secondary market debt prices, as are decisions to alter debt repayment flows.

2/ Net transfers from the debtors classified as severely indebted middle income countries (14 of the 19 in this category are included in the sample) to commercial banks rose from $10,920 billion in 1987 to $16,051 billion in 1988 (World Bank, 1989). New securities created by Brady Plan restructurings are guaranteed by third party funding.

In summary, the results suggest that sovereign debt returns are somewhat sensitive to innovations in procyclical indicators of the U.S. economy but that returns do not respond to borrower country balance of payment shocks. Sovereign loan prices are moved by announcements that foreshadow changes in expected lending to borrowers.

Sources and Estimation of Pervasive Macroeconomic Factors

Under the version of the arbitrage pricing theory used in this study the n asset returns are generated by innovations in k (less then n) macroeconomic aggregates. This appendix documents specification and estimation of the observed factors, and presents descriptive statistics. Note that the only guidance provided by the arbitrage pricing theory framework in the construction of the observed factors is that they must span k-dimensional state space, have zero expectation at the beginning of each month, and they must impact all security returns. Previous studies of U.S. equity returns that employed the observed factor approach used a set of forecast errors of important macroeconomic variables. 1/ Unexpected changes U.S. monthly aggregates listed below are used as macroeconomic factors in NLSUR estimation of the arbitrage pricing theory model. Sources are denoted as IFS for International Financial Statistics or DRI for Data Resources, Inc.

U.S. Equity Return Index - Based on Standard and Poor index of equity returns for 400 U.S. industrials (IFS).

U.S. Industrial Production - Federal Reserve Bank index of industrial production, non-seasonally adjusted (DRI).

Consumer Price Index - Index of consumer prices (IFS).

U.S. Government Bond Yield - 10 year constant maturity U.S. government bond yields (IFS).

U.S. Corporate Bond Risk Premium - Yield on Moody's BAA rated corporate bonds (DRI) less U.S. government bond yield.

All series except the corporate risk premium were transformed to logarithmic form. Since the corporate risk premium series begins in 1981, the VAR model was estimated from 1961 to October 1989. Log likelihood ratio (LLR) tests supported the inclusion of a trend and seasonal dummies in each equation, and the choice of eight lags. In-sample residuals from this model were used as the arbitrage pricing theory macroeconomic factors. Factor summary statistics, correlations, and autocorrelations are presented in Table 8.

1/ See Chen, Roll, and Ross (1986), McElroy and Burmeister (1988).

Table 8. Descriptive Summary Statistics for Pervasive Macroeconomic Factors 1/

	Average	Standard Deviation	Minimum	Maximum
U.S. equity returns	0.0015	0.0365	-0.1205	0.0511
U.S. industrial production	-0.0011	0.0084	-0.0191	0.0205
Consumer price index	0.0000	0.0015	-0.0044	0.0030
U.S. government bond yield	-0.0000	0.0046	-0.0086	0.0238
Corporate risk premium	0.0156	0.1555	-0.3843	0.4350

	Correlations			
	Equity Returns	Industrial Production	Consumer Price Index	Government Bond Yields
U.S. equity returns	1.000			
U.S. industrial production	-0.051	1.000		
Consumer price index	-0.050	-0.468	1.000	
U.S. government bond yield	-0.128	0.182	-0.356	1.000
Corporate risk premium	-0.029	0.362	-0.387	0.005

	Autocorrelations	
	One Lag	Two Lag
U.S. equity returns	0.2352	-0.1141
U.S. industrial production	-0.0404	-0.0494
Consumer price index	-0.0288	-0.0636
U.S. government bond yield	-0.2233	-0.0607
Corporate risk premium	0.1640	-0.1223

1/ The VAR model was estimated over the October 1961 through October 1989 period. These statistics are for the VAR model residuals for April 1989 to October 1989 interval.

Sources and Estimation of Country-Specific Shocks

The sources of country-specific observable idiosyncratic risk are assumed to impact sovereign debt returns, have a conditional expectation of zero at the beginning of the investment period, and are assumed to be included in investor information sets. The below four balance of payment indicators (or combinations) were tested in the model. All are from the IFS, series numbers are parenthesized, and all are in U.S. dollar terms.

International reserves - Gold reserves in ounces (1ad) times average gold price (11276krz) plus total reserves minus gold (11.d).

Exchange rate - Units of local currency per U.S. dollar (rf).

Exports - Export flows in millions of U.S. dollars (70); exports reported in local currency terms were converted using the exchange rate series.

Imports - Import flows in millions of U.S. dollars (71); imports reported in local currency terms were converted using the exchange rate series.

Country-specific shocks are defined as VAR model in-sample errors. Because of data availability, and the likely structural changes resulting from the onset of external debt problems, country-specific models were estimated over the January 1983 to October 1989 interval. Inclusion of seasonal dummies and trend constants, as well as the choice of two, four, or six lags were based on log likelihood ratio tests. Four-variable VAR models were estimated with the exceptions of Nigeria, since monthly exports and imports flows are reported at a substantial lag, and, because export figures are not available and currencies are fixed against the dollar, Panama and Honduras. In addition, the foreign currencies of Zaire, Mexico, Argentina, Bolivia, Brazil, Ecuador, Peru, Venezuela, and Yugoslavia were not modelled due to non-stationarity. Instead exchange rates were assumed to follow a random walk process, thus innovations in these series are defined as first differences.

Innovations to reserve-import ratios were defined as in-sample errors in ARIMA processes (monthly imports for Nigeria were obtained by interpolating quarterly data), with specification based on test statistics of best fit.

External Debt Repayment Interruptions and Resumptions

Announcements of discrete changes in debt payment streams were defined as publicly reported changes in interest and/or principle of 50 percent or more, as reported in the New York Times or Wall Street Journal. Dummy variables used in the estimation were assigned a value of one for the month that the announcement was made. The discrete payment changes that took place from April 1987 to October 1989 are listed below.

Dates of Discrete Payment Change Announcements

Country	Interruption	Resumption
Dominican Republic	August 18, 1989 September 28, 1989	
Argentina		July 21, 1989
Brazil	July 5, 1989 September 19, 1989	January 25, 1989
Ecuador	March 14, 1987	March 23, 1989 July 23, 1989
Venezuela	January 3, 1989 February 2, 1989	October 7, 1989
Poland	April 28, 1989	

References

Alexander, Lewis, and Samira Kawash, "Measuring Market Perceptions of Credit Risk on Bank Loans to Developing Countries", Board of Governors of the Federal Reserve System, (mimeographed, 1988).

Berg, Andrew, and Jeffrey Sachs, "The Debt Crisis: Structural Explanations of Country Performance," Journal of Development Economics, 29, (1988), 271-306.

Bird, Graham, Essays in International Finance "Loan-Loss Provisions and Third-World Debt," No. 176, (International Finance Section Editorial Staff, Department of Economics, Princeton University, Princeton, New Jersey, November 1989).

Bulow, Jeremy, and Kenneth Rogoff, "A Constant Recontracting Model of Sovereign Debt," Journal of Political Economy, 96, (1989b), 155-178.

Chamberlain, Gary, and Micheal C. Rothschild, "Arbitrage, Factor Structure, and Mean-Variance Analysis in Large Asset Markets," Econometrica 51, (1983), 1281-1304.

Chen, Nai-fu, Richard Roll, and Stephen A. Ross, "Economic forces and the stock market," Journal of Business 59, (1986), 383-403.

Cohen, Daniel, "Is the Discount on the Secondary Market a Case for LDC Debt Relief?," World Bank, PPR Working Paper, (1989).

Connor, Gregory, 1984, "A Unified Beta Pricing Theory," Journal of Economic Theory 34, (1984), 13-31.

Connor, Gregory, and Robert A. Korajczyk, "Performance Measurement with the Arbitrage Pricing Theory," Journal of Financial Economics, 15, (1986), 373-394.

Dornbusch, Rudiger, "Our LDC Debts," NBER Working Paper No. 2138, (1987).

Fischer, Stanley, "Resolving the International Debt Crisis," NBER Working Paper No. 2373, (1987).

Froot, Kenneth, and Paul Krugman, "Market-Based Debt Reduction for Developing Countries: Principles and Prospects," (mimeographed, 1990).

Gultekin, Bulent, and Richard Rogalski, "Government Bond Returns, Measurement of Interest Rate Risk, and the Arbitrage Pricing Theory," Journal of Finance 15, (1985), 43-61.

LDC Debt Report, various issues, 1990.

Lessard, Donald, "Beyond the Debt Crisis: Alternative forms of Finance Growth," presented at World Bank Symposium on Dealing with the Debt Crisis: The Evolution of Developing Country Debt Difficulties and a Range of Policy Options, (Washington, D.C., September 1988 and revised December 1988).

McElroy, Marjorie, and Edwin Burmeister, "Arbitrage Pricing Theory as a Restricted Multivariate Regression Model," Journal of Business and Economic Statistics 6, (1988), 29-42.

McFadden, Daniel, Richard Eckaus, Gershon Feder, Vassilis Hajivassiliou, Stephen O'Connell, "Is There Life After Debt? An Econometric Analysis of Developing Countries, in Gordon Smith and John Cuddington, eds.," International Debt and the Developing Countries, The World Bank, (Washington, D.C., 1985).

Roll, Richard, and Stephen A. Ross, "An Empirical Investigation of the Arbitrage Pricing Theory," Journal of Finance 35, (1980), 1073-1103.

Ross, Stephen A., "The arbitrage theory of capital asset pricing," Journal of Economic Theory 13, (1976), 341-360.

Sachs, Jeffrey, "International Policy Coordination: The Case of the Developing Country Debt Crisis," prepared for the NBER Conference on International Policy Coordination, Dorado Beach, Puerto Rico, Harvard University, (1987).

Sachs, Jeffrey, "New Approaches to the Latin American Debt Crisis," prepared for the Harvard Symposium on New Approaches to the Latin American Debt Crisis, Institute of Politics, Kennedy School of Government, Harvard University, (1988).

Stone, Mark R., "Country-Specific Effects and Alternative Distributional Assumptions for a Simple Developing Country Debt Rescheduling Model," (mimeographed, 1988).

_____"The responsiveness of Sovereign Debt Market Valuations to Economic Aggregates During the 1920s and 1930s," (mimeographed, 1989).

_____"Are Sovereign Debt Secondary Market Returns Sensitive to Macroeconomic Fundamentals? Evidence from the Contemporary and Interwar Markets," Journal of International Money and Finance (forthcoming).

Vatnick, Silvina, "The Secondary Market for Debt: A Possible Explanation of How LDC Debt Prices are Determined," (mimeographed, World Bank, 1988).

World Bank, Quarterly Review of Financial Flows to Developing Countries, various issues.

World Bank, World Debt Tables (1989).