Developing Countries in World Financial Markets:

Studies of Emerging Stock Markets, Direct Investment, and Debt

by

Elaine Karen Buckberg

B.A., Yale University (1989)

Submitted to the Department of Economics in partial fulfillment
of the requirements for the degree of

Doctor of Philosophy

at the

Massachusetts Institute of Technology

February 1993

© Elaine Karen Buckberg, 1993. All rights reserved.

The author hereby grants to MIT permission to reproduce and to distribute copies of this thesis document in whole or in part.

Signature of Author . . . . . .
Department of Economics
January 20, 1993

Certified by . . . . . .
Paul R. Krugman
Professor of Economics
Thesis Supervisor

Certified by . . . . . .
Stanley Fischer
Killian Professor of Economics
Thesis Supervisor

Accepted by . . . . . .
Richard Eckaus
Chairman, Graduate Committee

MASSACHUSETTS INSTITUTE
OF TECHNOLOGY

MAR 22 1993

ARCHIVES

LIBRARIES

Developing Countries in World Financial Markets:

Studies of Emerging Stock Markets, Direct Investment, and Debt

by

Elaine Karen Buckberg

Submitted to the Department of Economics on January 20, 1993, in partial fulfillment of the requirements for the degree of Doctor of Philosophy

Abstract

Three essays analyzing capital flows from industrial to developing countries comprise this dissertation. An analysis of how regulation of creditor banks may have impeded debt forgiveness in the 1980s debt crisis is followed by studies of two market-based sources of capital, foreign direct investment and portfolio investment. The three studies parallel the shift from sovereign debt to equity capital, in the form of direct or portfolio flows, as the dominant source of foreign capital available to developing economies. In each chapter, I address how policies in either the industrial (donor) countries or developing (recipient) economies can affect the magnitude of capital flows, and thereby affect investment and economic growth. Chapter 2 uses the International Capital Asset Pricing Model to investigate whether emerging stock markets are yet part of the global capital market and characterizes return behavior in these markets, with particular attention to market characteristics which may explain why risk premia persist. In Chapter 3, I analyze the impact of exchange rate policy, particularly the magnitude of the black market premium, on foreign direct investment flows to four highly-indebted countries. Chapter 4 provides an empirical study of the impact of bank regulation on secondary market prices of developing country debt and on the resistance of creditors to debt forgiveness in the 1980s debt crisis.

Thesis Supervisor: Paul R. Krugman
Title: Professor of Economics

Thesis Supervisor: Stanley Fischer
Title: Killian Professor of Economics

Acknowledgements

The deepest thanks belong to my parents, Albert and Gloria Buckberg, and to Ted Botimer, who provided unmeasurable emotional support over the last three and a half years. Without their patience and caring, I would not be writing these acknowledgements today, and might never have had the strength to complete my degree. Particular credit goes to my father, an economist himself, who regularly reminded me of why I wanted to be an economist in the first place, of the relevant policy problems economics could help me address, of the exciting jobs I could access with a Ph.D.

My professors have taught me so well that I am impressed with my own knowledge and command of economics. Paul Krugman has not only provided careful guidance on my thesis, but has taught me strategies to write a good paper, and has always found the time to talk with me, for thirty minutes or an hour at a time, when I needed feedback on my work. I am equally grateful for his confidence in me as a student and an economist, which helped to have confidence in myself and my work.

To Stanley Fischer, my toughest critic throughout my dissertation process, I extend my thanks for always being demanding, and thereby inducing me to improve my work and never settle for good enough. He deserves most credit for teaching me to make my work defensible, as well as commendation for his incredible meticulousness as an advisor (who else would comment on my footnotes?) I am grateful for his high standards; praise for my research from Professor Fischer meant more than from anyone else.

Rudi Dornbusch has taught me quick intuition and professionalism. His international finance lectures laid the foundation for my dissertation and for my thinking as an international economist. Rudi's notorious 8am international "breakfasts" taught me everything I know about public speaking and presentation strategy.

Several other members of the faculty were instrumental in guiding my dissertation. John Heaton spent at least as many hours discussing my emerging markets paper with me as my advisors and deserves equal credit; he patiently explained the subtleties of the conditional Capital Asset Pricing Model, of the generalized method of moments, of the relevant finance literature. Andrew Bernard tirelessly answered my econometrics questions at night and on weekends, read as many paper drafts as Professors Krugman and Fischer, and made special appearances at the international workshop whenever I spoke. I have also benefitted from discussions with Peter Diamond and Danny Quah.

My fellow students have helped me through my degree with camaraderie, cooperation, and comments. I want to extend special thanks to Nathan Sheets and Bill Miracky, my office mates and sounding boards; Tasneem Chipty and Ruth Judson, my econometrics and Gauss consultants; Maura Doyle, the roommate with whom I struggled through first year; Jim Morsink and Brian Aitkin for assuring me that there is life after graduate school; and also Martina Copelman, Raul Livas-Elizando, Linda Bui, and the members of the International Breakfast and Money Lunch Groups.

Finally, I am grateful to Guy Pfefferman and Peter Tropper of the International Finance Corporation for providing me with the Emerging Markets Database.

A National Science Foundation Research Fellowship provided dissertation research.

Table of Contents

List of Figures

Chapter 2

Chapter 3

Chapter 4

List of Tables

Chapter 2

Chapter 3

Chapter 4

Chapter 1

Introduction and Summary

Three essays analyzing capital flows from industrial to developing countries comprise this dissertation. An analysis of how regulation of creditor banks may have impeded debt forgiveness in the 1980s debt crisis is followed by studies of two market-based sources of capital, foreign direct investment and portfolio investment. The three studies parallel the shift from sovereign debt to equity capital, in the form of direct or portfolio flows, as the dominant source of foreign capital available to developing economies. In each chapter, I address how policies in either the industrial (donor) countries or developing (recipient) economies can affect the magnitude of capital flows, and thereby affect investment and economic growth.

In Chapter 2, I investigate whether emerging stock markets are yet part of the global financial market and characterize return behavior in these markets. Particular attention is given to market characteristics that may explain high risk premia. Tests of the conditional International Capital Asset Pricing Model (ICAPM) reveal that fourteen of the twenty largest emerging markets were integrated over 1985-91, but that many of the same markets reject the model using data from 1977-84. These results suggest that large capital inflows from industrial countries, catalyzed by East Asian stock market booms in the late eighties, caused prices in emerging markets to reflect covariance risk with the world portfolio and thus induced their consistency with the ICAPM. Small-market effects, policy uncertainty, and capital controls all contribute to high rates of return, thereby keeping the cost of capital high. The paper also finds strong predictable patterns in emerging-market returns, suggesting speculative inefficiency.

My third chapter examines the impact of exchange rate policy in developing countries on foreign direct investment (FDI) inflows. As real exchange rate shifts have been found to explain the dramatic rise in direct investment in the United States in the late eighties, this essay asks whether exchange rate effects can explain the large drop in direct investment flows to highly-indebted countries following 1982 and the rapid recovery between 1988 and 1990. I present

panel and time-series studies of direct investment flows to Argentina, Brazil, Mexico and the Philippines over 1979-89, using quarterly data. I find that the black market premium, representing the difference between the official exchange rate and the value that would prevail were the rate market-determined, is negatively and significantly correlated with direct investment flows; these results indicate that the uncertainty about profits arising from an expected devaluation and the overpricing effects resulting from an overvalued exchange rate both deter direct investment. The rate of change in the real exchange rate also has a negative impact on direct investment flows, however, the level of the real exchange rate has no significant impact. Lagged GDP growth has a strong and positive impact on direct investment flows. My results suggest that an exchange rate regime which keeps the official rate at its market-clearing level is most conducive to attracting direct investment, and that cycles of overvaluation and devaluation deter potential investors.

Chapter 4 analyzes how bank regulation in the United States has biased creditor banks against debt forgiveness, leading them to instead prefer agreements that reschedule interest and principal repayments. Because the federal government will take over insolvent banks, and the bank's debts will then be met by U.S. taxpayers, banks view their profits as bounded below at zero. If in any state of nature, a country's default can cause a bank to go bankrupt and be taken over, then the expected value of holding that debt to the bank is the expected value over all non-bankruptcy states, which exceeds the expected value of the debt over all states. An empirical analysis of secondary prices of loans to twenty highly indebted countries finds that the greater the exposure of the nine money-center banks to a given debtor in relation to their capitalization, the higher the secondary price of a nation's debt. The exposure of the banks to all large debtors combined similarly biases upward secondary prices of each country's debt.

Chapter 2

Emerging Stock Markets and International Asset Pricing

The year 1981 saw the formation of the first emerging market country funds to attract investors to developing country stocks; today, big Wall Street brokerages track LDC issues and *Business Week*'s June 1992 investment guide recommended a Brazilian cigarette manufacturer to investors seeking high yields. From the perspective of developing countries, stock markets offer a promising channel through which they can attract foreign capital to fund investment and growth.

So-called emerging markets are large and expanding rapidly, yet they continue to exhibit very different risk and return characteristics than comparably-sized developed markets. The combination of supranormal yields, highly autocorrelated returns, and volatile prices suggest that these markets may be inefficient, that excess returns may exist, and that emerging markets may not be fully integrated into global capital markets. More importantly, consistently high rates of return in these countries translate into a high cost of capital, which limits the stock market's role as a source of private financing.

This paper investigates whether emerging markets are now part of the world financial market and why they behave differently from developed markets. Using monthly data from December 1984 to December 1991, I test the conditional formulation of the International Capital Asset Pricing Model (ICAPM) and am unable to reject the model for fourteen of the twenty emerging markets. Tests on earlier data, however, indicate that few emerging markets were integrated prior over 1977-84. These results suggest that large capital inflows from industrial economies, catalyzed by Southeast Asian stock market booms around 1987, induced ICAPM relationships to evolve in many previously segmented markets. Emerging markets also exhibit powerful evidence of predictability--widely interpreted as evidence of speculative inefficiency in developed markets. Highly autocorrelated returns suggest that lagged prices may contain exploitable information about future returns; I test and reject the hypothesis that lagged price information cannot predict future returns.

How can emerging markets offer consistently higher returns, even with open borders? An analogy to another excess return phenomenon helps explain the presence of excess returns in emerging markets. The finance literature has documented that closed-end funds consistently sell at a discount relative to the value of their constituent stocks. Closed-end funds are illiquid relative to larger capitalization stocks, and often relative to their components; shares are fewer in number and are typically held and traded primarily by individual rather than institutional investors. Lee, Schleifer, and Thaler (1992) explain closed-end-fund underpricing as a reflection of the vulnerability of these illiquid issues to swings in investor sentiment (optimism or pessimism about the market), which compounds the risk inherent in the fund portfolio. They also argue that vulnerability to investor sentiment may similarly explain why small capitalization stocks are undervalued relative to their fundamentals. In other words, investors demand compensation for taking on pure variance risk, or illiquidity risk.

Like closed-end funds, emerging markets have small total capitalization (relative to the dominant markets in New York, Tokyo, and London) and relatively few participants. Insider information, rather than being banned, is often the norm; as a result, only a few well-informed nationals, foreign institutional investors such as country funds, and the rare foreign individual investor participate. While the major stock markets come as close as any real market to the ideal of the Walrasian auction, the combination of few listings and few traders means that trade in an emerging stock market may more closely resemble a search model.[1]

Standard models including the ICAPM ignore illiquidity risk inherent in small or highly concentrated models. They also ignore the impact of policy uncertainty that may introduce "peso

---

[1]The consistent underpricing of closed-end funds and the "small firm effect" of high returns to small capitalization stocks reveal imperfections in even the largest stock markets. The impact of investor sentiment on closed-end funds and small stocks reflects the fact that the large trade in these issues can move prices. See Lee, Schleifer, and Thaler (1991).

problems," where high compensation demanded against a low-probability event may cause returns to look excessively high. The ICAPM and Asset Pricing Theory (APT), for example, consider only a stock's sensitivity to risk factors common to all stocks in the portfolio in question, such as oil prices, interest rates, or the return on the world portfolio. Relative to the large markets such as New York and London, emerging markets have smaller total capitalizations, lower trading volumes, and are typically more concentrated in the largest stocks--all characteristics which introduce additional risk. In analyzing how emerging markets differ from developed markets, this paper will consider how market development and the policy environment may affect return behavior.

This paper is organized in eight sections. The first section establishes stylized facts which describe emerging markets. The second covers the econometric methodology for estimating the ICAPM, and the third documents the data. The fourth presents results of the ICAPM estimation, and section V tests for the impact of capital controls on integration. Section VI examines the power of fundamentals to predict stock returns. After an analysis of why emerging market returns differ from developed market returns in section VII, section VIII concludes.

I. Characterizing Emerging Markets

Emerging stock markets have risen swiftly both in value and as a source of financial flows. However, they remain different in many ways from the mature markets in industrial economies. This section briefly outlines the rise of emerging markets, then highlights return patterns and policy attributes that distinguish emerging markets from their developed counterparts.

In relation to world financial markets, emerging markets have expanded from insignificant

to substantial within a decade. At the end of 1991, the market capitalization of the twenty largest emerging markets totalled $624.7 billion, equal to 60 percent the size of the London stock market, or almost twice the size of either the French or German market. Taiwan's stock market now ranks tenth in the world in capitalization, between Australia and South Africa; Mexico, Korea, Malaysia, India and Brazil also fall in the top twenty. (See table 1.) The twenty largest markets grew 885 percent over 1982-91, 442 percent over 1985-91, and 69.6 percent over 1988-91, far outstripping growth rates of 303 percent, 136 percent, and 14.4 percent, respectively, for developed markets.

As the markets have grown, so has the magnitude and importance of equity flows to LDCs. The onset of the debt crisis in 1982 forced developing countries to seek new sources of financing. By 1989 equity investment superseded bank loans as the primary source of development finance: *The Economist* estimates 1991 equity flows to all developing countries at over $10 billion and bank loans around $3 billion.[2] Portfolio investment accounts for a substantial share of equity flows. Latin American stock exchanges alone received an estimated $50 billion in the eighteen months ending in June 1992.[3] Korea and India both announced openings in 1992 with the goal of attracting foreign funds to finance corporate investment; the head of the Bombay Stock Exchange predicted an inflow as high as $2 billion within a year.[4] In addition, many Eastern European nations are counting on new stock markets to facilitate privatization and attract capital to fund industrial transition and modernization.

Price and return patterns reveal some of the most crucial differences between emerging markets from their developed counterparts. Many LDC markets offer both yields far in excess

---

[2]*The Economist*, 12 September 1992, p.15.

[3]*Business Week*, 15 July 1992, p.61.

[4]*The Economist*, 19 September 1992, p.64.

of developed market returns and low to negative correlation with the world market, suggesting that unexploited profit opportunities may exist. High autocorrelation in returns, characteristic of speculative inefficiency, indicates that lagged prices may contain information about future returns; volatile stock prices also suggest inefficiency. Both small-market effects and informational imperfections may induce price volatility in emerging markets. In addition, rapidly rising price-earnings ratios signal ongoing transition in emerging markets. From 1988 to 1991, price-earnings ratios more than doubled in seven of twenty emerging markets tracked by the International Finance Corporation's Emerging Markets Database (EMDB), and more than tripled in four (Argentina, Chile, Pakistan and Turkey).[5] Over the same period, the ratio of price to earnings of Morgan Stanley Capital International's World index rose only 22 percent.

Policy and macroeconomic considerations also distinguish emerging markets from developed markets. The policy environment governing future returns tends to be more uncertain in emerging markets than in industrialized nations. Developing economies also tend to more dramatic cyclical fluctuations then OECD economics, with rapid growth followed by contraction, causing parallel swings in the ratio of firms' assets to earnings. In addition, many LDCs impose capital controls which insulate the local stock exchange from global markets. All but five of the twenty markets considered here bar nationals from holding foreign securities, such that emerging markets are populated by investors who cannot diversify internationally. All but two of the markets banned or severely restricted foreign investment during part of the 1985-91 sample period. Markets where neither foreign nor local capital can freely cross borders lack the capital flows necessary to induce a ICAPM relationship.

Those markets that have liberalized restrictions on foreign investment have consistently

---

[5]The Emerging Markets Database (EMDB) contains data on Argentina, Brazil, Chile, Colombia, Greece, India, Indonesia, Jordan, Korea, Malaysia, Mexico, Nigeria, Pakistan, the Philippines, Portugal, Taiwan, Thailand, Turkey, Venezuela and Zimbabwe.

experienced huge price increases. In 1991, four markets eliminated closed market regimes in favor of policies of free entry and exit. Each witnessed December-to-December price-earnings ratio increases between 40 and 1000 percent: Argentina (over 1000 percent), Brazil (43 percent), Colombia (over 140 percent), and Pakistan (over 180 percent).[6] (See table 2.) Because broader economic reforms typically accompany financial openings, price-earnings ratios may in some cases rise in the short run in expectation of future earnings gains, then return to their previous levels once earnings increase.[7] However, in a number of cases price-earnings ratios have risen continuously for several years after the opening, suggesting that the markets were historically undervalued; the 1989 openings in Chile, Mexico and the Philippines all provide examples.

Although emerging markets compose over five percent of world capitalization, developing country shares are underrepresented in international mutual funds, typically composing only 0.5 percent of American and British funds.[8] Fund managers generally hold fewer foreign stocks than optimal portfolio theory predicts; they steer away from emerging market stocks because they view them as particularly risky due to their high return variance. Papers by Speidell and Sappenfield and Divecha, Drach, and Stefak argue that given the low correlation of emerging market stocks with the Standard and Poors 500 (an average of 0.6), an investor should put up to 20 percent of his or her portfolio in emerging market issues. Despite substantial variance in returns, low covariance with the world would reduce total portfolio risk while increasing average returns as

---

[6]Argentina previously admitted foreign investors but prohibited repatriation of capital until three years from the date of initial investment. Brazil admitted investment only into special share classes or through a country fund, and also restricted repatriation.

[7]While in monopolized local industries a trade opening should reduce rents, earnings may actually rise in competitive industries. The entry of foreign firms increases competition in the local market, forcing domestic firms to become more productive, efficient, and competitive to survive. As a result, the government can no longer to appropriate as high rents from local producers, whether through taxation, fees or kickbacks. The average return retained by local firms may therefore actually rise; earnings may also rise as the firms become more streamlined and efficient.

[8]*The Economist*, 24 October 1992, p.87.

much as two percent.[9] These optimal portfolio share estimates, however, disregard both liquidity problems and the political risk associated with LDC stocks, introduced by potential devaluation, expropriation, or bans on repatriation. In fact, emerging markets are too small to absorb capital flows equal to even five percent of all mutual funds without becoming greatly overpriced. Moreover, such large capital inflows would doubtless change the relationship between world and emerging market returns, and subsequently change the optimal portfolio share. This paper will examine the impact of capital flows on both market development and the relationship between world and local returns.

II. Specification of the Conditional ICAPM

The International Capital Asset Pricing Model states that if emerging markets are part of a global market, then each market's returns should be proportional to that market's covariance with a capitalization-weighted world portfolio. If emerging markets are not integrated into the world markets--that is, if returns do not reflect covariance with the world portfolio--then by adding LDC issues to their portfolios, investors can both reduce overall risk and increase expected returns. As developed country investors increasingly participate in emerging markets (and vice versa), they should exploit and subsequently eliminate any excess returns relative to the ICAPM. This paper takes as given the ICAPM's validity as a description of mature markets, based on its success at describing return behavior on OECD exchanges.[10] Treating each

---

[9]Arjun Divrecha, Jaime Drach and Dan Stefek, "Emerging Markets: A Quantitative Perspective" and Lawrence Speidell and Ross Sappenfield, "Global Diversification: In a Shrinking World," both forthcoming in *The Journal of Portfolio Management* and reviewed by *The Economist*, 24 October 1992, p.87.

[10]See Harvey (1991), Dumas and Solnik (1992).

country's market index as a portfolio, the paper tests whether LDC market returns are consistent with the model's predictions. The study focuses on data covering 1985-91, for twenty markets, and also examines a smaller, longer sample from 1977-91 to investigate whether emerging markets became more integrated after equity capital inflows from industrialized countries took off in the late eighties.

Numerous papers have tested the Sharpe-Lintner (1964, 1965 respectively) asset pricing model using international data. The model assumes that investors divide their wealth between a riskless asset and risky assets or stocks, in proportions that depend on each investor's risk aversion. Extending the model internationally allows investors to choose among stocks from many countries rather than from a single stock market; the market portfolio now includes all the assets in the world. In choosing a portfolio of risky assets, investors seek a high expected return to variance ratio.

The ICAPM states that the expected return on any given risky asset in excess of the safe rate is proportional to the expected return on the market in excess of the safe rate:

$$E[r_j] - r_f = \beta\,[E[r_w] - r_f] = \frac{cov(r_w, r_j)}{var(r_w)}[E[r_w] - r_f], \tag{1}$$

where r_j is the return on some asset j and r_w is the return on the world, or market, portfolio. Under the model, optimizing behavior leads investors to care only about covariance risk with the market portfolio and about no other sources of risk; the ICAPM relationship should evolve out of investors' efforts to diversify risk. A stock or portfolio is integrated with the defined market in a ICAPM sense if its returns are consistent with the model.

Under the ICAPM, a stock with a large return variance may or may not require a risk premium for investors to hold it. If the stock's return fluctuations are positively correlated with

the market, the stock will have a large beta and a positive risk premium; if the stock's return fluctuations are uncorrelated with the market, investors can diversify away the asset's risk and $E[r_j] = E[r_f]$; if the stock's return fluctuations are negatively correlated with the market, the stock provides a hedge against market risk and investors will hold it even if its return is less than the riskless rate. Many empirical studies reduce the model's complexity by creating multi-stock portfolios and allowing the investors to divide their assets among the riskless asset and the risky portfolios. This study takes that approach, utilizing a representative portfolio for each emerging market.

The only integration tests on emerging market data appear in Errunza and Losq (1985b) and Errunza, Losq, and Padmanabhan (1991). Errunza and Losq develop a mild segmentation hypothesis intended to describe markets closed to foreign investment. Errunza, Losq and Padmanabhan use an unconditional model to test alternative hypotheses of integration, mild segmentation, and segmentation, all relative to the U.S. Using stock data for eight markets from January 1976 to December 1987, they find that six markets reject all except the mild segmentation hypothesis, two reject neither mild nor complete segmentation, and India to rejects all three hypotheses.[11] The fact that India falls into none of the three categories raises serious questions about Errunza et. al.'s market classification scneme. Another problem lies in the use of the U.S. to represent the world portfolio. Because it represented no more than two-fifths of the world market in capitalization between 1976 and 1987, the U.S. seems a poor proxy, especially for emerging markets in Asia or Europe.

Following recent work by Harvey (1989, 1991) and Dumas and Solnik (1992), this study uses conditional or expectational asset pricing to test Sharpe and Lintner's model. "Conditional" refers to the use of conditioning information--some information set Z_{t-1}--to calculate expected

[11]Seven to seventeen stocks per market, or five to ten percent of listings.

moments and properly test the ICAPM as a relation between expected returns and *ex ante* risk. Earlier tests of the ICAPM used realized or *ex post* return and covariance data, and thereby failed to capture the *ex ante* relationship described by the theoretical model. Sharpe (1978) himself criticized unconditional tests of the CAPM: "Unless one is prepared to reject the most rudimentary notions about risk aversion, it follows that at least some of the measured *ex post* values do not adequately reflect *ex ante* predictions.... Any test using *ex post* values is a joint test of asset pricing and a return generating process."

The conditional formulation restricts the conditionally expected return on an asset (based Z_{t-1}) to be proportional to the asset's covariance with the market portfolio, yet allows expected returns to vary over time:[12]

$$E[r_{jt}|Z_{t-1}] - E[r_{ft}|Z_{t-1}] = \beta\,(E[r_{mt}|Z_{t-1}] - E[r_{ft}|Z_{t-1}]),$$
$$\text{where } \beta \equiv \frac{Cov(r_{jt}, r_{mt}|Z_{t-1})}{Var(r_{mt}|Z_{t-1})}. \qquad (2)$$

The proportionality factor β, which is also calculated conditionally, represents the price of covariance risk or the expected return compensation investors demand for taking on a unit of covariance risk. My modelling and specification borrow from Harvey (1991).

The conditional ICAPM successfully explains both time-series variation and cross-section differences in OECD market returns.[13] Harvey(1991) finds returns consistent with the ICAPM in fourteen of seventeen OECD markets--an 82 percent success rate--over 1970-89; only Austria, Denmark, and Japan reject the model. Moreover, the betas he obtains for each market accurately explain differences in mean returns across markets, with the exception of underestimating the

---

[12]Conditional variances and covariances may also be allowed to vary over time, with sufficient data. The short sample of emerging markets data does not permit estimation of time-varying variances or covariances. See Harvey (1991) for an example.

[13]The unconditional formulation of the model had done poorly.

Japanese return. The fact that the model fails for Austria and Denmark, the two smallest OECD markets, suggests that illiquidity or other small-market effects may impede the evolution of ICAPM relationships. Harvey also runs a multi-country test over all Group of Seven nations and is unable to reject the model. Using a slightly different formulation, Dumas and Solnik analyze U.S., German, and Japanese returns simultaneously, and are unable to reject the model as a description of return patterns in all three markets.

Following Harvey (1991) and Stulz (1981), I make two assumptions necessary to extend the CAPM internationally: first, perfect correlation between the value of the world market portfolio and world consumption, and second, the existence of a global investor who measures returns in U.S. dollars.[14] For this global investor, the nominal rate of return on a Treasury bill thirty days to maturity is conditionally risk-free (conditionally known). The U.S. inflation component in dollar stock returns cancels out against the inflation component in the T-bill return.

The conditional ICAPM asserts that the conditionally-expected return on some asset j (adjusted for r_f) will be proportional to its covariance with the world portfolio:

$$E[r_j|\Omega_{t-1}] = \frac{E[r_m|\Omega_{t-1}]}{Var[r_m|\Omega_{t-1}]} Cov[r_j, r_m|\Omega_{t-1}], \tag{3}$$

where $E[r_m]$ is the conditionally-expected return on the market portfolio and $E[r_j]$ is the conditionally-expected return on asset j. Expected returns, covariances, and variances may all vary over time.

Assume that investors use a linear filter to interpret information:

where u_j is the forecast error on the return in market j, Z_{t-1} are l information variables (instruments) and a subset of the t-1 information set, and δ_j are time-invariant weights used to

[14]A valuable extension of this model would be to test an expanded ICAPM which includes the return on the dollar-local currency exchange rate as a second risk factor. Dumas and Solnik (1992) give some consideration to exchange risk.

$$u_{jt} = r_{jt} - Z_{t-1}\delta_j, \tag{4}$$

derive the conditional expected rate of return.

One obtains the estimable form of the model by using (4) to rewrite (3) in terms of prediction errors. Rearranging yields

$$\begin{aligned} Z_{t-1}\delta_j &= \frac{E[u_j u_w | Z_{t-1}]}{E[u_w^2 | Z_{t-1}]} Z_{t-1}\delta_w \\ &= \beta(Z_{t-1}\delta_w), \end{aligned} \tag{5}$$

where u_w is the forecast error on the market portfolio, $E[u^2_w | Z_{t-1}]$ is the conditional variance, and $E[u_w u_j | Z_{t-1}]$ is the conditional covariance.

The estimates in this paper impose the restriction that the conditional variance and covariance are constant over time and test whether expected returns in the local market are proportional to the expected return on a benchmark portfolio, in this case the world portfolio. Using Hansen's (1982) generalized method of moments(GMM), I estimate a constant proportionality factor β,

$$\epsilon_{jt} = r_{jt} - r_{wt}\beta, \tag{6}$$

which is equivalent to equation (3), and then form the orthogonality condition

$$f(r_{jt}, \beta) = \epsilon'_{jt} Z_{t-1}, \tag{7}$$

where r_j and r_w now denote the local and world excess returns.

Single market tests determine whether the time series behavior of local returns accords with equation (7) and identify which emerging markets do not reflect covariance with the world market. However, the single-market tests do not impose one of the ICAPM's restrictions: that

the price of covariance risk must be the same for each market,

$$\frac{E[r_{wt}|Z_{t-1}]}{Var[r_{wt}|Z_{t-1}]} = \textit{constant for all } j, \tag{8}$$

where the price of covariance risk is the conditionally expected world market return divided by the conditional variance of the world market. A stricter test of the model, including the cross-asset restriction, is obtained by estimating equation (6) on multiple countries in a system.

Under standard econometric assumptions, $E[\epsilon_t|Z_{t-1}] = 0$, where ϵ_t is a vector of pricing errors. For the equation to be identified, the number of orthogonality conditions (equal to the number of instruments in Z_{t-1}) must equal or exceed the number of parameters. Equation (6) allows expected returns to vary over time, but because of the small sample size I cannot estimate time-varying conditional variances or covariances. Although allowing more moments to vary makes the specification more flexible and more realistic, Harvey found that equation (6) produced results similar to those obtained using a more complex specification.

The generalized method of moments uses an iterative procedure to obtain a consistent and efficient estimate of β. GMM is a very flexible technique, of which any form of linear regression and non-linear instrumental variables are special cases. The estimates here use a minimum of three iterations; with three iterations, GMM is equivalent to three-stage least squares or generalized least squares (GLS). Additional iterations may improve the small sample properties of the estimates, and the GMM approach makes additional iterations easy to perform.[15]

The orthogonality condition (7) implies that the moment restrictions

[15]To perform my GMM estimation, I use the Gauss procedures prepared by Hansen, Heaton, and Ogaki (1992) under the sponsorship of the National Science Foundation.

$$E(\epsilon_j) = E(f(r_j, \beta)) = 0 \tag{9}$$

hold, where $f(r_j,\beta)$ is referred to as the wing. GMM estimation mimics this moment restriction by minimizing a quadratic form of the sample means,

$$J_T(\beta) = \left[\frac{1}{T}\sum_{t=1}^{T} f(r_j, \beta)'\right] W_T \left[\frac{1}{T}\sum_{t=1}^{T} f(r_j, \beta)\right] \tag{10}$$

with respect to β. W_T, the variance-covariance matrix(VCV) of wing $f(r_j,\beta)$, is a positive definite matrix satisfying

$$\lim_{t\to\infty} W_T = W_0 \tag{11}$$

with probability approaching one for positive definite matrix W_T; both W_T and W_0 are referred to as the weighting matrix. The weighting matrix provides a distance metric which translates the value of the squared function at each iteration to a measure of the function's distance from zero. For W = I, the distance metric is simply the squared deviation from zero. Hansen (1982) shows that the optimal weighting matrix, i.e., the one which minimizes the variance-covariance matrix of $\hat{\beta}$, is the inverse VCV of the wing.

One begins the iterative procedure with W = I and minimizes (7) to obtain β_T and W_T. Using the new matrix W_T, one then repeats the minimization process; the number of iterations equals the number of times (7) is minimized to obtain new values for β and W. Two iterations should yield an asymptotically consistent estimate for β, β_T. However, Monte Carlo simulations have shown that repeated iteration over the weighting matrix improves the small sample properties of the estimates. All single-market estimates in this paper are obtained after three to five iterations over W_T, with the procedure ceasing before five iterations if W_T has converged; multi-country estimates use as many as sixteen iterations to obtain convergence.

The minimized value of the quadratic form (7) is distributed χ^2 under the null hypothesis, with degrees of freedom equal to the number of orthogonality conditions less the number of parameters, or equal to the number of instruments less the number of parameters. In theory, the minimized value of the quadratic form should be very close to zero. The χ^2 statistic measures how close the errors are to zero (H_0) after repeated iteration, and can be interpreted as an indicator of the model's goodness of fit as it measures whether the quadratic maximand evaluated at the optimal parameter estimates is statistically different from zero. A high value of the χ^2 statistic signals that the disturbances are correlated with the instrumental variables, and that the model may be misspecified.

III. Data and Summary Statistics

The data for LDC stock exchanges come from the Emerging Markets Database(EMDB) compiled by the International Finance Corporation(IFC). The IFC has constructed its own indices for every market, which typically include 10 to 20 percent of listed stocks selected on the basis of high trading activity, large capitalization, or to give the index an industry composition representative of the market overall. Like many of developed market indices, the IFC indices are biased toward local blue-chip stocks, somewhat diminishing their representativeness. All empirical work in this paper uses the IFC's representative indices and treats each as a stock portfolio.[16] Monthly index data are available for seventeen markets from December 1984 to December 1991; data for Portugal, Turkey, and Indonesia start in December of 1986, 1987, and

[16]I choose to work with the IFC indices instead of the locally-calculated market indices as the former offer greater comparability across markets and are, I believe, more carefully calculated.

1988, respectively.[17] The database includes series dating back to December 1976 for ten markets; prior to 1985, however, fewer stocks were sampled to create the market indices.[18]

Market data for industrial nations come from Morgan Stanley Capital International Perspective (MSCI). I represent the World, U.S., Japanese, and European market portfolios by MSCI's indices, where for Europe I use the capitalization-weighted thirteen market index.[19] Ideally the world index would include all the emerging market stocks tested, but neither the MSCI index, nor any other standard world index does so. Like the EMDB indices, MSCI indices contain only selected stocks and are weighted toward large capitalization issues; studies have found, however, that MSCI indices are highly correlated with commonly quoted national indices such as the New York Stock Exchange Index (99.1 percent correlation) or the Nikkei 255 (93.8 percent).[20] The MSCI indices differ from EMDB indices in that investment companies and foreign-domiciled companies are excluded to avoid double counting. However, other forms of double counting still pose problems. According to McDonald (1989) and French and Poterba (1989), MSCI's world index weights Japanese stocks too heavily because it fails to correct for the extensive corporate cross-ownership. Unfortunately, no world index corrected for cross-holding exists.[21]

All developed- and emerging-market returns are calculated as the excess return over the holding yield on the U.S. Treasury bill closest to thirty days to maturity on the last trading day of the month. Government bond data comes from the Center for Research on Securities Prices

---

[17]Stock data is also available for those stocks included in the IFC indices.

[18]The ten markets with longer data series are Argentina, Brazil, Chile, Greece, India, Jordan (begins 1978), Korea, Mexico, Thailand, and Zimbabwe.

[19]The MSCI Europe 13 index includes the United Kingdom, France, Germany, Italy, Norway, Belgium, Denmark, Switzerland, Netherlands, Spain, Sweden, Austria, and Finland.

[20]Harvey, 1991.

[21]See Harvey, 1991.

(CRSP) Government Bond File.

The instrumental variable set should ideally replicate the information investors have and use to predict prices. For each period, I have selected as conditioning information actual rates of return set during the previous period. This choice allows expected returns to vary over time. The common instrument set, identical for all emerging markets, contains information about developed market returns only; local instrument sets also include the lagged rate of return in the local market.[22] Because returns in emerging markets are highly autocorrelated, knowledge of lagged local rates of return should improve an investor's prediction of current returns; moreover, investors likely consider knowledge of the lagged local return to be a prerequisite to investment. (Summary statistics and predictability tests will follow.) However, adding lagged local returns to the information set might generate inconsistent estimates by causing the instruments to be correlated with the model errors. A Hausman test verifies that correlation between errors and local instruments indeed does not pose a problem. I test the null hypothesis that the local instrument set produces estimates that are both consistent and more efficient than the common instrument results, and am unable to reject the null in any of the twenty markets. The results presented here will emphasize the local-instrument results because they are theoretically more appropriate and more efficient. Note that the underlying autocorrelation problem reflects a fundamental flaw of the CAPM. The CAPM assumes independent and identically distributed returns and ignores the presence of serial correlation, but, given serially correlated returns, most investors would prefer a more complicated, intertemporal investment strategy to the CAPM. Because the model assumes that neither serial correlation nor conditional heteroskedasticity exists, I will correct for neither.

---

[22]Preliminary tests also considered the lagged local dividend yield and the lagged return on the dollar-local currency exchange rate as instruments.

The selection of common instrumental variables draws on studies of U.S. stock returns and returns in other industrialized countries. Following Harvey (1991), the information set includes the lagged world excess stock return, a dummy variable for the month of January, the dividend yield on the MSCI World index, a U.S. term structure premium, and the U.S. default risk yield spread. The first instrumental variable is the lagged return on the world market portfolio. Fama (1965) and many studies since have found autocorrelation in returns. The January dummy is included because Keim (1983) and Gultekin and Gultekin (1983) have found systematically higher January returns in the U.S. and other industrialized countries. The third instrumental variable is the one-month return to holding a three-month Treasury bill less the return on a bill thirty days to maturity. Campbell and Hamao (1989) show that measures of the term structure statistically explain returns in Japan and the United States. Based on Keim and Stambaugh's (1986) and Fama and French's (1989) finding that the junk bond spread helps in predicting returns, the information set also includes the difference between the return on a Moody's Baa bond and a Moody's Aaa bond. The final instrumental variable is the dividend yield on the world portfolio. Fama and French (1988, 1989) show the importance of this term in predicting U.S. returns; Cutler, Poterba, and Summers (1989) find that lagged dividend yields also influence international returns. Again, all returns are calculated in excess of the return on a Treasury bill thirty days to maturity.

Table 4 presents summary statistics on the twenty emerging markets in the EMDB and the MSCI World, U.S., Japan, and Europe indices, calculated for 1985:1 to 1991:12. All returns are monthly and unconditional. Fourteen emerging markets have mean returns exceeding those of all the developed market indices, whereas five have mean returns below the developed market range. However, only five emerging markets have higher reward to risk ratios (mean/standard deviation) than the developed markets (Chile, Colombia, Pakistan, Zimbabwe, and the

Philippines), and all five of these opened during the sample period. Relatively low reward/risk ratios indicate that emerging market stocks may need to offer high returns to compensate investors for accepting greater (pure variance) risk. High reward-risk ratios may reflect large capital gains from increases in price-earnings ratios after a market opening, not compensation for additional risk.[23] Figure 1 plots mean returns against return variance for all twenty-four markets. All four developed market indices are closely clustered together, offering very low variances, but also lower than average returns. Three emerging markets also join this tight cluster--India, Korea, Pakistan--and another four offer higher means for only a small increase in variance--Chile, the Philippines, Thailand, and Zimbabwe. Note that Argentina, Brazil, and Turkey have very large return variances.

More striking is the high return autocorrelation in many emerging markets, shown in Table 4. Among developed markets, the world index exhibits the highest one-month autocorrelation at 0.0713, with only Japan exhibiting positive autocorrelation at two months. In contrast, twelve emerging markets exhibit one-month autocorrelation exceeding 0.1000 and the predictable component rises as high as 0.5509 in Indonesia and 0.4999 in Colombia; for Chile, Colombia, Indonesia, and the Philippines the autocorrelations are significant at 95 percent confidence.[24] Six markets also demonstrate autocorrelation over 0.1000 at two-month intervals, although most emerging markets exhibit mean-reversion after two to three months. The high predictable component in emerging market returns far exceeds the autocorrelation in developed markets. According to efficient-markets models that assume risk-neutral investors, high serial correlation suggests that returns contain a predictable component and, therefore, that the market

[23]Note that one developed market portfolio, MSCI's Europe 13 index, dominates the world portfolio.

[24]The Indonesian calculation is based on only 24 observations as the EMDB began tracking the Jakarta market only in December 1989.

is inefficient.[25] Note many of the high-autocorrelation markets experienced openings during or just before the sample period. Month after month of rising prices and high, capital-gains-based returns may explain the high autocorrelations.[26]

For ten emerging markets, Table 5 presents statistics on data covering the longer sample of 1977:1 to 1991:12. When the earlier years are included, all emerging markets' returns except Jordan's fall, and all risk/return ratios worsen, again excepting Jordan. Both emerging and developed market returns exhibit lower one-month serial correlation over this longer period, although five emerging markets still have autocorrelations greater than any of the developed markets (Chile, Greece, Mexico, Thailand, and Zimbabwe).

The correlation matrices of total equity returns in Table 6 show that emerging markets are generally less correlated with the world portfolio and developed markets than developed markets are with each other. Over 1985-91, the U.S., Japan, and European portfolios all exhibit correlations above 0.75 with the world market. However, only seven emerging markets exhibit correlations with the world portfolio exceeding 0.25: Malaysia (the highest at 0.51), Thailand, Portugal, Korea, the Philippines, Mexico, and Taiwan. Meanwhile, Argentina, Indonesia, India, Turkey, Venezuela, and Zimbabwe all offer consistent hedges against the world markets. The combination of high yields and negative correlation with the world portfolio suggest that returns in these markets do not reflect covariance risk and that these markets are not integrated into the world financial market.[27] Over 1976:12 to 1984:12, emerging markets exhibited on average even less correlation with the developed markets. The facts that the markets best known to foreign investors earn the highest correlations and that correlations between developed and

---

[25]See LeRoy (1989) for a survey of the efficient markets literature.

[26]The converse is not true. Not all markets that experienced openings had highly autocorrelated returns; for example, Argentina and Brazil. And Zimbabwe, which receives an autocorrelation coefficient of 0.2740 (significant at 90 percent), did not have an opening.

[27]Indonesia is excepted here; it has offered low returns and low covariance with the world.

emerging markets have risen over time suggest that once foreign investors "discover" an emerging market, it quickly becomes part of the global market.

The OLS regressions in Table 7 examine the predictability of emerging market returns based on the common and local information sets. The primary results are for regressions of the local return on the local instruments for 1985:1 to 1991:12; Newey-West heteroskedasticity- and autocorrelation-robust standard errors appear in parentheses. The last column gives the adjusted R^2 for regressions on the common instrument set, which includes all local instruments except the lagged local return. The fit of the local instrument equation ranges from very good to very poor, with adjusted R^2s ranging from highs of 0.338 for Colombia and 0.294 for Pakistan to negative values. In four markets the adjusted R^2 exceeds any obtained by Cutler, Poterba, and Summers (1989) or Harvey (1992) in their similar attempts to predict OECD market returns. Cutler, Poterba, and Summers (1989) obtained adjusted R^2s from -0.004 (Belgium, Denmark, France, and Sweden) to 0.017 (Austria) in stock return prediction equations. Testing a specification identical to my common instrument set on seventeen established markets, Harvey obtains adjusted R^2s between 0.005 and 0.125. Note that in a number of cases the addition of the lagged local return substantially improves return prediction. For example, for Colombia the R^2 improves from 0.147 with common instruments to 0.338 with the local; for the Philippines the comparable values are 0.131 and 0.074. However, the lagged local return earns a coefficient significant at 90 percent in only five markets, all of which had market openings; the coefficient's sign is positive in fourteen of twenty markets. The U.S. junk bond premium and the lagged world dividend yield have the most predictive power; both typically earn large, positive coefficients, but both are rarely significant. Surprisingly, the lagged return on the world market portfolio has little predictive power, and never yields a significant coefficient; the same holds for the U.S. term premium. Only Turkey exhibits a significant January effect.

IV. Tests of a Conditional ICAPM with Time-Varying Expected Returns

Tests of the conditional ICAPM on two different time periods reveal that many emerging markets were integrated into the global capital market over 1985-91, but that many of the same markets reject the model using data from 1977-84. Indeed, the late eighties marked a change in emerging markets' relationship with world financial markets as they began receiving large capital inflows from the industrialized countries. The greater success of integration tests in the more recent sample signals that many emerging markets were segmented from international capital markets until the late eighties and that rising cross-border capital flows served as the means of integration.

Table 8 presents tests of a conditional, international ICAPM on individual markets over 1985:1 to 1991:12. As modelled in section II, the original Sharpe-Lintner formulation assumes that asset returns are proportional to the return on the world market portfolio, with coefficient of proportionality β. The fourth and fifth columns of Table 8 provide chi-squared statistics for each test, which measure how well the model fits or, literally, how close the model's errors are to zero; high chi-squared statistics indicate poor fit. Although the chi-squared distribution changes shape for different numbers of degrees of freedom, one can rely on the more comparable p-value to indicate whether the ICAPM can be rejected.[28] The p-value is the probability that if the model's errors were indeed distributed chi-squared, one would obtain by chance a value exceeding the calculated chi-squared value. If $p \leq 0.100$, one can reject the ICAPM model with 90 percent confidence; if $p \leq 0.050$, one can reject with 95 percent confidence, etc.

---

[28]The chi-squared statistic has degrees of freedom equal to the number of orthogonality conditions (or instruments) less the number of parameters estimated. The tests with common instruments have six orthogonality conditions and one parameter, so five degrees of freedom. The tests with local instruments have one more instrument and still one parameter, so six degrees of freedom.

For fourteen of the twenty markets, the ICAPM cannot be rejected using either instrument set. For the remaining six markets, one can reject the null hypothesis of the ICAPM with at least 90 percent confidence, using either the local or common instrument set. The local instrument set produces rejection in five of the six markets: at 95 percent, Colombia, Mexico, Pakistan, and Zimbabwe, and at 90 percent, Portugal.[29] Using common instruments, one can reject the ICAPM in Colombia, Mexico, Pakistan, and Zimbabwe, all at 95 percent confidence, and in Turkey at 90 percent confidence. The model is also very nearly rejected for Venezuela. The model's success rate at describing emerging markets in the late eighties is in fact comparable to studies of developed markets.

Two features characterize the markets where the ICAPM fails. First, all the markets forbade or severely limited foreign investment during at least part of the period covered by the data; five of the six significantly liberalized these restrictive policies during the sample.[30] The model's failure in these markets suggests either that openness to foreign capital is a prerequisite to integration in global financial markets, or that transitional dynamics that change a market's relationship to other markets after a policy shift cause the model to fail. In particular, the ICAPM may be unable to explain high returns due to capital gains that occur when price earnings ratios are bid up after a market opening. Second, small capitalization typifies the markets where the ICAPM fails. At the end of 1991, Colombia, Pakistan, Portugal, and Zimbabwe had capitalizations smaller than the smallest developed markets; Turkey's year-end 1991 capitalization exceeded that of only two developed markets, Luxembourg and Zimbabwe. While Mexico's market capitalization stood at over $100 billion at the end of 1991, it was a mere $2.2 billion at

[29]As the EMDB began tracking the Jakarta market only in December 1989, the Indonesia estimates are based on only 24 observations and should be interpreted with caution.

[30]Zimbabwe did not experience an opening, but was effectively very closed over the entire period. Only Nigeria and India were as closed for the whole sample. Venezuela, which almost rejects the model, experienced an opening in 1988 after years of a closed-market policy.

the beginning of the sample. Note also that in studies of OECD markets, the model fails in the smallest two, Austria and Denmark.

A distinct difference between estimates of the ICAPM on developed and emerging markets lies in the estimated betas. I obtain betas statistically distinct from zero in only nine of twenty markets; in the remaining markets the standard error exceeds the estimated coefficient. In contrast, Harvey's study of developed markets yields betas two or more standard errors from zero for every market except Austria, for which he rejects the model. The failure to obtain insignificant betas for emerging markets is unsurprising for two reasons. The markets are very noisy and volatile, leading to large standard errors and making the beta unstable.[31] As I have shown, the correlation between returns on the world portfolio and in many emerging markets is negligible, such that covariance risk may be too small or too idiosyncratic for local returns to reflect covariance with the world market. In that case, one should not expect to obtain significant betas. Indeed, the strongest betas are obtained in the markets most correlated with the world portfolio: Chile, Korea, Mexico, the Philippines, Taiwan, and Thailand. These markets are also among the most developed in the sample and the most popular with foreign investors. Only Malaysia and Portugal have correlations with the world in the same range and fail to yield a strong beta; Portugal's beta is statistically distinguishable from zero, but Portugal also rejects the ICAPM under the local instrument set.

The lack of significant betas in no way invalidates the ICAPM tests. The ultimate test of the model's fit lies in the chi-squared statistic, not the estimated beta. Strong rejections of the model (at confidence levels as high as 99 percent for Pakistan and Colombia) confirm that the test indeed has the power necessary to discriminate between markets that do and do not reject the

[31]Allowing conditional moments to vary across time might alleviate this problem, but unfortunately adequate data is not yet available to estimate the additional parameters.

model. The model should not be rejected so long as the conditionally expected rate of return can be explained by any beta in the standard error range, as illustrated in figure 2. Frequent rejection in markets that have liberalized foreign investment laws suggests that high capital gains after opening raise the conditionally expected return above what any beta in the error range can explain. Autocorrelation resulting from repeated periods of high returns may also cause rejection of the ICAPM.[32]

I perform a stricter test of the ICAPM to confirm the finding that many emerging markets were integrated into the world financial market over 1985-91. Using system estimation I estimate the model simultaneously on thirteen markets, none of which individually reject the CAPM. This approach tests both that the time-series behavior of returns in each market accords with the model and that the cross-asset restriction of a common price of covariance risk holds across markets.[33] As shown in table 9, the ICAPM cannot be rejected for these thirteen markets. I then perform a similar multi-country test on the same thirteen markets plus four markets that do reject the ICAPM in single-market tests (Colombia, Mexico, Pakistan, and Zimbabwe) to verify that the multi-country test has sufficient power to reject the model where it should. Multi-country tests should reject the ICAPM if the model cannot explain the time series behavior of returns in any of the individual markets. In the seventeen-market test, the model is rejected with over 98 percent confidence using local instruments, but is not rejected using common instruments. Evidently, the multi-country tests which use common instruments have inadequate power. However, the model's strong rejection using the more efficient and theoretically appropriate local instruments indicates that this instrument set has more than adequate power to reject, and substantiates the validity of the thirteen-market test.

---

[32]The CAPM assumes independent and identically distributed returns.

[33]Several other markets that do not reject the ICAPM over 1985-91 are excluded due to incomplete samples; the system estimation requires that each country have a full sample.

To investigate whether emerging markets have become more integrated over time, I also consider a ten-market samples covering 1977:1 to 1984:12 and 1977:1 to 1991:12. The earlier data cover a period when emerging markets were effectively isolated from world capital markets and were much smaller in relation to the developed markets than they are today. One would expect that markets became more integrated beginning in the late eighties when industrial-country investors became active participants in emerging stock markets and many markets lifted restrictions on foreign investment. The critical year here may be 1987 or 1988, when booming Southeast Asian markets first attracted capital from developed economies to emerging markets.

Table 10 shows ICAPM estimates for ten markets over two time periods. For 1977-84, five markets reject the ICAPM under both the local and common instrument sets: Chile, Greece, India, Mexico, and Zimbabwe. All except the common instrument test for India reject the model at 95 percent confidence; that test rejects at 90 percent confidence. In addition, Argentina and Korea come close to rejecting the model, particularly using the common instrument set. That the ICAPM successfully describes 1985-91 return behavior (i.e., that the model is not rejected) in three of these markets--Chile, Greece, and India--indicates that they became integrated somewhere in the mid-eighties. Only Brazil, Greece, and Thailand obtain betas statistically different from zero; all three are one or more standard deviations above zero. In the full 1977-91 sample, the ICAPM successfully describes only seven markets and fails to describe three, including Chile, which does not reject the model over 1985-91.

Cross-country tests for 1977-84 provide additional evidence that the relationship between emerging stock exchanges and the world financial market changed in the mid to late eighties. For seven markets that are apparently integrated in the late eighties, I estimate a multi-country ICAPM. The test rejects the model with over 99 percent confidence using both local and common instrument sets. For the same markets, the model cannot be rejected with 90 percent

confidence over the longer period 1977-91.

The finding that many emerging markets have become integrated only in recent years suggests that large capital flows have induced ICAPM relationships to evolve. The liberalization of policies on foreign investment may also have contributed to increasing integration: the number of emerging markets admitting some form of foreign investment expanded from ten in 1985 to seventeen at the end of 1991. My results imply that where the model continues to fail, too few investors are active in both the local and developed markets to force returns to reflect covariance risk with the world market. Two forms of capital controls merit consideration: restrictions on nationals' rights to invest abroad and limits on foreign investors' participation in the local market. Most countries considered here bar citizens from holding foreign securities, and many have limited foreign participation by placing time restrictions on repatriation, admitting foreign investment only through country funds (which are generally committed by their charters to a buy-and-hold, long-term payoff strategy), or barring it all together. Sections V and VII will explicitly address the impact of market openness.

ICAPM relationships also seem unlikely to evolve in very small markets or markets with low turnover rates, such as many of the markets where the model fails. With few trades occurring, information about stock value--and therefore stock prices--tends to be noisy. And the smaller or less developed the market, the greater the potential role of insider information. The risk introduced by high volatility and information problems may alter the strategies of both domestic and foreign participants in emerging markets. Section VII will discuss in more detail how market size could impede evolution of the ICAPM relationship.

V. Restrictions on Foreign Investment and Market Integration

The ICAPM should describe a market's returns only if participants in the local market also invest abroad such that capital flows in and out of the local market until local returns reflect their covariance risk relative to the world market portfolio. Both a market's policies toward foreign investment and rules governing nationals' investment abroad should therefore affect the potential for an ICAPM relationship to evolve. This section considers both sides of market openness.

A priori, one might expect foreign investment regulations to have a greater impact, since the potential size of foreign capital inflows overwhelms the potential flight of domestic capital. The expected size of domestic capital movements is further reduced by evidence from industrial countries, including the U.S. and U.K. Studies of asset choice consistently find strong home bias in national portfolios, signalling that domestic investors keep most of their money in the local market.[34] However, evidence from the October 1987 stock crash suggests that controls on capital outflows may be more important in determining a market's sensitivity to fluctuations in world financial markets. Bertero and Mayer (1990) found that developed countries which restricted foreigners' access to the domestic stock market fell as much or more than average in the 1987 crash, but that countries which imposed capital controls on domestic residents fell less than others.

To consider the impact of a market's openness to foreign capital, I isolate periods of three or more years during which foreign investment policy is constant and test the ICAPM on each subsample. Three policy classes are considered: open, closed, or restricted. Open markets are defined as those where entry is not restricted to foreign investors and no time minimum is

---

[34] See Werner and Tesar (1992) for empirical references. Eldor, Pines and Schwartz (1988) show that home bias may result from either hedging or gambling motives.

imposed before capital or profits may be repatriated; these include Jordan, Malaysia, Portugal, Greece, Thailand, and Venezuela.[35] Closed markets are those that entirely bar foreign investment or impose a minimum of one or more years before capital may be repatriated; the closed markets are Argentina, Chile, Colombia, Nigeria, and Pakistan. Restricted markets are those that admit foreign investment only through closed-end country funds or to special share classes created exclusively for foreigners; Brazil, Korea, Mexico, Taiwan, Turkey, the Philippines, and Zimbabwe all fall into this class.

My tests suggest that openness is conducive to market integration, but also point to the disruptive effects of a market opening in causing the model to fail. Table 11 shows that of six open markets, only one (Portugal) rejects the ICAPM, whereas four of twelve closed or restricted markets reject the model. In estimates with the local instrument set, one closed market, Colombia, rejects the ICAPM with 95 percent confidence. Of the seven restricted markets, Mexico and Zimbabwe reject the ICAPM with 95 percent confidence under both instrument sets, and Turkey rejects with 90 percent confidence using common instruments. Among the markets that reject the model, only Zimbabwe does not undergo a liberalization of capital controls immediately before or after the period tested. Transitional dynamics may affect returns before opening occurs because if the opening is announced before the implementation date, prices should start rising immediately in anticipation that prices will be bid up by foreign market entrants; transition may also continue after the implementation date. Mexico's opening actually falls within the sample since the nature of the regime did not change, only became somewhat less restrictive. The results also suggest that restricted markets may prevent foreign investors from affecting the local stock exchange as successfully those that impose a complete ban on foreign investment.

---

[35]My information on capital controls affecting both nationals and foreigners comes from various issues of *Exchange Arrangements and Exchange Restrictions*, *The World Currency Yearbook*, and *The Emerging Stock Markets Factbook*.

To consider the impact of capital controls on nationals, I identify markets that allow citizens to freely invest in foreign securities and markets where citizens are explicitly forbidden from owning foreign securities.[36] Argentina, Indonesia, Malaysia, Mexico, Portugal, Taiwan, and Venezuela all allow nationals to trade in foreign securities. Brazil, Chile, Colombia, India, Jordan, Nigeria, Pakistan, Philippines, Thailand, and Zimbabwe do not.[37]

I find no clear impact of capital controls on market integration. Among the six markets that do not impose capital controls, the ICAPM is consistent with returns in four markets and can be rejected for two, Mexico and Portugal. (See Table 12.) Among the ten markets imposing capital controls, the ICAPM can be rejected for three markets: Colombia, Pakistan, and Zimbabwe. With the exception of Portugal, both instrument sets produce rejection. Again, expected returns are similarly distributed across the two groups of markets.

VI. The Predictive Power of Fundamentals

Recall from the data description that emerging markets exhibit powerful serial correlation in returns, which is widely interpreted as evidence of inefficiency in developed markets. This section uses dividend yields lagged one and twelve months to test whether price fundamentals can forecast future emerging market returns.[38] The high autocorrelation in emerging market returns

---

[36]I include in the latter group some countries where citizens can apply for central bank approval to invest abroad, but approval is granted only is very rare cases. Among these countries are India, Pakistan, the Philippines and Thailand.

[37]I exclude several markets here either because the policies are unclear or because two sources provided contradictory descriptions of the relevant policies.

[38]Campbell Harvey at Duke University's Fuqua School of Business is working on decomposing predictability in emerging markets into time-variation in risk-loading and time-variation in world risk premia. He also considers the impact of predictability on optimal trading strategies.

at one-month intervals suggests that past prices may contain unexploited information about future prices; in fact, the failure of the ICAPM in some markets may stem from those markets' inefficiency. If returns are not independent and identically distributed, as the ICAPM assumes, an investor's optimal strategy may instead be one that takes advantage of information in serially correlated returns. In such markets, nothing suggests that returns should follow the ICAPM. Although all four developed market indices also exhibit some serial correlation, the emerging market autocorrelation coefficients are greater by an order of magnitude, signalling a far higher predictable component.

According to the efficient markets literature, predictable returns signal market inefficiency. Fama(1970) defined an efficient market as one in which securities prices fully reflect all information in some information set Φ. In a weak-form efficient market past prices should have no predictive power for future prices; in a semi-strong-form efficient market no publicly available information should forecast future prices. Several studies, however, have discredited the martingale model of efficient markets by revealing predictable components in U.S. returns.[39] Most relevant here is the finding of Cutler, Poterba, and Summers (1991) that fundamentals could predict stock returns at long horizons (48 months).

Using the assumption that a stock's fundamental value equals the discounted cash flow or dividend stream it provides, one can measure the price fundamental as the logarithm of the dividend-price ratio. To test the null hypothesis that returns are unpredictable, one estimates

[39]See Fama and French (1988), Poterba and Summers (1988), Lo and MacKinlay (1988). The martingale model requires very restrictive assumptions: risk neutral investors, a constant discount factor (i.e., a flat consumption path), and no aggregate risk.

$$r_{t+k} = \alpha_k + \gamma_k \ln(div_t/p_t) + \epsilon_{t+k} \quad (12)$$

where r_{t+k} is the total return from period t to period $t+k$, and $log(div_t/p_t)$ measures the difference between a potentially noisy measure of fundamental value div_t and the asset price p_t. This equation assumes the underlying model that a stock's price should equal the discounted value of the dividend stream it is expected to yield.[40] γ_k represents the fraction of the deviation of price fundamental value which is eliminated over k months. If a stock's price is one percent below its fundamental price $log(div_t/p_t)$, then returns over the next month will be 0.01γ higher than otherwise. In an informationally efficient market, a stock's price should never deviate from its fundamental value or, more realistically, any deviation should amount to pure noise.[41] Given that divergence exists, an efficient market should eliminate the deviation rapidly. In other words, one should find $\gamma \approx 1$.

Table 13 presents estimates of equation (11) over one and twelve month horizons. Newey-West heteroskedasticity- and autocorrelation-robust standard errors appear in parentheses. For one-month intervals, the estimated γs are small and positive in fourteen of twenty markets; the mean value of 0.017 indicates that only 0.1 percent of any deviation of stock price from fundamental value is corrected in one month. Four markets obtain coefficients significant at 90 percent: Malaysia with the highest coefficient at 0.110 (t = 2.143), Pakistan, the Philippines, and Taiwan. Six markets earn *negative* coefficients, indicating that deviations are on average *exacerbated*, not eliminated, over time. Adjusted R^2 values are generally under 0.100, but in a few markets lagged deviations from fundamentals can explain substantial variation in returns, peaking at to 30 percent for Pakistan. More importantly, these results are far stronger than those

[40]Cutler, Poterba, and Summers use this specification; Campbell and Shiller (1988) and Fama and French (1988) estimate similar equations.

[41]See Pindyck and Rotemberg (1992) for work on the relation between stock prices and dividend yields.

obtained by Cutler et. al. on thirteen established markets. Cutler et.al. explain more than 1.4 percent of one-month return fluctuations in only three markets (Australia, Switzerland, and the United Kingdom), and obtain an average coefficient of 0.75.

The final columns of Table 13 present estimates over twelve month horizons. The coefficients exceed those for one-month intervals, but are substantially smaller than those Cutler, et. al. obtain. My lower and less robust coefficients (mean $\gamma = 0.370$ versus 14.16 found by Cutler et.al.) suggest that deviations from fundamentals can persist indefinitely in emerging markets. After one year, less than one-half of one percent of a deviation of price from its fundamental value would be eliminated--99.4 percent of the deviation would persist. Malaysia, Pakistan, and Portugal continue to earn negative coefficients, pointing to ever-widening deviations of price from fundamental value.

More striking than the coefficients is the extent to which lagged dividend yields can explain returns even in integrated markets. In ten of nineteen markets, I obtain adjusted R^2s exceeding 0.200. The Philippines provides the most extreme case of predictability: lagged dividend yields predict fully 86 percent of return movements. In contrast, Cutler et. al. explain over 20 percent of return variation in only two markets. The high predictability of returns using year-old dividend yields indicates that emerging markets are informationally extremely inefficient. Surprisingly, not only small, undeveloped markets such as Colombia or Venezuela, but also large and integrated markets such as Korea and Taiwan exhibit robust predictability relationships.

VII. Market Development, the Policy Environment and Risk Premia

Although emerging markets have become substantially integrated within the last decade, their return patterns continue to be irregular by developed country standards, characterized by high volatility, high yields, and high autocorrelation. This section seeks to identify the market characteristics that could cause high returns or inefficiency. The underlying question: What steps can be taken to eliminate the risk premium and reduce the cost of stock market financing in LDCs? Capital controls, small market size and policy uncertainty all distinguish emerging markets from developed, and help explain why emerging markets defy standard models of return behavior. This section considers each in turn.

Small markets suffer a number of illiquidity problems, which according to the ICAPM should not affect returns; however, the closed-end fund and small stock cases show that investors do demand compensation for pure variance risk. With infrequent trading, prices contain a high noise component, making them more volatile than they would be in a heavily-traded market. Limited reporting requirements in many markets mean that investors typically have less information about firms and receive less frequent updates than in do investors developed markets. The uncertainty about firms' financial condition may introduce high variance in expected returns. Low reporting also makes the markets vulnerable to manipulation and insider trading, as evidenced by a billion-dollar securities scam in India that sent the market crashing this spring.

The risk introduced by high volatility and information problems may alter the strategies of both domestic and foreign participants in emerging markets. If investors simply follow different trading rules in LDC exchanges, that alone should ensure that the relationship of any measure of risk to returns will differ from that for developed countries. In a small securities market, trades small by New York standards may adversely affect prices; due to the markets' small absorptive capacity, only small holdings can be considered liquid. The manager of one

investment firm that specializes in emerging markets stated that the company strictly limits itself to trading no more than 10 percent of any stock's daily volume to avoid singlehandedly moving prices.[42] Limitations on transaction size may prevent investors from fully exploiting all available information, and may explain why emerging market returns contain a large forecastable component.

Concentration of market value in the largest few issues may exacerbate small market problems. For example, the Buenos Aires stock market lists 174 companies, but the ten largest companies accounted for over 70 percent of both market capitalization and valued traded at the end of 1991. The markets in the remaining 164 stocks must be tiny by comparison, and may indeed resemble search models, with only a few traders in each issue on any given day. The results in this paper may make emerging markets look more efficient and integrated than they in fact are because the IFC indices include only each market's largest and most heavily-traded stocks and are calculated with capitalization-based weights. The next step in analyzing the relationship between emerging and developed markets involves working with the EMDB stock level data. A market may appear deceptively integrated with the world portfolio if only one or two large stocks are integrated--perhaps stocks also traded on developed markets. For the largest markets, stocks should be divided into several portfolios on the basis of capitalization to examine whether the world or local market better explains return fluctuations.

Institutional factors, most importantly capital controls, enhance small market effects. Barriers to foreign investment limit the number of market participants as well as the total capital supply available to the market. These limits restrict emerging markets' capitalization, and thus their capital formation potential. The typically narrow industry distribution of emerging markets

---

[42]Emerging markets offer an excellent opportunity to study how different aspects of market size and depth affect market behavior. Pagano (1986) offers a good model for such a study.

makes it difficult for domestic investors to diversify industry-specific risk. Foreign investors, able to diversify internationally, may evaluate the risk of emerging market stocks differently than domestic investors and may demand different, likely lower, rates of return. If international investors do follow the ICAPM, emerging markets' low correlation with developed markets suggests that foreign investors might demand lower returns than in more correlated small OECD markets.

After an opening, increases in both turnover and capitalization should reduce liquidity risk inherent in emerging markets, and thereby reduce required returns and the cost of capital. By admitting more traders, an opening to foreign investment should raise market activity and reduce price volatility. A look at actual openings shows that turnover ratios rose after nine of twelve openings, where the exceptions are Mexico's marginal 1989 opening and Brazil's 1987 and 1991 openings. (See Table 2.) Market capitalization rose permanently within a few years of many of the earlier openings, including Chile, Mexico, the Philippines, Turkey and Venezuela.[43] (See Table 2.) After some lag, the number of listings may expand as more firms go public, able to meet the now-reduced costs of raising capital in the stock markets. In most openings in our sample, the data are yet inadequate to judge whether new firms do gain market access after opening. Firms may wait several years before acting to ensure that the cost of capital remains low and that the financial reforms continue. They then need substantial cash and time to meet fees and make legal arrangements to obtain a listing on the stock exchange. In two markets, however, listings have already responded. Turkey's market had fifty listings in the three years up to and including its 1989 opening; by 1990, 110 firms were traded. Indonesia had twenty-four listings one year prior to its 1989 opening, fifty-seven by the end of 1989, and 141 by the end

[43]As many of the openings occurred in 1991, it is too early to judge whether market capitalization will sustain a rise.

of 1991. In addition, evidence from developed markets indicates that new issues rise during stock market booms, when the required rates of return are low.[44] As LDC banks typically change thirty percent interest or more on commercial loans, stock market financing is relatively inexpensive; more firms in the stock market translates to more capital formation and more growth.

Uncertainty about policies governing future earnings introduces additional variance, for which investors may demand compensation with higher mean returns. Policy uncertainty may introduce "peso problems" if investors fear some low probability policy shift that will dramatically reduce returns: a devaluation, closing of the stock market, expropriation, or imposition of capital controls that bar repatriation of capital or profits. The potential for any of these events to occur reduces the expected liquidity of holding emerging-market stocks, and may cause what appear to be excess returns in a period that the bad state never occurs. Suppose investors demand an expected return equal to some fixed value, calculated as a probability-weighted average of the returns in all states of nature. As a result, the return in the ordinary "good" state will have to be higher than if there existed no policy uncertainty in order to compensate investors for the very low return in the bad or policy-change state. Non-normal errors will result, as may autocorrelated returns.

VIII. Conclusions

Rapidly growing emerging markets already represent a substantial share of the global

[44]See Cho, Masulis and Nanda (1989).

capital market in terms of asset value, and have begun attracting large capital flows from industrialized nations. Investment opportunities in emerging markets may enable investors to increase the expected return on their portfolios while reducing overall risk, as many offer high average returns with only slightly higher return variance than developed markets and low or negative return correlation with the world market. Equally importantly, stock markets represent a promising, market-based channel through which developing countries can attract capital from industrial nations. However, high risk premia in emerging markets limit the effectiveness of stock markets as a source of capital, because only the most profitable firms can afford to raise money there.

This paper tests the hypotheses of ICAPM integration and market efficiency to understand how emerging markets differ from their developed counterparts, why risk premia persist, and how they may be eliminated. I find emerging markets substantially integrated in the late 1980s; however, high rate of return variance impedes estimation of market betas. I also find that emerging markets became increasingly integrated into global financial markets in the late eighties, with rising capital flows from industrial countries evidently the mechanism of integration. Tests of the conditional formulation of the Sharpe-Lintner international asset pricing model reveal that returns in fourteen of the twenty largest LDC stock markets were consistent with the ICAPM over 1985-91, and that fewer markets were integrated during the years 1977-84. Still-unintegrated markets tend to be small, suffer substantial illiquidity risk, and typically have opened to foreign investment during the sample period. The integration tests may fail because the ICAPM is unable to explain transitional dynamics, characterized by rising price-earnings ratios and high capital gains. I present evidence suggesting that opening expands markets in terms of participants, firms listed, and value, and promotes the capital flows necessary for integration.

I also find that emerging market returns exhibit very high serial correlation from month

to month and that lagged dividend yields can substantially predict return patterns. Both signal informational inefficiency. Small-market effects may also explain why emerging market investors do not exploit all available information. As with impediments to integration, opening local markets to foreign capital should alleviate market imperfections due to size.

References

Bertero, Elisabetta and Colin Mayer (1990). "Structure and performance: global interdependence of stock markets around the crash of October 1987." *European Economic Review* 34, 1155-1180.

Bonser-Neal, Catherine, Greggory Brauer, Robert Neal, and Simon Wheatley (1990). "International restrictions and closed-end country fund prices." *Journal of Finance* 45, 523-547.

Campbell, John Y. and Robert J. Shiller (1988). "Stock prices, earnings, and expected dividends." *Journal of Finance* 43, 661-676.

"Catch them young." *The Economist*, 24 October 1992, 87.

Cho, Masulis, and Nanda (1989). Mimeo.

Cohen, Kalman J., Walter L. Ness, Jr., Hitoshi Okuda, Robert A. Schwartz, and David K. Whitcomb (1976). "The determinants of common stock returns volatility: an international comparison." *Journal of Finance* 31, 733-740.

Cowitt, Philip P., ed. *World Currency Yearbook* (Brooklyn: International Currency Analysis, various years).

Cutler, David M., James M. Poterba, and Lawrence H. Summers (1991). "Speculative dynamics." *Review of Economic Studies* 58, 529-546.

Divecha, Arjun, Jaime Drach, and Dan Stefek (1992). *Journal of Portfolio Management*, forthcoming.

"The Debt Crisis R.I.P." *The Economist*, 12 September 1992, 15-16.

Dumas, Bernard and Bruno Solnik (1992). "The World Price of Exchange Rate Risk." Mimeo, Wharton School, University of Pennsylvania.

Economics Department (1991). "Financing corporate growth in the developing world." International Finance Corporation Discussion Paper no.12.

Eichenbaum, M., Lars Peter Hansen, and Kenneth J. Singleton (1988). "A time series analysis of representative agent models of consumption and leisure choice with uncertainty." *Quarterly Journal of Economics* 103, 51-78.

Eldor, Rafael, David Pines, and Abba Schwartz (1988). "Home asset preference and productivity shocks." *Journal of International Economics* 25, 165-176.

Errunza, Vihang and Etienne Losq (1985a). "Behavior of stock prices in LDC markets." *Journal of Banking and Finance* 9, 561-575.

_____ (1985b). "International asset pricing under mild segmentation." *Journal of Finance* 40, 105-124.

Errunza, Vihang, Etienne Losq, and Prasad Padmanabhan (1991). "Tests of integration, mild segmentation and segmentation hypotheses." Forthcoming, *Journal of Banking and Finance.*

Fama, Eugene F. (1970). "Efficient capital markets: a review of theory and empirical work." *Journal of Finance* 25, 383-417.

Fama, Eugene F. and Kenneth R. French (1988). "Permanent and temporary components of stock prices." *Journal of Political Economy* 96, 246-73.

Frankel, Jeffrey A. (1992a). "Is Japan creating a Yen bloc in East Asia and the Pacific?" N.B.E.R. Working Paper no. 4050, April.

_____ (1992b). "Measuring International Capital Mobility: A Review." *American Economic Review* 82, 197-202.

Grossman, Sanford J. and Joseph E. Stiglitz (1980). "On the impossibility of informationally efficient markets." *American Economic Review* 70, 393-408.

Gultekin, Mustafa N. and N. Bulent Gultekin (1983). "Stock Market Seasonality: International Evidence." *Journal of Financial Economics* 12, 469-481.

Hansen, Lars Peter (1982). "Large sample properties of generalized method of moments estimators." *Econometrica* 50, 1029-1054.

Hansen, Lars Peter, John Heaton, and Masao Ogaki (1992). GMM programs for Gauss. Funded by the National Science Foundation.

Hansen, Lars Peter, and Kenneth J. Singleton (1982). "Generalized instrumental variables estimation of non-linear rational expectations models." *Econometrica* 50, 1269-1286.

Harvey, Campbell R. (1989). "Time-varying conditional covariances in tests of asset pricing models." *Journal of Financial Economics* 24, 289-317.

_____ (1991). "The World Price of Covariance Risk." *Journal of Finance* 46, 111-157.

Huang, Chi-Fu and Robert H. Litzenberger (1988). *Foundations for Financial Economics* (New York: North-Holland).

International Finance Corporation. *Emerging Stock Markets Factbook* (Washington D.C.: International Finance Corporation, various years).

International Monetary Fund. *Annual Report on Exchange Arrangements and Exchange Restrictions* (Washington, D.C.: International Monetary Fund, various years).

"Latin America: the big move to free markets." *Business Week*, June 15, 1992, 50-62.

Lee, Charles M., Andrei Schleifer, and Richard H. Thaler (1991). "Investor sentiment and the closed-end fund puzzle." *Journal of Finance* 46, 75-109.

Lo, Andrew W. and MacKinlay, A. Craig (1988). "Stock prices do not follow random walks: evidence from a simple specification test." *Review of Financial Studies* 1, 41-66.

Newey, Whitney and K. West (1987). "A simple positive semi-definite heteroskedasticity and autocorrelation consistent covariance matrix." *Econometrica*, 55, 703-6.

Ogaki, Masao (1992). "Generalized Method of Moments: Econometric Applications." Mimeo, University of Rochester, March.

"Opening Up." *The Economist*, 19 September 1992, 94.

Pagano, Marco (1985). "Market size and asset liquidity in stock exchange economies." Ph.D. thesis, M.I.T.

_____ (1986). "Market size, the informational content of stock prices and risk: a multiasset model and some evidence." Centre for Economic Policy Research (CEPR) Discussion Paper no. 144.

Pindyck, Robert S. and Julio J. Rotemberg (1992). "The Comovement of Stock Prices." M.I.T. Sloan School of Management mimeo, April.

Roll, Richard (1988). "The international crash of October 1987." *Financial Analysts Journal*, September/October, 19-35.

_____ (1989). "Price volatility, international market links, and their implications for regulatory policies." *Journal of Financial Services Research* 3, 211-246.

_____ (1992). "Industrial structure and the comparative behavior of international stock market indices." *Journal of Finance* 47, 3-41.

Sappenfield, Ross and Lawrence Speidell (1992). *Journal of Portfolio Management*, forthcoming.

Sharpe, William F. (1978). "Comment." *Journal of Finance* 33, 917-920.

Solnik, Bruno H. (1974). "An equilibrium model of the international capital market." *Journal of Economic Theory* 8, 500-524

Stehle, Richard (1977). "An empirical test of the alternative hypotheses of national and international pricing of risky assets." *Journal of Finance* 32, 493-502.

Stulz, René (1981). "A model of international asset pricing." *Journal of Financial Economics* 9, 383-406.

Sudweeks, Brian Lorin (1989). *Equity Market Development in Developing Countries* (New York: Prager).

Summers, Lawrence H. (1986). "Does the stock markets rationally reflect fundamental values?" *Journal of Finance* 41, 591-601.

Tauchen, George (1986). "Statistical properties of generalized method-of-moments estimators of structural parameters obtained from financial market data." *Journal of Business and Economic Statistics* 4, 397-416.

Tesar, Linda and Ingrid Werner (1992). "Home Bias and the Globalization of Securities Markets." Mimeo, Graduate School of Business, Stanford University, July 1992.

Virmani, Arvind (1985). "Government policy and the development of financial markets: the case of Korea." World Bank Staff Working Paper no. 747.

"The World According to Stock Pickers." *Business Week*, June 22, 1992, 96-97.

Key to Market Codes

Argentina	AGT
Brazil	BRA
Chile	CHL
Colombia	COL
Greece	GRC
India	IND
Indonesia	IDN
Jordan	JOR
Korea	KOR
Malaysia	MYS
Mexico	MEX
Nigeria	NGA
Pakistan	PAK
Philippines	PHL
Portugal	PRT
Taiwan (ROC)	OAN
Thailand	THA
Turkey	TUR
Venezuela	VEN
Zimbabwe	ZWE

TABLE 1: Market Capitalization, year-end 1991
($ billion)

United States	4180.2
Japan	3130.9
United Kingdom	1003.2
ALL EMERGING MKTS	642.9
Germany	393.5
France	374.1
Canada	266.9
Switzerland	179.5
Italy	154.1
Australia	144.9
TAIWAN	124.9
S. Africa	124.0
Hong Kong	122.0
MEXICO	101.2
Sweden	97.5
KOREA	96.4
Belgium	71.3
MALAYSIA	58.6
Denmark	53.6
Singapore	47.6
BRAZIL	42.8
INDIA	38.6
THAILAND	35.8
CHILE	28.0
Austria	25.6
Norway	22.0
ARGENTINA	18.5
TURKEY	15.7

TABLE 2: MARKET OPENINGS:
Year-end price-earnings and turnover ratios for the year before and year of the opening

Market	Opening Date	Price-earnings ratio before	Price-earnings ratio after	Turnover ratio before	Turnover ratio after	Capitalization before	Capitalization end 1991	Nature of Opening
Argentina	Oct 1991	3.11	38.89	33.6	45.3	3.268	18.5	Full opening
Brazil	Sept 1987	4.24	15.38	74.4	41.5	42.1	42.7	Country fund admitted
	May 1991	5.34	7.65	23.6	22.0	16.3	42.7	Full opening
Chile	Oct 1989	4.4	5.82	6.3	8.8	6.8	28.0	Country fund admitted
Colombia	Oct 1991	10.66	26.08	5.6	7.1	1.4	4.0	Full opening
Indonesia	March 1989	n/a	n/a	2.5	38.6	0.2	6.8	minor restrictions on entry and exit; previously, wholly closed
Mexico	May 1989	5.04	10.66	51.7	33.3	13.8	101.2	Restrictions reduced
Pakistan	June 1991	8.53	23.87	8.7	12.6	2.9	7.3	Full opening
Philippines	Oct 1989	9.92	18.5	24.4	29.1	4.3	10.2	Country fund admitted
Portugal	Jan 1986	n/a	n/a	4.0	7.1	0.2	9.6	Full opening
Turkey	Dec 1989	2.62	17.64	5.5	19.0	1.1	15.7	Country fund admitted
Venezuela	Dec 1988	16.91	11.45	8.1	10.9	2.3	11.2	minor restrictions on entry and repatriation; previously, special share classes only

TABLE 3: MARKET PRICE-EARNINGS RATIOS, 1986-91

	1986	1987	1988	1989	1990	1991	Ratio of 1991/1986
EMERGING MARKETS:							
Argentina	15.99	3.76	11.30	22.14	3.11	38.89	2.43
Brazil	4.24	15.38	7.95	8.30	5.34	7.65	1.80
Chile	5.27	5.00	4.40	5.82	8.86	17.38	3.30
Colombia	8.26	11.63	8.75	6.96	10.66	26.08	3.16
Greece	.	30.54	10.59	24.30	26.23	10.43	0.34*
India	18.02	22.05	21.51	18.34	20.59	13.85	0.77
Indonesia	.	.	.	.	30.84	26.66	
Jordan	12.94	12.76	17.30	14.93	8.15	10.62	0.82
Korea	25.66	21.70	39.51	38.57	21.48	17.57	0.68
Malaysia	32.72	30.74	24.14	30.75	23.01	14.56	0.44
Mexico	10.52	6.23	5.04	10.66	13.20	24.36	2.32
Nigeria	5.84	4.94	6.07	6.99	7.01	9.74	1.67
Pakistan	8.22	6.85	9.37	8.44	8.53	23.87	2.90
Philippines	4.40	8.90	9.92	18.50	24.51	16.23	3.69
Portugal	24.81	27.23	26.50	21.42	15.47	18.91	0.76
Taiwan	12.00	13.01	40.23	51.17	44.41	14.50	1.21
Thailand	12.46	10.51	12.62	23.07	10.90	17.16	1.38
Turkey	.	19.78	2.62	17.64	22.50	21.60	1.09*
Venezuela	9.43	16.91	11.45	6.44	29.31	30.50	3.23
Zimbabwe	4.20	7.04	4.24	7.00	12.01	8.35	1.99
DEVELOPED MARKETS:							
New York	16.77	15.41	12.19	14.70	15.19	21.85	1.30
Tokyo	47.3	58.3	58.4	70.6	9.8	37.8	0.80

*For Greece and Turkey, ratio is 1991/1987.

**The price-earnings ratio is the ratio of end-of-month price to trailing

TABLE 4: DATA STATISTICS ON TOTAL EQUITY RETURNS, INCLUDING REINVESTED DIVIDENDS
MONTHLY, 1985:1 TO 1991:12

				Autocorrelation				
Market	mean	std.dev.	reward/ risk	rho1	rho2	rho3	rho4	rho12
World	0.0146	0.0488	0.2991	0.0713	-0.0458	-0.0329	-0.1073	0.0274
U.S.	0.0138	0.0513	0.2682	0.0545	-0.0903	-0.0921	-0.1850	-0.0481
Japan	0.0164	0.0786	0.2080	0.0192	0.0012	0.0025	0.0388	0.1383
Europe	0.0178	0.0574	0.3103	-0.0176	-0.0646	0.0141	0.0566	-0.1214
Argentina	0.0358	0.2797	0.1279	-0.1045	-0.1087	0.0949	-0.2005	-0.1158
Brazil	0.0069	0.2239	0.0308	-0.0483	0.0768	-0.0717	-0.0921	-0.0234
Chile	0.0402	0.0779	0.5159	0.3147	-0.0404	-0.2566	-0.1809	0.1005
Colombia	0.0334	0.0779	0.4287	0.4999	0.1961	0.0374	0.0271	0.0378
Greece	0.0244	0.1292	0.1891	0.1282	0.1591	-0.0060	-0.1650	-0.1327
India	0.0146	0.0852	0.1712	0.0500	-0.0291	0.0538	0.0249	-0.1425
Indonesia	-0.0215	0.1006	-0.2138	0.5509	0.2867	0.1835	0.2753	0.6103
Jordan	0.0038	0.0531	0.0707	0.0751	0.0526	0.2962	0.0243	0.2791
Korea	0.0194	0.0833	0.2323	-0.0268	0.2075	-0.0186	0.2030	0.1256
Malaysia	0.0079	0.0812	0.0974	0.1109	0.0808	-0.0438	0.0423	-0.0893
Mexico	0.0361	0.1593	0.2268	0.3494	-0.1669	-0.2875	-0.0560	-0.0889
Nigeria	-0.0001	0.1179	-0.0007	0.1241	-0.0488	-0.1300	0.1124	-0.0006
Pakistan	0.0206	0.0547	0.3759	0.3789	0.0365	0.0647	0.1375	0.0264
Philippines	0.0348	0.1101	0.3162	0.3652	0.0261	0.0520	0.1669	0.0864
Portugal	0.0303	0.1390	0.2177	0.2846	-0.0098	0.0271	0.2686	0.0646
Taiwan	0.0234	0.1591	0.1468	0.0391	0.0730	-0.0411	0.0410	0.1679
Thailand	0.0261	0.0906	0.2883	0.1034	0.0360	-0.0534	-0.2401	-0.1184
Turkey	0.0579	0.2294	0.2524	0.1804	0.0298	0.2486	0.2723	-0.0977
Venezuela	0.0267	0.1393	0.1913	0.2124	0.2012	0.0558	-0.0167	-0.1320
Zimbabwe	0.0270	0.0833	0.3234	0.2749	0.2544	0.2134	0.1678	-0.2273

Fig. 1: Mean Returns and Variances

20 emerging, 4 developed market indices

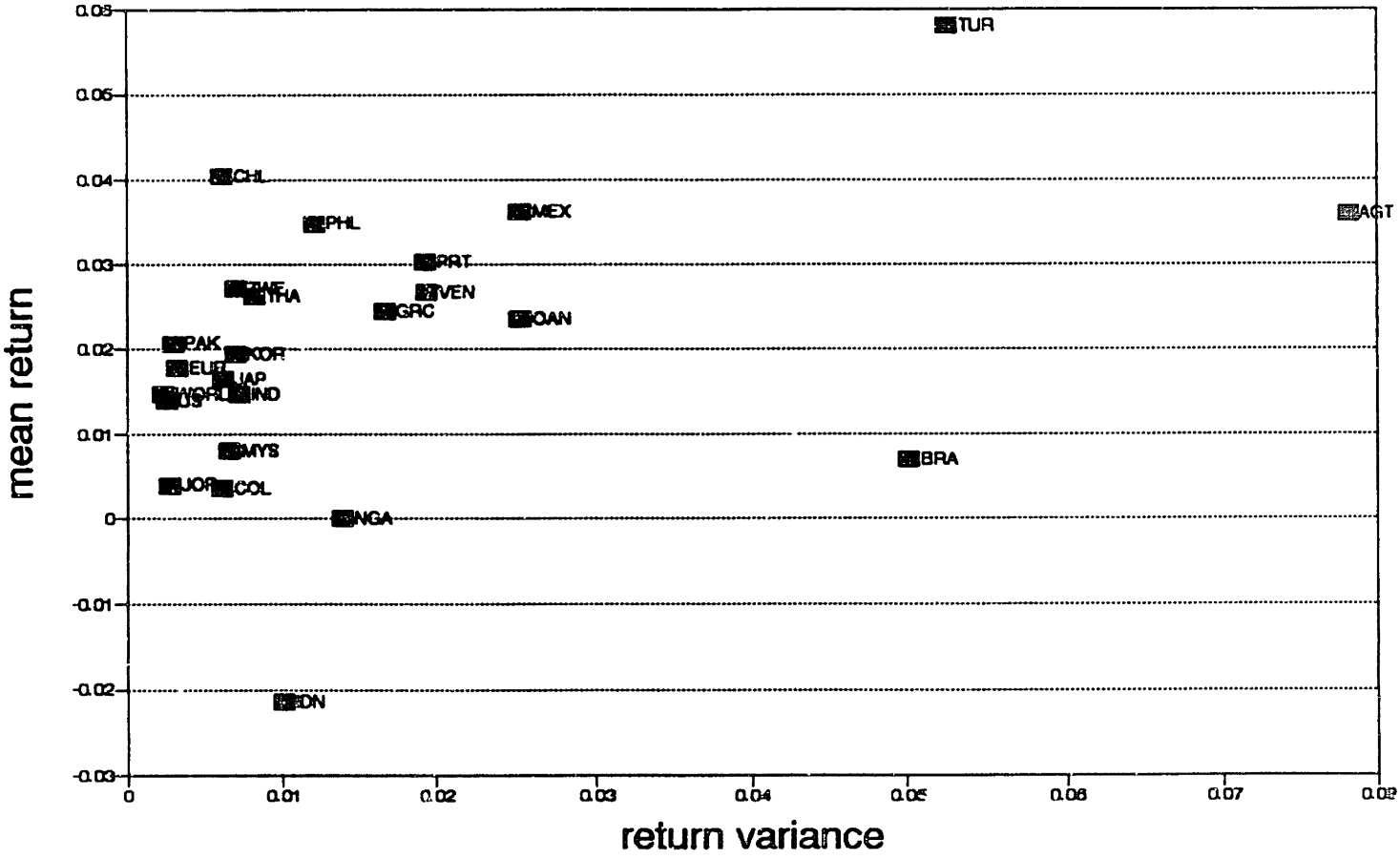


TABLE 5: DATA STATISTICS ON TOTAL EQUITY RETURNS, INCLUDING REINVESTED DIVIDENDS
MONTHLY, 1977:1 TO 1991:12

				Autocorrelation				
Market	mean	std.dev.	reward/ risk	rho1	rho2	rho3	rho4	rho12
World	0.0118	0.0425	0.2770	0.0536	-0.0693	-0.0407	-0.0448	0.0003
U.S.A.	0.0108	0.0458	0.2354	0.0326	-0.0776	-0.0874	-0.0495	-0.0155
Japan	0.0145	0.0665	0.2180	0.0105	-0.0442	0.0324	0.0623	0.1208
Europe	0.0131	0.0503	0.2605	-0.0606	-0.0242	-0.0044	0.0130	-0.1271
Argentina	0.0175	0.2463	0.0710	-0.0507	-0.0828	0.0471	-0.0814	-0.1024
Brazil	0.0052	0.1754	0.0295	-0.0137	-0.0045	-0.0403	-0.0674	-0.0038
Chile	0.0230	0.1051	0.2185	0.2364	0.2621	-0.0025	0.0444	0.0546
Greece	0.0033	0.1010	0.0322	0.1520	0.1647	0.0485	-0.0402	-0.0315
India	0.0131	0.0669	0.1951	-0.0253	-0.0553	0.0726	-0.0095	-0.0999
Jordan	0.0083	0.0540	0.1541	0.0088	0.0246	0.2032	-0.0341	0.0000
Korea	0.0150	0.0875	0.1717	0.0152	0.0901	0.0148	0.0112	0.1160
Mexico	0.0189	0.1426	0.1324	0.2551	-0.0628	-0.0816	-0.0014	-0.0386
Thailand	0.0184	0.0768	0.2402	0.1152	0.1538	0.0068	-0.1214	0.0027
Zimbabwe	0.0082	0.0976	0.0838	0.1554	0.1305	0.2189	0.1893	-0.0333

TABLE 6:

Total return correlations including reinvested gross dividends, 1985:1 to 1991:12

	BRA	CHL	COL	GRC	IDN	IND	JOR	KOR	MEX	MYS	NGA	OAN	PAK	PHL	PRT	THA	TUR	VEN	ZWE	USA	JAP	EUR	WLD	
AGT	-0.06	-0.02	-0.07	0.04	-0.23	0.22	-0.13	-0.14	0.11	-0.04	0.11	-0.02	-0.03	-0.11	-0.03	0.10	0.10	0.08	-0.26	0.04	-0.13	-0.08	-0.09	AGT
BRA		0.13	0.03	-0.01	-0.12	-0.03	-0.04	0.01	-0.01	0.12	0.00	0.10	0.01	0.13	0.11	0.07	0.13	-0.18	-0.02	0.12	0.16	0.14	0.17	BRA
CHL			0.10	0.17	0.03	-0.06	-0.06	0.12	0.33	0.27	0.04	0.35	-0.05	0.23	0.24	0.27	0.01	-0.20	-0.02	0.33	0.07	0.19	0.22	CHL
COL				0.22	0.16	-0.08	0.05	-0.09	0.07	0.03	0.03	0.07	0.51	0.08	0.17	0.11	0.08	0.02	-0.19	0.14	0.00	0.08	0.09	COL
GRC					0.34	0.04	0.07	-0.14	0.15	0.08	0.05	0.05	-0.10	0.12	0.42	0.32	0.20	-0.08	0.01	0.15	0.06	0.18	0.16	GRC
IDN						-0.03	0.21	-0.11	0.23	0.43	-0.26	0.18	0.20	0.48	0.09	0.48	0.17	0.04	0.28	0.20	-0.20	0.18	-0.01	IDN
IND							0.14	-0.03	-0.00	-0.05	0.07	-0.12	0.08	-0.09	-0.06	0.01	0.23	0.05	0.07	-0.05	-0.12	0.08	-0.06	IND
JOR								-0.17	-0.04	0.06	-0.01	0.12	0.08	0.11	-0.02	0.15	-0.16	0.01	0.06	0.02	0.10	0.23	0.13	JOR
KOR									0.15	0.10	0.01	0.05	-0.02	0.20	0.10	-0.02	-0.09	-0.23	-0.12	0.26	0.35	0.23	0.36	KOR
MEX										0.44	-0.09	0.34	0.03	0.10	0.43	0.39	0.12	-0.05	-0.09	0.45	0.09	0.23	0.30	MEX
MYS											-0.22	0.30	-0.03	0.34	0.28	0.57	0.20	0.01	0.01	0.57	0.24	0.43	0.51	MYS
NGA												-0.18	0.01	-0.00	-0.22	-0.12	0.08	0.03	-0.06	0.02	0.08	0.06	0.05	NGA
OAN													-0.02	0.12	0.35	0.43	0.12	-0.25	-0.08	0.20	0.21	0.17	0.26	OAN
PAK														-0.01	0.00	0.12	-0.00	0.05	-0.14	-0.01	-0.05	0.08	0.00	PAK
PHL															0.07	0.27	-0.01	-0.19	0.01	0.30	0.29	0.29	0.36	PHL
PRT																0.39	0.22	-0.06	0.12	0.23	0.40	0.34	0.42	PRT
THA																	0.19	-0.09	-0.04	0.42	0.26	0.42	0.46	THA
TUR																		-0.16	0.05	-0.05	-0.00	0.05	-0.00	TUR
VEN																			0.07	-0.09	-0.16	-0.13	-0.16	VEN
ZWE																				-0.09	0.01	-0.06	-0.05	ZWE
USA																					0.25	0.64	0.75	USA
JAP																						0.52	0.79	JAP
EUR																							0.84	EUR
	BRA	CHL	COL	GRC	IDN	IND	JOR	KOR	MEX	MYS	NGA	OAN	PAK	PHL	PRT	THA	TUR	VEN	ZWE	USA	JAP	EUR	WLD	

Total return correlations including reinvested gross dividends, 1976:12 to 1984:12

	BRA	CHL	GRC	IND	JOR	KOR	MEX	THA	ZWE	USA	JAP	EUR	WLD	
AGT	-0.07	0.08	0.05	0.09	-0.03	-0.06	0.16	-0.16	0.17	0.07	0.08	0.09	0.11	AGT
BRA		-0.10	-0.17	-0.22	-0.01	-0.02	-0.13	-0.17	-0.10	-0.06	-0.13	-0.02	-0.07	BRA
CHL			0.23	0.11	0.17	0.01	0.04	-0.03	0.23	-0.15	0.08	0.04	-0.06	CHL
GRC				0.25	0.32	-0.04	-0.20	0.13	0.31	0.03	0.19	0.25	0.15	GRC
IND					0.35	-0.02	-0.00	0.14	0.27	-0.01	0.28	0.28	0.17	IND
JOR						-0.16	-0.04	-0.04	-0.01	0.15	0.10	0.24	0.20	JOR
KOR							0.05	0.07	-0.09	0.04	0.15	0.12	0.09	KOR
MEX								0.06	0.15	0.12	0.03	0.13	0.15	MEX
THA									-0.06	-0.13	0.05	0.13	-0.04	THA
ZWE										0.05	0.08	0.15	0.11	ZWE
USA											0.22	0.46	0.86	USA
JAP												0.53	0.59	JAP
EUR													0.79	EUR
	BRA	CHL	GRC	IND	JOR	KOR	MEX	THA	ZWE	USA	JAP	EUR	WLD	

TABLE 7: Predictability of Emerging Market Returns Using Local Instruments, 1985-1991

$$r_{j,t-1} = \beta_0 + \beta_1 r_{j,t-1} + \beta_2 r_{m,t-1} + \beta_3 jan + \beta_4 usjunk_{t-1} + \beta_5 usterm_{t-1} + \beta_6 div_{m,t-1} + \varepsilon_t$$

$r_{j,t}$ denotes the return on the local market portfolio. The local instrument set contains $r_{j,t-1}$, the lagged return on the local market portfolio; $r_{m,t-1}$, the lagged return on the world portfolio; *jan*, a dummy for the month of January; $usjunk_{t-1}$, the lagged difference between the returns on Moody Baa and Moody Aaa bonds; $usterm_{t-1}$, the lagged difference between the one month holding yields on a 90 day Treasury bill and the Treasury bill 30 days closest to maturity; $div_{m,t-1}$, the lagged dividend yield on the world market portfolio. Common instruments include all local instruments except the lagged local return, $r_{j,t-1}$. All returns are calculated as the excess return over the yield on the Treasury bill closest to 30 days to maturity.

	Coefficients on							Common Inst.
Market	$r_{j,t-1}$	$r_{m,t-1}$	*jan*	$usjunk_{t-1}$	$usterm_{t-1}$	$div_{m,t-1}$	adj. R^2	adj. R^2
Argentina	-0.121	-0.154	-0.075	84.22	-101.4	2.209	-0.031	-0.033
	(-0.518)	(-0.214)	(-0.373)	(0.194)	(-0.803)	(0.036)		
Brazil	-0.100	0.693	-0.147	125.0	116.4	-6.068	-0.028	-0.025
	(-0.564)	(0.930)	(-0.796)	(0.477)	(0.832)	(-0.131)		
Chile	0.267	0.184	-0.044	73.13	71.24	1.695	0.114	0.059
	(2.086)	(0.825)	(-1.079)	(0.910)	(2.186)	(0.151)		
Colombia	0.497	0.213	0.019	-137.3	-40.75	28.13	0.338	0.147
	(3.152)	(0.861)	(0.309)	(-1.276)	(-1.128)	(1.819)		
Greece	0.074	0.192	0.013	23.77	-14.39	-25.74	-0.017	-0.009
	(0.646)	(0.407)	(0.089)	(0.140)	(-0.168)	(-1.216)		
India	0.031	-0.042	0.004	19.77	-20.39	-7.427	-0.062	-0.049
	(0.183)	(-0.194)	(0.059)	(0.198)	(-0.396)	(-0.648)		
Indonesia	-0.522	-0.086	-0.301	166.7	145.3	0.526	0.103	-0.107
	(2.668)	(-0.189)	(-1.390)	(0.851)	(0.586)	(0.016)		
Jordan	-0.056	-0.107	-0.008	58.38	8.492	-0.062	-0.047	-0.037
	(-0.322)	(-0.683)	(-0.157)	(0.811)	(0.295)	(-0.007)		
Korea	-0.118	0.131	-0.034	151.4	20.95	1.836	0.012	0.013
	(-0.689)	(0.431)	(-0.590)	(1.336)	(0.570)	(0.121)		
Malaysia	0.103	-0.052	0.002	-3.896	15.32	6.749	-0.056	-0.051
	(0.524)	(-0.160)	(0.046)	(-0.043)	(0.408)	(0.590)		
Mexico	0.259	0.965	0.109	-120.8	-50.66	18.38	0.156	0.106
	(1.367)	(0.966)	(1.266)	(-0.784)	(-0.856)	(0.812)		
Nigeria	0.049	0.073	0.084	-112.2	-69.85	-8.767	-0.011	-0.000
	(0.263)	(0.186)	(0.903)	(-0.955)	(-1.114)	(-0.536)		

Pakistan	0.291	0.083	0.003	-142.9	-24.65	28.90	0.294	0.250
	(1.177)	(0.544)	(0.145)	(-1.666)	(-0.803)	(2.058)		
Philippines	0.279	0.033	-0.028	197.1	15.54	1.355	0.131	0.074
	(2.000)	(0.080)	(0.080)	(1.986)	(0.250)	(0.085)		
Portugal	0.149	0.575	0.069	204.7	-29.37	-6.758	0.112	0.108
	(0.594)	(0.886)	(0.538)	(1.544)	(-0.325)	(-0.368)		
Taiwan	-0.004	0.301	-0.002	187.5	72.34	4.192	0.007	0.019
	(-0.021)	(0.551)	(-0.015)	(1.197)	(0.909)	(0.191)		
Thailand	0.088	0.124	-0.008	-23.78	34.72	8.360	-0.037	-0.030
	(0.310)	(0.272)	(-0.171)	(-0.197)	(0.742)	(0.527)		
Turkey	0.168	0.089	0.456	-17.52	-257.7	-34.55	0.069	0.062
	(1.066)	(-0.115)	(1.830)	(-0.056)	(-1.272)	(-0.949)		
Venezuela	0.212	-0.310	0.138	-120.3	-97.41	15.59	0.034	0.003
	(1.380)	(-0.855)	(1.356)	(-0.655)	(-1.004)	(0.593)		
Zimbabwe	0.160	-0.128	0.005	100.4	43.90	-25.95	0.074	0.061
	(1.689)	(-0.627)	(0.071)	(0.735)	(0.724)	(-1.469)		

* Newey-West heteroskedasticity- and autocorrelation-robust t statistics appear in parentheses. Estimates of the constant are omitted.

TABLE 8: Estimates of a Conditional CAPM with Time-varying Expected Returns and Constant Conditional Betas
1985-1991

$$\epsilon_{jt} = r_{jt} - r_{wt}\beta$$

Market	β	Mean excess return	Local inst. χ_6^2	Common inst. χ_5^2
Argentina	0.533	0.030	4.63	2.96
	(1.774)		(0.592)	(0.707)
Brazil	1.044	0.001	3.47	2.98
	(1.386)		(0.748)	(0.703)
Chile	1.961	0.035	8.13	6.44
	(0.729)		(0.229)	(0.266)
Colombia	0.376	0.028	38.23**	15.44**
	(0.510)		(0.000)	(0.009)
Greece	-0.088	0.019	6.42	6.12
	(0.852)		(0.378)	(0.295)
India	0.125	0.009	2.15	2.068
	(0.567)		(0.905)	(0.840)
Indonesia	-0.409	-0.027	8.50	4.63
	(0.733)		(0.204)	(0.463)
Jordan	0.270	-0.002	1.89	1.59
	(0.347)		(0.930)	(0.903)
Korea	1.240	0.014	3.95	1.35
	(0.533)		(0.683)	(0.930)
Malaysia	0.113	0.003	1.88	1.096
	(0.494)		(0.931)	(0.954)
Mexico	1.878	0.031	18.52**	4.84**
	(1.033)		(0.005)	(0.011)
Nigeria	-0.991	-0.005	3.10	2.91
	(0.856)		(0.796)	(0.714)
Pakistan	0.619	0.015	24.44**	23.63**
	(0.411)		(0.000)	(0.000)
Philippines	2.931	0.029	1.73	1.45
	(0.902)		(0.942)	(0.918)
Portugal	0.984	0.025	16.51*	6.31
	(0.733)		(0.011)	(0.278)

Taiwan	1.831	0.018	3.76	2.49
	(0.935)		(0.709)	(0.779)
Thailand	0.858	0.021	7.25	6.508
	(0.535)		(0.298)	(0.260)
Turkey	-2.825	0.053	8.05	11.03*
	(3.222)		(0.235)	(0.051)
Venezuela	0.232	0.021	10.10	6.22
	(0.928)		(0.120)	(0.285)
Zimbabwe	0.070	0.022	15.57**	12.20**
	(0.497)		(0.016)	(0.032)

* Denotes that the null hypothesis of the CAPM can be rejected with 90 percent confidence; ** denotes that the null can be rejected with 95 percent confidence. All estimates use Hansen's (1982) Generalized Method of Moments (GMM). The GMM procedure iterates three to five times over the weighting matrix, as Monte Carlo simulations have found that repeated iteration improves the small sample properties of the estimates.

Common instruments include a constant, the lagged return on the world index less the return on a 30 day Treasury bill, a dummy for the month of January, the lagged differential between the return to holding a 90 day Treasury bill for one month and the return on a Treasury bill 30 days to maturity, the lagged differential between the yield on a Moody Baa bond and the yield on a Moody Aaa bond, and the lagged dividend yield on the world portfolio less the return on a 30 day Treasury bill. The local instrument set includes all common instruments plus the lagged return on the local index less the return on a 30 day Treasury bill.

Figure 2

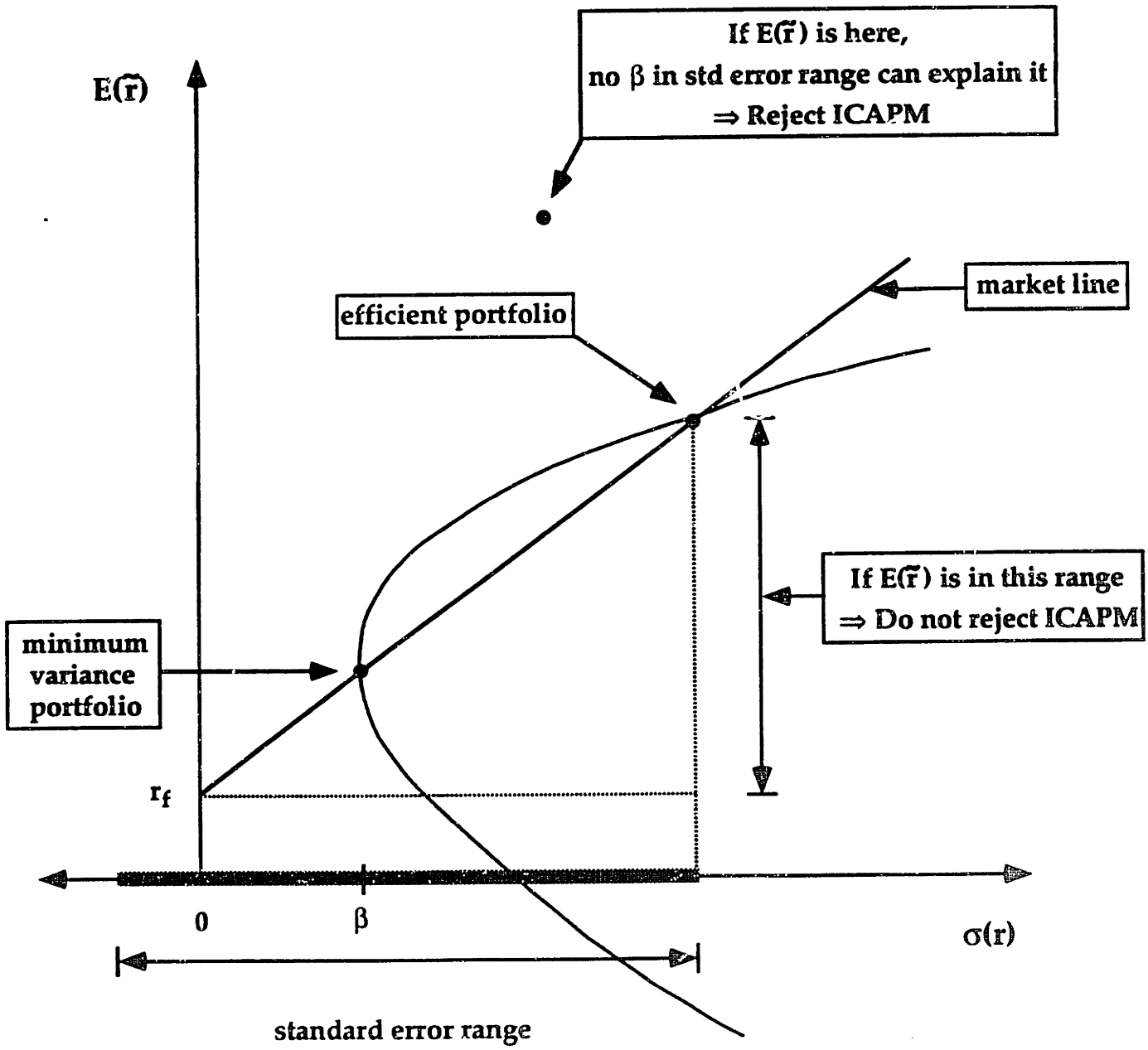

If E(r̃) is here,
no β in std error range can explain it
⇒ Reject ICAPM
E(r̃)
market line
efficient portfolio
If E(r̃) is in this range
⇒ Do not reject ICAPM
minimum
variance
portfolio
r_f
0
β
σ(r)
standard error range

TABLE 9: Estimates of a Conditional CAPM with Time-varying Expected Returns and Constant Conditional Betas, 1977-1984 and 1977-1991

$$\epsilon_{jt} = r_{jt} - r_{wt}\beta$$

Market	1977-84			Full Sample, 1977-91		
	β_{loc}	Local inst. χ_6^2	Common inst. χ_5^2	β_{loc}	Local inst. χ_6^2	Common inst. χ_5^2
Argentina	-0.726	8.27	8.27	0.274	6.91	5.72
	(1.725)	(0.219)	(0.142)	(1.359)	(0.329)	(0.335)
Brazil	-1.434	4.17	4.14	-0.244	1.869	1.614
	(0.847)	(0.654)	(0.529)	(0.931)	(0.931)	(0.900)
Chile	-0.176	14.50**	13.88**	0.756	25.87**	22.26**
	(0.934)	(0.025)	(0.016)	(0.611)	(0.000)	(0.000)
Greece	0.961	20.72**	20.04**	-0.253	9.88	8.14
	(0.524)	(0.002)	(0.001)	(0.570)	(0.130)	(0.148)
India	-0.101	14.72**	9.40*	0.012	4.99	4.88
	(0.370)	(0.023)	(0.094)	(0.376)	(0.544)	(0.431)
Jordan	-0.218	3.84	3.96	-0.083	1.74	1.85
	(0.356)	(0.699)	(0.555)	(0.268)	(0.942)	(0.869)
Korea	0.617	0.839	8.17	0 890	3 04	3.03
	(0.719)	(0.211)	(0.147)	(0.483)	(0.804)	(0.696)
Mexico	0.254	18.74**	18.74**	1.49	31.78**	29.32**
	(0.967)	(0.005)	(0.002)	(0.783)	(0.000)	(0.000)
Thailand	1.473	1.78	0.97	1.25	6.32	4.23
	(0.603)	(0.939)	(0.965)	(0.446)	(0.388)	(0.516)
Zimbabwe	-0.024	17.58**	17.60**	-0.015	16.10**	13.93**
	(0.761)	(0.007)	(0.003)	(0.546)	(0.013)	(0.016)

* Denotes that the null hypothesis of the CAPM can be rejected with 90 percent confidence; ** denotes rejection with 95 percent confidence. All estimates use Hansen's (1982) Generalized Method of Moments (GMM). The GMM procedure iterates three to five times over the weighting matrix, as Monte Carlo simulations have found that repeated iteration improves the small sample properties of the estimates.

Common instruments include a constant, the lagged return on the world index less the return on a 30 day Treasury bill, a dummy for the month of January, the lagged differential between the return to holding a 90 day Treasury bill for one month and the return on a Treasury bill 30 days to maturity, the lagged differential between the yield on a Moody Baa bond and the yield on a Moody Aaa bond, and the lagged dividend yield on the world portfolio less the return on a 30 day Treasury bill. The local instrument set includes all common instruments plus the lagged return on the local index less the return on a 30 day Treasury bill.

TABLE 10: Multi-Country Estimates of a Conditional CAPM with Time-varying Expected Returns and Constant Conditional Betas

$$\epsilon_{jt} = r_{jt} - r_{wt}\beta$$

Time Period and Sample	Local inst. χ^2	Common inst. χ^2
13 markets, 1985-91		
None individually reject CAPM	55.47	41.61
Argentina, Brazil, Chile, Greece, India, Jordan, Korea, Malaysia, Nigeria, Taiwan, Philippines, Thailand, Venezuela	(0.975)	(0.990)
17 markets, 1985-91	135.9**	96.16
Four individually reject CAPM	(0.014)	(0.192)
Above plus Colombia, Mexico, Pakistan, Zimbabwe		
7 markets, 1977-84	80.15**	72.42**
None reject CAPM over 85-91	(0.002)	(0.001)
Argentina, Brazil, Chile, Greece, India, Korea, Thailand		
7 markets, 1977-91	42.55	51.73
None reject CAPM over 85-91	(0.178)	(0.144)
Same markets as above		

* Denotes that the null hypothesis of the CAPM can be rejected with 90 percent confidence; ** denotes that the null can be rejected with 95 percent confidence. For the local instruments tests the degrees of freedom are equal to the number of markets times six; for the common, the degrees of freedom is the number of markets times five.

TABLE 11: Tests of a Standard CAPM on Open, Closed and Restricted Markets

$$k_{jt} = r_{jt} - r_{wt}\beta$$

Market & Dates	Mean excess return	LOCAL INST χ^2_6(p)	COMMON INST χ^2_5(p)	no. observations
OPEN MARKETS				
Greece 1989:1-1991:12	0.024	1.364 (0.968)	0.586 (0.989)	36
Jordan 1985:1-1991:1	-0.002	1.89 (0.930)	1.59 (0.903)	82
Malaysia 1985:1-1991:12	0.003	1.88 (0.931)	1.10 (0.954)	73
Portugal 1987:1-1991:12	0.025	16.51** (0.011)	6.31 (0.278)	61
Thailand 1989:1-1991:12	0.019	8.54 (0.201)	2.30 (0.806)	36
Venezuela 1989:1-1991:12	0.049	8.07 (0.233)	2.75 (0.738)	36
CLOSED MARKETS				
Argentina 1985:1-1991:09	0.029	4.29 (0.637)	2.80 (0.731)	79
Chile 1985:1-1991:09	0.038	8.95 (0.176)	7.14 (0.211)	79
Colombia 1985:1-1991:09	0.018	15.51** (0.017)	2.57 (0.765)	70
Nigeria 1985:1-1991:12	-0.005	3.10 (0.796)	2.91 (0.714)	73

Pakistan 1985:1-1990:12	0.005	2.52 (0.866)	2.47 (0.780)	61
RESTRICTED				
Brazil 1987:9-1991:9	0.007	2.39 (0.881)	2.49 (0.778)	43
Korea 1985:1-1991:12	0.014	3.95 (0.683)	1.347 (0.930)	82
Mexico 1985:1-1991:12	0.031	18.52** (0.005)	14.84** (0.011)	82
Philippines 1989:1-1991:12	0.001	6.96 (0.324)	7.50 (0.186)	35
Taiwan 1985:1-1991:12	0.018	3.76 (0.709)	2.49 (0.778)	73
Turkey 1988:1-1991:12	0.053	8.05 (0.235)	11.03* (0.051)	49
Zimbabwe 1985:1-1991:12	0.022	15.57** (0.016)	12.20** (0.032)	82

* Denotes that the standard CAPM can be rejected with 90 percent confidence; ** denotes rejection with 95 percent confidence. All estimates use Hansen's (1982) Generalized Method of Moments (GMM). The GMM procedure iterates three to five times over the weighting matrix, as Monte Carlo simulations have found that repeated iteration improves the small sample properties of the estimates.

Open markets are defined as those where entry is not restricted to foreign investors and no time minimum is imposed before capital or profits may be repatriated. Closed markets are those that entirely bar foreign investment or impose a minimum period of one or more years before capital may be repatriated. Restricted markets permit foreign investment only through closed-end country funds or in special share classes (created exclusively for foreigners). At a given time, some markets do not fall into any category. Only periods where a consistent policy lasts three or more years are tested here.

Common instruments include a constant, the lagged return on the world index less the return on a 30 day Treasury bill, a dummy for the month of January, the lagged differential between the return to holding a 90 day Treasury bill for one month and the return on a Treasury bill 30 days to maturity, the lagged differential between the yield on a Moody Baa bond and the yield on a Moody Aaa bond, and the lagged dividend yield on the world portfolio less the return on a 30 day Treasury bill. Local instruments include the lagged return on the local market index less the return on a 30-day T-bill plus all common instruments.

TABLE 12: Tests of a Standard CAPM:
Markets with and without Capital Controls on Nationals' Investment Abroad

$$k_{jt} = r_{jt} - r_{wt}\beta$$

Market & Dates	Mean excess return	LOCAL INST χ^2_6(p)	COMMON INST χ^2_5(p)	no. observations
NO CAPITAL CONTROLS				
Argentina 1985:1-1991:12	0.030	4.63 (0.592)	2.96 (0.706)	82
Mexico 1985:1-1991:12	0.031	18.52** (0.005)	14.84** (0.011)	84
Malaysia 1985:1-1991:12	0.003	1.88 (0.931)	1.10 (0.954)	73
Portugal 1985:1-1991:12	0.025	16.51** (0.011)	6.31 (0.278)	61
Taiwan 1985:1-1991:12	0.018	3.76 (0.709)	2.49 (0.779)	73
Venezuela 1985:1-1991:12	0.021	10.10 (0.120)	6.22 (0.285)	73
MARKETS IMPOSING CAPITAL CONTROLS				
Brazil 1985:1-1991:12	0.002	3.47 (0.748)	2.98 (0.703)	83
Chile 1985:1-1991:12	0.035	8.13 (0.229)	6.44 (0.266)	83
Colombia 1985:1-1991:12	0.028	38.23** (0.000)	15.44** (0.009)	73
India 1985:1-1991:12	0.009	2.15 (0.905)	2.07 (0.840)	84

Jordan 1985:1-1991:12	-0.002	1.89 (0.930)	1.59 (0.903)	84
Nigeria 1985:1-1991:12	-0.005	3.10 (0.796)	2.91 (0.714)	73
Pakistan 1985:1-1991:12	0.015	24.44** (0.000)	23.63** (0.000)	73
Philippines 1985:1-1991:12	0.029	1.73 (0.942)	1.45 (0.918)	73
Thailand 1985:1-1991:12	0.021	7.25 (0.298)	6.51 (0.260)	84
Zimbabwe 1985:1-1991:12	0.022	15.57** (0.016)	12.20** (0.032)	84

* Denotes that the standard CAPM can be rejected with 90 percent confidence; ** denotes rejection with 95 percent confidence..

All estimates use Hansen's (1982) Generalized Method of Moments (GMM). The GMM procedure iterates three to five times over the weighting matrix, as Monte Carlo simulations have found that repeated iteration improves the small sample properties of the estimates.

Common instruments include a constant, the lagged return on the world index less the return on a 30 day Treasury bill, a dummy for the month of January, the lagged differential between the return to holding a 90 day Treasury bill for one month and the return on a Treasury bill 30 days to maturity, the lagged differential between the yield on a Moody Baa bond and the yield on a Moody Aaa bond, and the lagged dividend yield on the world portfolio less the return on a 30 day Treasury bill. Local instruments include the lagged return on the local market index less the return on a 30-day T-bill plus all common instruments.

TABLE 13: Forecasting Monthly Returns using Dividend-Based Fundamentals, 1985:1 to 1991:12

We study returns over one and twelve month horizons *(k = 1,12)* to determine whether lagged returns can predict future returns by estimating

$$r_{j,t+k} = \alpha_k + \gamma_k \ln(div_{j,t}/p_{j,t}) + \varepsilon_{j,t+k}$$

where $r_{j,t+k}$ is the total return from period t to period $t+k$, and $(z_t - p_t)$ is the difference between the logarithm of a potentially noisy measure of fundamental value (z_t) and the asset price. We use the log of the dividend price ratio, $log(div_{j,t}/p_{j,t})$, to proxy this value, where the dividend-price ratio is a constant multiple of the real dividend. We interpret γ as the fraction of the deviation from the price fundamental.

	1 Month		12 Months	
Market	γ_1	adj. R^2	γ_{12}	adj. R^2
Argentina	0.002	-0.012	0.079	0.017
	(0.079)		(0.647)	
Brazil	-0.016	-0.009	0.511	0.227
	(-0.347)		(2.863)	
Chile	0.002	-0.012	0.065	-0.010
	(0.072)		(0.285)	
Colombia	0.002	-0.014	0.822	0.701
	(0.023)		(7.700)	
Greece	0.021	-0.001	0.431	0.269
	(0.660)		(2.561)	
India	0.033	0.003	0.400	0.157
	(0.871)		(1.930)	
Indonesia	0.020	-0.141	Insufficient obs.	
	(0.364)			
Jordan	-0.003	-0.011	0.058	0.008
	(-0.238)		(0.808)	
Korea	0.016	0.014	0.330	0.492
	(0.889)		(4.498)	
Malaysia	0.110	0.063	-0.039	-0.016
	(2.143)		(-0.168)	
Mexico	0.040	0.002	0.700	0.392
	(0.599)		(2.558)	
Nigeria	-0.021	-0.010	0.065	-0.013
	(-0.442)		(0.234)	
Pakistan	-0.108	0.303	-0.449	0.078
	(-1.943)		(-1.028)	

Philippines	0.082 (2.385)	0.113	1.065 (8.128)	0.860
Portugal	-0.033 (-0.751)	0.013	-0.240 (-1.111)	0.101
Taiwan	0.062 (3.599)	0.121	0.402 (2.488)	0.292
Thailand	0.008 (0.321)	-0.010	0.050 (0.269)	-0.007
Turkey	0.090 (1.147)	0.025	1.377 (2.758)	0.325
Venezuela	-0.010 (-0.219)	-0.012	0.762 (3.089)	0.377
Zimbabwe	0.051 (1.309)	0.045	0.650 (3.588)	0.526

* Newey-West heteroskedasticity- and autocorrelation-robust t statistics appear in parentheses. Estimates of the constant are omitted.

Chapter 3

Attracting Foreign Direct Investment to LDCs:

A Role for Exchange Rate Policy

Stimulated by the surge in foreign direct investment (FDI) in the U.S. that accompanied the late eighties dollar depreciation, several recent papers have sought a link between FDI and real exchange rates.[1] Although the U.S. trade deficit narrowed in the late eighties and total capital inflows declines, direct investment inflows rose substantially. Surprisingly, no one has explored whether other countries undergoing large real depreciations shared the U.S. experience, nor whether exchange rate effects can explain swings in other countries' FDI flows. In the last dozen years, heavily-indebted developing countries(LDCs) have experienced equally dramatic swings in FDI, characterized by drops of 50 percent or more in 1982-83 as the debt crisis set in, continued low investment through the mid-1980s, and spectacular recovery between 1988 and 1990, as FDI inflows climbed rapidly to equal or exceed pre-82 levels (See Figure 1).

This paper explores the experiences of several large debtors, in an attempt to define the link between FDI flows to LDCs and the exchange rate policies of these nations. In the 1970s, many developing economies, most exceptionally in Latin America, enjoyed rapid growth under the protection of overvalued exchange rates, financing trade imbalances by accumulating massive debts. As the countries' debt service burdens exceeded their capacity to pay, the debt supply dried up, and with it the high growth. Today many policy makers and economists tout foreign direct investment as the nineties alternative to debt, and many developing countries actively court direct investment as a source of foreign exchange, investment, and employment. These economies would welcome an exploitable relationship between direct investment flows and exchange rate policy. The question becomes whether setting competitive exchange rates and attracting equity capital in the form of FDI can help Latin American and other large debtors rejuvenate rapid growth.

The panel and time-series evidence presented here will indicate that by maintaining

---

[1]See Caves(1988), Froot and Stein(1991), Klein and Rosengren(1990), Mann(1989), among others.

market-based exchange rates, LDCs can substantially increase foreign direct investment inflows. As the countries in question--specifically Argentina, Brazil, Mexico, and the Philippines--all maintain fixed or highly- managed exchange rates, as opposed to the floating rates of industrial nations, only half the story lies in the relative price effect of real exchange rates. One must also consider the impact of distorted relative prices and peso problems facing any country that is maintaining an overvalued exchange rate and will ultimately need to devalue when it exhausts its reserves. Mispricing and devaluation risk, as reflected in the black market premium, prove more important than pure relative price shifts; the black market premium combined with lagged economic growth explains much of the fluctuation in FDI. The evidence that follows suggests that if LDCs maintain competitive exchange rates, they can maintain steady FDI inflows, whereas cycles of overvaluation and devaluation deter FDI. The empirical analysis requires quarterly data to capture FDI responses to devaluations. Unfortunately, few LDCs keep quarterly balance of payments accounts, restricting the sample to four countries.

As one of the few sources of capital accessible to post-debt countries, any FDI inflow is crucial both as a source of balance of payments finance and a source of investment. The swings in FDI flows to these countries, matched with their shortage of both foreign exchange and investment funds, explain this paper's focus on credit-constrained, highly-indebted economies.[2] Foreign direct investment offers its host country long-term contributions to output growth and employment, while also supplying new technologies, skills, and management expertise. Moreover, FDI projects typically involve some export production, and thereby provide a continuing stream of foreign exchange; historically high rates of reinvestment promise a continuing investment stream. This paper will not explicitly explore the link between FDI and

---

[2]The empirical analysis that follows requires quarterly data to capture FDI responses to devaluations. Unfortunately, few LDCs keep quarterly balance of payments accounts, restricting the sample to four countries: Argentina, Brazil, Mexico and Chile.

growth, focussing instead on the relationship between FDI and exchange rates. Clearly FDI is expansionary in terms of increasing output, creating new jobs, and often increasing exports. Foreign investment may also lead the creation of new sectors by introducing new technologies and production expertise. Growth began a recovery in these countries around 1989, more or less simultaneous with the upsurge in FDI.

Faced with binding capital constraints, a country has two options. The government may impose capital controls and maintain an overvalued exchange rate with the intent of conserving its foreign exchange supplies, resulting in excessive demand for effectively subsidized imports, depressed exports, and also low FDI flows. This strategy can last only the country's reserves are drained and may backfire, actually accelerating reserve exhaustion (depending on export and import elasticities). Alternatively, the country can align its exchange rate with the market-equilibrium value, thus controlling import demand, encouraging exports, and simultaneously attracting capital inflows. FDI may further promote export expansion by opening new sectors or introducing new, lower-cost technologies. The addition of FDI to the standard theory of exchange rate stabilization underscores the benefits of the latter strategy: from exchange rate stabilization, countries can expect to gain not only improved trade balances, but also capital inflows that can finance any remaining trade deficit.

The paper is organized in seven parts. The first discusses stylized evidence about FDI behavior. The second surveys the literature on FDI and exchange rates, and explains the additional considerations needed to study developing countries. A model of portfolio choice with two countries follows in section three. Sections four and five describe the empirical model and techniques, followed by results in section six. Section seven concludes.

I. Trends in Foreign Direct Investment

The importance of foreign direct investment in the global economy has been rising steadily. FDI has grown at an annual rate of 29 percent per year since 1983, triple the rate of export growth and quadruple the rate of world output growth. (See Figure 2) For LDCs, foreign direct investment has arisen as an important source of capital formation, providing an average of 6 percent of national investment for the years 1985-87. FDI flows to developing countries have grown at a rate of 22 percent per annum over 1985-89, versus only 3 percent annually in the first half of the decade and 13 percent in the late seventies.[3]

Mobile investment dollars have followed high growth to the high rates of return promised by rapidly growing regions. Many Asian LDCs and NICs enjoyed unprecedented growth in the eighties, while Latin American saw a rapid expansion begun in the sixties come to an end. East, Southeast and South Asia have enjoyed the most rapidly expanding inflows, at an annual rate of 37 percent for 1985-89, as Asia's share of FDI to LDCs has risen from 37 to 48 percent and the role of FDI in regional capital formation grew. Latin America and the Caribbean, which grew slowly in the mid-eighties, received only 38 percent of flows to developing countries, versus 49 percent in the early eighties. Simultaneously, the share of FDI in the region's capital formation dropped over 1985-87.[4] Numerous studies of FDI (including Lipsey and Kravis 1982, Schneider and Frey 1985) point to total GDP, or market size, and GDP per capita, an indicator of per capita demand, as the most important determinants of FDI flows to developing countries. Indeed, figures 3-6 show that FDI movements closely follow GDP growth fluctuations, with a

---

[3]Recognizing the increased role of FDI, many nations have shifted policies from an anti-foreign-influence line to a more accommodating approach to foreign capital; a study of 30 policies in 46 nations by the UN Committee on Transnational Corporations found that two-thirds of legal restrictions on MNCs had been liberalized.

[4]The above statistics come from UNCTC, *World Investment Report 1991: The Triad in Foreign Direct Investment* (New York: United Nations, 1991), which serves as a basis for much of this section.

lag of two years. One should note, however, that foreign direct investment and total private investment responded very differently to the shocks of the last decade (see figures 7-10).

Much of Latin America's FDI losses in the mid-eighties tie in with the 1982 onset of the debt crisis and simultaneous stagnation in the region. At the same time, the demand for foreign exchange to meet debt service obligations and the decline in direct investment made FDI flows more valuable to highly-indebted countries. Of the limited investment received by high-debt nations, debt-equity swaps accounted for 20 to 80 percent over 1985-90; the impact of swap programs on net FDI remains unclear.[5] Since the late eighties, FDI has begun a rapid recovery in some of the prominent FDI host countries, notably Chile, Mexico, and Argentina. Economic growth began a revival in the same period.

As an alternative to debt, FDI remains very small, with total FDI stocks in all LDCs equal to only 11 percent of total debt claims on the same countries in 1988.[6] Claessens(1991) argues that the rate of return on FDI exceeds and is therefore more burdensome than debt interest payments: 16.2 percent for U.S. direct investment abroad (12.2 percent for Latin America, 28.5 percent for Asia) versus 9.7 percent on debt for 1980-86. This comparison, however, misses the crucial differences between debt and FDI. Debt, granted directly to governments, financed balance of payments deficits and thus subsidized increased consumption as it propped up overvalued exchange rates. FDI, by funding investment, offers continuing contributions to employment and output supply. Moreover, FDI may bring productivity-enhancing technological advances--new production technologies, skills training, and management expertise--that no domestic source can provide.

---

[5]Ibid.

[6]Stijn Claessens, "Alternative Forms of External Finance: A Survey," World Bank Debt and International Finance Working Paper WPS 812 (Washington, D.C.: World Bank, December 1991), p.4.

Whereas debt interest must be exported, a heavy share of FDI profits are reinvested, adding to the benefits mentioned above and reducing the service ratio on FDI to well below the rate of return. Moreover, most FDI projects involve export of some percentage of production, and thereby provide continuing foreign exchange earnings that may offset or exceed the reserve losses due to profit repatriation. In 1989, U.S. companies reinvested 43 percent of the income earned on direct investments abroad. In the same year, the rate of return on U.S. investments in developing countries averaged 13.9 percent across all sectors and 21 percent in manufacturing (Western hemisphere LDCs, 8.9 and 18.1 percent).[7]

In theory, where FDI goes should be determined by location-specific characteristics. For resource-based industries, the single most crucial factor is resource endowments--location, size, quality, ease of extraction. Export-oriented production should go to the sites with the lowest production cost and most favorable exchange rate policies; competitive (relatively depreciated), stable exchange rates and unrestricted convertibility are optimal. For production directed at the local market, the size of the economy and its growth dominate location choice so as to take advantage of economies of scale; per capita income should be as important as the economy's sheer magnitude in determining product demand. In countries with high trade barriers, firms may decide to produce locally rather than export to the market, so as to avoid tariffs or quotas. Realistically, most secondary-industry FDI involves production for both the domestic market and for export, so multinational corporations(MNCs) should seek a host country that combines low costs and strong domestic demand.

Strong regional patterns also characterize FDI site choice. Each major FDI source--the U.S., EC nations, and Japan--concentrates its investment in a sphere of influence. (See figure

---

[7]*Survey of Current Business*, August 1990, p.60. The reinvestment figure is for U.S. investment worldwide; for LDCs profit reinvestment is actually the largest component of FDI flows, so I imagine the share is higher.

11.) U.S investment dominates neighboring Western hemisphere countries, the Philippines, and Pakistan. The first reflects the legacy of the Monroe Doctrine, the second Spanish-American War era imperialism. EC firms dominate the FDI scene in some former European colonies, such as Ghana, and in neighboring East and Central Europe. Japanese investment in LDCs tends to stay within Asia; Japan recently gained dominance in several East Asian nations and Fiji.[8]

A nation's direct investment abroad typically begins in host markets where political, commercial or historical ties already exist, and where the cultural gap is either smallest or best understood. Only when a country becomes a mature and experienced foreign investor do its MNCs branch out globally, without concern for geographical or cultural proximity. At this point, production costs and market considerations may start to dominate site choice.[9]

II. The Literature, and its Gaps

While there exists an extensive literature on the determinants of foreign direct investment, the impact of exchange rate policy has received little attention. Moreover, most studies of FDI flows to developing countries examine cross-sectional evidence, asking which countries were winners or losers and why; typical considerations include market size and trade openness. A

---

[8]Large Japanese MNCs have taken to establishing regional core networks, with a distribution center in one East Asian country and plants in several others in East or Southeast Asia. In some cases these networks are wholly self-sufficient, using no parts from the Japanese parent. Such networks typically export about 50 percent of sales, with the rest consumed in network countries.

[9]With the rising shares of Europe and Japan in outward FDI flows, we see regions of dominance beginning to shift--mostly loss of ground by the U.S. to either of the other two. Expanded EC investment in Brazil and Peru gave Europe the largest role in two markets largely controlled by the U.S. In Asia, Japan has significantly eroded the U.S. position as the major source country in Hong Kong, Singapore, Taiwan, and Thailand. At the same time, some Asian NICs have become foreign investors in their own right, sending production to poorer neighbors either to cut costs or to evade country-specific import quotas in the West.

study of the relation between exchange rates and FDI flows requires a time series or panel approach, so one can compare periods of overvaluation with periods of competitive rates.

The literature linking FDI to exchange rates began when Lough and Willet (1974) noted that a devaluation of the dollar both increased foreign investment in the U.S. and decreased U.S. direct investment abroad. However, the high levels of American overseas investment and dearth of foreign ventures into the U.S. in the quarter before the February 1973 devaluation suggest that firms may have opportunistically rushed or stalled investment plans in anticipation of the devaluation.[10] Lough and Willet proposed that the relationship might reflect intertemporal substitution and not hold up with a longer post-devaluation data series.

The post-85 dollar depreciation proved exceptional as, despite the U.S.'s shrinking trade deficit, foreign direct investment in the U.S. enjoyed an extended boom, rising more or less continuously from mid-1985 through 1989. *A priori* one would have expected a proportional decrease of all capital flows: FDI, portfolio investment, purchases of government securities. Instead, direct investment increased disproportionately, while other forms of investment fell. Observers explained that the weak dollar made real U.S. assets more attractive than in the past--but this argument proves economically invalid because the low dollar should have equally improved the attractiveness of all assets, nominal or real, direct or portfolio. Furthermore, strategic investment timing like that observed in 1973 cannot alone explain such a sustained rise.

Froot and Stein (1991) turn to an imperfect capital markets approach to explain direct investment's extraordinary behavior. If an American and a Japanese investor compete for the purchase of an American asset, both having access to the same loan contract, the winner of the bidding will the investor who can put up the greater down payment, or the investor with higher

---

[10]A *de facto* devaluation of the dollar occurred in February 1973 shift from the Bretton Woods system to floating exchange rates.

dollar wealth. Simply, a real depreciation of the dollar increases the relative wealth of the Japanese investor such that foreigners will more frequently be able to outbid Americans for U.S. assets. In support of their theory, Froot and Stein find a consistently negative coefficient on the real exchange rate (where the real exchange rate increases with currency appreciation) using quarterly data on foreign direct investment as a share of U.S. GDP over 1973-87. However, Froot and Stein's efforts to extend their analysis to four other industrial countries prove successful only for Germany.

Other studies have yielded mixed results. Caves (1988) found that depreciation of the dollar increased foreign direct investment in the United States, using annual data over 1976-86. In her study of the determinants of Japanese direct investment in the U.S., Catherine Mann(1989) found no evidence of exchange rate effects. Klein and Rosengren (1990) do find a real exchange rate effect, and present evidence that relative wealth, rather than relative real wages, acts as the primary transmission mechanism affecting investment in the U.S. Only one paper has extended these considerations to LDCs; in a paper emphasizing the effects of tax policy, trade policy, and public investment on new equity flows, Renelt and Seles (1991) also consider changes in the real exchange rate. They find inconsistent results: their coefficient on changes in the real exchange rate is insignificant for investment from the U.S. or U.K., but for German and Japanese investment real depreciation of the local currency decreases FDI. However, annual data may mask the FDI response to major devaluations; in particular, any intertemporal shifting of investment would likely get lost. Their specification, moreover, introduces measurement error. The dependent variable is the ratio of FDI to GDP measured in the home currency; when the host country is devalued, the GDP term jumps downward and the ratio upward, even if no real change in FDI or GDP occurs.

While Froot and Stein's wealth effect theory may explain acquisitions in and by industrial

nations, it seems inadequate for foreign investment in less developed countries(LDCs). Froot and Stein specifically discuss the auction of an office building that will endure for one year--an asset whose income is invariant to its ownership, to management or to additional investment. As acquisitions of existing assets composed 78.2 percent of FDI in the U.S. over 1976-82, with real estate a large share, this simple example does not seem grossly inaccurate for the United States.[11] In contrast, foreign direct investment in developing countries typically involves either new construction or substantial expansion of existing facilities, as well as significant managerial or technology changes likely to alter the rate of return. The multinational corporations that spend most FDI dollars can raise money in bond markets, escaping the capital market imperfection on which Froot-Stein rests; should it choose to seek bank loans, an internationally-diversified MNC can doubtless obtain rates preferential to those a domestic company would receive. Furthermore, a huge share of FDI comes through profit reinvestment, where no bidding effect comes into play.[12]

Equally importantly, the real exchange rate alone is not a sufficient measure of exchange rate policy for developing countries due to both the use of controlled rates and the presence of capital controls. Whereas the dollar's value floats, continuously adjusting with relatively little intervention, LDCs typically impose strong management on their currencies, which may trade at overvalued rates for extended periods.[13] Overvaluation occurs when a country's inflation rate exceeds the world rate, but the exchange rate stays fixed or depreciates at a rate below the

---

[11]Caves, 1988.

[12]Balance of Payments accounts measure FDI as the sum of new equity flows, reinvested profits, and intrafirm debt. Reinvested profits are accounted as if they were repatriated to the home country, then returned to the host country as new foreign investment.

[13]By overvaluation, I refer to a situation where the official rate exceeds the market-clearing rate that would prevail were the currency permitted to float. Many would argue that in the mid-eighties the dollar's market-clearing exchange rate was higher than either its long term value or relative prices could justify.

inflation rate differential. Rather than letting supply and demand for the currency set the exchange rate so as to balance payments, LDCs meet balance of payments deficits with reserves; a country can maintain an overvalued exchange rate until it exhausts its foreign exchange holdings. In order to prevent reserve exhaustion, many LDCs impose capital controls on the export of currency: nationals may be barred from holding foreign currency or assets, the rights of foreign investors to repatriate their profits or capital may be strictly limited, and import licenses are typically restricted. A black market arises to meet illicit foreign currency demands, and to provide more competitive rates.

Two measures of currency prices are needed to study the effects of exchange rates on FDI. The real exchange rate reflects relative prices and the expected strength of the nation's economy; the black market premium reflects the extent of currency overvaluation and the expectations of devaluation. (Foreign direct investment, real exchange rates, and black market premia are graphed in figures 12-15.) The black market premium tends to be a noisy measure, substantially affected by current financial transactions which alter the supply of dollars in the local market; however, it should capture the extent of overvaluation (mispricing) reasonably well.

An expected devaluation has two effects on anticipated profits. First, an MNC's expected dollar profits in the current period equal the rate of return in the host currency, adjusted for any change in the exchange rate,

$$E(1 + r_s) = (1 + r_p)[1 - E(\frac{e_{t+1} - e_t}{e_t})], \qquad (1)$$

where r_p denotes the return in host currency ("pesos"), r_s denotes the return in U.S. dollars, and e = pesos/dollars.[14] The immediate conversion loss due to devaluation affects only short-term

[14]One should think of dollars simply as an international currency; for a British-based firm, Sterling might be more appropriate.

profits and thus should have little impact on the long-term returns involved in foreign direct investment. High devaluation risk may, however, cause MNCs to delay investment until post-devaluation (similar to the opportunistic timing observed by Lough and Willet), or lead firms to repatriate profits that it would otherwise reinvest. Post-devaluation, the firm might return some of the funds to its LDC subsidiary; but if the firm has in mind an optimal reinvestment sum in terms of domestic currency (or in real terms), it will return fewer dollars than it took out, causing a net reserve loss to the host country.[15]

Devaluation may also have a long-term impact on profits, if domestic demand affects the subsidiary's return. Major devaluations typically induce recessions, shrinking demand; the prices of imported goods rise while prices of domestically-produced goods do not change, and wages may drop as the labor market stagnates. Domestic sales revenues should fall, with costs fixed or even rising if inputs must be imported, thus squeezing profits for perhaps several years. If, however, the subsidiary is primarily export-oriented, devaluation may increase profitability. Meanwhile, the dollar value of real wages and other domestic costs will fall, although foreign content costs will rise; dollar-denominated revenue should hold steady, allowing increased profits for as long as the real exchange rate holds steady at its new, lower level.[16] Since direct investment is inherently long-term, the black market premium impact should primarily come from the recessionary impact of devaluation on future profits and the mispricing of domestic goods during overvaluation. Previous papers, as well as my own results below, show that the size of

---

[15]Heavy flight of MNC profits (whose repatriation is generally unrestricted) could cause a major drain on reserves and actually precipitate a devaluation the country might otherwise have avoided.
The term subsidiary may be used to refer to an individual FDI project; it assumes nothing about incorporation, only that the project is part of a larger, foreign-based organization.

[16]Because labor is an important cost component in all production, I assume here that reductions in local input costs will exceed increases in imported input costs.

the domestic market plays an important role determining FDI flows.[17] On this evidence, we should expect that devaluation will, on average, diminish rates of return to FDI for several periods. In addition, any panel study of FDI must control for other factors that differ across countries and time--political stability, market size and growth.

III. A Model of Portfolio Choice with Foreign Direct Investment

The following model provides a general equilibrium framework in which to analyze foreign direct investment flows, with explicit consideration of output growth and the black market premium. Based on a 1969 Tobin money-securities-capital model, this two country extension distinguishes domestic and foreign asset holders and divides the three assets into domestic and foreign.[18] The domestic nation should be thought of as an LDC and foreign as an industrialized country. Currency remains domestic currency(pesos) and domestic capital is taken to be the only non-monetary asset in the LDC (no bonds, nor other portfolio assets). The securities in the original model become a foreign asset, which may be thought of as nominal bonds denominated in foreign currency, or simply as foreign currency itself (with zero foreign inflation); the term *dollars* will often be used to refer the foreign asset, in the context of redeeming domestic currency for the foreign asset at the central bank (or vice versa). While domestic investors hold all three assets, foreigners hold only domestic capital and foreign assets; foreign holdings of domestic capital should be interpreted as foreign direct investment. The model describes changes

---

[17]See Lipsey and Kravis(1982), Schneider and Frey(1985).

[18]The model uses as its foundation James Tobin's "A General Equilibrium Approach to Monetary Theory, *Journal of Money, Credit and Banking*, 1 (February 1969), 15-29.

in foreign and domestic holdings of the three assets in response to changes in exogenous economic variables. Changes in foreign holdings of LDC capital represent net foreign direct investment flows.

A limitation of q-theory models lies in the fact that asset supplies remain fixed. However, stocks that push q above one--in words, shocks that cause the marginal value of capital to exceed its replacement cost--create incentives to generate additional capital; shocks that drive q below one make net depreciation appropriate. While the capital stock does not respond within the model, these changes in the capital stock should be viewed as a result of the model. For example, if $q > 1$ and desired foreign holdings of capital rise, assume that FDI involving new construction occurs. If $q > 1$ and desired domestic holdings of capital rise, assume domestically-financed construction occurs.

The Model with No Capital Controls

Three assets exist in the economy:

(1) Domestically-located capital(K) with real rate of return r_K

(2) Domestic currency (M=pesos) with return r_M

(3) Foreign assets (in dollars) with return r_F, which trade at a fixed rate *e* with domestic money (i.e., 1 unit of foreign asset = 1 unit foreign currency).

We will refer to the vector of rates of return as $\hat{r} = [r_M, r_K, r_F]$

Nationality distinguishes two kinds of investors:

Domestic investors hold all 3 assets, M, K, F,

Foreigners hold domestic K and the foreign asset F.

We also define prices and exchange rates:

Domestic price level P, with domestic inflation = ρ_p^e such that,

$$p_{t+1} = p_t(1+\rho_p^e).$$

We impose rational expectations such that $\rho_p^e = \rho_p^{actual}$.

Foreign inflation = 0.

Real exchange rate e = Pesos/$. If a peso devaluation occurs, $\Delta e > 0$; otherwise, $\Delta e = 0$.

The LDC central bank maintains fixed exchange rate *e* by holding stocks of both domestic money M and the foreign asset F, and allowing foreign and domestic citizens to trade M for F at *e* until its supply of either should run out, forcing a resetting of the exchange rate. As a result, the supplies of M and F held by private investors are not fixed, but instead the supply of the composite asset (M+F) is fixed. At any point, the relative supplies of M and F are endogenously determined by asset demands, hence by E(*e*) and relative asset returns. So long as the LDC central bank can defend its fixed exchange rate, effectively only two assets exist, domestic capital K and (M+F).

When foreigners wish to purchase domestic capital K, foreign assets F flow into the central bank and are exchanged for currency M, which foreign investors then use in transactions to purchase K; the private supply of F will drop and the supply of M rise by the amount foreigners change at the bank, or the amount they shift their portfolios from F to K. (Foreigners use M only for transactions and do not hold it; such an increase in the money supply must end up in the portfolios of domestic investors.) The balance between currency and foreign assets may also be altered, given the maximum F in the country (between citizens and the central bank), if domestic investors wishing to shift their portfolios redeem M for F (or vice versa) at the central bank.

Changes in either domestic or foreign demand for F may alter reserve levels, i.e. the supply of foreign assets held by the central bank. Neither seignorage nor open market operations exist in the model at present; only changes in private asset demands can change private asset supplies. Since the supplies of M and F are endogenous, the superscript c (F^c, M^c) will designate the current level of the asset in circulation, or in private hands; the total asset supply split between central bank and private holdings will be designated as s, and central bank holdings will be designated as g for government:

$$F^d + F^f = F^c \leq F^s = F^d + F^s + F^g. \tag{3}$$

Economic growth will affect the economy indirectly through an exogenous variable, R, the marginal efficiency of capital relative to its reproduction cost. We will assume that R is a function of the strength of the domestic economy,

$$R = R(G), \tag{4}$$

where G represents per capita GDP growth and is also exogenous.

Growth has two offsetting effects on R:

(1) As the economy grows, domestic demand rises, increasing production revenues and the return to capital. Moreover, under high demand, capital operates at full capacity, increasing the productivity and income of capital,

$$R'(\textit{capacity utilization, consumer demand}) > 0. \tag{5}$$

This effect will be particularly important in host-market-oriented production.

(2) An expanding economy, particularly one overheated or growing at a rate faster than the economy can absorb, will experience tight markets for labor and other locally-obtained inputs, producing demand-pull inflation,

This cost effect will have greatest importance in pure export industries where expansion will

$$R'(\textit{input demand}) < 0. \tag{6}$$

increase costs without increasing revenues.

Based on stylized evidence, we will assume that the capacity/consumer demand effect dominates such that

$$R'(G) > 0. \tag{7}$$

We define wealth in pesos:

$$\textit{Domestic Wealth} \qquad q\bar{K}^d + M/p + eF^d = W^d \quad (\textit{in pesos}) \tag{8}$$

$$\textit{Foreign Wealth} \qquad qK^f + eF^f = W^f \quad (\textit{also in pesos}) \tag{9}$$

Assume foreign wealth so swamps K^f that a change in the price of capital q will not alter foreign wealth W^f.[19] One should think of all foreign assets (other than holdings of LDC capital) as being subsumed in F^f.

$$\textit{World Wealth} \qquad W = W^d + W^f = qK^s + M^c/p + eF^c. \tag{10}$$

Three balance equations summarize asset ownership:

[19]One need not necessarily assume that all foreigners invest equal shares of their individual wealth in K^f; one can instead think of a continuum of foreign investors with varying propensities to invest in t' LDC, where the total share of foreign wealth held in capital, h^f_K, is the wealth-weighted average across all foreign investors.

$$h_K^d(\bar{r})W^d + h_K^f(\bar{r})W^f = qK \tag{11}$$

$$h_M^d(\bar{r})W^d = M^c/P \tag{12}$$

$$h_F^d(\bar{r})W^d + h_F^f(\bar{r})W^f = eF^c, \tag{13}$$

where h^i_j represents the share of type i investors in asset J, as a function of relative asset returns and the investor's income-to-wealth ratio.

The assets yield real rates of return as defined below (primes denote nominal values):

$$r_K q = R \tag{14}$$

$$r_M = r'_M - \rho^e_p \tag{15}$$

$$r_F = r'_F(1 + \Delta e/e), \tag{16}$$

where generally $\Delta e=0$.

Let $r_M' = 0$.

Let r_F' be fixed.

So long as the LDC government can defend fixed exchange rate e, $r_F = r_F'$. In general, assume that $E(\Delta e) = 0$; however, we will also consider the case where $E(\Delta e) > 0$. For simplicity, it will be convenient to assume that initially, $e = 1$.

The following four equations summarize asset market equilibrium; subscripts d and f denote domestic and foreign asset holdings.

$$K^d + K^f = K^s \tag{17}$$

$$M^d = M^c \tag{18}$$

$$F^d + F^f = F^c \tag{19}$$

$$M^d + F^d + F^f = \overline{(M+F)^c} = \tilde{M}^c + \tilde{F}^c \tag{20}$$

Recall that

$$F^c + F^g = F^s; \quad M^c + M^g = M^s, \tag{21}$$

where g denotes assets held by the central bank.

Combining balance and asset equilibrium equations yields:

$$h_k^d(\hat{r})W^d + h_k^f(\hat{r})W^f = qK^s \tag{22}$$

$$h_M^d(\hat{r})W^d + h_F^d(\hat{r})W^d + h_F^f(\hat{r})W^f = eF^c + M^c/P \tag{23}$$

Exogenous variables are $(M+F)^c$, K^s, R (and G), e, ρ^e_p, p, r_M', r_F'.

Endogenous variables are M^c, F^c, q, W^d, W^f, r_K, r_F, r_M.

The asset shares are also endogenously determined based on asset return vector $\hat{r}$. Combining the asset shares with wealth enables us to determine how much foreigners hold in each asset, i.e. qK^f, M^d/P, etc. The portfolio shares necessarily sum to one:

$$\begin{aligned} h_M^d + h_K^d + h_F^d &= 1 \\ h_K^f + h_f^f &= 1 \end{aligned} \tag{24}$$

Since as defined in equations (17) and (18), the model effectively has only two assets, (M+F) and K, we can solve the model by consolidating these expressions into a single equation in q and employing the two wealth equations stated previously. By Walras' Law, we can equivalently use an equation for K or (M+F). Because this model is designed to illustrate ownership of capital, I choose the equation for domestic capital.

We can now consolidate the model into three equations:

$$h_K^d(R/q, r_M, r_F)\,W^d + h_K^f(R/q, r_M, r_F)\,W^f = qK^s \qquad (25)$$

$$W^d = qK^d + M/P + eF^d \qquad (2)$$

$$W^f = qK^f + eF^d \qquad (3)$$

Since r_M is determined by exogenous factors r_M' and ρ_p°, and by r_F (which equals exogenously-determined r_F' whenever $\Delta e = 0$) the consolidated equations above determine only q and the portfolio shares; of all factors affecting rates of return and asset demands, q alone shifts to ensure market equilibrium.[20] In solving the model, we will assume that the assets are gross substitutes, i.e. that the own derivative of the h_i are positive and the cross-derivatives non-positive,

$$\partial h_i/\partial r_i > 0 \quad and \quad \partial h_i/\partial r_j \leq 0. \qquad (27)$$

Moreover, the sum of the changes in assets shares for a given class of investor J must equal zero,

[20]Recall the p and e can jump.

$$\sum_i \partial h_i^J/\partial x = 0. \qquad (28)$$

Table 1a, below, explains the impact of exogenous variables on endogenous variables, and hence on foreign and domestic asset ownership. Any change in an exogenous variable has two effects on asset ownership: a direct effect on asset returns and hence desired asset shares as reflected in equation (18), and an indirect effect through the rate of return equation for q (equation 8), which alters both r_K and relative domestic and foreign wealth.

Table 1a: Impact of an Increase in Exogenous Variables on Asset Distribution and Asset Supplies with no capital controls

	$\mathbb{R}$	e	$\mathbb{E}(\Delta e), r_F'$	r_M'	ρ^e_p (r_M)
qK^f	+	+	-	+	-
K^f	+	+	-	+	-
qK^d	+	- or =	-	+	+
eF^f	-	+	+	-	+
eF^d	- or =	+	+ (small)	-	+
M^d/P, M^c	+	+	-	+	-
F^b, $-F^c$	-	-	+	-	+
q	+	+		-	-

Model with Capital Controls

In this version of the model, we assume that the LDC government has forbidden domestic investors to purchase F; the central bank will no longer allow citizens to redeem pesos for dollars. Foreigners, however, may freely change either pesos for dollars or dollars for pesos as

they buy or sell domestic capital. Domestic investors seeking dollars to purchase foreign assets must use a black market and pay a rate equal to *e(1-b)* to purchase dollars, where *b* is a non-negative premium over the official rate. The size of the premium depends directly on domestic investors' demand for foreign assets.

In principle, domestic investors may exchange dollars holdings (F) for pesos, but we assume that citizens will not divest of F as long as a positive black market premium exists. In the short term (in which the model operates), F^d is effectively fixed, such that

$$W^d = qK^d + M/P + e(1+b)\overline{F^d}. \tag{29}$$

Note that changes in b affect domestic wealth. The supply of dollars foreigners may hold is now limited as well,

$$\begin{aligned} F^f_{max} &= F^s - \overline{F^d} \\ F^f = F^c &= F^s - \overline{F^d} - F^g. \end{aligned} \tag{30}$$

and a fluctuating share of domestic capital K. Again, superscript *c* denotes assets in circulation and superscript *g* denotes assets held by the central bank.

Under capital controls, there exist effectively three assets: domestic capital(K), the fixed domestic supply of foreign assets($\bar{F}^d$), and a mixed asset combining money and all remaining foreign assets $(M + F^f)^c$. Foreigners again hold only domestic capital K and foreign assets F^f. The central bank must still hold some supply of F to meet the exchange demands of foreign investors at exchange rate e; now foreign investors' asset preferences exclusively determine the relative supplies of M^c and F^c. Domestic investors hold capital, the endogenous stock of money, and $\bar{F}^d$.

Currency trades on the black market at

$$e^{BM} = e(1 + b), \quad b = \textit{black market premium}. \tag{31}$$

Black market premium b adjusts to ensure that domestic demand for foreign assets exactly equals the fixed supply,

$$h_F^d(\hat{r})W^d = e(1+b)\overline{F^d}. \tag{32}$$

With capital controls, we have a system of two unknowns, b and q, adjusting simultaneously to achieve asset market equilibrium. We assume that domestic residents make all foreign exchange transactions on the black market and that foreigners make all transactions on the official market.

The revised system is summarized by the following equations:

Wealth is now composed as follows:

$$W^d = qK^d + M/P + e(1+b)\overline{F^d} \tag{33}$$

$$W^f = qK^f + eF^f. \tag{34}$$

The asset balance equations become:

$$h_K^d(\hat{r})W^d + h_K^f(\hat{r})W^f = qK \tag{35}$$

$$h_{Fd}^d(\hat{r}) = e(1+b)\overline{F^d} \tag{36}$$

$$h_M^d(\hat{r})W^d + h_F^f(\hat{r})W^f = eF^c + M^c/P, \tag{37}$$

where $eF^c = h_F^f(\hat{r})$ determines M^c.

Real rates of return may be expressed as:

$$r_K q = R \tag{38}$$

$$r_M = r_M' - \rho_p^e \tag{39}$$

$$r_F = r_F'(1 + \Delta e/e) \tag{40}$$

$$r_{F^d} = \frac{r_F}{1 + b} = \frac{r_F'(1 + \frac{\Delta e}{e})}{1 + b(\frac{1+\Delta b}{b})} \tag{41}$$

To simplify the model's solution, we assume that $E(\Delta b) = \Delta b = 0$.

Asset Market Equilibrium Conditions:

$$K^d + K^f = K^s \tag{42}$$

$$F^d = \overline{F^d} \tag{43}$$

$$M^d + F^f = M^c + F^c = (M^s - M^g) + (F^s - \overline{F^d} - F^g). \tag{44}$$

We can consolidate the model into four equations:

$$h_K^d(R/q, r_M, \frac{r_F}{1+b}) W^d + h_K^f(R/q, r_M, r_F) W^f = qK^s \tag{45}$$

$$h_F^d(R/q, r_M, \frac{r_F}{1+b}) W^d = (1 + b)eF^d \tag{46}$$

$$W^d = qK^d + M/P + e(1+b)\overline{F^d} \quad (38)$$
$$W^f = qK^f + eF^f. \quad (39)$$

Exogenous variables are F^d, K^s, R, e, ρ^e_p, p, r_M', r_F'.

Endogenous variables are F^c (= F^f), M^c (= M^d), q, W^d, W^f, r_K, r_F, r_M, and b.

The asset shares h_j^i are also determined endogenously as a function of rate of return

vector f. Asset shares combined with wealth yield the values of foreign and domestic holdings of each asset (i.e. qK^f, M^d/P). As in the model without capital controls, the portfolio shares of the foreign investors and the domestic investors each sum to one.

One can describe the asset market under capital controls as the intersection of two curves in b-q space, as shown in figure 16, one curve describing equilibrium in the capital market (KK, equation 45), the other (MM, equation 47) describing equilibrium in the domestic currency market. The KK curve slopes upward as a decrease in q and increase in r_K would expand demand for capital, requiring a fall in b (increase in r_{Fd}) to induce domestic investors to shift out of K toward F^d until both markets cleared. The same decrease in q would also reduce demand for currency while an inflow of foreign assets adds to M^c; an increase in b will occur, making $\bar{F}^d$ less attractive and inducing citizens to shift their portfolios from F to M until the domestic currency market is in equilibrium. Hence, the MM curve slopes downward.

The KK curve will shift down whenever total demand for capital rises, causing q to rise for all b; the shift may be driven by an increase in R(G) or a decrease in r_F or r_M. The MM curve will shift out and right whenever real money demand falls below real money supply, such that b or q must fall to induce citizens to hold more money. A decrease in R or increase in r_F or r_M may cause the shift. Important causes of an outward shift of the MM curve include an expected devaluation ($E(\Delta e) > 0$) and tightening of capital controls ($\bar{F}^d \downarrow$). Changes in q shift both curves: if q rises the KK curve will shift to the left and the MM curve will shift out. Note that we now have a new case to consider, that of a liberalization of capital controls or an increase in F^d.

Changes in the Asset-holding Equilibrium

Table 1b describes the impact of changes in each exogenous variable on the asset-holding equilibrium. The model with capital controls differs in that shifts in exogenous variables that would otherwise increase domestic holdings of the foreign asset F^d instead increase the black market premium b. In the presence of capital controls, q and b must adjust to ensure clearance of the domestic currency market. In cases where q must rise to ensure money market equilibrium, the return to capital must fall, thereby reducing the propensity of domestic and foreign investors to hold capital. As a result, capital formation--both domestically-funded and foreign direct investment--is lower than in the absence of capital controls. In addition, capital controls typically lessen reserve losses, because domestic residents are forbidden to convert pesos to dollars; however, reserve gains are similarly dampened because a fall in the ideal foreign asset share in domestic wealth is reflected in a drop in b, rather than exchanges of F^d for M. Simply, as long as citizens are barred from increasing their holdings of foreign assets, they will never give up existing holdings; supply rigidity causes hoarding.[21] Following table 1b, I describe the channels through which the new equilibrium is obtained for the cases of an increase in the profitability of capital and a liberalization of capital controls.

[21]The case of an exchange rate devaluation is exceptional. The model yields an increase in the black market premium as a second-order effect, due to an unrealistic model simplification that eliminates the first-order decline in the premium. Were the premium defined as a function of $(e - e^e)$, where e^e represents the equilibrium or market-clearing rate, rather than as a function of pure asset demand, b would not increase.

Table 1b: Impact of an Increase in Exogenous Variables on Asset Distribution, Asset Supplies, b, q, with capital controls

	R	e	$E(\Delta e), r_F'$	r_M'	$\rho^c_p(r_M)$	F^d
qK^f	+	+	-	+	-	+
K^f	+	+	-	+	-	+
qK^d	+	-	uncertain	-	+	-
eF^*	-	+	+	-	+	-
$e(1+b)F^d$	-	+	+	-	+	+
M^d/P, M^c	+	+	-	+	-	-
F^b, $-F^c$	-	-	+	-	+	+
b	-	+	+	-	+	-
q	+	+	-	-	+	-

In the model without capital controls, an increase in economic growth, G, and subsequently in capital income, R, will raise the rate of return to capital, r_K, such that both domestic and foreign investors will seek to hold a greater share of their wealth in capital and bid up capital price q until the market for real assets clears. The appreciation in value of existing capital holdings (whether kept or sold at the higher price) will increase domestic wealth, dampening initial reductions in domestic demand for currency and foreign assets; however, foreigners hold so little of their wealth in LDC capital that W^f is essentially unchanged. Foreign assets will flow into the country as foreign investors exchange dollars for pesos in order to purchase capital; domestic citizens will keep some of their increased wealth in currency, and convert part back in to foreign assets, resulting in a net reserve gain, an increase in the money supply, and reduction in private holdings of foreign assets. In the new equilibrium, foreign direct investment(qK^f) rises as a new inflow of investment funds occurs.

The impact under capital controls can be seen in figure 16a, where the KK curve shifts

up in response to increased R. Rising foreign and domestic demand for capital, coupled with falling demand for foreign assets, will drive up q, while falling LDC demand for dollars will cause black market premium b to fall. Reserve gains from foreign direct investment will be fully retained, because domestic citizens cannot increase their dollar holdings. Instead, b will fall, increasing r_{Fd} until domestic residents demand foreign assets exactly equal to the fixed $\bar{F}^d$. As demand for domestic money M also falls, second-order increase in b and q must occur to bring the money market back into equilibrium. As a result, q rises higher than it would in the absence of capital controls, decreasing the attractiveness of holding capital and thus reducing both domestic investment qK^d and foreign direct investment qK^f. Thus, exchange restrictions deter foreign direct investment and capital formation.

Consider now a liberalization of capital controls or increase in $\bar{F}^d$, which realistically a government can carry out only if it has controlled or eliminated overvaluation. As such, an increase in $\bar{F}^d$ is equivalent to an exogenous reduction in the black market premium b. The immediate impact is a decline in b, making foreign assets more attractive relative to capital or currency; domestic citizens will seek to shift currency and capital holdings into foreign assets up to the new limits. Falling domestic demand for capital will depress q and increase r_K, shrinking domestic wealth relative to foreign. Foreign investors will pick up the slack in the capital market, bringing dollars to the country to increase their domestic capital holdings. The net impacts on reserves and the money supply will be ambiguous, with both diminished by domestic demand for F, yet increased through foreign demand for capital. As b declines uniformly for all q, but the new equilibrium involves a lower q, one can view this as an inward shift of the MM curve as seen in figure 16b.

IV. A Statistical Model

The empirical component of this paper seeks to test the hypothesis that competitive, market-clearing exchange rates are conducive to FDI. Or, stated differently, that overvalued exchange rates and peso problems deter foreign investors due to (1) uncertainty about future profits imposed by devaluation risk, reducing expected profits, and (2) the overpricing of goods and services that result from overvaluation (the failure of purchasing power parity). The alternative hypothesis, that foreign direct investors are unconcerned with exchange rate alignment or exchange rate risk, would instead be supported if regression analysis finds exchange rate factors insignificant.

The portfolio model presented above shows that the existence of capital controls and positive black market premia can reduce foreign direct investment flows. In the model, this effect arises because domestic investors bid up the price of capital when the domestic money supply expands and foreign currency becomes unavailable. The deviation of prices, including capital prices, from purchasing power parity can be measured by the black market premium. Changes in foreign holdings of LDC capital represent net FDI flows; whenever q rises above one, net capital formation occurs. In real investment decisions, intertemporal optimization and expectations (lacking in the model) play an important role. A firm considering a direct investment project examines the long-term profit horizon. Exchange risk matters not only for its impact on current profits but also for its impact on future revenues, costs, and rates of return.

We will approach the question by studying the fluctuations in four countries' inward FDI flows over a ten-year period, using quarterly panel data for Argentina, Brazil, Mexico, and the Philippines, from 1979:4 to 1989:3. Analysis of quarterly data represents a gain over much of the literature on FDI in developing countries, as most studies rely on cross-section data or annual series. A cost, of course, comes in losing countries; but to capture responses to devaluations,

a minimum of quarterly data is essential. Because cross-country heterogeneity may mask important effects and limit estimation accuracy, times series regressions for each country supplement the panel studies. (Table 2 shows FDI statistics for each country.)

Data availability determined the exact bounds of the sample period: ideally the data should start several years before the debt crisis and growth slowdown, as it does, and continue as close to the present as possible. Unfortunately, the sample misses much of the recent upward swing in FDI, but the Summers-Heston real per capita GDP growth series limits the study to 1989.

The theoretically ideal model appears below:

$$\frac{FDI_t}{GDP_t} = \alpha_i + \beta_1 RER_{it} + \beta_2 BMP_{it} + \beta_3 GDPD_{it} + \beta_4 INSTINV_{it} + \varepsilon_{it} \qquad (48)$$

where

FDI = net foreign direct investment received,

GDP = nominal GDP, in dollars, over sample period,

RER = real exchange rate,

BMP = black market premium,

GDPD = real per-capita GDP growth,

INSTINV = *Institutional Investor* country rating,

subscript *i* denotes country (for panel regressions), subscript *t* denotes time. An explanation of each variable's role will follow.

The dependent variable should ideally measure the rate at which foreign investors increase their share of capital holdings in the developing economy, corresponding to the changes in qK^f in the model summary table. The first-choice specification of the dependent variable, FDI(t)/GDP(t), with both measured in dollars, proved problematic. Both the black market

premium and the dollar valuation of GDP will jump each time a devaluation occurs, even holding constant GDP as measured in domestic currency.[22] As a result, using FDI(t)/GDP(t) yields excessively powerful coefficients on the black market premium, stemming from correlation between 1/GDP and the black market premium.

We solve the problem by using FDI(t)/GDP(mean) as the dependent variable, where GDP(mean) is the nation's average dollar GDP over the sample period. This specification controls for differences in country size in the panel regressions, while avoiding spurious correlation. Changes in country size over the sample period, both relative and absolute, may be partially captured by adding a time trend to the regression. Because the real value of the dollar changed substantially over the sample period, we must extract noise in FDI measurement caused by the conversion of other currencies to dollars; to do so we include the contemporaneous U.S. real exchange rate as a regressor. A strong dollar (say early 1985), for example, would undervalue German FDI paid in deutsche marks.

The final estimation model becomes

$$\frac{FDI_{it}}{GDP_{mean,i}} = \alpha_i + \beta_1 RER_{it} + \beta_2 BMP_{it} + \beta_3 GDPD_{i,t-1} + \beta_4 GDPD_{i,t-2} + \beta_5 INSTINV_{it} + \beta_6 USRER_{it} + \beta_7 T + \varepsilon_{it} \quad (49)$$

where

GDP_{mean} = average nominal GDP over sample period,

USRER = U.S. dollar real exchange rate,

T = time trend,

and other variables are defined on the previous page. Additional regressions are estimated

[22]Whether one measures both FDI and GDP in dollars or domestic currency, the same problem arises; in the former case GDP jumps, in the latter case FDI jumps.

excluding the *Institutional Investor* rating(INSTINV), or adding a terms of trade index.

Our selection of explanatory variables is designed to capture exchange rate effects, the general robustness of the host economy, and political stability. Because FDI moves when a corporate executive decides to invest, based on observed conditions–not because of invisible forces–all dependent variable values are taken at the end of the previous quarter, or the end of the previous year for variables available only at annual frequency.[23] All final results include the real exchange rate, black market premium, and real per capita GDP growth for one and two years previous. (For detailed information on data sources and variable construction, please turn to the data appendix.) The Morgan Guaranty real exchange rate index used here rises with an appreciating currency with the 1980-82 average normalized to 100; in accordance with previous work, we anticipate a negative coefficient. The black market premium measures the percentage by which the parallel market exchange rate exceeds the most common official rate. Based on the overvaluation and devaluation risk effects discussed in previous sections, this term should also have a negative impact.[24]

We also include the *Institutional Investor* country credit ratings (as shown above in the ideal and final estimation models), which range from 0 to 100, with 100 safest. Twice annually, *Institutional Investor* surveys bankers about countries' likelihood of default on sovereign debt; thus the rating incorporates expectations of economic prosperity, political stability, and changes in attitudes toward foreign capital and influence. A country that defaults on debt would also be likely to bar repatriations of FDI profits or capital dues to foreign exchange shortages, so default risk should be closely correlated with risk of profit losses. Moreover, since the regression

---

[23]We will use the convention of treating as current(t) the last-observed or end-of-previous-period values, and treating lags from n periods previous as t-n-1.

[24]How the impacts of the real exchange rate and black market premium should be distinguished is discussed in detail in section VI.

already controls for all major, relevant economic factors, the *Institutional Investor* rating serves as a measure of political stability, and should earn a positive coefficient.[25] We also need the *Institutional Investor* term to capture any political risk, in order to ensure that the coefficient on the black market premium reflects only exchange rate misalignment and not political uncertainty. Political risk as intended here includes odds of expropriation, violence or war.

We also consider an augmented specification that includes the rate of change in the real exchange rate (DRER), which indicates whether the currency has been in a cycle of appreciation and overvaluation or one of real depreciation. If high relative prices deter foreign direct investment, we would expect a negative coefficient on this term, as found in Caves (1988). Recall, however, that Renelt and Seles (1991) found insignificant or positive effects. The model becomes

$$\frac{FDI_{it}}{GDP_{world,t}} = \alpha_i + \beta_1 RER_{it} + \beta_2 BMP_{it} + \beta_3 GDPD_{i,t-1} + \beta_4 GDPD_{i,t-2} + \beta_5 INSTINV_{it} + \beta_6 USRER_{it} + \beta_7 DER_{it} + \beta_8 T + \varepsilon_{it} \quad (50)$$

where DRER = the percentage change in the real exchange rate over the previous quarter, and other variables are defined as in equations 48 and 49.

Additional specifications test the explanatory power of other potentially important variables. To conserve degrees of freedom, we consider these variables one at a time and drop the time trend when doing so. As the black market premium may be positively correlated with the overall prevalence of regulation in the economy, a market openness measure is considered

---

[25]Schneider and Frey(1985) run cross-section regressions using the *Institutional Investor* rating as the sole explanatory variable, asserting that it captures all economic and political considerations. While the regression preforms reasonable compared with their other models, it explains nothing about foreign direct investment decisions. The only meaningful interpretation of their result is that either *Institutional Investor*'s survey either accurately reflects business concerns about various nations, that MNCs consider the ratings in FDI decisions, or that the bankers surveyed have a large enough role in financing FDI to control flows in accord with their risk assessments.

as a proxy for the extent of regulation. OPEN, the ratio of imports plus exports to GDP, measures the importance of trade in the economy. We anticipate a positive coefficient on OPEN, where a low-regulation climate is more attractive to foreign investors. More crucially, if the black market premium coefficient disappears when OPEN is added, the BMP coefficient in fact reflected regulation, not exchange rate factors. We also consider a terms of trade index which reflects changes in the relative world prices of the country's major export and import goods, as well as changes in those goods baskets. Favorable, or high, terms of trade should promise high rates of return and thus attract investment; high export prices may also induce strong demand for domestic currency, causing nominal and real exchange rate appreciation. We expect to find that favorable terms of trade induce higher investment.

Exchange rate uncertainty or volatility may affect FDI flows by adding uncertainty about future profits or introducing costs for foreign exchange portfolio management if a firm acts to reduce foreign exchange risk. To test the impact of uncertainty, we employ the nominal and real exchange rate variances as regressors, both calculated using monthly rates for the previous twenty-four months; both should yield a negative coefficient. Finally, we consider the local deposit rate. A high deposit rate driven by high inflation should deter FDI, while high real exchange rates translate to a high domestic cost of capital and may lead local investors to forego attractive investment projects. Firms from industrial countries, able to raise capital at lower rates at home, may then step in to exploit these investment opportunities. The net effect is uncertain, depending on which factor dominates.

V. Estimation Issues and Techniques

Because this paper intends to explain the causes of FDI variation across time, not across countries, the panel estimates use fixed effects. Fixed effects estimates a different intercept for each country, under the assumption that inherent differences between nations may affect FDI inflows, such as different forms of government, right/left political alignment, or natural resource endowments. The White correction adjusts standard error values for heteroskedasticity and also helps control for autocorrelation.

The comparable time-series estimates for each country used OLS with Newey-West heteroskedasticity- and autocorrelation-robust standard errors. The Newey-West correction incorporated four lags, following the guideline of a lag series between $T^{1/3}$ and $T^{1/4}$ for the 40 observation series.[26]

Potential endogeneity of the real exchange rate introduced a simultaneous equations problem. High inflows of foreign capital may increase international demand for the domestic currency enough to bid up its price or, under fixed exchange rates, boost central bank reserves enough that the bank can support an overvalued exchange rate. The bank may maintain a fixed rate, or depreciate more slowly than called for by the gap between domestic and world inflation. Empirical evidence reveals a substantial correlation between FDI and portfolio investment (as high as 0.44 for the Mexico sample used here), and a significant correlation between the real exchange rate and FDI as well (also highest for Mexico at 0.38). To correct for possible endogeneity, all regressions were repeated with two-stage least squares to instrument for the real exchange rate, using as instruments two lags of the reserve-to-import ratio, two lags of the current account, and the terms of trade index (where not employed as an explanatory variable).

Because net FDI ranges from negative to positive, all estimates use levels. Coefficients

[26]Performing Newey-West with only three lags produced little difference in standard error estimates.

should not be interpreted as elasticities; for major results, elasticities are reported separately.

VI. Estimation Results

As a starting point, and to underscore the distinctions between FDI flows to LDCs and industrial nations, the regressions of Froot and Stein were replicated for both the panel and individual countries. As seen in table 3, positive coefficients on the real exchange rate were obtained in all except the Philippines regression, indicating that FDI rises as the currency appreciates–a result opposite to that obtained by Froot and Stein. That the Philippines regression also earns by far the highest R^2 further indicates that the positive sign on RER in other regressions may well reflect simultaneity, not pure real exchange rate effects. With developing countries, the real exchange rate may substantially reflect expectations about the economy's future prospects; if high growth appears ahead, demand for the currency will increase, causing appreciation. For this reason, we expect the black market premium term to capture the impact of overvaluation and relative price changes, as well as expectations of devaluation, in later regressions.

Table 4 presents panel results for the basic specifications discussed above, using both fixed effects and fixed effects combined two-stage least squares(2SLS) to instrument for the real exchange rate. Note that in all three regressions using simple fixed effects, the coefficient on the real exchange rate is positive and significant, indicating the presence of an identification problem. We emphasize the 2SLS results, in which the real exchange rate coefficient becomes negative and insignificant. The black market premium term yields the predicted negative coefficient, significant at 5 percent in the specifications including the change in the real exchange rate

(DRER) and at 10 percent in the specification excluding that term. The robust coefficient supports our primary hypothesis: that exchange rate overvaluation and peso problems deter foreign investment by increasing current real costs and making future profits uncertain. The associated elasticity ranges from -0.230 to -0.373, depending on the specification; a ten percent increase in the black market premium will cause a two to four percent drop in FDI inflows. Based on the 2SLS results, the relative price effect induced by changes in the real exchange rate has no effect beyond the mispricing and exchange rate uncertainty captured by the black market premium. However, the change in the real exchange rate clearly matters, earning a negative coefficient significant at the 10 percent level. This term signals the trend in relative prices, whether they are becoming more unfavorable as the currency becomes more overvalued, or more favorable as a real depreciation occurs. Its negative coefficient underscores the deterrent effect of exchange rate overvaluation on direct investment, however the effect is small in magnitude: a ten percent acceleration in the rate of real exchange rate growth will induce less than a one percent decline in FDI.

Real per capita GDP growth two years previous (t-1, according to our convention) has the single most powerful impact on FDI inflows, while the impact of growth in the previous year tends to insignificance. A 10 percent increase in GDP growth will induce an 0.68 to 0.87 percent increase in FDI inflows two years later. Only in the 2SLS regression with the change in the real exchange rate and the time trend does the last observed rate of GDP growth earn significance, but its negative sign seems counterintuitive. The *Institutional Investor* term earns the expected positive coefficient and is significant at 5 percent in two of the three 2SLS regressions, which appropriately seems to reflect some investor concern with political stability and host nations' attitude toward foreign capital. Note also that the U.S. real exchange rate term is never significant, and that the time trend is positive and significant. However, we present the results

of the specification including the change in the real exchange rate with and without a time trend, both because the trend may reflect the impact of omitted variables and to conserve degrees of freedom.

Table 5 shows comparable regressions over only the post-debt-crisis period, from the third quarter of 1982 to the third quarter of 1989. The results are similar to those described above, with a few exceptions. The black market premium is now significant at 5 percent only in the change in the specification with DRER and a trend, at 10 percent when the trend is excluded, and insignificant when DRER is dropped. One explanation lies in the fact that when debt inflows fell, so did the magnitude of overvaluation, such that the black market premium may move less in the post-debt era, leaving less to estimate. The elasticity of the *Institutional Investor* rating rises in all three specifications, reflecting greater investor wariness about heavily-indebted economies and their attitudes to foreign capital. Generally, the sample countries ratings plummeted after the debt crisis and recovered only in the late eighties. Tests for structural change after the onset of the debt crisis would clearly fail; the sum of squared errors (not shown) falls only minutely from the full sample to the debt crisis era regressions.

Estimates of additional specifications appear in Table 6. The basic model used to build on includes the percentage change in the real exchange rate but excludes a trend; each specification adds one additional regressor. All estimates use 2SLS and fixed effects; none of the coefficients on the original regressors change markedly in sign or significance unless stated. The variance of the real exchange rate is the only added regressor to earn a significant coefficient, which is small and negative, as predicted. The variance of the nominal exchange rate yields a coefficient approximately equal to zero, as does the deposit rate. Similarly, an annual measure of terms of trade earns a negative and insignificant coefficient. The openness measure yields a positive but insignificant coefficient; more importantly, note that the strength and

magnitude of the black market premium term does not change when OPEN is added, indicating that this coefficient indeed reflects exchange rate effects, not the effect of forms of regulation other than capital controls.

For the country time-series tests, pure OLS and two-stage least squares results differ little. Tables 7 and 8 present OLS results; Table 7 presents the specification without the change in the real exchange rate, table 8 adds DRER but drops the time trend to conserve degrees of freedom. Tables 9 and 10 are 2SLS equivalents of Tables 7 and 8, respectively. Note that doing two-stage least squares does not affect the coefficient on the real exchange rate, regardless of specification. As a result, we will outline only the OLS results here; the 2SLS results are provided for completeness. In Table 7, the real exchange rate term earns a positive coefficient, which is significant for Argentina and Mexico. The coefficient on the black market premium is negative and significant at 5 percent in three economies, at 10 percent for Argentina. GDP growth two years lagged remains powerful, with the exception of the Philippines, while the *Institutional Investor* rating proves significant and positive only for Mexico. The results in Table 8 are roughly similar, with the exception of the negative coefficient on DRER in every economy except Mexico; only for Brazil is this term statistically significant.

VII. Conclusion

The theoretical and empirical results presented above indicate that by maintaining competitive and stable exchange rates, developing countries, particularly credit-constrained, highly-indebted countries, can expand foreign direct investment inflows. For countries seeking to reignite growth after a decade of stagnation or contraction, FDI promises not only hard cash,

but also long-term contributions to output in the form of continuing investment, new technologies, and high-wage employment. This paper's findings only augment to the long-recognized benefits of exchange rate stabilization, most importantly increased export competitiveness and dampened import demand; in addition, increased foreign capital flows can help finance any remaining trade deficit.

References

Caves, Richard E. "Exchange Rate Movements and Foreign Direct Investment in the United States." Harvard Institute for Economic Research Discussion Paper, No. 1383, May 1988.

Claessens, Stijn. "Alternative Forms of External Finance: A Survey." Debt and International Finance Working Paper WPS 812, The World Bank, December 1991.

Cole, Harold L. and William B. English. "Direct Investment: A Doubtful Alternative to International Debt." *Federal Reserve Bank of Minneapolis Quarterly Review*, Winter 1992, 12-22.

Cushman, David O. "Real Exchange Rate Risk, Expectations, and the Level of Direct Investment." *Review of Economics and Statistics*, 67 (May 1985), 297-308.

Edwards, Sebastian. "Capital Flows, Foreign Direct Investment, and Debt-Equity Swaps in Developing Countries." National Bureau of Economic Research, Working Paper No. 3497, October 1990.

Edwards. *Real Exchange Rates, Devaluation, and Adjustment* (Cambridge, MA: M.I.T. Press, 1989).

Froot, Kenneth A. and Jeremy C. Stein. "Exchange Rates and Foreign Direct Investment: An Imperfect Capital Markets Approach." *Quarterly Journal of Economics*, Vol. CVI, No. 427, 1191-1217, (November 1991).

Frey, Bruno S. and Friedrich Schneider. "Economic and Political Determinants of Foreign Direct Investment." *World Development*, Vol. 13, No. 2, 161-175 (1985).

Graham, Edward M. and Paul R. Krugman. *Foreign Direct Investment in the United States* (Washington, D.C.: Institute for International Economics, 1991).

Green, Joshua and Delano Villanueva. "Private Investment in Developing Countries." *IMF Staff Papers* (38:1), March 1991.

Kindleberger, Charles P. *American Business Abroad* (New Haven: Yale University Press, 1969).

Klein, M. and E. Rosengren. "Determinants of Foreign Direct Investment in the United States." Mimeo, Clark University, 1990.

Kravis, Irving B. and Robert E. Lipsey. "The Location of Overseas Production and Production for Export by U.S. Multinational Firms." *Journal of International Economics* 12 (1982) 201-223.

Logue, Dennis E. and Thomas D. Willet. "The Effects of Exchange Rate Adjustment on International Investment." *The Effects of Exchange Rate Adjustments*, eds. Peter B. Clark, et.al. (Washington, D.C.: Government Printing Office, 1978), 137-150.

Mann, Catherine. "Determinants of Japanese Direct Foreign Investment in U.S. Manufacturing Industries." International Finance Discussion Paper No. 362, Board of Governors of the Federal Reserve System, 1989.

Pindyck, Robert S. "Irreversibility, Uncertainty and Investment." *Journal of Economic Literature*, Vol. XXIX (September 1991), 1110-1152.

Prachowney, Martin F.J. "Direct Investment and the Balance of Payments of the United States: A Portfolio Approach." *International Mobility and Movement of Capital*, eds. Fritz Machlup, et.al. (New York: Columbia University Press for National Bureau of Economics Research, 1972), 443-464.

Renelt, David A. and Carlos Seles. "Effects of Host Country Government Policies on Foreign Direct Investment." Harvard mimeo, April 1991.

Swenson, Deborah Lynne. "The Determinants of Foreign Direct Investment in the U.S." M.I.T. Department of Economics dissertation, 1991.

Tobin, James. "A General Equilibrium Approach to Monetary Theory." *Journal of Money, Credit, and Banking*, 1 (February 1969), 15-29.

United Nations Centre on Transnational Corporations. *The Determinants of Foreign Direct Investment: A Survey of the Evidence* (New York: United Nations, 1991).

United Nations Centre on Transnational Corporations. *World Investment Report 1991: The Triad in Foreign Direct Investment* (New York: United Nations, 1991).

Data Sources

All series are quarterly unless otherwise noted.

FDI: Net foreign direct investment, in dollars, from *International Financial Statistics* (IFS). Used to construct the dependent variable, FDI(t)/GDP(mean).

Data is supplied by each country to the International Monetary Fund by either the central bank or national statistical office. As a result, accounting definitions may differ slightly across countries, particularly on the handling of debt-equity swaps. The standard balance of payments definition includes new equity flows, reinvested profits and intrafirm debt.

GDP in national currency units(NCGDP): Nominal GDP supplied on an annual basis by IFS. Used to create dollar GDP = NCGDP/e, where e denotes exchange rate, and subsequently in the calculation of the dependent variable.

Nominal exchange rate(e): Expressed as national currency units to the dollar and taken for the end of the previous quarter from IFS.
The variance of the nominal exchange rate is calculated using the last 24 months of the nominal rate.

Real exchange rate(RER): Morgan Guaranty monthly index, taken for last month of previous quarter. The average value for 1980-82 = 100. Indexes adjust the nominal effective exchange rate for differences in wholesale price inflation (non-food manufactures). A higher index number indicates an appreciated exchange rate.
The rate of change in the real exchange rate (DRER) is the percentage change in the real rate over the previous quarter. The variance of the real rate is calculated using the last 24 months of the real rate.

Black market exchange rate(BLK): From *Pick's Currency Yearbook*, various years. Value is for the end of the last month of the previous quarter. Used to construct the black market premium(BMP),

$$BMP = \frac{BLK - e}{e}.$$

Real per capita GDP growth: Change in real per capita GDP, RGDPCH, from the Summers-Heston dataset version PWT5. Heston and Summers calculate RGDPCH using the purchasing power parity (PPP) assumption. Available only annually, and used on a calendar year basis (i.e., for all of 1980, the rate of change between 1978 and 1979 is used as the t value, and the rate from 1977 and 1978 is treated as the t-1 value).

Institutional Investor country credit rating(INSTINV): Provided by *Institutional Investor* twice-annually since September 1979 (thus defining the sample starting point) based on interviews with international banks. For the second quarter, the March ratings are used; for the fourth quarter, September ratings are used; for the first and third quarters, the value used is the average of the last and next ratings.

Bankers are asked to rate each country on a scale from 0 to 10, with zero the least and ten the most creditworthy. Banks do not rate their home countries. The calculation of final ratings on a scale of 0 to 100 weight each bank's response by the extent of its global exposure and the sophistication of its country analysis system.

U.S. real exchange rate(USRER): Real exchange rate based on normalized unit labor costs, from IFS. The series is calculated by dividing an index of hourly compensation per worker by a five-year moving average of output per man hour so as to remove distortions from cyclical movements.

Terms of Trade index: Annual series TOT4 from the *World Development Report*, with 1980=100. Calculated as

$$\frac{\textit{exports at current prices}}{\textit{exports at constant prices}} * \frac{\textit{imports at constant prices}}{\textit{imports at current prices}},$$

to capture changes in the consumption or production basket.

OPEN: The sum of imports plus exports divided by nominal GDP, quarterly. All raw data from IFS.

Deposit Rate: Annual percentage rate on most common maturity, as reported quarterly by IFS.

Reserves(RES): From IFS, reported by countries in terms of dollars. Used to calculate the reserve-to-import ratio, RES/IMP, as an instrument for the real exchange rate.

Imports(IMP): From IFS, reported by countries in terms of dollars.

Current account balance: From IFS, reported by countries in terms of dollars. An instrument for the real exchange rate.

Private Investment as share of GDP: Constructed by Andrea Madarassy and Guy Pfefferman of the International Finance Corporation, Economics Department. I thank Luis Serven, Andrés Solimano, and Raymundo Fopo of the World Bank for providing me with this data. (Used in graphs only.)

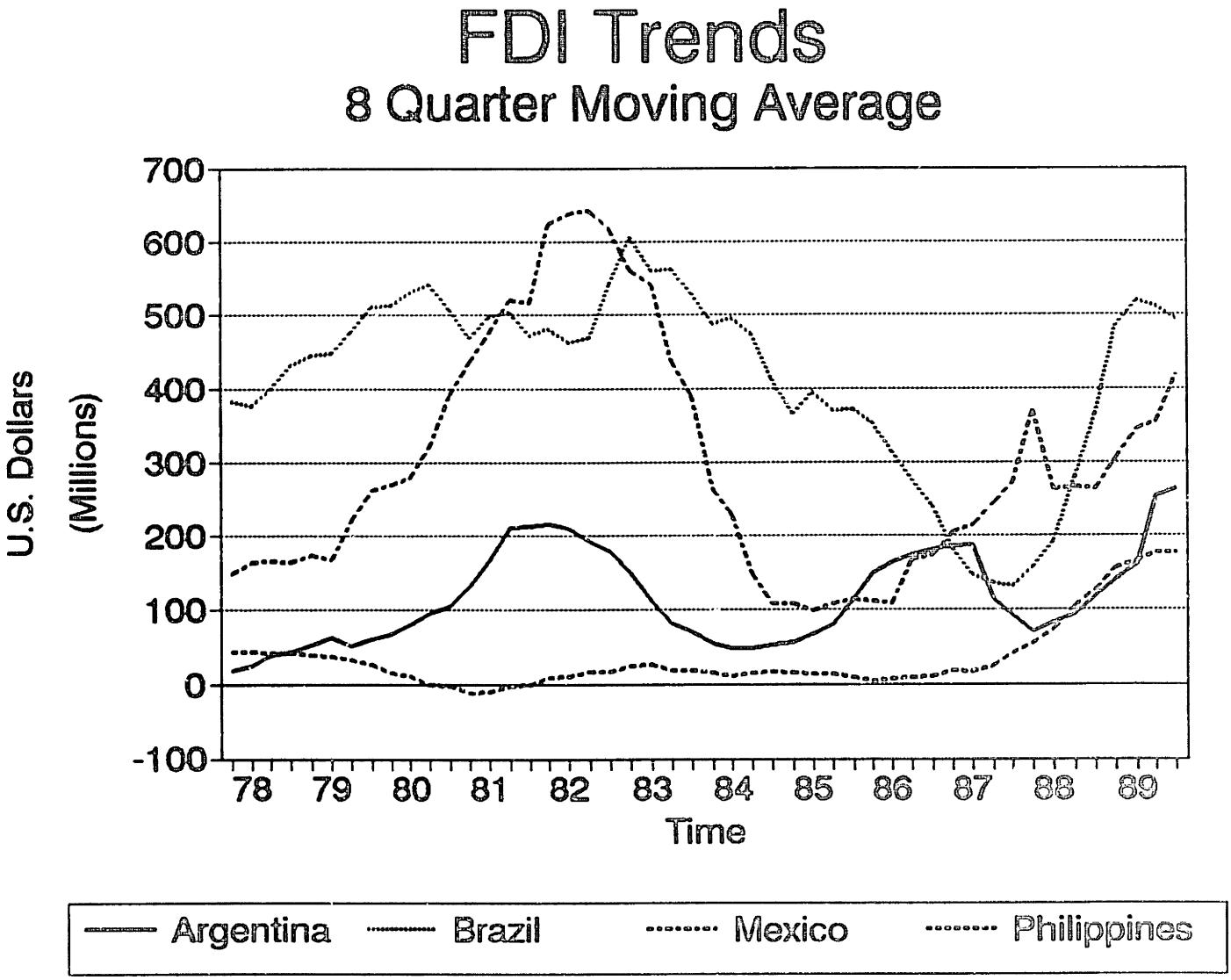
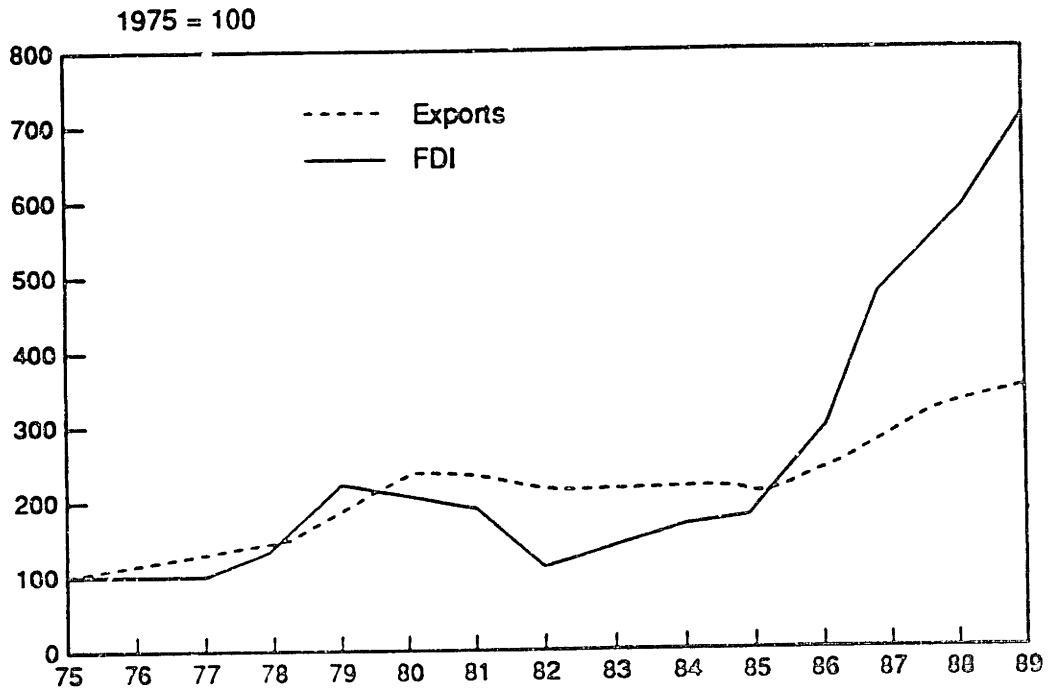

FDI Trends
8 Quarter Moving Average
U.S. Dollars
(Millions)
700
600
500
400
300
200
100
0
-100
78
79
80
81
82
83
84
85
86
87
88
89
Time
Argentina
Brazil
Mexico
Philippines

Figure 2

Index of current value of exports and foreign-direct-investment outflows, 1975-1989



Sources: UNCTC estimates, based on UNCTC, *World Investment Directory* (New York, UNCTC 1991), International Monetary Fund balance-of-payments tape, retrieved on 10 January 1991; and United Nations, *Monthly Bulletin of Statistics*, October 1984 (ST/ESA/STAT/SER.Q/142) and October 1990 (ST/ESA/STAT/SER.Q/214).

FIG. 3: ARGENTINA, 1979-89

FDI v. GDP GROWTH

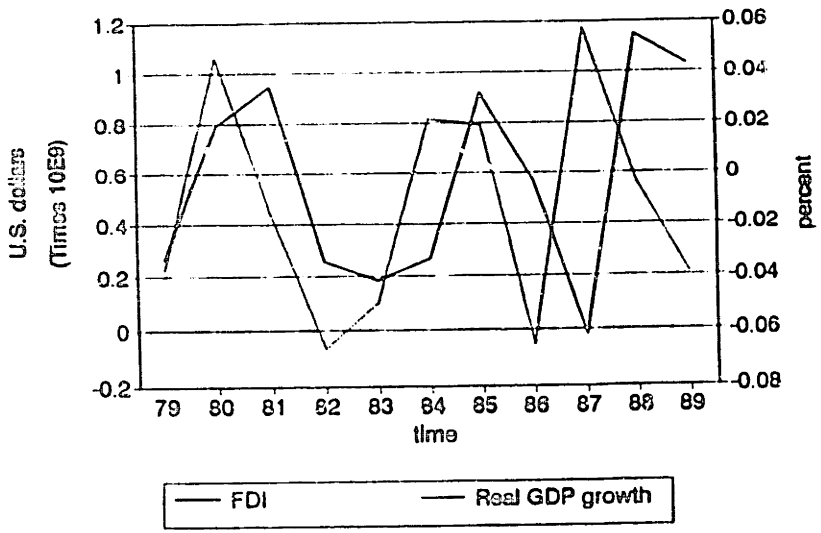


FIG. 4: BRAZIL, 1979-89

FDI v. GDP GROWTH

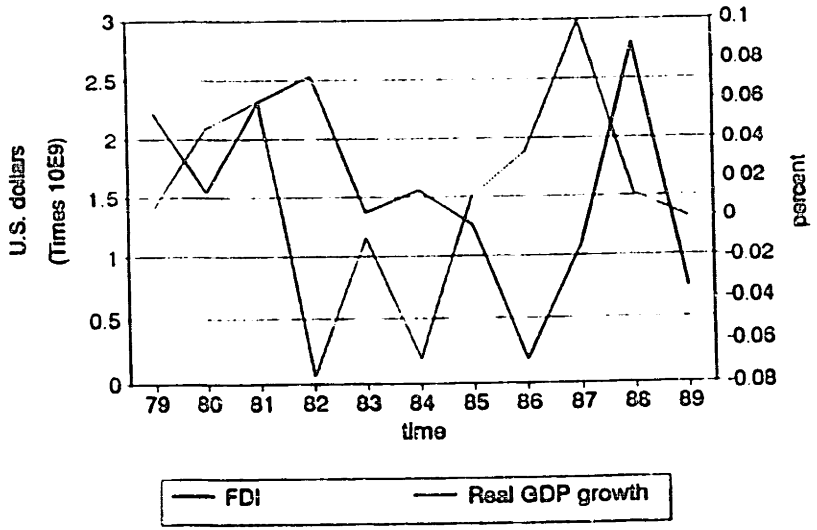


FIG. 5: MEXICO, 1979-89

FDI v. GDP GROWTH

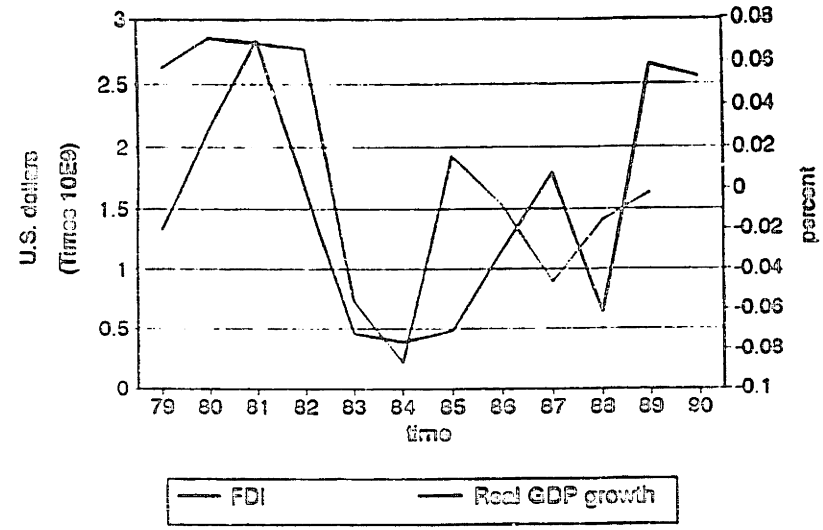


FIG. 6: PHILIPPINES, 1979-89

FDI v. GDP GROWTH

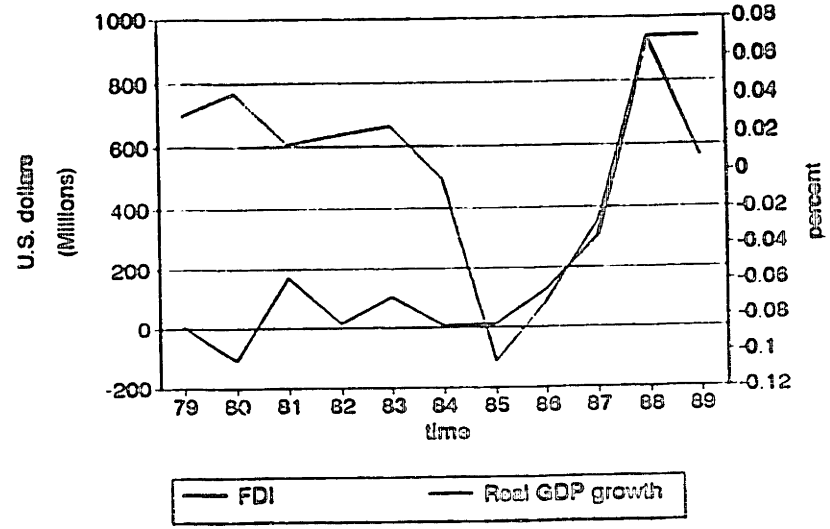


FIG. 7: ARGENTINA, 1979-89

FDI v. Private I, as shares GDP

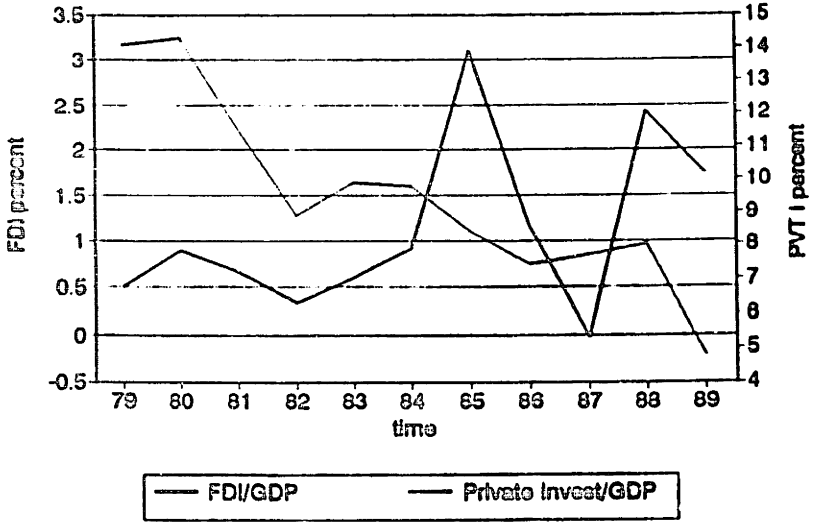


FIG. 8: BRAZIL, 1979-89

FDI v. Private I, as shares GDP

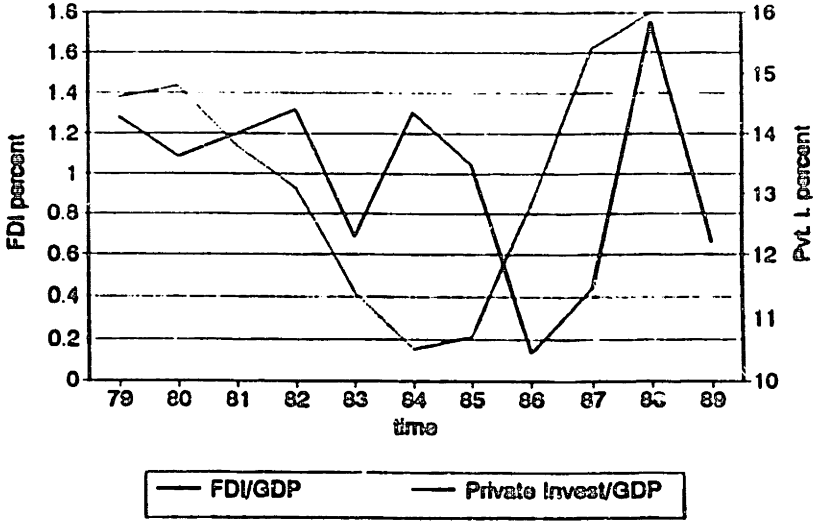


FIG. 9: MEXICO, 1979-90

FDI v. Private I, as shares GDP

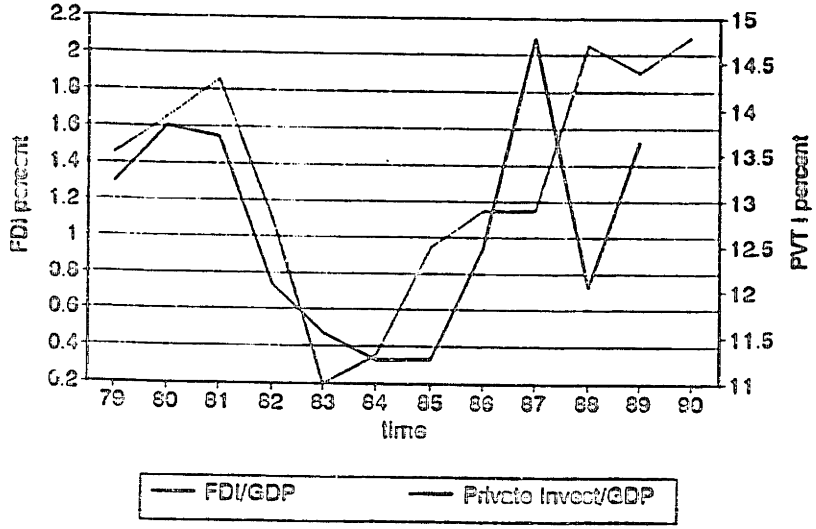


FIG. 10: PHILIPPINES, 1979-89

FDI v. Private I, as shares GDP

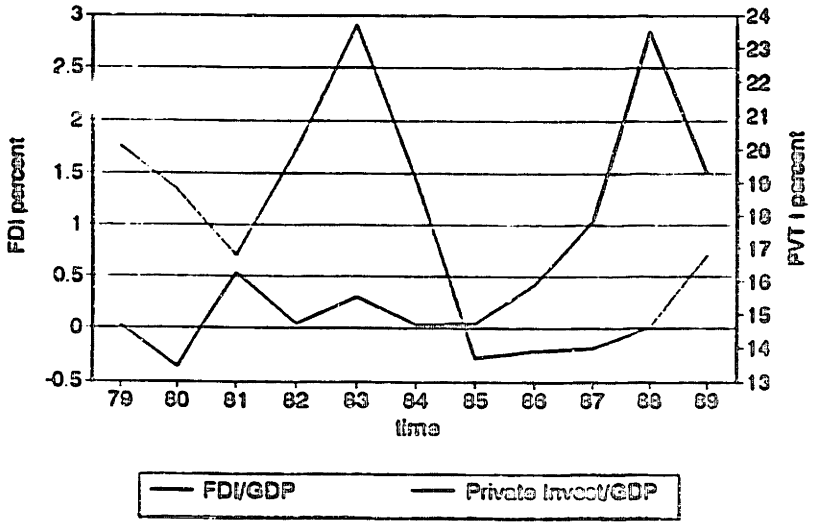


Figure 11

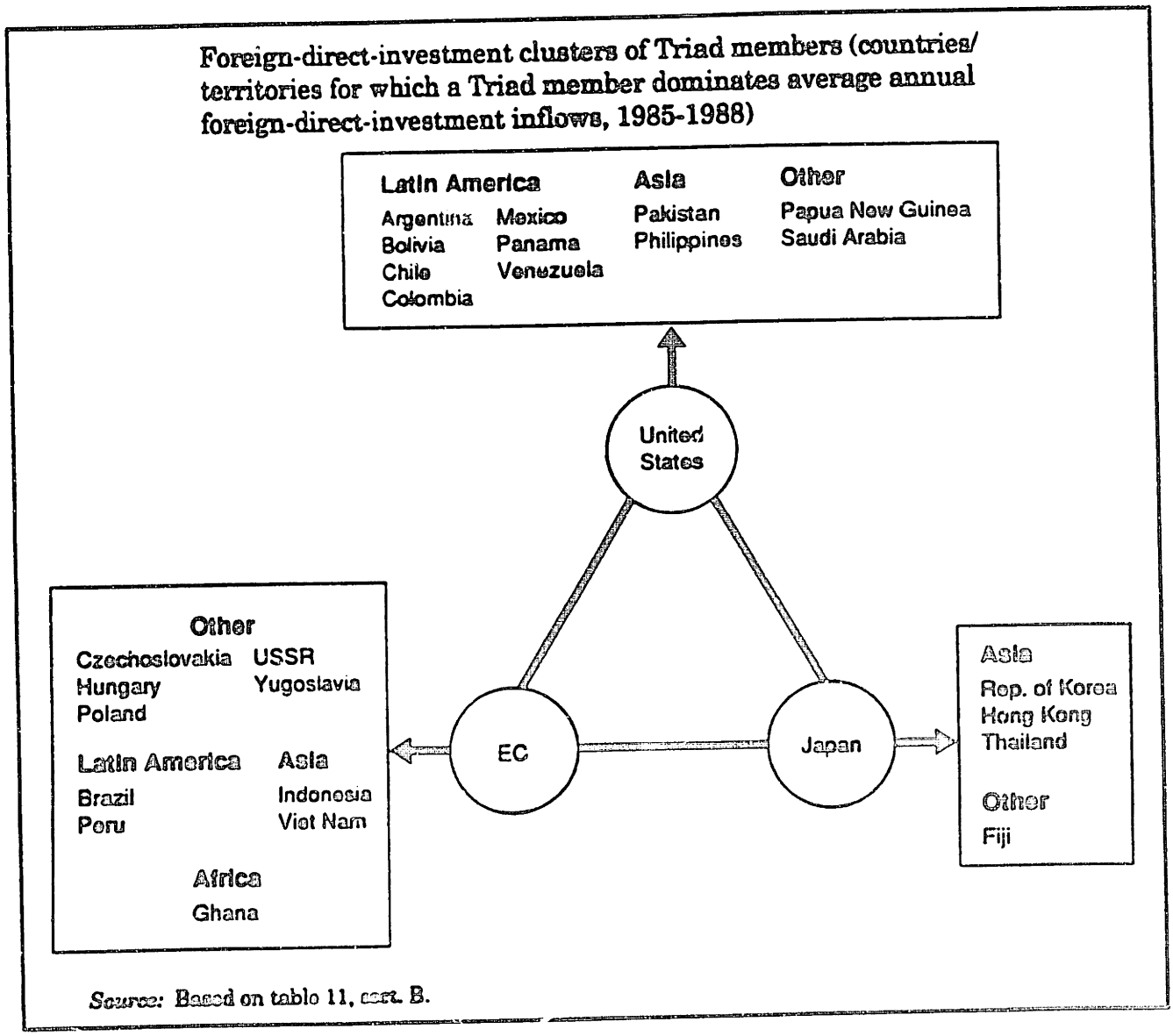

Foreign-direct-investment clusters of Triad members (countries/ territories for which a Triad member dominates average annual foreign-direct-investment inflows, 1985-1988)
Latin America
Argentina
Bolivia
Chile
Colombia
Mexico
Panama
Venezuela
Asia
Pakistan
Philippines
Other
Papua New Guinea
Saudi Arabia
United States
EC
Japan
Other
Czechoslovakia
Hungary
Poland
USSR
Yugoslavia
Latin America
Brazil
Peru
Asia
Indonesia
Viet Nam
Africa
Ghana
Asia
Rep. of Korea
Hong Kong
Thailand
Other
Fiji
Source: Based on table 11, cont. B.

FIG.12: ARGENTINA, 1979-89

FDI v. RER, Black Mkt. Prem.

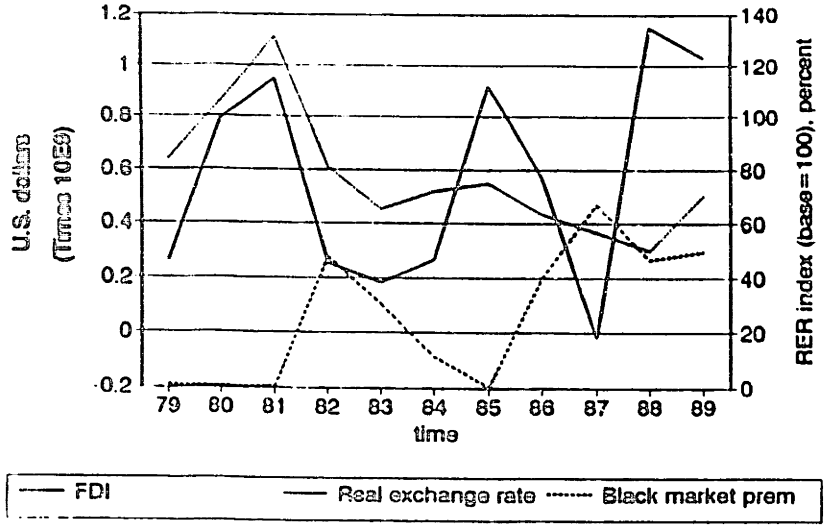


FIG. 13: BRAZIL, 1979-89

FDI v. RER, Black Mkt. Prem.

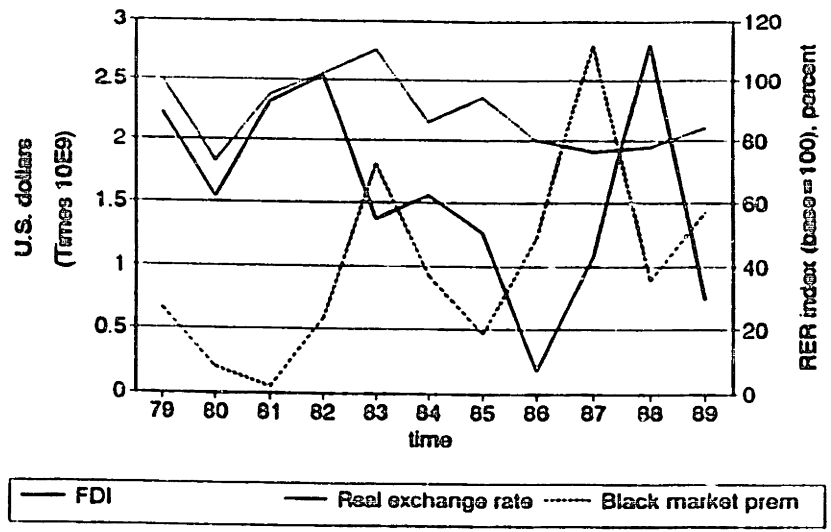


FIG. 14: MEXICO, 1979-90

FDI v. RER, Black Mkt. Prem.

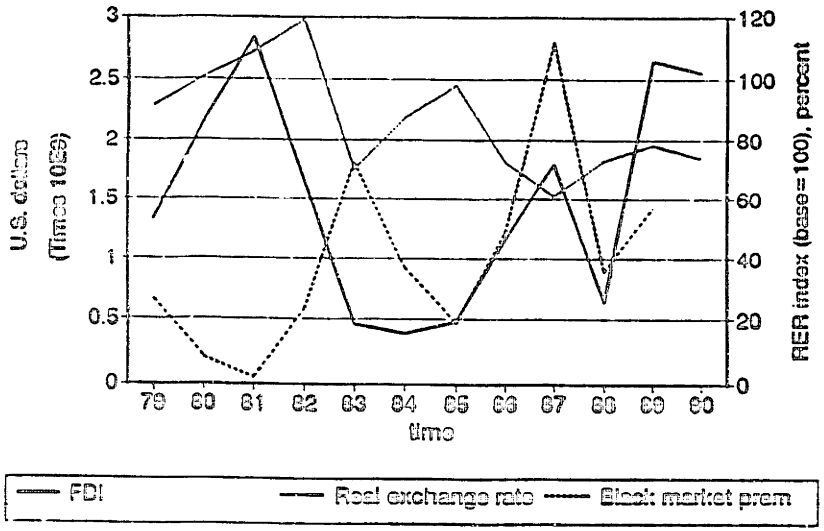


FIG. 15: PHILIPPINES, 1979-89

FDI v. RER, Black Mkt. Prem.

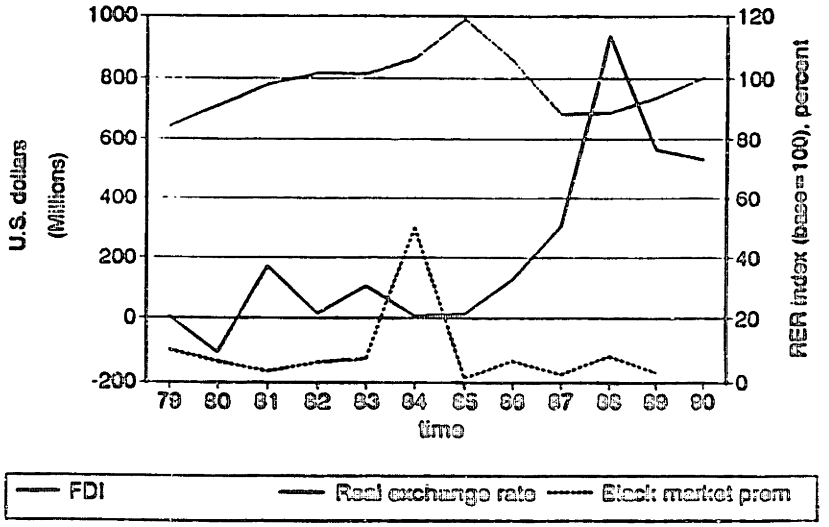
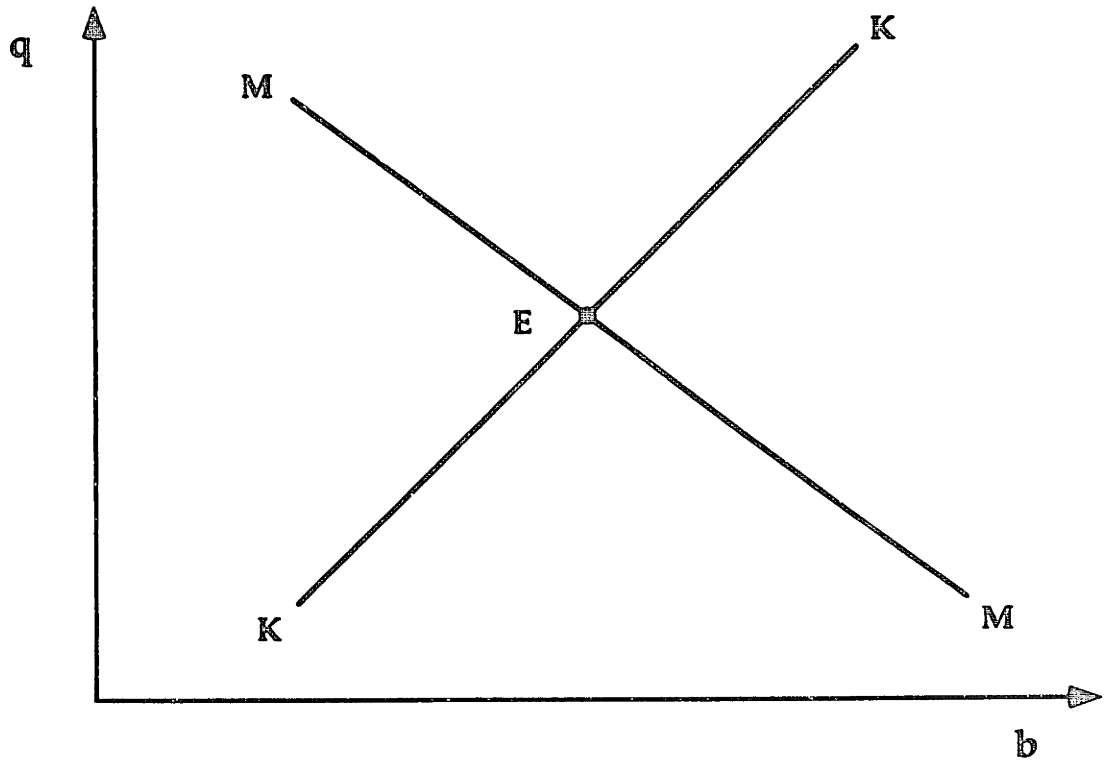


Figure 16: Asset Market Equilibrium Under Capital Controls



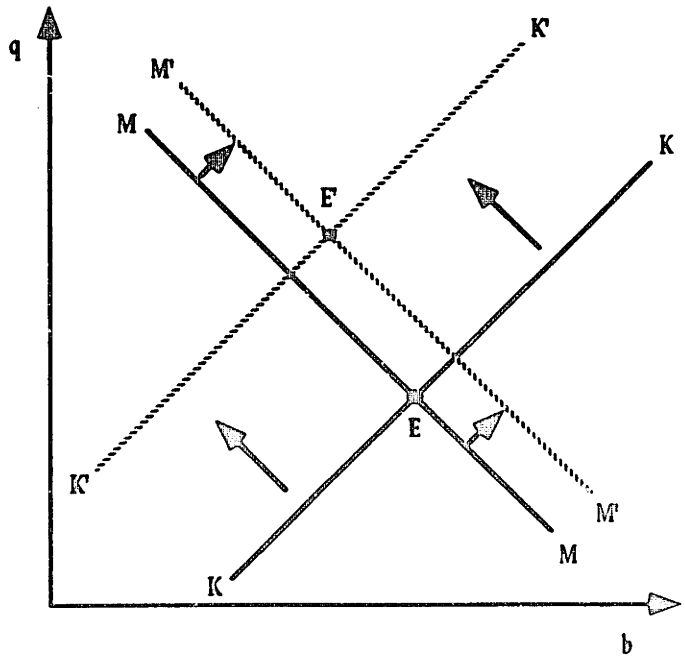


Figure 16a

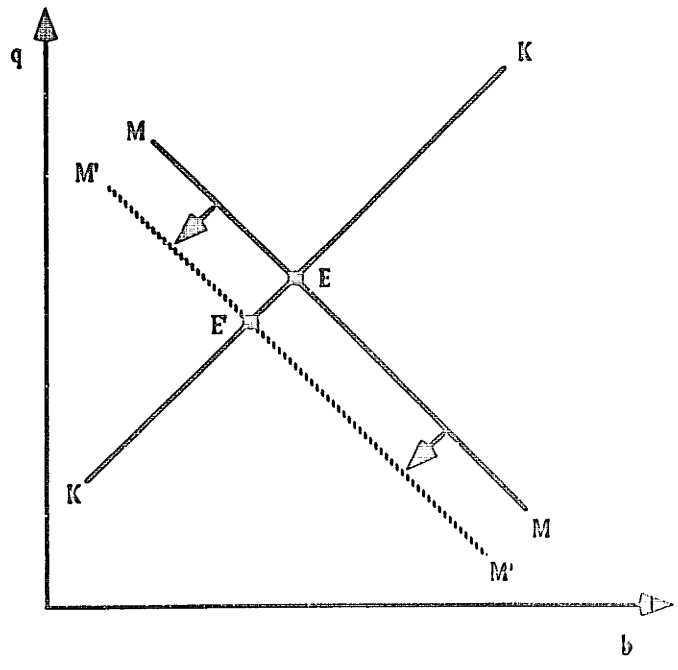


Figure 16b

Table 2: Foreign Direct Investment Data Statistics

Data from International Financial Statistics, 1979:4 to 1989:3
FDI is reported quarterly, GDP annually

Country	variable	mean	std. dev.	min.	max.
Argentina	FDI($mil)	150.4	136.9	-416.0	368.0
	FDI/GDP	0.014	0.013	-0.039	0.035
Brazil	FDI	399.6	234.1	-133.0	919.0
	FDI/GDP	0.014	0.008	-0.005	0.032
Mexico	FDI	342.6	309.6	-650.0	1075.0
	FDI/GDP	0.012	0.011	-0.022	0.037
Philippines	FDI	48.6	79.1	-61.0	284.0
	FDI/GDP	0.007	0.011	-0.081	0.038
Pre-Debt Crisis 1979:4 to 1982:2	FDI/GDP	0.014	0.010	0.008	0.037
Debt-Crisis Era 1982:3 to 1989:3	FDI/GDP	0.011	0.011	-0.039	0.038

Table 3: Replication of Froot-Stein for Four Highly-Indebted Countries Argentina, Brazil, Mexico, and the Philippines, 1979:4 to 1989:3

Dependent Variable: Net FDI / Avg. nominal GDP(79-89)

Technique: For panel, fixed effects with White errors
For country regressions, OLS with Newey-West errors

Sample	Real ER	trend	R^2	Adj. R^2	dof
Full Panel	0.026**	0.033**	0.117	0.112	154
1979:4 to 1989:3	(0.007)	(0.008)			
Debt-Crisis Era	0.019*	0.046**	0.116	0.104	110
1979:4 to 1989:2	(0.010)	(0.046)			
Argentina	0.065**	0.116**	0.367	0.333	37
	(0.009)	(0.012)			
Brazil	0.027**	-0.003	0.187	0.143	37
	(0.010)	(0.016)			
Mexico	0.028**	0.013	0.128	0.081	37
	(0.014)	(0.019)			
Philippines	-0.032**	0.057**	0.571	0.547	37
	(0.013)	(0.013)			

Notes: Standard errors in parentheses. * denotes statistical significance at the 10 percent level, ** denotes statistical significance at the 5 percent level.
Dependent variable is scaled by 100.

Table 4: Basic Panel Regressions for Full Sample
Argentina, Brazil, Mexico, and the Philippines, 1979:4 to 1989:3

Dependent Variable: Net FDI / Avg. nominal GDP(79-89)

Technique: Fixed effects with White heteroskedasticity-robust standard errors, with and without instrumenting for RER (2SLS)

Independent var.	**Fixed Effects**			**Fixed w/2SLS**		
real exch. rate(RER)	0.020**	0.019**	0.031**	-0.023	-0.041	-0.027
	(0.008)	(0.008)	(0.008)	(0.024)	(0.033)	(0.030)
black mkt. prem.	-0.947*	-0.934**	-0.579	-1.286*	-1.601**	-0.990**
	(0.540)	(0.451)	(0.354)	(0.0753)	(0.707)	(0.491)
real GDP growth, pc	-0.333	-0.455	1.446	-3.222	-4.618*	-1.470
	(1.752)	(1.785)	(1.818)	(2.109)	(2.64)	(2.215)
GDP growth (t-1)	5.291**	5.551**	5.920**	4.770**	5.344**	6.076**
	(1.500)	(1.568)	(1.699)	(1.580)	(1.703)	(1.839)
Instit. Investor	0.034*	0.035*	-0.027**	0.104**	0.128**	0.016
	(0.019)	(0.019)	(0.008)	(0.043)	(0.053)	(0.743)
change in RER (%)		-0.990	-0.804		-3.094*	-3.125*
		(0.979)	(0.955)		(1.771)	(1.629)
U.S. RER	-0.009	-0.009	-0.031	0.018	0.025	-0.015
	(0.010)	(0.009)	(0.006)	(0.019)	(0.021)	(0.011)
trend	0.071**	0.073**		0.122**	0.140**	
	(0.021)	(0.021)		(0.037)	(0.043)	
Adj. R^2	0.323	0.324	0.271			
dof	149	144	145	149	144	145
Elasticities						
real exch. rate	1.507	1.432	2.336	-1.733	-3.089	-2.034
black mkt. prem.	-0.220	-0.217	-0.135	-0.299	-0.373	-0.230
real GDP growth	-0.003	-0.004	0.015	-0.033	-0.047	-0.015
GDP growth (t-1)	0.076	0.079	0.085	0.068	0.076	0.087
Instit. Investor	1.105	1.137	-0.877	3.380	4.159	0.520
change in RER		0.019	0.015		0.059	0.060

Notes: Standard errors in parentheses. * denotes statistical significance at the 10 percent level, ** denotes statistical significance at the 5 percent level. Dependent variable is scaled by 100.
Instruments for RER used in two-stage least squares (2SLS): terms of trade (annually), current account (current value and one lag), and the reserve-to-import ratio (also current and once lagged).

Table 5: Panel Regressions for Debt Era
Argentina, Brazil, Mexico, and the Philippines, 1979:4 to 1982:2

Dependent Variable: Net FDI / Avg. nominal GDP(79-89)

Technique: Fixed effects with White heteroskedasticity-robust standard errors, with and without instrumenting for RER (2SLS)

Independent var.	Fixed Effects			Fixed w/2SLS		
Real exch. rate(RER)	0.014	0.012	0.025**	-0.044	-0.072	-0.055
	(0.009)	(0.009)	(0.010)	(0.030)	(0.052)	(0.044)
black mkt. prem.	-0.921	-0.926**	-0.646	-1.112	-1.457**	-0.967*
	(0.587)	(0.456)	(0.415)	(0.767)	(0.640)	(0.508)
real GDP growth, pc	-2.315	-2.800	0.204	-6.370**	-9.007**	-3.781
	(2.182)	(2.233)	(2.131)	(2.784)	(3.951)	(3.229)
GDP growth (t-1)	4.927**	5.417**	5.467**	4.404**	5.513**	5.617**
	(1.670)	(1.801)	(1.971)	(1.828)	(2.632)	(2.276)
Instit. Investor	0.059**	0.064**	-0.015	0.142**	0.176**	0.034
	(0.027)	(0.027)	(0.011)	(0.048)	(0.069)	(0.028)
change in RER (%)		-1.391	-1.311		-4.201	-4.276*
		(1.221)	(1.252)		(2.558)	(2.274)
U.S. RER	-0.001	0.001	-0.034**	0.036	0.051	-0.011
	(0.011)	(0.012)	(0.006)	(0.022)	(0.032)	(0.014)
trend	0.095**	0.104**		0.159**	0.191**	
	(0.029)	(0.031)		(0.043)	(0.057)	
Adj. R^2	0.280	0.283	0.219			
dof	105	100	101	105	100	101
Elasticities						
Real exch. rate	1.065	0.914	1.903	-3.350	-5.482	-4.188
black mkt. prem.	-0.281	-0.283	-0.197	-0.340	-0.445	-0.295
real GDP growth	0.021	-0.026	-0.002	0.059	0.083	0.035
GDP growth (t-1)	-0.046	-0.050	-0.051	-0.041	-0.051	-0.052
Instit. Investor	1.653	1.793	-0.420	3.979	4.931	0.953
change in RER		0.001	0.001		0.004	0.004

Notes: Standard errors in parentheses. * denotes statistical significance at the 10 percent level, ** denotes statistical significance at the 5 percent level. Dependent variable is scaled by 100.
Instruments for RER used in two-stage least squares (2SLS): terms of trade (annually), current account (current value and one lag), and the reserve-to-import ratio (also current and once lagged).

Table 6: Additional Panel Regressions for Full Sample Argentina, Brazil, Mexico, and the Philippines, 1979:4 to 1989:3

Dependent Variable: Net FDI / Avg. nominal GDP(79-89)

Technique: Fixed effects with White heteroskedasticity-robust standard errors, and using two-stage least squares(2SLS) to instrument for RER

Independent var.					
Real exch. rate(RER)	-0.036 (0.033)	-0.053 (0.040)	-0.018 (0.030)	-0.018 (0.028)	-0.003 (0.024)
black mkt. prem.	-1.056** (0.504)	-1.130** (0.528)	-0.948** (0.457)	-0.873* (0.456)	-0.874** (0.441)
real GDP growth, pc	-1.567 (2.350)	-5.262 (3.576)	-1.312 (2.112)	-1.513 (2.136)	-0.651 (1.991)
GDP growth (t-1)	6.310** (3.333)	5.915** (2.014)	5.764** (1.756)	5.435** (3.356)	5.370** (1.686)
Instit. Investor	0.027 (0.024)	0.041 (0.031)	0.009 (0.023)	0.015 (0.021)	0.004 (0.020)
change in RER (%)	-3.574** (1.733)	-3.923** (1.879)	-2.721* (1.515)	-2.710* (1.537)	-2.073 (1.420)
U.S. RER	-0.012 (0.011)	-0.006 (0.014)	-0.020* (0.011)	-0.020** (0.010)	-0.023** (0.008)
terms of trade	-0.011 (0.007)				
variance(RER)		-0.003* (0.002)			
variance(nom ER)			-0.000 (0.000)		
openness = ((imp + exp)/GDP)				0.438 (0.300)	
deposit rate					0.001 (0.000)
dof	144	144	144	144	144
Elasticity for added variable	-0.972	-0.224	-0.413	0.203	0.133

Notes: Standard errors in parentheses. * denotes statistical significance at the 10 percent level, ** denotes statistical significance at the 5 percent level. Dependent variable is scaled by 100. Instruments for RER used in two-stage least squares (2SLS): terms of trade (where not used as a regressor, available annually), current account (current value and one lag), and the reserve-to-import ratio (also current and once lagged).

Table 7: Country Regressions using Trend, excluding the Change in the Real Exchange Rate Argentina, Brazil, Mexico, and the Philippines, 1979:4 to 1989:3

Dependent Variable: Net FDI / Avg. nominal GDP(79-89)

Technique: Ordinary least squares (OLS) with Newey-West heteroskedasticity- and autocorrelation-robust standard errors

Independent var.	Argentina	Brazil	Mexico	Philippines
Real exch. rate(RER)	0.061**	0.021	0.011*	0.012
	(0.013)	(0.015)	(0.007)	(0.020)
black mkt. prem.	-0.566*	-1.235**	-1.005**	-1.156**
	(0.309)	(2.237)	(0.393)	(0.563)
real GDP growth, pc	-2.833	-3.355	-6.582	11.629**
	(3.833)	(2.237)	(4.479)	(5.923)
GDP growth (t-1)	10.384**	5.467*	8.571**	-5.207
	(3.588)	(2.882)	(2.564)	(5.052)
Instit. Investor	-0.030	0.024	0.110**	0.014
	(0.022)	(0.039)	(0.035)	(0.043)
U.S. RER	-0.022*	-0.004	0.008	-0.002
	(0.013)	(0.016)	(0.009)	(0.017)
trend	0.067*	0.029	0.159**	0.070*
	(0.040)	(0.031)	(0.036)	(0.040)
Adj. R^2	0.430	0.355	0.439	0.703
dof	32	32	32	32

Notes: Standard errors in parentheses. * denotes statistical significance at the 10 percent level, ** denotes statistical significance at the 5 percent level.
A constant is estimated, but not reported. Dependent variable is scaled by 100.

Table 8: Country Regressions using the Change in the Real Exchange Rate, excluding trend, for Argentina, Brazil, Mexico, and the Philippines, 1979:4 to 1989:3

Dependent Variable: Net FDI / Avg. nominal GDP(79-89)

Technique: Ordinary least squares (OLS) with Newey-West heteroskedasticity- and autocorrelation-robust standard errors

Independent var.	Argentina	Brazil	Mexico	Philippines
Real exch. rate(RER)	0.064**	0.030**	0.021	0.012
	(0.012)	(0.013)	(0.014)	(0.020)
black mkt. prem.	-0.458	-0.950**	6.249**	-1.783**
	(0.286)	(0.324)	(1.690)	(0.830)
real GDP growth, pc	-2.943	-2.356	-1.105**	15.542**
	(3.678)	(1.921)	(0.529)	(4.505)
GDP growth (t-1)	-2.942	7.245**	6.249**	-3.939
	(3.678)	(3.169)	(1.690)	(4.813)
Instit. Investor	-0.073**	-0.011	-0.022	-0.063**
	(0.015)	(0.014)	(0.025)	(0.014)
Change in RER	-0.396	-2.436**	0.569	-0.267
	(1.177)	(1.118)	(1.210)	(1.589)
U.S. RER	-0.048**	-0.008	-0.018	-0.018*
	(0.010)	(0.012)	(0.011)	(0.010)
Adj. R^2	0.449	0.377	0.322	0.671
dof	31	31	31	31

Notes: Standard errors in parentheses. * denotes statistical significance at the 10 percent level, ** denotes statistical significance at the 5 percent level.
A constant is estimated, but not reported. Dependent variable is scaled by 100.

Table 9: Country Regressions using Trend, excluding the Change in the Real Exchange Rate Argentina, Brazil, Mexico, and the Philippines, 1979:4 to 1989:3

Dependent Variable: Net FDI / Avg. nominal GDP(79-89)

Technique: Two-stage least squares (2SLS) with Newey-West heteroskedasticity- and autocorrelation-robust standard errors

Independent var.	Argentina	Brazil	Mexico	Philippines
Real exch. rate(RER)	0 054**	0.051	0.002	-0.052
	(0.026)	(0.036)	(0.026)	(0.063)
black mkt. prem.	-0.519	-1.447**	-1.168**	-2.679
	(0.363)	(0.454)	(0.452)	(1.736)
real GDP growth, pc	-2.218	-2.285	-7.535	10.118
	(4.154)	(2.254)	(4.766)	(7.210)
GDP growth (t-1)	10.883**	2.213	7.805**	-0.608
	(3.840)	(6.119)	(3.732)	(7.336)
Instit. Investor	-0.023	-0.010	0.127**	0.002
	(0.027)	(0.042)	(0.054)	(0.041)
U.S. RER	-0.019	-0.024	0.013	0.030
	(0.014)	(0.029)	(0.013)	(0.034)
trend	0.065	0.015	0.172**	0.068*
	(0.042)	(0.028)	(0.044)	(0.038)
dof	32	32	32	32

Notes: Standard errors in parentheses. * denotes statistical significance at the 10 percent level, ** denotes statistical significance at the 5 percent level.
A constant is estimated, but not reported. Dependent variable is scaled by 100.

Instruments for RER used in two-stage least squares (2SLS): terms of trade (annually), current account (current value and one lag), and the reserve-to-import ratio (also current and once lagged).

Table 10: Country Regressions using the Change in the Real Exchange Rate, excluding trend, for Argentina, Brazil, Mexico, and the Philippines, 1979:4 to 1989:3

Dependent Variable: Net FDI / Avg. nominal GDP(79-89)

Technique: Two-stage least squares (2SLS) with Newey-West heteroskedasticity- and autocorrelation-robust standard errors

Independent var.	Argentina	Brazil	Mexico	Philippines
Real exch. rate(RER)	0.079**	0.106**	0.060**	-0.023
	(0.031)	(0.053)	(0.021)	(0.070)
black mkt. prem.	-0.525	-1.818**	-0.533	-2.659
	(0.340)	(0.735)	(0.722)	(1.968)
real GDP growth, pc	-3.995	-0.057	3.838**	14.562**
	(4.573)	(3.950)	(1.919)	(5.352)
GDP growth (t-1)	12.133**	0.787	11.466*	-1.920
	(2.662)	(6.997)	(6.183)	(6.403)
Instit. Investor	-0.091**	-0.065*	-0.051*	-0.068**
	(0.037)	(0.034)	(0.027)	(0.015)
U.S. RER	-0.056**	-0.052	-0.029**	-0.001
	(0.016)	(0.036)	(0.011)	(0.035)
Change in RER	-1.076	-5.722**	-1.336	0.988
	(1.052)	(2.576)	(1.034)	(3.348)
dof	31	31	31	31

Notes: Standard errors in parentheses. * denotes statistical significance at the 10 percent level, ** denotes statistical significance at the 5 percent level.
A constant is estimated, but not reported. Dependent variable is scaled by 100.

Instruments for RER used in two-stage least squares (2SLS): terms of trade (annually), current account (current value and one lag), and the reserve-to-import ratio (also current and once lagged).

Chapter 4

The Impact of Regulated Bank Exposure on LDC Debt Prices

Resistance to debt forgiveness has marked the 1980s debt crisis, with relief coming almost exclusively in the form of new financing to bridge interest obligations and principal reduction rare. Meanwhile, debt trades on a secondary market at discount prices as low as seven cents on the dollar (Ivory Coast, December 1989), reflecting banks' assessment of debt as far below par. Although discounted debt trading occurred as early as 1825, in previous crises creditors granted explicit principal reduction to sovereign debtors in grave financial distress. But the banks that hold most LDC debt today are more organized and possess more coercive power than yesterday's creditors, who were mostly individual investors.[1]

Recent work by Krugman(1990) asserts that banking regulation renders regulated banks particularly resistant to forgiveness. Bank profits become effectively bounded below at zero because, should the bank fail, the bill falls to the taxpayers. Minimum capitalization requirements combined with no-cost bankruptcy encourage banks to maintain risky assets so as not to reduce the face value of their portfolios. The resulting preference for high-volume, high-risk portfolios may impede debt relief. By integrating measures of bank exposure and capitalization into a debt Laffer curve, this paper tests for and finds evidence supporting Krugman's hypothesis. A systematic relationship links discounted debt prices positively to both country-specific and total sovereign debt exposure, with total exposure the dominant force.

Concern about how creditor incentives affect discounted debt prices arose in response to Bulow and Rogoff's(1988) challenge to market-based debt reduction. Asserting that buyback schemes lead debtors to overpay by paying the average market price to retire marginal debt, the authors condemn debt buyback and similar market-based schemes as unjust rather than efficient. Since, work by Ozler and Huizinga and by Fernandez and Ozler has examined the relationship

[1]Carballo(1989) and Krugman(1990) provide more historical information on debt crises.

between creditor characteristics and secondary prices. Both studies offer suggestive results. Ozler and Huizinga find correlations between prices and bank capital aggregates. Observing that while repayment accrues proportionately to all creditors, the costs of punishment fall disproportionately on the largest banks, Fernandez and Ozler find positive correlation between a concentration index and secondary prices. This study will attempt to offer a more directed analysis of the problem, focussing specifically on bank failure risks and on regulatory incentives affecting portfolio management. By adopting a new estimation strategy, it also strives to obtain better estimates.

This paper contains seven major parts. The first motivates the paper, discussing how banking regulation affects creditor behavior, while the second presents a model of the market and describes the model's empirical application. Part III focuses on data selection and preparation. Part IV discusses model specification and estimation while part V presents results. Part VI tests for structural change following the Citibank reserve and inception of the Brady Plan. Analysis of price behavior appears in part VII, with implications for LDC debt management.

I. Bank Regulation and Distortion of Bank Incentives

That deposit insurance induces risk-loving behavior comes as no surprise in light of today's savings and loan crisis. This paper, however, focuses on how regulation encourages banks to hold on to risky assets already in their portfolios, rather than how deposit insurance encourages banks to select risky investments. The farther an asset's market price diverges from face value, the more a write-off or discounted sale would damage the bank's asset position and the more unlikely forgiveness becomes. Yet, with sovereign debt, face value indebtedness may actually influence yield: the debt relief Laffer curve literature argues that debt burdens may rise

so high that a reduction in nominal obligations will increase total payments. In such a scenario, where debt relief will benefit both debtor and creditor, the country is said to be on the wrong side of the debt Laffer curve.

Consider the trade-offs that face both a regulated and an unregulated bank when contemplating debt relief. An unregulated bank wants to maintain a high nominal value of debt so as not to relinquish any potential profit should the country prosper. Froot aptly names this the "gold mine" effect. A high debt burden, however, reduces a country's incentive to adjust because most if not all benefits will fall to creditors, not citizens. Debt forgiveness may induce a greater adjustment effort and improve repayment prospects on the remaining debt.[2]

Under regulation the bank's incentives change. Krugman explains that heavily exposed banks will give less importance to increases in adjustment effort as, in very bad states, the bank will go bankrupt anyway, with depositors compensated by the insuring agency. If an increase in country effort will only increase payment in bankruptcy states, without averting bankruptcy, then greater adjustment effort merely reduces outlays for the insurer. Basing decisions on shareholder gains, regulated banks will put zero weight on states involving bank failure and consider only positive profits, engendering risk-loving behavior. The debt Laffer curve changes from the bank's point of view to involve only states where the bank survives. A bank offering debt relief also suffers a reduction in the face value of bank capital, potentially forcing the bank to issue new equity and causing its stock price to fall. As a result, minimum capitalization requirements defined in terms of assets' par value may increase regulated banks' bias against forgiveness.

The effect of minimum asset requirements on LDC portfolio management parallels the

---

[2]In fact, most estimates have not found evidence of a debt Laffer curve. Nonetheless, a few have and the idea remains compelling.

lock-in phenomenon discussed in the capital gains literature. Capital gains lock-in arises when taxation alters asset management incentives, particularly when tax incentives deter asset sales that would be optimal in the absence of taxation. Because capital gains are taxed upon realization rather than on accrual, holding an asset avoids taxation and delaying sale may make the seller eligible for preferential long-term gains treatment. Taxation on realization of gains effectively creates a hefty transactions cost that may be large enough to turn a sale from profitable to inadvisable. As a result, lock-in prevents optimal portfolio management (where optimal is defined in absence of taxes) and hinders efficient operation of capital markets.

Regulation distorts bank incentives toward lock-in in two major ways. Minimum asset requirements may induce banks to hold onto an undesirably risky asset because selling it at the current discount and subsequently purchasing a new asset at face value would push the bank below its asset minimum.[3] Banks may thus hold unwanted LDC debt in order to maintain the face value of its portfolio although the portfolio's expected value might rise should it trade. This problem stems from the recognition of losses on realization rather than on accrual, exactly paralleling the capital gains situation. Discounted sales doubly damage a bank's portfolio position; not only will the bank's asset holdings fall by the difference between the face value of the debt and the sale price, but following such a trade the bank must write down all remaining loans to that country to the sale price.[4] As a result, secondary market sales mean big holding losses, which will typically force the bank to reshuffle its portfolio. The write-down requirement renders the cost of selling an asset greater than the asset's expected yield, and thereby increases prices beyond their level in the absence of regulation.

---

[3]If a bank's asset-to-deposit ratio falls too low, the banks must raise capital by issuing new equity. As the sale of additional shares will drive down the price of existing shares, stockholders will be hurt. Naturally, banks strenuously avoid being forced into such an equity issue.

[4]A bank that purchases discounted debt is not, however, required to write-down pre-existing holdings of the same asset to the discounted value.

Moreover, the portfolio reorganization costs of selling discounted debt or of debt forgiveness may preclude optimal portfolio management. If forgiveness or sale would drive a bank below its minimum asset requirement, the bank becomes locked-in (until either the bank's capital-deposit ratio or the discount prices rise enough to make the asset sale desirable); we will call this a regulatory or necessity lock-in. Less marginal banks may suffer strategic lock-in if the banks believe that regulators and/or potential depositors recognize only loss realization and are blind to loss accrual. Strategic lock-in may apply both to banks with and without enough excess capital to reorganize their portfolios that believe business will be better if they retain (face value) LDC debt on their books. One could conjecture that if all major U.S. banks' portfolios were evaluated at resale values, the FDIC would judge some insolvent.

Locked-in banks of either type will sell only above their lock-in levels, leading to prices unrelated to the debt's expected repayment value. If there exist non-locked-in sellers, equilibrium will depend on supply and demand excluding the locked-in institutions. If, however, all sellers are locked in, the secondary market price will represent the bank's cost of selling, including the portfolio loss equal to one dollar less the sale price and the cost of writing down all remaining loans to the country to the sale price. For a bank near its minimum asset-deposit ratio, the value of holding debt will far exceed its expected yield. Demand and the lock-in level of the most solvent seller will determine whether trade occurs and the final sale price. Where regulation produces such price distortion, secondary prices offer no reasonable guideline for debt reduction efforts.

Despite bank incentives to hold LDC debt already in their portfolios, a faltering bank would prefer to take on short-term risk combining high stakes and fast maturity. Recall that the FDIC alone cares how badly a bank fails; the bank only cares whether it fails, and how much money it makes if it survives. LDC debt fills the high-yield requirement, but the outcome,

contingent on the debtor's stabilization success, may take years to reveal itself. By then the bank will either be once again solvent or history.

From this perspective, the Brady Plan's coerced debt reduction agreements have new merit. Deposit insurance encourages banks to maximize expected profit, not expected repayment, when contemplating debt forgiveness. As a result, banks pursue high-risk strategies at the expense of taxpayers. Forcing banks to maximize expected repayment would reduce the public cost of bank and savings and loan bailouts. For each bank,

E(taxpayer cost) = prob(bank failure) * E(expense of bailout).

Maximizing expected repayment should increase bank income, even if the banks fails, thereby bringing down the expected bailout cost. Simultaneously, debt reduction would compel banks to reduce the riskiness of their portfolios (by forcing them out of lock-in) and thus reduce the probability of bank failure. Brady plan debt reduction could actually generate significant public savings by averting bank failures and reducing bailout costs both on each failed bank and in total.[5]

This paper will attempt to overcome the weaknesses of previous studies by directly addressing the bank solvency issue. Ozler and Huizinga find positive correlation between price and bank exposure, and negative correlation between price and bank capital aggregates. While these results appear consistent with the Krugman theory, one would expect the overvaluation of debt to diminish as bank capital increases and the odds of bank failure decline. This interplay may explain the downward trend in prices over 1986-89 as bank capital recovered during the post-1982 expansion. The impact of total bank exposure to LDC debt on the price of any one

[5]To date, Costa Rica, Mexico, the Philippines and Venezuela have completed debt reduction programs under the Brady Plan; Morocco and Uruguay have initiated talks. Although the Costa Rican and Venezuelan agreements include costly buyback provisions, the gains from debt forgiveness may dominate the cost incurred repurchasing debt at a premium.

country's loans also demands addressing.

II. A Model of Price Determination

The following model, largely taken from Krugman(1990), describes the bank or seller side of the secondary market. This paper will not attempt to represent the buyer's side, due to the heterogeneity of purchasers. Instead we will establish the equilibrium sale price by determining the price at which banks may agree to sell. When the market began in 1984, trade focussed on debt-for-equity swaps. Prospective investors in debtor countries bought the debt as a means of reducing capital costs, and banks engaged in speculative trade among themselves.[6] Today purchasers also include mutual funds, pension funds, and others seeking high-yield, long-term assets. As no transactions are published, one can only estimate the actual sale price as the average of bid and offer prices.

Consider first the debtor nation. Time has two periods, now (period one) and the future (where period two encompasses all the future). The country's future repayment resources, x_2, depend on adjustment effort a and a random component s, with density f(s) over $[\underline{s}, \bar{s}]$:

$$x_2 = a + s \tag{1}$$

Actual repayment(R) in the second period follows x_2:

---

[6]Regardless of purchase price, investors could exchange debt for domestic currency at face value. Debt-equity swaps enabled investors to slash set-up costs: by spending $1 million to purchase debt selling for fifty cents on the dollar, the company could exchange the paper for $2 million in the debtor's currency to finance new investment. The countries saw these programs as a means of attracting investment, while paying off obligations in domestic currency rather than precious foreign exchange. Observers suggest, however, that swap programs attracted little new investment and merely made pre-planned projects cheaper for corporations at the countries' expense.

$$R = \min[x_2, L(1+r_L)] \tag{2}$$

where L and r_L represent the size of the loan and the interest rate on the loan. The country chooses a level of adjustment effort to maximize its objective function, subject to convex costs of adjustment, v(a):

$$U = x_2 - R - v(a) \tag{3}$$

where $v' > 0$, $v'' > 0$.

A regulated bank holding loans to the debtor country wishes to manage the loan portfolio so as to maximize profits. Thanks to deposit insurance, the bank's depositors will accept the safe rate of return r_d. Profits(V) equal the excess of repayment over obligations to depositors, or zero, whichever is greater:

$$V = \min[R - D(1+r_D), 0]. \tag{4}$$

We define s_1 as the minimum value of s at which depositors may be paid in full and s_2 as the minimum value at which the country meets its full debt obligation:

$$s_1 = D(1+r_D) - a \tag{5}$$

$$s_2 = L(1+r_L) - a. \tag{6}$$

A private investor or a bank without deposit insurance would seek to maximize expected repayment by the country. While debt forgiveness schemes typically involve a reduction in loan principal(L), we will simplify the model by treating a reduction in r_L as equivalent (both reduce total repayment; we assume r_L could be reduced into the negative range). Without insurance, a creditor would set r_L to maximize

An insured bank, however, maximizes expected profits--the difference between repayment and obligations to depositors. As a result, banks give zero weight to states where $s < s_1$ and focus

$$E(R) = \int_{\underline{s}}^{L(1+r_L)-a} (a+s)f(s)ds + L(1+r_L)\int_{L(1+r_L)-a}^{\bar{s}} f(s)ds. \quad (7)$$

on maximizing returns in high payment states only:

$$E(V) = \int_{s_1}^{s_2} [a+s-D(1+r_D)]f(s)ds + [L(1+r_L)-D(1+r_D)]\int_{s_2}^{\bar{s}} f(s)ds. \quad (8)$$

The uninsured investor will value debt at its expected repayment value, per nominal dollar of obligations.[7] Such parties will resell or purchase one nominal dollar of debt at P_0:

$$P_0 = (1/L)\int_{\underline{s}}^{L(1+r_L)-a} (a+s)f(s)ds + (1+r_L)\int_{L(1+r_L)-a}^{\bar{s}} f(s)ds. \quad (9)$$

Insured creditors, however, will sell only at a higher price(P_{ins}), because they put zero weight on states between [$\underline{s}$, s_1] in which the banks fails:

$$P_{ins} = (1/L)\int_{s_1}^{L(1+r_L)-a} (a+s)f(s)ds + (1+r_L)\int_{L(1+r_L)-a}^{\bar{s}} f(s)ds, \quad (10)$$

assuming $s_1 < L(1+r) - a$.[8]

Secondary prices may measure not expected repayment value, as predicted by the debt Laffer curve literature. The results following suggest that secondary prices instead follow a truncated Laffer curve, such that

price(i,t) = EV[debt(i,t)|bank survives]

as consistent with the model presented above.

---

[7] For simplicity, we disregard the possibility of senior debt and assume all creditors are repaid proportionately.

[8] Krugman(1990) presents results demonstrating that situations may arise where a reduction in r_L will raise total expected payments to creditors but may lower expected profits to bank stockholders. These results are not included here for the sake of brevity.

III. Data Selection and Preparation

The analysis below uses annual, year-end data for twenty countries whose debt traded at a discount over 1986-89. The six variables collected are P_{it}, the secondary price at time t of a one dollar loan to country i; D_{it}, country i's total external debt at t; X_{it}, country i's exports in year t; D_{it}, the nine money center banks' holdings of loans to country i in December of year t; and K_t, total assets plus loan loss reserves of the money center banks at the end of year t.[9]

Because figures on bank capital and national exports come out only annually, all data uses annual frequency. Today, the debt of twenty-four countries sells at a discount; although thirty-five countries have traded at some point since 1986.[10] Incomplete export or debt data necessitated the elimination of Poland, Senegal, and Zaire. Algeria was eliminated because discounting did not begin until 1987. The logistic specification chosen cannot handle prices equal to one, and certain estimation techniques demand that the panel include the same number of observations for each country.

The introduction of debt-for-equity swap programs, beginning with Mexico in 1984, prompted discount trading of LDC loans. In 1985, prices reportedly averaged 70 percent of par. Only as the market expanded did Salomon Brothers began releasing prices on 11 March 1986; since mid-1987 prices have come out approximately bi-monthly.[11] Carballo(1989) estimates that

---

[9]Over the relevant period, the nine money center banks, according to the Federal Financial Institutions Council of the Federal Reserve, were Bank of America, Citibank, Chase Manhattan, Manufacturers' Hanover, Morgan Guaranty, Chemical Bank, Continental Illinois, Bankers Trust, and First Chicago.

[10]The following countries' debts traded over the entire period, 1986-89: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Côte d'Ivoire, Dominican Republic, Ecuador, Honduras, Jamaica, Mexico, Morocco, Nigeria, Panama, Peru, the Philippines, Poland, Senegal, Uruguay, Venezuela, Yugoslavia, Zaire. Trading in 1986 but not in 1989 were Gabon, Guatemala, Liberia, Nicaragua, Madagascar, Malawi, Romania, Sudan, Togo, Turkey, and Zambia. Algerian debt entered the market in 1987 and continues to trade today.

[11]Merrill Lynch Capital Markets now also releases prices, although Salomon Brothers remains the primary source.

trading volume grew steadily from $100 million in 1983 to $20 million in 1988, while prices fell. Taking the average of bid and offer prices provides a proxy of (would-be) sale prices.[12]

In order to explain discounted price setting, this paper considers only debt trading at non-zero discounts. At the end of 1989, Colombia' debt earned the highest price of the twenty-four at 64.5 cents on the dollar. That banks value all non-discounted LDC debts at face value--fully 50 percent higher than the highest discount price--seems incredible, even if these debtors have lesser obligations or debt-to-export ratios. Inclusion of non-discounted debt would likely only bias upward debt Laffer coefficients. The shift of eleven debtors from trade at a wide range of prices to par value underscores this position. Ozler and Huizinga's estimation of a Tobit model for secondary sales led them to the conclusion that countries whose debt trades at a discount have the largest obligations to private creditors, suggesting that transactions costs of secondary debt trade may keep nations with limited loans out of the market. In fact, ten of the eleven once-traded debtors are small, poor nations.

Although twenty-four countries' debts earn monthly prices, six countries account for the vast majority of actual trade. According to Carballo, Argentina, Brazil, Chile, Mexico, the Philippines and Venezuela composed 94 percent of the volume of trade in 1987 and 92 percent in 1988.[13] Carballo concludes that prices at which no trade occurs are meaningless. I differ. Bid prices signal a willingness to buy, offer prices signal a willingness to sell, and both are hence legitimate. The two rarely differ by more than three cents and never match, even for the much-traded six. Trade may have occurred in any period, although volume is typically low for these fourteen countries. Because transactions are secretive, no evidence is available either way, no

---

[12]Price data prepared by John F.H. Purcell and Diego J. Orlanski of Salomon Brothers High Yield Division.

[13]A recent paper by Daniel Cohen includes Poland and Yugoslavia in the high trade group and excludes the Philippines.

actual sale prices are published. The primary estimates below include all twenty countries; six country tests also appear for some specifications. Unfortunately, as the model demands annual data, working with only six countries provides a mere twenty-four observations.

The Federal Reserve Board releases monthly the money center banks' joint exposure to each debtor country.[14] Tests with several different measures of D_{it}, ranging from all sovereign debt to subsets of high risk debt pointed to all sovereign debt as the most relevant figure. Unless stated otherwise, this figure will be used; section five will discuss this decision and its implications. Exports data and total country debt were drawn from the *World Debt Tables 1989-90, First Supplement*, compiled by the World Bank.

IV. Selection of Functional Form

Debt Laffer curves express expected repayment as a function of a nation's debt burden. Repayment obligations act as a high marginal tax rate on any country that expects to meet less than its full obligations: most if not all gains from any adjustment program will accrue to creditors, leaving nothing to the people. Naturally such a government will find little domestic support for an austerity program that will increase future output at the expense of current welfare (the utility function in equation 2 of the model represents this problem.) Generally stated, higher debt will increase the probability of nonpayment and at all levels of debt above some threshold, further indebtedness may actually reduce the expected value of total debt. (See figure 1.)

---

[14]U.S. exposure figures appear in the monthly *Country Exposure Lending Survey* published by the Federal Financial Institutions Council, Federal Reserve Board. This study examines only U.S. banks largely because no international exposure data is available. Among U.S. banks, the money center banks hold about 75 percent of LDC debt in commercial bank hands. For the record, European banks have participated in secondary markets, but Japanese banks have stayed away, largely due to Ministry of Finance disapproval of discount debt trading.

Sachs and Huizinga(1987) designed the now-standard formulation of the debt Laffer curve:

$$\ln(P_{it}) = \alpha + \beta \ln(D/X)_{it} + \gamma Y_{it} + e_{it} \qquad (11)$$

where Y denotes other regressors including measures of arrearages and rescheduling. A β smaller than -1.0 signifies a backward bending Laffer curve, but most estimates have fallen in the -0.3 to -0.7 range. However, this specification fails by forcing the elasticity of price with respect to the debt to export ratio to a single value for all levels of (D/X).

Cohen recommends a logistic specification:

$$\ln(P_{it}/1-P_{it}) = \alpha + \beta \ln(D/X)_{it} + e_{it} \qquad (12)$$

that allows the elasticity of price with respect to (D/X) to vary across countries.[15] Other right hand side variables have been eliminated as they may be influenced by the level of debt and hence collinear with the (D/X) term and each other. On a cross-section of thirty-five countries, Classens, et.al.(1991) obtain a backward bending Laffer curve with β = -1.41, which is less than -1.0 at 90 percent significance. One problem lingers: high debt may reflect prior creditworthiness, biasing β upwards toward zero.

Our final design for a debt Laffer curve incorporating bank exposure and bankruptcy potential becomes:

$$\ln(P_{it}/1-P_{it}) = \alpha + \beta \ln(D/X)_{it} + \gamma \ln(D_b/K)_{it} + \delta \ln(D_b/K)_{it} + e_{it} \qquad (13)$$

where $(D_b/K)_{it}$ represents the ratio of money center bank holdings of country i's debt to bank capital at time t, and $(D_b/K)_t$ gives the ratio of banks' entire sovereign debt to bank capital at time t. These terms serve as proxies for, respectively, the likelihood of bank failure if a single debtor

---

[15]Daniel Cohen(1989), "Is the Discount on the Secondary Market a Case for LDC Debt Relief?" PRE Working Paper, World Bank, Washington, D.C. as cited in Classens, et. al.

defaults and the total potential for bankruptcy posed by sovereign debt.

By estimating price as a function of lenders' bankruptcy potential as well as of repayment indicators, we find evidence suggesting that banks weigh only profitable states when evaluating LDC loans. Taking the ratio of exposure to capital for the nine money center banks combines the capital and exposure effects into a proxy of bankruptcy potential. Separate ratios gauge the effects of both country-specific exposure and total sovereign debt exposure to directly pinpoint the banks' concerns. The $(D_b/K)_i$ term should have a strong positive impact on debt prices: if one country's default could cause bank failure, its price should reflect the expected value of debt taken over only those high payment states where the bank survives. The $(D_b/K)_t$ term represents the total bankruptcy risk posed by holding LDC debt, or more broadly, all sovereign debt; this term would likely bear a strong positive coefficient as well. Which debt-to-capital ratio would more affect repayment prices seemed *a priori* unpredictable. Naturally, the (D/X) term, an indicator of repayment potential, should bear a negative coefficient. For the sake of notational simplicity, equation (14) will also appear as

$$PRI = \alpha + \beta DX + \gamma DIK + \delta DETK + \varepsilon_{it} \qquad (14)$$

IV. Estimation Techniques and Results

Theoretical priors and preliminary tests led to treatment of the data as a single cross section, rather than a panel. Unfortunately, no currently available techniques can simultaneously control for year-specific worldwide economic fluctuations and country-specific factors such as political stability and export diversity. Experimental results proved consistent with *a priori* beliefs that omitted right hand side variables common to all observations in a given year dominate

country characteristics in determining prices.[16] (Factors that may influence repayment potential or refinancing include oil prices, global recession or boom, and U.S. government attitudes to debt relief.) Estimates using OLS and OLS with time dummies proved most successful, based on corrected R-squared and robustness of coefficients. All results appear in Table 1, and all include all sovereign debt in the DETK term.[17]

The superior performance of the time dummies regression identifies it as the best estimate. Nonetheless, one must interpret the time dummy regression in complement with simple OLS to consider the large robust coefficient on DETK, i.e. the effect of the banks' total debt portfolio on the debt Laffer curve. Because DETK varies only across years and not across countries, year dummies pick up all its explanatory power; DETK becomes redundant in the time dummy regression. The time dummy and OLS regressions respectively produced the following results. The sign of all coefficients are robust to their standard errors; t statistics appear in parentheses.

$$PRI = \underset{(4.6)}{1.711} \underset{(-5.7)}{-0.937DX} \underset{(5.5)}{+0.248DIK} \underset{(6.0)}{+1.300DUM87} \underset{(2.5)}{+0.541DUM87} \underset{(0.8)}{+0.171DUM88} \quad (15)$$

Corrected $R^2 = 0.594$

---

[16]Exploitation of panel techniques proved to sacrifice more explanatory power than was gained. Fixed effects, the panel method appropriate when individuals (countries) logically bear different constants, captures only the time-series evolution of variables and loses the explanatory power of differences in levels. While use of fixed effects was readily dismissed, a hybrid approach was tested combining ordinary OLS terms and deviations from the individual specific mean. The regression becomes:

$$Y_{it} = \beta_0(X_{it} - X_i) + \beta_1 X_{it} + e_{it}$$

Although this regression performed less well than plain OLS or the time dummy regression, results appear in Table 1, where deviations-from-means variables are designated by the suffix D, i.e. $(X_{it} - X_i)$ appears as XD.

[17]In addition, because the time dummy regression forced elimination of the highly significant DETK term, results of a regression combining OLS and deviations from year-specific means also appear in Table 1. This regression proved less successful than the other three.

$$PRI = 9.416 \underset{(7.5)}{} -0.956DX \underset{(-5.7)}{} +0.246DIK \underset{(5.4)}{} +4.426DETK \underset{(5.9)}{} \quad (16)$$

Corrected $R^2 = 0.573$

Recall that DX represents the ratio of a country's total external debt to its exports, DIK represents the ratio of bank holdings of country i's debt to bank capital, and DETK designates the ratio of banks' total sovereign debt portfolio to capital.

The negative coefficient on DX indicates, as predicted, that banks interpret the debt-to-export ratio as an important repayment indicator. Both the ratio of the banks' total debt holdings to capital(DETK) and that of individual country debt to capital(DIK) exert positive pressure on the price of the same country's loans. Consistent with the Krugman hypothesis that banks value debt over expected value if certain incomplete payment states imply bankruptcy, we find a small positive coefficient on DIK. This coefficient signals the presence of a price premium on debts to which the banks are heavily exposed.

The impact of total debt holdings, however, far exceeds that of the country's own share in the bank portfolio, by a power of twenty. Moreover, since the DETK figures are far greater than the DIK numbers, the total bank exposure effect overwhelms that of banks' exposure to individual countries. DETK's large coefficient may imply that as a bank's total exposure to (risky) sovereign debtors rises relative to its capital, the bank becomes increasingly aware of potential bankruptcy.[18] The price premium may rise dramatically, perhaps because if regulated banks were to sell debt at its expected value, their asset portfolios would be decimated. Here the lock-in effect comes into play: secondary prices may more closely represent the cost to a bank of selling debt at a discount, inclusive of portfolio losses than the expected value of holding that

[18]One may note that the sign of the DETK term differs in the fixed effects hybrid regression, and the sign of the coefficient on DETK differs in the regression combining time effects and magnitudes. Neither shift seems easily explicable, and both should be attributed to misspecification of functional form.

debt. The cost to a bank of selling one dollar of debt includes the portfolio loss equal to one dollar less the sale price and the cost of writing down all remaining loans to the same country to the sale price; for a bank near its minimum asset-deposit ratio, the value of holding debt will far exceed its expected yield.[19]

Estimation of the same set of equations on only the six most traded debtors--Argentina, Brazil, Chile, Mexico, the Philippines and Venezuela--produced a close fit as the time dummy and OLS results below demonstrate. Again, parentheses show t statistics; complete results appear in table 2.

$$PRI = \underset{(3.6)}{0.935} - \underset{(-6.9)}{1.553DX} + \underset{(10.5)}{2.034DUM86} + \underset{(6.1)}{1.154DUM87} + \underset{(2.7)}{0.472DUM88} \quad (17)$$

Corrected $R^2 = 0.839$

$$PRI = \underset{(9.3)}{13.502} - \underset{(6.3)}{1.580DX} + \underset{(9.6)}{7.151DETK} \quad (18)$$

Corrected $R^2 = 0.804$

Note the absence of DIK, the ratio of bank exposure to a given country over bank capital; DIK produced only an insignificant coefficient and was dropped from the regression. Our theory would instead have predicted a stronger coefficient because default by any one large debtor could threaten a bank's solvency. The DETK coefficient, meanwhile, nearly doubled in magnitude from the twenty-country regression.

A quick empirical example shows that exposure differences do indeed matter. Recall that in the twenty country regression, the coefficient on DIK(0.246) predicts that one dollar of loans, holding constant repayment indicators, will sell at a higher price on the secondary market if the

[19]The ratio of bank sovereign debt holdings to capital (DETK) fell steadily over 1986-89; the decline was largely due to increasing bank capital, although debt holdings fell somewhat.

country's total obligations are larger. Comparing loans to Brazil and Honduras in 1989 confirms this prediction. Honduras' debt, with a debt-to-export ratio of 3.05 and $45 million in loans sold at 21.25 percent of par; Brazil's with a debt-to-export ratio equal to 3.10 but $13.228 billion of debt in the hands of the money center banks, sold at 40.38 percent of par, a difference of 19.13 cents on the dollar. One possible interpretation runs that over a certain critical level of debt, differences in obligations cease to matter. The substantially stronger coefficient on DX signals that banks take repayment indicators more seriously for the big six, or that prices adjust more rapidly to (D/X) due to frequent trading. Indeed, the substantially improved R^2 indicates that the price setting formula is more consistent for those debts that trade often.

At this point, we must test the robustness of our theory by exploring alternative interpretations. Questions arose whether the systematic relationships between price and both DIK and DETK did not reflect some omitted variable. The DIK coefficient demanded most skepticism. As big countries tend to have big debts, it might in fact represent a "big country effect," such as the relative ease of monitoring an investment in a NIC such as Brazil, which *The Wall Street Journal* and *The Financial Times* cover faithfully, over a small country whose fates do not make the press. For countries with hefty debts, sheer debt magnitude might affect prices as the transactions costs of creating a market could be shared over more loans traded. Also, Ozler and Huizinga had raised the question whether lending by governments and multinational institutions, intended to stabilize creditor country banking systems, improves repayment prospects of exactly those debtors to whom the banks are most exposed.

Tests incorporated four new variables into the basic regression: ln D_i(LDI), the log of a country's debt; ln GNP(LGNP), the log of national GNP as an indicator of a country's financial importance and hence the availability of current information; OFFCRED, the percentage of long term debt held by official creditors; and ARRDUM, a dummy for arrears owed on debt. On the

full twenty country sample, testing showed only the arrears dummy as influencing secondary pricing (see table 3). Although inclusion of arrears seems to improve fit, arrears is endogenous; simply, countries with the biggest debts are most likely to run arrears. So we continue to use our original results, equation 16, as the best specification.

Running the same tests separately on the six heavily traded debtors and the infrequently traded fourteen produced striking results. The DIK coefficient proved insignificant in both the smaller samples, despite its robust coefficient in the twenty-country test (table 3). Glancing at the data, one sees that bank exposure to the top six grossly exceeds exposure to any other country. Big six exposure ranges from $2.5 billion for the Philippines up to $15.0 billion for Brazil. Among the other fourteen, Colombia owed most, with a debt of $1.5 billion to the money center banks--only three-fifths of the minimum Philippine debt over that period. These results suggest that over some critical exposure level banks treat debt differently, and place higher value on holding it, repayment indicators constant. One is tempted to point to the lock-in hypothesis here: do banks demand a higher price to sell these debts because of the indirect costs of the sale (particularly writing down remaining holdings)? Yet, the fact that these same loans trade most actively undermines this logic--why will buyers pay more than the debt's expected value--leaving a puzzle.

One must also ask whether the DETK model is indeed the true model, or whether the time dummy model is more appropriate. Theory suggests that banks should be concerned about the overall risk posed by LDC loans, that banks should view the debt of different LDCs as similar assets posing similar problems. This position seems reasonable both because all these countries have grown far more slowly than foreseen when the loans were made and because any new policy on debt relief will likely apply to all problem debtors. Moreover, default by one or more large debtors may set a precedent for smaller countries and produce a chain reaction of

defaults. But theory also causes concern about omitted right hand side variables, creating the need to look at the time dummy regression. Unfortunately, the effects of DETK cannot be separated from other year-specific effects in this regression. A test that showed both separately would clearly be ideal.

Due to strong convictions about the importance of overall debt holdings to banks' pricing behavior, we assume that the DETK coefficient responds primarily to shifts in DETK and only secondarily picks up other annual shifts. This position seems particularly reasonable if one tries to think of shifts in omitted variables that might explain the large differences in the time dummy coefficients across years. Only two present themselves immediately: the Citibank reserve in 1987 and introduction of the Brady Plan in 1989. Chow tests for both shifts (presented in the next section) find structural change only in response to the Citibank reserve. Lack of explanation for or evidence of shifts between 1987 and 1988, and between 1988 and 1989 further suggest that the time dummy coefficients mainly reflect shifts in DETK.

The decision to include all sovereign debt in calculating DETK resulted unexpectedly from trials of different measures. *A priori*, risky debt seemed most relevant to bank fears of solvency and to management of individual loans. Testing, however, revealed that consideration of the entire debt portfolio(GT) yielded greater explanatory power than highly indebted country(HIC) debt holdings. Regressions on the full twenty country sample with GT data(Table 1) yielded equal or better corrected R^2 and t statistics(including on DETK) than the same regressions using HIC data(Table 4).[20] An attempt to verify these results separated the high risk(HIC) and low risk(LOW) components of the banks' portfolios--(HIC/K) + (LOW/K) = DETK. High collinearity between the volume of high and low risk debt virtually ensured that the

[20]Similarly, regressions on the six most traded debtors produced far better fit with GT than HIC data. For the sake of brevity, these results are not included.

null hypothesis of equal coefficients on (HIC/K) and (LOW/K) would not reject. The unrestricted and restricted regressions appear below (the restricted equation is identical to equation 16); parentheses show standard errors.

Unrestricted: (19)

$$PRI = \underset{(1.754)}{12.476} - \underset{(0.169)}{0.958DX} + \underset{(0.046)}{0.248DIK} + \underset{(1.664)}{1.120(HIC/K)} + \underset{(2.167)}{3.435(LOW/K)}$$

SSE = 36.817 Corrected R^2 = 0.567

Restricted: (20)

$$PRI = \underset{(1.247)}{9.416} - \underset{(0.168)}{0.956DX} + \underset{(0.046)}{0.246DIK} + \underset{(0.752)}{4.425DETK}$$

SSE = 37.001 Corrected R^2 = 0.573

The resulting F statistic, F = 0.375, fell far short of the critical value for 95 percent confidence, F[1,75] = 3.97; hence, the null hypothesis of equal coefficients did not reject.

Note, however, that the restricted regression achieves a far more robust coefficient on DETK than either (HIC/K) or (LOW/K) earns in the unrestricted regression. Furthermore, (LOW/K) yields a more powerful coefficient than (HIC/K), which seems to corroborate with our finding of better fit on regressions including low risk as well as risky debt.

VI. Tests for Structural Change: the Citibank Reserve and the Brady Plan

Two events during the sample period may have altered banks' valuation and pricing of LDC debt. In May 1987, Citibank created a $2 million unallocated loan loss reserve designated for losses on LDC loans, simultaneously declaring a once-and-for-all accounting loss so that actual future losses could be drawn from the reserve without appearing on the balance sheet. Citibank's unprecedented move marked the first public admission by banks that LDC loans could

prove a major liability, yielding far less than their face value. Evidently Citibank feared losses so damaging that if they appeared individually on balance sheets, the company's stock would suffer; the loan loss reserve amounted to a face-saving gesture that would conceal future debits. By this point, Brazil's February 1987 refusal to continue servicing her mammoth debt had already taken its toll on first quarter balance sheets.[21] Over 1987 prices dropped an average of 50 percent from their previous discounts. Table 5 shows annual debt relief Laffer curves for each year 1986 to 1989; as the data comes from December of each year, one is looking for a break between 1986 and 1987-89.

The second event occurred in March 1989, when Treasury Secretary Nicholas Brady announced a new program for LDC debt management based on the Bush administration's belief in debt reduction. The Brady plan broke with the Reagan era line that debtors would outgrow their debt; under Reagan, the Treasury predicted that GNP and export expansion would outstrip debt growth, rendering debt service obligations manageable. New expectations of debt reduction might either increase or reduce secondary prices, depending whether banks expected the primary mechanism to be buybacks or voluntary reductions by creditors. The Brady plan would have induced a shift in the debt Laffer curve between 1986-88 and 1989, if at all.

Several Chow test specifications tested each break to obtain conclusive results.[22] For the Citibank reserve, four out of five OLS tests rejected the null hypothesis of no structural change at either 95 or 99 percent confidence. The *a priori* preferred tests appear below.

---

[21]Brazil recommenced debt service a year later after receiving additional loans.

[22]The basic test used the best-fitting OLS regression, included all sovereign debt in the DETK figure, and covered 1986-89. Variations included whether the test formulation used one or two unrestricted equations, and the specification of the restricted and unrestricted equations. In addition to tests covering 1986-89, Citibank reserve tests excluding 1989 and Brady plan tests excluding 1986 were each performed to eliminate noise that might arise from the other (potential) structural change. Inclusion of 1989, for example, might distort the test for change between 1986 and 1987.

H_0: $\beta_{22} = \beta_{32} = 0$

Restricted: $PRI = \beta_0 + \beta_1 DX + \beta_2 DIK + \beta_3 DETK$

Unrestricted: $PRI = \beta_0 + \beta_1 DX + \beta_{21} DIK + \beta_{22}(D86*DIK) + \beta_{31} DETK + \beta_{32}(D86*DETK)$,

where D86 is a dummy for 1986.

One test of this model, using all four years of data, rejected at 95 percent confidence with a generous margin. The other, using only data between 1986-88, did not formally reject, but inspection shows strong evidence of a shift. Complete results of both tests appear in Table 6.

From the combined test results, one can conclude that the debt Laffer curve indeed shifted following Brazil's default and Citibank's establishment of its loan loss reserve.[23] Structural change concentrated in bank weighting of its country-specific and total debt to capital ratios (after 1987, DIK bore a smaller coefficient, DETK a much larger coefficient) suggests greater awareness of bankruptcy potential from LDC debt. The positive impact of bank exposure to a single country(DIK) on the price of the same debt diminished following the Citibank reserve. Banks perhaps became anxious to diversify their portfolios to prevent any one country's default from causing insolvency. Simultaneously, DETK's impact on debt prices surged, as reflected by the near-doubling of its coefficient. If banks value debt at expected value over all non-bankruptcy states, the higher DETK coefficient for 1987-89 may indicate a rise in the number of low-payment states believed to induce bankruptcy. So striking are the changes that one wonders whether Citibank merely made public fears long harbored by the banking community, or whether Brazil's default and the subsequent blow to bank profits awakened slumbering bankers to the problem's severity.

All five tests for a shift following introduction of the Brady plan found that the null

[23]Annual data does not allow us to distinguish which is the critical event.

hypothesis of no change could not be rejected at 95 percent confidence. The *a priori* preferred model appears below. Table 7 presents results on both the full four-year sample and using only 1987-89 data (to eliminate noise from the Citibank reserve in 1987).

H_0: $\beta_{22} = \beta_{32} = 0$

Restricted: $PRI = \beta_0 + \beta_1 DX + \beta_2 DIK + \beta_3 DETK$

Unrestricted: $PRI = \beta_0 + \beta_{11} DX + \beta_{12}(D89*DX) + \beta_{21} DIK + \beta_{22}(D89*DIK) + \beta_{31} DETK + \beta_{32}(D89*DETK)$,

where D89 is a dummy for 1989.

The F statistics calculated for both tests in Table 7 fall far short of the 95 percent confidence critical values; one cannot reject the null hypothesis of no structural change following the Brady Plan announcement. Inspection confirms this verdict: the coefficients change little, even percentage-wise, between the restricted and unrestricted equations. Further, the 1989 dummies produce small coefficients, all with t statistics of or below 1.8 (and all below 1.3 in the second test presented). Hanson and Zhu(1990) examined secondary market bid prices from March 1989 to June 1990 and found that the Brady Plan affected debt prices only during the negotiation periods for countries obtaining debt reduction deals; those periods saw a speculative price increase, followed by fluctuation around the peak.

VIII. Analysis

My estimation of a debt Laffer curve for regulated banks suggests that not only repayment prospects, but also the riskiness of the banks' portfolios influence secondary market prices. Analysis on a twenty country sample shows positive correlation between the price of a country's debt and both the ratio of loans to the country to bank capital(DIK) and the ratio of banks' overall sovereign debt portfolio to capital(DETK). These results seem to corroborate the

Krugman theory that regulated banks value debt above its expected value if some states of nature lead to bankruptcy, with the costs met by taxpayers. The combination of minimum capitalization requirements and deposit insurance may make it optimal for banks to retain assets that, in the absence of regulation, would be hastily unloaded. Facing distorted incentives, banks may consider only profitable states in evaluating LDC loans, such that secondary prices equal the expected value of debt over all non-bankruptcy states. Naturally those loans to which the banks are most exposed pose the greatest bankruptcy risk and will, *ceteris paribus*, have the highest prices.

Further tests indicate that differences in DIK cease to matter among the six debtors who owe most to the money center banks. The same six debts are also the most actively traded in the sample. Simultaneously, exposure differences have no significant impact on pricing among the less active fourteen. The most appealing explanations suggest that exposure differences only affect prices when they become great or that banks treat debt differently when it exceeds some threshold level. Regulation may create transactions costs such that once debt reaches a certain critical size in relation to bank capital, banks will demand a price premium on sales. The price premium, equal to the sale price less the expected value of the debt, partially compensates for the portfolio losses both realized in the sale and from writing down unsold loans. Banks may also recognize that default by any single large debtor could drive them into bankruptcy.[24] [25]

The estimates produced here find no evidence whatsoever of a backward bending debt Laffer curve. A backward bend exists if the coefficient on $D_i < -1$. Since debt appears in

---

[24]Because large debtors have more bargaining power, they can get away with default strategies that no single small debtor could. Moreover, successful default by a large debtor may start a chain reaction.

[25]One should note that, because exposure varies significantly across banks, these estimates might change if the top thirteen regional banks were added to the nine money center powerhouses in the sample. The thirteen held 27 percent as much LDC debt in December 1989 as did the money center banks: $36.726 billion versus $137.428 billion. In fact, the smaller banks may be more marginal in their debt holdings; those creditors most frequently exiting under rescheduling agreements have been smaller banks.

several right hand side variables, one must examine the sum of these coefficients. Rewriting equation (13), one obtains

$$\ln(P_{it}/1-P_{it}) = \alpha + (\beta+\gamma+\delta)lnD^{b}_{it} - \beta lnX_{it} - (\gamma+\delta)lnK_{t} + \delta\ln(D_{it}-D_{it-1}) + e_{it} \quad (21)$$

A backward bend is present only if $(\beta + \gamma + \delta) < -1$. However, the OLS tests on both the twenty and six country samples actually yield positive sums: 3.715 and 5.571 respectively. These estimates diverge sharply from coefficients obtained with traditional DLCs (typically -0.3 to -0.7).

Controversy over the DLC's significance for debt policy began with Bulow and Rogoff's condemnation of debt buyback based on marginal vs. average distinctions. Ozler and Huizinga offered new evidence against market-based debt reduction in the relevance of institutional factors to discounting. The authors reject secondary prices as a guideline for debt management, effectively discounting the validity of the debt Laffer curve. Conditioning forgiveness on details of creditor institutions and bank regulation, they charge, is irrational. My findings strongly corroborate Ozler and Huizinga's conclusion. As the earlier comparison of Brazil and Honduras demonstrated, due to regulated bank incentives, the size of a country's obligations may virtually double the secondary price of her debt, holding repayment indicators constant. The vastly different DLC coefficients obtained here by adding creditor characteristics raise questions about the meaning of previous estimates that ignore these factors. Further complicating the picture, a critical paper by Zhu points out that buyback schemes may worsen an economy's growth prospects and repayment potential. Each dollar of debt bought back by a country could actually reduce the expected value of each dollar remaining because funds spent on loan retirement could instead have been spent on productive investment. Clearly, secondary prices do not constitute fair prices for a country's debt reduction efforts; nor does buyback necessarily present a wise

approach.

Conclusion

Examining secondary pricing of LDC debt has shown that prices reflect bankruptcy concerns particular to regulated banks, as well as repayment indicators. A debt Laffer curve estimated with terms reflecting exposure and assets of nine of the nation's largest banks shows heavy dependence on bank solvency, capitalization requirements, and the no-cost bankruptcy of regulated banks. These results serve to reinforce the position that secondary prices present an unfair basis for debt relief. My results raise questions about the existence of a backward bending debt relief Laffer curve but clearly signal that, due to a refinancing bias of regulated banks, debt relief cannot arise through a market approach, only through concerted action.

References

Bulow, Jeremy and Kenneth Rogoff. 1988. "The Buyback Boondoggle." *Brookings Papers on Economic Activity* (2a), 675-698.

Carballo, Carlos Federico. 1989. *Valuation Models of Less Developed Countries' Debt in the Secondary Market.* Sloan School of Management, Massachusetts Institute of Technology, Cambridge, Massachusetts.

Classens, Stijn, Issac Diwan, Kenneth A. Froot, and Paul R. Krugman. 1991. "Market-Based Debt Reduction for Developing Countries: Principles and Prospects." Policy and Research Working Paper 16. World Bank, International Economics Department, Washington, D.C.

Fernandez, Raquel and Sule Ozler. 1991. "Debt Concentration and Secondary Market Prices." PRE Working Paper, WPS570. World Bank, International Economics Department, Washington, D.C.

Froot, Kenneth A., David Scharfstein, and Jeremy Stein. 1989. "LDC Debt: Forgiveness, Indexation, and Investment Incentives." *Journal of Finance*, vol. XLIV, no.5, 1335-1350.

Greene, William H. 1990. *Econometric Analysis* (New York: Macmillan Publishing Company).

Hanson, James and Ning Zhu. 1990. "The Secondary Market Price of LDC Debt since the Brady Plan: A Note." World Bank, International Economics Department, Washington, D.C.

Hausman, Jerry A. 1978. "Specification Tests in Econometrics." *Econometrica*, vol. 46, no. 6, 1251-1271.

Krugman, Paul R. 1990. "Bank Regulation and LDC Debt." Massachusetts Institute of Technology, Cambridge, Massachusetts.

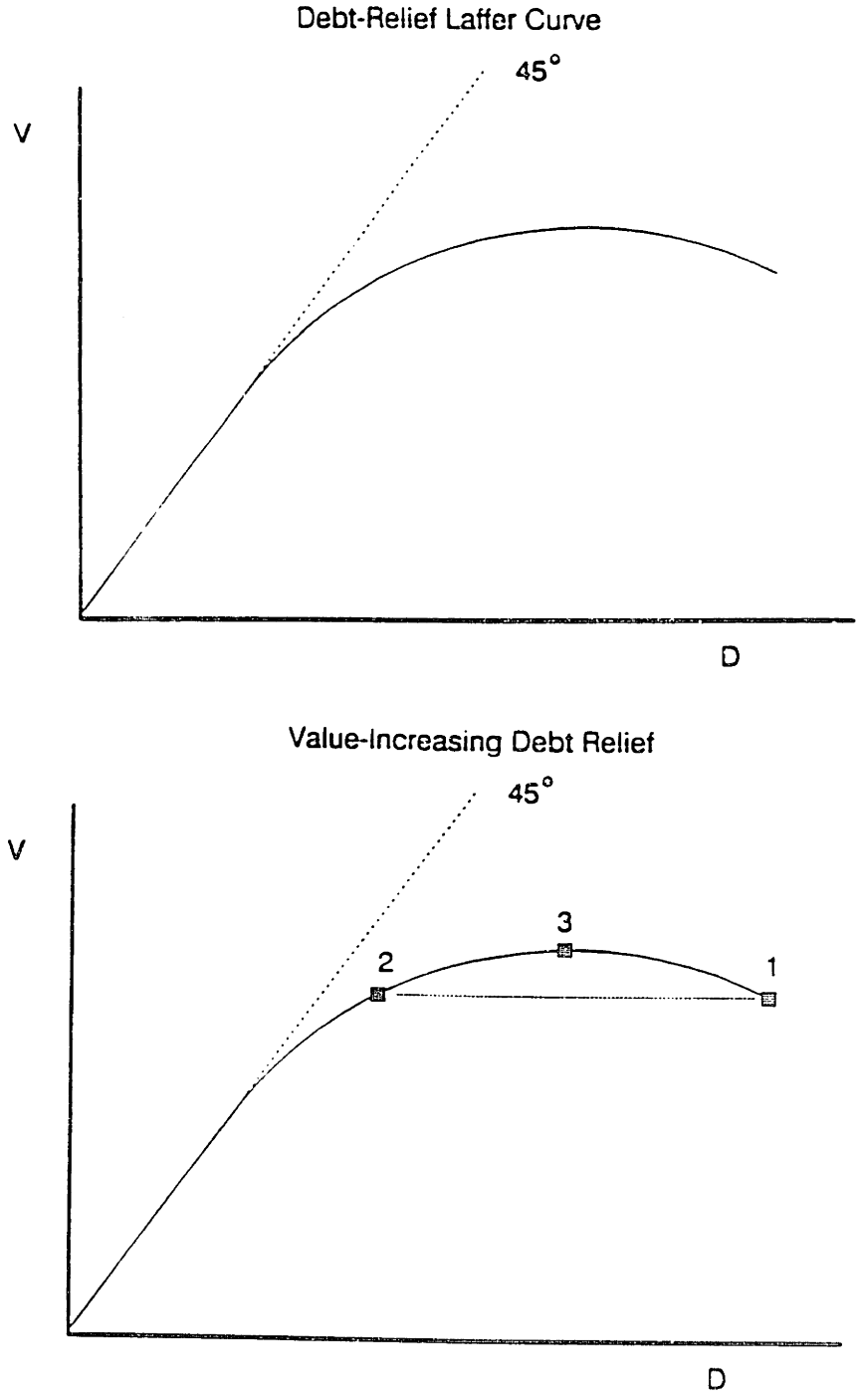
Krugman. 1988. "Financing vs. Forgiving a Debt Overhang." *Journal of Development Economics*, vol. 29, 253-268.

Krugman. 1989. "Market-Based Debt Reduction Schemes for Developing Country Debt: The Role of Creditor Country Factors." Department of Economics, University of California, Los Angeles.

Sachs, Jeffrey and Harry Huizinga. 1987. "U.S. Commercial Banks and the Developing Country Debt Crisis." *Brookings Papers on Economic Activity*, 2, 555-606.

Zhu, Ning. 1990. "The Inferiority of Debt Buybacks to Investment." World Bank, International Economics Department, Washington, D.C.

Figure 1: Debt Relief Laffer Curve



Debt reduction from point 1 to any level between 1 and 2 would increase the total expected value of the debt.

Graphs from Classens, et.al., "Market-Based Debt Reduction for Developing Countries: Principles and Prospects," mimeo, 1990.

Table 1: Estimation of Debt Relief Laffer Curve for 20 Countries

Dependent variable: $PRI = \ln(\frac{p}{1-p})$

	Estimation Technique			
dep. var.	OLS	OLS w/ yr dum	combo: fixed effs & mags	combo: time effs & mags
DX	-0.956 (-5.7)	-0.937 (-5.7)	-0.969 (-5.0)	-0.216 (0.1)
DIK	0.246 (5.4)	0.248 (5.5)	0.258 (4.9)	-1.962 (-2.2)
DETK	4.435 (5.9)		-1.427 (-5.7)	8.438 (3.1)
DIKD			-0.557 (-1.6)	
DETKD			6.989 (6.0)	
DUM86		1.6 (6.0)		
DUM87		0.541 (2.5)		
DUM88		0.171 (0.8)		
DXT				-7.2 (-0.4)
DIKT				2.21 (2.2)
adj. R^2	0.573	0.594	0.578	0.551

t statistics appear in parentheses.
Estimates of a constant for OLS specifications is omitted.
Total bank holdings include all sovereign debt.
Note that removing DXT, DX from time effects and magnitudes regression greatly worsened fit.

Table 2: Debt Laffer Curve Estimates on Six Often-Traded Debtors
Argentina, Brazil, Chile, Mexico, Philippines, Venezuela

Dependent variable: $PRI = \ln(\frac{p}{1-p})$

	Estimation Technique		
	OLS	**OLS w/ year dum**	**combo: fixed effs & mags**
DX	-1.538 (6.3)	-1.553 (6.9)	-1.446 (-4.8)
DETK	7.151 (9.6)		-1.059 (-4.6)
DXD			-1.391 (-1.4)
DETKD			10.005 (6.6)
DUM86		2.034 (10.5)	
DUM87		1.154 (6.1)	
DUM88		0.472 (2.7)	
adj. R^2	0.804	0.839	0.811

t statistics appear in parentheses. The constant estimated for OLS specifications is omitted here.
Total bank holdings include all sovereign debt.

Table 3: Tests to Rule Out Alternative Explanations for Correlation Between Secondary Prices and DIK

Dependent variable: $\frac{p}{1-p}$

	20 country		Big 6		Low-trade 14	
dep. var.	full	best	full	best	full	best
DX	-5.46	-0.646	-0.999	-1.031	-0.622	-0.7
	(-2.5)	(-4.0)	(-2.2)	(-2.5)	(-2.5)	(-3.7)
DIK	0.229	0.127	0.101		0.137	
	(2.4)	(2.7)	(0.3)		(1.0)	
DETK	4.347	4.557	6.972	7.139	4.118	4.399
	(6.2)	(6.9)	(6.6)	(8.9)	(4.7)	(5.4)
LDI	-0.223		-0.961	-0.891	0.123	
	(-0.1)		(-1.7)	(-1.8)	(0.4)	
OFFCRED	0.113		0.141	0.134	0.172	
	(1.1)		(2.0)	(2.1)	(0.6)	
LGNP	-0.092		0.488	0.505	-0.256	
	(-0.5)		(1.5)	(1.6)	(-1.0)	
ARRDUM	-0.933	-0.87	-0.259	-0.275	-1.313	-1.207
	(-5.1)	(-5.0)	(-1.2)	(-1.3)	(-5.1)	(-5.8)
Adj. R^2	0.669	0.674	0.815	0.825	0.667	0.677

t statistics appear in parentheses. A constant is estimated for each regression, although omitted here. All tests use OLS so the DETK coefficient may be examined.

Table 4: Estimation of Debt-Relief Laffer Curve
20 Countries, 1986-89

Dependent variable: $\ln(\frac{p}{1-p})$

	Estimation Technique		
	OLS	OLS w/ year dummies	combo: fixed effs. & mags
DX	-0.955	-0.937	-0.97
	(-5.6)	(-5.7)	(-4.9)
DIK	0.246	0.248	0.258
	(5.3)	(5.5)	(4.8)
DETK	3.595		-0.895
	(5.6)		(5.6)
DIKD			-0.599
			(-1.6)
DETK			5.555
			(5.5)
DUM86		1.30	
		(6.0)	
DUM87		0.541	
		(2.5)	
DUM88		0.171	
		(0.8)	
adj. R^2	0.560	0.594	0.566

t statistics appear in parentheses. For OLS regressions, the estimated constant is omitted.

Table 5: Annual Debt Laffer Curves, using OLS

$$PRI = \alpha + \beta\, DX + \gamma\, DIK$$

	1986	1987	1988	1989
constant	4.015 (0.747)	2.230 (0.666)	1.743 (0.682)	1.203 (0.637)
DX	-0.994 (0.306)	0.599 (0.282)	-1.098 (0.357)	-1.363 (0.384)
DIK	0.391 (0.098)	0.302 (0.085)	0.202 (0.091)	0.117 (0.086)
corrected R^2	0.562	0.449	0.456	0.482

TABLE 6: TESTS FOR STRUCTURAL CHANGE FOLLOWING THE 1987 CITIBANK RESERVE

TEST (1) Data covers 1986-1989
t statistics appear in parentheses.
H_0: $\beta_{22} = \beta_{32} = 0$

Restricted: PRI= 9.416 -.956 DX +.246 DIK +4.425 DETK
(7.5) (-5.7) (5.4) (5.9)

SSE= 37.001 R^2= 0.573

Unrestricted: PRI= 6.256 -.958 DX +.209 DIK +.181 (D86*DIK)
(3.6) (-5.9) (4.2) (1.7)

+2.729 DETK -1.204 (D86*DETK)
(2.7) (-2.4)

SSE= 33.035 R^2= 0.608

Test yields an F statistic of F= 4.44
Critical levels $F_{0.05}[2,75] = 3.12$ and $F_{0.01}[2,74] = 4.90$.

Reject H_0 at 95 percent confidence, with a generous margin. Confidence level probably approaches 98 percent.

TEST (2) Data covers only 1986-1988. 1989 excluded to prevent noise created by supposed structural shift following the 1989 Brady plan announcement. t statistics appear in parentheses.
H_0: $\beta_{22} = \beta_{32} = 0$

Restricted: PRI= 11.573 -.870 DX +.299 DIK +5.657 DETK
(6.3) (-4.3) (5.6) (4.9)

SSE= 25.517 Corrected R^2= 0.581

Unrestricted: PRI= 6.978 -.869 DX +.255 DIK +.135 (D86*DIK)
(2.5) (-4.9) (4.1) (1.2)

+3.048 DETK -.972 (D86*DETK)
(1.8) (-1.8)

SSE= 23.182 Corrected R^2= 0.605

Test yields F=2.720, but critical $F_{0.05}[2,54] = 3.17$.

Formally, do not reject H_0.
Note, however, the large difference in DETK coefficients and constants between the restricted and unrestricted regressions.
Restricted $\beta_3 = 5.657$ vs. Unrestricted $\beta_{31} = 3.048$, $\beta_{32} = -0.942$.

TABLE 7: TESTS FOR STRUCTURAL CHANGE FOLLOWING THE ANNOUNCEMENT OF THE BRADY PLAN, MARCH 1989

TEST (1) Chow test using 1986-89 data.
Unrestricted regression takes form of best fit achieved.
D89 is a dummy for 1989.
t statistics appear in parentheses.

H_0: $\beta_{12} = \beta_{22} = \beta_{32}$

Restricted: PRI = 9.416 - .956 DX + .246 DIK + 4.425 DETK
(7.5) (-5.7) (5.4) (5.9)

SSE = 37.001 R^2 = 0.573

Unrestricted: PRI = 11.573 - .870 DX - .493 (D89*DX) + .299 DIK
(6.2) (-4.7) (1.2) (5.5)

- .181 (D89*DIK) + 5.657 DETK + .213 (D89*DETK)
(-1.8) (4.9) (0.5)

SSE = 34.162 Corrected R^2 = 0.589

Test yields F = 2.022, well below critical value $F_{0.05}[3,73] = 2.73$.
Reject H_0: No structural change occurred after the introduction of the Brady Plan.

TEST (2) Chow test using data from 1987-1989 only. Data from 1986 omitted to eliminate any noise from structural shifts between 1986 and 1987.

Restricted: PRI = 6.228 - .944 DX + .210 DIK + 2.719 DETK
(3.6) (-4.9) (4.2) (2.6)

SSE = 25.058 R^2 = 0.482

Unrestricted: PRI = 6.857 - .797 DX - .566 (D89*DX) + .258 DIK
(2.4) (-3.5) (-1.3) (4.0)

- .140 (D89*DIK) + 3.014 DETK - .186 (D89*DETK)
(-1.4) (1.7) (0.4)

SSE = 23.736 Corrected R^2 = 0.481

Test yields a F = 0.984, far below critical value $F_{0.05}[3,53] = 2.78$. Do not reject H_0: No structural change occurred.