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Institutional Investors and Asset Pricing in Emerging Markets

Prepared by Elaine Buckberg 1/

Authorized for distribution by Steven Dunaway

January 1996

Abstract

This paper presents a new theory of asset pricing intended to address why other developing country equity markets responded so strongly to the Mexican devaluation, while the world's major stock markets were unmoved. This phenomenon can be explained if investors follow a two-step portfolio allocation process, first determining what share of their portfolio to invest in developing countries, then allocating those funds across the emerging markets. For 12 of 13 markets studied, the one-factor CAPM is rejected in favor of a two-factor asset pricing model, including both a broad emerging markets portfolio and the global market portfolio.

JEL Classification Numbers:

G11, G12, G15

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Research Department

Central Bank Independence: A Free Lunch?

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Authorized for distribution by Peter Isard

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Abstract

This paper extends the analysis of central bank independence to a model in which there is more than one policymaker. It shows that the degree of central bank independence as generally defined in the existing theoretical literature is only one of the influences on macroeconomic performance. The objectives of the fiscal authority, the commitment mechanisms available to the authorities and the nature of the policy game play a key role in determining the inflation rate and output in the economy. Furthermore, the model can be solved for the optimal degree of inflation aversion of the central bank.

JEL Classification Numbers:

E58, E31

Keywords: Central Banking, Monetary Policy, Inflation

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Summary

This paper presents a new theory of asset pricing intended to explain why other developing country equity markets responded so strongly to the December 1994 devaluation of the Mexican peso, while the world's major stock markets were unmoved. Standard finance models such as the Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (APT) predict that all equity returns should be a function of the stock or portfolio's sensitivity to global risk factors, such as commodity prices or returns on the world portfolio. To the extent that the crash of the Mexican stock market only reflected news about Mexican fundamentals, it would have been expected to have only a very small impact on the world portfolio, since Mexico represented less than 2 percent of global stock market capitalization at the time.

The "tequila" effect stemming from the Mexican crisis can be explained if investors are assumed to follow a two-step portfolio allocation process--first determining what share of their portfolio to invest in developing countries, and then allocating those funds across the emerging markets. This is consistent with the behavior of institutional investors, who appear to treat developing country equity markets as a separate asset class.

If investors follow such a two-step process, then returns in a given developing country market should be a function of returns in other emerging markets and of returns on the world portfolio. This paper tests a two-factor asset pricing model that includes both a global portfolio and a broad emerging market portfolio against the standard one-factor CAPM, which includes only the world portfolio. In both weekly and monthly data for 1989-95, the CAPM can be rejected in favor of the two-factor model for 8 of the 13 markets studied.

Splitting the sample into two subperiods gives even stronger results. For 1992-95, when institutional investor involvement in developing country markets was greatest, the two-factor model dominates the CAPM far more strongly: the CAPM is rejected in 11 of the 13 markets studied, with Jordan and Colombia as the exceptions. The two-factor estimates also indicate that returns in developing country markets are more sensitive to changes in returns on the composite developing country stock portfolio than to the world portfolio in 12 of the 13 markets. However, for 1989-91 the CAPM dominates in five markets. The significant structural change suggests that the increased role of institutional investors in these markets has increased their sensitivity to each other.

A four-factor model with regional emerging market portfolios for Latin America and Asia is also estimated.

No conventional model of equity markets can explain the dramatic declines in developing country stock markets, referred to as the Tequila effect, that occurred in the wake of the Mexican financial crisis beginning in late 1994. Standard finance models such as the Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (APT) predict that all equity returns should be a function of the stock or portfolio's sensitivity to global risk factors, such as commodity prices or returns on the world portfolio. To the extent that the crash of the Mexican market only reflected news about Mexican fundamentals, it would have been expected to have only a very small impact on the world portfolio, since Mexico represented less than 2 percent of global stock market capitalization. With only a small impact on the world portfolio, the impact of the Mexican crash on other developing country stock markets would have been expected to be insignificant.

A new model of asset pricing is needed to explain why other developing country equity markets responded so strongly to the Mexican devaluation, while the world's major stock markets were unmoved. The contagion effect among developing country stock markets, and particularly within Latin America, suggests that investors do not analyze these markets solely in the context of the global risk factors. This is consistent with the behavior of institutional investors who appear to treat developing country equity markets as a separate asset class, first deciding what share of their portfolio to allocate to industrial and developing country equity markets, respectively, then allocating the funds within each asset class. Moreover, the across-the-board (albeit short-lived) liquidation of developing country equity holdings by in the wake of the Mexican devaluation suggests that portfolio managers had not substantially differentiated among developing country equity markets based on their individual risks and interpreted the peso devaluation to signal that underlying risks in other economies might be higher than they had recognized.

I. Asset Pricing with Developing Country Equities as a Separate Asset Class

According to the capital asset pricing model (CAPM), investors should allocate their funds among risky assets according to the assets' expected rates of return relative to the expected return on the market portfolio. 1/ Investors divide their wealth between a riskless asset and risky assets or portfolios; the representative investor would hold a portfolio of risky assets identical to the market portfolio. 2/ An

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1/ All returns are measured in excess of the riskless rate of return.

2/ Assuming zero transactions or informational costs and that assets are infinitely divisible, a representative investor would hold each equity in proportion to its share in the world portfolio, such that his or her portfolio would be identical to the world portfolio in composition.

investor would deviate from holding the market portfolio only if by doing so he could improve the efficiency of his overall portfolio, increasing his expected return without accepting additional risk. As such, the only factor that should affect investors' demand for an asset is that asset's return covariance with the market portfolio. If we assume that investors invest globally, then the market portfolio is the world stock portfolio and the rate of return on each country's stock market should be a function of that market's return covariance with the world stock portfolio:

$$r_{jt} = \alpha + \beta_w r_{wt} + u_t \qquad (1)$$

where r_{jt} is the expected return on market j and r_{wt} is the expected return on the world portfolio. 1/ Therefore, if developing country equity markets are part of the global market, the return in any given market j should be proportional to that market's covariance with a capitalization-weighted world portfolio. Higher expected returns in any market should be exploited by investors who shift their portfolios into that market until the excess returns are eliminated and the CAPM equation again holds.

The composition of institutional investor portfolios, however, suggests that investors do not determine their holdings based solely on each developing country equity's relationship to the world portfolio and without regard to other factors. In particular, investors have not allocated as much of their portfolios to developing country equities as the CAPM would have suggested based on historical return patterns. Over the period from December 1988 to December 1992, investors could have substantially improved the efficiency of their portfolios, increasing returns without accepting additional risk, by increasing their holdings of developing country equities. 2/

The low proportion of developing country equities in investor portfolios suggests that investors intentionally limit their developing country holdings to a lower share than potentially optional. Because many developing country markets are very illiquid, only a few investors could achieve an apparently optimal portfolio allocation between developing and industrial country equities. If all portfolio managers tried to shift simultaneously into developing country equities, stock prices would be quickly driven up and expected returns driven down, reducing the optimal portfolio share of developing country equities. As such, the portfolio

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1/ All returns are calculated in excess of the holding yield on a constant one-month maturity U.S. Treasury bill intended to represent the riskless rate of return.

2/ By shifting from a portfolio composed entirely of the Financial Times-Actuaries (FT-A) World index to a portfolio composed of 50 percent of the IFC Emerging Markets Data Base (EMDB) Investible Composite index and 50 percent the FT-A World index, investors would have increased the return on their portfolios from roughly 7 to 17 percent, while slightly decreasing portfolio variance from about 17 to 16 percent.

share invested in developing country equities may be optimal once liquidity problems are considered. Alternatively, the under-allocation of assets to developing country stocks might simply indicate that the realized returns on these securities were much better than expected. 1/

II. Why Institutional Investors May Treat Developing Country Equities as a Distinct Asset Class

Investors may believe that developing country equities are subject to larger shifts in investor sentiment (than are equities in mature markets) and other class-wide risks, and as such, are riskier as a class than the variance of their individual returns might suggest. Aitken (1995) explains that if institutional investors together influence a significant share of developing country equities and jointly experience a shift in sentiment away from developing country markets, they may push asset prices out of line with the assets' underlying economic fundamentals. Arbitrage traders (who trade on the basis of economic fundamentals) would normally be expected to buy the assets that become undervalued and offset the trend. However, the magnitude of their potential loss, should asset prices fall further and they be forced to liquidate before prices recover, may limit the arbitrage traders' willingness to purchase the undervalued assets. Institutional investors could then create self-fulfilling shifts in investor sentiment toward developing country equities as a class, where investors sell their developing country securities because they expect prices to decline, and prices decline because investors sell.

Using a variance ratio test on asset return data to evaluate developing county market stability in 1989-91 and 1992-95, Aitken finds that the variance ratios increase profoundly in the later period, when institutional

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1/ Bekaert and Urias's (1995) analysis of the diversification benefits from emerging market closed-end funds versus from the IFC EMDB indices suggest that the high returns on the indices may overstate the effective return once transactions costs and other barriers to investment are considered. Bekaert and Urias assume that returns on closed-end funds approximate achievable returns inclusive of all transactions and other costs. They find statistically significant diversification benefits from U.K. emerging market funds, but not from comparable U.S. funds.

investors played a larger role in developing country stock markets. 1/ He interprets these results as indicating that institutional investor participation has had a destabilizing, rather than stabilizing, impact on these markets. Notably, the increases in variance ratios are greatest for the EMDB composite indices, indicating that developing country equities as a class are more subject to destabilizing noise trading than the individual markets.

Restrictions on institutional investor behavior may contribute to their treating developing country equities as a separate asset class. Dedicated developing country mutual funds are forced to keep the vast majority of their assets in developing country securities at all times, whereas many broadly-based mutual funds are limited in the proportion of assets that can be invested in developing country securities by the portfolio allocation guidelines outlined in their prospectuses.

Portfolio allocation by risk-based asset class is also consistent with the allocation of pension fund assets between stocks and bonds, where the share of assets invested in stocks is typically substantially lower than the proportion that would maximize the portfolio's expected return. 2/ Benartzi and Thaler (1995) present myopic loss aversion as a plausible explanation for such low-risk portfolio allocations, and this explanation also seems relevant to the apparent underallocation of assets to high-variance developing country equities. If investors are loss-averse, their utility loss from a marginal loss in asset value exceeds their utility gain

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1/ The variance ratio test begins with the proposition that if a stock price reflects all available information about asset fundamentals, then under certain conditions, an asset's price would then be expected to follow a random walk as the current price would be the best forecast of future prices. Under a random walk, actual future prices would on average remain in a range that would widen linearly over time, such that the return variance would increase proportionately with the period over which the asset is held and the variance ratio would equal one:

$$VR = \frac{[\frac{\sigma_T}{T}]}{\sigma_1} = 1$$

where σ_T is the return variance over a T week period and σ_1 is the return variance over one week. If however, the ratio exceeds one, price increases today would signal future price increases and indicate that deviations from asset fundamentals may be exploding rather than mean-reverting.

2/ Benartzi and Thaler cite 60 percent stocks and 40 percent bonds and treasury bills as typical asset-allocation proportions. Leibowitz and Langetieg indicate that for a twenty-year horizon, the stock to bond ratio should exceed 100 percent most of the time.

from an equally-sized gain in asset value. 1/ Kahneman and Tversky (1979) formalized loss aversion as a utility function defined over changes in wealth, rather than levels of wealth, that is concave for gains, but convex for losses and steeper for losses than gains. 2/ Essentially, loss-averse investors attempt to maximize expected returns subject to a downside risk constraint, which may induce them to hold fewer high-variance assets than would be suggested in models that assume investors' utility is symmetric with respect to changes in wealth.

Based on their downside risk constraint, loss-averse investors may determine how much of their equity portfolio to allocate to high-variance developing country equities versus lower-variance industrial country equities--a share that will be lower than if investors were maximizing the expected return of their portfolio--then allocate their assets within each class. Kramer and Smith (1995) have observed that the price behavior of mutual funds specialized in Mexican equities is consistent with loss-aversion. They interpret the shift in fund prices from trading at a premium (relative to the underlying portfolio value) after, as indicating that investors did not want to realize paper losses on their closed-end fund shares. 3/

1/ Benartzi and Thaler also present myopic loss aversion as an explanation for the equity premium puzzle--the return premium, typically estimated at 6.5 percent, which investors demand on stock relative to bonds. Benartzi and Thaler attribute the premium to the fact that stocks have both upside and downside risk, whereas a bond is often treated as having no downside risk if held to maturity. However, even if held to maturity, bonds have downside risk in the form of default risk.

2/ Loss-averse investors will demand a return premium for accepting additional variance risk, regardless of the asset's covariance with the market portfolio and, due to the utility function's convexity over losses, the magnitude of the premium will increase more than one-for-one with increases in an asset's variance. Hence, loss aversion is in contradiction to the Capital Asset Pricing Model.

3/ The size of the return premium that loss-averse investors will demand is greater if the investor evaluates his portfolio over short-time horizons, as do institutional investors. Benartzi and Thaler observe that institutional investors typically operate with relatively short horizons tied to the length of time they expect to remain in their job; in addition, investment managers' portfolio performance is evaluated annually, and their bonus set accordingly. Similarly, De Bondt and Thaler (1994) observe that institutional investors have higher turnover ratios than individual investors.

III. A Two-Class Asset Pricing Model

Portfolio allocation by asset class suggests that a two-factor asset pricing model may be more appropriate to describe returns in developing country equity markets. If investors first determine what percentage of their portfolio to allocate to developing versus industrial country markets, then distribute those funds across developing country stock markets, the return in developing country equity market j would depend both on the world market return (where the world portfolio is composed of assets in mature stock markets) and on the return on a broad portfolio of developing country stocks (the developing country market portfolio):

$$r_{jt} = \alpha + \beta_w r_{wt} + \beta_{em} r_{emt} + u_t \qquad (2)$$

where $r_{j,t}$ is the expected return on market j, $r_{w,t}$ is the expected return on the world portfolio (the FT-A World index), $r_{em,t}$ is the expected return on the IFC EMDB Global Composite index. The coefficient $\beta_{em,t}$ represents the covariance between the expected return in market j and the expected return on a capitalization-based developing country equity portfolio, where the return an investor would require to hold the portfolio of market j--as opposed to holding the developing country market portfolio--would be an increasing function of that covariance. 1/ If investors select each asset only based on its relation to the world portfolio, as the CAPM predicts, β_{em} should not be significantly different from zero. Any significant β_{em} would be consistent with investors treating developing country equities as a separate class, allocating within that class according to market j's relationship with returns on the developing country portfolio, and signify a rejection of the CAPM. 2/

1/ The IFC EMDB Global Composite portfolio is used to proxy a true capitalization-weighted portfolio of developing country equities.

2/ This is the case even if expected returns are correlated with one another within the asset class--any two developing country assets which are correlated with one another should affect expected returns only through their impact on the world portfolio. When using actual returns as a proxy for expected returns, however, a non-zero coefficient on the developing country portfolio can reflect two possibilities: (i) the traditional one-factor CAPM is insufficient to explain investor behavior or (ii) unanticipated shocks to asset returns are shared across developing countries. If an unanticipated shock to one country spreads to others because investors, who treat developing country assets as a class, shift their sentiment regarding other markets, a non-zero coefficient would imply that the strict one-factor CAPM did not hold.

IV. Data Description

The data for stock exchanges in developing countries come from the Emerging Markets Data Base (EMDB) compiled by the International Finance Corporation (IFC). The EMDB has both global and investible indices for each market, as well the overall Composite, Latin America, and Asia indices used in this paper. This paper treats the general indices, constructed based on all the stocks in the market, as representative portfolios of local stocks to examine the behavior of the overall stock market. 1/ The IFC's consistent methodology across countries makes its indices preferable to local indices for statistical analysis, although the local indices may be more closely watched by market participants. 2/ EMDB indices typically include 10 to 20 percent of listed stocks, selected on the basis of high trading volume or large capitalization or to give the index an industry composition representative of the market overall; indexes are capitalization-weighted. Like many industrial market indices, the IFC indices are biased toward local blue chip stocks. The analysis below uses end-week data on total returns (price plus accrued dividends) evaluated in U.S. dollars from January 1989 to April 1995; all returns are calculated in excess of the holding yield on a U.S. Treasury bill one month from maturity, which serves as the riskless rate. The markets studied are in Argentina, Brazil, Chile, Colombia, India, Jordan, Korea, Mexico, Malaysia, the Philippines, Taiwan Province of China, Thailand, and Venezuela.

The world market portfolio is represented by the Financial Times-Actuaries (FT-A) World index. The FT-A index has an advantage over other standard global indices (such as the Morgan Stanley Capital International (MSCI) world index) in that it includes developing country stocks as well as industrial country stocks. As such, the FT-A world index will reflect, as the CAPM market portfolio should, changes in prices in the developing country markets under study, a factor that has become increasingly important over time; emerging markets accounted for over 12 percent of world market capitalization at end-1994. Again, data is end-week total returns, evaluated in U.S. dollars and in excess of the holding yield on a U.S. Treasury bill one month to maturity, for January 1989 to April 1995.

Data statistics for raw returns (not excess returns) are presented in Table 1, and excess return correlations between the individual markets and the multi-country indices are presented in Table 2.

1/ The investible indices include only those stocks accessible to foreign investors.

2/ The IFC indices are available only weekly, whereas local indices are available on every trading day and, in some cases, continuously throughout the day.

Contents

Table 1. Data Statistics for Emerging Markets, the World, and IFC Portfolios 1/

Market	Mean	Standard Deviation
Argentina	5.88	28.55
Brazil	3.87	20.50
Chile	3.39	8.87
Colombia	3.60	12.01
India	1.35	10.19
Jordan	0.93	5.60
Korea	0.31	8.89
Mexico	2.29	10.41
Malaysia	1.63	6.60
Philippines	1.86	10.38
Taiwan Province of China	1.22	13.54
Thailand	2.45	9.21
Venezuela	2.04	14.48
FT-A World	0.66	3.99
IFC-G Composite	1.04	6.19
IFC-G Latin America	2.51	9.91
IFC-G Asia	0.81	6.82

1/ The emerging markets composite index and the indices for each emerging market are from the IFC Emerging Markets Data Base global indices. The world market is represented by the Financial Times-Actuaries World index. All series are monthly from December 1988 to April 1995.

Table 2. Correlations between Excess Returns in Emerging Markets, and the World and IFC Portfolios 1/

$$r_{j,t} = \alpha + \beta_w r_{w,t} + \beta_{em} r_{em,t} + \beta_{Asia} r_{Asia,t} + \beta_{LatAm,t} + u_t$$

Market	FT-A World	IFC-G Composite	IFC-G Latin America	IFC-G Asia
Argentina	--	0.05	0.23	-0.04
Brazil	0.20	0.40	0.82	0.14
Chile	0.05	0.22	0.39	0.09
Colombia	0.01	0.05	0.06	0.01
India	-0.04	0.07	-0.01	0.10
Jordan	0.12	0.12	-0.05	0.14
Korea	0.20	0.34	0.10	0.38
Mexico	0.27	0.39	0.59	0.17
Malaysia	0.47	0.47	0.17	0.49
Philippines	0.03	0.08	0.05	0.08
Taiwan Province of China	0.24	0.79	0.12	0.86
Thailand	0.28	0.44	0.16	0.44
Venezuela	-0.09	-0.04	0.05	-0.08
FT-A World	--	0.39	0.27	0.33
IFC-G Composite	--	--	0.49	0.17
IFC-G Latin America	--	--	--	0.17

1/ Returns are calculated in excess of the holding yield on a U.S. Treasury bill with one month to maturity. The emerging markets composite index and the indices for each emerging market are from the IFC Emerging Markets Data Base global indices. The world market is represented by the Financial Times-Actuaries World index. All series are weekly from December 31, 1988 to April 28, 1995.

V. Estimates of the Asset Pricing Model

Ordinary least squares (OLS) estimates of the two-factor model of equation (2) indicate that the addition of the developing country market portfolio substantially improves the explanation of returns in individual developing country equity markets relative to the standard CAPM of equation (1). In weekly data covering the period January 1989 to April 1995, the one-factor CAPM specification can be rejected in favor of the two factor specification for eight of 13 markets, including the largest and most liquid of the developing country equity markets (Taiwan Province of China, Malaysia, Mexico, Brazil) (Table 3). 1/ The estimated two-factor equations explain up to 63 percent of returns in individual markets, with explanatory power highest in some of the largest and most liquid markets (Malaysia, Mexico, Taiwan Province of China, Thailand). Explanatory power is very low, however, and the model is rejected in markets that are either legally or practically closed to foreign investors (Colombia, India, and Venezuela). Argentina, is an interesting exception where the equation has little explanatory power despite the presence of substantial foreign investment. 2/ The coefficient on the developing country portfolio is statistically significant in eight markets. 3/ The coefficient on the world portfolio is significant in five of the 13 markets.

Monthly data, which may be less affected by noise and better demonstrate longer-term relationships, produce similar results. Two developing country equity markets are more sensitive to the world portfolio in monthly data (Korea, the Philippines) (Table 3). In monthly data, the CAPM can be rejected in favor of the two factor model in eight markets. The CAPM is no longer rejected for India; however, the CAPM is rejected for the Philippines in monthly, but not weekly, data.

A perfect test of equation 2 is impossible in that expected returns cannot be observed. The OLS results above use ex post realized returns as an estimate of ex ante expected returns on the assumption that ex post

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1/ Using an F test, the CAPM can be rejected with 95 percent confidence in seven markets (Brazil, Chile, Korea, Mexico, Malaysia, Taiwan Province of China, and Thailand) and with 90 percent confidence for India.

2/ Tests on a split sample (presented below) indicate that the rejection may be due to substantial structural change in the Argentine market's behavior. The CAPM model is rejected in favor of the two-factor model for 1992-95, but not for 1989-91.

3/ The estimates of β_{em} may be biased upward somewhat because the return on market j, $r_{j,t}$, may have a significant weight in determining $r_{em,t}$.

Table 3. Two-Factor Model for 13 Emerging Markets, Weekly and Monthly Data, 1989-95 1/

$$r_{j,t} = \alpha + \beta_w r_{w,t} + \beta_{em} r_{em,t} + u_t$$

Market	Weekly Data				Monthly Data			
	β_w (t-statistic)	β_{em} (t-statistic)	Adj. R^2	$F_{1,305}$ (p-value)	β_w (t-statistic)	β_{em} (t-statistic)	Adj. R^2	$F_{1,67}$ (p-value)
Argentina	-0.12 (0.29)	0.25 (0.80)	-0.003	0.84 (0.36)	-0.32 (0.38)	0.12 (0.18)	-0.028	0.03 (0.85)
Brazil	0.26 (0.86)	1.33 (5.49)	0.161	44.04 (—)	0.25 (0.43)	1.71 (3.95)	0.236	18.45 (—)
Chile	-0.08 (0.68)	0.30 (4.04)	0.043	14.97 (—)	-0.13 (0.50)	0.52 (3.59)	0.085	8.03 (0.01)
Colombia	-0.03 (0.30)	0.09 (0.87)	0.002	0.71 (0.40)	-0.22 (0.52)	0.05 (0.22)	-0.025	0.03 (0.86)
India	-0.19 (1.12)	0.18 (1.68)	0.004	2.70 (0.10)	-0.35 (1.17)	0.10 (0.48)	-0.012	0.22 (0.64)
Jordan	0.13 (1.84)	0.09 (0.95)	0.014	1.77 (0.18)	0.30 (1.41)	0.01 (0.11)	0.021	0.01 (0.92)
Korea	0.16 (1.25)	0.43 (5.43)	0.119	28.79 (—)	0.70 (3.07)	0.29 (2.63)	0.233	4.06 (0.05
Mexico	0.32 (2.44)	0.53 (4.48)	0.159	33.81 (—)	0.04 (0.18)	0.74 (3.96)	0.177	14.10 (—)
Malaysia	0.58 (6.41)	0.41 (5.10)	0.313	43.59 (—)	0.47 (2.98)	0.39 (4.17)	0.301	11.77 (—)
Philippines	0.02 (0.09)	0.63 (2.39)	—	1.65 (0.20)	0.73 (2.13)	0.49 (2.35)	0.224	6.77 (0.01)
Taiwan Province of China	-0.25 (2.25)	1.84 (17.19)	0.627	468.25 (—)	-0.19 (-0.85)	1.68 (8.87)	0.550	78.18 (—)
Thailand	0.31 (1.93)	0.65 (4.56)	0.204	49.40 (—)	0.38 (1.22)	0.38 (1.94)	0.095	4.05 (0.05)
Venezuela	-0.27 (1.11)	-0.01 (0.07)	0.007	0.01 (0.93)	-0.26 (0.58)	-0.44 (-1.31)	0.018	1.92 (0.17)

1/ Linear regressions with heteroskedasticity-consistent errors. Estimates of constant terms are not shown. Returns are calculated in excess of the holding yield on a U.S. Treasury bill with one month to maturity. The emerging markets composite index and the indices for each emerging market are from the IFC Emerging Markets Data Base (EMDB) global indices. The world market is represented by the Financial Times-Actuaries (FT-A) World index. Weekly data cover the period December 31, 1988 to April 28, 1995; monthly data cover the period January 1989 to April 1995.

returns are equal to expected returns plus some forecast error:

$$r_{j,t} = E_{t-1}[r_{jt}] + \epsilon_t \qquad (3)$$

where ϵ_t is assumed to be iid. An alternative approach is conditional or expectational estimation, as used in Harvey (1989, 1991) and Buckberg (1995) among others, which attempts to more closely capture ex ante expected returns by using an information set Z_{t-1} to calculate expected returns and then using these to estimate the expected moments of equations 1 and 2. Generalized Method of Moment (GMM) conditional estimates (not shown here) were weak with large standard errors and few significant coefficients. The weak coefficients may indicate that the model specification is inappropriate for the data, or, more likely given the far stronger OLS results, that the instruments provide a poor estimate of expected returns.

Given the significant structural changes in developing country equity markets in recent years, including the significant increase in foreign and institutional investor participation, the one and two factor equations are also estimated over two subsamples of weekly data, January 1989 to December 1991 and January 1992 to April 1995. During the 1989-91 period, many developing countries imposed substantial restrictions on foreign investment in their stock markets, with 1991 a significant turning point in a number of countries' regulations. The 1992-95 period reflects both liberalized foreign investment regimes and a significant increase in institutional investor participation in developing country stock markets. The increase in institutional investor involvement relates not only to improved market access but also increased interest in the high yields offered by developing country equities due to the decline in interest rates and equity returns in the U.S. and other industrial countries.

The results indicate that the two-factor model is a more appropriate description of developing country asset pricing in the 1992-95 period, when foreign and institutional investors played a larger role in these markets, than for 1989-91 or for the full sample. For 1992-95 the two-factor model dominates the CAPM in 11 of 13 markets, where the exceptions are Colombia and Jordan, versus only seven of 13 markets in the 1989-91 sample and eight of 13 in the full sample (Table 4). In 12 markets, asset prices are more sensitive to other emerging markets than to the world portfolio in the 1992-95 period (versus nine for the full sample and seven in the 1989-91 sample). 1/ For Argentina, the Philippines, and Venezuela, the CAPM is rejected in favor of the two-factor model for 1992-95, although the CAPM is preferred over the full sample; in all three cases, β_{em} is higher in the 1992-95 tests and for Argentina and the Philippines β_w is also higher. These results suggest significant structural change in developing country equity pricing following the large-scale entry of institutional investors, particularly an increased sensitivity of developing country markets to each other, consistent with portfolio allocation by asset class.

1/ The exception is Jordan.

Table 4. Two-Factor Model for 13 Emerging Markets, Weekly Data 1989-91 and 1992-95 1/

$$r_{j,t} = \alpha + \beta_w r_{w,t} + \beta_{em} r_{em,t} + u_t$$

	January 1989-December 1991				January 1992-April 1995			
Market	β_w (t-statistic)	β_{em} (t-statistic)	Adj. R^2	$F_{1,150}$ (p-value)	β_w (t-statistic)	β_{em} (t-statistic)	Adj. R^2	$F_{1,152}$ (p-value)
Argentina	-0.36	-0.06	-0.010	-0.02	0.60	1.22	0.216	28.81
	(0.60)	(0.13)		(0.89)	(1.80)	(5.08)		(0.00)
Brazil	0.48	0.91	0.111	12.09	-0.17	2.54	0.296	61.83
	(1.20)	(3.18)		(0.00)	(0.44)	(8.93)		(0.00)
Chile	-0.03	0.17	0.009	2.97	-0.16	0.69	0.137	25.82
	(0.17)	(1.97)		(0.09)	(0.78)	(5.02)		(0.00)
Colombia	-0.01	0.05	-0.012	0.17	-0.06	0.19	-0.008	0.81
	(0.08)	(0.47)		(0.68)	(0.24)	(0.68)		(0.37)
India	0.04	-0.06	-0.011	0.32	-0.67	0.84	0.067	11.88
	(0.23)	(0.51)		(0.57)	(1.71)	(3.79)		(0.00)
Jordan	0.22	0.11	0.035	1.59	-0.07	-0.01	-0.011	0.01
	(2.34)	(0.93)		(0.21)	(0.65)	(0.13)		(0.92)
Korea	0.26	0.31	0.132	10.36	-0.05	0.78	0.146	26.31
	(1.67)	(3.40)		(0.00)	(0.20)	(5.13)		(0.00)
Mexico	0.50	0.19	0.219	6.29	-0.01	1.52	0.292	59.00
	(4.70)	(2.16)		(0.01)	(0.24)	(5.24)		(0.00)
Malaysia	0.61	0.34	0.380	22.36	0.50	0.61	0.239	25.13
	(5.20)	(3.47)		(0.00)	(3.76)	(4.60)		(0.00)
Philippines	0.10	0.66	-0.001	0.66	-0.10	0.49	0.050	9.80
	(0.28)	(1.88)		(0.42)	(0.53)	(2.94)		(0.00)
Taiwan Province of China	-0.37	2.15	0.820	627.43	-0.04	0.92	0.166	29.86
	(3.00)	(20.92)		(0.00)	(0.17)	(5.53)		(0.00)
Thailand	0.61	0.53	0.253	19.33	-0.38	0.92	0.187	37.42
	(2.84)	(2.99)		(0.00)	(1.97)	(5.24)		(0.00)
Venezuela	-0.43	0.22	0.037	1.64	0.22	0.65	0.043	6.47
	(1.37)	(1.01)		(0.20)	(0.71)	(2.41)		(0.01)

1/ Linear regressions with heteroskedasticity-consistent errors. t- statistics appear in parentheses. Estimates of constant terms are not shown. Returns are calculated in excess of the holding yield on a U.S. Treasury bill with one month to maturity. The emerging markets composite index and the indices for each emerging market are from the IFC Emerging Markets Data Base (EMDB) global indices. The world market is represented by the Financial Times-Actuaries (FT-A) World index. Weekly data cover the period December 31, 1988 to April 28, 1995; monthly data cover the period January 1989 to April 1995.

VI. Asset Pricing with Regional Portfolio Allocation

The existence of region-specific developing country mutual funds also suggests that investors may be managing portfolios on a regional basis. The sharper and more sustained drop in Latin American stock markets after the Mexican devaluation, as compared to Asian markets, lends support to this observation. Similarly, Latin markets were substantially correlated in the months following the Mexican devaluation but were far less correlated with Asian markets. Perceived common macroeconomic characteristics across Asian and Latin American economies, respectively, support investors' tendencies to classify markets by region.

If investors made their portfolio allocation decisions by region and considered the relative returns among individual markets only as a second step, then returns in Latin American markets would be a function only of other Latin American markets and not of non-Latin markets; the same could be expected to hold among developing country equity markets in Asia. More specifically, returns in Argentina would be a function of their covariance with returns on a portfolio of Latin American equities, but would not depend on their covariance with returns on a portfolio of developing Asian market equities. For Argentina, β_{LatAm} would be statistically significant and β_{Asia} would be zero in the equation:

$$r_{j,t} = \alpha + \beta_w r_{w,t} + \beta_{em} r_{em,t} + \beta_{Asia} r_{Asia,t} + \beta_{LatAm} r_{LatAm,t} + \epsilon_t \quad (4)$$

where $r_{LatAm,t}$ is the return on a Latin American portfolio (proxied by the IFC Global Latin America returns index) and $r_{Asia,t}$ is the return on an Asian portfolio (proxied by the IFC Global Asia returns index). β_{em} will reflect covariance with the emerging markets in Africa, Europe, and the Middle East that are included in the IFC Composite index. In OLS estimates of equation (4) for 13 markets over the period January 1989 to April 1995, the results are varied (Table 5). 1/ The regional portfolio only has explanatory power for returns in Brazil, Chile, Malaysia, and Taiwan Province of China. However, for Mexico and Korea, the IFC Composite portfolio has explanatory power beyond the regional term; the Latin America portfolio return is not statistically significant in explaining Mexican returns, which would be consistent with the view that investors treat Mexican securities as a benchmark for other Latin American country securities.

Another reason that the CAPM might fail to describe asset pricing in developing country equity markets could relate to the fact that much of the foreign funds entering these markets are channeled through U.S.-based mutual funds and investment banks, and that the U.S. is a common destination for

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1/ The estimates of β_{em} and the regional betas may be biased upward somewhat because the return on market j, $r_{j,t}$, may have a significant weight in determining $r_{em,t}$ or the regional return.

Table 5. Four-Factor Model for 13 Emerging Markets 1/

$$r_{j,t} = \alpha + \beta_w r_{w,t} + \beta_{em} r_{em,t} + \beta_{Asia} r_{Asia,t} + \beta_{LatAm} r_{LatAm,t} + u_t$$

Market	β_w (t-statistic)	β_{em} (t-statistic)	β_{Asia} (t-statistic)	β_{LatAm} (t-statistic)	Adj. R^2 (t-statistic)
			Weekly data		
Argentina	-0.28 (-0.68)	1.12 (0.64)	-1.11 (0.92)	0.47 (0.81)	0.052
Brazil	-0.11 (-0.60)	-0.55 (0.61)	0.42 (0.61)	2.05 (10.22)	0.672
Chile	-0.14 (-1.26)	0.03 (0.09)	0.03 (0.10)	0.34 (3.05)	0.151
Colombia	-0.05 (-0.44)	1.26 (2.39)	-0.95 (2.30)	-0.22 (1.90)	0.007
India	-0.18 (1.01)	-0.51 (0.83)	0.57 (1.21)	0.10 (0.67)	-0.004
Jordan	0.15 (2.06)	0.48 (1.31)	-0.25 (0.99)	-0.18 (1.86)	-0.026
Korea	0.18 (1.49)	-0.87 (1.96)	1.07 (3.04)	0.21 (1.77)	0.149
Mexico	0.20 (1.70)	2.11 (3.12)	-1.53 (-2.97)	0.12 (0.79)	0.403
Malaysia	0.60 (6.39)	-0.61 (1.46)	0.85 (2.70)	0.15 (1.46)	0.341
Philippines	0.02 (0.05)	-1.03 (-0.76)	1.26 (1.11)	0.44 (0.83)	0.005
Taiwan Province of China	-0.14 (1.66)	0.38 (0.96)	1.42 (4.59)	-0.12 (1.32)	0.741
Thailand	0.33 (2.03)	0.28 (0.52)	0.34 (0.81)	— (0.02)	0.206
Venezuela	-0.31 (1.25)	1.38 (1.95)	-1.16 (2.18)	-0.19 (1.08)	0.012

1/ Linear regressions with heteroskedasticity-consistent errors. Estimates of constant terms are not shown. Returns are calculated in excess of the holding yield on a U.S. Treasury bill with one month to maturity. The emerging markets composite index and the indices for each emerging market are from the IFC-EMDB global indices. The world market is represented by the FT-A World index. All series are weekly from December 31, 1988 to April 28, 1995.

flight capital from many developing countries. It therefore seems plausible that returns in developing country equity markets could respond more to covariance with the U.S. portfolio than the world portfolio. However, tests of an expanded version of equation (2), adding the returns on a U.S. and Canadian market portfolio, did not improve the explanation of return behavior in any of the 13 developing country stock markets tested.

VII. Conclusion

This paper proposes that portfolio allocation by asset class on the part of institutional investors can explain the very strong response of developing country stock markets to events in another developing country market, even when the events in the other country do not seem to affect economic fundamentals outside its own borders. A good example of such behavior, of course, was the widespread selling of developing country securities across the board in the immediate wake of the Mexican devaluation in December 1994. This paper argues that this can be explained if institutional investors allocate their portfolios according to a two-step process, first determining what share of their portfolios to invest in developing country versus industrial country stock markets, then allocating their funds among developing country markets. To determine whether developing country stocks are priced as a function of other developing country stocks, rather than solely as a function of the world market portfolio, as assumed by the CAPM, the paper tests a two-factor pricing model. In the two-factor model, returns on the developing country market are evaluated as a function of returns on a broad emerging market portfolio and of returns on the world portfolio.

The tests indicate that the two-factor model dominates the CAPM in most of the developing country markets studied. Over the full sample period of 1989-95, the CAPM is rejected in favor of the two-factor model for eight of 13 markets. However, for the period 1992-95, when institutional investor involvement in developing country markets was greatest, the two factor model dominates the CAPM far more strongly. Over 1992-95, the CAPM is rejected in favor of the two-factor model in 11 of the 13 markets studied, with Jordan and Colombia as the exceptions. The two-factor estimates also indicate that returns in developing country markets are more sensitive to changes in returns on the composite developing country stock portfolio than to the world portfolio in 12 of the 13 markets. The significant structural change suggests that the increased role of institutional investors in these markets has increased their sensitivity to each other--which is logical only if investors make investment decisions in developing country markets primarily by comparing the markets to each other, not by comparing each market to the world portfolio.

References

Aitken, Brian, "Impact of Institutional Investors' Trading on Developing Country Stock Prices," IMF, unpublished manuscripts.

Aziz, Jahangir, "Market Participation and Asset Price Volatility," paper presented at the North American Economics and Finance Association Annual Meetings, Washington, D.C., January 6-8, 1995.

Bekaert, Geert, "Market Integration and Investment Barriers in Emerging Equity Markets," World Bank Economic Review (January 1995): pp. 75-108.

_____ and Campbell R. Harvey, "Emerging Equity Market Volatility," Stanford University mimeo (April 9, 1995).

_____, "Time-Varying World Market Integration," National Bureau of Economic Research Working Paper No. 4843 (August 1994).

_____ and Michael S. Urias, "Diversification, Integration and Emerging Market Closed-End Funds," National Bureau of Economic Research Working Paper No. 4990 (January 1995).

Benartzi, Sholmo and Richard Thaler, "Myopic Loss Aversion and the Equity Premium Puzzle," Quarterly Journal of Economics (February 1995): pp. 73-92.

Buckberg, Elaine, "Emerging Stock Markets and International Asset Pricing," World Bank Economic Review (January 1995): pp. 51-74.

De Bondt, Werner F.M. and Richard H. Thaler, "Financial Decision-Making in Markets and Firms: A Behavioral Perspective," National Bureau of Economic Research Working Paper No. 4777 (June 1994).

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

Harvey, Campbell R, "The World Price of Covariance Risk," Journal of Finance (March 1991): pp. 111-157.

Kahneman, Daniel and Amos Tversky, "Prospect Theory: An Analysis of Decision Under Risk," Econometrica (March 1979): pp. 263-291.

Kramer, Charles and R. Todd Smith, "Recent Turmoil in Emerging Markets and the Behavior of Country-Fund Discounts: Renewing the Puzzle of the Pricing of Closed-End Mutual Funds," IMF Working Paper WP/95/68 (July 1995).

Summary

Central bank independence has emerged at the forefront of political agendas around the world. A significant part of the impetus for increased central bank independence derives from the performance of the German economy under the Bundesbank, but it also comes from the recent theoretical and empirical literature, which has highlighted the positive association between lower inflation and increased central bank independence.

The theoretical rationale for increased central bank independence has developed from the time-consistency model of Barro and Gordon (1983a, b). That model and most of its successors examine the effect of central bank independence on inflation and output in isolation from the actions of other policymakers. The purpose of this paper is to explicitly model a separate monetary and fiscal authority and to examine the interaction between the two in determining the macroeconomic performance of the economy.

The model used in this paper highlights three factors that affect inflation and output in addition to the central bank's degree of inflation aversion (which is the traditional definition of central bank independence in the literature). First, the preferences of the fiscal authority play a key role in determining the state of the economy; the central bank's preferences are no longer the sole determining factor. Second, the nature of the policy game affects the level of inflation and output. The existing literature has focused on the Nash equilibrium of the policy game. Here the Stackelberg equilibria are also examined, which may more accurately reflect the practical relationship between central banks and governments. Third, the obligations of the two authorities to repay debt affect the equilibrium outcomes.

The model can be solved for the optimal degree of inflation aversion of the central bank. The optimal inflation aversion is shown to depend on the preferences of the fiscal authority and of society and on the institutional structure of the economy. An increase in the inflation aversion of the central bank, while always reducing the inflation rate, may reduce welfare because of its adverse effects on output and government spending. The net welfare effect is shown to depend on the weights in the welfare functions of the fiscal authority and society. Thus, increasing the central bank's inflation aversion is not necessarily a free lunch.

Lee, Charles M., Andrei Schleifer, and Richard H. Thaler, "Investor Sentiment and the Closed-End Fund Puzzle," Journal of Finance (1991): pp. 75-109.

Leibowitz, M. L. and T.C. Langetieg, "Shortfall Risks and the Asset Allocation Decision: A Simulation Analysis of Stock and Bond Risk Profiles," Salomon Brothers Research Department (January 1989).

"Too little, Not Too Much," Economist (June 24, 1995): pp. 72-73.