Capital Flows to Developing Countries: Long- and Short-Term Determinants

Mark P. Taylor and Lucio Sarno

This article focuses on the determinants of the large portfolio flows from the United States to Latin American and Asian countries during 1988–92. Cointegration techniques reveal that both domestic and global factors explain bond and equity flows to developing countries and represent significant long-run determinants of portfolio flows. The article also investigates the dynamics of portfolio flows by estimating seemingly unrelated error-correction models. Global and country-specific factors are equally important in determining the long-run movements in equity flows for both Asian and Latin American countries, while global factors are much more important than domestic factors in explaining the dynamics of bond flows. U.S. interest rates are a particularly important determinant of the short-run dynamics of portfolio, especially bond, flows to developing countries.

International capital flows have recently been marked by a sharp expansion in net and gross capital flows and a substantial increase in the participation of foreign investors and foreign financial institutions in the financial markets of developing countries (World Bank 1997). This expansion has been much greater than that of international trade flows (Goldstein, Mathieson, and Lane 1991 and Montiel 1993). It has been reinforced by the ongoing abolition of impediments and capital controls and the broader liberalization of financial markets in developing countries since the late 1980s. Feldstein and Horioka’s (1980) finding of low international capital mobility based on the correlation between the shares of savings and investment in gross domestic product (GDP) still remains a puzzle (see Obstfeld 1995). However, studies based on interest rate differentials generally provide evidence that there is a high and increasing degree of international capital mobility among the major industrial countries and among international and developing countries (Montiel 1993).

1. For a comprehensive review of some recent prospects and developments concerning capital flows to developing countries, see World Bank (1995, 1997), IMF (1994a, 1994b, 1995), and, for Latin American countries, United Nations Economic Commission for Latin America and the Caribbean (1994).

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Another main feature of recent capital flows to developing countries is that private (bond and equity) flows, as opposed to official flows, have become a crucial source of financing large current account imbalances: "This surge of portfolio investment combined with the large amounts of foreign direct investment has meant that in the early 1990s, close to half of all aggregate external financing of development economies comes from private sources and goes to private destinations" (Bruno 1993, foreword).

These trends raise important issues concerning the factors that motivate capital flows and their effect on the performance of developing countries. This article identifies the main determinants of capital flows to developing countries. It sheds light on the relative importance of the improved economic performance of these countries—country-specific or "pull" factors—and of the stimulus provided by the decline of U.S. interest rates and the slowdown of the U.S. economy in the early 1990s—global or "push" factors (Chuhan, Claessens, and Mamingi 1993; Fernández-Arias 1996; and Agenor forthcoming).

Identifying the relative importance of push and pull factors is important for designing effective policy and therefore worthy of investigation. This has recently been shown by Fernández-Arias and Montiel (1996), who first summarize a number of arguments describing why large capital flows may, under various circumstances, adversely affect developing countries unless policies designed to neutralize such effects are adopted. They then point out that if the causes of capital flows are largely exogenous to the developing country, compensatory policies are appropriate. But if the causes are largely domestic, then direct policy design may be more appropriate and effective.

I. THE DETERMINANTS OF INTERNATIONAL CAPITAL FLOWS

Net capital flows arise when saving and investing are unbalanced across countries, resulting in a transfer of real resources through a trade or current account imbalance. Gross capital flows, in contrast, need not involve any transfer of real resources. In fact, they may be offsetting across countries. Nevertheless, they allow individuals and firms to adjust the composition of their financial portfolios and are therefore important for improving the liquidity and diversification of portfolios.

Both net and gross capital flows respond to economic fundamentals, official policies, and financial market imperfections. International capital flows play an important role in increasing economic efficiency, assuming that international financial markets can correctly evaluate the portfolio preferences of savers, identify and fund investments that have the highest expected rate of return, appropriately price financial assets on the basis of their underlying risks and returns, and provide information to reduce uncertainty. Following the traditional literature in financial economics, assets are priced, in the absence of distortions, so that the riskiest assets offer the highest rates of return. Also, although unsystematic risk can be reduced to a minimum by appropriately diversifying portfolios, sys-
tematic risk cannot be diversified and should be reflected in the price of assets—
investors should be compensated for holding a portfolio of assets whose returns
have a high covariance (see Taylor 1991 for a survey of this literature).

These arguments imply that among the fundamental determinants of interna-
tional capital flows are factors such as the investment opportunities available in
the global economy, the covariances between the expected returns on various
investment projects, and the preferences of individuals for present and future
consumption, as well as their attitudes toward risk. There is a major problem,
however, in measuring empirically the effect of those factors on capital flows:
international capital markets may react to a shock in one country through a
change in capital flows, through a change in the prices of the country’s financial
claims, or through a mix of the two. Moreover, as the international financial
system becomes more integrated and portfolios more diversified, asset prices are
more likely to change than are net capital flows to restore market equilibrium.
Thus most econometric models try to express financial linkages across countries
in terms of interest rate parity conditions. That is, they specify the asset price
linkages that are the outcome of arbitrage between financial markets rather than
the capital flows that are part of the arbitrage process (Goldstein, Mathieson,
and Lane 1991).

In addition to these economic fundamentals, government policies and capital
market imperfections also determine international capital movements. It is, how-
ever, extremely difficult to assess the impact of these policies and distortions
because they generally overlap, creating both impediments and stimuli to capital
flows.

The processes of deregulation, globalization, and innovation have increased
both the efficiency of and volatility in financial markets. Volatility adds another
source of risk, not only making the pricing of financial assets more difficult but
also generating portfolio flows that are potentially more unstable (Corrigan 1989;
Claessens, Dooley, and Warner 1995; Grabel 1995; and Clarke 1996). Also
some evidence suggests that volatility is not correlated with any measure of fi-
nancial integration and that it does not rise because of financial liberalization
(see, for example, Tesar and Werner 1995 and Bekaert 1995).

**Push and Pull Factors**

The recent literature usually distinguishes between two sets of factors affect-
ing capital movements (see, for example, Claessens, Dooley, and Warner 1995;
Chuhan, Claessens, and Mamingi 1993; Fernández-Arias 1996; Fernández-Arias
and Montiel 1996; and Agenor forthcoming). The first are country-specific—
pull—factors reflecting domestic opportunity and risk. As developing countries’
creditworthiness is restored, capital (bond and equity) flows are likely to be-
come an increasingly prominent source of external finance. For example, equity-
related capital flows could be very large and come in the form of either foreign
direct investment (FDI) or portfolio investment in equities. FDI may be attracted
by the opportunity to use local raw materials or employ a local labor force.
Although portfolio equity flows to developing countries have increased sharply in recent years, they are expected to be extremely sensitive to a country's openness, particularly to rules concerning the repatriation of capital and income (Williamson 1993). The right to repatriate dividends and capital may be the most important factor in attracting significant foreign equity flows (Goldstein, Mathieson, and Lane 1991). The International Finance Corporation differentiates between countries that allow foreign investors to repatriate capital and income freely and without restriction from countries that are "relatively open," which apply some restrictions on the repatriation of capital and income, and countries that are "relatively closed," which apply very strict restrictions.

Rates of return—obviously a crucial determinant of capital flows—are often very high in the financial markets of developing countries relative to many major markets in industrial countries, reflecting the high risk generated by their typically high volatility. In particular, rates of return rose significantly in developing countries in the late 1980s relative to those available in the major industrial economies (Calvo, Leiderman, and Reinhart 1993 and Chuhan, Claessens, and Mamingi 1993).

Credit ratings and secondary-market prices of sovereign debt, reflecting the opportunities and risks of investing in the country, are likely to be important in determining capital flows as well (Bekaert 1995). Those indicators also rose in the late 1980s (Mathieson and Rojas-Suárez 1992 and Chuhan, Claessens, and Mamingi 1993).

The second set of determinants of capital flows to developing countries are global—push—factors. For example, the sharp increase in U.S. capital flows, which represent a significant share of the portfolio flows received by emerging markets, may have been induced to some extent by the fast and marked fall of U.S. interest rates (short, medium, and long term) in the late 1980s. Moreover, the slowdown of the U.S. economy in the late 1980s may also have attracted U.S. capital flows, especially because during that period macroeconomic policies, labor market conditions, and exchange rate policies in many developing countries were becoming noticeably more stable (Calvo, Leiderman, and Reinhart 1993 and 1996). One would expect that as the governments of developing countries make macroeconomic and institutional reforms, international investors will gain confidence and be more willing to direct capital flows toward the new markets (Papaioannou and Duke 1993).

Chuhan, Claessens, and Mamingi (1993), using panel data for 1988–92, find that portfolio flows to a sample of Latin American and Asian countries are about equally sensitive to push and pull factors. They also find that equity flows, relative to bond flows, are more responsive to global factors; bond flows, however, are more responsive to a country's credit rating and to the secondary-market price of debt.

Using a model with partial irreversibility of investment, Daveri (1995) derives a negative relationship between foreign investment and costs of entry and exit from financial markets. His theoretical framework is consistent with the results of Chuhan, Claessens, and Mamingi (1993).
A Simple Theoretical Framework

Fernández-Arias and Montiel (1996) have developed a useful analytical framework that incorporates the effect of domestic and global factors on capital flows. They separate potential domestic causes into those operating at the project level and those operating at the country level. Assuming that capital flows may be transactions in different types of assets, indexed by \( s = 1, \ldots, n \), the domestic return on an asset of type \( s \) is decomposed into two components: a project-level expected return \( (G_s) \) and an adjustment factor dependent on the creditworthiness of the country \( (C_s) \). The project-level return is assumed to be a function of a vector of net flows \( (F) \) going to projects of all types, while the creditworthiness factor is assumed to be a function of a vector of the end-of-period stocks of liabilities of all types, \( S = S_{-1} + F \), where \( S_{-1} \) denotes initial stocks of liabilities. Given that external creditors will diversify their portfolios, the opportunity cost of assets of type \( s \), \( V_s \), is a function of \( S \).

Fernández-Arias and Montiel (1996) establish an arbitrage condition—from which \( F \) may be solved for—of the form:

\[
G_s(g,F)C_s(c,S_{-1} + F) = V_s(v,S_{-1} + F)
\]

(1)

where \( g \), \( c \), and \( v \) represent shift factors associated with the domestic economic environment, domestic creditworthiness (pull factors), and the financial conditions of the creditor country (push factors). \( G_s \), \( C_s \), and \( V_s \) are assumed to be increasing functions of \( g \), \( c \), and \( v \). The equilibrium or “desired” value of the vector of net flows \( F \), \( F^* \), say, determined implicitly by equation 1, may be expressed as:

\[
F^* = F^*(g,c,v,S_{-1})
\]

(2)

where \( F^* \) is increasing in \( g \) and \( c \) but decreasing in \( v \) and \( S_{-1} \). Holding \( S_{-1} \) constant, totally differentiating equation 2, and approximating total derivatives by first differences yield:

\[
\Delta F^* = F^*_g \Delta g + F^*_c \Delta c + F^*_v \Delta v
\]

(3)

where subscripts denote partial derivatives. Equation 3 describes the pattern of changes in desired capital flows, determined by changes in the pull factors \( g \) and \( c \) and the push factors \( v \) and by the initial value of \( S \). Increases in \( g \) and \( c \) and decreases in \( v \) may induce prolonged growth in capital flows to developing countries. This simple model is clearly consistent with both the push and the pull view of the surge in capital inflows, although the relative importance of the two factors will depend on the relative magnitude of the partial derivatives of \( F^* \) as well as on the relative magnitude of changes in the factors themselves.

Equation 3 states that differences in short-run and long-run capital movements might arise in accordance with the types of changes in \( g \), \( c \), and \( v \): permanent changes in \( g \), \( c \), and \( v \) may cause long-run, permanent changes in the pattern.
of net flows, whereas transitory changes in these factors may generate transitory, short-term changes in net flows, which may be reversed over time. For example, the gradual, permanent removal of capital controls and liberalization of restrictions on FDI may reduce the adjustment costs that foreign investors face in diversifying their portfolios and thus give rise to a gradual stock adjustment (flow) over time. This gradual adjustment also implies a complex dynamic pattern of net flows moving toward their long-run equilibrium value and is consistent with an estimation methodology that distinguishes the short- from the long-run determinants of capital flows.

Dynamic adjustment can be formally introduced into the Fernández-Arias–Montiel framework by assuming a simple cost-of-adjustment model. In this model factors such as market imperfections, informational asymmetries (Stiglitz and Weiss 1981), and entry and exit costs to emerging financial markets (Daveri 1995) are captured in the assumption that creditors face costs in adjusting their portfolios that are increasing in the size of the adjustment. The desired vector of capital flows is given by equation 2.

Assume that agents want to minimize the difference between desired and actual flows, subject to adjustment costs. A simple way of modeling this is to assume a simple quadratic loss function for investors:

\[
\mathcal{L} = (F - F^*)'M_1(F - F^*) + (F - F_{-1})'M_2(F - F_{-1})
\]

where \(M_1\) and \(M_2\) are positive definite weighting matrices. From the first-order conditions for minimizing \(\mathcal{L}\), we can derive a simple equation for changes in \(F\):

\[
\Delta F = (M_1 + M_2)^{-1}M_1(F^* - F_{-1})
\]

which, rearranging and using equation 3, can be equivalently expressed in the error-correction form:

\[
\Delta F = A_0(F^* - F_{-1}) + A_1\Delta g + A_2\Delta c + A_3\Delta \nu
\]

where \(A_0 = (M_1 + M_2)^{-1}M_1\) and \(A_i = (M_1 + M_2)^{-1}M_iF^*\), \(i = 1, 2, 3\).

According to equation 6 changes in current capital flows are determined partly by the difference between desired and actual capital flows in the previous period and partly by changes in the factors determining the desired level of capital flows. Again, changes in push and pull factors can be decomposed into permanent and transitory components, with only the permanent ones affecting the long-run level of \(F\). Transitory movements, which are reversed over time, will generate transitory movements in \(F\), which are also reversed over time. For example, a temporary reduction in U.S. interest rates, which might be interpreted as a downward movement in \(\nu\), will, other things being equal, generate a rise in capital flows to the developing country equal to \(A_3\Delta \nu\) (which is positive because \(F^*\) is decreasing in \(\nu\) and \(\Delta \nu\) is negative). If this change persists over time, then the long-run level of \(F\) will be raised because of the permanent effect on \(F^*\) operating through equation 2. If, however, the change in \(\nu\) is ultimately reversed, then although \(\Delta F\) will be affected
for several periods, the net long-run effect on both desired and actual capital flows will be zero.

Although the simple theoretical framework developed in this section should not be taken too literally, it does suggest, together with a reading of the literature presented, that shifts in capital flows may be determined by both push and pull factors and by both permanent and transitory factors. But the issue as to which of these factors is relatively more important is difficult to determine theoretically. It therefore remains largely an empirical matter.

II. Data

The data set used here is identical to that employed by Chuhan, Claessens, and Mamingi (1993). We use monthly data on U.S. portfolio flows, defined as gross and net purchases of foreign long-term securities for a group of nine Latin American countries—Argentina, Brazil, Chile, Colombia, Ecuador, Jamaica, Mexico, Uruguay, and Venezuela—and nine Asian countries—China, India, Indonesia, the Republic of Korea, Malaysia, Pakistan, the Philippines, Taiwan (China), and Thailand. For a full statistical description of the data set employed in this study, see Chuhan, Claessens, and Mamingi (1993). The data on capital flows are taken from the International Capital Reports of the U.S. Treasury Department and, according to the computations of Chuhan, Claessens, and Mamingi (1993), cover a substantial portion of U.S. portfolio flows to developing countries. Note, however, that the U.S. share in total portfolio flows is far larger for the Latin American countries than for the Asian countries. Also, following Chuhan, Claessens, and Mamingi (1993), we use net equity flows (ef) and gross bond flows (bf) to developing countries, which cover a substantial share of their portfolio inflows. Even if we are concerned with modeling net capital flows in principle, using gross measures for bond flows is preferable in order to abstract from the effect of sterilizations and other types of reserve operations by central banks.3

There are two sets of explanatory variables: country-specific factors and global factors. For country-specific factors we use the country credit rating (cr) and the black market exchange rate premium (bm), which are available for both groups of countries considered.4 The credit rating variable is constructed on the

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3. These data are collected by the U.S. treasury from financial intermediaries in the United States through the International Capital Form S reports. Hence, the data do not include direct dealings of U.S. investors with foreign intermediaries, because these transactions bypass the system. Note also that the data on bonds cover transactions of foreign securities in the United States from and to developing countries; transactions in bonds not issued by the developing country concerned nor by U.S. parties are expected to be insignificant (see Chuhan, Claessens, and Mamingi 1993: 6–7).

4. Another possible country-specific variable is secondary-market debt prices, which are a continuous random variable likely to be an integrated process of order one. Chuhan, Claessens, and Mamingi (1993: 10–11) use secondary-market prices only for the countries for which Salomon Brothers provide data. Because secondary-market prices are not available for all the countries considered in this article, we do not use them.
basis of the Institutional Investor’s semiannual country credit rating, while the black market exchange rate premiums are calculated from data taken from the International Monetary Fund’s World Currency Yearbook and the official exchange rates of the International Monetary Fund’s International Financial Statistics (IFS).

Finally, we also take from the IFS data base a short-term and a long-term U.S. nominal interest rate—the treasury bill rate (i) and the government bond yield (r)—and the level of real U.S. industrial production (y), which we consider to be global factors that potentially determine U.S. capital flows to developing countries.

The sample period examined runs from January 1988 to September 1992, corresponding exactly to that considered by Chuhan, Claessens, and Mamingi (1993). An immediate avenue for research is to extend this sample period. Some of the global factors considered here, as well as in Chuhan, Claessens, and Mamingi (1993), have changed over the past five years. In particular, U.S. interest rates have started to rise after a prolonged period of decline, and the U.S. economy is recovering after the slowdown in the early 1990s. Although these changes may have caused structural breaks, generating additional estimation difficulties, it would be interesting to investigate whether and how they have affected portfolio flows to developing countries.

III. Estimation Techniques

In this section we describe the estimation methods used in the analysis. We provide, first, a formal treatment of these methods and, then, a briefer, more intuitive discussion. A summary is given at the end.

A Formal Statement

Consider a panel of \( N \) countries, indexed by \( i (i = 1, \ldots, N) \), with portfolio flows at time \( t \) denoted \( f_{it} \), assumed to be an integrated process of order one, \( I(1) \). Also, define a vector of country-specific factors as \( x_{it} \) and a vector of global factors as \( w_{it} \) and assume that both vectors contain at least one \( I(1) \) variable and no higher-order integrated process. We can analyze the long-run behavior of portfolio flows by investigating cointegrating relationships of the kind:

\[
\begin{align*}
    f_{it} &= \beta'x_{it} + \gamma'w_{it} + \varepsilon_{it}, \quad i = 1, \ldots, N
\end{align*}
\]

where \( f_{it} \) may be either equity flows, say \( ef_{it} \), or bond flows, say \( bf_{it} \).

If cointegration is established in equation 7, that is, the error term \( \varepsilon_{it} \) is approximately stationary, then the \( I(1) \) variables in \( x_{it} \) and \( w_{it} \) may be thought of as

5 Chuhan, Claessens, and Mamingi (1993: 13-15) provide a detailed description of the data employed here and also include illustrative graphs of all the data series. In addition, they present a panel correlations table, finding that most correlations are of the expected sign: negative between U.S. interest rates and flows, negative between black market exchange rate premiums and flows, negative between U.S. industrial production and flows, and positive between credit ratings and flows. These preliminary results are encouraging in that they support the underlying rationale of empirical models employed here.
capturing the long-run or permanent components in $f_t$, while $e_t$ captures the short-run or temporary movements. Given that the dependent variable is $I(1)$, there must be at least one $I(1)$ variable among the explanatory variables; if all of the explanatory variables are $I(0)$, then equation 7 will be misspecified (Pagan and Wickens 1989: 1002; Banerjee and others 1993; and Baffes 1997). In fact, after we execute preliminary unit root tests on the series in question in order to identify their order of integration, we immediately test to see if the residuals of the cointegrating regressions described by equation 7 are nonstationary using the two-step procedure of Engle and Granger (1987).

In order to ensure that equation 7 is a cointegrating relationship, we also employ the relatively more powerful technique described by Johansen (1988) in a vector autoregression (VAR) context (see Kremers, Ericsson, and Dolado 1992). The Johansen estimation method is based on an error-correction representation of the $p$th order vector autoregression model $[\text{VAR}(p)]$ with Gaussian errors of the form:

$$
\Delta q_{it} = \phi_i + \Gamma_{ii}\Delta q_{it-1} + \Gamma_{i2}\Delta q_{it-2} + \ldots + \Gamma_{ip-1}\Delta q_{it-p} + \Pi q_{it-p} + B_i z_{it} + u_{it}
$$

where $q_{it}$ is an $m \times 1$ vector of $I(1)$ variables, $\phi_i$ is an $m \times 1$ vector of constants, $z_{it}$ is an $s \times 1$ vector of $I(0)$ variables, the $\Gamma_{ij}$s and $\Pi$ are $m \times m$ matrices of parameters, $B_i$ is an $m \times s$ matrix equation, and $u_{it}$ is normally distributed with mean zero. The Johansen maximum likelihood procedure is based on the estimation of equation 8 subject to the hypothesis that the matrix $\Pi$ has reduced rank $r < m$, which may be written formally as $H(r): \Pi = \alpha \delta'$, where $\alpha$ and $\delta$ are $m \times r$ matrices. $\delta' q_{it-1}$ represents the cointegrating vectors. In the Johansen cointegration framework we can also test the hypothesis that the estimated coefficients on the country-specific or global factors are zero. These tests may in fact shed light on the relative importance of the two sets of factors, indicating whether push or pull factors are the major determinants of longer-run capital flows.

Because $e_{it}$ may alternatively be interpreted as the deviation from long-run equilibrium ($e_{it} = f_{it} - \beta' x_{it} - \gamma' w_{it}$), it may be used in an analysis of the short-run dynamics of capital flows through estimation of the error-correction model:

$$
\Delta f_{i,t} = \psi_i - \rho_i (f - \beta' x - \gamma' w)_{i,t-1} + \theta_i \Delta f_{i,t-1} + \sum_{j=0}^{p} \lambda_{ij} \Delta x_{i,t-j} + \sum_{j=0}^{p} \delta_{ij} \Delta w_{i,t-j} + \omega_{i,t}, i = 1, \ldots, N
$$

where $i$ is a country index, $\psi_i$ is a constant term, $j = 0, \ldots, p$ denotes the number of lags, and $w_{i,t}$ is approximately white noise. Equation 9 is a panel data generalization of the error-correction representation of cointegrated variables established by Engle and Granger (1987) and follows directly from the Granger representation theorem (Granger 1987 and Engle and Granger 1987). The equation may be interpreted as a statistical approximation to the theoretical error-correction form in equation 6, on the assumption that desired capital flows $F^*$
are achieved in the long run and are well approximated by the cointegrating vector.

The adoption of a seemingly unrelated error-correction system, employed in other dynamic modeling contexts in international finance, allows us to compare the dynamics and long-run determination of bond and equity flows, and differentiates the present study from earlier studies on how portfolio flows are determined. Equation 9 provides the full dynamic interaction of the determinants of capital flows. In particular, the analysis of the parameters $p_i$ may shed some light on the degree of persistence in the flow series considered (Claessens, Dooley, and Warner 1995; Dooley, Fernández-Arias, and Kletzer 1996; and Sarno and Taylor 1997), conditional on the dynamics of the underlying fundamental determinants.

**An Intuitive Interpretation**

If over the sample period we find that capital flows do not tend to settle at any particular level—that is, they are nonstationary—then at least some of their determinants must also be nonstationary. Thus if we believe that flows to country $i$, $f_{it}$, are affected by a vector of pull factors $x_{it}$ and a vector of push factors $w_{it}$, then we would expect to find a relationship of the form written in equation 7. Thus rapid changes in flows are determined by rapid changes in some of the push or some of the pull factors, or both. It is possible, however, that some of the push and pull factors are relatively stable over the sample period but still enter into equation 7.

Given that $e_{it}$ is expected to be highly stable over time, equation 7 can be interpreted as a long-run relationship because, on average, we would expect to find $f_{it} = \beta'x_{it} + \gamma'w_{it}$. In the econometric literature the relationship in equation 7 is termed a cointegrating relationship, and there are well-developed econometric techniques for testing for such relationships, estimating the parameters, and determining if some of the parameters are zero. These methods allow us to determine which of the long-run determinants of capital flows are important.

If we assume that actual and desired capital flows coincide in the long run, then we can think of the cointegrating relationship as determining the desired level of capital flows: $f_{it}^* = \beta'x_{it} + \gamma'w_{it}$. Under this interpretation equation 7 is the empirical analog of the theoretical equation 2. Hence the error term $e_{it}$ can be thought of as the difference between desired and actual flows, $e_{it} = f_{it} - f_{it}^*$. This suggests that, having estimated the long-run parameters $\beta$ and $\gamma$, we can then estimate an error-correction equation that is the empirical counterpart of the theoretical error-correction model (equation 6), in which changes in flows are a function of changes in the variables determining the desired level of flows—that is, changes in $x_{it}$ and $w_{it}$—as well as of the error-correction term itself, $e_{it}$. In fact, econometric theory shows that if a cointegrating relationship exists, then such an error-correction model must also exist. Estimating the dynamic error-correction form then allows us to determine which factors are important in determining short-run movements in capital flows.
We estimate these dynamic error-correction models jointly for our sample Asian and Latin American countries because the exogenous disturbance terms in these equations are likely to covary across countries. Also, exploiting the panel nature of the data by accounting for this covariation in our estimation method allows us to obtain more efficient—broadly speaking, more precise—estimates of the parameters because we are using more information than is used in single-equation estimation. Systems of equations of this kind are termed seemingly unrelated regressions.

Note also that, in principle, country-specific factors could be influenced by global factors. For example, global interest rates may affect the pattern of secondary-market debt prices and credit ratings (see, for example, Dooley, Fernández-Arias, and Kletzer 1996 and Fernández-Arias 1996). To the extent that country-specific factors affect portfolio flows only insofar as they are collinear with global factors, country-specific factors would appear to be insignificant when both sets of explanatory variables are included.

IV. Long-Run Fundamental Determinants of Portfolio Flows

As a preliminary step to testing for cointegration in equation 7, we execute augmented Dickey-Fuller (ADF) unit root test statistics on the series used. The results (available from the authors on request) show that all of the series appear to be realizations from integrated processes of order one. The null hypothesis of nonstationarity is never rejected for both portfolio flows (equities and bonds) and global factors, while it is rejected once—Chile—for the credit rating and 5 times out of 18—Argentina, Malaysia, the Philippines, Taiwan (China), and Uruguay—for the black market exchange rate premium. In general, the ADF test statistics are relatively close to the rejection region for credit ratings and black market premiums, perhaps indicating, as one would expect, less evidence of nonstationarity in these series. In fact, credit ratings are discrete random variables that cannot assume a very large number of outcomes. Also, black market premiums tend to widen before crises but may become very thin over time as a result, for example, of international capital market integration. Overall, however, the unit root tests suggest that a permanent component is statistically significant in credit ratings and generally statistically significant in black market premiums at the 5 percent nominal significance level. Thus these variables can potentially contribute to the long-run determination of portfolio flows.

Given the finding that the series considered appear to be realizations of I(1) processes, we are justified in testing for cointegration in equation 7. We test for nonstationarity of the residuals in equation 7, considering first equity flows and then bond flows as dependent variables (table 1). In all but 6 of the 36 regressions examined we were able to reject the null hypothesis of no cointegration at the 5 percent nominal level of significance, suggesting that a combination of domestic and global factors share a common trend with equity and bond flows. In order to gauge which of the two sets of variables, \( x_u \) and \( w^\prime \), are more important in determining
Table 1. Results of Tests for Nonstationarity of the Residuals of the Cointegration Equation for 18 Countries, 1988–92

<table>
<thead>
<tr>
<th>Dependent variable and country</th>
<th>Augmented Dickey-Fuller test statistics</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>ADF1</td>
</tr>
<tr>
<td><strong>Asian equity flows</strong></td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>-8.4265</td>
</tr>
<tr>
<td>( -5.0141)</td>
<td>(-3.8963)</td>
</tr>
<tr>
<td>India</td>
<td>-6.2328</td>
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<tr>
<td>( -5.0257)</td>
<td>(-3.9053)</td>
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<td>Indonesia</td>
<td>-7.1897</td>
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</table>

Note: ADF1, ADF2, and ADF3 are augmented Dickey-Fuller test statistics computed on the residuals from the regression (equation 7) of equity/bond flows on both country-specific and global factors, only country-specific factors, and only global factors, respectively. Critical values are reported in parentheses. The number of lags included is such that the error term is approximately white noise.

a. The null hypothesis of no cointegration cannot be rejected at standard nominal levels of significance.

Source: Authors' calculations.

long-run movements of capital flows, we employ the ADF test statistic on a regression including only country-specific factors, and then only global factors. In fact, a test of the null hypothesis \( H_0: \beta = 0 \) or \( H_0: \gamma = 0 \) cannot be executed in such a framework because of the strong bias of the estimated standard errors. The results show that cointegration is often established in both regressions (table 1). Nevertheless, in three of the six cases for which the ADF fails to reject the null hypothesis, the results suggest that if we cannot reject the null of no cointegration in a regression of capital flows on \( x_a(u_j,t) \), we cannot reject no cointegration in a regression of capital flows on \( w_a(x_{a,t}) \), perhaps supporting the view that it is appropriate to consider both \( x_a \) and \( w_a \) as explanatory variables.

It must be noted, however, that results are subject to the problem of small-sample bias in cointegrating relationships originally highlighted by Banerjee and
others (1986) and by Stock (1987). Therefore, in order to strengthen the finding of cointegration in equation 7, we employ a relatively more powerful cointegration technique, the Johansen (1988) procedure, in a VAR system including capital flows and country-specific as well as global factors (Kremers, Ericsson, and Dolado 1992). The results of the Johansen procedure are available from the authors on request. In this framework we can also check, using likelihood ratio tests, for zero restrictions on the coefficients of the push or pull factors. The results enable us, based on both of the test statistics suggested by Johansen, to establish cointegration in all 36 systems analyzed at conventional nominal levels of significance. Thus the failure of the Engle and Granger procedure to detect cointegration in several cases may simply be a result of the low power of the test. In particular, the evidence of cointegration is impressive because it is based on the estimation of individual regressions with a relatively small number of observations. This obviates the need to employ more powerful panel cointegration tests (Quah 1994 and Im, Pesaran, and Shin 1995).

The Johansen procedure also suggests that there are multiple cointegrating vectors among the variables examined, as may be the case whenever cointegration is investigated among more than two variables. Further, the zero restrictions on the coefficients of country-specific or global factors are always strongly rejected, pointing to the long-run importance of both push and pull factors. This result also suggests that pull factors are important determinants of capital flows in their own right, not only because they may be correlated with push factors.

V. A Dynamic Analysis of Portfolio Flows

The existence of at least one cointegrating relationship between a set of variables implies that an error-correction model exists, because, as established by the Granger representation theorem, for any set of I(1) variables error-correction and cointegration are equivalent representations. Therefore, the residuals from the equilibrium regressions (equation 7) can be used to estimate, by generalized least squares, the error-correction models (equation 9) as seemingly unrelated regressions. The speed-of-adjustment coefficients \( \rho_i \) have important implications for the dynamics of the model. In fact, for any given value of the deviations from long-run equilibrium \( \{ f_{it} - \beta' x_{it} - \gamma' w_{it} \} \), a large value of \( \rho_i \) is associated with a large value of the change in capital flows, \( \Delta f_{it} \). If \( \rho_i \) is zero, the change in capital flows does not respond at all to the deviation from long-run equilibrium in period \( t - 1 \). If \( \rho_i \) is zero and all \( \lambda_j = 0 \) (\( \delta_{ij} = 0 \)), then \( \Delta x_{it} (\Delta w_{it}) \) does not Granger-cause \( \Delta f_{it} \). We know, however, that one or both of these coefficients should be significantly different from zero because the variables are found to be cointegrated (Engle and Granger 1987).

We examine the panel data generalization of the error-correction representation of cointegrated variables (equation 9) using the cointegrating residuals retrieved from the cointegrating regressions (equation 7). Note that the estimation of seemingly unrelated error-correction mechanisms exploits the nature of the
panel data and is an efficient technique for analyzing the effect of a common set of global factors across a group of countries in a dynamic framework. In fact, the disturbances in the individual regressions are expected to be very highly correlated because they include some factors that are common to all of the countries (Dwivedi and Srivastava 1978).

We adopt the conventional general-to-specific procedure to estimate a parsimonious error-correction model, as suggested by Davidson and others (1978) and Hendry (1983). The resulting models appeared to be quite adequate in terms of high coefficients of determination and residuals that are approximately white noise (table 2). Although space considerations preclude us from reporting each of the estimated equations in detail, the equation estimated for bond flows to Colombia is reasonably representative:

\[
\Delta bf_t = -0.976e_{t-1} + 0.197\Delta cr_t + 0.555\Delta cr_{t-1} -1.811\Delta i_{t-1} \\
(0.097) (0.083) (0.083) (0.687)
\]

\[R^2 = 0.79, Q(24) = 15.138 [0.917]\]

where \(R^2\) denotes the coefficient of determination and \(Q(24)\) denotes the Ljung-Box statistic for residual autocorrelation computed for 24 autocorrelations. The figures in parentheses are estimated standard errors, and the figure in square brackets is the marginal significance level (a constant term was also included). The variable \(bf\) denotes the bond flow, \(cr\) the country credit rating, \(i\) the U.S. short-term interest rate, and \(e\) the cointegrating residual or error-correction variable. The equation shows a strongly significant and relatively large error-correction coefficient—indicating rapid adjustment—and demonstrates the importance of both push and pull factors. The full set of results with the point estimates is available from the authors.

The underlying dynamics of the error-correction models for Asian capital flows are, especially for equities, slightly more complicated than those for Latin American capital flows, in the sense that more variables are found to be statistically significant on the right-hand side of the error-correction models. Global and country-specific factors seem to have roughly the same statistical significance in determining the change in equity flows for both Asian and Latin American countries. The change in bond flows, however, appears to be relatively more strongly determined by global factors than by domestic factors, while equity flows are relatively more responsive to changes in country-specific factors.

Even if significant lags in country-specific factors are included in the error-correction model, overall bond flows appear to react predominantly to changes in global factors. From table 2 we can see that a change in U.S. interest rates explains the dynamics of bond flows better than the other global factor considered in this study, the growth of U.S. industrial production. It must be pointed out, however, that the two interest rate series considered are not expected to have the same cyclical properties. The finding that the dynamics of bond flows,
Table 2. Number of Significant Push and Pull Factors in the Error-Correction Models for Asia and Latin America, 1988–92

<table>
<thead>
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<th>Region and capital flow type</th>
<th>Credit rating</th>
<th>Black market premium</th>
<th>U.S. interest rates</th>
<th>U.S. real industrial production</th>
<th>Total</th>
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<tr>
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<td>15</td>
<td>9</td>
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<tr>
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<td>8</td>
<td>40</td>
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<tr>
<td>Total</td>
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<td>31</td>
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<td>89</td>
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<tr>
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<tr>
<td>Total</td>
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<td>13</td>
<td>35</td>
<td>12</td>
<td>77</td>
</tr>
</tbody>
</table>

Source: Authors’ calculations.

relative to those of equity flows, are determined more by global factors than by country-specific factors contrasts with the finding of Chuhan, Claessens, and Mamingi (1993), who conclude that equity flows are more sensitive than bond flows to global factors, while bond flows are more sensitive to country-specific factors. However, they are primarily interested in identifying the long-term determinants of the large capital flows to developing countries rather than in fully modeling the dynamics of capital flows. Hence their conclusions are drawn for illustrative purposes, using a simpler approach based on the computation of standardized coefficients and elasticities.

The relative importance of the global factors suggested by our results is consistent with those of Calvo, Leiderman, and Reinhart (1993 and 1996), who first suggested the importance of U.S. interest rates and of the slowdown in U.S. industrial production over 1988–92 in explaining portfolio flows to emerging markets. They also argued that a reversal of the global conditions could induce a fast outflow of capital from developing countries. Our results go further in pointing out that interest rates are likely to be the most important determinant of the dynamics of portfolio flows (especially bonds) to Asian and Latin American countries.

Finally, note that interest rates are a more important short-term determinant of portfolio flows in Latin American countries than in Asian countries: interest rates are statistically significant 31 times (34 percent of the total number of significant terms) in the Asian error-correction models, while they are significant 35 times (45 percent of the total number of significant terms) in the Latin American error-correction models. Put another way, Latin American inflows are as sensitive as Asian inflows to interest rates, but they are less sensitive to all the other factors.

VI. Conclusions

In this article we examined the determinants of U.S. capital flows directed to nine Latin American and nine Asian countries over 1988–92, extending previ-
ous work by Chuhan, Claessens, and Mamingi (1993). In particular, we investigated whether bond and equity inflows were induced by push or pull factors, differentiating between short- and long-run determinants.

We considered in our set of country-specific factors the domestic credit rating and the black market exchange rate premium as well as a set of global factors including two U.S. interest rates and the level of U.S. real industrial production (Calvo, Leiderman, and Reinhart 1993 and 1996). We examined the long-run determinants of portfolio flows by employing two complementary cointegration techniques. The results provide unequivocal evidence that long-run equity and bond flows are about equally sensitive to global and country-specific factors and, therefore, that both sets of variables help to explain U.S. portfolio flows to the developing countries considered.

Moreover, we also estimated seemingly unrelated error-correction models for equity and bond flows in order to shed light on the underlying short-run dynamics of U.S. portfolio flows. The models for portfolio flows to Asian developing countries, especially for equity flows, are more complicated in terms of their short-run dynamics than the error-correction models for portfolio flows to Latin American countries.

A count of the number of significant push and pull factors appearing in the error-correction forms, classified by type of flow and geographic area, revealed that both seem to be equally important in determining short-run equity flows for Asian and Latin American countries. When bond flows are considered, however, global factors seem to be much more important than domestic factors in explaining the short-run dynamics of flows. In particular, changes in U.S. interest rates are found to be the single most important determinant of short-run movements in bond flows to developing countries.

REFERENCES

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