Relationship between Different Types of Private Capital Flows to Developing Countries*

1. Introduction:

External finance for developing countries can come from one of the following four sources: i) official loans and grants, ii) private debt including commercial bank loans, bonds issued by developing countries' entities/institutions in developed countries, and export credits, iii) foreign direct investment (FDI), and iv) foreign portfolio equity investment (PI).[1] Traditionally, official loans and grants had been dominant. However, there have been significant changes in the composition of external finance to developing countries in recent years.

First, FDI flows to developing countries have increased at double digit average annual compound rates since 1986; by 1993 FDI became the largest single source of external finance for developing countries. (See World Bank, 1993) Second, foreign portfolio equity investment and bonds issued by developing countries in industrial countries increased sharply during 1990's: by a factor of three and one half times. At the same time, official flows fell to about a quarter of their earlier level. These developments resulted in private flows being 94.3% of all external finance flows to developing countries during the three year period 1999-2001.[2] These relative

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[1]FDI includes both related-party equity investments and related-party borrowings.

[2]The corresponding proportion during 1989-1991 was 47.5%.

magnitudes are unaltered qualitatively for the the current decade. (See World Bank's *Global Development Finance*, various issues).

However, despite their overwhelming importance, not enough attention has been paid to studying the possibly different effects of these types of private capital flows; or to analyze interrelationships between them. Like portfolio investment, FDI is also a financial transaction in the first instance.[3] Still, the control element inherent in FDI ensures that the FDI-investor also takes some real decisions. Since portfolio (equities and bonds) and other inflows (e.g., commercial bank loans and "Eurodollar" deposits) are pure financial investments, there is no presumption of any real investment accompanying them automatically.

The following features and effects of different types of private capital flows have been compared and contrasted: their volatilities and effects on efficiency, growth, and real exchange rate appreciation. Neumann (2003), using an asymmetric information model where foreign lenders have less information about developing countries than foreign equity investors, shows that equity trade is preferable on efficiency grounds to foreign borrowing. Razin and Sadka (2003) study the relative efficiency of two kinds (direct and portfolio) of foreign equity investors. They use an international macroeconomic model where foreign direct investors have a hands-on management ability to react in real time to changing economic environment; and show that direct investors will be more efficient in industries in which they specialize in the source country.

[3]The term portfolio investment as used in this paper includes both portfolio equity and portfolio bond investment. On the other hand, commercial bank loans are assumed to be non-securitized, and are not part of what is termed as portfolio investment.

Frankel and Rose (1996) have an agnostic prior about the differential effects of FDI. FDI funds may be fungible so that an observed FDI surplus in BOP accounts is no guarantee of higher investment. Razin, Sadka, and Yuen (1999) model differing degrees of domestic credit market development. They show that the inter-temporal gains from FDI depend on whether the domestic credit market is underdeveloped or well-functioning. In the former, the gains are substantial; in the latter FDI is a loss-generating phenomenon. Soto (2003) estimates a model using annual observations by GMM to analyze the links between GDP growth and different types of capital inflows. He finds bank flows as the sole source of foreign financing that displays a positive and robust correlation with growth.

Regarding the relative volatility of FDI and other inflows, most models/theorizing have concluded that FDI is more stable.[4] Aghion, Bacchetta, and Banerjee (2004), using a dynamic open economy model where firms face tighter credit constraint at lower level of financial development, and Albuquerque (2003) employing an international capital flows model with imperfect enforcement of financial contracts and inalienablity of FDI, conclude that non-FDI flows are more volatile and destabilizing. Similarly, Sarno and Taylor (1999) suggest that deregulation, decreasing transaction costs, and lack of depth of their markets make portfolio flows to emerging markets sensitive to short-term return differentials and cyclical conditions in industrial countries.

[4]The only exception to this assertion seems to be Frankel and Rose (1996) who hypothesize that multinational firms (MNFs) may be able to move funds in and out of a country through transfers between subsidiaries and parent firms with greater ease than can be done outside the corporate walls.

The empirical evidence on the relative volatility of different kinds of inflows also generally finds that FDI is more stable.[5] Tudela (2004) uses a duration model for OECD countries for the 1970-97 period. He finds that increased portfolio flows increases the probability of crises. Eichengreen (2000) suggests liberalizing FDI first, then stock and bond markets, and finally offshore bank-funding. Sarno and Taylor (1999) use monthly data on equity, bond, and official flows and quarterly data on bank credit and FDI flows from 1988 to 1997 from the US to the East Asian countries (and Japan and Australia). They find that portfolio (equity and bond) flows were most volatile while FDI was the least volatile capital account item.[6]

Non-sterilized capital inflows of any kind (by boosting overall absorption and increasing the relative price of non-tradables) cause real exchange rate appreciation. Balance of payments (BOP) statistics record exchange of value between residents and non-residents rather than exchange of payment. Thus, reinvestment of earnings by, say, MNF-subsidiaries is considered a capital inflow in the BOP statistics. One way to classify capital inflows may be whether they constitute reinvested earnings or not. Either kind increases domestic absorption. But, an increase in output precedes the increase in absorption for the former (since these earnings are a part of net value-added of such subsidiaries) while there is no such claim to a prior increase in capital-importing country's output from a new capital inflow. The former can hence be expected

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[5]The only exception to this assertion seems to be Claessens, Dooley and Warner (1995) who, using quarterly data from 1976I to 1992I for five developing and five industrial countries, suggest that what a flow is labeled, whether FDI or portfolio or short term or long term, has no bearing on its time series properties.

[6]However, permanent component of portfolio flow to Japan and Australia was larger.

to cause a smaller increase in the relative price of non-tradables/real exchange rate than the latter. If reinvested earnings are a more important part of what is reported as FDI as compared to that is reported for portfolio investment, then real exchange rate appreciation attendant with an FDI inflow will also be smaller.[7]

Sachs, Tornell, and Velasco (1996) report that their most striking finding was that in the large sample of emerging markets considered, there was a lack of correlation between the size of capital inflows and real exchange rate behavior. Countries with the largest capital inflows (Colombia, Indonesia, Malaysia, and Thailand) had the least appreciation. One explanation of this anomaly could be that in these countries reinvestment of earnings by MNFs was a larger part of BOP-reported total capital inflows. Kant (1996) analyzes the relationship of one type of inflow, FDI, to a subset of outflows, capital flight, from developing countries. He concludes that FDI inflows are always associated with a reduction in capital flight and the latter is primarily caused by general economic mismanagement rather than by favorable treatment of the former.

The above literature review reveals little work on the interrelationships of different components of private flows to developing countries; e.g., whether, and how FDI and portfolio flows to developing countries are themselves related. Any or all of the possible different effects can exist without dilution only if these flows are not substitutes for each other. Since households

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[7]Feldstein (1994) reports that only about 20% of the value of assets owned by U.S. affiliates abroad is financed by cross-border flows of capital from the U.S. while an additional 18% represents retained earnings attributable to U.S. investors. Similar data for portfolio investment are not available because of the large number of such investors, difficulty of tracking their rebalancing of portfolios across countries and companies, and the relatively shorter period of such investment.

do not undertake FDI investments, one cannot build up a theoretical model based on such substitutability at the individual level. Nevertheless, one can examine whether this substitutability exists as an empirical regularity at the macro level. Using such an approach Ruffin and Rassekh (1986) find that FDI and portfolio outflows from the U. S. are perfect substitutes. If so, capital is fully fungible, and one type of capital is indistinguishable from the other. Further, volatility of one component, say, portfolio, need not be a cause for concern since the other flow will be offsetting its volatility.[8]

Ruffin and Rassekh's explain their result by two factors: a) Non-firm-specific MNF capital, and b) Full integration of capital markets in the U. S. and foreign countries. Then, a dollar of FDI investment temporarily disturbs home and foreign capital markets raising interest rates at home and lowering them abroad. To restore equilibrium portfolio investment abroad falls by exactly one dollar.

A somewhat different conclusion is reached by Feldstein (1994). He finds that for major industrial countries of OECD, each dollar of cross-border flow of FDI reduces domestic investment by approximately one dollar. A dollar of FDI investment abroad again raises home interest rates. But, now while FDI (which in this framework presumably consists of specific capital) can cross borders, portfolio flows - in accordance with the famous Feldstein-Horioka (1980) result - are largely segmented into national capital markets. In his view, portfolio and direct investment abroad are not related at all - so that there is no decrease in portfolio investment abroad by one dollar to restore domestic capital market equilibrium: the latter is

[8]Claessens, Dooley, and Warner (1995) also make this point. They find that simple correlation matrix between the various categories of flows show some degree of substitution between most flows for almost all countries.

achieved solely by one dollar fall in domestic investment.

This paper examines the perfect substitutability results for developing countries. Neither of the Ruffin and Rassekh assumptions is likely to hold in practice. Ethier (1986) concludes that firm-specific (or internal) transactions is the singular characteristic distinguishing multinational's transactions from the (usual) inter-firm transactions. Hence, FDI and MNF capital is likely to be firm or industry specific. Second, the Feldstein-Horioka (1980) and Feldstein (1994) result of segmented portfolio capital markets is even more likely to be valid for developing countries due to poor credit ratings, high and variable inflation, lack of high-quality regulatory and accounting framework, dearth of sufficient country funds, and the limited size of some stock markets.

The main task of this study is to empirically examine this result with help of a portfolio-balance model. The specific model employed is the same as that used in Kant (2005). Its differences from Ruffin and Rassekh (1986) will be noted below. The model and hypotheses are described next.

2. Model and Hypotheses:

A portfolio balance model is used for the following reasons. According to the internalization hypothesis, MNFs come into being to internalize returns to their ownership-specific assets (Hood and Young, 1979). For example, specific inputs like R & D, advertising, marketing, distribution, management, finance, trade secret, patent and organization could be ownership-specific. In fact, it is the ownership of these inputs that enables the MNF to produce and compete effectively in distant countries with different industrial relations, legal system, culture, and 1anguage. Thus, a large number of micro and industrial organization type of factors that are generally un-measurable explain establishment of an MNF.

If FDI is a function of many unobserved microeconomic variables, which are uncorrelated contemporaneously with the relevant macroeconomic variables, aggregate FDI can be taken as a regressor in a time-series analysis of the portfolio balance model.[9] Thus, if we include FDI as an explanatory variable in an equation that otherwise is for portfolio investment, we can test the relationship, if any, between FDI and portfolio investment.

Model:

We start with the assumption that home and foreign investments are imperfect substitutes. Let r represent the real rate of return to domestic investment, then:

$$r = (i - \pi^e)/(1 + \pi^e), \quad (1)$$

where i is the nominal interest rate and π^e is the expected inflation rate in the home country. Similarly, let r* denote the real rate of return domestic residents earn by covered investment in foreign country. Taking the real interest version of the parity condition permits us to incorporate overshooting effects. Covered investments necessitate the use of forward exchange rate to calculate the return domestic investors earn in the foreign country since the forward rate takes into account the differential risk/variability of return of investing in the foreign country. Thus, r* is

$$r^* = [(1 + i^*)F/(1 + \pi^e)S] - 1, \quad (2)$$

where i* is the appropriate foreign nominal interest rate, and F and S are forward and spot

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[9]As noted below, we only need the right hand side variables to be predetermined in the sense that they be orthogonal to the current error term. We do not need the regressors to be strictly exogenous, i.e. be orthogonal to the past, current, and future error terms. See Hayashi (2000). We will also show below that the Durbin-Wu-Hausman (DWH) test does not show FDI to be endogenous (in the sense of causing estimation to be inconsistent).

exchange rates on the date of investment defined as U.S. dollars per foreign currency. The forward rate is for delivery of the foreign currency on the maturity date of foreign investment.

Let Z denote the real quantity of private assets held by U.S. private agents in developing countries; similarly, Z* is the real quantity of private assets owned by developing countries' residents in the U.S. and W the quantity of U.S. real financial wealth. The version of the portfolio balance model used here is

$$Z = F(r, r^*, W, Z^*). \qquad (3)$$

The variable r* in equation (3) is a vector and Z* is added as an explanatory variable to capture any link between capital imports and capital exports to and from the U.S.

Money market equilibrium is incorporated in the model as follows. Under the standard theory, the demand for real money balances, L, depends on real income, y, and the nominal interest rate, i. Further, from (1),

$$i = \pi^e + r + \pi^e r. \qquad (1')$$

Thus, money market equilibrium holds in the home country when

$$m = L(i, y) = L(\pi^e+r+\pi^e r, y) \qquad (4)$$

where m is the exogenously given real money supply. Combining (1), (3) and (4), we get

$$Z = \Xi(\pi^e, r^*, m, y, W, Z^*). \qquad (5)$$

Equation (5) is not estimable. To obtain an estimable equation, linearize (5) by taking its total differential, that is,

$$dZ = \Xi_{\pi e} d\pi^e + \Xi_{r^*} dr^* + \Xi_m dm + \Xi_y dy + \Xi_w dW + \Xi_{Z^*} dZ^*, \qquad (6)$$

where the symbols Ξ with various subscripts represent the partial derivatives with respect to the variable in the subscript, while the d_ expressions are the first differences of the respective variables. Further, taking first differences also makes the non-stationary variables stationary.[10]

Specific Hypotheses:

The final regression equation that will be estimated can now be stated. Separate dZ into its two components: $dZ^p + dZ^d$, where Z^p and Z^d are portfolio and direct investment (respectively) from the U. S. in developing countries; and keep only dZ^p on the left hand side. Then, the final form of (6) can be stated as

$$dZ^p = a_0 + a_1 d\pi^e + a_2 dr^* + a_3 dm + a_4 dy + a_5 dW + a_6 dZ^d + a_7 dZ^* + a_8 dG^e + a_9 dI + u. \quad (7)$$

A constant term is added to capture the effects of omitting variables with a time trend; u is the Gaussian white noise term. The expected real price of gold, G^e, is added as a variable to serve as a proxy for speculation. The last variable, index of globalization, I, is added because both direct and portfolio flows may have been influenced by increasing globalization of the world economy during the estimation period.

The coefficient of special interest is a_6. If it is negative, portfolio flows substitute for FDI flows. Further, greater its absolute magnitude, greater is the extent of substitutability.   On the other hand, if a_6 is positive, the two flows are complementary, with the magnitude giving us strength of the now positive relationship. The expected effects of the other variables are as follows: An increase in U.S. real GDP and/or in the real expected price of gold will decrease U.S. portfolio investment abroad. On the other hand, the effect of each of the other right hand side variables on Z^p can be expected to be positive.

[10]Strictly speaking, d_ expressions should refer to differentials of the respective variables. However, in the estimation, first differences are taken to approximate the differentials.

3. Data and Estimation:

The model was estimated using quarterly data from 1979:I to 1998:III.[11] Data on changes in the U.S. international investment position on a quarterly basis by geographical areas as published in the December issue of the *Survey of Current Business* (published by the U.S. Department of Commerce's Bureau of Economic Analysis) were used.

The *Survey of Current Business* presents data on U.S. investments abroad (and foreign investment in U.S.) by area for the following components of capital flows: a) FDI outflows (and inflows), i.e. changes in claims on (and liabilities to) affiliated non-residents; b) purchase from (and sale to) non-residents of domestic and foreign securities, i.e. portfolio investment; c) changes in claims on (and liabilities to) non-residents reported by U.S. banks/depository institutions, brokers, and dealers; and d) changes in non-banking U.S. institutions' claims on (and liabilities to) unaffiliated non-residents. The latter two are called capital flows by banks and non-banks, respectively, in this paper. Quarterly stock numbers were constructed by using end of 1991 as the benchmark stock and adjusting backward and forward by quarterly flows. Although historical data by developed country regions are also reported, relevant areas for us are developing countries regions of Eastern Europe, Latin America, Asia (other than Japan, Australia, and New Zealand), Africa, and Others. Stock data for these areas are added to yield the developing countries total.

One issue concerns countries included in the vector of foreign real interest rates: we limit ourselves to a few representative developing countries. The following criteria were used to choose such countries: a) the U.S. had substantial investments in those countries, b) they did not

[11]A justification for limiting the data to 1998III is that the Asian Financial Crisis of 1998 caused a dramatic structural break with the past.

suffer hyperinflation during the estimation period, c) they were placed in the category of countries having more flexible exchange rates in Exchange Rate Arrangements pages of IMF's *International Financial Statistics* (IFS) for this period, d) and for which forward exchange rate information was available. On these criteria, Mexico, Korea, and Indonesia are chosen.[12]

The information on total private financial wealth in the U.S. is obtained from the *Balance Sheets for the U.S. Economy* published by the Board of Governors of the Federal Reserve System. End of the year data was converted to quarterly data by multiplying changes in the year-end amounts by quarterly savings ratio. Quarterly domestic savings were obtained from various issues of IFS by subtracting private and government consumption from GDP. Rest of the data, i.e., U.S. GDP, M2 and M3 money supply measures, consumer price index (CPI), spot exchange rates, foreign interest rates, and gold price are obtained from either the IFS or the Federal Reserve Web-site. Forward exchange rate information for Mexico, Korea, and Indonesia is obtained from the IMF staff. All relevant variables are measured in real terms.

One variable that is derived from other data is the index of globalization, I. Following Obstfeld (1998), the sum of absolute values of current account balances of fifteen largest

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[12]Other than tax haven countries (Bahamas, Bermuda, British West Indies, and Netherlands Antilles) U.S. had substantial investments in the following developing countries also: Argentina, Brazil, Chile, and Colombia. See various issues of U.S. Department of Treasury *Bulletin*. Of these countries, Brazil suffered from hyperinflation during this period (its CPI increased from 4 in 1980 to 100 million in 1990, and then to 5100 billion in 1997), Argentina's currency was pegged to U.S. dollar at least since 1993 (see Exchange Rate Arrangements pages of IMF's *International Financial Statistics*), and forward rates for Chile and Columbia are not available.

economies divided by the sum of their GDPs is used as the index of globalization. Countries selected based on both having among the highest GDP for the whole period, 1979-1998 and availability of consistent set of data are Australia, Brazil, Canada, France, Germany, India, Italy, Japan, Korea, Mexico, Netherlands, Spain, Sweden, U.K., and U.S.A. As far as we know, this is the first time this index has been used in a regression: it should tell us whether changes in capital account flows (relative to GDP) over the period affected portfolio flows to developing countries.

Estimates of expected inflation and expected gold price are needed directly in the equation; those of the former are also needed indirectly to calculate the r* variables. Inflation rate for each quarter for the 1979-IQ to 1998-IVQ period is computed in two ways: a) with respect to CPI for the previous quarter, and b) in relation to CPI for the same quarter of the previous year. Augmented Dicky-Fuller test for unit roots is performed on these inflation rates and on gold price. The version of the test with a constant but no trend is used. The results are presented in Table 1. The null of a unit root is rejected for annual inflation and gold price at the 5% significance level; and for quarterly inflation at the 10% significance level.[13] Both inflation and gold price are stationary; so must be expected inflation and expected gold price.

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[13]Nevertheless, quarterly inflation is used in further analysis. This is for the following reasons: a) the nominal interest rate data are on instruments of 90-days maturity. For such investors, expected inflation over the next quarter is more relevant than over the next year. b) The number of lagged terms, p, chosen by the ADF tests to ensure that there is no serial correlation is eight and three for the annual and quarterly inflation, respectively. Parsimony (and likely better forecasting performance) and to have lag-length in the model that is consistent with that chosen by the ADF test, we use quarterly inflation to estimate expected inflation.

Box-Jenkins techniques are used to estimate both the expected inflation rate and expected gold price. Different ARMA models are fitted to the inflation rate since 1979. Following Enders (1994), the model with the lowest SBC (Schwartz Bayesian criterion) and AIC (Akaike information criterion) statistics among those whose Ljung-Box-Pierce statistic (Q-statistic) was insignificant (indicating no serial correlation) at all meaningful lags is selected.[14] This model is ARMA (1, 3), and is stated below:

$$\pi_t = \alpha_0 + \alpha_1\pi_{t-1} + \varepsilon_t + \theta_1\varepsilon_{t-1} + \theta_2\varepsilon_{t-2} + \theta_3\varepsilon_{t-3}, \qquad (8)$$

where the sequence { ε_t } is a white noise process, and we follow the convention of normalizing units so that θ_0 is always equal to unity. The first three terms on the right hand side of (8) give the autoregressive process AR(1), while the right-hand side of (8) except the second term state the MA(3) process with α_0 interpreted as the mean of π_t.

The selected model, ARMA (1, 3), also had R^2 and adjusted R^2 that were among the highest (.7682 and .7558, respectively).[15] Since we a) use quarterly data and b) to compute real interest rates use nominal interest rates on instruments of 90-days maturity, the expected inflation

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[14]Between SBC and AIC, SBC will always select a more parsimonious model and has superior large sample properties. However, the selected model had both lowest SBC and AIC values.

[15]Of the twelve models fitted two, ARMA (1,4) and ARMA (2,3), had both R^2 and adjusted R^2 values quite close to those for the selected model. Nevertheless, their SBC and AIC values were higher. Both because of their higher SBC and AIC values and an additional parameter, they can be expected to have lower forecasting performance. The results from the three models are presented in Table 1. Note that all the three models are well specified and the Box-Pierce test (Q test) for serial correlation is insignificant for all three models.

rate is defined as the one-step ahead forecasted inflation rate from the fitted time-series model.[16] Similar Box-Jenkins techniques lead to the selection (on the bases of low SBC and AIC values among models with insignificant Q-statistic at all meaningful lags) of ARMA (2, 2) model to forecast the expected gold price. This model's R^2 and adjusted R^2 are .8617 and .8550, respectively (and its lag length is consistent with that given by the ADF test on gold price).

Regression Results:

As stated above, each nominal variable was deflated by CPI to get the respective real values. Augmented Dicky-Fuller test for stationarity is applied to all variables in our model. This procedure is adopted since r* variables also may have unit roots. The version of the ADF test with constant and no trend (random walk with drift) and 5% significance level is used. As expected, expected inflation and expected gold price are stationary. In addition, real rate of return in Korea does not have a unit root. The other variables are I(1), i.e., are difference-stationary. [17]

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[16]Ruffin and Rassekh (1986) use a four-step ahead forecast of inflation. Other differences are that we use country risk and covered interest parity while they assume zero risk premium and uncovered interest parity; we use expected gold price and M2 or M3 as the money supply measures (rather than current gold price and M1), and include the index of globalization. Further, we restrict the data to developing countries, perform stationarity and co-integration tests, use Durbin-Wu-Hausman test to examine whether endogenous elements in explanatory variables cause estimators to become inconsistent, and use the GMM estimation.

[17]Unit root tests were also conducted on the logged forms of all variables where taking logs was feasible. Of these variables, only gold price was found to be I(0). Non-logged versions

The extended definition of co-integration due to Flôres and Szafarz (1996) is used. Thus, all the variables could be co-integrated even though three are I(0) and the rest are I(1). Three tests of co-integration are performed. These are: a) The augmented Engle-Granger (1987) test on the co-integrating regression's residuals[18] with the critical values for the more than two variables case given by Engle and Yoo (1987); b) The Philips (1987) test on the said residuals with the critical values given by Davidson and MacKinnon (1993); and c) The VAR-based test developed by Johansen (1991, 1995). The null of unit-root in the residuals in not rejected by the EG test. However, as discussed by Davidson and MacKinnon (2005), power of this test diminishes as the number of co-integrating variables increases. The high R^2 (0.9842) and the low DW statistic (1.036) of the co-integrating equation indicate that the variables are co-integrated. This is confirmed by both the Philips and Johansen tests.[19] The co-efficient estimates from the co-integrating equation are presented in column 2 of Table 3.

Co-integration means stochastic trends of the variables are linked (i.e., the variables have a long-term or equilibrium relationship) and equation (5) or stock-equilibrium holds. Estimating equation (5)'s first difference form, i.e. equation (7), would therefore make us lose valuable information concerning the long-run equilibrium properties of the data. According to Granger

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of variables were used in the regressions, also to have all right hand side variables in one form: either all logged or all non-logged.

[18]This procedure is very similar to ADF test.

[19]The Johansen test showed the presence of 11 co-integrating vectors by both the trace test and the maximum eigenvalue test. Nevertheless, construction of a VEC model is beyond the scope of this paper as its express objective is to examine the relationship between portfolio and direct investment in developing countries.

representation theorem, for any set of I(1) variables, error correction and co-integration are equivalent representations. The dynamic paths of these variables (“error correction”) must bear some relation to the current deviation (“error”) from the equilibrium relationship. Alternatively, if the dynamic paths of variables respond to previous period’s deviations, estimating the equation only in first differences entails a specification error. To avoid this specification error, the “error correction term” must be incorporated in the estimating equation. Accordingly, the equation in first differences must be augmented by the lagged error-correcting term, called hereinafter simply as ECT. This ECT-augmented equation (7) is estimated in this paper.[20]

The four components of capital outflow from the U.S. for which data are available by area are FDI, portfolio investment, banks outflows, and non-banks outflows (e.g., trade credits). Our assumption is that FDI is orthogonal to the error term. FDI from the U.S. and total investments by developing countries in the U.S. were always kept on the right hand side. The left-hand side variable was changed from the most aggregative of other outflows to the least aggregate. This is explained below.

With FDI always on the right-hand side, the other outflows from the U.S. to the developing countries are: portfolio investment, banks outflows, and non-banks outflows. The left-hand side variable first used was the sum of these three outflows, i.e., portfolio+banks+non-banks. Then, we took sum of two out of three of them on the left-hand side and the third one on the right-hand side (with FDI always on the right-hand side). After that we used only one (of the other three) on the left-hand side used the other two on the right-hand side in the following ways: sum of the other two on the right-hand side; both of the other two individually on the right-hand

[20]See Kennedy (2003), page 324 for a general form of the ECM equation which he recommends be used by practitioners. This form is employed in this paper.

side; only one of them on the right-hand side; and neither of them on the right-hand side. It turns out that with portfolio on the left-hand side and neither of the other two, or only non-banks on the right hand side, had the most significant relationship to FDI. Changing the money measure from M2 to M3 did not change this result.

In the interest of "testing down," non-banks variable was retained on the right hand side of the equation explaining U.S. portfolio investment in developing countries. Results at this stage of the analysis are presented in column 3 of Table 3. This table also presents SBC and AIC statistics, adjusted R^2, and Jarque-Bera statistic (distributed chi-square with two degrees of freedom) for testing normality of errors. On the other hand, the Lagrange multiplier statistic (distributed standard normal) for Breusch-Pagan test for serial correlation at any specific lag-length is presented in Table 4. These statistics show that the errors are non-normal and are auto-correlated at lag 4.[21]

The regression had some variables with low absolute t-values. These variables were not explaining anything. Following Kennedy (2003), to improve explanatory power of the other variables and the model, variables with low t-values (absolute t's of .20 or less) were deleted. The deleted variables are real GDP, and real rates of return in Indonesia and Malaysia. Results from the regression with these variables deleted are shown in column 4 of Table 3. The model selection statistics improved. Still, both equations had non-normal errors and auto correlation.

We still have to contend with any potential endogeneity in explanatory variables. The variable Z* could to be endogenous, and r* and W may have endogenous elements. Durbin-Wu-Hausman (DWH) test is used to examine whether endogenous elements in any of these variables

[21]The computer output for the LM statistic for lags greater than 6 is not reported in Table 4. Nevertheless, this statistic is not significant for any lag-length other than four.

make the OLS estimators inconsistent. Following Davidson and MacKinnon (1989), this test is described below.[22] Let

$$Y = \Gamma X + \Psi, \qquad (8)$$

where Y is a 1xT vector representing the dependent variable, Γ is a 1xk vector of coefficients, X is a kxT matrix of explanatory variables some of whom may have endogenous elements, and Ψ is a 1xT vector of the error term. Because of correlation of X with Ψ, estimation of (8) may not give consistent results.

DWH test first involves regressing the endogenous elements of X on a set of instruments. Let E be an hxT matrix of purely exogenous variables in X, and V a (k-h)xT matrix of variables in X that contain endogenous elements. The corresponding 1xh and 1x(k-h) coefficient vectors are Γ^E and Γ^V, respectively. Then,

$$Y = \Gamma^E E + \Gamma^V V + \Psi. \qquad (8')$$

The first stage of this test is to regress each variable in V on E: E is an appropriate choice of instruments for each variable in V since E is known to be exogenous. Let the predicted or fitted values of V from these regressions be V^P so that the residuals, R, are:

$$R = V - V^P, \qquad (9)$$

where R is a (k-h)xT matrix.

The second stage is running artificial regression of Y on V and R, i.e. using OLS on

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[22]Since the DWH-test is sensitive to several types of mis-specifications, Godfrey and Hutton (1994) recommend testing for general misspecification before applying it. Following their recommendation, we apply the DWH-test at this stage. However, applying it at an earlier stage does not change the qualitative relationship between FDI and portfolio investment presented in this paper.

$$Y = \Gamma^V V + \Gamma^R R + \Psi, \qquad (10)$$

where Γ^R is the 1x(k-h) vector of coefficients on residuals from the first stage regressions. Under the null hypothesis, these coefficients should equal zero. Then, the DWH test is simply the *F* test for $\Gamma^R = 0$. Alternatively, the second stage regression may be run on V and V^P, and performing an *F* test for coefficients on V^P to equal zero. The two tests will give identical results since they have the same SSR.

The three variables suspected of having endogenous elements are Z*, r* for Korea, and W. DWH test was performed on all three of these variables, all six combinations of two variables at a time, and each of the three variables separately. The null hypothesis of $\Gamma^R = 0$ (inconsistent estimators) was rejected for r* for Korea, but not rejected for Z* and W.[23] Due to the presence of serial correlation, linear 2SLS or linear IV techniques are not suitable for estimating the model. In addition, we want the estimator to be robust to non-normal distribution of the error term.

We use the Newey-West (1987) estimator to handle estimation under these conditions. This is a generalized method of moments (GMM) estimator under conditions of serial correlation. It is based on the following assumptions: ergodic stationarity of unique and non-constant elements of variables and instruments, orthogonality of the vector of instruments to the current error term, full column rank of the covariance matrix of regressors and instruments, and Gordin's condition restricting ergodicity that delivers asymptotic normality. (See Hayashi, 2000). The Newey-West estimator is consistent and asymptotically normal under these assumptions. With a proper weighting matrix (Bartlett in our case), it achieves minimum variance that is heteroskedasticity and autocorrelation consistent.

[23] DWH test also rejected endogeneity for Z^d.

Let Z^{nb} represent U.S. investment in developing countries by non-banking institutions. We use lagged values of Z*, W, I, π^e, Z^d. Z^{nb}, and ECT as instruments for Z* and W. The equation satisfies Hansen’s (1982) test of over-identifying restrictions. That means it satisfies all the restrictions of the model (which are the assumptions stated in the previous paragraph). This non-linear estimator was actually computed by the iterative linearization method, and t and model detection tests were applied to the linear regression corresponding to the final linearization of the iterative process. Results from this regression are presented in column 5 of Table 3.

The regression equation is highly significant. Like Ruffin and Rassaekh (1986), we find that the interest rate variables and expected inflation are insignificant. Of the twelve variables (other than the constant and the error correction term) used in ECM regressions, all except three, expected inflation, real money supply, and real rate of return in Korea, have correct signs. The globalization index and total financial wealth in the U.S. are significant at 5% level of significance. In either case, the effect is positive. Thus, both increased globalization and an increase in U.S. real financial wealth increase U.S. portfolio investment in developing countries.

Of all the variables, Z^d has the most significant and powerful effect on U. S. portfolio investment in developing countries; and is significant at 1%-level all through out. The marginal effect is shown by the estimated coefficient. *Ceteris paribus,* a one million dollar of additional U.S. direct investment in developing countries increases U.S. portfolio investment there by .54 million dollars. Ruffin and Rassekh's result that U.S. FDI perfectly substitutes (dollar for dollar) U.S. foreign portfolio investment does not hold for developing countries. FDI is not a substitute for portfolio investment. The two flows are complementary. U.S. FDI has a magnifying effect on developing countries by inducing substantial portfolio investment there.[24]

There are two possible reasons for the different results. First is the different geographical region covered. Ruffin and Rassekh estimated the model for total or global U.S. capital outflows; we estimate it for outflows to developing countries only. Outflows to developing countries were an insignificant part of U.S. total capital outflows in the earlier estimation period.[25] The relative extent of outflows going to the two regions matters since the relationship between the two kinds of outflows could be different and some assumptions may not be applicable. Thus, Ruffin and Rassekh's assumption of full integration of capital markets although applicable to the U.S. and Europe capital markets may not directly and fully apply to the U.S. and developing countries' capital markets. This, and the domination of total outflows by outflows to developed countries, could explain their result.

The second reason is that overriding determinants of the two kinds of outflows may have changed since 1982, the end of Ruffin and Rassekh's period. We may distinguish between two kinds of factors explaining these outflows: distinct or common. The distinct determinants for portfolio investment are: in the U.S.: interest rate and the degree of risk aversion; in developing countries: price-earnings ratio, stock market return, credit rating, secondary market price of debt, regulatory, accounting, and enforcement standards, the extent of correlation between equity returns with the U.S., and share of domestic capital market in world stock market, etc. Similarly, FDI is distinctly explained by good infrastructure, preferential (for FDI) as well as

[24]This reinforces Kant's (1996) result that FDI has a magnifying effect on the host countries since it reduces capital flight from these countries.

[25]For example, outflows to developing countries were only 10% of the total for the 1979I to 1982IV period, the period used by Ruffin and Rassekh.

protectionist (for imports) policies, wage costs, education level, R&Ds scale and intensity, and property and sales tax rates.

On the other hand, both portfolio and direct investment could be explained by common factors like the level of U.S. industrial and economic activity, deregulation, bureaucratic efficiency, and deceasing transactions costs in developing countries, degree of openness and foreign perceptions of a country, index of economic activity and GDP growth rate, inflation rate, external debt situation and current account balance, non-diversifiable investment risk, income tax rates etc.[26] For the earlier period used by Ruffin and Rassekh, distinct factors possibly having opposite effects for the two outflows, or two distinct factors changing at the same time in opposite directions, could have been important. On the other hand, for this paper's period, the common factors may be dominating, causing the two flows to become complementary.

4. Summary and Conclusions:

We find that direct and portfolio investment from the U.S. to developing countries are not perfect substitutes. The specific composition of private flows is relevant: a decrease in portfolio investment will not be made up by an equal increase in FDI inflows, and vice versa. Consequently, different types of capital flows to developing countries could have different effects. In fact, portfolio investment is complementary to direct investment: the marginal effect of one dollar increase in U.S. direct investment in developing countries is to increase portfolio

[26]See Cheng and Kwan (2000), Sarno and Taylor (1999), and Chuhan, Claessens, and Mamingi (1998) for discussion of these determinants of direct and portfolio investment in developing countries.

investment there by 54 cents. U.S. FDI in developing countries has magnified effects on these economies.

One theoretical implication of this work is that future work on asset-based exchange rate models (at least for developing countries) may benefit by giving some attention to the composition of asset flows. This observation is consistent with Taylor’s (1995) conclusion that explaining exchange rate movements solely in terms of macroeconomic fundamentals may not prove successful. On the empirical side, the future work would be to examine the sequence of these two kinds of outflows to developing countries. That is, whether direct investors provide signals to portfolio investors, or is it vice-versa: or, is either of these two inflows the "follower" and whether that flow remains the "follower" in the outward direction also. Clearly, this question is not relevant if the two flows are perfect substitutes.

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Table 1: ADF Test Statistics for π and Gold Price

$H_0: \alpha_1 = 0$			$H_0: \alpha_0 = \alpha_1 = 0$		
Quarterly π	Annual π	Gold Price	Quarterly π	Annual π	Gold Price
-2.87	-3.10	-2.93	4.94	5.44	5.69

Note: α_0 and α_1 are the first two coefficients for the estimating equation: $\Delta Y_{t1} = \alpha_0 + \alpha_1 Y_{t-1} + \sum \beta_i \Delta Y_{t-i+1} + \varepsilon_t$; where $\{Y_t\}$ is the series we are examining for unit roots, i takes values from 2 to p, and p gives the number of lagged terms to ensure that the errors are uncorrelated.

Table 2: Estimation of Expected Inflation

VARIABLE TEST OR STATISTIC	ARMA(1,3)	ARMA(1,4)	ARMA(2,3)
AIC	-1.6550	-1.5935	-1.6374
SBC	-1.5061	-1.4149	-1.4587
R^2	0.7682	0.7663	0.7675
Adjusted R^2	0.7558	0.7505	0.7518
Q-Statistic	39.83	38.17	47.60
AR(1)	0.98282 (0.02054)	1.0053 (0.004982)	1.2941 (0.08738)
AR(2)			-0.34114 (0.08540)
MA(1)	0.20395 (0.09969)	0.24633 (0.1122)	0.44883 (0.1066)
MA(2)	0.61698 (0.07677)	0.66980 (0.09991)	0.60357 (0.07246)
MA(3)	-0.48286 (0.09670)	-0.53040 (0.09417)	-0.67616 (0.09139)
MA(4)		0.00710 (0.1154)	
Constant	0.023719 (0.04967)	-0.01870 (0.02638)	0.05840 (0.04999)

Note: The figures in parenthesis are the standard errors.

Table 3: Estimation of ECT-Augmented Equation (7)

Variable test or statistic	Co-integrating Regression	ECM	y, r_I, r_M deleted	GMM Estimator
AIC		.123E+8	.114E+8	.115E+8
SBC		. 188E+8	. 159E+8	.162E+8
Adjusted R^2	..9810	. .4284	.4539	.3532
Jarque-Bera Statistic		18.9169	18.8512	
Deterministic Trend	-7123.7			
y	41.657	-.17459		
r_I	2083.8	113.86		
r_M	952.72	70.257		
π^e	-13089	-1055.4	-1038.4	-97.224 (2965.1)
m	-33.643	-6.0715	-5.5711	-11.974 (18.157)
r_K	-22958	-2182.1	-1976.8	-2325.3 (3669)
G^e	15.629	-3.882	-3.7350	-3.0693 (6.8685)
W	-1.9745	4.2975	4.3982	10.942** (5.467)
I	3187.9	1795.5	1793.3	1738.7** (790.5)
Z^d	0.89352	.69944	.69553	.53969*** (.11917)
Z*	0.20517	.04557	.04557	-.01176 (.07412)
Z^{nb}	0.13453	.10136	.09793	.14774 (.09816)
ECT		-.08010	-.07911	-.07445* (.04115)
Constant	93590	-3125.0	-3120.2	-2553.8** (1091.2)

Note: r_I, r_K, and r_M are real rates of return in Indonesia, Korea, and Mexico, respectively, and *, **, and *** denote coefficients that are significant at 10%, 5%, and 1% levels, respectively.

Table 4: LM Statistic For Auto-Correlation

Lag	ECM	y, r_I, r_M deleted
1	1.2738	1.2789
2	1.3333	1.3073
3	0.4393	0.5206
4	2.7285	2.6967
5	1.5821	1.6361
6	0.3908	0.4613