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Foreign Direct Investment, Other Capital Flows, and Current Account Deficits

What Causes What?

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The more liberal a country's foreign exchange system, the more foreign direct investment is likely to be independent of current account and other capital flows.

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Summary findings

Fry, Claessens, Burridge, and Blanchet examine flows of foreign direct investment to 46 developing countries to test whether such flows are autonomous or accommodating *vis-à-vis* the current account and other capital flows.

Using Granger-causality tests, they find that:

- Requirements to surrender export proceeds to the monetary authorities and the existence of special exchange rates for some capital account transactions

reduce the probability that foreign direct investment is independent.

- The more liberal a country's foreign exchange system, the more foreign direct investment is likely to be independent or exogenous.
- Foreign direct investment is associated with a larger increase in capital formation when it is independent than when it is Granger-caused by other capital flows.

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What Causes What?

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1 Introduction

Foreign capital inflows to developing countries constitute part of the world's saving. Over the past two decades, world saving as a proportion of world income has fallen. As world saving has shrunk, so the real interest rate measured in terms of U.S. dollar interest and inflation rates has risen from 0.8 per cent during the period 1971–1978 to 4.8 per cent in the period 1981–1991 (*International Financial Statistics*, CD-ROM, September 1994).¹ It is against this background that foreign direct investment (FDI) has appeared increasingly attractive to developing countries facing declining domestic investment and higher costs of foreign borrowing. Foreign direct investment seems an attractive form of capital inflow because it involves a risk-sharing relationship with the suppliers of this type of foreign capital. This kind of risk sharing does not exist in the formal contractual arrangements for foreign loans. Furthermore, as the World Bank (1993, 3) claims, there may be dynamic benefits: “Foreign direct investment is a large and growing source of finance that may help developing countries close the technology gap with high-income countries, upgrade managerial skills, and develop their export markets.”

Globally, FDI has increased dramatically over the past decade. However, most of this increase has occurred in the industrial countries. In the developing countries, FDI has been heavily concentrated among a small number of countries; over 90 per cent of FDI inflows to developing countries in 1990 was received by only 18 countries. Half of this total flowed to eight Pacific Basin developing market economies (Hong Kong, Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan, and Thailand). Given that neither Korea nor Taiwan has shown strong interest in attracting FDI, it may seem surprising that these economies feature in this group of developing countries. Their appearance in this list may support the view that explicit incentive packages are not the key determinants of FDI flows.

In undertaking any analysis of FDI, one must recognize that FDI data record financial flows which may or may not correspond to changes in capital formation. Whether or not they do depends on (a) the extent of substitutability of this type of financial flow for other types of financial flows and (b) the extent to which FDI crowds out domestically financed

¹The real interest rate is proxied here by the London interbank offered rate on U.S. dollar deposits adjusted for the percentage change in the U.S. GDP deflator. During the period 1992–1995, this real interest rate averaged only 1.5 percent, but has been rising rapidly since 1993 (*World Economic Outlook*, May 1994, 177).

investment. In some of the literature, the view prevails that FDI can serve two purposes, namely, raise investment and relieve foreign exchange shortages.² Unless FDI affects national saving, however, it can raise domestic investment or provide additional financing for a preexisting current account deficit or achieve some combination of the two, but these two effects must always sum to one. In other words, if \$100 FDI increases capital formation by only \$75, it would provide \$25 for additional current-account financing. If it simply substitutes for an alternative type of capital inflow, however, FDI neither raises capital formation nor does it provide additional current-account financing.

This study examines the question of whether FDI to a sample of developing countries substitutes for other capital flows, increases capital formation, or provides additional foreign exchange for balance-of-payments support. Using James Meade's (1951) distinction between autonomous and accommodating capital flows, Philip Turner (1991, 91–95) addresses the question of whether or not net FDI flows are accommodating and hence constitute additional balance-of-payments financing by regressing components of the capital account on the current account financing requirement (both in first differences) for some OECD countries.

Turner's estimated equation takes the form:

$$\Delta KF_i = a_0 + a_1 \Delta KFR, \quad (1)$$

where ΔKF_i is the year-on-year change in the net capital flow item expressed as a percentage of GNP and ΔKFR is the year-on-year change in the current account minus changes in official reserves also expressed as a percentage of GNP (both in current prices). Turner (1991, 92) finds that short-term bank flows are significantly correlated with the current account financing requirement with coefficients ranging from 0.27 (United Kingdom) to 0.88 (Canada) for seven of the 10 OECD countries. In the case of FDI, however, Turner concludes that this flow is much closer to being autonomous than accommodating; the coefficient is significant only in the case of France with a value of only 0.13.

Using Turner's methodology with annual data on net capital flows from *International Financial Statistics* CD-ROM for a sample of 16 developing countries³ for the period 1975–

²For example, Laurence Cockcroft and Roger Riddell (1991, 3) note: "Two of the principal factors inhibiting higher levels of economic growth in Sub-Saharan Africa in the 1990s are low levels of investment and foreign exchange shortages. The first attraction of foreign investment lies in its potential to address both these constraints."

³Argentina, Brazil, Chile, Egypt, India, Indonesia, Korea, Malaysia, Mexico, Nigeria, Pakistan, the Philip-

1990, Fry (1993, 13) finds a rather different response pattern in developing countries. In contrast to the OECD countries, other long-term capital flows appear to be just as sensitive to current account financing requirements as short-term flows in this sample of developing countries. For these countries, therefore, one might rank portfolio investment as the most autonomous, FDI or capital inflows to the public sector next, and both long- and short-term bank loans as the most accommodative type of capital flow.

All but one of the estimated coefficients for FDI are less than 0.1. Even in the case where FDI is most accommodative (Malaysia), the coefficient is still only 0.14. On the basis of these estimates, therefore, FDI appears to be autonomous on Turner's criterion. The negative coefficients of FDI in India and Korea (Fry 1993, 13), and in the United Kingdom (Turner 1991, 92) may reflect the deterrent effect of increasing current account deficits on FDI inflows, since large current account deficits can worsen a country's investment climate. This would also support the view that FDI inflows are largely unrelated to balance-of-payments financing requirements. However, it does suggest that FDI should be treated as endogenous to a country's saving-investment process.

Unfortunately, Turner's technique is seriously flawed. First, with enough substitutability between alternative types of capital inflows, there may be no bivariate correlation between any of the components and the overall current account financing requirement. Indeed, Fry's (1993, 13) results indicate that this is the case for Egypt, Nigeria, and the Philippines. Out of 80 regressions, only 12 yield significant coefficients at the 95 per cent confidence level. Fry's findings support Michael Dooley's (1990, 75) assertion that financial flow variables such as FDI have far too high degrees of substitutability to provide any useful analytical information. Second, the bivariate regressions fail to establish causality. To explore these issues, this paper presents Granger-causality tests to examine not only the direction of causation between current and capital account imbalances but also between current account and three components of the capital account, FDI, portfolio investment (PI), and other capital flows (OKF). Whether or not substitutability and fungibility are so high that FDI flows provide no relevant economic information at all is an empirical question.

pines, Sri Lanka, Thailand, Turkey, and Venezuela.

2 Granger-Causality in the Balance of Payments

Our first question is whether current account imbalances Granger-cause capital account imbalances or *vice versa*. To answer this question, we use an error-correction model (ECM) with one lag. For the long-run analysis conducted here, we ignore errors and omissions in the balance-of-payments accounts and assume that the desired level of international reserves is zero. Hence, the balance of payments on current account is equal and opposite to the balance of payments on capital account. Since changes in international reserves are a disequilibrium phenomenon, we use them as an error-correction term.

So that all countries can be treated in a uniform manner, we assume that international reserves are stationary with a constant long-run equilibrium ratio to GNP. Hence, the previous period's reserve balance can be treated as the disequilibrium term in an ECM of the form:

$$\Delta CA_t = a + b(CA_{t-1} + KA_{t-1}) + \sum_{i=1}^m c_i \Delta CA_{t-i} + \sum_{j=1}^n d_j \Delta KA_{t-j} + u, \quad (2)$$

where CA is the current account and KA is the capital account. The term $CA_{t-1} + KA_{t-1}$, the lagged change in official reserves, is the error-correction mechanism. The rationale is that, if there are co-movements in CA and KA , they should be equilibrating in the long run.⁴ This leads to a causality test based on the significance of either the coefficient b or the coefficients d_j . When KA is substituted for CA as the dependent variable, the relevant coefficients are b and c_i .

We faced a choice between examining quarterly data for a small sample or annual data for a larger sample of developing countries. From a total of 115 developing countries for which some balance-of-payments data were available, we selected an initial sample of 75 developing countries that had experienced FDI inflows of at least half a percent of GNP for at least five years over the period 1970–1992. Data deficiencies reduced this sample to 46 countries with annual data and only 14 countries with quarterly data. We chose the larger country sample,

⁴Peter Montiel (1994, 329) makes a similar point about the relationship between national saving, domestic investment, and the current account: "The current account provides the resources with which a country repays its external creditors. Solvency thus imposes a constraint that prevents deviations between national saving and investment from becoming permanent. Because gaps between saving and investment must eventually be reversed for the country to remain solvent, sufficient observations should show these two series to be cointegrated." In this case, the lagged current account is the error-correction mechanism that equilibrates saving and investment in the long run.

Table 1: Granger-Causality Tests for Current (*CA*) and Capital (*KA*) Accounts, 1970–1992.

<i>KA</i> Causes <i>CA</i> <i>CAUSKC</i>	<i>CA</i> Causes <i>KA</i> <i>CAUSCK</i>	Neither <i>CAUSN</i>
Algeria	Algeria	Bolivia
Argentina	Honduras	Barbados
Brazil	Indonesia	Chile
Costa Rica	Korea	Côte d'Ivoire
Greece	Malta	Colombia
Kenya	Mexico	Ecuador
Malta	Panama	Egypt
Mauritius	Portugal	El Salvador
Paraguay	Rwanda	Guatemala
Peru	Singapore	Jamaica
Philippines	Turkey	Malawi
Rwanda	Uruguay	Malaysia
Singapore		Niger
Swaziland		Nigeria
Thailand		Saudi Arabia
Tunisia		Sierra Leone
Venezuela		South Africa
		Suriname
		Togo
		Trinidad and Tobago
		Zambia

which meant that a wider search for possible ECM forms was not feasible. For the same reason, we use only one lag for $\sum_{i=1}^m c_i \Delta CA_{t-i}$ and $\sum_{j=1}^n d_j \Delta KA_{t-j}$. In other words, we set both i and j equal to one.

Table 1 shows the results of the initial Granger-causality tests between the current and capital account over the period 1970–1992. Both variables are expressed as proportions of GNP. The capital account Granger-causes current account imbalances in 13 countries and

we detect the opposite direction of causation in eight countries. In four countries Granger-causation goes both ways, while no causality is detected in the remaining 21 countries.

The second question we address here is whether disaggregated capital flows are interdependent or independent. Interdependence means that one or more other capital flows Granger-cause this particular capital flow. Independence means that neither of the other capital flows exerts any causal influence. If the capital account Granger-causes the current account, all three capital flows may be independent and hence could Granger-cause the current account imbalance. However, it is also possible that high substitutability ensures that all three capital flows are interdependent and that no individual capital flow Granger-causes the current account imbalance. There are six additional possibilities: any one of the three capital flows may be independent or two capital flows in any of the three combinations may be independent. Hence, eight different Granger-causality results can occur among the components if the capital account Granger-causes the current account. If the current account Granger-causes the capital account, the same eight results are possible. The current account imbalance may influence all three flows, two flows, one flow, or no individual flow at all because of high substitutability. In other words, all capital flows or no capital flow can be independent.

In testing for causality within and between components of *CA* and *KA*, there is no natural measure of disequilibrium. Hence, we adopt a form of the procedure advocated by Cheng Hsiao (1979), and elaborated by Mitsuhiro Odaki (1986) and Edward Gharvey (1993). Using the finding by Jean-Pierre Urbain (1989) that the Schwartz information criterion performs relatively well in small samples, we use it to determine lag length in the Hsiao procedure described below.

First, we test all component series for unit roots. If either y or x were found to be nonstationary, we employ the Hsiao procedure using the appropriate level of differencing. The Hsiao procedure starts by assuming a maximum possible order $p_{\max}$ for the unrestricted VAR linking the variables under investigation; we chose $p_{\max} = 4$. Univariate $AR(p)$ models, $p = 1, \dots, p_{\max}$ are then fitted to y ; the lag length p^y that minimizes the chosen information criterion is selected. This minimized value is denoted $SBC_y(p^y, 0)$. Now lags p^x of the variable x that could be causal are added in sequence up to lag p^y . If the minimum of the corresponding $SBC_{yz}(p^y, p^x)$ lies below $SBC_y(p^y, 0)$, we conclude that x causes y since the optimum model for predicting y contains p^y lags of y and $p^x > 0$ lags of x .

This procedure can be generalized to more than two variables to control for covariates as advocated by Gharvey (1993). However, constraints on degrees of freedom prevent us from testing a multivariate model. Hence, the results reported below in Table 2 and Appendix A-1 and A-2 are based on bivariate equations only.

Table 2 shows the key part of the second-stage estimation results concerning FDI; the full results are presented in Appendix A-1. Even where the capital account Granger-causes the current account, all three capital flows are interdependent in four countries (Argentina, Brazil, Peru, and Venezuela). Conversely, all three capital flows are independent in Indonesia, where the current account Granger-causes the capital account. Of central relevance to this study is the finding that FDI is independent of other capital flows in 20 of the 46 countries.

The third question is whether or not there is any Granger-causality between one of the disaggregated capital flows—FDI, PI, and OKF—and the current account or *vice versa*. Countries with no Granger-causation between current and capital accounts are excluded. For countries with Granger-causation running from the capital account to the current account, we test Granger-causality from each capital flow to the current account. For countries with Granger-causation running from the current account to the capital account, we test Granger-causality from the current account to each capital flow. Finally, for countries with bidirectional Granger-causality, we run combined tests of Granger-causality from and to each capital flow to and from the current account. The full results are presented in Appendix A-2. They show that FDI Granger-causes the current account in seven countries (Algeria, Brazil, Costa Rica, Peru, Rwanda, Singapore, and Venezuela) and is Granger-caused by the current account in four countries (Algeria, Malta, Panama, and Rwanda).

3 Explaining Causality Results

The results reported in Tables 1 and 2 display no evident patterns or country groupings. A cursory inspection indicates that these classifications bear no relation to either location or per capita income. However, there may be some feature or features of a country's economy, specifically of its balance-of-payments regime, that are associated with particular causal patterns. To investigate such possibilities, we ran logit and probit regressions to explain the causal variables. The four dependent variables we examine are *CAUSKC* for the capital account Granger-causing the current account, *CAUSCK* for the current account Granger-causing the capital account, *CAUSN* for no Granger-causation between the capital and current

Table 2: Independent and Interdependent Foreign Direct Investment.

FDI Independent	FDI Interdependent
Colombia	Algeria
Côte d'Ivoire	Argentina
Greece	Barbados
Guatemala	Bolivia
Honduras	Brazil
Indonesia	Chile
Kenya	Costa Rica
Malta	Ecuador
Mexico	Egypt
Nigeria	El Salvador
Panama	Jamaica
Paraguay	Korea
Philippines	Malawi
Saudi Arabia	Malaysia
Suriname	Mauritius
Swaziland	Niger
Thailand	Peru
Tunisia	Portugal
Uruguay	Rwanda
Zambia	Sierra Leone
	Singapore
	South Africa
	Togo
	Trinidad and Tobago
	Turkey
	Venezuela

Table 3: Potential Explanatory Variables for Direction of Balance-of-Payments Causation.

<i>RESC</i>	- Article XIV status
<i>RESD</i>	- Special rates for some or all capital transactions and/or some or all invisibles
<i>RESE</i>	- More than one exchange rate for imports
<i>RESF</i>	- More than one exchange rate for exports
<i>RESG</i>	- Restrictions on current account payments
<i>RESH</i>	- Restrictions on capital account payments
<i>RESI</i>	- Import surcharges
<i>RESJ</i>	- Advance import deposits
<i>RESK</i>	- Surrender of export proceeds required
<i>PCY</i>	- Natural logarithm of per capita income in U.S. dollars
<i>YG</i>	- Rate of growth in real GNP
<i>INF</i>	- Inflation (continuously compounded rate of change in GNP deflator)
<i>OPEN</i>	- Exports plus imports as a proportion of GNP
<i>FLY</i>	- Cumulated current account deficit as proportion of GNP
<i>DETY</i>	- Foreign debt as a proportion of GNP
<i>GBLY</i>	- Government deficit (-) as a proportion of GNP
<i>DCGR</i>	- Net domestic credit to the government as a proportion of total domestic credit
<i>DCGY</i>	- Net domestic credit to the government as a proportion of GNP
<i>BLA</i>	- Black market exchange rate premium
<i>RR</i>	- Square of real interest rate
<i>DCPY</i>	- Domestic credit to the private sector as a proportion of GNP

account, and *FDIX* for FDI being independent or exogenous. These variables take a value of 1 when a country exhibits the particular Granger-causation specified and 0 when it does not. Since there were only four countries with bidirectional Granger-causation, these were treated as positive for both *CAUSKC* and *CAUSCK*.

The potential explanatory variables are listed in Table 3. The first set of explanatory variables consist of balance-of-payments restriction variables reported annually at the back of the International Monetary Fund's *Balance of Payments Yearbook*. The variables *RESC*

to *RESK* take a value of 1 if the practice exists and 0 otherwise.

An informal principal components-type aggregation suggests that these variables might be meaningfully summed in various combinations. Specifically:

$$RESU = RESC + RESD + RESE + RESF + RESG + RESH + RESI + RESJ + RESK; \quad (3)$$

$$RESV = RESD + RESE + RESF; \quad (4)$$

$$RESW = RESG + RESH; \quad (5)$$

$$RESX = RESI + RESJ + RESK; \quad (6)$$

$$RESY = RESI + RESJ; \quad (7)$$

$$RESZ = RESG + RESI. \quad (8)$$

The remaining explanatory variables include per capita income, real GNP growth, inflation, the openness of the economy, two foreign debt variables, three measures of the government's domestic borrowing requirements, and three indicators of distortions in the domestic economy. The three indicators of domestic distortions are the black market exchange rate premium *BLA*, used as a proxy for the degree of foreign exchange liberalization, the square of the real rate of interest *RR*, an indicator of the extent of financial repression or financial distortion, and the ratio of private sector domestic credit to GNP *DCPY*, another indicator of financial repression.

The functional form for the real interest rate follows a claim by José De Gregorio and Pablo Guidotti (1992) that real interest rates are not a good indicator of financial repression or distortion. Appealing to work by Guillermo Calvo and Fabrizio Coricelli (1991), they suggest that the relationship between real interest rates and economic growth might resemble an inverted *U*-curve: "Very low (and negative) real interest rates tend to cause financial disintermediation and hence tend to reduce growth, as implied by the McKinnon-Shaw hypothesis. ... On the other hand, very high real interest rates that do not reflect improved efficiency of investment, but rather a lack of credibility of economic policy or various forms of country risk, are likely to result in a lower level of investment as well as a concentration in excessively risky projects" (De Gregorio and Guidotti 1992, 9). For this reason, De Gregorio and Guidotti abandon real interest rates in favor of domestic credit to the private sector divided by GNP *DCPY*.

Since there are 46 observations for each Granger-causation variable in Tables 1 and 2, we chose for each country two alternative values for each variable listed in Table 3. The first is the value in 1970 at the start of the observation period, the second is the average value throughout the period 1970–1992. As no variable measured at its 1970 value provided any predictive power, we report only estimates using average values.

The significant bivariate associations using these measures are shown in Table 4.⁵ On the one hand, higher levels of both foreign and domestic indebtedness reduce the probability of causation running from capital to current accounts and increase the probability that there is no causation. On the other hand, a high rate of economic growth increases the probability of causation running from current to capital account, while reducing the probability that there is no causation. A higher ratio of private sector credit to GNP also increases the probability of causation running from current to capital account.

The existence of restrictions on capital account payments reduces the probability of causation running from current to capital accounts. The existence of special exchange rates for some capital account transactions reduces the probability that FDI is independent. Finally, the probabilities of causation running from current to capital accounts and of FDI being independent of the current account are reduced in countries where export proceeds must be surrendered to the monetary authorities. Table 4 suggests that the more liberal is a country's foreign exchange system, the more likely is FDI to be exogenous or independent.

4 Foreign Direct Investment and Capital Formation

Where FDI is not independent but Granger-caused by other capital inflows, one might reasonably assume that FDI inflows would be less likely to increase capital formation than in the case where FDI is independent. Hence we now estimate the impact of FDI on domestic investment for countries in which FDI is independent and for countries in which FDI is interdependent.

The investment function specified here in terms of the ratio of investment to GNP is based on the flexible accelerator model. Mario Blejer and Mohsin Khan (1984, pp. 382–383) describe some of the difficulties of estimating neoclassical investment functions for developing

⁵Multivariate estimates produced similar results, but multicollinearity considerably reduced coefficient precision.

Table 4: Determinants of Causality.

Dependent Variable	Logit Model			Probit Model		
	Constant	Explanatory Variable	Count R^2	Constant	Explanatory Variable	Count R^2
<i>CAUSKC</i>	1.139 (1.338)	-3.569(<i>DETY</i>) (-2.001)	0.683	0.700 (1.356)	-2.184(<i>DETY</i>) (-2.090)	0.683
<i>CAUSKC</i>	0.316 (0.594)	17.524(<i>GBLY</i>) (1.785)	0.644	0.195 (0.591)	10.728(<i>GBLY</i>) (1.844)	0.644
<i>CAUSCK</i>	-2.902 (-3.173)	6.171(<i>DCPY</i>) (2.322)	0.804	-1.669 (-3.441)	3.511(<i>DCPY</i>) (2.362)	0.804
<i>CAUSCK</i>	-2.397 (-2.843)	33.793(<i>YG</i>) (1.899)	0.783	-1.438 (-3.037)	20.203(<i>YG</i>) (1.936)	0.783
<i>CAUSCK</i>	0.180 (0.234)	-1.620(<i>RESH</i>) (-1.704)	0.761	0.107 (0.224)	-0.982(<i>RESH</i>) (-1.707)	0.761
<i>CAUSCK</i>	1.391 (1.110)	-2.809(<i>RESK</i>) (-2.021)	0.783	0.799 (1.136)	-1.661(<i>RESK</i>) (-2.140)	0.783
<i>CAUSN</i>	1.213 (1.811)	-38.535(<i>YG</i>) (-2.301)	0.696	0.747 (1.840)	-23.518(<i>YG</i>) (-2.390)	0.696
<i>CAUSN</i>	-1.137 (-1.988)	2.348(<i>FLY</i>) (1.880)	0.622	-0.706 (-2.036)	1.462(<i>FLY</i>) (1.932)	0.622
<i>CAUSN</i>	-1.910 (-2.336)	3.255(<i>DETY</i>) (2.186)	0.732	-1.170 (-2.435)	2.004(<i>DETY</i>) (2.273)	0.732
<i>CAUSN</i>	-1.073 (-1.944)	-16.881(<i>GBLY</i>) (-1.870)	0.622	-0.670 (-1.998)	-10.609(<i>GBLY</i>) (-1.918)	0.622
<i>FDIX</i>	0.265 (0.670)	-1.985(<i>RESD</i>) (-1.915)	0.587	0.164 (0.667)	-1.220(<i>RESD</i>) (-1.993)	0.587
<i>FDIX</i>	1.947 (1.394)	-2.467(<i>RESK</i>) (-1.654)	0.630	1.216 (1.465)	-1.542(<i>RESK</i>) (-1.732)	0.630

countries. Without data on the capital stock and the return to capital, there is little choice in practice but to use some version of the accelerator model.

The accelerator model has the desired capital stock K^* proportional to real output y :

$$K^* = \alpha y. \quad (9)$$

This can be expressed in terms of a desired ratio of net investment to output $(I/Y)^*$:

$$(I/Y)^* = \alpha \gamma, \quad (10)$$

where γ is the rate of growth in output denoted YG in the regression equation.

The partial adjustment mechanism specified for the investment *ratio* is somewhat more complicated than the equivalent mechanism for the *level* of investment. Specifically, there could be a lag in achieving the same investment ratio this year as last year if output rose rapidly last year; this year's desired investment *level* will be higher than last year's, despite a constant desired *ratio* of investment to output. To incorporate this adjustment lag, last year's growth rate γ_{t-1} can be included as an explanatory variable. In this case, however, the coefficient of γ_{t-1} was insignificant; hence, γ_{t-1} is omitted from the estimate.

The remaining adjustment mechanism allows the actual investment ratio to adjust partially in any one period to the difference between the desired investment ratio and the investment ratio in the previous period:

$$\Delta(I/Y) = \lambda[(I/Y)^* - (I/Y)_{t-1}] \quad (11)$$

or

$$I/Y = \lambda(I/Y)^* + (1-\lambda)(I/Y)_{t-1}, \quad (12)$$

where λ is the coefficient of adjustment.

The flexible accelerator model allows economic conditions to influence the adjustment coefficient λ . Specifically,

$$\lambda = \beta_0 + \left[\frac{\beta_1 z_1 + \beta_2 z_2 + \beta_3 z_3 + \dots}{(I/Y)^* - (I/Y)_{t-1}} \right], \quad (13)$$

where z_i are the variables that affect λ . Since one of these variables can be an intercept term for the depreciation rate, the flexible accelerator model can be estimated for the gross rather than the net investment ratio.

A simple specification search suggests that, for the 46 developing countries analyzed here, the speed of adjustment is determined by the ratio of FDI inflows to GNP FDI/Y , the lagged

real exchange rate index expressed in natural logarithms $REXL_{t-1}$,⁶ the lagged cumulated net foreign liabilities converted into domestic currency and divided by lagged GNP FLY_{t-1} , and credit availability as measured by the change in domestic credit divided by GNP $DDCY$.

The price of intermediate imports may affect the profitability of investment projects in these developing countries. Hence, the real exchange rate expressed in natural logarithms $REXL$ is included as a proxy for the price of nontradable goods in relation to import prices. We measure the real exchange rate REX as (domestic GNP deflator/U.S. wholesale price index)/domestic currency per U.S. dollar. Therefore, a higher value of $REXL$ implies a lower relative price of imports. By appreciating the real exchange rate, capital inflows may stimulate investment. On the other hand, an appreciation in the real exchange rate prices exports out of world markets and may worsen the investment climate. Hence, its effect on investment is ambiguous.

Effective domestic costs of borrowing are extraordinarily difficult to measure in almost all developing countries because of selective credit policies and disequilibrium institutional interest rates; hence the quantity rather than the price of credit is used here. The availability of institutional credit can be an important determinant of the investment ratio, for the reasons discussed by Alan Blinder and Joseph Stiglitz (1983), Fry (1980) and Peter Keller (1980). Banks specialize in acquiring information on default risk. Such information is highly specific to each client and difficult to sell. Hence, the market for bank loans is a customer market, in which borrowers and lenders are very imperfect substitutes. A credit squeeze rations out some bank borrowers who may be unable to find loans elsewhere and so be unable to finance their investment projects (Blinder and Stiglitz 1983, p. 300). Here, therefore, the investment ratio is influenced by the change in total domestic credit scaled by GNP $DDCY$.

The variable FLY_{t-1} is included as a proxy for the effective domestic real interest rate. If a buildup of foreign indebtedness makes foreign lenders more reluctant to lend, the effective domestic real interest rate rises and so deters investment (Fry 1993).

The regression method used here is iterative three-stage least squares which is, asymptotically, full-information maximum likelihood (Johnston 1984, pp. 486–492). We estimate the 46 individual country investment equations as two systems of equations with cross-equation equality restrictions on all coefficients except the intercept. Hence, the estimates apply to a representative member of these samples of developing countries. The estimation technique

⁶The variable $REXL$ is divided by 10 for scaling purposes in the regression estimates.

corrects for heteroscedasticity across country equations and exploits contemporaneously correlated disturbances. The instruments are the exogenous explanatory variables plus the lagged FDI ratio, lagged domestic credit expansion divided by GNP, the lagged terms-of-trade index in natural logarithms, lagged growth, the public sector borrowing requirement divided by GNP, the world real interest rate, oil price inflation, and the rate of growth (continuously compounded) in OECD output. The estimation period is 1970–1991 and the dependent variable IY is gross domestic investment divided by GNP at current prices.

The first estimate is for the 20 countries in which FDI is independent (354 observations):⁷

$$\begin{aligned}
 IY = & 0.635 \widehat{FDIY} - 0.010 FLY_{t-1} + 0.525 \widehat{DDCY} \\
 & (10.548) \quad (-2.933) \quad (34.128) \\
 & + 0.037 REXL_{t-1} + 0.386 \widehat{YG} + 0.640 IY_{t-1}. \\
 & (10.575) \quad (27.781) \quad (44.593) \\
 R^2 = & 0.613 \quad DW = 1.92
 \end{aligned} \tag{14}$$

The corresponding estimate for the 26 countries with interdependent FDI is (513 observations):

$$\begin{aligned}
 IY = & 0.129 \widehat{FDIY} - 0.028 FLY_{t-1} + 0.003 \widehat{DDCY} \\
 & (8.996) \quad (-26.451) \quad (0.596) \\
 & - 0.012 REXL_{t-1} + 0.174 \widehat{YG} + 0.658 IY_{t-1}. \\
 & (-7.601) \quad (29.339) \quad (73.026) \\
 R^2 = & 0.806 \quad DW = 2.10
 \end{aligned} \tag{15}$$

The coefficient of $FDIY$, the ratio of FDI to GNP, is not only substantially but also significantly higher for the country group in which FDI is independent of other balance-of-payments flows than it is for the country group in which FDI is Granger-caused by some other balance-of-payments flow. Hence, these estimates support our assumption that Granger-caused FDI inflows are less likely to affect capital formation than independent FDI inflows.

⁷Saudi Arabia and Suriname were dropped because of data deficiencies, so reducing the number of countries in this estimate to 18.

5 Conclusion

In this paper, we have examined the question of whether capital flows, particularly inflows of foreign direct investment, Granger-cause current account deficits or *vice versa*. The initial results produce considerable diversity. While Granger-causality runs from capital to current accounts in some countries, it runs from current to capital accounts in others. We detect bidirectional Granger-causality in some countries and no causality at all in others. Within the capital account, three types of capital flows are Granger-caused by other flows in some countries, while all three are independent of movements in other capital and current-account flows in others. The six other possible combinations of Granger-causality among the three types of capital flows are all detected. There are no signs of any predominant tendencies among this sample of 46 developing countries.

Nevertheless, we are able to find variables that can predict the direction of Granger-causality. High levels of both foreign and domestic indebtedness reduce the likelihood that the capital account Granger-causes the current account and increase the likelihood of no causality. Conversely, a high rate of economic growth raises the likelihood that the current account Granger-causes the capital account and reduces the likelihood of no causality. A higher ratio of private sector credit to GNP also increases the probability of causation running from current to capital account.

The existence of restrictions on capital account payments reduces the probability of causation running from current to capital accounts. The existence of special exchange rates for some capital account transactions reduces the probability that FDI is independent. Finally, the probabilities of causation running from current to capital accounts and of FDI being independent of the current account are reduced in countries where export proceeds must be surrendered to the monetary authorities. The empirical results suggest that the more liberal is a country's foreign exchange system the more likely is FDI to be exogenous or independent.

Finally, we find that when FDI is independent of other balance-of-payments flows it increases capital formation in the host country by considerably more than it does when FDI is Granger-caused by some other balance-of-payments flow. This finding is consistent with our interpretation of the Granger-causality tests. Although FDI could still crowd out domestically financed investment even if it were independent, we find that the majority of independent FDI increases capital formation; for each \$100 in FDI capital formation is increased by \$64. On the other hand, endogenous or interdependent FDI raises capital formation by only \$13

for every \$100 FDI inflow.

References

- Blejer, Mario I. and Mohsin S. Khan (1984), "Government Policy and Private Investment in Developing Countries," *International Monetary Fund Staff Papers*, 31(2), June 1984, 379-403.
- Blinder, Alan S. and Joseph E. Stiglitz (1983), "Money, Credit Constraints, and Economic Activity," *American Economic Review*, 73(2), May 1983, 297-302.
- Calvo, Guillermo A. and Fabrizio Coricelli (1992), "Stagflationary Effects of Stabilization Programs in Reforming Socialist Countries: Enterprise-Side vs. Household-Side Factors," *World Bank Economic Review*, 6(1), January 1992, 71-90.
- Cockcroft, Laurence and Roger C. Riddell (1991), "Foreign Direct Investment in Sub-Saharan Africa" (Washington, D.C., International Economics Department, WPS 619: World Bank, March 1991).
- De Gregorio, José, and Pablo E. Guidotti (1993), "Financial Development and Economic Growth" (Washington D.C.: International Monetary Fund, July 1993).
- Dooley, Michael P. (1990), "Comment" in *Taxation in the Global Economy* edited by Assaf Razin and Joel Slemrod (Chicago: University of Chicago Press for the National Bureau of Economic Research, 1990), 74-78.
- Fry, Maxwell J. (1980), "Money, Interest, Inflation and Growth in Turkey," *Journal of Monetary Economics*, 6(4), October 1980, 535-545.
- Fry, Maxwell J. (1993), *Foreign Direct Investment in Southeast Asia: Differential Impacts* (Singapore: Institute of Southeast Asian Studies, 1993).
- Ghartey, Edward E. (1993), "Causal Relationship between Exports and Economic Growth: Some Empirical Evidence in Taiwan, Japan and the U.S.," *Applied Economics*, 25(9), September 1993, 1145-1152.
- Hsiao, Cheng (1979), "Autoregressive Modeling of Canadian Money and Income Data," *Journal of American Statistical Association*, 74(367), September 1979, 553-560.
- Johnston, John (1984), *Econometric Methods*, third edition (New York: McGraw-Hill, 1984).
- Keller, Peter M. (1980), "Implications of Credit Policies for Output and the Balance of Payments," *International Monetary Fund Staff Papers*, 27(3), September 1980, 451-477.

- Meade, James E. (1951), *The Theory of International Economic Policy. Volume 1: The Balance of Payments* (Oxford: Oxford University Press, 1951).
- Montiel, Peter J. (1994), "Capital Mobility in Developing Countries: Some Measurement Issues and Empirical Estimates," *World Bank Economic Review*, 8(3), September 1994, 311-350.
- Odaki, Mitsuhiro (1986), "Tests of Granger Causality by the Selection of the Orders of a Bivariate Autoregressive Model," *Economics Letters*, 22(2-3), 1986, 223-227.
- Turner, Philip (1991), *Capital Flows in the 1980s: A Survey of Major Trends* (Basel: Bank for International Settlements, Monetary and Economic Department, BIS Economic Papers No. 30, 1991).
- Urbain, Jean-Pierre (1989), "Model Selection Criteria and Granger Tests: An Empirical Note," *Economics Letters*, 29(4), 1989, 317-320.
- World Bank (1993), "Global Economic Prospects and the Developing Countries" (Washington, D.C.: World Bank, 1993).

Appendix A-1: Independent and Interdependent Capital Flows.

<i>KA Causes CA CAUSKC</i>	<i>CA Causes KA CAUSCK</i>	<i>Both CAUSB</i>	<i>Neither CAUSN</i>
<i>All Capital Flows Independent</i>			
Greece Kenya Paraguay	Indonesia		Côte d'Ivoire Guatemala
<i>FDI and PI Independent</i>			
Swaziland	Honduras Mexico Panama	Malta	Suriname
<i>FDI and OKF Independent</i>			
Thailand	Uruguay		Colombia Nigeria Saudi Arabia
<i>PI and OKF Independent</i>			
		Algeria	Bolivia Egypt
<i>FDI Independent</i>			
Philippines Tunisia			Zambia
<i>PI Independent</i>			
Costa Rica	Turkey		Barbados Chile El Salvador Malawi Malaysia
<i>OKF Independent</i>			
Mauritius	Portugal		Ecuador Jamaica Sierra Leone Trinidad and Tobago
<i>No Capital Flows Independent</i>			
Argentina Brazil Peru Venezuela	Korea	Rwanda Singapore	Niger South Africa Togo

Appendix A-2: Causality Tests for Current and Capital Accounts Components.

KA Causes CA	CA Causes KA	Bidirectional Causation	
		Capital Flow Causes CA	CA Causes Capital Flow
FDI			
Brazil	Panama	Algeria	Algeria
Costa Rica		Rwanda	Malta
Peru		Singapore	Rwanda
Venezuela			
PI			
Brazil	Uruguay	Malta	Rwanda
Costa Rica		Rwanda	Singapore
Mauritius		Singapore	
Tunisia			
OKF			
Argentina	Korea	Malta	Algeria
Costa Rica	Portugal	Singapore	Malta
Philippines	Turkey		Rwanda
Thailand	Uruguay		

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Foreign Direct Investment, Other Capital Flows, and Current Account Deficits

What Causes What?

Maxwell J. Fry

Stijn Claessens

Peter Burridge

Marie-Christine Blanchet

The more liberal a country's foreign exchange system, the more foreign direct investment is likely to be independent of current account and other capital flows.

Summary findings

Fry, Claessens, Burridge, and Blanchet examine flows of foreign direct investment to 46 developing countries to test whether such flows are autonomous or accommodating *vis-à-vis* the current account and other capital flows.

Using Granger-causality tests, they find that:

- Requirements to surrender export proceeds to the monetary authorities and the existence of special exchange rates for some capital account transactions

reduce the probability that foreign direct investment is independent.

- The more liberal a country's foreign exchange system, the more foreign direct investment is likely to be independent or exogenous.
- Foreign direct investment is associated with a larger increase in capital formation when it is independent than when it is Granger-caused by other capital flows.

This paper — a product of the Debt and International Finance Division, International Economics Department — is part of a larger effort in the department to study the determinants and impact of foreign direct investment. The study was funded by the Bank's Research Support Budget under the research project "Foreign Direct Investment in a Macroeconomic Framework" (RPO 678-15). Copies of this paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Rose Vo, room N3-046, telephone 202-473-3722, fax 202-522-3277, Internet address hvo1@worldbank.org. October 1995. (21 pages)

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Foreign Direct Investment, Other Capital Flows
and Current Account Deficits:
What Causes What?

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1 Introduction

Foreign capital inflows to developing countries constitute part of the world's saving. Over the past two decades, world saving as a proportion of world income has fallen. As world saving has shrunk, so the real interest rate measured in terms of U.S. dollar interest and inflation rates has risen from 0.8 per cent during the period 1971–1978 to 4.8 per cent in the period 1981–1991 (*International Financial Statistics*, CD-ROM, September 1994).¹ It is against this background that foreign direct investment (FDI) has appeared increasingly attractive to developing countries facing declining domestic investment and higher costs of foreign borrowing. Foreign direct investment seems an attractive form of capital inflow because it involves a risk-sharing relationship with the suppliers of this type of foreign capital. This kind of risk sharing does not exist in the formal contractual arrangements for foreign loans. Furthermore, as the World Bank (1993, 3) claims, there may be dynamic benefits: “Foreign direct investment is a large and growing source of finance that may help developing countries close the technology gap with high-income countries, upgrade managerial skills, and develop their export markets.”

Globally, FDI has increased dramatically over the past decade. However, most of this increase has occurred in the industrial countries. In the developing countries, FDI has been heavily concentrated among a small number of countries; over 90 per cent of FDI inflows to developing countries in 1990 was received by only 18 countries. Half of this total flowed to eight Pacific Basin developing market economies (Hong Kong, Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan, and Thailand). Given that neither Korea nor Taiwan has shown strong interest in attracting FDI, it may seem surprising that these economies feature in this group of developing countries. Their appearance in this list may support the view that explicit incentive packages are not the key determinants of FDI flows.

In undertaking any analysis of FDI, one must recognize that FDI data record financial flows which may or may not correspond to changes in capital formation. Whether or not they do depends on (a) the extent of substitutability of this type of financial flow for other types of financial flows and (b) the extent to which FDI crowds out domestically financed

¹The real interest rate is proxied here by the London interbank offered rate on U.S. dollar deposits adjusted for the percentage change in the U.S. GDP deflator. During the period 1992–1995, this real interest rate averaged only 1.5 percent, but has been rising rapidly since 1993 (*World Economic Outlook*, May 1994, 177).

investment. In some of the literature, the view prevails that FDI can serve two purposes, namely, raise investment and relieve foreign exchange shortages.² Unless FDI affects national saving, however, it can raise domestic investment or provide additional financing for a preexisting current account deficit or achieve some combination of the two, but these two effects must always sum to one. In other words, if \$100 FDI increases capital formation by only \$75, it would provide \$25 for additional current-account financing. If it simply substitutes for an alternative type of capital inflow, however, FDI neither raises capital formation nor does it provide additional current-account financing.

This study examines the question of whether FDI to a sample of developing countries substitutes for other capital flows, increases capital formation, or provides additional foreign exchange for balance-of-payments support. Using James Meade's (1951) distinction between autonomous and accommodating capital flows, Philip Turner (1991, 91-95) addresses the question of whether or not net FDI flows are accommodating and hence constitute additional balance-of-payments financing by regressing components of the capital account on the current account financing requirement (both in first differences) for some OECD countries.

Turner's estimated equation takes the form:

$$\Delta KF_i = a_0 + a_1 \Delta KFR, \quad (1)$$

where ΔKF_i is the year-on-year change in the net capital flow item expressed as a percentage of GNP and ΔKFR is the year-on-year change in the current account minus changes in official reserves also expressed as a percentage of GNP (both in current prices). Turner (1991, 92) finds that short-term bank flows are significantly correlated with the current account financing requirement with coefficients ranging from 0.27 (United Kingdom) to 0.88 (Canada) for seven of the 10 OECD countries. In the case of FDI, however, Turner concludes that this flow is much closer to being autonomous than accommodating; the coefficient is significant only in the case of France with a value of only 0.13.

Using Turner's methodology with annual data on net capital flows from *International Financial Statistics* CD-ROM for a sample of 16 developing countries³ for the period 1975-

²For example, Laurence Cockcroft and Roger Riddell (1991, 3) note: "Two of the principal factors inhibiting higher levels of economic growth in Sub-Saharan Africa in the 1990s are low levels of investment and foreign exchange shortages. The first attraction of foreign investment lies in its potential to address both these constraints."

³Argentina, Brazil, Chile, Egypt, India, Indonesia, Korea, Malaysia, Mexico, Nigeria, Pakistan, the Philip-

1990, Fry (1993, 13) finds a rather different response pattern in developing countries. In contrast to the OECD countries, other long-term capital flows appear to be just as sensitive to current account financing requirements as short-term flows in this sample of developing countries. For these countries, therefore, one might rank portfolio investment as the most autonomous, FDI or capital inflows to the public sector next, and both long- and short-term bank loans as the most accommodative type of capital flow.

All but one of the estimated coefficients for FDI are less than 0.1. Even in the case where FDI is most accommodative (Malaysia), the coefficient is still only 0.14. On the basis of these estimates, therefore, FDI appears to be autonomous on Turner's criterion. The negative coefficients of FDI in India and Korea (Fry 1993, 13), and in the United Kingdom (Turner 1991, 92) may reflect the deterrent effect of increasing current account deficits on FDI inflows, since large current account deficits can worsen a country's investment climate. This would also support the view that FDI inflows are largely unrelated to balance-of-payments financing requirements. However, it does suggest that FDI should be treated as endogenous to a country's saving-investment process.

Unfortunately, Turner's technique is seriously flawed. First, with enough substitutability between alternative types of capital inflows, there may be no bivariate correlation between any of the components and the overall current account financing requirement. Indeed, Fry's (1993, 13) results indicate that this is the case for Egypt, Nigeria, and the Philippines. Out of 80 regressions, only 12 yield significant coefficients at the 95 per cent confidence level. Fry's findings support Michael Dooley's (1990, 75) assertion that financial flow variables such as FDI have far too high degrees of substitutability to provide any useful analytical information. Second, the bivariate regressions fail to establish causality. To explore these issues, this paper presents Granger-causality tests to examine not only the direction of causation between current and capital account imbalances but also between current account and three components of the capital account, FDI, portfolio investment (PI), and other capital flows (OKF). Whether or not substitutability and fungibility are so high that FDI flows provide no relevant economic information at all is an empirical question.

pines, Sri Lanka, Thailand, Turkey, and Venezuela.

2 Granger-Causality in the Balance of Payments

Our first question is whether current account imbalances Granger-cause capital account imbalances or *vice versa*. To answer this question, we use an error-correction model (ECM) with one lag. For the long-run analysis conducted here, we ignore errors and omissions in the balance-of-payments accounts and assume that the desired level of international reserves is zero. Hence, the balance of payments on current account is equal and opposite to the balance of payments on capital account. Since changes in international reserves are a disequilibrium phenomenon, we use them as an error-correction term.

So that all countries can be treated in a uniform manner, we assume that international reserves are stationary with a constant long-run equilibrium ratio to GNP. Hence, the previous period's reserve balance can be treated as the disequilibrium term in an ECM of the form:

$$\Delta CA_t = a + b(CA_{t-1} + KA_{t-1}) + \sum_{i=1}^m c_i \Delta CA_{t-i} + \sum_{j=1}^n d_j \Delta KA_{t-j} + u, \quad (2)$$

where CA is the current account and KA is the capital account. The term $CA_{t-1} + KA_{t-1}$, the lagged change in official reserves, is the error-correction mechanism. The rationale is that, if there are co-movements in CA and KA , they should be equilibrating in the long run.⁴ This leads to a causality test based on the significance of either the coefficient b or the coefficients d_j . When KA is substituted for CA as the dependent variable, the relevant coefficients are b and c_i .

We faced a choice between examining quarterly data for a small sample or annual data for a larger sample of developing countries. From a total of 115 developing countries for which some balance-of-payments data were available, we selected an initial sample of 75 developing countries that had experienced FDI inflows of at least half a percent of GNP for at least five years over the period 1970–1992. Data deficiencies reduced this sample to 46 countries with annual data and only 14 countries with quarterly data. We chose the larger country sample,

⁴Peter Montiel (1994, 329) makes a similar point about the relationship between national saving, domestic investment, and the current account: "The current account provides the resources with which a country repays its external creditors. Solvency thus imposes a constraint that prevents deviations between national saving and investment from becoming permanent. Because gaps between saving and investment must eventually be reversed for the country to remain solvent, sufficient observations should show these two series to be cointegrated." In this case, the lagged current account is the error-correction mechanism that equilibrates saving and investment in the long run.

Table 1: Granger-Causality Tests for Current (CA) and Capital (KA) Accounts, 1970–1992.

<i>KA Causes CA</i> <i>CAUSKC</i>	<i>CA Causes KA</i> <i>CAUSCK</i>	Neither <i>CAUSN</i>
Algeria	Algeria	Bolivia
Argentina	Honduras	Barbados
Brazil	Indonesia	Chile
Costa Rica	Korea	Côte d'Ivoire
Greece	Malta	Colombia
Kenya	Mexico	Ecuador
Malta	Panama	Egypt
Mauritius	Portugal	El Salvador
Paraguay	Rwanda	Guatemala
Peru	Singapore	Jamaica
Philippines	Turkey	Malawi
Rwanda	Uruguay	Malaysia
Singapore		Niger
Swaziland		Nigeria
Thailand		Saudi Arabia
Tunisia		Sierra Leone
Venezuela		South Africa
		Suriname
		Togo
		Trinidad and Tobago
		Zambia

which meant that a wider search for possible ECM forms was not feasible. For the same reason, we use only one lag for $\sum_{i=1}^m c_i \Delta CA_{t-i}$ and $\sum_{j=1}^n d_j \Delta KA_{t-j}$. In other words, we set both i and j equal to one.

Table 1 shows the results of the initial Granger-causality tests between the current and capital account over the period 1970–1992. Both variables are expressed as proportions of GNP. The capital account Granger-causes current account imbalances in 13 countries and

we detect the opposite direction of causation in eight countries. In four countries Granger-causation goes both ways, while no causality is detected in the remaining 21 countries.

The second question we address here is whether disaggregated capital flows are interdependent or independent. Interdependence means that one or more other capital flows Granger-cause this particular capital flow. Independence means that neither of the other capital flows exerts any causal influence. If the capital account Granger-causes the current account, all three capital flows may be independent and hence could Granger-cause the current account imbalance. However, it is also possible that high substitutability ensures that all three capital flows are interdependent and that no individual capital flow Granger-causes the current account imbalance. There are six additional possibilities: any one of the three capital flows may be independent or two capital flows in any of the three combinations may be independent. Hence, eight different Granger-causality results can occur among the components if the capital account Granger-causes the current account. If the current account Granger-causes the capital account, the same eight results are possible. The current account imbalance may influence all three flows, two flows, one flow, or no individual flow at all because of high substitutability. In other words, all capital flows or no capital flow can be independent.

In testing for causality within and between components of *CA* and *KA*, there is no natural measure of disequilibrium. Hence, we adopt a form of the procedure advocated by Cheng Hsiao (1979), and elaborated by Mitsuhiro Odaki (1986) and Edward Ghartey (1993). Using the finding by Jean-Pierre Urbain (1989) that the Schwartz information criterion performs relatively well in small samples, we use it to determine lag length in the Hsiao procedure described below.

First, we test all component series for unit roots. If either y or x were found to be nonstationary, we employ the Hsiao procedure using the appropriate level of differencing. The Hsiao procedure starts by assuming a maximum possible order $p_{\max}$ for the unrestricted VAR linking the variables under investigation; we chose $p_{\max} = 4$. Univariate $AR(p)$ models, $p = 1, \dots, p_{\max}$ are then fitted to y ; the lag length p^y that minimizes the chosen information criterion is selected. This minimized value is denoted $SBC_y(p^y, 0)$. Now lags p^x of the variable x that could be causal are added in sequence up to lag p^y . If the minimum of the corresponding $SBC_{yx}(p^y, p^x)$ lies below $SBC_y(p^y, 0)$, we conclude that x causes y since the optimum model for predicting y contains p^y lags of y and $p^x > 0$ lags of x .

This procedure can be generalized to more than two variables to control for covariates as advocated by Ghartey (1993). However, constraints on degrees of freedom prevent us from testing a multivariate model. Hence, the results reported below in Table 2 and Appendix A-1 and A-2 are based on bivariate equations only.

Table 2 shows the key part of the second-stage estimation results concerning FDI; the full results are presented in Appendix A-1. Even where the capital account Granger-causes the current account, all three capital flows are interdependent in four countries (Argentina, Brazil, Peru, and Venezuela). Conversely, all three capital flows are independent in Indonesia, where the current account Granger-causes the capital account. Of central relevance to this study is the finding that FDI is independent of other capital flows in 20 of the 46 countries.

The third question is whether or not there is any Granger-causality between one of the disaggregated capital flows—FDI, PI, and OKF—and the current account or *vice versa*. Countries with no Granger-causation between current and capital accounts are excluded. For countries with Granger-causation running from the capital account to the current account, we test Granger-causality from each capital flow to the current account. For countries with Granger-causation running from the current account to the capital account, we test Granger-causality from the current account to each capital flow. Finally, for countries with bidirectional Granger-causality, we run combined tests of Granger-causality from and to each capital flow to and from the current account. The full results are presented in Appendix A-2. They show that FDI Granger-causes the current account in seven countries (Algeria, Brazil, Costa Rica, Peru, Rwanda, Singapore, and Venezuela) and is Granger-caused by the current account in four countries (Algeria, Malta, Panama, and Rwanda).

3 Explaining Causality Results

The results reported in Tables 1 and 2 display no evident patterns or country groupings. A cursory inspection indicates that these classifications bear no relation to either location or per capita income. However, there may be some feature or features of a country's economy, specifically of its balance-of-payments regime, that are associated with particular causal patterns. To investigate such possibilities, we ran logit and probit regressions to explain the causal variables. The four dependent variables we examine are *CAUSKC* for the capital account Granger-causing the current account, *CAUSCK* for the current account Granger-causing the capital account, *CAUSN* for no Granger-causation between the capital and current

Table 2: Independent and Interdependent Foreign Direct Investment.

FDI Independent	FDI Interdependent
Colombia	Algeria
Côte d'Ivoire	Argentina
Greece	Barbados
Guatemala	Bolivia
Honduras	Brazil
Indonesia	Chile
Kenya	Costa Rica
Malta	Ecuador
Mexico	Egypt
Nigeria	El Salvador
Panama	Jamaica
Paraguay	Korea
Philippines	Malawi
Saudi Arabia	Malaysia
Suriname	Mauritius
Swaziland	Niger
Thailand	Peru
Tunisia	Portugal
Uruguay	Rwanda
Zambia	Sierra Leone
	Singapore
	South Africa
	Togo
	Trinidad and Tobago
	Turkey
	Venezuela

Table 3: Potential Explanatory Variables for Direction of Balance-of-Payments Causation.

<i>RESC</i>	- Article XIV status
<i>RESD</i>	- Special rates for some or all capital transactions and/or some or all invisibles
<i>RESE</i>	- More than one exchange rate for imports
<i>RESF</i>	- More than one exchange rate for exports
<i>RESG</i>	- Restrictions on current account payments
<i>RESH</i>	- Restrictions on capital account payments
<i>RESI</i>	- Import surcharges
<i>RESJ</i>	- Advance import deposits
<i>RESK</i>	- Surrender of export proceeds required
<i>PCY</i>	- Natural logarithm of per capita income in U.S. dollars
<i>YG</i>	- Rate of growth in real GNP
<i>INF</i>	- Inflation (continuously compounded rate of change in GNP deflator)
<i>OPEN</i>	- Exports plus imports as a proportion of GNP
<i>FLY</i>	- Cumulated current account deficit as proportion of GNP
<i>DETY</i>	- Foreign debt as a proportion of GNP
<i>GBLY</i>	- Government deficit (-) as a proportion of GNP
<i>DCGR</i>	- Net domestic credit to the government as a proportion of total domestic credit
<i>DCGY</i>	- Net domestic credit to the government as a proportion of GNP
<i>BLA</i>	- Black market exchange rate premium
<i>RR</i>	- Square of real interest rate
<i>DCPY</i>	- Domestic credit to the private sector as a proportion of GNP

account, and *FDIX* for FDI being independent or exogenous. These variables take a value of 1 when a country exhibits the particular Granger-causation specified and 0 when it does not. Since there were only four countries with bidirectional Granger-causation, these were treated as positive for both *CAUSKC* and *CAUSCK*.

The potential explanatory variables are listed in Table 3. The first set of explanatory variables consist of balance-of-payments restriction variables reported annually at the back of the International Monetary Fund's *Balance of Payments Yearbook*. The variables *RESC*

to *RESK* take a value of 1 if the practice exists and 0 otherwise.

An informal principal components-type aggregation suggests that these variables might be meaningfully summed in various combinations. Specifically:

$$RESU = RESC + RESD + RESE + RESF + RESG + RESH + RESI + RESJ + RESK; \quad (3)$$

$$RESV = RESD + RESE + RESF; \quad (4)$$

$$RESW = RESG + RESH; \quad (5)$$

$$RESX = RESI + RESJ + RESK; \quad (6)$$

$$RESY = RESI + RESJ; \quad (7)$$

$$RESZ = RESG + RESI. \quad (8)$$

The remaining explanatory variables include per capita income, real GNP growth, inflation, the openness of the economy, two foreign debt variables, three measures of the government's domestic borrowing requirements, and three indicators of distortions in the domestic economy. The three indicators of domestic distortions are the black market exchange rate premium *BLA*, used as a proxy for the degree of foreign exchange liberalization, the square of the real rate of interest *RR*, an indicator of the extent of financial repression or financial distortion, and the ratio of private sector domestic credit to GNP *DCPY*, another indicator of financial repression.

The functional form for the real interest rate follows a claim by José De Gregorio and Pablo Guidotti (1992) that real interest rates are not a good indicator of financial repression or distortion. Appealing to work by Guillermo Calvo and Fabrizio Coricelli (1991), they suggest that the relationship between real interest rates and economic growth might resemble an inverted *U*-curve: "Very low (and negative) real interest rates tend to cause financial disintermediation and hence tend to reduce growth, as implied by the McKinnon-Shaw hypothesis. ... On the other hand, very high real interest rates that do not reflect improved efficiency of investment, but rather a lack of credibility of economic policy or various forms of country risk, are likely to results in a lower level of investment as well as a concentration in excessively risky projects" (De Gregorio and Guidotti 1992, 9). For this reason, De Gregorio and Guidotti abandon real interest rates in favor of domestic credit to the private sector divided by GNP *DCPY*.

Since there are 46 observations for each Granger-causation variable in Tables 1 and 2, we chose for each country two alternative values for each variable listed in Table 3. The first is the value in 1970 at the start of the observation period, the second is the average value throughout the period 1970–1992. As no variable measured at its 1970 value provided any predictive power, we report only estimates using average values.

The significant bivariate associations using these measures are shown in Table 4.⁵ On the one hand, higher levels of both foreign and domestic indebtedness reduce the probability of causation running from capital to current accounts and increase the probability that there is no causation. On the other hand, a high rate of economic growth increases the probability of causation running from current to capital account, while reducing the probability that there is no causation. A higher ratio of private sector credit to GNP also increases the probability of causation running from current to capital account.

The existence of restrictions on capital account payments reduces the probability of causation running from current to capital accounts. The existence of special exchange rates for some capital account transactions reduces the probability that FDI is independent. Finally, the probabilities of causation running from current to capital accounts and of FDI being independent of the current account are reduced in countries where export proceeds must be surrendered to the monetary authorities. Table 4 suggests that the more liberal is a country's foreign exchange system, the more likely is FDI to be exogenous or independent.

4 Foreign Direct Investment and Capital Formation

Where FDI is not independent but Granger-caused by other capital inflows, one might reasonably assume that FDI inflows would be less likely to increase capital formation than in the case where FDI is independent. Hence we now estimate the impact of FDI on domestic investment for countries in which FDI is independent and for countries in which FDI is interdependent.

The investment function specified here in terms of the ratio of investment to GNP is based on the flexible accelerator model. Mario Blejer and Mohsin Khan (1984, pp. 382–383) describe some of the difficulties of estimating neoclassical investment functions for developing

⁵Multivariate estimates produced similar results, but multicollinearity considerably reduced coefficient precision.

Table 4: Determinants of Causality.

Dependent Variable	Logit Model			Probit Model		
	Constant	Explanatory Variable	Count R^2	Constant	Explanatory Variable	Count R^2
<i>CAUSKC</i>	1.139 (1.338)	-3.569(<i>DETY</i>) (-2.001)	0.683	0.700 (1.356)	-2.184(<i>DETY</i>) (-2.090)	0.683
<i>CAUSKC</i>	0.316 (0.594)	17.524(<i>GBLY</i>) (1.785)	0.644	0.195 (0.591)	10.728(<i>GBLY</i>) (1.844)	0.644
<i>CAUSCK</i>	-2.902 (-3.173)	6.171(<i>DCPY</i>) (2.322)	0.804	-1.669 (-3.441)	3.511(<i>DCPY</i>) (2.362)	0.804
<i>CAUSCK</i>	-2.397 (-2.843)	33.793(<i>YG</i>) (1.899)	0.783	-1.438 (-3.037)	20.203(<i>YG</i>) (1.936)	0.783
<i>CAUSCK</i>	0.180 (0.234)	-1.620(<i>RESH</i>) (-1.704)	0.761	0.107 (0.224)	-0.982(<i>RESH</i>) (-1.707)	0.761
<i>CAUSCK</i>	1.391 (1.110)	-2.809(<i>RESK</i>) (-2.021)	0.783	0.799 (1.136)	-1.661(<i>RESK</i>) (-2.140)	0.783
<i>CAUSN</i>	1.213 (1.811)	-38.535(<i>YG</i>) (-2.301)	0.696	0.747 (1.840)	-23.518(<i>YG</i>) (-2.390)	0.696
<i>CAUSN</i>	-1.137 (-1.988)	2.348(<i>FLY</i>) (1.880)	0.622	-0.706 (-2.036)	1.462(<i>FLY</i>) (1.932)	0.622
<i>CAUSN</i>	-1.910 (-2.336)	3.255(<i>DETY</i>) (2.186)	0.732	-1.170 (-2.435)	2.004(<i>DETY</i>) (2.273)	0.732
<i>CAUSN</i>	-1.073 (-1.944)	-16.881(<i>GBLY</i>) (-1.870)	0.622	-0.670 (-1.998)	-10.609(<i>GBLY</i>) (-1.918)	0.622
<i>FDIX</i>	0.265 (0.670)	-1.985(<i>RESD</i>) (-1.915)	0.587	0.164 (0.667)	-1.220(<i>RESD</i>) (-1.993)	0.587
<i>FDIX</i>	1.947 (1.394)	-2.467(<i>RESK</i>) (-1.654)	0.630	1.216 (1.465)	-1.542(<i>RESK</i>) (-1.732)	0.630

countries. Without data on the capital stock and the return to capital, there is little choice in practice but to use some version of the accelerator model.

The accelerator model has the desired capital stock K^* proportional to real output y :

$$K^* = \alpha y. \quad (9)$$

This can be expressed in terms of a desired ratio of net investment to output $(I/Y)^*$:

$$(I/Y)^* = \alpha \gamma, \quad (10)$$

where γ is the rate of growth in output denoted YG in the regression equation.

The partial adjustment mechanism specified for the investment *ratio* is somewhat more complicated than the equivalent mechanism for the *level* of investment. Specifically, there could be a lag in achieving the same investment ratio this year as last year if output rose rapidly last year; this year's desired investment *level* will be higher than last year's, despite a constant desired *ratio* of investment to output. To incorporate this adjustment lag, last year's growth rate γ_{t-1} can be included as an explanatory variable. In this case, however, the coefficient of γ_{t-1} was insignificant; hence, γ_{t-1} is omitted from the estimate.

The remaining adjustment mechanism allows the actual investment ratio to adjust partially in any one period to the difference between the desired investment ratio and the investment ratio in the previous period:

$$\Delta(I/Y) = \lambda[(I/Y)^* - (I/Y)_{t-1}] \quad (11)$$

or

$$I/Y = \lambda(I/Y)^* + (1-\lambda)(I/Y)_{t-1}, \quad (12)$$

where λ is the coefficient of adjustment.

The flexible accelerator model allows economic conditions to influence the adjustment coefficient λ . Specifically,

$$\lambda = \beta_0 + \left[\frac{\beta_1 z_1 + \beta_2 z_2 + \beta_3 z_3 + \dots}{(I/Y)^* - (I/Y)_{t-1}} \right], \quad (13)$$

where z_i are the variables that affect λ . Since one of these variables can be an intercept term for the depreciation rate, the flexible accelerator model can be estimated for the gross rather than the net investment ratio.

A simple specification search suggests that, for the 46 developing countries analyzed here, the speed of adjustment is determined by the ratio of FDI inflows to GNP FDI/Y , the lagged

real exchange rate index expressed in natural logarithms $REXL_{t-1}$,⁶ the lagged cumulated net foreign liabilities converted into domestic currency and divided by lagged GNP FLY_{t-1} , and credit availability as measured by the change in domestic credit divided by GNP $DDCY$.

The price of intermediate imports may affect the profitability of investment projects in these developing countries. Hence, the real exchange rate expressed in natural logarithms $REXL$ is included as a proxy for the price of nontradable goods in relation to import prices. We measure the real exchange rate REX as (domestic GNP deflator/U.S. wholesale price index)/domestic currency per U.S. dollar. Therefore, a higher value of $REXL$ implies a lower relative price of imports. By appreciating the real exchange rate, capital inflows may stimulate investment. On the other hand, an appreciation in the real exchange rate prices exports out of world markets and may worsen the investment climate. Hence, its effect on investment is ambiguous.

Effective domestic costs of borrowing are extraordinarily difficult to measure in almost all developing countries because of selective credit policies and disequilibrium institutional interest rates; hence the quantity rather than the price of credit is used here. The availability of institutional credit can be an important determinant of the investment ratio, for the reasons discussed by Alan Blinder and Joseph Stiglitz (1983), Fry (1980) and Peter Keller (1980). Banks specialize in acquiring information on default risk. Such information is highly specific to each client and difficult to sell. Hence, the market for bank loans is a customer market, in which borrowers and lenders are very imperfect substitutes. A credit squeeze rations out some bank borrowers who may be unable to find loans elsewhere and so be unable to finance their investment projects (Blinder and Stiglitz 1983, p. 300). Here, therefore, the investment ratio is influenced by the change in total domestic credit scaled by GNP $DDCY$.

The variable FLY_{t-1} is included as a proxy for the effective domestic real interest rate. If a buildup of foreign indebtedness makes foreign lenders more reluctant to lend, the effective domestic real interest rate rises and so deters investment (Fry 1993).

The regression method used here is iterative three-stage least squares which is, asymptotically, full-information maximum likelihood (Johnston 1984, pp. 486-492). We estimate the 46 individual country investment equations as two systems of equations with cross-equation equality restrictions on all coefficients except the intercept. Hence, the estimates apply to a representative member of these samples of developing countries. The estimation technique

⁶The variable $REXL$ is divided by 10 for scaling purposes in the regression estimates.

corrects for heteroscedasticity across country equations and exploits contemporaneously correlated disturbances. The instruments are the exogenous explanatory variables plus the lagged FDI ratio, lagged domestic credit expansion divided by GNP, the lagged terms-of-trade index in natural logarithms, lagged growth, the public sector borrowing requirement divided by GNP, the world real interest rate, oil price inflation, and the rate of growth (continuously compounded) in OECD output. The estimation period is 1970–1991 and the dependent variable IY is gross domestic investment divided by GNP at current prices.

The first estimate is for the 20 countries in which FDI is independent (354 observations):⁷

$$\begin{aligned}
 IY = & 0.635 \widehat{FDIY} - 0.010 FLY_{t-1} + 0.525 \widehat{DDCY} \\
 & (10.548) \quad (-2.933) \quad (34.128) \\
 & + 0.037 REXL_{t-1} + 0.386 \widehat{YG} + 0.640 IY_{t-1}. \\
 & (10.575) \quad (27.781) \quad (44.593) \\
 R^2 = & 0.613 \quad DW = 1.92
 \end{aligned} \tag{14}$$

The corresponding estimate for the 26 countries with interdependent FDI is (513 observations):

$$\begin{aligned}
 IY = & 0.129 \widehat{FDIY} - 0.028 FLY_{t-1} + 0.003 \widehat{DDCY} \\
 & (8.996) \quad (-26.451) \quad (0.596) \\
 & - 0.012 REXL_{t-1} + 0.174 \widehat{YG} + 0.658 IY_{t-1}. \\
 & (-7.601) \quad (29.339) \quad (73.026) \\
 R^2 = & 0.806 \quad DW = 2.10
 \end{aligned} \tag{15}$$

The coefficient of $FDIY$, the ratio of FDI to GNP, is not only substantially but also significantly higher for the country group in which FDI is independent of other balance-of-payments flows than it is for the country group in which FDI is Granger-caused by some other balance-of-payments flow. Hence, these estimates support our assumption that Granger-caused FDI inflows are less likely to affect capital formation than independent FDI inflows.

⁷Saudi Arabia and Suriname were dropped because of data deficiencies, so reducing the number of countries in this estimate to 18.

5 Conclusion

In this paper, we have examined the question of whether capital flows, particularly inflows of foreign direct investment, Granger-cause current account deficits or *vice versa*. The initial results produce considerable diversity. While Granger-causality runs from capital to current accounts in some countries, it runs from current to capital accounts in others. We detect bidirectional Granger-causality in some countries and no causality at all in others. Within the capital account, three types of capital flows are Granger-caused by other flows in some countries, while all three are independent of movements in other capital and current-account flows in others. The six other possible combinations of Granger-causality among the three types of capital flows are all detected. There are no signs of any predominant tendencies among this sample of 46 developing countries.

Nevertheless, we are able to find variables that can predict the direction of Granger-causality. High levels of both foreign and domestic indebtedness reduce the likelihood that the capital account Granger-causes the current account and increase the likelihood of no causality. Conversely, a high rate of economic growth raises the likelihood that the current account Granger-causes the capital account and reduces the likelihood of no causality. A higher ratio of private sector credit to GNP also increases the probability of causation running from current to capital account.

The existence of restrictions on capital account payments reduces the probability of causation running from current to capital accounts. The existence of special exchange rates for some capital account transactions reduces the probability that FDI is independent. Finally, the probabilities of causation running from current to capital accounts and of FDI being independent of the current account are reduced in countries where export proceeds must be surrendered to the monetary authorities. The empirical results suggest that the more liberal is a country's foreign exchange system the more likely is FDI to be exogenous or independent.

Finally, we find that when FDI is independent of other balance-of-payments flows it increases capital formation in the host country by considerably more than it does when FDI is Granger-caused by some other balance-of-payments flow. This finding is consistent with our interpretation of the Granger-causality tests. Although FDI could still crowd out domestically financed investment even if it were independent, we find that the majority of independent FDI increases capital formation; for each \$100 in FDI capital formation is increased by \$64. On the other hand, endogenous or interdependent FDI raises capital formation by only \$13

for every \$100 FDI inflow.

References

- Blejer, Mario I. and Mohsin S. Khan (1984), "Government Policy and Private Investment in Developing Countries," *International Monetary Fund Staff Papers*, 31(2), June 1984, 379-403.
- Blinder, Alan S. and Joseph E. Stiglitz (1983), "Money, Credit Constraints, and Economic Activity," *American Economic Review*, 73(2), May 1983, 297-302.
- Calvo, Guillermo A. and Fabrizio Coricelli (1992), "Stagflationary Effects of Stabilization Programs in Reforming Socialist Countries: Enterprise-Side vs. Household-Side Factors," *World Bank Economic Review*, 6(1), January 1992, 71-90.
- Cockcroft, Laurence and Roger C. Riddell (1991), "Foreign Direct Investment in Sub-Saharan Africa" (Washington, D.C., International Economics Department, WPS 619: World Bank, March 1991).
- De Gregorio, José, and Pablo E. Guidotti (1993), "Financial Development and Economic Growth" (Washington D.C.: International Monetary Fund, July 1993).
- Dooley, Michael P. (1990), "Comment" in *Taxation in the Global Economy* edited by Assaf Razin and Joel Slemrod (Chicago: University of Chicago Press for the National Bureau of Economic Research, 1990), 74-78.
- Fry, Maxwell J. (1980), "Money, Interest, Inflation and Growth in Turkey," *Journal of Monetary Economics*, 6(4), October 1980, 535-545.
- Fry, Maxwell J. (1993), *Foreign Direct Investment in Southeast Asia: Differential Impacts* (Singapore: Institute of Southeast Asian Studies, 1993).
- Ghartey, Edward E. (1993), "Causal Relationship between Exports and Economic Growth: Some Empirical Evidence in Taiwan, Japan and the U.S.," *Applied Economics*, 25(9), September 1993, 1145-1152.
- Hsiao, Cheng (1979), "Autoregressive Modeling of Canadian Money and Income Data," *Journal of American Statistical Association*, 74(367), September 1979, 553-560.
- Johnston, John (1984), *Econometric Methods*, third edition (New York: McGraw-Hill, 1984).
- Keller, Peter M. (1980), "Implications of Credit Policies for Output and the Balance of Payments," *International Monetary Fund Staff Papers*, 27(3), September 1980, 451-477.

- Meade, James E. (1951), *The Theory of International Economic Policy. Volume 1: The Balance of Payments* (Oxford: Oxford University Press, 1951).
- Montiel, Peter J. (1994), "Capital Mobility in Developing Countries: Some Measurement Issues and Empirical Estimates," *World Bank Economic Review*, 8(3), September 1994, 311-350.
- Odaki, Mitsuhiro (1986), "Tests of Granger Causality by the Selection of the Orders of a Bivariate Autoregressive Model," *Economics Letters*, 22(2-3), 1986, 223-227.
- Turner, Philip (1991), *Capital Flows in the 1980s: A Survey of Major Trends* (Basel: Bank for International Settlements, Monetary and Economic Department, BIS Economic Papers No. 30, 1991).
- Urbain, Jean-Pierre (1989), "Model Selection Criteria and Granger Tests: An Empirical Note," *Economics Letters*, 29(4), 1989, 317-320.
- World Bank (1993), "Global Economic Prospects and the Developing Countries" (Washington, D.C.: World Bank, 1993).

Appendix A-1: Independent and Interdependent Capital Flows.

<i>KA Causes CA CAUSKC</i>	<i>CA Causes KA CAUSCK</i>	<i>Both CAUSB</i>	<i>Neither CAUSN</i>
<i>All Capital Flows Independent</i>			
Greece Kenya Paraguay	Indonesia		Côte d'Ivoire Guatemala
<i>FDI and PI Independent</i>			
Swaziland	Honduras Mexico Panama	Malta	Suriname
<i>FDI and OKF Independent</i>			
Thailand	Uruguay		Colombia Nigeria Saudi Arabia
<i>PI and OKF Independent</i>			
		Algeria	Bolivia Egypt
<i>FDI Independent</i>			
Philippines Tunisia			Zambia
<i>PI Independent</i>			
Costa Rica	Turkey		Barbados Chile El Salvador Malawi Malaysia
<i>OKF Independent</i>			
Mauritius	Portugal		Ecuador Jamaica Sierra Leone Trinidad and Tobago
<i>No Capital Flows Independent</i>			
Argentina Brazil Peru Venezuela	Korea	Rwanda Singapore	Niger South Africa Togo

Appendix A-2: Causality Tests for Current and Capital Accounts Components.

KA Causes CA	CA Causes KA	Bidirectional Causation	
		Capital Flow Causes CA	CA Causes Capital Flow
FDI			
Brazil	Panama	Algeria	Algeria
Costa Rica		Rwanda	Malta
Peru		Singapore	Rwanda
Venezuela			
PI			
Brazil	Uruguay	Malta	Rwanda
Costa Rica		Rwanda	Singapore
Mauritius		Singapore	
Tunisia			
OKF			
Argentina	Korea	Malta	Algeria
Costa Rica	Portugal	Singapore	Malta
Philippines	Turkey		Rwanda
Thailand	Uruguay		

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