The relationship between capital flows and current account: volatility and causality

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Abstract

This paper examines the relationship between net private capital inflows and the current account in a set of industrial and developing countries. The first question asks whether the cyclical volatility in current accounts can be explained by the volatility of capital flows. The second question addresses the causal link between net capital inflows and current account imbalances. There is evidence in our data that inflows do cause current account imbalances in the developing countries. In contrast, the evidence implies that inflows do not cause current account imbalances in the industrial countries, nor does the inflow volatility affect current account volatility.

JEL classification: F32; F21

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1. Introduction

This paper examines the relationship between net private capital inflows and the current account in a set of industrial and developing countries. International capital flows among industrial countries soared in the 1980s, and the flows from industrial to developing countries resumed their pre-debt crisis levels in the 1990s. This surge in international capital flows to developing countries coincided with widening current account deficits in many of these countries. Running large current account deficits also became common among industrial countries. Australia, New Zealand, Portugal and the US have been running large current account deficits for the most part of the 1990s. At the end of 2000, the US current account deficit reached to $415.5 billion, equivalent to 4.5 percent of US GDP (IMF, 2001). The empirical evidence suggests that inflows are increasingly used to finance current account deficits in some developing countries, and reversals in current accounts are often accompanied by reversals in international capital inflows[1].

Theoretical models of capital flows and empirical evidence suggest that while foreign capital can stimulate growth, smooth consumption, provide portfolio diversification and productive efficiency, they also incur some costs[2]. Free flow of capital possibly comes at the cost of increased contagion, monetary instability and a

[1] Milesi-Ferretti and Razin (1996, 1998, 1999) study the probability of a crisis in the face of current account reversals, which are often associated with reversals in capital flows.
[2] The theoretical benefits from capital flows were based on a benchmark of perfect capital mobility as was assumed in neoclassical trade and economic growth theories.

loss of independence on domestic policies[3]. Calvo et al. (1996) argue that widening current account deficits is one of the less desirable macroeconomic effects of large capital inflows to the debtor countries. In the first half of the 1990s, larger shares of capital inflows were allocated to reserve accumulation in developing countries[4]. Recent trends indicate that reserve accumulation is slowing as an increasing proportion of capital flows is financing current account deficits (IMF, 2001).

Current account imbalances are not strictly a phenomenon of the 1990s. Following the oil price shocks in the 1970s, there have been large swings in the current account balances of most countries. Persistent current account deficits raised concern over their sustainability. The empirical evidence suggested that while some countries such as Ireland, Australia, Israel, Malaysia and South Korea were able to sustain large current account deficits for many years, other countries such as Chile and Mexico suffered severe losses[5]. Excessive current account deficits in crisis countries were also a prevalent feature of the 1997 Asian crisis.

Large private capital inflows may affect the behaviour of the current account through their effect on savings and investment. Current account imbalances are caused by a mismatch between savings and investment. Periods of large capital inflows are generally accompanied by increased rates of investment. If international capital inflows are used to increase investment, assuming savings remain stable, this may imply an increase in the current account deficit. When capital flows are reversed,

[3] See, for example, Calvo et al. (1996), and Goldstein et al. (1994) for a discussion on trends in capital flows in 1990s and costs and benefits from them.
[4] From 1990 to 1994, the share of capital flows that were accumulated in reserves was 59 percent in Asia and 35 percent in Latin America (Calvo et al. 1996).
[5] See Milesi-Ferretti and Razin (1996).

there may be sharp reductions (or reversals) in the current account, as well as macroeconomic costs[6].

The first question addressed in this paper is whether cyclical volatility in net inflows has any effect on current account volatility. Using panel fixed-effect regression analysis, the volatility of the capital flows and the current account in a set of industrial and developing countries are examined. The second question addressed is whether capital flows cause current account imbalances. As a first step, cointegration techniques are used to establish whether capital inflows and current account imbalances are related. The direction of causality is then tested by standard Granger causality tests and causality tests on ECM (error correction model). Finally, cointegrating regressions are estimated between the current account imbalances and net inflows.

The remainder of this paper is organized as follows. Section 2 provides the theoretical and empirical background for the relationship between capital flows and the current account. Section 3 examines the (unconditional) volatility of the current account and the components of the capital account for individual countries. Section 4 presents the results of the panel fixed-effects data estimation. Section 5 addresses the question whether capital flows cause current account imbalances by using cointegration and causality tests, and estimates cointegrating regressions for the countries where the causality runs from inflows to the current account. Section 6 concludes.

[6] See Hutchison and Noy (2002) for output costs of sudden-stop crises, and see IMF (1999), Claessens et al.(1995); Sarno and Taylor (1997); Bacchetta and Wincoop (1998) for volatility in capital flows.

2. Theoretical and Empirical Background

In a closed economy, the current account balance is zero, as savings must equal investment. In open economies, however, domestic agents can borrow or lend in international capital markets in the face of shocks to income and smooth consumption. Savings can be allocated to accumulating domestic assets or foreign assets, and investment can be financed by accumulating domestic assets or by issuing foreign liabilities. The resultant current account deficit is the outcome of an intertemporal decision of consumption and saving in an open economy with capital mobility, in the tradition of Irving Fisher (Calvo et al. 1996).

Calvo et al. (1996) argue that the effect of capital inflows on the current account can be derived from standard open economy models, such as Irving Fisher's model. In such a model, a fall in interest rate will induce income and substitution effects, for debtor countries, which results in a consumption boom and a widening in the current account deficit. For capital-importing countries, a decline in interest rates reduces the present value of its debt and also makes further borrowing cheaper. Thus, standard open economy models suggest that increased capital inflows are likely to be accompanied by a rise in consumption and investment, and a widening in the current account[7]. This effect of capital inflows is similar to the effect of a decrease in interest rates.

These models imply that investment and saving, and ultimately the current account balance, may depend on capital flows. It is also likely that the capital inflows a country receives are endogenously determined by its macroeconomic fundamentals. There are some studies such as the well-known study by Feldstein and Horioka (1980)

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[7] Calvo and Vegh (1993) offer an alternative approach with a focus on monetary economy with similar implications.

that derive conclusions on international capital mobility from theories on the current account. Since widening current account deficits were usually accompanied with increased investment and a fall the in rate of savings, this was accepted as a sign of the high integration of capital markets. Feldstein and Horioka (1980) interpreted the slope coefficient of a regression of investment on savings as a measure of international capital mobility. The high correlation between investment and saving led them to argue that there is less than perfect capital mobility.

The relationship between capital inflows and current account dynamics is formalized by the consumption-smoothing theory. The consumption-smoothing approach combines the assumptions of high capital mobility and permanent income theory of consumption in a small, open economy to predict what capital flows would be if agents behave in accordance with the permanent income theory. According to this approach, a country's current account will be in deficit whenever national cash flow (i.e. GDP less investment less government spending), is expected to rise over time. It will be in surplus whenever national cash flow is expected to fall. Ghosh and Ostry (1995) argue that the intertemporal model of the current account therefore provides a benchmark for judging what capital flows should be, given specific shocks affecting economy.

In an empirical study, Ghosh and Ostry (1993) use the consumption-smoothing model as a benchmark for calculating optimal capital flows, i.e. flows that can smooth consumption in the face of shocks to the national cash flow. They compare the actual series to the benchmark series and conclude that flows to the developing countries were determined by economic fundamentals to a significant degree. Ghosh and Ostry (1995), in another paper, calculate optimal current account levels for a sample of forty-five developing countries, using a vector autoregression analysis, and conclude that actual current account levels suggest consumption smoothing, or high capital mobility.

Other empirical studies on the determinants of current account, such as Calderon et al. (2002), Chinn and Prasad (2000), and Freund (2000) find that net foreign assets have significant power in explaining the CA/GDP ratios in developing and industrialized countries. Recent studies by Kraay and Ventura (2000, 2002) introduce a new rule to assess the response of the current accounts in debtor and creditor countries following a temporary income shock. The current account response, they propose, equals the savings generated by the shock multiplied by the country's share of foreign assets in total assets. One important implication of this study is that this new rule implies that favourable shocks lead to deficits in debtor countries and surpluses in creditor countries. In the long-run, they find that countries invest a marginal unit of wealth in domestic and foreign assets in the same proportion as their initial portfolio, which implies that country portfolios are remarkably stable. In the short-run, a marginal unit of saving is mostly invested in foreign assets.

A study by Bosworth and Collins (1999) examines the relationship between capital flows to developing countries and the current account. They use a panel data set that includes 58 developing countries over 17 years (1979-1995) to analyse the effect of capital flows on investment and savings and the current account. They conclude that a large proportion of capital flows to the developing countries over the past two decades have been used to finance current account deficits. These resource transfers were primarily used to finance investment, not to increase consumption. When they examine different types of capital flows, they find that FDI has highly beneficial effects on investment, whereas portfolio flows have no impact.

Lane and Milesi-Ferretti (2001) examine how net foreign asset positions affect the behaviour of the trade balance. This relationship is tested in a panel data set that includes 20 industrial and 38 developing countries for the sample period 1970-1998. Their results from panel fixed-effect regressions conclude that there is a statistically significant relationship between the (transfer adjusted) trade balance and the dynamics of the net foreign assets position in both industrial and developing countries. Holding fixed the fundamentals and short-run fluctuations from the long-run equilibrium, the trade balance is negatively correlated to returns on the outstanding net foreign asset position. This relationship is found to be stronger in developing countries than it is in industrial countries.

Above, a number of papers that examine the relationship between current account and capital flows are summarized. These theoretical and empirical studies provide a rich background on which this paper aims to build on. The contribution of this paper to the existent literature is in examining causal links between the volatility of capital flows and the current account. The study by Fry et al. (1995), which examines Granger causality between capital account and current account imbalances, is the closest study to this chapter. They focus on FDI flows to 46 developing countries and test whether such flows are autonomous or accommodating vis-à-vis the current account and other capital flows. This paper extends on their study by including industrial countries as well as a set of developing countries in the sample and the data period covers the surge in international capital flows of the1990s. This paper also differs from the study of Fry et al. (1995) since it combines the volatility of capital flows with causality between capital flows and the current account.

3. Volatility

Recent trends of international capital flows to the developing countries indicate that large capital flows that were directed to emerging markets were easily reversible, suggesting that these flows were highly volatile. Sharp capital outflows from and/or sudden cessation of foreign capital inflows (i.e. sudden stops) to emerging markets have been commonly observed characteristics of several recent financial crises. Such extreme volatility is often associated with severe consequences for the economy. For example, a sudden reversal of foreign capital inflows may cause a sharp drop in domestic investment, domestic production and employment (Hutchinson and Noy, 2002)[8]. Besides the loss of output caused by sudden stops of international capital flows, volatility of international capital flows creates instability by introducing uncertainty to the economy. For this reason, economists concentrated on the factors that may contribute to volatility in international capital flows.

One particular focus was based on analysing characteristics of different types of capital flows. This approach was partly justified by the emergence of a new combination of international capital flows that dominated the 1990s compared to the 1980s. First, the majority of capital flows in the 1990s to the developing countries were private flows, contrary to the official flows of the 1980s. Second, portfolio equity and foreign direct investment flows constituted the majority of private capital flows to emerging markets, which were facilitated by the liberalization of emerging market economies and technological developments. The increased reliance on portfolio equity capital for foreign finance in these markets and the short-term nature

[8] Recent theoretical literature emhpasizes the linkages between sudden stops and output losses (e.g. Aghion et al., 2001; Mendoza, 2001).

of these flows, compared to long-term commitment characteristic of direct investment, also justified concerns on increased volatility.

The experience of the 1997 Asian crisis indicated that portfolio equity capital flows have been highly volatile and have turned negative, while foreign direct investment has remained stable (World Bank, 1999). Analysis of the volatility of international capital flows in some studies (e.g. Turner, 1991) was based on Meade's distinction between 'temporary' and 'continuing' capital movements. Meade (1951) described 'temporary' flows as short-term funds attracted by interest rate differentials. This definition implied that capital pulled in by certain temporary factors was reversible once the attraction disappeared. Turner (1991) found that for the period 1975-82, the elements of the capital account with greatest volatility were public sector and short-term banking flows, in a sample of five industrial countries[9]. For the period 1983-89, Turner found that the volatility of bonds and equity investment was much higher. In terms of hierarchy of volatility, direct investment flows have been among the least volatile, whereas portfolio equity flows have been particularly volatile.

Osei et al. (2002) study the volatility of capital flows to a sample of 60 developing countries over the period 1970 to 1997. Their results indicate that volatility has increased in the 1990s, relative to the 1980s, but not to the 1970s. A study on the volatility of portfolio capital flows by Claessens et al. (1995) focus on the speculative and unstable behaviour of portfolio capital flows, compared to direct investment. Using time-series analysis, their results, perhaps surprisingly, indicate that one cannot tell the difference between long-term and short-term flows in terms of volatility. In a sample of ten industrial and developing countries, they find that long-term flows are as volatile as short-term flows. Sarno and Taylor (1997) also analyse

[9] The sample included the US, Japan, Germany, Canada and the UK.

the persistence of portfolio flows to a group of Latin American and Asian developing countries. They conclude that portfolio flows to these countries over the sample period (1988-92) may be regarded as entirely temporary.

These studies highlight the importance of the volatility of international capital flows and its policy implications. The focus of this paper, however, is not based on identifying the volatility of different types of capital flows. The issue that we seek to address is the relationship between volatility of the current account and the volatility of the capital account. It is often mentioned in the literature that one important feature of the recent trends in capital flows to developing countries is that private equity and bond flows as opposed to official capital flows are increasingly a crucial source of large current account imbalances (e.g. Sarno and Taylor, 1997). This may have policy implications in terms of the sustainability of recent current account deficits.

In this section, the balance-of-payments identity is used to analyse current and capital account volatility. The balance-of-payments accounting relates current account transactions to capital account transactions. Hence, any international transaction requires two offsetting entries to the balance of payments: One entry on the current account and the other entry on the capital account. In theory, the current account and capital account should add up to zero, but almost always a discrepancy item, called errors and omissions, is required as described below:

$$\text{Balance of Payments} = \text{Current Account} + \text{Capital Account} = 0, \qquad (1)$$

or

$$0 = \text{Current Account} + \text{Inflows} + \text{Outflows} + \Delta\text{Reserves} + \text{Errors}^{10} \qquad (2)$$

[10] We have included the capital account (a new item that records capital transfers and transactions related to the purchase and sale of used equipment) in the errors and omissions item.

The equation (2) is based on the balance of payments identity in the fifth edition of IMF's Balance of Payments Manual. By convention, the sources of foreign exchange, such as exports and inflows are denoted as positive, and uses of foreign exchange, such as imports and outflows, are denoted as negative. This identity requires that a current account transaction can be offset by a capital account transaction, via any of the components. Inflows do not always finance current account deficits. They can be used to increase outflows and to build reserve assets. This suggests that the volatility in international capital inflows need not always be transferred one-for-one to the current account, if the inflows are channelled into outflows or reserves[11].

As a first step, we examine the unconditional volatility in the current account and components of capital account. From equation (2), the variance of the current account (CA) can be shown to be equal to the variance of the capital account (KA), and its components:

$$var\,(CA) = var\,(KA) \tag{3}$$

$$\begin{aligned} var(CA) = \; & var\,(In) + var\,(Out) + var\,(\Delta Res) + var(Err) + 2covar(In,Out) \\ & + 2covar(In, \Delta Res) + 2covar(In,Err) + 2covar(Out, \Delta Res) \\ & + 2covar(Out, Err) + 2covar(\Delta Res, Err) \end{aligned} \tag{4}$$

[11] We refer to private outflows by the use of the word 'outflows'. Reserve account, which can be categorized as public outflows is treated separately.

Equation (4) implies that the individual components of the capital account can be more or less volatile than the current account. For example, capital inflows and outflows can be highly volatile, as suggested by the empirical literature[12]. However, if gross inflows are negatively correlated with gross outflows, the impact of net inflows on the current account may be stabilizing. Conversely, net inflows can add to the volatility in the current account, if net inflows are positively correlated with official reserves[13].

Tables 1a and 1b present results of the volatility analysis of the current account and the components of the capital account for a set of industrial countries and developing countries (See Appendix for the list of countries). The sample was determined by data availability. The data for industrial countries cover all major financial investors with the exception of Ireland and Greece. In terms of the data on developing countries, the set of developing countries includes the major recipients of international capital flows. The sample period differs for each country. The annual data on the balance-of-payments statistics are taken from IMF's International Financial Statistics (2001) database. The current account and the components of the capital account are all expressed as a percent of the GDP. The volatility of each series is calculated as the standard deviations of the ratios. All variables are in 1996 constant US$, deflated by the US GDP deflator. Both Tables 1a and 1b report results from HP (100) filtered series that enable us to concentrate on the cyclical component of the

[12] See Turner (1991) for an account of the volatility of different capital flows in the 1980s, and IMF (1999) for the volatility in capital flows in the 1990s.
[13] The errors and omissions is an equilibrating item in the capital account, therefore it is endogenously determined.

series[14]. We chose to report results only from HP (100) series since this method helps us concentrate on the cyclical volatility without loss of degrees of freedom and valuable information on the long-run trends[15].

There are clear differences between industrial and developing countries in our sample. For the industrial countries, inflows and outflows are more volatile than the current account, whereas for the developing countries outflows are more stable than both inflows and the current account. This may suggest that inflows are mostly offset by outflows in industrial countries. Although many developing countries started liberalizing their capital accounts, restrictions such as capital controls imply that these countries do not have fully open financial markets[16]. Even for industrial countries, capital account liberalization came as late as the 1980s, where barriers were lowered and controls were abolished. By the late 1980s, there were only six industrial countries in the world with fully open financial markets: Canada, Germany, Netherlands, Switzerland, UK and US.

The relatively high volatility of reserves in the developing countries, compared to the industrial countries is another difference. During a surge period of capital inflows, policymakers in emerging markets often intervened to limit the expansionary consequences of capital inflows. Often, sterilization of capital inflows was the policy tool used. This involved a swap of international reserves for public bonds or increased reserve requirements. During the early 1990s in Chile, sterilization meant that over

[14] Hodrick-Prescott filter is used in empirical studies to identify the business-cycle component of the macroeconomic time-series. HP filter minimizes the variance of the cyclical component subject to a penalty for the variation in the second difference of the growth component, where a smoothness parameter penalizes the variability in the growth component. Recently, the use of HP filter and the somewhat arbitrary choice of the smoothness parameter has been criticized (King and Rebelo, 1993; Harvey and Jaeger (1993); Baxter and King (1995); Guay and St-Amant (1997)).

[15] Another alternative is first-differencing the series. The results are qualitatively similar to the results of HP (100) filtered series.

[16] Johnston and Tamirisa (1998) show that controls on capital outflows are more prevalent than controls on inflows on all types of transactions, except in the case of FDI and real estate purchase.

three quarters of capital inflows (7 percent of GDP) went to international reserves accumulation in the central bank every year (Caballero and Krishnamurthy, 2001). Bosworth and Collins (1999) also show that for developing countries, around one-third of capital inflows were channelled into reserves. Aizenman and Marion (2002) argue that, following a crisis, countries that have increased perceived sovereign risk will increase their demand for international reserves, as was the case for East Asia after 1997[17]. Today developing countries hold 60.4 percent of total global reserves.

4 Panel Data Analysis

In this section, the relationship between the current account and net capital inflow volatility is examined in a panel fixed-effects regression framework. Panel data analysis concentrates on the effect of (conditional) volatility of capital inflows on the current account in industrial countries versus in developing countries. As the examination of unconditional volatility for individual industrial and developing countries suggests, these two country groups exhibit different dynamics in their current and capital accounts. Pooling cross-country and time-series data often produces more efficient results than examining time-series or cross-country alone (Verbeek, 1999). While a panel fixed-effects estimator concentrates on within variation (i.e. the dynamic response of the current account to net inflows volatility), the country fixed-effects controls for unobserved heterogeneity. The previous section suggests considerable cross-country heterogeneity in the current account and capital

[17] Lane and Burke (2001) find that trade openness is by far the most important determinant of reserve holdings in cross-country sample of industrial and developing countries. Trade openness can proxy for vulnerability to external shocks.

account dynamics of both industrial and developing countries. In such a case, fixed-effects panel regression should produce more efficient results compared to pooled OLS estimation[18].

4.1 Model

The volatility of current account is formulated as a function of the volatility of net private inflows as follows:

$$V(CA_{it}) = \alpha_i + \beta_1 \, (V(Inflow_{i,t}))+ \; t_t + \varepsilon_{i\,t} \qquad (5)$$

where:

$V(CA_{it})$: volatility of CA to GDP ratio of country i at time t,

$V(Inflow_{it})$: volatility of inflows to GDP ratio of country i at time t,

t_t: year dummies.

The sample periods for annual data on current account and capital flows vary for each country[19]. The volatility of the current account and capital inflows, measured as standard deviations of respective variables, were calculated over 5-year non-overlapping periods for the sample period 1970-2000[20]. Both current account and net inflows have been normalized by country size (i.e. dividing the respective variables by the GDP of the country). Here we measure volatility of inflows and the current

[18] Pooled OLS estimation models do not control for individual heterogeneity, therefore, run the risk of obtaining biased results (Baltagi, 1999).

[19] We choose to use annual data instead of quarterly data since this allows us to work with a larger sample.

[20] The last period includes 6 years and runs from 1995-2000.

account as the standard deviation around a detrended series. By removing the growth component, we focus on the cyclical component.

In this model, the focus is on the effect of international capital flows on current account. Net capital flows arise when there is a saving and investment mismatch across countries, and therefore, it involves a transfer of real resources through the current account. However, gross capital flows need not involve any transfer of real resources since they may be offsetting across countries. For this reason, net inflows, rather than gross flows, are used as the independent variable. The positive values of this variable indicate net capital inflows, whereas negative values indicate net outflows. For the current account, negative figures indicate a current account deficit.

Overall, the relationship between current account and net inflows may differ across the two groups depending on the relationship between net inflows and reserves. The inflow volatility may be passed on for less than one-for-one, if the cyclical fluctuations in reserves are offsetting net inflow volatility. If the reserve account has sufficient independent volatility, the current account may be more volatile than net inflows.

4.2 Descriptive Statistics on Panel Data

Before presenting results from panel fixed-effects estimation, we examine the summary statistics for industrial and developing countries. Table 2a summarizes descriptive statistics on the current account, net inflows, gross inflows and outflows, and reserves for industrial countries. As the volatility analysis suggested, gross inflows and outflows are nearly equally volatile. Large gross inflows accompanied by large gross outflows have been one of the trends in international capital flows among industrial countries. Figure (1) presents the time-series trends in gross inflows, outflows and the current account balance for the industrial countries in our sample. This graph indicates that gross inflows and outflows of industrial countries have become highly correlated starting in the early 1980s, which coincides with capital account liberalizations. Throughout the sample period the current account balances of industrial countries have been stable.

Descriptive statistics for the same variables are summarized in Table 2b for the developing countries. Gross inflows are more volatile than gross outflows for the set of developing countries, as was reported in Table 1b. Figure (2) illustrates the time-series evolution of gross inflows, outflows and the current account over a sample period for the developing countries in our sample. One important difference from the trend in industrial countries is that, gross inflows to the developing countries have been more volatile than outflows, and constitute a larger ratio to country GDPs. While gross inflows fluctuate over the years, the outflows have remained at a steady ratio to GDP. Only in the 1990s, has there been an increase in the outflow to GDP ratios. This suggests that net inflow volatility in developing countries is mostly due to gross inflow volatility. The current account of the developing countries has also been more volatile than the current account of industrial countries over the sample period (Figures (1) and (2)).

4.3 Bivariate Relations in the Data

Examining bivariate relations between the volatility of current account and net inflows, and between the volatility of net inflows and reserves can give us some idea on the underlying trends in our data. Figures (3a) and (3c) illustrate the bivariate relationship between the current account and net inflow volatility in the 1980s versus the 1990s for the developing countries. Figures (3b) and (3d) provide a cross-section comparison of these scatter plots with the relationship between reserves and net inflow volatility in the 1980s versus the 1990s. As Figure (3a) suggests, in the 1980s, developing countries with volatile net inflows also had volatile current accounts. For the same period, the relationship between reserves and net inflows is also positive, but stronger, as indicated by a steeper fitted regression line. Among the developing countries, the ones with higher net inflow volatility also had more volatile reserve accounts. In the 1990s, the relationship between current account and net inflows seems as volatile as in the 1980s (Figure (3c)). Again, compared to volatility in current account and net inflows in the 1990s, the relationship between reserves and net inflow volatility is slightly stronger.

Figures (4a)-(4d) represent the same bivariate relationships for industrial countries. In Figures (4a) and (4b), we find a positive relationship between current account versus net inflows, and reserves versus net inflows in the 1980s. Among the industrial countries, countries with more volatile net inflows also have more volatile current accounts and reserve accounts. In the 1990s (Figure 4c), the relationship between net inflow volatility and the current account is positive but it appears that the relationship is now less strong. The relationship between reserve volatility and net inflows, however, seems to have been stable over the two decades. In the 1990s, there appears to be a strongly positive relationship between reserve and net inflow volatility, whereas the relationship between current accounts and net inflows has become weaker. The fitted regression line for the CA-inflows volatility (Figure 4c) is flatter than the one for reserves-net inflows volatility (Figure 4d).

4.4 Results

Panel fixed-effects estimation results are reported in Table 3 in column (1) for the industrial countries and in column (2) for the developing countries. In both columns, CA volatility is regressed on inflow volatility. The regression model includes year dummy variables to control for common global effects. *A priori*, as the inflows volatility increases, current account volatility should also increase (i.e. $\beta>0$). If the inflows are used to finance current account deficits, we expect to see a large positive and significant β coefficient. A small positive, or statistically insignificant β, may indicate that inflow volatility may be offset by other components of the capital account (i.e. reserves).

The results of panel regressions on current account volatility do not indicate that volatility in net inflows has any significant effect on the current account for the industrial country sample (column (1) Table 3). Although there is no statistically significant evidence in our data that net inflows have any effect on current account volatility, this specification explains 42 percent of the variation in current account volatility. This may indicate that unobserved heterogeneity accounts for most of the explanatory power of this model.

The results for the developing countries from the panel fixed-effects estimation are reported in column (2) of Table 3. The regression results indicate a statistically significant relationship between net inflows and current account volatility. When net inflow volatility increases by one unit, the current account volatility also increases by 0.35 units. This specification explains 65 percent of the variation in current account volatility.

4.5 Robustness Checks

4.5.1 Test on fixed-effects

The results of the fixed-effects panel regression indicate that the unobserved heterogeneity in the data is soaking up some of the variation in the dependent variable. The statistical significance of the fixed-effects (H_0: $\alpha_i = 0$) is formally tested by a Chow test. The fixed-effects model is the unrestricted model, and the OLS on the pooled sample is the restricted model, where we obtain the unrestricted and restricted residual sum of squares (URSS versus RRSS). For the industrial countries, the observed F-statistics of moving from the restricted to the unrestricted model is 2.82 and is distributed as $F(19, 83)$. The F-test rejects the null hypothesis that the fixed-effects are all equal to zero at 1 percent significance level. This implies that the fixed country effects have explanatory power[21]. The simple OLS regression on panel data, which allows for cross-country variation as well as within variation, indicates that volatility in net inflows has a statistically significant positive effect on the current accounts of industrial countries (column (1) Table 4). Pooled OLS estimation models do not control for individual heterogeneity, therefore, run the risk of obtaining biased results (Baltagi, 1999). Also, the results of the Chow test indicate that there is significant cross-country heterogeneity among the industrial countries.

The Chow test on the fixed-effects justifies the use of the fixed-effects model over simple OLS on pooled data for the developing countries as well. The observed F-statistics for the developing countries is 6.81 and distributed as $F(18, 66)$. The F-test rejects the hypothesis that all fixed country effects are equal to zero at 1 percent significance level. The results of the simple OLS regressions are reported in Table 4.

[21] This might lead to the question whether the data are, in cross-section dimension, poolable. However, we cannot test for this since we have 5 to 6 observations for each cross-section.

The OLS results also find a statistically significant and positive relation between net inflows and current account for the developing countries (column (2) Table 4).

4.5.2 *Outliers*

The results for industrial countries are not robust to the exclusion of outliers (New Zealand, Norway and Portugal) (column (1) Table 5)[22]. The volatility of net inflows has a statistically significant and positive effect on current account volatility when the outliers are excluded. The partial correlation coefficient of net inflow volatility indicates that a unit increase in its volatility may induce an increase of 0.24 in current account volatility. The Wald coefficient test confirms that β is significantly different than one. This may suggest that, for the industrial countries, net inflows may be correlated with the reserve account.

The statistical significance of net inflow volatility is robust to the exclusion of outliers for developing countries (Egypt, Korea and Malaysia[23]) (column (2) Table 5). The economic significance of net inflow volatility improves only slightly to 0.37. Without the outliers, this model explains 77 percent of the variation in current account volatility.

Overall, the results indicate that there is evidence of a statistically significant relationship between inflows and current account volatility for the industrial countries, only when the outliers are excluded from the sample. For the developing countries the economic significance of inflows on current account volatility is much less than one-for-one. One unit increase in the volatility of inflows increases current account

[22] The outliers are defined as residuals more than twice the standard error of the regression.
[23] In Egypt reserves are highly volatile and net inflows and reserves are highly correlated. In Korea, both reserves and net inflows are highly correlated with the current account, reinforcing volatility in the current account. In Malaysia, both reserves and net inflows are highly volatile and not strongly correlated, indicating that reserves do not offset inflow volatility.

volatility by 0.37 units (Table 5). These results lead to another question: do inflows affect reserves volatility?

4.6 Net Inflows and Reserves

The relationship between net inflow and reserves volatility is tested by a fixed-effects model, similar to the one presented previously. On this occasion, however, the dependent variable is reserve volatility. The reserve volatility is calculated as the standard deviation of HP (100) filtered reserve series over non-overlapping 5-year periods from 1970 to 2000. Table 6 reports results for the industrial countries in column (1) and for the developing countries in column (2).

The results for the industrial countries indicate that the effect of net inflows on reserve volatility is both economically and statistically significant. The coefficient for inflow volatility indicates that one unit increase in the volatility of inflows leads to an increase of 0.43 units in reserve volatility. This coefficient is much smaller (0.28), however, when the outliers (New Zealand, Norway, Portugal and Switzerland) are excluded from the sample (Table 7). This specification explains 63 percent of the within variation in reserve volatility in our sample.

The results for the developing countries also suggest a statistically and economically significant relationship between inflows and reserves. One unit increase in net inflow volatility leads to an increase of 0.57 units in reserves volatility (Table 6). The statistical significance of net inflows is robust to the exclusion of outliers (Egypt and Venezuela), however, the economic significance is lower (β_1 = 0.49) (Table 7). The net inflow volatility explains 56 percent of the within variation in reserve volatility in the developing countries.

For the developing countries, the effect of net inflow volatility on current account volatility is positive and significant. However, net inflows and current account are less than perfectly correlated. This may be explained by the significant impact of net inflows on reserve volatility. Precautionary motives for reserves accumulation have been important for developing countries. For the industrial countries, net inflow volatility also has a statistically significant effect on the within variation in current account volatility. The economic impact of inflow volatility on current account volatility is larger for the developing countries than it is for the industrial countries in our sample. The impact of net inflow volatility on reserve volatility is also larger for the developing countries than it is for industrial countries. These results suggest that inflows to the developing countries have been used to finance the current account deficits and to build international reserves, more so than in industrial countries, reminiscent of results from Bosworth and Collins (1999).

5. Causality

In this section we address the question of whether net inflows cause current account imbalances[24]. The first step in answering this question is to look for evidence of a relationship between net inflows and the current account. In other words, as a precursor to establishing causality between these two variables, we need to ask whether inflows and current account imbalances are related. Once the relationship is established, the second step is to test for the direction of causality. The method of analysis involves three steps: first, a check on the stationarity of net inflows and current account imbalances, then, tests of cointegration for non-stationary series, and

[24] Unlike the previous section, the focus is on the question of causality between net inflows and current account imbalances. For this reason, the remainder of econometric analyses utilises non-filtered data.

finally tests of Granger causality and causality tests on error correction models (ECM).

Unlike the previous section on panel data, our focus here is on individual countries. The argument is that each country, industrial or developing, has country-specific experiences, and examining individual countries may add to our understanding of the dynamics of capital flows and the current account imbalances. Although this section does not refer to the question of volatility directly, establishing causal links may help explain the different experience of industrial countries compared to developing countries. If the direction of causality for most industrial countries is from current account to capital inflows, or bi-directional, the panel data results present problems of endogeneity[25].

5.1 Stationarity

The concept of stationarity is important in establishing a causal link between time-series variables[26]. In models where a time-series variable is regressed on another time-series variable, one may get very high R^2 results, although there is no meaningful relationship. This presents the problem of a spurious relationship between these two variables, where the strong relationship is due to a common trend (Gujarati, 1995). For this reason, the stationarity of current account imbalances (ratio to GDP) and net inflows (ratio to GDP) was tested and the results are reported in Tables 8a and 8b. When the error term is white noise, the OLS estimator is best linear unbiased estimator, and when the two series are stationary, OLS estimation is valid.

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[25] The tests of panel causality are unapplicable to our data sets because of the shortness of the time-series dimension. Panel unit root and cointegration tests, as suggested by Kao (1999) have large size distortions when T is small (T is at maximum 6, and mostly less for the majority of the countries in our sample).

[26] By stationarity, we refer to weak stationarity, i.e. constant mean, variance and autocovariance of the series.

Ultimately, we can test for causality between current account imbalances and net inflows in those countries, where both series are either stationary, I(0), or integrated of the same order, I(*d*). When the two series are found to be nonstationary processes but are integrated of the same order, I(*d*), then even though the underlying series are nonstationary, they can be cointegrated, if the residuals from the cointegrating regression are I(0). When the two variables are cointegrated, they have a long-run equilibrium relationship.

We examine stationarity in our data by employing Augmented Dickey Fuller (ADF) tests of unit roots. Although ADF tests have been criticized for having low power (especially in finite samples), they are the most commonly used unit root tests. Assuming that the data generating processes for current account (ratio to GDP) and net inflows (ratio to GDP) can be written as follows:

$$\Delta(\text{Inflow}_t) = \alpha + \beta\text{Inflow}_{t-1} + \lambda_1\Delta\text{Inflow}_{t-1} \ldots \lambda_{p-1}\Delta\text{Inflow}_{t-p+1} + u_t \qquad (6)$$

$$\Delta(\text{CA}_t) = \mu + \gamma\text{CA}_{t-1} + \delta_1 \Delta\text{CA}_{t-1} \ldots.. \delta p \, \Delta\text{CA}_{t-p+1} + e_t \qquad (7)$$

then ADF tests,

H_o: $\beta = 0$, H_1: $\beta<0$

H_o: $\gamma = 0$, H_1: $\gamma<0$

The null hypothesis is that the series has unit root (i.e. nonstationary), against the alternative hypothesis that the series is stationary. ADF tests involve parametric corrections for higher-order correlation by assuming the series follows AR(*p*) process, at which lag the error term is white noise[27]. The lag length of the ADF tests was determined by using the general-to-specific methodology starting at a lag length of 3. The model selection was based on the Akaike information criterion (AIC). Tables 8a and 8b report results of ADF tests on current account to GDP (CA/GDP) and net inflow to GDP (Inflow/GDP) ratios in columns (1) and (3). Columns (2) and (4) report results of ADF tests for first-differenced series.

Among the industrial countries, both current account and inflow series are stationary, I(0) processes for Canada, Japan, New Zealand, Spain, Sweden and UK. For Austria, Belgium-Luxembourg, Iceland and US, both series are I(1). For those industrial countries, where current account and inflow series are integrated of a different order (i.e. Australia, Denmark, Finland, France, Germany, Italy, Netherlands, Norway, Portugal and Switzerland), we cannot estimate economically meaningful relationships. For the industrial countries, where net inflows and current account imbalances are integrated of different order, a long-run steady-state relationship does not exist. These two series may be diverging in time, violating the condition of white noise error term, and invalidating the OLS estimator.

Among the developing countries, Argentina, Colombia, Egypt, Korea, Malaysia, Morocco, Turkey and Venezuela have stationary processes for both current account and net inflow series. Brazil and Singapore's current account and net inflow series are both I(1). Since the two series are integrated of a different order for Chile, China, Costa Rica, India, Israel, Mexico, Philippines and Thailand, these countries are left out of further analysis[28].

[27] Although ADF tests restricts the series to be an AR(p) process, ADF test remain valid even when the series is an MA process (Said and Dickey, 1984). For this reason, we prefer ADF tests over Phillips-Perron unit root tests.

[28] The examination of the reserve account for these countries indicated I(0) prcesses, except for Costa Rica. For Chile, Israel, Mexico and Thailand, the CA series may have structural breaks.

5.2 Cointegration

In this section, the question of whether current account imbalances and net inflows are related is addressed. If the two series are cointegrated, these series are said to have a long-run equilibrium relationship. Cointegration was tested for those countries where both series were found to be non-stationary and integrated of the same order by two different tests. The first test procedure involves a two-step test suggested by Engle-Granger (1987). The first step is to estimate a cointegrating regression as equation (8):

$$CA_t = \alpha + \beta Inflw_t + u_t \qquad (8)$$

The second step is to apply an ADF test on the residuals, u_t, obtained from a cointegrating regression as follows:

$$\Delta\hat{u}_t = \rho\hat{u}_{t-1} + \varepsilon_t \qquad (9)$$

If the residuals are I(0), current account imbalances and net inflows are cointegrated. In other words, current account imbalances and net inflows have a long-run equilibrium relationship. Since the residuals are an estimate of the actual population disturbances, the correct asymptotic critical values are computed by Davidson and MacKinnon (1993), whereas the critical values for small sample sizes are found in MacKinnon (1991).

Table 9a reports the test statistics in column (1) for the unit root test on the estimated residuals for industrial countries. The lag lengths satisfy the criteria of lowest AIC, and are reported in column (2). For most countries, the null of unit root is rejected at 1 percent significance level. For the US, the ADF test statistic is significant at 5 percent level. Among the developing countries, both for Brazil and Singapore, the current account and net inflows have a long-run equilibrium relationship and this relationship is statistically significant at 1 percent level (column (1) Table 9b). In summary, for the countries that the unit root tests found both series non-stationary and integrated I(1), the Engle-Granger test strongly suggests the presence of a long-run equilibrium relationship.

The second test on cointegration involves a method developed by Johansen (1991, 1995). The Johansen test is a vector autoregression (VAR) based cointegration test, where the restrictions imposed by cointegration on the unrestricted VAR are tested. The results from Johansen cointegration test on net inflows and current account imbalances are reported in column (3) of Tables 9a and 9b. The test is carried out on the same set of industrial and developing countries as the ones used in Engle-Granger cointegration test. The same lag lengths are used in the VAR specification, as in the Engle-Granger cointegrating regressions (column (2))[29]. The choice of VAR and cointegration equation specifications is based on the lowest AIC, which invariably indicated no deterministic trend in the data[30]. The cointegrating equation is assumed to have a constant but no trend. The test statistic is λ_{trace}, which is based on the eigenvalues. The null hypothesis is of no cointegrating equations against the general alternative of cointegration.

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[29] For the regressions where the Engle-Granger test suggest a lag length of zero, the Johansen test is carried out on the first lag.

[30] The only exception is Singapore. The AIC is lowest when a linear deterministic trend is assumed in the data for this country. Johansen tests are performed by the Eviews econometrics package. This program offers five options: (1) no deterministic trend in data, no constant, no trend in the cointegrating equation (CE), (2) no deterministic trend in data, constant but no trend in CE, (3) linear deterministic trend, and constant in CE only, (4) linear deterministic trend, constant and trend in CE, (5) quadratic trend in data, linear trend in CE.

For the industrial countries, the calculated λ_{trace} statistic is greater than the critical value at 1 percent significance level for Austria and 5 percent significance level for Iceland (column (3) Table 9a). The Johansen test statistic cannot reject the null of no cointegrating equations for Belgium-Luxembourg and the US at the lag lengths specified by the Engle-Granger test. However, there is evidence of cointegration for both of these countries at lag length of 5 for Belgium-Luxembourg and at 7 lags for the US. The Johansen test fails to reject the null of no cointegrating equations for both Brazil and Singapore at the lag length specified by the Engle-Granger test. For both of these countries, there is evidence of cointegration at 3 lags. In summary, the Engle-Granger test finds cointegration between current account imbalances and net inflows for all the countries in this sub-sample, whereas Johansen test finds sporadic evidence of cointegration. Given that we are estimating a bivariate relationship, the Engle-Granger test is more appropriate than the Johansen technique, which is more data demanding.

5.3 Causality Tests

The results of unit root and cointegration tests prepared the background for causality tests. For those countries with stationary series, the OLS is the best linear unbiased estimate and the regression expresses an economically meaningful relationship. In the case of countries, where current account imbalances and inflows are cointegrated, the fully modified OLS proposed by Phillips-Hansen is the preferred method of estimating the cointegrating relationship[31]. Before estimating the economic significance of the cointegrating relations, we test for the direction of causality by

[31] In finite samples, OLS can have a large bias when I(1) variables are used in the regression (Harris, 1995).

using two different methods. We use simple Granger causality tests to establish the direction of causality for those countries where both series are stationary. For the countries where current account and inflows are cointegrated, error correction mechanism (ECM) is used to detect the direction of causality.

5.3.1 Granger Causality Test

The Granger causality test (1969) involves assessing whether, by introducing lagged values of *x*, we can improve the explanatory power of the model that regresses lagged values of *y* on current *y*.

$$CA_t = \alpha + \beta_1 CA_{t-1} \ldots + \beta_p CA_{t-p} + \gamma_1 Inflow_{t-1} \,..\, + \gamma_p Inflow_{t-q} \qquad (12)$$

$$Inflow_t = \mu + \delta_1 Inflow_{t-1} \,..\, + \delta_{t-p} Inflow_{t-p} + \varepsilon_1 CA_{t-1} \ldots + \varepsilon_p CA_{t-q} \qquad (13)$$

The null hypothesis for the first equation is that inflows do not cause current account imbalances, and for the second, it indicates that the current account does not cause inflows. This hypothesis is tested by a Wald test, where the estimated F-statistics are calculated for the joint significance of the coefficients:

$$\gamma_1 = \ldots\ldots \gamma_q = 0 \qquad \text{and} \qquad \varepsilon_1 = \ldots\ldots \varepsilon_q = 0$$

The results from the Granger causality tests are reported in Tables 10a and 10b. There are four possibilities. The direction of causation can be running from inflows to current account imbalances (i.e. inflows cause current account imbalances), or from current account imbalances to inflows. There can also be a feedback between the two variables, or they can be independent. The lag lengths of the independent and dependent variables in the model are chosen to minimize the AIC.

There is no evidence of net inflows causing current account imbalances in any of the industrial countries (Table 10 a). In Japan, New Zealand and the UK, there is evidence of current account imbalances causing net inflows. In Canada, Sweden and Spain, these two variables are independent. In Argentina, Venezuela and Egypt, net inflows cause current account imbalances (Table 10b). Only in Malaysia, do current account imbalances cause net inflows. In Korea, the causation is bi-directional, whereas for Colombia, Turkey and Morocco, the current account and net inflows are independent.

5.3.2 Causality tests on Error Correction Models

For the countries that have current account and inflows series with I(1) processes, cointegration tests suggest there is a statistically significant long-run equilibrium relationship between these variables. In the short-run, there may be disequilibrium. The error correction mechanism (ECM) incorporates the short-run disequilibrium into the long-run behaviour of the current account and inflows, using the error term as "equilibrium error" (Gujarati, 1995). Since all terms in the ECM model are stationary, standard regression techniques are valid. Granger's representation theorem implies that if two variables are cointegrated, then there must exist an ECM (and vice versa). The relationship between inflows and current account can be formulated as an ECM model as follows:

$$\Delta CA_t = \alpha + \theta\,(CA_{t-1} - \nu - \lambda Inflow_{t-1}) + \sum \beta_p \Delta CA_{t-p} + \sum \gamma_p \Delta inflow_{t-p} \qquad (14)$$

$$\Delta Inflow_t = \mu + \rho\ (CA_{t-1} - \nu - \lambda Inflow_{t-1}) + \sum \delta_{t-p}\ \Delta Inflow_{t-p} + \sum \varepsilon_p\ \Delta CA_{t-p} \qquad (15)$$

The term in parenthesis is the error term estimated from the cointegrating regression (i.e. error correction term), and it represents a short-run deviation from the long-run equilibrium[32]. When the error correction terms are ignored, equations (14) and (15) are Granger causality equations. In fact, if error correction terms are not included when there is cointegration between the variables, then the model is misspecified (Granger, 1988). We perform three different Granger causality tests. The first test of causality is based on the significance of the error correction term, which can be interpreted as long-run causality (Wald 1). The second test is an F-test on the joint significance of the lagged independent variable, i.e. standard Granger causality test (Wald 2). The final test involves testing for the joint significance of the error correction terms and the lagged independent variables (Wald 3)[33].

The ECM was estimated for four industrial countries: Austria, Belgium-Luxembourg, Iceland and the US (Table 11a). For Austria, the error correction term is statistically significant in both equations and both long-run causality tests (Wald 1) are significant at 10 percent level. When CA is the dependent variable the error correction term is negative, and when inflow/GDP is the dependent variable, the error correction term is positive. There is also evidence that there is significant short-run causality running from CA to inflows. The lagged independent variables have the expected negative sign. When the inflows/GDP is the dependent variable, all three Wald tests are significant, but since the error correction term is positive, it is

[32] The choice of the dependent variable in the cointegration regression is arbitrary (Enders, 1995).
[33] The lag length of the dependent and independent variables in the model are chosen to minimize the AIC.

ambiguous in Austria whether CA imbalances cause net inflows[34]. For Belgium-Luxembourg and the US, the direction of causality is also from CA imbalances to net inflows. Both Wald 1 tests are significant only when inflows/GDP is the dependent variable. On the other hand, in Iceland, the causality runs from net inflows to CA. The error correction term is the only statistically significant term and the Wald 1 test suggests that it is significantly different than zero.

The causality tests involving the ECM model are reported for Brazil and Singapore in Table 11b. For Brazil, the long-run causality test (Wald 1) is significant when the dependent variable is the CA imbalance, and the error correction term is significant. This suggests that net inflows cause current account imbalances in Brazil[35]. For Singapore, the direction of causality is the opposite. Both the error correction term and the lagged independent variables are significant when net inflow is the dependent variable. The causality tests indicate that there is only evidence of long-run causality from current account imbalances to inflows. For Singapore, the sign of the lagged independent variable is positive, which is counter- intuitive[36].

The results of standard Granger causality tests and ECM equations indicate that the country experiences are varied. However, broadly, there is evidence in our sample that net inflows cause current account imbalances in developing countries, whereas in industrial countries there is no such evidence, except in Iceland. Among the industrial countries, only in Iceland, net inflows cause current account imbalances. In Argentina, Brazil, Egypt and Venezuela there is evidence of causality running from net inflows to current account imbalances. Singapore, however, is similar to industrial

[34] The negative and statistically significant lagged dependent variables for Austria also may indicate misspecification.
[35] The lagged independent variable (Inflw) has a positive sign, contrary to expectations, but the Wald 2 test is not significant.
[36] The positive and significant coefficient for the independent variable for Singapore can be the result of model misspecification.

countries, like the US, Belgium-Luxembourg, New Zealand and the UK, where its causality runs from CA to net inflows.

5.4 Economic Significance

The previous sections have established that for a subset of industrial and developing countries, net capital inflows and current account imbalances are related. The causality tests identified the direction of causality in these countries. In this section, the economic significance of the relationship between net inflows and current account imbalances are tested. Since the focus in this paper is on the effect of inflows on the current account, this relationship is estimated only for countries in which the direction of causality is from inflows to the current account.

The economic significance of the relationship is estimated by standard OLS for the countries where both series were found to be stationary processes, I(0). For the countries where both series are I(1), standard OLS coefficients are consistent, however, in finite samples, the bias may be large and the asymptotic distribution of t-statistics depend on nuisance parameters. Phillips-Hansen Fully Modified OLS (FMOLS) corrects for this problem by applying nonparametric corrections to the OLS estimator (Harris, 1995).

Tables 12a and 12b report results of the relationship between net inflows and current account imbalances. For Iceland and Brazil, the results are from FMOLS estimation, whereas, for Argentina, Venezuela and Egypt, standard OLS coefficients are reported. The FMOLS estimated coefficients are both statistically and economically significant. Both for Iceland and Brazil, net inflows and current account imbalances are negatively correlated[37]. The standard OLS coefficients for Argentina, Egypt and Venezuela are also negative, however, they are not statistically significant at 10 percent significance level for Argentina and Egypt. For Venezuela the coefficient for net inflows is economically significant, indicating that a unit increase in net inflows causes a 1.16 unit current account deficit. The economic impact of net inflows is also large in Iceland, but less than unity, where a unit increase in net inflows causes 0.82 unit decrease in the current account imbalance. Compared to Venezuela and Iceland, the economic impact of net inflows on the current account imbalance in Brazil is moderate.

5.5 Summary

In summary, the cointegration and causality tests indicate that net inflows and current account imbalances have a long-run steady-state relationship in a subset of industrial and developing countries. The focus in this section was to answer the question whether net inflows cause current account imbalances. Among the industrial countries, there is evidence of causality running from net inflows to the current account imbalance only in Iceland. Among the developing countries in our sample, in Argentina, Brazil, Egypt and Venezuela net inflows cause current account imbalances.

Fry et al. (1995) also find evidence of capital account causing current account imbalances in Argentina, Brazil and Venezuela for the period 1970-1992[38]. Our results indicate that the direction of the relationship in these countries remained stable throughout the 1990s. Contrary to the results in this paper, Fry et al. (1995) show that capital account and current account are independent in Egypt. The difference in

[37] Both series are entered into the regression equation in levels.

[38] The capital account in Claessens *et al* (1995) is equivalent to net inflows variable used in this study.

results may be based on the specific time periods captured. Most developing countries progressively liberalized their capital account in the 1990s.

Fry et al. (1995) further investigate the predictability of the direction of causality in their sample of 46 developing countries. They find that high levels of debt (foreign and domestic) reduce the likelihood that capital account Granger-causes the current account and increase the likelihood of no causality. This may explain our results on Turkey, Morocco and Colombia. The existence of restrictions on capital account payments reduces the likelihood of causality running from current account to capital account. This may explain why in Singapore, and some industrial countries, causality runs from current account to net inflows[39]. Overall, the balance-of-payments regime of a country may define the causal relationship between its current account and net inflows.

6. Conclusion

The relationship between international capital inflows and the current account has been implied in the models of current account determination, and in the 'sustainability' literature, but this relationship has remained relatively unexplored. This paper examined the relationship between net private capital inflows and the current account in a set of industrial and developing countries. The aim of this paper was to answer two specific questions regarding the relationship between net private capital inflows and the current account. The first question asked whether the cyclical volatility in current accounts could be explained by the volatility of capital flows. The second question addressed the causal link between net capital inflows and current account imbalances.

[39] Singapore's capital account is one of the most liberal among the developing countries.

The results indicate that country experiences vary. The evidence implies that inflows do not cause current account imbalances in the industrial countries, nor does the inflow volatility affect current account volatility. This may be explained due to the fact that most industrial countries have liberalized capital accounts. Domestic markets are open to foreign capital inflows and domestic agents are also free to invest abroad. This may mean that in industrial countries, there are fewer barriers to borrowing and lending internationally, compared to developing countries. Although, some developing countries have undertaken structural reforms and liberalized their current accounts, capital controls would have been prevalent for the most part of the time period analysed. Such institutional barriers may be the reason why inflows cause imbalances or volatility in the current account.

Another distinction between industrial and developing country current and capital inflow dynamics may be based on their ability to borrow in the international capital markets. Most industrial countries can borrow and lend freely, whereas most developing countries are liquidity constrained. The ability to borrow in international markets is restricted for developing countries, and mostly determined by foreign investors' willingness to lend. During an economic downturn, sudden reversals in inflows can induce a liquidity crisis. This may explain the relationship between volatility in inflows and current accounts in developing countries.

Finally, it is worth remembering the consumption-smoothing hypothesis of the current account. The consumption-smoothing approach combines the assumptions of high capital mobility and permanent income theory of consumption in a small, open economy to predict what capital flows would be if agents behave in accordance with the permanent income theory. According to this approach, a country's current account will be in deficit whenever national cash flow, is expected to rise over time. It will be in surplus whenever national cash flow is expected to fall. One important implication of this theory is that all countries are expected to behave the same under the same circumstances. Our results indicate that the experience of the industrial and developing countries are quite different. This may be closely linked to the fact that developing countries are credit-constrained in contrast with industrial countries.

This paper shows that the behaviour of the capital inflows is different in industrial countries compared to developing countries. This implies that comparative research on the consumption smoothing effects of capital inflows in industrial versus developing countries would be worthwhile.

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Appendix

List of Countries

Industrial Countries	**Developing Countries**
Australia (AUS)	Argentina (ARG)
Austria (AUT)	Brazil (BRA)
Belgium-Luxembourg (BEL)	Chile (CHL)
Canada (CAN)	China (CHN)
Denmark (DEN)	Colombia (COL)
Finland (FIN)	Costa Rica (CRI)
France (FRA)	Egypt (EGY)
Germany (GER)	India (IND)
Iceland (ICE)	Indonesia (IDN)
Italy (ITA)	Israel (ISR)
Japan (JAP)	Korea (KOR)
Netherlands (NET)	Malaysia (MYS)
Norway (NOR)	Mexico (MEX)
New Zealand (NZL)	Morocco (MAR)
Portugal (PRT)	Philippines (PHL)
Spain (ESP)	Singapore (SGP)
Sweden (SWE)	Thailand (THA)
Switzerland (SWI)	Turkey (TUR)
United Kingdom (UK)	Venezuela (VEN)

United States (US)

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Table 1a
Current Account Volatility – Industrial Countries

Volatility	CA	Inflows	Outflows	Reserve	Net Inflows	Year
Australia	0.012	0.013	0.007	0.013	0.012	1960-2000
Austria	0.012	0.023	0.024	0.010	0.012	1967-2000
BEL	0.011	0.209	0.210	0.007	0.012	1975-2000
Canada	0.012	0.017	0.014	0.006	0.012	1948-2000
Denmark	0.014	0.053	0.050	0.025	0.028	1975-2000
Finland	0.020	0.038	0.032	0.019	0.027	1975-2000
France	0.007	0.029	0.028	0.006	0.007	1975-2000
Germany	0.013	0.016	0.023	0.008	0.016	1971-2000
Iceland	0.021	0.026	0.012	0.010	0.013	1976-2000
Italy	0.015	0.020	0.020	0.013	0.024	1970-2000
Japan	0.010	0.016	0.016	0.006	0.010	1977-2000
Netherlands	0.014	0.042	0.037	0.007	0.016	1967-2000
New Zealand	0.031	0.023	0.017	0.023	0.022	1972-2000
Norway	0.037	0.034	0.033	0.026	0.032	1975-2000
Portugal	0.035	0.034	0.028	0.026	0.037	1975-2000
Spain	0.016	0.037	0.037	0.020	0.020	1975-2000
Sweden	0.013	0.047	0.031	0.017	0.026	1970-2000
Switzerland	0.014	0.061	0.071	0.019	0.024	1977-1999
UK	0.013	0.078	0.075	0.014	0.016	1970-2000
US	0.008	0.011	0.008	0.001	0.009	1970-2000

Notes: All variables are expressed as a ratio to GDP. The volatility measure is the standard deviation of HP(100) filtered series.

Table 1b
Current Account Volatility – Developing Countries

Volatility	CA	Inflows	Outflows	Reserve	Net Inflows	Year
Argentina	0.020	0.033	0.011	0.031	0.031	1976-2000
Brazil	0.012	0.017	0.005	0.017	0.016	1975-2000
Chile	0.028	0.069	0.026	0.061	0.063	1975-2000
China	0.020	0.014	0.009	0.017	0.017	1982-2000
Colombia	0.029	0.021	0.007	0.018	0.021	1968-2000
Costa Rica	0.024	0.027	0.014	0.034	0.032	1977-1999
Egypt	0.026	0.049	0.020	0.055	0.059	1977-2000
India	0.006	0.006	0.004	0.008	0.005	1975-2000
Indonesia	0.020	0.027	0.001	0.015	0.037	1981-1999
Israel	0.030	0.029	0.022	0.031	0.029	1952-2000
Korea	0.040	0.032	0.011	0.024	0.028	1976-1999
Malaysia	0.061	0.047	0.025	0.048	0.055	1974-1999
Mexico	0.025	0.028	0.013	0.027	0.032	1979-2000
Morocco	0.027	0.043	0.005	0.019	0.043	1975-1999
Philippines	0.033	0.033	0.048	0.031	0.043	1977-2000
Singapore	0.031	0.108	0.103	0.022	0.048	1972-2000
Thailand	0.035	0.039	0.007	0.027	0.042	1975-2000
Turkey	0.015	0.022	0.010	0.011	0.019	1974-2000
Venezuela	0.069	0.032	0.020	0.044	0.035	1970-2000

Notes: All variables are expressed as a ratio to GDP. The volatility measure is the standard deviation of HP(100) filtered series.

Table 2a
Descriptive Statistics – Industrial Countries

	CA	Net Inflows	Inflows	Outflows	Reserves
Median	0.0004	0.0001	0.0002	0.0003	0.0003
Maximum	0.0672	0.0808	0.5061	0.3508	0.0544
Minimum	-0.1158	-0.0708	-0.3558	-0.5095	-0.0627
Std. Dev.	0.0177	0.0194	0.0554	0.0542	0.0149
Observations	580	580	580	580	580
Cross sections	20	20	20	20	20

Table 2b

Descriptive Statistics – Developing Countries

	CA	Net Inflows	Inflows	Outflows	Reserves
Median	-0.0010	0.0005	0.0010	0.0002	-0.0010
Maximum	0.1665	0.1189	0.3458	0.2144	0.2096
Minimum	-0.1306	-0.2204	-0.3136	-0.3399	-0.1329
Std. Dev.	0.0333	0.0367	0.0429	0.0298	0.0318
Observations	462	462	462	462	462
Cross sections	19	19	19	19	19

Table 3
Fixed-Effects Estimation on Current Account Volatility

Dependent Variable: (CA) volatility	**(1)** Industrial countries	**(2)** Developing countries
Net Inflow volatility	0.17	0.35
	(1.38)	(5.13)***
N	109	91
Adj R^2	0.42	0.65
s.e	0.008	0.01

*, **, and *** indicate statistical significance at 10, 5 and 1 percent level.

Table 4
OLS Panel Estimation on Current Account Volatility

Dependent Variable: (CA) volatility	**(1)** Industrial countries	**(2)** Developing countries
Net Inflow volatility	0.47	0.40
	(4.74)***	(3.77)***
N	109	91
Adj R^2	0.27	0.21
s.e	0.01	0.02

*, **, and *** indicate statistical significance at 10, 5 and 1 percent level.

Table 5
Robustness Checks- Panel Fixed-Effects Estimation
(Outliers excluded)

Dependent Variable: (CA) volatility	**(1)** Industrial countries	**(2)** Developing countries
Net Inflow volatility	0.20 (3.13)***	0.37 (5.61)***
N	94	87
Adj R^2	0.66	0.77
s.e	0.005	0.008

*, **, and *** indicate statistical significance at 10, 5 and 1 percent level.

Table 6
Fixed-Effects Estimation on Reserve Volatility

Dependent Variable: (RES) volatility	**(1)** Industrial countries	**(2)** Developing countries
Net Inflow volatility	0.43 (3.41)***	0.57 (4.05)***
N	109	91
Adj R^2	0.49	0.55
s.e	0.007	0.01

Table 7
Robustness Checks- Panel Fixed-Effects Estimation
(Outliers excluded)

Dependent Variable: (RES) volatility	**(1)** Industrial countries	**(2)** Developing countries
Net Inflow volatility	0.28 (4.03)***	0.49 (3.84)***
N	105	89
Adj R^2	0.63	0.56
s.e	0.005	0.01

*, **, and *** indicate statistical significance at 10, 5 and 1 percent level.

Table 8a
Unit Root Tests (Augmented Dickey Fuller test)
Sample: Industrial Countries

	CA	ΔCA	Net Inflow	ΔNet Inflow	Period
Australia	-1.77	-5.37***	-3.30**		1960-2000
Austria	-2.45	-6.16***	-1.76	-8.16***	1967-2000
BEL	-0.05	-3.51***	-0.42	-3.26***	1975-2000
Canada	-2.86*		-3.68***		1948-2000
Denmark	-2.00**		-1.13	-8.48***	1975-2000
Finland	-1.09	-3.72***	-3.11***		1975-2000
France	-1.78*		-1.38	-5.59***	1975-2000
Iceland	-1.91	-5.88***	-2.04	-5.08***	1976-2000
Germany	-1.58	-4.25***	-2.19***		1971-2000
Italy	-2.79***		-2.38	-3.52***	1970-2000
Japan	-3.68**		-4.11***		1977-2000
Netherlands	-2.55	-5.97***	-4.58***		1967-2000
New Zealand	-2.75*		-2.22**		1972-2000
Norway	-2.42	-3.62***	-3.10***		1975-2000
Portugal	-2.57	-4.28***	-3.17**		1975-2000
Spain	-4.08***		-3.38**		1975-2000
Sweden	-1.89*		-2.98***		1970-2000
Switzerland	2.28	-6.50***	-1.69	-1.36	1977-1999
UK	-2.99**		-2.51**		1970-2000
US	0.33	-3.90***	-1.27	-6.01***	1970-2000

Table 8b
Unit Root Tests (Augmented Dickey Fuller test)
Sample: Developing Countries

	CA	ΔCA	Net Inflow	ΔNet Inflow	Period
Argentina	-4.10***		-2.36**		1976-2000
Brazil	-1.43	-4.56***	-1.41	-4.85***	1975-2000
Chile	-0.75	-5.84***	-2.40**		1975-2000
China	-2.55**		-2.10	-4.67***	1982-2000
Colombia	-3.10**		-2.67*		1968-2000
Costa Rica	-1.48	-6.43***	-2.12**		1977-1999
Egypt	-2.17**		-3.01***		1977-2000
India	-3.53**		-2.22	-7.45***	1975-2000
Israel	-2.00	-7.34***	-3.31**		1952-2000
Korea	-2.06**		-1.93*		1976-1999
Malaysia	-2.57**		-1.70*		1974-1999
Mexico	-2.34	-2.54**	-3.06**		1979-2000
Morocco	-2.60**		-3.60***		1975-1999
Philippines	-1.73*		-1.29	-4.41***	1977-2000
Singapore	-0.40	-3.82***	-1.41	-5.29***	1972-2000
Thailand	-1.47	-4.52***	-1.86*		1975-2000
Turkey	-1.84*		-4.93***		1974-2000
Venezuela	-5.32***		-2.15**		1970-2000

Notes: All variables are expressed as a ratio to GDP. The lag length and the choice to include a constant or not are based on AIC. The test statistics (τ) are significant at 1 percent (***), 5 percent (**) and 10 percent (*).

Table 9a
Engle-Granger and Johansen Cointegration Tests
Cointegrating regression: CA = a + b(Inflw)
Sample: Industrial Countries

	(1) ADF Test Statistic	(2) Number of Lags	(3) λ_{trace}
Austria	-4.22***	0	29.52***
Belgium-Luxembourg	-3.79***	0	13.36
Iceland	-4.01***	3	20.33**
US	-2.61**	1	9.80

Notes: All cointegrating models include a constant.
ADF test includes no constant and no trend.

Table 9b
Engle-Granger and Johansen Cointegration Tests
Cointegrating regression: CA = a + b(Inflw)
Sample: Developing Countries

	(1) ADF Test Statistic	(2) Number of Lags	(3) λ_{trace}
Brazil	-2.70***	0	13.19
Singapore	-3.37***	2	14.96

Notes: All cointegrating models include a constant.
ADF test includes no constant and no trend.

Table 10a
Standard Granger Causality tests
Sample: Industrial countries

	Y	Y_{t-1}	Y_{t-2}	Y_{t-3}	X_{t-1}	X_{t-2}	X_{t-3}	F-stat	Decision
Canada	*CA*	0.59			0.04			0.03	Independent
		(2.27)**			(0.16)				
	Net	0.35			-0.07			0.05	
	Inflows	(1.30)			(-0.27)				
Japan	*CA*	0.44			-0.39			2.31	CA⇒Inflw
		(1.77)*			(-1.52)				
	Net	0.02	-0.24		-1.05	0.51		3.68**	
	Inflows	(0.08)	(-0.70)		(-2.56)**	(1.56)			
New	*CA*	0.56			0.09	-0.29	0.19	0.84	CA⇒Inflw
Zealand		(3.77)***			(0.48)	(-1.52)	(1.03)		
	Net	0.58			0.26			3.30***	
	Inflows	(3.73)***			(1.82)*				
Spain	*CA*	0.87	-0.28	-0.27	-0.01			0.01	Independent
		(3.83)***	(-0.98)	(-1.24)	(-0.10)				
	Net	0.26			-0.21			0.60	
	Inflows	(1.22)			(-0.77)				
Sweden	*CA*	0.77			0.02			0.07	Independent
		(4.95)***			(0.26)				
	Net	0.51			-0.06			0.05	
	Inflows	(2.75)***			(-0.22)				
UK	*CA*	0.57			-0.20			1.60	CA⇒Inflw
		(3.22)***			(-1.26)				
	Net	0.06			-0.54			3.73***	
	Inflows	(0.24)			(-1.93)*				

Table 10b: Standard Granger Causality tests *(Sample: Developing countries)*

	Y	Y_{t-1}	Y_{t-2}	Y_{t-3}	X_{t-1}	X_{t-2}	X_{t-3}	F-stat	Decision
Argentina	*CA*	0.22	-0.22	0.06	-0.36			20.96***	Inflw⇒CA
		(1.42)	(-1.43)	(0.42)	(-4.58)***				
	Net Inflows	0.63			0.35			1.33	
		(3.27)***			(1.15)				
Colombia	*CA*	0.34			-0.55			2.56	Independent
		(1.36)			(-1.60)				
	Net	0.55			-0.19	0.24		1.37	
	Inflows	(2.01)**			(-0.84)	(1.66)			
Egypt	*CA*	-0.31			-0.36	-0.22	-0.23	8.81***	Inflw⇒CA
		(-1.47)			(-3.98)***	(-2.60)**	(-2.58)**		
	Net	0.39			-0.11			0.09	
	Inflows	(1.70)			(-0.30)				
Korea	*CA*	-0.20			-1.24			15.99***	CA⇔Inflw
		(-0.79)			(-4.00)***				
	Net Inflows	1.09			0.39			3.31*	
		(4.09)***			(1.82)*				
Malaysia	*CA*	0.55	-0.19	-0.40	-0.42			1.74	CA⇒Inflw
		(1.99)*	(-0.59)	(-1.49)	(-1.32)				
	Net Inflows	0.28			-0.46			3.28***	
		(1.01)			(-1.81)*				
Morocco	*CA*	0.51			-0.27	0.34	-0.32	2.15	Independent
		(2.55)**			(-1.18)	(1.56)	(-2.48)**		
	Net	0.82	-0.40	0.19	-0.10			0.23	
	Inflows	(3.26)***	(-1.68)	(1.37)	(-0.48)				
Turkey	*CA*	0.27	-0.29	0.41	0.33			1.97	Independent
		(1.04)	(-1.30)	(1.97)*	(1.40)				
	Net Inflows	0.08			0.47			2.83	
		(0.33)			(1.68)				
Venezuela	*CA*	0.05			-0.75			3.42***	Inflw⇒CA
		(0.23)			(-1.85)*				
	Net Inflows	0.67	-0.20	-0.30	0.16			2.33	
		(3.15)***	(-0.95)	(-1.61)	(1.53)				

Table 11a

Error Correction Model *Sample: Industrial countries*

	Y	X	e_{t-1}	ΔY_{t-1}	ΔY_{t-2}	ΔY_{t-3}	ΔX_{t-1}	ΔX_{t-2}	ΔX_{t-3}	Wald1	Wald2	Wald3
Austria	*CA*	*INFLW*	-0.80**	0.36			0.51**	0.36		4.77**	2.18	1.87
			(-2.19)	(1.40)			(2.09)	(1.65)				
	INFLW	*CA*	0.39+	-0.97*	-0.67*		-0.76*			3.35+	36.76*	22.74*
			(1.83)+	(-6.14)	(-4.85)		(-6.06)					
BEL	*CA*	*INFLW*	0.01	0.34			0.05			0.00	0.05	0.05
			(0.04)	(1.00)			(0.22)					
	INFLW	*CA*	-0.84*	0.04			0.10			6.63**	0.06	4.13**
			(-2.57)	(0.12)			(0.25)					
Iceland	*CA*	*INFLW*	-1.03**	0.18			0.33			5.82**	0.67	2.93+
			(-2.41)	(0.40)			(0.82)					
	INFLW	*CA*	0.03	-0.14			-0.07			0.00	0.02	0.00
			(0.05)	(-0.27)			(-0.14)					
US	*CA*	*INFLW*	-0.12	0.25			-0.01			0.16	0.00	0.19
			(-0.40)	(0.71)			(-0.05)					
	INFLW	*CA*	-0.53+	-0.19			-0.32			2.93+	0.53	2.37
			(-1.71)	(-0.71)			(-0.73)					

Notes: Wald 1 is an F-test on the statistical significance of the error correction term, Wald 2 tests the joint significance of the coefficients of the lagged independent variable, and the Wald 3 is an F-test on the joint significance of the error correction term and the coefficients of the lagged independent variable

Table 11b
Error Correction Model *Sample: Developing countries*

	Y	X	e_{t-1}	ΔY_{t-1}	ΔY_{t-2}	ΔY_{t-3}	ΔX_{t-1}	ΔX_{t-2}	ΔX_{t-3}	Wald1	Wald2	Wald3
Brazil	*CA*	*INFLW*	-0.60*	0.22			0.08			9.24*	0.15	6.56*
			(-3.04)	(1.14)			(0.39)					
	INFLW	*CA*	0.41	-0.35			-0.18			1.41	0.67	0.93
			(1.19)	(-1.44)			(-0.82)					
Singapore	*CA*	*INFLW*	-0.20	-0.19			-0.02	0.17		2.51	1.39	2.03
			(-1.58)	(-1.09)			(-0.12)	(1.36)				
	INFLW	*CA*	-0.48*	0.20			0.62**	0.18		9.31*	0.53	4.51*
			(-3.05)	(1.03)			(2.57)	(0.58)				

Notes: Wald 1 is an F-test on the statistical significance of the error correction term, Wald 2 tests the joint significance of the coefficients of the lagged independent variable, and the Wald 3 is an F-test on the joint significance of the error correction term and the coefficients of the lagged independent variable

Table 12a
Fully Modified OLS estimation
$CA_t = \alpha + \beta(Inflow)_t$

Country	β	Sample Period
Iceland	-0.82 (-8.89)***	1977-2000
Brazil	-0.55 (-4.91)***	1975-2000

Note: Bartlett Weights, 2 lags, no trend. t-statistics in parantheses.
Significance levels at 1, 5 and 10 percent are indicated by ***, **, *.

Table 12b
OLS estimation
$CA_t = \alpha + \beta(Inflow)_t$

Country	β	R^2	DW	Sample Period
Argentina	-0.12 (-1.27)	0.28	1.87	1977-2000
Egypt	-0.19 (-1.66)	0.51	1.98	1977-1999
Venezuela	-1.16 (-3.68)***	0.37	1.75	1970-2000

Note: Newey-West heteroskodasticity and autocorrelation consistent t-statistics in parantheses. Significance levels at 1, 5 and 10 percent are indicated by ***, **, *. AR(1) correction included.

Figure 1.1
CA, Inflows and Outflows : Industrial Countries

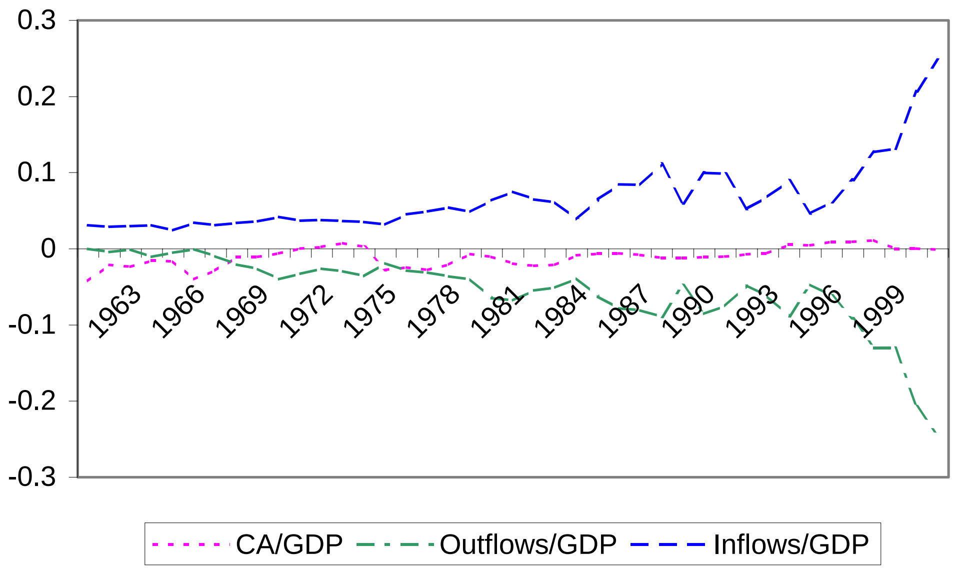
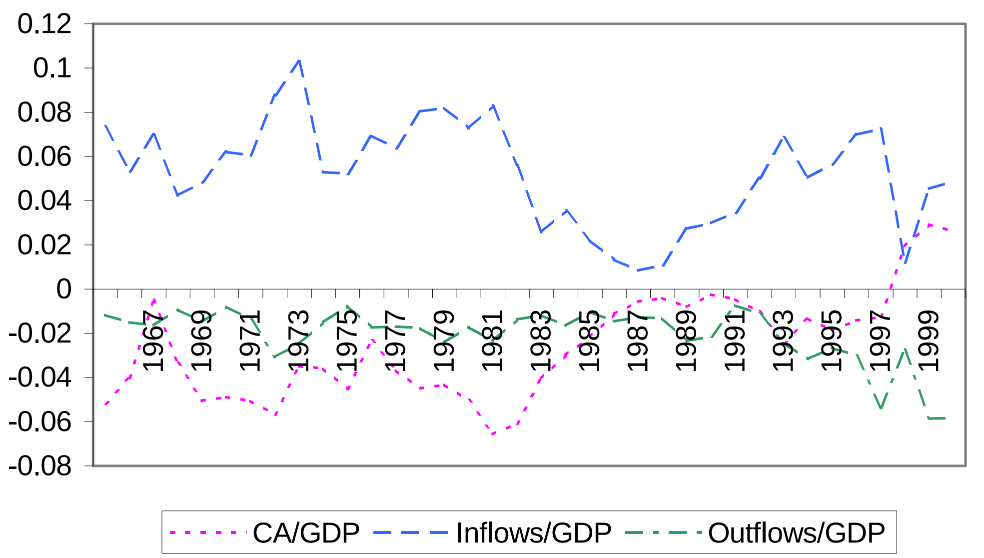
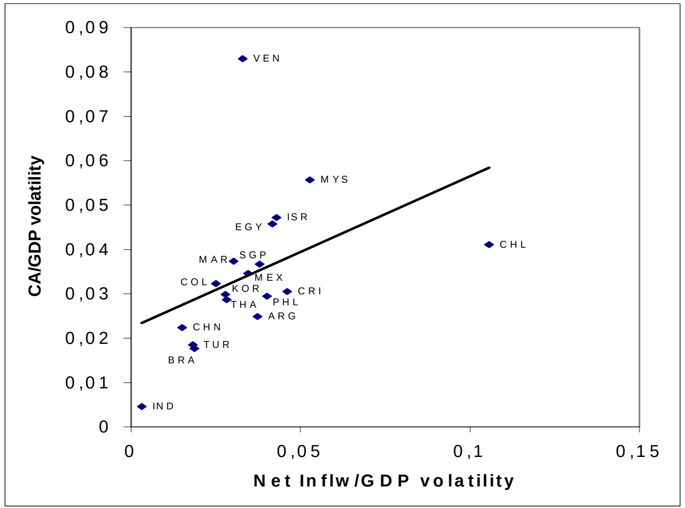


Figure 1.2
CA, Inflows, Outlfows : Developing Countries




CA/GDP volatility
Net Inflw/GDP volatility
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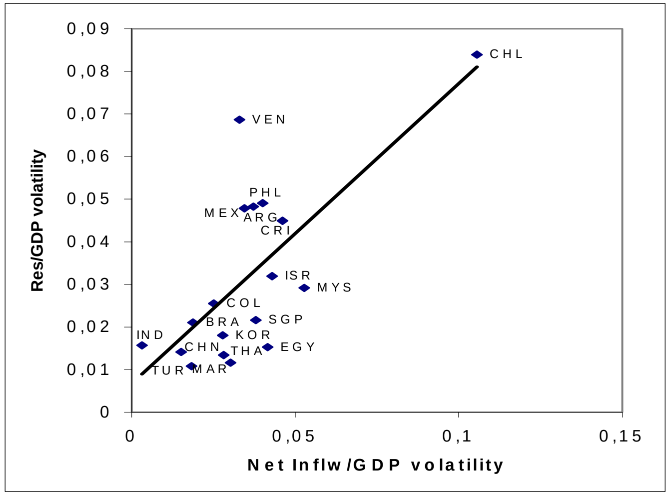
Res/GDP volatility
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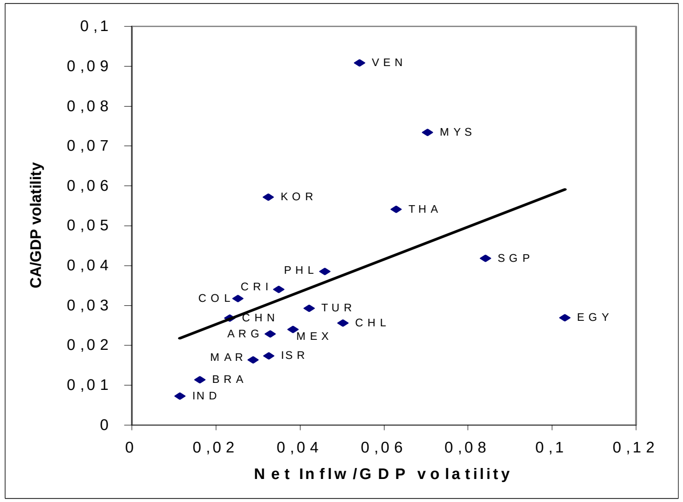
CA/GDP volatility
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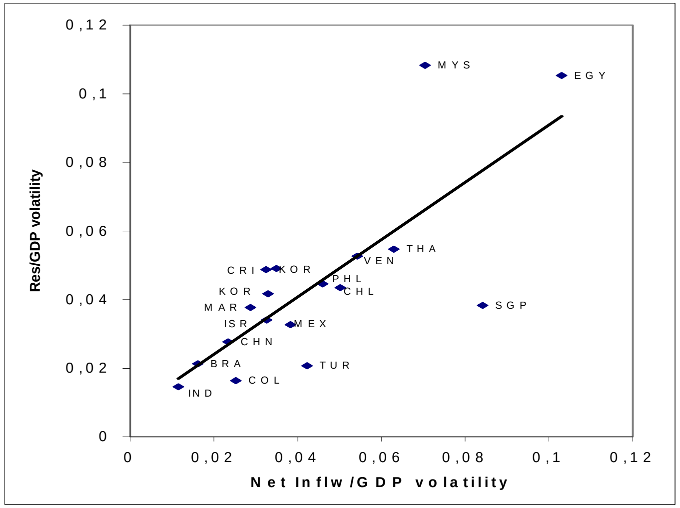
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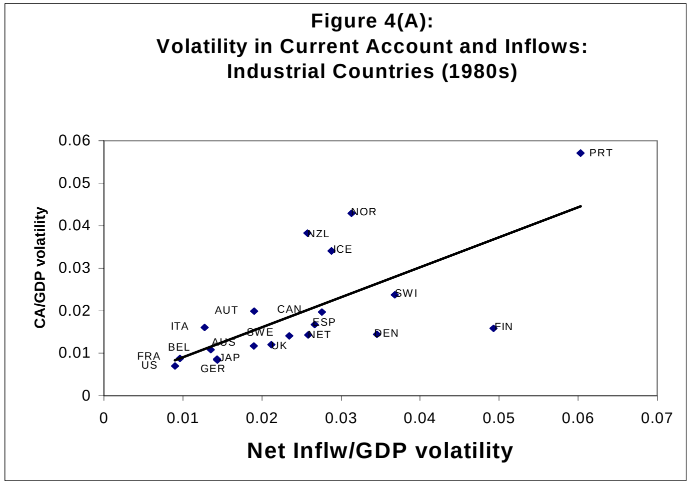
Figure 4(A):
Volatility in Current Account and Inflows:
Industrial Countries (1980s)
CA/GDP volatility
Net Inflw/GDP volatility
PRT
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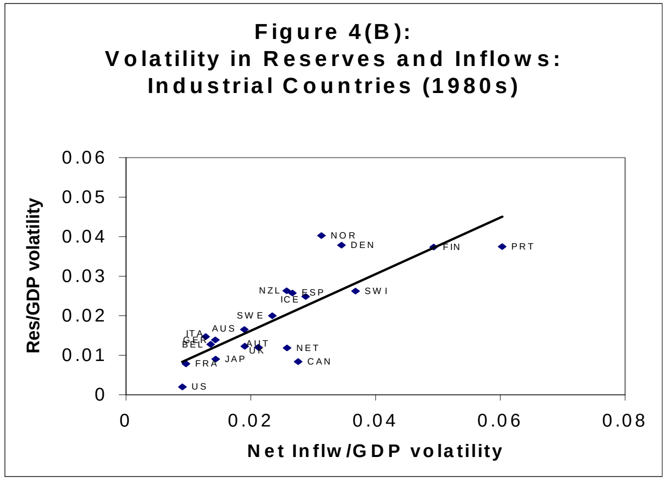
Figure 4(B):
Volatility in Reserves and Inflows:
Industrial Countries (1980s)
Res/GDP volatility
Net Inflw/GDP volatility
NOR
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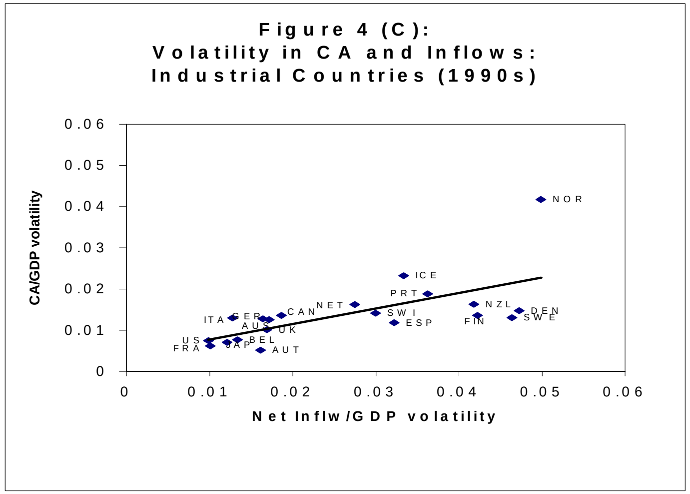
Figure 4 (C):
Volatility in CA and Inflows:
Industrial Countries (1990s)
CA/GDP volatility
Net Inflw/GDP volatility
NOR
ICE
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SWI
ESP
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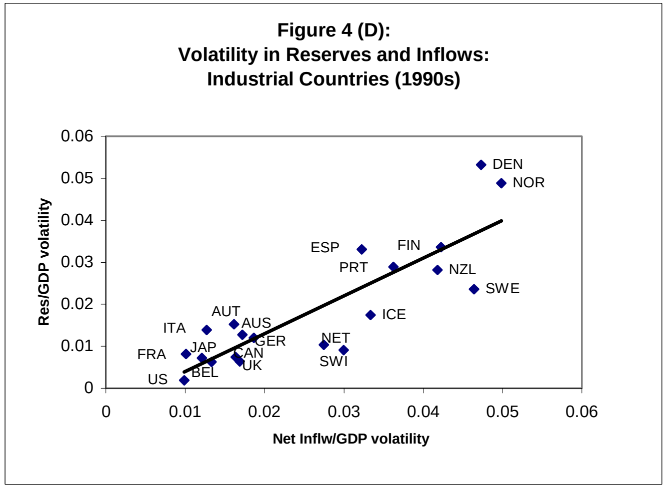
Figure 4 (D):
Volatility in Reserves and Inflows:
Industrial Countries (1990s)
Res/GDP volatility
Net Inflw/GDP volatility
DEN
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SWE
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