Growth from International Capital Flows: The Role of Volatility Regimes

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Abstract

Recent commentary has downplayed the growth dividend from international financial integration, highlighting the possibly negative correlation between capital inflows and long-run growth. This paper presents new evidence consistent with standard economic theory and a more benign interpretation of cross-border private capital flows. The key observation is that a country's growth volatility changes over time. With volatility below a threshold, an inflow of foreign capital has promoted growth. However, during periods of volatile growth, more flows have been associated with slower growth. Volatility levels and changes reflect an interaction of domestic production and institutional structures with global factors.

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1. Introduction

By definition, developing countries are short of capital. As such, they stood to benefit from the large inflows of international capital that came online in the 1980s and 1990s; but apparently they did not. In a recent survey, Kose et al. (2006) find little robust evidence for long-run growth benefits from global capital inflows. They suggest instead that international financial integration brings collateral benefits—greater financial development and better macroeconomic policies—but these do not necessarily or immediately translate into superior growth outcomes. Prasad et al. (2006) go a step further. They conclude that developing countries grow faster when they rely less on foreign capital, as revealed by a positive relationship between current account surpluses (capital outflows) and average growth (Figure 1). The implication then is that international capital may even hurt economic growth in poor countries.[1] This determination has acquired the status of a "stylized fact" and is now the cornerstone of a growing theoretical literature (Gourinchas and Jeanne, 2007; Benhima, 2008; Devereux and Sutherland, 2009; Sandri, 2010).

Yet some are not persuaded by the emerging consensus. They seek to identify the conditions that generate social value in moving capital from rich to poor countries. Eichengreen (2007, p. 1) has remarked that "…capital flows are something about which it is especially hard to make unconditional statements…" In particular, the effectiveness of capital flows may increase continuously with some conditioning characteristic: for example, Arteta et al. (2003) conclude that greater policy reform allows more gains from capital account liberalization. Similarly, Borensztein et al. (1998) and Alfaro et al. (2004) respectively, show that FDI is more effective in countries with a more educated workforce and stronger financial

[1] The Chinese example, a fast-growing exporter of capital, is misleading. In fact, China lies well above the regression line in Figure 1. This reflects a variety of factors which have contributed to the extraordinary growth performance of China (the same is true of other East Asian economies, Korea and Malaysia). When this extraordinary dimension is controlled for, China's growth is higher with capital inflows, as we show below.

markets. Alternatively, the effectiveness of inflows may increase *discretely* beyond certain conditioning thresholds. The search for such non-linearities, however, has been elusive, as Kose et al. (2009, p. 9) conclude: "The empirical literature has reported many interesting results but the robustness of these results and the estimated thresholds vary widely." From their own research, no decisive thresholds emerge, although they argue that institutional quality and financial development are the most likely conditioning variables.

We make three contributions to the thresholds research agenda. First, we introduce growth volatility as a threshold variable. We present evidence that a current account deficit, i.e., a capital inflow, can be beneficial for growth in a "low" volatility regime but this relationship breaks down when volatility crosses a threshold.[2] Second, this finding relies on the recognition that there occur within-country shifts in the volatility regime, i.e., countries are not immutably in one regime. Such shifts are in the spirit of Pritchett (2000) and Jerzmanowski (2006) who show that countries fall in and out of regimes, with distinct growth dynamics.Finally, we examine proximate determinants of volatility and find that shifts in a country's growth volatility are driven in large part by external factors.

Volatility, we argue, is a more inclusive variable than "institutions" or other partial characterizations of the productivity of investment. Besides being partial, earlier characterizations also tend to be slow-moving, with the consequence that countries typically remain within the same general business environment over extended periods of time. Volatility, in contrast, varies over time, and, importantly, there are good reasons to expect the productivity of capital will decline as volatility increases. When volatility is high, investment in equipment and technology will tend to be deferred and be associated with greater planning

[2] Sandri (2010) develops a model where countries facing financial frictions (and therefore high volatility) grow by increasing precautionary savings and running current account surpluses, while countries with developed financial markets (which experience less volatility) grow by running current account deficits. Thus the model has similar implications for the relationship between the current account, growth and volatility, although the causality runs from exogenous growth opportunities to the current account, rather than the other way around.

errors.[3] Higher macroeconomic volatility also depresses complimentary investment in human capital (Krebs et al., 2010). Further, capital flows that are intermediated through the banking system will tend to be misallocated when there is greater uncertainty about the risk-return characteristics of borrowers, reducing the productivity of the investments and also damaging the financial sector itself (Ritz, 2010; Baum et al. 2009)

Thus, the greater uncertainty of high volatility periods will deter investors, reducing, as we find, inflows of private capital. In other words, a change in regime from low to high volatility will tend to change both the extent of capital inflows and their productivity. The implication also is that the "long-term" effects of capital flows for an individual country are not precisely defined where countries do not stay in the same regime.

Using growth over 5-year periods as the unit of observation, we find that volatility (the standard deviation of growth) varies between a low of 0.27 and a high of 25.65 percent within our core sample of 61 developing countries. This is similar to the range observed by Ramey and Ramey (1995). On the basis of Hansen (1996 and 2000), we distinguish two regimes—a low volatility regime where growth volatility is less than 5.35 percent of real GDP, and high regime where volatility exceeds this threshold. Of our 61-country sample, 59 were in the low volatility regime for at least one of the 5-year periods covered by our analysis; 35 were in the high volatility regime for at least one period.

Within this set up, we separately analyze the determinants of growth for observations in the low and high volatility regimes. We conclude that earlier findings which point to no relationship between capital inflows and growth are driven principally by the breakdown of that relationship in high volatility regimes. In contrast, when countries are in the lower

[3] Across countries, high volatility is associated with lower growth (Ramey and Ramey, 1995, and Burnside and Tabova, 2010). Jerzmanowski (2006) finds this inverse relationship holds over time within a country. Similarly Zarnowitz and Moore (1986) report that periods of low growth in the United States have been marked by higher volatility. Bachmann et al. (2010), using U.S. and German data, find that increased uncertainty is associated with medium-term reductions in manufacturing output and employment.

volatility zone, they receive capital flows largely in the form of private capital and these higher inflows are, in fact, associated with higher growth. This relationship holds in the cross-section and in GMM models that potentially account for endogeneity. Interestingly, the aggregate capital inflows/GDP ratio has not necessarily been lower in the high volatility regime: rather, in the high regime, capital arrives mainly in the form of official aid, which (as Deaton, 2010 summarizes) is not associated with higher growth.

Our findings are related to a recent paper by Alfaro et al. (2010). There the authors argue the negative correlation between capital flows and growth, reported in Kose et al. (2006) and Gourinchas and Jeanne (2008), is driven principally by depressed growth in aid-dependent countries, as well by a few fast-growing capital exporters in Asia—notably China. Once aid flows are purged from current account data and the Asian outliers are removed, Alfaro et al. (2010) argue that a positive correlation re-emerges. Attempting to purge official financing from current account data however is not trivial and has yielded mixed results. Gourinchas and Jeanne (2008) for instance report a negative correlation between capital flows and productivity growth even when capital flows are netted of foreign aid.[4]

Our findings are in agreement with Alfaro et al. (2010); flows from official and private sources have differing effects on growth. However, the productivity of capital, even when it is primarily from private sources, varies across volatility regimes. Thus while the composition of the current account matters, it does not offer a complete explanation for the large variations in the relationship between capital flows and growth across countries and over time.

Finally, there is the question whether volatility itself is elevated by capital inflows, in which case our results would lose their force since higher volatility would only be a proxy for

[4] Admittedly, high productivity growth rates in Botswana, China, Korea, Hong Kong, Singapore and Taiwan appear to leverage the negative correlation between productivity growth and capital inflows in Gourinchas and Jeanne (2008). However removing these countries from their sample does not make the correlation positive, at best capital flows exhibit no correlation with productivity growth.

larger capital inflows and their harmful impact on growth. Our results show that the quality of institutions is just one of a constellation of factors that combine to determine overall volatility in a country. Rather a country's volatility arises from the interaction of its location and institutional features with global factors. Location is important because it is associated with production diversity (Malik and Temple, 2009). Conditional on these country characteristics, the level and changes in volatility are, to a large extent, the consequence of specific external factors most germane to the economy's external transactions including global growth, interest rates, and commodity prices (Burnside and Tabova, 2010). Once these considerations are accounted for, international capital flows do not add to the explanation of either the cross-sectional or within-country variation in volatility. Thus, volatility regimes—and with it the effectiveness of capital inflows—can change for exogenous reasons.

The remainder of this paper is organized as follows. To persuade the reader that our results are not the outcome of a particular sample or methodology, in Section 2, we trace the evolution of results from the benchmark regression of Prasad et al. (2006) through variations that highlight the role of volatility. In particular, we find that maximum likelihood estimates, as distinct from standard OLS, support a strongly positive role for capital inflows. This difference stems from the fact that maximum likelihood estimation places lower weight on high growth-volatility observations, reducing their influence in the determination of the coefficients. But since maximum likelihood is expected to increase efficiency and not correct for bias, we interpret the difference between the OLS and maximum likelihood results to signal a misspecification.

The intuition for this statistical finding is developed in Section 3 by identifying a volatility threshold that differentiates two regimes: one where volatility is low and foreign capital is productive, and one where it is high and foreign capital has little growth impact. We also report that conventional distinctions between good and bad institutions do not

differentiate the productivity of international capital. In Section 4, GMM results are used to address the endogeneity concern. Here we also report results for private and official flows. The distinction between low and high volatility regimes continues to be robust.

In Section 5, we examine the determinants of growth volatility. Our analysis, which is based on two recent papers—Malik and Temple (2009) and Burnside and Tabova (2010)—identifies structural characteristics important for understanding cross-country differences in volatility. However, conditional on these characteristics, growth volatility is a function of external drivers, which are largely exogenous. Section 6 concludes.

2. Specifying the Growth-Capital Flows Relationship

The empirical basis for the capital flows-growth relationship is the standard cross-country growth equation:

$$g_i = x_i'\beta + \theta k_i + \varepsilon_i \qquad (1)$$

Here g_i is the average long-run growth rate of real GDP per capita in country i, x_i is a set of controls, and k_i is a measure of the average capital inflow in country i. In Prasad et al. (2006) this measure of capital flows is the size of the current account surplus. When countries run a current account surplus, they export capital and when they run a deficit, they receive foreign capital to finance that deficit. Foreign capital inflows may take the form of private investment, portfolio equity, or credit flows; supplemented by loans from official agencies. The controls for other growth determinants are the usual suspects—initial income, life expectancy, trade openness, fiscal balance, and institutional quality.

We begin by trying to reproduce the Prasad et al. (2006) findings before considering a number of extensions. Since a current account surplus measures an outflow of capital, a positive coefficient on the current account implies that larger outflows are associated with higher growth. There are two main differences between our replication effort and the Prasad

et al. (2006) baseline. First, we focus on a 24-year period from 1980 to 2003, while they covered the period, 1970-2000; we omit their first ten years since the emergence of sizeable global capital flows is a characteristic of the post-1980s. Second, we increase country-coverage by measuring openness using the volume of trade (exports plus imports normalized by GDP) as opposed to the Sachs and Warner dummy. Thus, while our coefficient on openness is not directly comparable with theirs, all other coefficient estimates are, including that on the current account. The data sources are listed in the Data Appendix (Table A.1).

Column 1 in Table 1 reports the Prasad et al. (2006) results and column 2 reports our version of their specification. The comparable coefficients are of similar magnitudes, differences in statistical significance notwithstanding. They find that a decline in the current account-to-GDP ratio of one percent (i.e., an increase in the capital inflows-to-GDP ratio) is associated with a 0.1 percentage point drop in the average annual growth rate. From this they conclude that capital inflows hurt rather than help growth. Although with a smaller t-statistic, we find a coefficient of 0.06, supporting their result.

The adverse relationship between capital flows and growth is particularly characteristic of heavily aid-dependent countries, which are developmentally weak (Deaton, 2010). This is evident in column 3, where we omit countries with average aid flows exceeding ten percent of GDP. That brings the sample down from 87 to 61 countries (see Table A.2, Data Appendix), and the significance of the current account coefficient disappears. Yet, while capital flows no longer appear detrimental to growth, they do not appear to promote growth either. In particular, when we consider private and official sources of financing separately, we find that the coefficient on private capital is positive, but the relationship is far from statistically significant (column 4). Foreign aid on the other hand appears to be negatively associated with growth and that relationship is statistically significant (column 5). Thus, while our results are consistent with the distinction that Alfaro

et al. (2010) make between private and official flows, we do find that this differentiation by itself solves the puzzle.

2.1. Dealing with heteroscedasticity reveals misspecification

Typically, when estimating cross-country growth regressions, the average growth rate over the entire period is regressed against initial values or averages of covariates. But is averaging necessary for identifying long-run relationships and is it the most efficient use of data? When data are heteroscedastic, the answer is "no." Growth datasets are panels, providing a time dimension (as well as one that spans countries), and therefore a basis exists for estimating the heteroscedasticity in the errors. It is surprising then that OLS and not GLS is the standard econometric framework for growth-analysis.

A notable exception to the common approach is the important contribution by Ramey and Ramey (1995). In their study on the link between output volatility and growth, volatility matters not only because it is a determinant of long-run growth, but also because it suggests scope for improving estimation efficiency. To this end, they regress *annual* growth rates against a set of country-specific growth determinants using a maximum likelihood procedure that simultaneously exploits the time series variation in growth (to estimate growth volatility) as well as the cross-country variation in explanatory variables.

We adapt the Ramey and Ramey (1995) framework to estimate the following model:

$$g_{i,t} = x_i^{'}\beta + \theta k_i + \varepsilon_{i,t} \quad (2a)$$

$$\varepsilon_{i,t} \sim N(0, \sigma_{i,j}) \quad (2b)$$

where $g_{i,t}$ is the annual growth rate in country i for i =1,2, ….61 at time t for t =1980, 1981,…,2003. The explanatory variables retain their cross-sectional nature: hence the growth determinants, x_i, vary only across countries, and, thus, k_i is the average size of the current account balance for country i. The innovations to growth, $\varepsilon_{i,t}$, are assumed to be normally distributed with mean zero and standard deviation, $\sigma_{i,j}$, which, as in Ramey and Ramey

(1995), varies across countries but—distinctively in our case—also over time. We allow for five non-overlapping time intervals: j=1980-84, 1985-89, 1990-94, 1995-99, and 2000-03. Volatility is allowed to change from one interval to another but stays the same within each interval.

To help the reader appreciate the evolution of the results, we present these in a number of steps. First in column 1, of Table 2, we regress the *annual* growth rate against initial values and averages of our control variables. Since there are 24 observations for each country, there are now 1464 observations in our regression. Importantly, although the dependent variable varies from year to year, the variation in the independent variables is purely cross-sectional, hence OLS yields identical coefficients to those reported in column 3 of Table 1 (where the dependent variable is the *average* growth rate for each country).[5] However, now the standard errors will be biased downward, making a correction for clustering (by country groups) necessary. The resulting corrected standard errors are smaller than those reported in column 3 of Table 1, although only marginally.

Next, in columns 2 and 3 of Table 2, we present the maximum likelihood estimates as in Ramey and Ramey (1995), i.e., allowing volatility to vary *only* across countries. Now, the sign on the coefficient on the current account balance, suggestively, does change. However, the relationship appears little more than statistical noise. Note that our results are consistent with Ramey and Ramey's finding that higher volatility is associated with lower growth.

The important departure is when we estimate the system 2(a)-(b) allowing volatility to vary not only across countries but also over five-year intervals. In column 4, the covariates are retained as country averages or initial values. The coefficients on income, life expectancy,

[5] This is by construction. The regression using pooled annual data can be thought of as two separate regressions; in the first step, for each country i, we minimize the within sum of squared errors and in a second step we minimize the between group sum of squared errors. Because our controls exhibit no within country variation, the first stage is, in effect, a regression of the annual growth rate, y_i, against a constant, such that, $\hat{y}_i = \bar{y}_i$ for each i, which means that in the second step we would simply be regressing the mean growth rate in each country (the fitted value from the first step) against our controls.

trade openness and institutional quality are comparable to the earlier regressions. The effect of the current account, however, is very different: the negative coefficient has a larger absolute size and is marginally significant at the 10 percent level. In columns 5 to 8, the covariates also vary over five-year periods,[6] thus the emphasis shifts from a long-run to a medium-term analysis of growth. In these specifications, capital inflows show a strong relationship with higher growth, one that is significant at the conventional 5-percent level. Thus capital inflows may actually help, as the simplest economic theory leads us to expect.

But why are these results so different from those of Prasad et al. (2006)? Two aspects of our approach generate these differences: estimation by maximum likelihood and allowing for time-varying volatility. In maximum likelihood estimation, each observation is weighted by the reciprocal of volatility. Such a transformation should generate efficiency gains since high volatility episodes, which contain less information, are rendered less influential. It is unlikely, however, that efficiency gains can explain the large difference between the coefficient estimates. Notice, for example, that the other explanatory variables do not change sign, always retain their statistical significance, and change modestly in quantitative terms through the various exploratory exercises. It is only the current account coefficient that changes steadily from positive to negative (and significant). Thus, we might conjecture that the models relating capital flows and growth are misspecified, which, in turn, imparts a bias to the estimates. In particular, these results suggest that the relationship between the current account and growth is a function of the volatility of growth. Hence, an estimator that places more weight on observations for which the conditional variance of growth is low will tend to isolate a relationship that only holds during those country-periods.

Moreover, volatility can change significantly within countries. This is evident from

[6] Since the institutional quality index (taken from Hall and Jones, 1999) is measured around 1985, this variable is unchanging over time. Also, due to the paucity of annual fiscal-balance data, we use a country average for this variable. Thus both our measures of institutional quality and fiscal imbalances are country-specific and do not exhibit any variation over time.

between- and within-country breakdowns of volatility reported in Table 3.[7] If volatility is time varying and if a positive relationship between capital flows and growth only holds when volatility is low, then a division of the sample along country lines will not isolate the capital flows-growth relationship. This is evident from maximum likelihood regressions (Table 2, columns 2 and 3) where we allow volatility to vary only across countries. Some countries receive greater weight, while others with higher average volatility receive lesser weight. The relationship between capital flows and growth is not revealed precisely because capital does not always have a beneficial growth impact in a particular country. This contrasts sharply with the results in Table 2, where volatility is allowed to vary over time and the coefficient on the current account is negative and significant.

To be sure, the inference from the above exercise should not be about the appropriate methodology. Rather the findings are suggestive that the specification of the growth equation is suspect. In particular *time-varying* volatility should belong in this equation as a variable that conditions the impact of capital flows.

2.2. Alternate specification

If the issue is one of misspecification, then re-specifying the model to account for the variation in the relationship between the current account and growth should yield consistent results, even when the method of estimation is OLS. Below we take this approach. In particular, we regress the *average* growth rate, $g_{i,j}$, in country i in period j (for j=1980-84, 1985-89, 1990-94, 1995-99, and 2000-03) against average and initial values of our controls, the average size of the current account, $k_{i,j}$, as well as a measure of volatility, $\sigma_{i,j}$, and a term that interacts the current account with volatility. The measure of volatility is obtained from

[7] For developing countries, Burnside and Tabova (2009) find that external factors (such as U.S. GDP growth, the U.S. interest rate, and commodity prices) account for about 70 percent of GDP fluctuations in developing economies. Since these external factors have a high degree of time variation, it stands to reason that country volatility will also be time-varying. For developed economies, Zarnowitz and Moore (1986) and, more recently, Bachmann, Elstner, and Sims (2010) also find such time variation.

the model estimated in column 7 in Table 2. The results are presented in Table 4.

Simply interacting the current account with growth-volatility does not reveal a statistically meaningful relationship (column 1). This could be because the proper specification of the interaction may be nonlinear. Hence, in columns 2 to 4, we consider interactions between the average size of the current account balance and dummies for whether volatility lies below the 25th percentile (column 2), below the 50th percentile (column 3) and below the 75th percentile (column 4). Our results suggest that when volatility is high, the capital flows-growth relationship is weaker. This differentiation is most evident when the top quartile (the highest 25 percent volatility outcomes) is contrasted with the bottom three quartiles. For the top quartile, growth is *positively* correlated with the current account, i.e., countries exporting more capital grow faster (a one-percentage point increase in the capital inflows-GDP ratio is associated with 0.159 percentage points lower growth). However, countries in the bottom three quartiles benefit from additional flows: a one percent point increase in the capital inflows-to-GDP ratio translates into a growth rate that is 0.075 percentage points higher (Table 4, column 4). The relevant coefficients are significant at the 7-8 percent confidence level rather than the conventional 5 percent level.

In sum, the evidence presented in this section leads to two significant considerations. First, time-varying volatility conditions the relationship between capital flows and growth. Second, the variation in volatility is particularly germane when volatility exceeds a (relatively high) threshold: volatility must be in the top quartile to influence that relationship, but then it does so in a significant way. These results are consistent with threshold effects in the current account-growth-relationship, though they are not based on a formal statistical test for such a hypothesis. In the next section, we provide a more rigorous treatment of threshold effects.

3. Volatility Thresholds

To test if the capital flows-growth relationship is characterized by threshold effects in volatility, we estimate the following nonlinear growth model:

$$g_{i,j} = x_{i,j}'\beta + \theta_1 k_{i,j}\left[1 - I\left(\sigma_{i,j} > \tau\right)\right] + \theta_2 k_{i,j}\left[I\left(\sigma_{i,j} > \tau\right)\right] + \varepsilon_{i,j} \quad (3)$$

This specification allows the effect of the current account, $k_{i,j}$, on growth, $g_{i,j}$, to vary with growth-volatility, $\sigma_{i,j}$. As before, the subscript i indexes countries and j denotes one of the following time periods: j=1980-84, 1985-89, 1990-94, 1995-99, and 2000-03. $I\left(\sigma_{i,j} > \tau\right)$, is an indicator function that allows the relationship between $g_{i,j}$ and $k_{i,j}$ to change when $\sigma_{i,j}$ exceeds a threshold, τ. Although τ is unknown it can be estimated (see Hansen, 1996; 2000), however under the null hypothesis of no threshold, τ is unidentified. Accordingly the distributions of classical test statistics are non-standard. Nevertheless a test of the null can be formed and p-values can be computed by bootstrap (see Hansen 1996; 2000).

Below we test this null, i.e., the hypothesis $H_0: \theta_1 = \theta_2$ against the alternative $H_a: \theta_1 \neq \theta_2$. Since our focus is on a threshold in the *current account-growth* relationship, we have imposed the restriction that other model parameters are constant across regimes. This restriction is in the spirit of the empirical results reported above, which show that only the capital inflows-growth relationship changes in a meaningful way with volatility.[8]

The evidence strongly favors a split based on volatility; the null hypothesis is rejected with a p-value of 0.02. The split occurs when the standard deviation of growth crosses 5.35 percent of real GDP per capita (Table 5). This is a high threshold; only 25 percent of observations belong to this high volatility regime. Since the low- and high-volatility group regressions are jointly estimated with the threshold using OLS, there is now no weighting of

[8] We follow Hansen (1999) in constraining the slope coefficients on a subset of the model variables to be the same across the regimes. This focuses attention on the variable of interest, i.e., the current account. Thus any evidence of a threshold is based solely on the additional explanatory power provided when we allow the effect of the current account to change across regimes.

observations by time-varying volatility as was the case in our exploratory exercise above. In the low-variance regime, an inflow of capital of one percent of GDP is associated with a 0.094 percent increase in the growth rate. In the high-volatility regime capital inflows accompany a sharp reduction in growth. These results are depicted also in Figure 2. Notice that while China is an "outlier" in cross-sectional regressions, indicating some omitted factors that explain Chinese performance, once these are put into the black box of country fixed-effects, Chinese growth is positively correlated with capital inflows in the low growth-volatility regime and negatively correlated with capital flows in the high volatility regime. Thus, not taking into account China's special growth drivers, leads to misinterpretation of that country's relationship with capital flows.

If instead, we separate countries by an institutional threshold (columns 3 and 4), the coefficient on capital flows is not significant at the 5 percent level in either the low or the high institutions regime. Thus, institutions do not differentiate countries by the productivity of capital flows; indeed there is no statistical basis for rejecting the null (p-value of 0.54). By contrast, the case for a threshold in income is somewhat stronger. In poor countries, with per-capita income less than $2350, capital flows have negative effects on growth; and this relationship is statistically significant. In richer countries, the relationship between capital inflows and growth is unclear. However, these differences are not sufficiently large to reject the null hypothesis of no threshold in income (p-value is 0.2).

The quality of institutions and average per-capita income are only marginally lower in the high volatility group [see Panel A of Table 6 where we sort the 298 observations (=61 countries*5 periods-7 missing observations) by low and high volatility]. A large number of countries fall in *both* low and high volatility regimes over the 24-year span of our data. Slow-moving variables such as institutions and income do not change with these large volatility movements. While private capital flows are clearly higher in the low volatility regime, total

inflows across the regimes are similar (in fact, aggregate capital flows are somewhat larger in the high volatility regime) because of the size of official flows in the high volatility regime.

Another helpful differentiation of countries is by the number of periods spent in the high-volatility regime [Panel B of Table 6 and Figure 3(a)]. In our 61-country sample, 26 countries were in the low volatility regime throughout. Of the other 35 that experienced high volatility for at least one period, Suriname had four periods of high volatility and the Republic of Congo and Zimbabwe experienced high volatility throughout. Thus, the bulk, 32 countries, experienced high volatility in three periods or less. The incidence of high volatility was not however disproportionately concentrated in any specific time period [Figure 3(b)].

Countries in a high volatility regime for fewer periods are richer and have better institutions (the exception are countries with only one period of high volatility which perform better on some dimensions than countries with zero periods of high volatility.) As the number of volatility periods increases, the ratio of *private* capital flows to GDP decreases; with the exception of the last group of three countries with either 4 or 5 periods of volatility where private capital flows are rather high. In this group, Suriname and the Republic of Congo, have large commodity-producing sectors that attract sizeable private capital flows. However, their heavy reliance on commodities implies that private investment is directed to small enclaves while the broader economy remains underdeveloped and subject to high volatility. Finally, the group with zero periods of high volatility has somewhat high foreign aid flows but, thereafter, the ratio of aid flow-to-GDP increases with the number of periods of volatility.

In Table 7, we present another set of regressions, where observations are organized by the number of periods a country falls into the high volatility regime. Column 1 includes only countries with zero periods of high volatility. Here simple OLS suggests that capital inflows are associated with higher growth; moreover, the maximum likelihood estimates (which weight the observations) are virtually identical to the OLS estimates. In this group, there is,

thus, no evidence of misspecification. When we add countries with one period of high volatility, the OLS result becomes fuzzy and it takes the maximum likelihood estimates to reveal the positive relationship between capital inflows and growth. The same conclusion applies to the samples that include two and three periods of high volatility.

In summary, we have presented evidence of a break in the reduced form relationship between capital flows and growth when volatility increases beyond a high threshold. Capital inflows are associated with higher growth only in the low volatility regime. This regime also attracts more private capital and, therefore, stimulates productive investment. A high volatility regime, on the other hand, attracts smaller private capital flows and has greater dependence on foreign aid; in this regime, increased capital flows are associated with reduced growth. We pursue the distinctions between private and official flows in the next section, where we also consider the issue of endogeneity of capital flows.

4. Panel Regressions and Endogeneity

Our results are subject to the concern that causality may run from growth to capital flows. Isolating an exogenous source of variation correlated with the flow of capital into countries but uncorrelated with innovations to growth in cross-country data however has proved particularly difficult. Wei and Wu (2002) and Portes and Rey (2005) use distances between nations as an instrument for the volume of bilateral capital flows, the idea being that proximity provides informational advantages to investors and is therefore associated with the volume of capital movements. While distance is a plausible instrument for bilateral capital flows, it is less clear how one might instrument for the average size of the current account balance, which measures the overall net inflow or outflow of capital into a country. One possibility is a measure of “distantness”—a weighted average of distances from one country to other countries. Unfortunately, we found this variable to be weakly correlated with the

average size of current account balance and thus not a suitable instrument.

We attempt to address the issue of identification within a panel framework. This also allows us to control for country-specific effects. We estimate our models using the system-GMM estimator outlined in Arellano and Bover (1995) and Blundell and Bond (1998). This estimator is well suited for handling endogenous variables that exhibit a large degree of persistence (Bond et al., 2001)—a characteristic common to many macro panels.[9] We report results based on the one-step variant of this estimator, since the standard errors in the two-step estimator are downward biased in finite samples.

Using the threshold level of volatility reported in Table 5, we split our data into high- and low-volatility samples (Table 8). While we report fixed effects estimates, which are known to be biased, we rely on the Arellano-Bover estimates in drawing inferences.[10] Fiscal balances and institutional quality are omitted from these regressions due to the lack of time-series variation in these data.[11] Our finding above is confirmed for the low volatility regime. In fact, the relationship in the low volatility setting is stronger within countries than across them. A one percent increase in the current account deficit relative to GDP is associated with a 0.184 percent increase in average annual growth rates, which compares with a 0.094 percent increase in the OLS results (Table 5). In the high volatility regime, the GMM point estimate on the capital flows coefficient is indistinguishable from zero—thus, while capital does not foster growth in the high volatility regime, it also does not hurt growth as implied by the OLS (and fixed-effects) estimates. Possibly, negative shocks to growth attract capital inflows to smooth the effects of those shocks. Bluedorn (2005), for instance, finds that a

[9] Bond et al. (2001) also note that this estimator mitigates the measurement error problem.

[10] Following Arellano and Bond (1991) we are unable to reject the null of the validity of the over-identifying restrictions [Table 9, columns (2) and (4)]. Also second-order serial correlation is absent.

[11] While annual data on fiscal balances are available. For some countries there are large gaps in these data. Calculating five-year averages of this variable would therefore sharply reduce the sample. For this reason we have omitted the fiscal balance variable from our analysis.

shock valued at one year's GDP pushes the current account into deficit by 5 percent.

4.1. Breakdown by type of flows

Next, we distinguish between private and official forms of external financing in the low and high volatility regimes (Table 9). We measure flows as the average net inflow of private capital and the average inflow of foreign aid over each of the five-year periods. Our data on private capital flows, which are sourced from the *World Economic Outlook*, may, in some cases, include a small element of official flows. Unfortunately, this limitation is not easy to overcome, and better data are, as of yet, unavailable. Alfaro et al. (2010) consider an alternative measure of private inflows which subtracts the official component of capital from the current account balance. Here we do not take this approach, since our estimates of foreign aid, as is conventional, are not just the estimates of official flows on the capital account but also those such as grants, which are included in the current account. Hence the sum of the private capital flows and the official inflows does not equal the current account deficit.

In our benchmark specification, we regress growth against flows, initial period income, life expectancy, the average volume of trade flows and time period dummies; an extended specification also includes population growth, financial development and financial integration as additional controls.

Our results suggest that inflows of private capital are associated with higher growth in the low volatility regime. The Arellano-Bover estimates suggest that a one percent increase in private capital inflows relative to GDP raises growth between 0.144 and 0.242 percent annually (Table 9, columns 2 and 4). Private capital flows and growth are also positively correlated with growth in the high volatility regime (Table 9, columns 5 and 6); however this relationship is not statistically significant or robust (Table 9, columns 7 and 8).

Foreign aid appears to retard growth during periods of low volatility, but not in a statistically significant manner. The negative coefficients on the aid variable are somewhat

larger in the high volatility regime but they are also never significant at the 5 percent level. Moreover, the size of the coefficient is sensitive to the inclusion of Suriname and the Republic of Congo—absent these two countries, the size of the coefficient falls even further. Thus, whether in the low or high volatility regimes, inflows of official flows do not have a significant effect on growth (as Rajan and Subramanian, 2009, conclude).

5. Determinants of Volatility

Our finding that the effect of flows varies across a volatility threshold raises the further question: what exactly does volatility represent? It could be that volatility proxies for a "mysterious" combination of factors that make some economies operate well and others not. So it may not be volatility, per se, that deters foreign investors and creates a poor response to foreign investment. Rather, factors that raise volatility hurt the investment climate.

In considering the determinants of growth volatility, we base our analysis on two recent papers—Malik and Temple (2009) and Burnside and Tabova (2010). Using a Bayesian approach, Malik and Temple (2009) distill the most robust cross-country determinants of volatility. While they find that weak institutions contribute to higher volatility, their results also highlight an important role for the geographical features of an economy. These are associated with production structures that create high volatility conditions. In contrast, Burnside and Tabova (2010) compute a summary metric of volatility generated by time-varying global (external) shocks interacting with an indirect characterization of domestic structural features. We find the Burnside and Tabova (2010) metric to be a surprisingly good proxy for the determinants of country-volatility, both in the cross-section (as they report) and within-countries over time, as in our extension.

To obtain their proxy for exposure to external volatility, for each country, Burnside and Tabova begin by regressing the annual GDP growth rate on six global factors. Three of

these—US growth, the three month T-Bill rate corrected for inflation, and excess returns on US stock markets—are related to the phase of the US business cycle, and the other three are shocks to commodity price indexes. We estimate a similar set of equations:

$$g_{i,j} = \alpha_i + x_j^{'}\beta_i + \varepsilon_{i,j} \qquad (4)$$

The dependent variable, $g_{i,j}$, is the annual per-capita GDP growth rate in country i in each year $j = 1980, \ldots, 2003$, and x_j includes the six global factors in Burnside and Tabova's specification along with the median growth rate in our 61-country sample as a proxy for developing-country-growth trends.[12] The correlation between the median growth rate and errors in the country-specific growth equation can be assumed to be negligibly small; as such, all explanatory variables can be treated as exogenous.

Growth responds in each country to these exogenous influences in varying ways. That is, for each country, the regressions generate a specific set of β's, which reflect structural features of that country (such as whether it is an oil importer, its relationship to the US, and so on). Although often these growth equations do not have high explanatory power, the volatility of *predicted* growth rates from the country-specific growth equations is cross-sectionally highly correlated with actual growth volatilities. This is the basis for Burnside and Tabova's conclusion: conditional on domestic structures, the variation in growth generated by external factors picks up much of the actual variation in cross-country growth rates. In our re-estimation of their results (for a different country set and time period), the coefficient on the volatility of predicted growth rates, $\hat{\sigma}_i$, was 1.469 (t-statistic=7.92) and the R-squared was 0.76 (Table 10, column 1);[13] this is very similar to the Burnside and Tabova (2010) result,

[12] We also considered the mean growth rate in our sample as a regressor, as well as the baseline Burnside and Tabova specification. These alternatives generated qualitatively similar results.

[13] Burnside and Tabova (2010) estimate the actual volatility of growth as the standard deviation of the annual real GDP growth rate. To stay consistent with our earlier analysis, we follow Ramey and Ramey (1995) and estimate the volatility of innovations to growth jointly in a maximum likelihood regression of annual growth rates on country-specific determinants of growth. Specifically our estimate of growth volatility is obtained from the regression equation reported in Table 1, column 6.

confirming the robustness of their original finding.

In columns 2 and 3 of Table 10, we assess to what extent the Burnside and Tabova (2010) summary measure is capturing standard determinants of volatility, such as those considered by Malik and Temple (2009)—geographical characteristics measuring remoteness to external markets, the volatility of its terms of trade, ethnic fractionalization, the incidence of wars, institutional quality, and government type. Geographical "remoteness" matters for volatility, according to Malik and Temple (2009), since it is associated with undiversified export bases, which makes countries susceptible to volatility.

Our coefficient estimates are generally consistent with Malik and Temple's results. For instance, output is more volatile in smaller countries and volatility rises (although non-linearly) with a country's distance from the coast. We considered three measures of institutions—the Hall and Jones index, the composite ICRG risk rating and a measure of constraints on the executive branch of government in 1980. All three measures of institutions matter in specifications excluding a proxy for government type. When government type is included in the specification, volatility is found to be lower in democracies (Weede, 1996; Henisz, 2000), and the other institutional variables become insignificant. Thus political institutions dominate other institutional quality ratings. Ethnic fractionalization and external wars combine to raise volatility and in some specifications terms of trade volatility is significant. Together, however, the Malik and Temple (2009) variables account for only 45 percent of the cross-country variation in growth volatility.

In column 3, when we add the Burnside and Tabova measure as an additional regressor in the equation, there is evidence of overlap. The Burnside and Tabova measure has now a smaller point estimate than when entered by itself, but remains highly statistically significant. The Malik and Temple variables retain their signs and significance but are less influential. The interesting conclusion is that the inclusion of the Malik and Temple variables

adds little explanatory power, since the Burnside and Tabova variable by itself explains 76 percent of the cross-country variation in growth volatilities, with the R-squared rising to 81 percent following the inclusion of the Malik and Temple variables.

For our purpose, it is also important to evaluate the determinants of changes in a country's volatility over time. These changes create the potential for a regime change. It is natural to focus on the Burnside and Tabova measure, which is clearly salient in the cross-section and also has a natural time variation arising from the variation in external factors. The inclusion of country-specific fixed effects implies, in any case, that the bulk of the Malik and Temple variables drop out.[14] In column 4, we report the results from a within-country regression of actual volatility against predicted volatility and time-period dummies.[15] These results suggest that the variation in actual volatility almost exactly mirrors the variation in predicted volatility, implying that the volatility of external influences strongly conditions the changes in volatility within a country.

Although external factors appear to be important, there exists the possibility that the capital inflows themselves raise volatility. Such a correlation would undermine our finding of a positive relationship between capital flows and growth since the implication would be that beyond a certain size, capital inflows actually hurt growth through their volatility-inducing effects. In columns 5 to 6, we include the average size of current account balances, average net private flows and foreign aid, over five-year windows as regressors in our equation. The results suggest that an inflow of capital, i.e., a current account deficit, is unrelated to output volatility. Private capital flows are negatively associated with volatility and official flows are

[14] Terms of trade volatility does vary over time but is largely captured by variation in the Burnside and Tabova measure. Institutional variations are captured in the ICRG measure and do show that improved institutions are associated with reduced volatility (results not reported).

[15] Actual volatility in this case is estimated jointly in a regression of annual growth rates on country-specific determinants of growth. Specifically our estimate of growth volatility is obtained from the regression equation reported in Table 2, column 4. Predicted volatility, is the five-year volatility of *predicted* growth rates estimated from country-specific growth equations of the form (4).

positively associated with volatility; but, given the low statistical significance of these findings, not much can be read from them.

We thus reach a number of conclusions. Externally-induced volatility differentiates country volatility: but, as the Burnside and Tabova method implies, the level of volatility is a function of the domestic structure. Though the Malik and Temple approach helps identify some of these structural factors, the greater explanatory power of the Burnside and Tabova variable suggests that additional structural features are at play. Our new finding is that changes in growth volatility within countries over time, conditioned by unchanging structural features, are largely dependent on changes in global drivers, and are not correlated with capital flows in aggregate (or private and official flows separately).

Thus for countries that stay in a particular regime over time, their structural and institutional characteristics matter. Weak institutions raise volatility, but there is much more going on. As a result institutions are not a good proxy for volatility. Geographical remoteness is an important additional feature and other, as yet unidentified, country features also amplify global shocks. In this sense, volatility is an inclusive measure, encompassing several country features that deter international capital and render them less effective. Our results, however, also highlight that the movement of a country in and out of a volatility regime is most likely due to global factors that can be considered largely exogenous to domestic influences.

6. Conclusion

The failure to find the expected growth-enhancing role of foreign capital has led some to accept this as a stylized fact. Others have continued an elusive search for non-linearities in that relationship. This paper offers a new perspective. We conclude that non-linearites are important: with countries differentiated by their level of growth volatility. Some countries tend to stay in a volatility regime; but in others, movement from one regime to another causes

shifts in the productivity of capital inflows.

We have tried to persuade the reader that our results are not the consequence of a particular sample or methodology. We did so by tracing out the evolution of our result, from a benchmark, where capital flows are negatively correlated with growth—a popular current view—to our final specification where capital flows and growth are positively correlated during periods of low volatility. We find that a standard deviation of innovations to growth of 5.35 percent of real GDP per-capita demarcates low and high volatility regimes. In the high regime, capital inflows are negatively correlated with growth, which also drive the negative correlation between capital inflows and growth when all countries are pooled. Thus, a failure to distinguish between volatility regimes leads to an unwarranted conclusion that capital inflows are damaging in all situations.

Even when growth and capital flows are positively correlated, the possibility exists that growth causes capital flows. Recognizing the limitations of GMM estimates in dealing with endogeneity, our results suggest that capital inflows do spur growth.

The action in our results comes mainly from private capital flows. In a low volatility regime, countries are able to attract larger private capital flows, but importantly also within this regime, capital flows raise growth; in high volatility settings, private capital flows diminish and have an insignificant relationship with growth. Aid flows increase in high volatility regimes but whether in a low or high volatility period, aid has a negative relationship with growth.

That a volatility threshold should distinguish the productivity of foreign capital seems natural. Low volatility conditions are more conducive to investment. They thus tend to attract more private capital.[16] And, in that setting, private capital can undertake more medium-term and riskier investments enhancing growth. In high volatility conditions, reliance on foreign

[16] Some heavily commodity-reliant economies do attract private capital that is large in relation to the economy but being of an enclave nature has limited impact on growth or in mitigating the volatility of that economy.

aid is greater, which has had a poor record of accelerating growth.

Our exploration of the determinants of volatility showed that structural features, that include geographical remoteness, distinguish levels of a country's growth volatility. Weak institutions do raise volatility, but are only part of the explanation and hence do not, by themselves distinguish capital flow-growth regimes. Our findings also imply that the shift from one regime to another is largely a function of changes in global factors.

A final implication of our findings is that statements about "long-run" effects of foreign capital do not apply when countries move in and out of regimes. As noted, only 26 of the 61 countries in our sample were in the low volatility regime throughout the period analyzed. For the other 35 countries, the effective long-run relationship between capital inflows and growth will be a combination of the effects in low and high volatility regimes.

Abstract

Table A.1. Descriptions of Variables and Data Sources

	Dependent Variable
Growth	Log difference of chained real GDP (× 100) (series rgdpch, PWT 6.2). In a number of regressions the dependent variable is the annual growth rate. In others, it is the average, either over the entire sample period 1980 to 2003, or over the following non-overlapping periods: 1980-84, 1985-89, 1990-94, 1995-99, and 2000-03.
	Explanatory Variables
Current Account	Expressed as a percent of GDP (series BCA, *World Economic Outlook*). The current account appears as an average, either over the entire sample period or from 1980-84, 1985-89, 1990-94, 1995-99, and 2000-03.
Ethnic Fractionalization	One minus the Herfindahl index of ethnolinguistic group share, reflecting the probability two randomly selected individuals belong to different groups (Alesina et al., 2003).
Financial Development	Private credit as a percent of GDP intermediated through the financial sector (World Bank, *Financial Structure Database*).
Financial Integration	Sum of stocks of (the absolute value of) external assets plus external liabilities as a percentage of GDP (Lane and Milesi-Ferretti, 2007).
Fiscal Balance	General government balance expressed as a percent of GDP (series GGB, *World Economic Outlook*). Due to the paucity of these data, this variable appears only in our cross-country regressions as an average for the entire sample period.
Foreign Aid	Net official development assistance, (series DT.ODA.ALLD.CD, *World Development Indicators*, 2008). We take the average of this variable, either over the entire sample period, or over the following periods: 1980-84, 1985-89, 1990-94, 1995-99, and 2000-03.
Government Type	The difference between democracy and autocracy scores (Polity IV project).
Institutional Quality	A measure of government anti-diversion policies (Hall and Jones, 1999) constructed from five ICRG variables: "Corruption in Government," "Rule of Law," "Expropriation Risk," "Repudiation of Contracts by Government," and "Quality of the Bureaucracy." This variable is measured for each country around 1985.
Initial Income	Log of real per capita GDP adjusted for differences in purchasing power (series rgdpl, Penn World Tables 6.2). In our regressions this variable is either the 1980 value, or the initial value in each of the following periods: 1980-84, 1985-89, 1990-94, 1995-99, and 2000-03.
Life Expectancy	Measured in years (series SP.DYN.LE00.IN, *World Development Indicators*, 2008) in 1980, or the initial period value in each of our five non-overlapping periods.
Land Area from Coast	The proportion of a country's total area within 100 km of the ocean or ocean navigable river (Gallup et al., 1999).
Landlocked	Dummy for landlocked country (Gallup et al., 1999).
Openness	Total volume of trade flows as a percent of GDP (series NE.TRD.GNFS.ZS, *World Development Indicators*, 2008). We take the average of this variable, either over the entire sample period, or over following periods: 1980-84, 1985-89, 1990-94, 1995-99, and 2000-03.
Population	The logarithm of the initial population in 1980 (series SP.POP, *World Development Indicators*, 2008).
Population Growth	Average population growth (series SP.POP.GROW, *World Development Indicators*, 2008) over the following periods: 1980-84, 1985-89, 1990-94, 1995-99, and 2000-03.
Private Capital	Sum of net direct investment, net portfolio flows, and other net private capital flows (series BFXP, *World Economic Outlook*). Due to data limitations "other private capital flows" are calculated by subtracting liabilities to official creditors from total other investment. As such, these data *may* include *some* official investment. In our regressions, we take the average of this variable over the following periods: 1980-84, 1985-89, 1990-94, 1995-99, and 2000-03.
Primary Commodities Price Indexes	Oil, metals, and agricultural products price indices, converted to relative prices using the US PPI (Burnside and Tabova, 2010).
US Real GDP Growth	Calculated as the log difference of US real GDP per capita in constant 2000 dollars (× 100) (Burnside and Tabova, 2010).
US Real Interest Rates	Difference between the 3 month T-bill rate and the rate of inflation of the US producer price index (Burnside and Tabova, 2010).
US Excess Returns	Excess return on the US stock market (Burnside and Tabova, 2010, original source: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html).
Volatility of Terms of Trade	Standard deviation from 1980 to 2003 of the log difference in net terms of trade (× 100) (series TT.PRI.MRCH.XD.WD, *World Development Indicators*, some gaps filled using data from *International Financial Statistics*).
War	Dummy for external war between 1960 and 1985 (Gallup et al., 1999).

Table A.2. List of Countries: Main Sample

61 Country Sample	
East Asia and the Pacific	*Middle East and North Africa*
China	Algeria
Fiji	Egypt
Hong Kong	Iran
Indonesia	Israel
Korea	Malta
Malaysia	Morocco
Philippines	Oman
Thailand	Saudi Arabia
East and Central Europe	Syria
Hungary	Tunisia
Poland	South Asia
Romania	India
Turkey	Pakistan
Latin America and the Caribbean	Sri Lanka
Argentina	*Sub-Saharan Africa*
Bahamas	Botswana
Barbados	Cameroon
Bolivia	Republic of Congo
Brazil	Cote d`Ivoire
Chile	Ethiopia
Colombia	Ghana
Costa Rica	Kenya
Dominican Republic	Mauritius
El Salvador	Namibia
Guatemala	Nigeria
Haiti	South Africa
Honduras	Swaziland
Jamaica	Zimbabwe
Mexico	*Western Europe*
Panama	Cyprus
Paraguay	
Peru	
Suriname	
Trinidad &Tobago	
Uruguay	
Venezuela	

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Table 1. Cross-Country Current Account-Growth Relationship and Breakdowns by Type of Flows

Dependent Variable: Average of Annual Growth Rates 1970/1980 to 2000/2003					
	Prasad et. al. (2006)	Replicating Prasad et. al. (2006)	Dropping Aid Dependent Countries	Private Flows	Foreign Aid
	(1-1)	(1-2)	(1-3)	(1-4)	(1-5)
Current Account Balance	0.098	0.060	0.012		
	(2.13)	(1.45)	(0.13)		
Private Flows				0.075	
				(1.09)	
Foreign Aid					-0.228
					-(1.98)
Initial Income	-1.257	-1.584	-1.782	-1.783	-2.029
	-(6.19)	-(4.22)	-(3.72)	-(3.76)	-(4.48)
Initial Life Expectancy	0.032	0.138	0.111	0.111	0.090
	(1.33)	(3.56)	(2.32)	(2.42)	(2.02)
Openness	1.879	0.005	0.008	0.008	0.013
	(2.90)	(1.30)	(1.84)	(1.69)	(3.03)
Institutional Quality	4.252	5.084	6.745	6.489	5.410
	(2.77)	(2.99)	(3.58)	(3.31)	(2.70)
Fiscal Balance	0.023	0.066	0.043	0.049	-0.013
	(0.52)	(0.89)	(0.56)	(0.62)	-(0.14)
Number of Countries	60	87	61	61	61

Notes: In column 1, which reproduces the results reported in Prasad et al. (2006), the dependent variable is the average real per capita GDP growth rate from 1970 to 2000. The current account and fiscal balance are averages over the same period. Life expectancy, income and openness—the Sachs and Warner dummy—are measured in 1970 (or the earliest available date), and institutional quality, which is taken from Hall and Jones (1999), is measured around 1985. In regressions 2 to 5, the sample period is from 1980 to 2003 and openness is measured using the average trade volumes (relative to GDP) over this sample period. The numbers in parentheses below the coefficients are t-statistics based on robust standard errors.

Table 2. Current Account-Growth Relationship: Weighted Regressions

Dependent Variable: Average of Annual Growth Rates 1970/1980 to 2000/2003; Annual Growth Rates 1980 to 2003							
	OLS	Ramey and Ramey (1995) Regressions: Volatility Varies Across Countries		Volatility Varies Across Countries and Over Five-Year Intervals			
	(2-1)	(2-2)	(2-3)	(2-4)	(2-5)	(2-6)	(2-7)
Current Account Balance	0.012	-0.013	-0.027	-0.082	-0.068	-0.070	-0.091
	(0.15)	-(0.14)	-(0.27)	-(1.66)	-(1.99)	-(2.01)	-(3.38)
Initial Income	-1.782	-2.248	-2.168	-1.763	-2.186	-1.986	-2.247
	-(4.77)	-(4.79)	-(4.07)	-(3.22)	-(3.45)	-(2.70)	-(2.88)
Initial Life Expectancy	0.111	0.091	0.082	0.068	0.127	0.115	0.126
	(2.91)	(2.16)	(2.24)	(1.83)	(3.37)	(2.30)	(2.45)
Openness	0.008	0.013	0.013	0.013	0.014	0.015	0.153
	(2.23)	(4.54)	(5.90)	(5.47)	(5.39)	(4.89)	(5.42)
Institutional Quality	6.745	7.644	7.666	7.882	9.613	9.741	10.510
	(4.07)	(4.68)	(4.36)	(4.83)	(5.08)	(4.88)	(5.48)
Fiscal Balance	0.043	-0.012	-0.043	-0.062		-0.069	-0.730
	(0.65)	-(0.17)	-(0.65)	-(1.14)		-(1.34)	-(1.46)
Volatility		-(0.24)					
		-(1.85)					
Number of Countries	61	61	61	61	61	61	61
Number of Observations	1464	1464	1464	1464	1429	1429	1429

Notes: The regressions are based on a pooled panel of observations. The dependent variable in each case is the annual growth rate of real GDP per capita from 1980 to 2003 for each country in our sample however the covariates are sample-period averages and initial period-values of our controls. In regressions 1 to 4, averages are taken over the entire sample period, and initial values are measured in 1980. In the remainder of the regressions averages are taken over five- (and four-year) periods, while income and life expectancy are initial period values. In column 7 we include time period dummies, although the coefficients are not reported here. Regressions 2 to 7 are estimated using maximum likelihood. The numbers in parentheses below the coefficients are t-statistics corrected for cluster dependence.

Table 3. Within and Between Country Variation in Volatility

	Overall	Between	Within
Mean	4.43		
Standard Deviation	3.26	2.38	2.23
Minimum	0.27	1.24	-4.23
Maximum	25.65	13.99	17.17

Notes: The negative value for the minimum within volatility is not an error; the "within" column is showing the variation of volatility within countries around the global mean.

Table 4. Current Account, Growth and Volatility: Interactions

Dependent Variable: Average Growth Rate, 1980 to 1984; 1985 to 1989; 1990 to 1994; 1995 to 2000; 2000 to 2003				
	(4-1)	(4-2)	(4-3)	(4-4)
Current Account Balance	-0.042	0.058	0.089	0.159
	-(0.82)	(0.86)	(1.07)	(1.75)
Volatility*Current Account Balance	0.010			
	(1.18)			
Low Volatility*Current Account Balance		-0.112		
		-(1.71)		
Medium Low Volatility*Current Account Balance			-0.151	
			-(1.77)	
Medium High Volatility*Current Account Balance				-0.234
				-(2.54)
Initial Income	-2.145	-2.183	-2.197	-2.259
	-(4.08)	-(4.25)	-(4.40)	-(4.22)
Initial Life Expectancy	0.130	0.138	0.128	0.126
	(2.83)	(3.14)	(3.04)	(3.03)
Openness	0.012	0.011	0.011	0.013
	(3.34)	(2.91)	(3.17)	(3.86)
Institutional Quality	8.570	8.859	8.732	8.604
	(4.23)	(4.44)	(4.15)	(4.10)
Fiscal Balance	0.068	0.074	0.102	0.097
	(0.88)	(0.99)	(1.35)	(1.16)
Volatility	-0.076			
	-(0.64)			
Low Volatility (< 2.54%)		0.600		
		(1.95)		
Medium Low Volatility (<3.86%)			0.896	
			(2.22)	
Medium High Volatility (<5.35%)				1.064
				(2.42)
Impact of current account in low /mid-low /mid-high regime		-0.053	-0.062	-0.075
		-(1.66)	-(1.83)	-(1.89)
Number of Countries	61	61	61	61
Number of Observations	298	298	298	298

Notes: In each case, the dependent variable is the average real GDP per capita growth rate over the following non-overlapping intervals: 1980-84, 1985-89, 1990-94, 1995-99, and 2000-03. Income and life expectancy are initial period values and openness is the period average. Fiscal balance however continues to be measured using an average for the entire sample period and institutional quality is measured around 1985. Our estimate of volatility was obtained from the regression reported in Table 2, column 7, where it was estimated jointly with the growth equation as a model parameter. Dummies for low, medium-low and medium-high volatility indicate whether volatility lies in the lowest 25^{th} percentile, in the lowest 50^{th} percentile or the lowest 75^{th} percentile. In each specification, we include time period dummies, though the coefficients on these variables not reported. The numbers in parentheses below the coefficients are t-statistics corrected for cluster dependence. At the bottom of the table, in addition to the number of countries and sample size, we report the magnitude of the relationship between the current account and growth in each of the volatility regimes, along with the corresponding t-statistic.

Table 5. Threshold Effects

Dependent Variable: Average Growth Rate, 1980 to 1984; 1985 to 1989; 1990 to 1994; 1995 to 2000; 2000 to 2003						
	Low Regime $\sigma \leq$ 5.35	High Regime $\sigma >$ 5.35	Low Regime institutions $\leq$ 0.614	High Regime institutions > 0.614	Low Regime income $\leq$ 7.76	High Regime income > 7.76
	(5-1)	(5-2)	(5-3)	(5-4)	(5-5)	(5-6)
Current Account Balance	-0.094	0.177	-0.029	0.115	0.189	-0.034
	-(2.86)	(2.07)	-(0.44)	(1.80)	(2.13)	-(0.75)
Initial Income	-2.299	-2.299	-2.175	-2.175	-2.211	-2.211
	-(6.10)	-(6.10)	-(5.86)	-(5.86)	-(5.80)	-(5.80)
Initial Life Expectancy	0.136	0.136	0.136	0.136	0.114	0.114
	(3.85)	(3.85)	(3.79)	(3.79)	(3.21)	(3.21)
Openness	0.013	0.013	0.011	0.011	0.012	0.012
	(3.76)	(3.76)	(3.03)	(3.03)	(3.66)	(3.66)
Institutional Quality	8.916	8.916	9.378	9.378	9.086	9.086
	(5.97)	(5.97)	(5.78)	(5.78)	(6.30)	(6.30)
Fiscal Balance	0.095	0.095	0.065	0.065	0.071	0.071
	(1.61)	(1.61)	(1.08)	(1.08)	(1.22)	(1.22)
Volatility	-0.052	-0.052	-0.135	-0.135	-0.099	-0.099
	-(0.43)	-(0.43)	-(1.18)	-(1.18)	-(0.87)	-(0.87)
Threshold	5.35		0.61		7.76	
95% confidence interval	(3.21, 6.96)		(0.24, 0.79)		(6.13, 10.34)	
p-value	(0.02)		(0.54)		(0.20)	
Number of observations	225	73	202	96	55	243
Number of countries	59	35	41	20	15	55
Joint R-square	0.26		0.23		0.24	

Notes: The dependent variable is the average growth rate over the following non-overlapping intervals: 1980-84, 1985-89, 1990-94, 1995-99, and 2000-03. Income and life expectancy are initial period values and openness is the period average. Fiscal balance however continues to be measured using an average for the entire sample period and institutional quality is measured around 1985. Our estimate of volatility was obtained from the regression reported in Table 2, column 7, where it was estimated jointly with the growth equation as a model parameter. All the specifications include time-period dummies (coefficients not reported). Threshold regressions were performed using a Gauss code written by the based on Hansen (2000). In columns 1 and 2 the threshold variable is the volatility of growth, in columns 3 and 4 the threshold variable is the Hall and Jones (1999) institutions measure, in columns 5 and 6 the threshold variable is income. At the bottom of the table, we report in parentheses the p-values associated with Hansen's test of threshold significance, which were generated by bootstrap using 1000 replications. Also reported are the number of observations and countries that constitute each regime.

Table 6. Descriptive Statistics by Regime

Panel A											
		Growth	Current Account	Private Flows	Official Flows	Income	Life Expectancy	Trade Volume	Institutions	Fiscal Balance	Volatility
Low Volatility Regime		1.88	-1.85	1.64	2.14	8.54	66.35	71.75	0.58	-3.26	3.07
		(2.23)	(4.04)	(4.06)	(2.83)	(0.76)	(7.34)	(45.79)	(0.12)	(3.75)	(1.36)
High Volatility Regime		-0.10	-2.06	0.92	3.64	8.27	62.05	68.28	0.53	-4.90	8.61
		(4.64)	(6.38)	(4.61)	(3.98)	(0.86)	(8.49)	(39.97)	(0.12)	(4.64)	(3.82)
Panel B											
	Countries with	Growth	Current Account	Private Flows	Official Flows	Income	Life Expectancy	Trade Volume	Institutions	Fiscal Balance	Volatility
Full Sample	zero periods of high volatility	1.75	-2.22	1.92	2.21	8.64	66.54	72.32	0.57	-3.91	2.68
Low Volatility Regime		1.75	-2.22	1.92	2.21	8.64	66.54	72.32	0.57	-3.91	2.68
High Volatility Regime		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Full Sample	one period of high volatility	2.73	-1.44	1.24	1.34	8.54	69.46	84.50	0.61	-1.58	3.43
Low Volatility Regime		2.73	-1.44	1.56	2.14	8.54	69.46	84.50	0.61	-1.58	3.43
High Volatility Regime		0.53	-2.01	-0.04	2.19	8.61	69.07	87.95	0.61	-3.12	7.26
Full Sample	two periods of high volatility	-0.37	-1.36	1.15	1.74	8.44	61.69	67.23	0.55	-2.70	5.34
Low Volatility Regime		0.98	-2.18	1.76	1.69	8.41	61.74	61.98	0.56	-2.36	3.82
High Volatility Regime		-1.98	-0.26	0.31	1.79	8.48	61.61	73.46	0.54	-3.14	7.41
Full Sample	three periods of high volatility	0.88	-1.96	0.81	3.98	8.13	60.61	53.86	0.52	-2.57	6.32
Low Volatility Regime		1.17	-0.67	0.03	3.92	8.14	61.69	52.72	0.52	-1.18	3.63
High Volatility Regime		0.69	-2.82	1.32	4.02	8.12	59.89	54.63	0.52	-3.27	8.12
Full Sample	four/five periods of high volatility	-0.17	-2.33	1.54	6.08	8.03	59.69	81.88	0.45	-10.83	11.86
Low Volatility Regime*		-0.94	-5.64	1.64	5.88	8.44	66.45	117.62	0.39	-15.23	5.88
High Volatility Regime		-0.11	-2.10	1.53	6.09	8.00	59.20	79.33	0.46	-10.28	12.32

* Only one observation available.

Notes: Observations are separated into low and high volatility regimes using a threshold value for the volatility of real GDP growth of 5.35 percent. This estimate of the volatility threshold was obtained from the regression reported in Table 5.

Table 7. Current Account-Growth Relationship in Countries By Incidence of High Volatility

Dependent Variable: Annual Growth Rates 1980 to 2003												
	0 Periods High Volatility			0 or 1 Periods of High Volatility			0, 1, or 2 Periods of High Volatility			0, 1, 2, or 3 Periods of High Volatility		
	OLS	Maximum Likelihood		OLS	Maximum Likelihood		OLS	Maximum Likelihood		OLS	Maximum Likelihood	
	(7-1)	(7-2)	(7-3)	(7-4)	(7-5)	(7-6)	(7-7)	(7-8)	(7-9)	(7-10)	(7-11)	(7-12)
Current Account Balance	-0.099	-0.111	-0.097	0.001	-0.083	-0.095	-0.012	-0.087	-0.109	0.030	-0.072	-0.092
	-(2.01)	-(3.45)	-(2.60)	(0.02)	-(3.01)	-(3.52)	-(0.22)	-(2.66)	-(4.24)	(0.67)	-(2.11)	-(3.54)
Initial Income	-2.289	-2.578	-2.707	-1.801	-1.931	-2.193	-2.155	-2.062	-2.261	-2.076	-1.930	-2.188
	-(4.78)	-(5.41)	-(5.14)	-(2.53)	-(2.32)	-(2.75)	-(3.32)	-(2.74)	-(2.82)	-(3.89)	-(2.62)	-(2.80)
Initial Life Expectancy	0.091	0.084	0.116	0.087	0.071	0.094	0.132	0.114	0.128	0.127	0.107	0.118
	(2.97)	(2.87)	(4.31)	(2.09)	(1.14)	(2.01)	(2.80)	(2.10)	(2.63)	(2.96)	(2.01)	(2.26)
Openness	0.017	0.023	0.021	0.011	0.016	0.016	0.012	0.016	0.016	0.013	0.015	0.016
	(6.29)	(6.07)	(6.44)	(2.66)	(4.51)	(5.43)	(2.98)	(4.43)	(5.52)	(3.12)	(4.69)	(5.48)
Institutional Quality	9.716	11.771	11.591	9.470	10.342	10.995	9.290	9.871	10.435	8.850	9.639	10.462
	(5.79)	(19.00)	(10.60)	(3.71)	(6.76)	(7.27)	(3.83)	(5.02)	(5.77)	(4.50)	(4.73)	(5.66)
Fiscal Balance	-0.053	-0.078	-0.075	-0.011	-0.075	-0.068	0.004	-0.086	-0.091	0.048	-0.073	-0.076
	-(0.76)	-(1.41)	-(1.46)	-(0.14)	-(1.12)	-(1.07)	(0.06)	-(1.37)	-(1.49)	(0.63)	-(1.35)	-(1.50)
Number of Countries	26	26	26	41	41	41	48	48	48	58	58	58
Number of Observations	604	604	604	959	959	959	1117	1117	1117	1357	1357	1357

Notes: The dependent variable in each case is the annual growth rate of real GDP from 1980 to 2003 for each country in our sample however the covariates are sample-period averages and initial period-values of our controls. Income and life expectancy are initial period values and openness is the period average. Fiscal balance however continues to be measured using an average for the entire sample period and institutional quality is measured around 1985. Specifications (7-3), (7-6), (7-9), and (7-12) include time-period dummies (coefficients not reported). The numbers in parentheses below the coefficients are t-statistics where we make allowance for within country cluster dependence, by adjusting the standard errors using the Rogers (1993) approach. Each regression was estimated using maximum likelihood.

Table 8. Panel Regressions

Dependent Variable: Average Growth Rate, 1980 to 1984; 1985 to 1989; 1990 to 1994; 1995 to 2000; 2000 to 2003				
	Low Regime		High Regime	
	Fixed Effects	Arellano-Bover	Fixed Effects	Arellano-Bover
	(8-1)	(8-2)	(8-3)	(8-4)
Current Account	-0.112	-0.184	0.251	0.000
	-(2.99)	-(2.33)	(2.19)	(0.00)
Initial Income	-1.986	-0.871	-6.880	-6.247
	-(2.74)	-(1.03)	-(1.76)	-(2.08)
Initial Life Expectancy	0.051	0.097	0.342	0.638
	(0.95)	(1.02)	(1.47)	(4.74)
Openness	0.017	0.029	0.041	-0.052
	(2.76)	(3.66)	(0.80)	-(1.45)
Number of Countries	59	59	35	35
Number of Observations	225	225	73	73
First order serial correlation		(0.00)		(0.29)
Second order serial correlation		(0.77)		(0.18)
Sargan test		(0.23)		(0.98)
Number of Instruments		41		27

Notes: The dependent variable is the average growth rate over the following non-overlapping intervals: 1980-84, 1985-89, 1990-94, 1995-99, and 2000-03. Income and life expectancy are initial period values and openness is the period average. Each specification also includes time dummies (coefficients not reported). The low regime includes all observations for which volatility of growth was less than or equal to 5.35 percent; the high volatility regime includes all observations for which volatility exceeded this figure. The numbers in parentheses below the coefficients are robust t-statistics.

Table 9. Breakdown by Type of Flow

Dependent Variable: Average Growth Rate, 1980 to 1984; 1985 to 1989; 1990 to 1994; 1995 to 2000; 2000 to 2003								
	Low Regime				High Regime			
	Fixed Effects	Arellano-Bover	Fixed Effects	Arellano-Bover	Fixed Effects	Arellano-Bover	Fixed Effects	ellano-Bover
	(9-1)	(9-2)	(9-3)	(9-4)	(9-5)	(9-6)	(9-7)	(9-8)
Private Flows	0.098	0.242	0.064	0.144	0.193	0.166	0.003	-0.007
	(2.54)	(2.76)	(1.63)	(2.29)	(0.98)	(1.55)	(0.02)	-(0.05)
Foreign Aid	-0.099	-0.113	-0.086	-0.072	-0.563	-0.210	-0.482	0.134
	-(1.09)	-(0.74)	-(0.96)	-(0.67)	-(1.68)	-(0.64)	-(1.15)	(0.48)
Initial Income	-2.000	-0.413	-3.044	-1.593	-6.037	-8.258	-1.671	-7.110
	-(2.66)	-(0.53)	-(2.83)	-(2.82)	-(1.53)	-(3.77)	-(0.37)	-(6.48)
Initial Life Expectancy	0.044	0.011	0.027	0.085	0.333	0.618	0.525	0.690
	(0.78)	(0.16)	(0.48)	(1.80)	(1.26)	(6.80)	(1.95)	(5.55)
Openness	0.016	0.030	0.007	0.011	0.037	-0.085	0.096	0.025
	(2.45)	(2.86)	(0.92)	(2.02)	(0.73)	-(2.73)	(1.70)	(1.19)
Population Growth			0.408	-1.066			-2.921	-1.696
			(1.26)	-(2.64)			-(1.75)	-(1.90)
Financial Development			0.008	0.024			-0.041	0.015
			(0.70)	(2.87)			-(0.36)	(0.21)
Financial Integration			-0.004	-0.001			0.008	-0.027
			-(1.48)	-(0.52)			(0.26)	-(2.40)
Number of Countries	58	58	54	54	35	35	32	32
Number of Observations	216	216	194	194	73	73	64	64
R-squared (within)	(0.20)		(0.24)		(0.35)		(0.42)	
First order serial correlation		(0.00)		(0.00)		(0.34)		(0.63)
Second order serial correlation		(0.85)		(0.17)		(0.21)		(0.19)
Hansen test		(0.57)		(1.00)		(1.00)		(1.00)
Number of Instruments		50		77		29		29

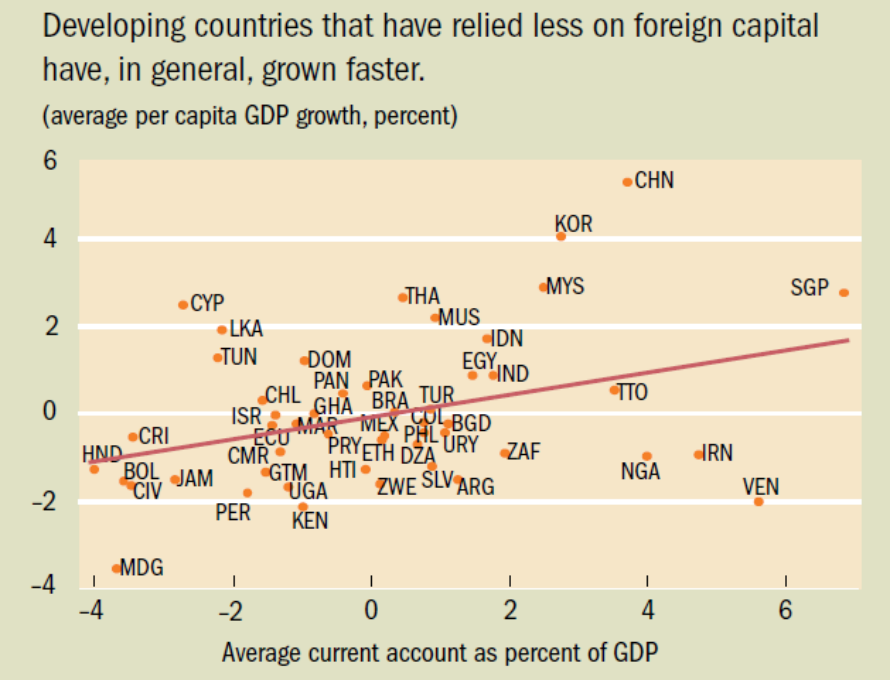
Notes: The dependent variable is the average growth rate over the following non-overlapping intervals: 1980-84, 1985-89, 1990-94, 1995-99, and 2000-03. Income and life expectancy are initial period values. Flows, openness, population growth, financial development and financial integration are period averages. Each specification also includes time dummies (coefficients not reported). The low regime includes observations for which volatility of growth was less than or equal to 5.35 percent; the high volatility regime includes all other observations. Below the coefficients the numbers in parentheses are robust t-statistics, at the bottom of the table they are p-values.

Table 10. Determinants of Volatility

	Dependent Variable: Volatility 1980 to 2003			Dependent Variable: Volatility Five Year Windows		
	(10-1)	(10-2)	(10-3)	(10-4)	(10-5)	(10-6)
Standard Deviation of Predicted Growth	1.469		1.128	1.024	1.009	1.036
	(7.92)		(6.79)	(10.46)	(9.39)	(8.73)
Initial Population		-0.416	-0.103			
		-(2.15)	-(1.03)			
Percent of Land Area 100 km from Coast		-0.117	-0.044			
		-(2.66)	-(1.87)			
Percent of Land Area 100 km from Coast^2		0.001	0.000			
		(2.69)	(1.70)			
Landlock		-1.012	-0.002			
		-(0.96)	(0.00)			
Volatility of Terms of Trade		0.056	0.031			
		(0.97)	(0.83)			
War		-7.006	-2.738			
		-(3.35)	-(2.10)			
Ethnic Fractionalization		-0.004	0.006			
		-(0.29)	(0.69)			
Ethnic Fractionalization*War		0.126	0.047			
		(3.14)	(1.64)			
Institutional Quality		1.277	-0.735			
		(0.51)	-(0.44)			
Government type		-0.103	-0.054			
		-(2.19)	-(1.78)			
Current Account					-0.061	
					-(0.93)	
Private Flows						-0.029
						-(0.64)
Official Flows						0.031
						(0.30)
Number of observations	61	53	53	298	298	266
Number of Countries	61	53	53	61	61	54
R-squared within				0.25	0.26	0.26
R-squared between				0.74	0.73	0.73
R-squared	0.76	0.45	0.81	0.50	0.50	0.50

Notes: In columns 1 to 3 the dependent variable is an estimate of the volatility of growth between 1980 and 2003 obtained from Table 1, column 6. Population, institutional quality and government type are 1980 values. The volatility of terms of trade is the standard deviation of terms of trade shocks between 1980 and 2003. All other variables are country-specific. In columns 4 to 6, the dependent variable is our estimate of growth volatility over the following non-overlapping intervals: 1980-84, 1985-89, 1990-94, 1995-99, and 2000-03. See regression reported in Table 2, column 7 for details. The current account deficit and private and official flows are averages over the same periods. The specifications in columns (4) to (6) include time dummies (coefficients not reported). The numbers in parentheses below the coefficients are t-statistics where we make allowance for within country cluster dependence, by adjusting the standard errors using the Rogers (1993) approach.

Figure 1: The Paradox of Capital

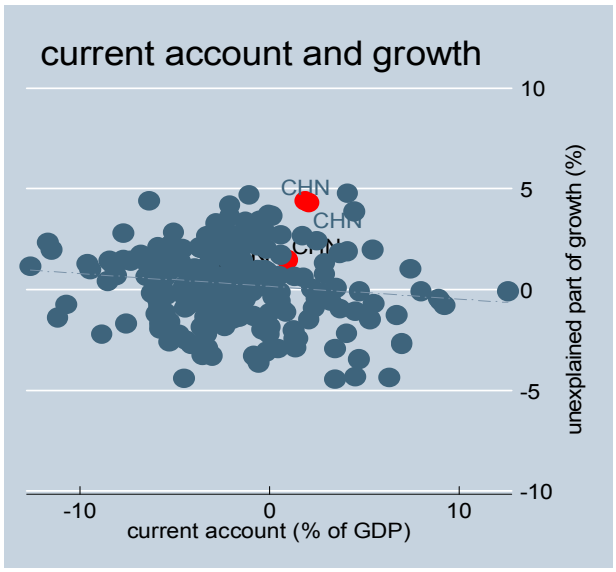


Source: Prasad et al. (2007).

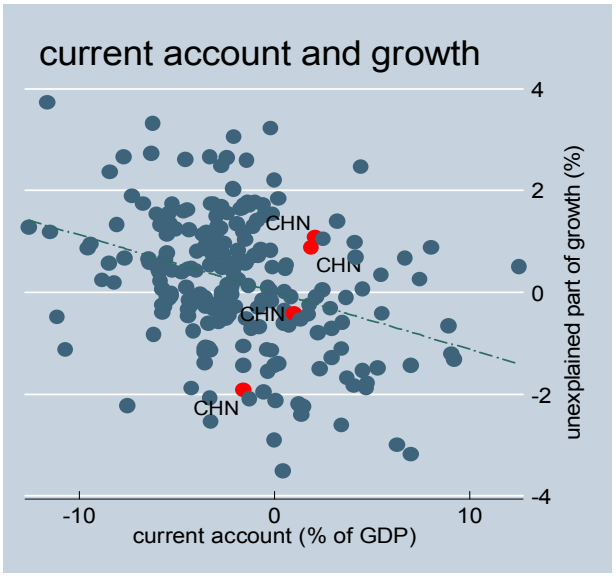
Figure 2: Current Account and Growth: Volatility Regimes

Low Volatility Regime

Cross-Sectional Regression

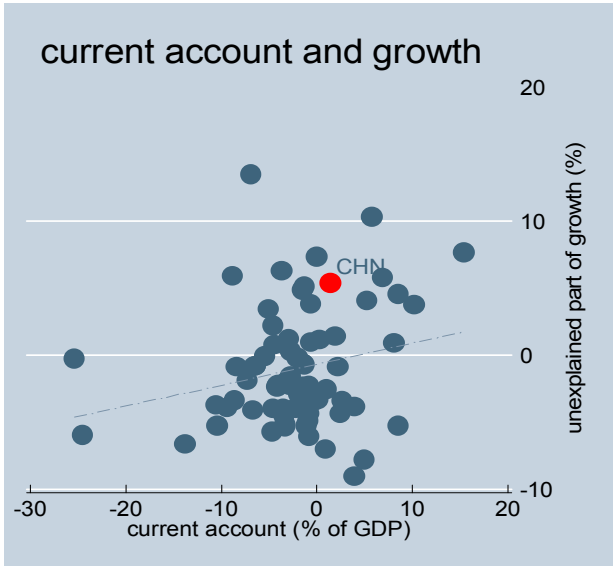


Fixed Effects Regression



High Volatility Regime

Cross-Sectional Regression



Fixed Effects Regression

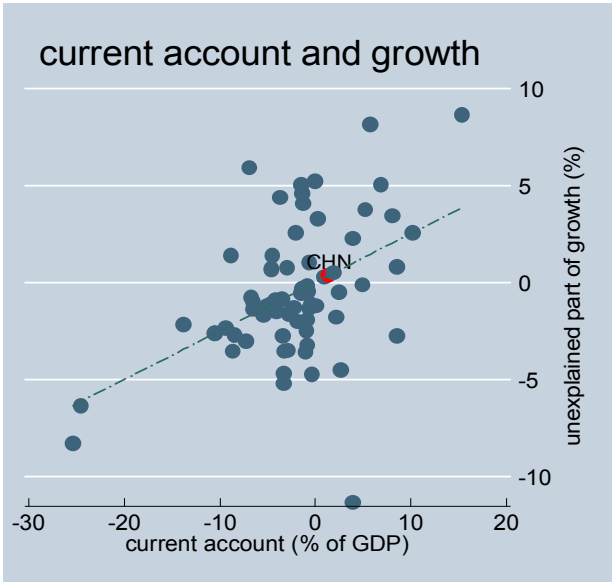


Figure 3. A: Number of Times Countries Experienced High Growth Volatility

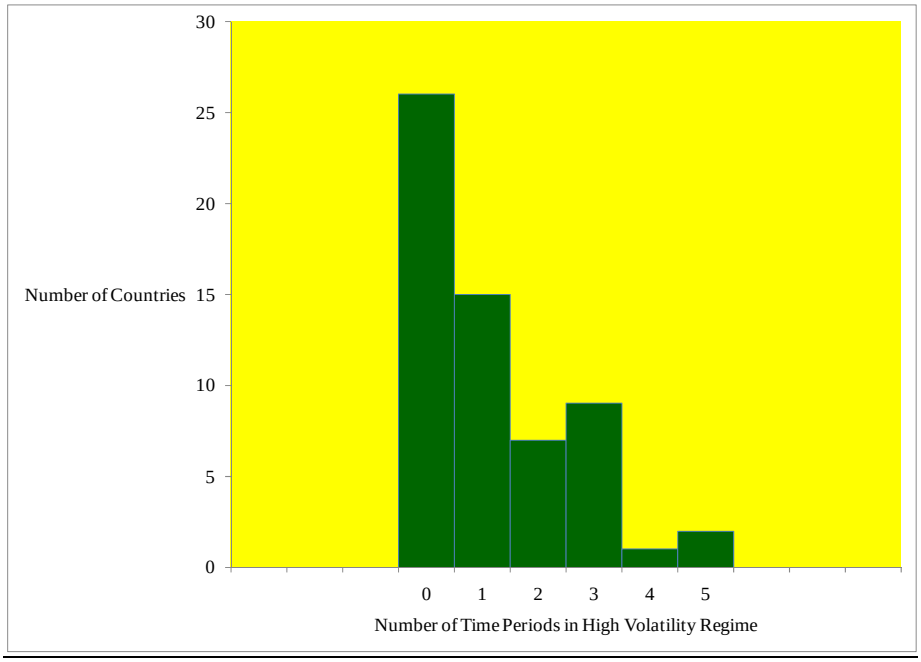


Figure 3. B: Number of Times Countries Experienced High Growth Volatility by Time Period