Financial Integration Without the Volatility

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Abstract

Integration to international capital markets is one of the key pillars of development. However, capital flows also bring volatility to emerging markets. Are there mechanisms to reap the benefits of capital flows without being hurt by their volatility? Are current practices, such as large reserves accumulation, public deleveraging, and export promotion strategies, efficient external insurance mechanisms? In this paper we start by documenting the external volatility faced by emerging markets as well as current self-insurance practices, especially among prudent economies. We then provide a simple model that illustrates the inefficient nature of these practices. We argue that with the help of the IFIs in developing the right contingent markets, similar protection could be obtained at lower cost by using financial hedging strategies. We also argue that, at least for now, local governments have an important role to play in the implementation of these external insurance mechanisms.

1 Introduction

Integration to international capital markets is one of the key pillars of development, allowing lower income economies to draw on foreign savings to fund investment and smooth consumption. However, capital flow volatility is also an important factor behind emerging markets' volatility, both as a source of shocks and as an amplification mechanism. Imprudent economies following inconsistent domestic macroeconomic policies or with poorly regulated domestic financial systems that open their economies to international capital flows systematically experience deep crises. This is well understood. Less noticed and understood is that prudent emerging markets economies (EMEs) also experience significant external volatility, despite their extensive efforts to avoid external crises. These are the economies that concern us in this paper.

Currently, these economies are dealing with the volatility problem through massive self-insurance. Measures such as running large primary surpluses and shifting public sector financing to domestic markets, accumulating large amounts of international reserves, limiting (relatively) cheap short-term international borrowing, protecting and attempting to diversify their export sectors, and the list goes on. However, these precautions also render a significant cost to EMEs. In all cases the variance of capital flows is reduced by lowering the average level of these flows. Indeed, in as much as they curtail access to foreign savings they reduce current consumption, investment, and available resources in general. Relative to a first best environment, this is exactly the opposite of what one would want to recommend to economies that still have plenty of catching up to do. Simply put: these countries are sacrificing current output, investment and consumption with the hope of lowering future volatility.

In this context, the question of how to minimize country exposure to external financing shocks, without sacrificing the benefits of accessing international capital markets becomes crucial. Note that this is a second best question, in that it takes as given that external shocks will take place in the future and that financial markets will not help ex-post. It then asks what is the most efficient way of implementing an insurance package. It is also an international financial architecture question, as it asks for the optimal instrument design to facilitate external insurance for EMEs.

We address this question and those that follow from it with a combination of data, models and conjectures. From the data, we document the extent of the volatility faced by emerging markets and describe current precautionary practices. We argue that EMEs are exposed to larger real and

financial shocks than developed economies. We also show that EMEs are currently in a precautionary mode, relying less on external financing and holding larger reserve stocks than in previous booms. We then develop a simple conceptual framework to characterize private and public insurance decisions in the face of external shocks. The model shows that it is unlikely that the private sector can implement the optimal insurance arrangement, without substantial help and financial development. We then use this framework, combined with further data, to evaluate current practices and to formulate a few conjectures on the potential role of the IFIs in fostering the development of external insurance arrangements.

Anticipating some of the main conclusions, we argue that: 1) If international contingent markets are available, and domestic financial markets are deep, the private sector is likely to adopt the right contingent strategy from a social point of view. While this scenario is desirable, it is not yet a good description of EMEs' reality. 2) If international markets are complete, but domestic banks and agents' international collateral (credibility) is limited, then the government is justified to undertake some external insurance to supplement private insurance. However, this should not be done by accumulating reserves (or by borrowing less) beyond what it may need to do in order to meet margin requirements. Instead, the government should hedge external shocks through contingent markets. 3) These contingencies should be indexed to non-EMEs' specific instruments, so as to bring new funds to the asset class during systemic events.[1] 4) In practice, governments do not use nearly as much contingent instruments as our analysis suggests they should. One of the main reasons for this is domestic political economy issues. 5) The other reason is lack of adequate and liquid financial instruments to do so. We document that the amount of resources needed to fund these markets is small under most reasonable metrics. 6) We conclude that both, demand and supply considerations, point to the need of an involvement by IFIs.

In sections 2 and 3 we discuss the facts. Section 2 documents the sources of external instability in EMEs, while Section 3 describes the current prudential policy environment in these economies. Sections 4 and 5 provide the theoretical counterpart of the previous sections. Drawing from the stylized facts on the sources of external instability, section 4 sets up the environment, describes ideal private sector risk-management practices as well as some of the main sources of departure from this ideal. Section 5 discusses optimal

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[1] See Caballero (2002, 2003) and Caballero and Panageas (2005, 2006a,b) for extensive discussion and illustrations of this point.

public risk management under a variety of fiscal constraints and contrasts the policies with what countries actually do, as described in section 3. Section 6 takes stock and broadens the policy discussion beyond the model. Several appendices follow.

2   Sources of External Volatility for Emerging Market Economies

In this section we document the volatility of the external environment faced by EMEs and the main factors behind this volatility. We focus on a subset of economies that have had access to international financial markets (this corresponds to those countries classified as Market Access Economies by the World Bank) and for which we have data for a sufficiently long period (at least 20 years). The main cost of this last filter is that we exclude Eastern European Economies from all of our analysis. The advantage is that it allows us to put the current "boom" phase in a broader historical context. Appendix 1 lists the EMEs and developed economies in our sample, while appendix 2 provides details of the construction of all variables used.

For clarity, we discuss real and financial volatility separately, although and important dimension of financial volatility in EMEs is that it does not help to smooth, and often exacerbates, real volatility.

2.1   Real Shocks

Table (1, panel A) shows that over the period 1985-2004 the variance of the annual percentage change of the terms of trade of the average EME dwarfs that of the average developed economy in our sample.[2] The difference in volatility across these groups of countries is shared by both export and import prices, and is explained by *what* they trade rather than by *whom* they trade with, as evidenced by the similar levels volatility in the weighted growth rate of their trading partners.[3]

Henceforth we focus on the volatility of export prices, as it explains a substantial share of the difference in the variance of terms of trade across groups, and because this has been the concern of much policy discussion

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[2] For this calculation we exclude Nigeria. Otherwise the results would be even more pronounced as Nigeria's terms of trade are extremely volatile.

[3] The measures of terms of trade, export and import price volatility reported in table 1 are from the export and import price indices reported in the WDI database of the World Bank.

and prescriptions in the past.[4] Which factors are responsible for the higher volatility of export prices in EMEs? We start answering this question by means of a variance-decomposition. Let $\widehat{p}_x$ denote the percentage change of a geometric average of the export prices of n goods in a given country, and σ_x^2 be the variance of $\widehat{p}_x$. Then,

$$\sigma_x^2 = \sum_{i=1}^{n} \alpha_i^2 \sigma_i^2 + 2 \sum_{i=1}^{n} \sum_{j>i}^{n} \alpha_i \alpha_j \sigma_{ij} \tag{1}$$

where α_i is the share of good i in total exports, σ_i^2 the variance of individual price changes $\widehat{p}_i$ and σ_{ij} the covariance between the percentage change in the price of i and the price of j. This expression can be rearranged so that

$$\sigma_x^2 = \sum_{i=1}^{n} \alpha_i^2 (\sigma_i^2 - \sigma^2) + \sigma^2 \sum_{i=1}^{n} \alpha_i^2 + 2 \sum_{i=1}^{n} \sum_{j>i}^{n} \alpha_i \alpha_j \sigma_{ij}$$

where the terms without subindices correspond to simple averages across all n goods. The first term measures the association between the relative volatility of the individual price changes of each good (σ_i^2) and its share in the export basket. The second is the product of the average price volatility σ^2 and the square of the Herfindahl concentration index h ($h = \sqrt{\sum \alpha_i^2}$). The last term captures correlations between good prices

Using this expression, table (2) decomposes the differences between the average σ_x^2 in the sample of EMEs and DEs. Each column corresponds to a term from the previous decomposition. Although the terms are not orthogonal, and hence there is no unique variance decomposition, it seems safe to conclude from the table that the bulk of the difference between σ_x^2 in DEs and EMEs is due to two features, with about equal weights: EMEs have a higher share of export goods with volatile prices and a higher concentration of exports.

Note that the group averages reported in table (2) hide substantial intra-group variance. This is clear in figure (1), which plots the volatility of export prices against the corresponding Herfindahl indices. In both EMEs and DEs oil exporting countries have high concentration levels and price volatilities. Moreover, it is the low income countries that have the highest concentration

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[4] As early as Prebisch (1950) and Singer (1950) economists have been concerned with the negative impact of large terms of trade shocks on developing economies, in particular those shocks stemming from commodity price movements. For recent contributions to the literature on export diversification see Strobl (2001), Imbs and Wacziarg (2003) and Klinger and Lederman (2006).

levels and price-volatility. This can be seen in figure (2), which plots the correlation between export concentration and income per capita[5]. This last result is important from a policy perspective: as we will discuss below, domestic financial development (highly correlated with per capita income) plays an important role in the private insurance decisions of EMEs.

With an eye to the policy section we investigate changes over time in export concentration. For this, figure (3) plots export concentration in 1998-00 against concentration in 1985-87. Note first that concentration is persistent. High export concentration will be a fact of life for EME for some time to come. Second, despite this persistence, diversification *is* increasing across the board, and in particular in EMEs. Part of this is likely a side effect of growth. A simple panel regression of the Herfindahl index on GDP per capita and a country fixed effect (reported in appendix 3) shows a positive and significant negative correlation between income levels and export concentration. Finally, the figure also shows that there are some particularly "successful" stories in terms of reducing concentration. Egypt, Mexico and Indonesia all achieved substantial reductions in their degree of concentration in this time frame.

Figure (4) shows how this increased diversification of exports has translated into lower export price volatility. Specifically, the figure holds the covariance matrix of 4 digit export price changes constant and varies export shares over time to build year-by-year measures of export price volatility. As the shares are built using constant good prices, and the covariance is held constant, the changes shown in the figure are the result of real changes in the share of export products over time. However, despite this good news, the dominant feature of the figure reinforces the fact that the pattern of high export price variance in EME is highly persistent.

2.2   Financial Shocks

As we argued earlier, capital flows are a pillar for development, but also a source of instability, both as a source of shocks and as an amplification mechanism for other shocks – external or domestic.

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[5]We also find that country size is negatively correlated with concentration (see appendix 3). See Imbs and Wacziarg (2003) for a previous study that uses employment and value added data to show that product diversification is closely related to the level of per capita income.

2.2.1 Volatility

Table (1), panel B reports several statistics documenting financial volatility. The first row shows that the standard deviation of the EMBI is three times larger than that of T-bills, used as proxies for sovereign borrowing in EMEs and DEs, respectively. The second row shows that the volatility of the net financial account over GDP in the average EME exceeds that of the average DE by about 50 percent. Finally, we concentrate on the likelihood of a large capital account reversal. Figure (5) shows the cumulative probability of experiencing deviations in net capital inflows (as a share of lagged GDP) from the country mean for the period 1985-2004. The figure shows that the probability of a large outflows is considerably larger for an EME than a DE. For example, there is a 15% chance that in a given year an EME experiences an inflow that is more than 5% of GDP below its average inflow, whereas this probability for DEs is 5%.[6]

2.2.2 Valuation effects and gross factor payments

Part of this financial vulnerability is likely due to the structure of the international liabilities of EMEs. Indeed, there is an extensive literature arguing that reliance on short term debt exposes EM to higher rollover risk and makes interest payment more sensitive to changes in international interest rates. In turn it has been argued that "dollar" denominated debt amplifies the effects of terms of trade and financial shocks by making debt service and the valuation of debt increase whenever the country is hit by a negative external shock. However, data on the term and currency structure of EME and DEs debt are mostly unavailable.[7] A way around this limitation is to focus directly on the response of exogenous changes in gross international liabilities (made up of changes in the valuation of gross international liabilities and gross factor payments) to changes in domestic and external conditions. We follow this approach in this section.[8] Our main finding is that these changes

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[6] In principle, there is a severe identification issue since reversals of capital flows could be demand as well as supply driven. In practice this less of a concern for EMEs in the sample period we consider, as many of the sudden stops are systemic in nature. See Calvo et al (2004) for evidence on this and, especially, Broner at al (2004) who use detailed yield curve evidence to document the dominant role of supply shocks.

[7] Data on the term structure of external debt is available for EMEs only. For currency composition, the only data available is on the currency composition of *bonds* issued offshore collected by Eichengreen et al (2003),

[8] The extent to which net external financial positions (NFPs) provide income insurance has been explored by Kalemli-Ozcan et al (2000) in the context of production specialization and insurance. In addition, a recent paper by Volosovych (2005) also looks at the insurance

in gross liabilities are less correlated to output and terms of trade shocks in EMEs than in DEs, confirming the view that the structure of liabilities is less likely to smooth external (and domestic) shocks in EMEs. From an insurance perspective, this is exactly the opposite of what one would expect. EMEs, with more precarious access to international financial markets should have *more* insurance, in this case in the form of liabilities that fall in value when the economy is in a downturn or hit by a negative real external shock.

The change in the stock of gross liabilities reported in balance of payment statistics L (in dollars) between $t-1$ and t is given by

$$\frac{L_t - L_{t-1}}{L_{t-1}} = \frac{P_t}{P_{t-1}} - 1 + \frac{I_t}{L_{t-1}}$$

where P_t is the price of the liabilities and I_t gross inflows.[9] This expression ignores liabilities that accrue and are paid off in the current period in the form of gross factor payments. Adding and subtracting net factor payments F_t to the above expression, rearranging and defining the rate of return r_t on liabilities as F_t/L_{t-1}, we obtain an expression for the *exogenous* change in gross liabilities l_t

$$l_t = p_t + r_t = \frac{L_t - I_t + F_t}{L_{t-1}}$$

where $p_t = \frac{P_t}{P_{t-1}} - 1$ is the change in valuation. The right hand side of this expression and r_t are readily available from balance of payments data, so that it is possible to calculate both l_t and its components p_t and r_t.[10]

This *exogenous* change in gross liabilities l_t measures the change in liabilities that takes place mechanically – due to the accrual of interest and profits or to changes in the dollar value of liabilities. Hence, larger profits in FDI during an expansion phase lead to higher F and an exogenous increase in liabilities. In turn, the extent of dollarization of debt affects how l responds to a depreciation: if dollar debt is high, gross liabilities rise relative to domestic output during depreciations. Short term debt also affects the behavior of both r_t and p_t. The effect on r_t is obvious: gross factor payments

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provided by NFPs, and finds a positive correlation between the extent of insurance and domestic financial development. The main difference in our approach is that both of the previous papers look directly at NFPs, which is problematic if one is looking to study ex-ante contracts, because part of the changes in NFPs are due to changes in the stocks of assets and liabilities.

[9] Note that I_t is a choice variable and part of financing decisions, not ex-ante contracts.

[10] Appendix (4) reports descriptive statistics for $\widehat{l}_t$, r_t and $\widehat{p}_t$ for both EME and DEs economies in the period 1990-2004.

are more sensitive to changes in rates if debt is short term. The effect on p_t comes from the fact that yearly data mask refinancing decisions, that lead to changes in L_t not captured by I_t.

Our main concern is the correlation between l_t and output or external demand shocks, which we estimate from the regression:

$$l_t = \tau + \alpha_i g_{it} + u_i + \delta_t + \varepsilon_{it}$$

where g_{it} is either the growth rate of real GDP or the annual percentage change in terms of trade. We include country fixed effects (u_i) to capture differences across countries in the average returns or valuation changes and δ_t year dummies to capture sample wide trends in the variables. Countries in which external liabilities smooth domestic and external shocks should have a larger (positive, since these are liabilities) estimated value of α. To capture these differences we allow α_i to vary across regions by interacting g_{it} with a dummy for DE ($g_{it} \times DE$). In addition, in some specifications we also allow α_i to vary according to the share of equity in gross international liabilities, as discussed below.

Table (3) reports the results for the exogenous changes in liabilities, l_{it}. As reported in column (1) the estimated value on $g_{it} \times DE$ shows that there is a significantly higher positive correlation between l_{it} and GDP growth in DEs than in EMEs. If countries need to access international markets when growth is low, and the cost of this access is increasing in the value of current liabilities, then more procyclical international liabilities smooth the effects of output on consumption. Viewed from the opposite angle, EMEs see the value of their gross liabilities fall less than those of DEs when they experience a recession.

It is reasonable to expect that a higher equity share in gross liabilities leads to higher ex-post procyclicality of l_{it}, as profits themselves are pro-cyclical. With this in mind column (2) introduces an additional interaction term between g_{it} and an indicator dummy that takes on values of one if the country´s share of equity in total external liabilities exceeds the sample median over the period 1990-2004. Not surprisingly this coefficient is positive and significant. Note that this result does not imply that equity (in any form) is a safer form of financing than debt, as we are not considering changes in the stocks of equity liabilities, only changes in valuation and factor payments. More importantly the interaction between growth and the DE dummy remains positive and significant. After controlling for differences in the debt equity mix, liabilities in EMEs are less pro-cyclical than in DEs. This is consistent with a higher share of external debt in foreign currency

and a larger share of short term financing, as discussed in the literature. Faced, for example, with an expansionary (positive) terms of trade shock, the currency appreciates, pushing up the dollar value of liabilities in those countries with domestic currency foreign debt (mostly DEs). It is also consistent with shorter term debt and more extensive use of floating rate debt in EMEs, if shocks to the cost of external financing lead to reductions in output (as suggested by table 1).

In columns (3) and (4) we repeat the previous analysis substituting GDP growth with the annual percentage change in the trade weighted terms of trade. This specification has the advantage that it provides a direct measure of the covariance of exogenous changes in liabilities with the real external shocks discussed in the previous section. Furthermore, as we argue below, it should be easier for EMEs to subscribe contracts contingent on external shocks, over which domestic policies have no impact. Once again we find a significantly higher correlation between l_{it} and $d\ln(TT)$ in DEs than in the EME sample.

In table (4) we report the estimated interaction terms ($g_{it} \times DE$) from regressions identical to column (1) of table (3) for both components of l_{it} (the change in valuation, p and returns, r) using either country growth or terms of trade as the key independent variable. Note that all of the differential effect across country groups is driven by differences in the valuation effects. Indeed, although not significantly so, r is less procyclical in DEs than in EMEs.

All in all, we find that exogenous changes in the gross international liabilities of EMEs provide less insurance than in DEs. This observation has two implications. First, part of the lower volatility in capital flows in DEs can be explained by a liability structure that does not amplify external financing shocks. For example, a rise in international interest rates has a small effect on the debt service of long term contracts of DEs and leads to a fall in the dollar value of their liabilities as the depreciation associated with higher international rates reduces the dollar value of local currency debt. Second, despite accumulating reserves and other precautionary measures, EMEs are currently making little use of contingent contracts. Even in a world without financial market imperfections, contingent contracts can provide insurance against idiosyncratic output shocks. Ex-ante insurance becomes crucial if countries have imperfect access to international capital markets and are therefore unable to draw on external financing to smooth aggregate demand in the event of a temporary negative shock.

3 Policy Responses

This section describes the main precautionary measures being adopted by EMEs. It does so from two perspectives – by comparing key macroeconomic outcomes during the current recovery phase with those prevalent in previous recoveries, and by describing specific policies followed by governments that are directly related to reducing exposure to the external shocks discussed in the previous section.

3.1 Recent Changes in Precautionary Behavior in Emerging Market Economies

In this section we support the claim we made in the introduction that EMEs are taking a series of precautionary measures during the current boom cycle. Moreover, we show that the observed precautioning is high even after controlling for current external conditions, suggesting that this time around EMEs are behaving with exceptional prudence.

We start by comparing the most recent recovery phase with previous EME cycles. To do this we construct a series of EME business cycles based on the average behavior of the EMEs in our sample.[11] We define recessions as periods of substantial growth reduction. Specifically, a recession is a period in which growth falls below two standard deviations of the average growth rate.[12] Figure (6) shows the recessions identified by this simple methodology. It also plots average GDP growth for the sample, and the share of EMEs that are in a recession in a given year. We identify three large slowdowns in EME activity since the mid 70s: the debt crisis of the early 80s, the late 80s and the year 1998. The apparent bunching of recessions shown by the individual country data in the figure has been highlighted (indirectly) by Calvo et al (2004) as evidence of the large systemic shocks hitting EMEs.

We then proceed to build averages for each of our key variables in the five years following the last collective recession (1998) and compare them with the average across the previous two recoveries: 1990-94 and 1984-89. The results are shown in table (5). The first set of variables shows overall

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[11]We start with growth rates for the representative economy in the EMEs $\overline{g}_t = \frac{1}{N} \sum_i g_{i,t}$, where i are individual EMEs. Next we build 7 year rolling averages and standard deviations of $\overline{g}_t$. A recession is defined as $\overline{g}_{j,t} < \left(\mu_{j,t}^{\overline{g}} - 2\sigma_{j,t}^{\overline{g}} \right)$. A similar approach using individual country cycles leads to identical results - as a result of the high degree of synchronization in the growth collapses in this set of economies. These results are available from the authors upon request.

[12]Both standard deviation and average growth are built using a moving seven year window.

reliance on external financing, as summarized by the current account surplus and the net financial account. Compared with the average over the previous two recoveries, the current EME recovery relies to a much lesser extent on international financing. Current account deficits are four percent below the averages of previous upturns. Part of this is the result of lower investment rates. Compared to previous recovery phases, reserves over GDP are also significantly higher during the recent recovery, while reliance on "risky" short term financing is down. Figure (7) plots each of these variables for the five years after the recession and shows that the changes discussed above are systematic across periods, and not the result of one or two data points. The difference is also apparent in the fiscal deficits. Compared to the average of previous booms, public deficits are smaller.

The only variable in which this prudential behavior is not apparent is total public debt. Public debt scaled by GDP is higher in the current cycle. However, the current cycle differs considerably from previous periods in the composition of public debt. Drawing on detailed data recently assembled by the IADB on public debt in the Americas, figure (8) shows that the current boom phase is characterized by much higher reliance on domestic debt than previous boom episodes. This suggests a "precautionary" approach to external public funding but raises several questions as to the general equilibrium effects of this change: How much of this debt crowds out private sector domestic funding? (which could be particularly costly if the private sector faces higher financing costs abroad) How does the composition of foreign investors change when denomination changes? (which could increase rather than reduce vulnerability), and so on. We return to some of these questions later in the paper.

The empirical concern remains that the precautionary behavior we document is purely cyclical – the response of a favorable combination of external shocks not present in previous cycles. In particular the very high rate of growth of terms of trade in the current cycle may be explaining the differences discussed above (see figure (9) and (10) on external conditions). One way to address this concern is to control directly for these variables, and test whether the last five years of the sample are significantly different from the previous 15 years. Table (6) reports the results of regressing each of the variables discussed in table (5) against: log of the export prices, log of import prices, log of trading partner growth (all de-trended), the high yield spread (a proxy of the risk appetite or risk perception of investors in DEs) and the libo90 lending rate. All regressions include country fixed effects. The regressions also include a dummy for the period 1999-04, the most recent recovery. The bottom line is that *the increased precautionary behavior can-*

not be explained away by controlling for these external factors. Compared to previous periods: reserve stocks are higher, there is less reliance on external financing, investment is lower and short term debt is lower. The drop in public deficits is not robust to this set of controls, however. In addition to the significant coefficient on the dummy variable in most specifications, many of the estimated coefficients have the correct sign and are significant at conventional confidence levels. Similar results are obtained if terms of trade are used instead of export and import prices, if growth rate of prices are used instead of the cyclical components, and if the US-Tbill rate replaces the libor rate.

3.2   Policies Aimed at Reducing Terms of Trade Volatility

Over the years, governments in EMEs have pursued a series of policies explicitly aimed at reducing their exposure to the real external shocks documented in Section 2. Although strategies aimed at reducing the volatility of specific export prices directly have mostly been abandoned, export diversification policies remain in place in many economies.[13] To illustrate this point, table (7) summarizes export promotion efforts in EMEs and DEs at the top and bottom of the export concentration distribution. While it is not clear that countries with more concentrated exports actually do more than other countries, it is apparent that export diversification is a policy objective in most of the countries included in the table. Indeed, many of the countries in our sample currently pursue policies that allocate resources to the promotion of "non-traditional" export goods, non-commodity goods etc.. We are unaware of any study that attempts to quantify the impact of export diversification policies empirically, so there is no gauge as to their effectiveness. What is clear, however, is that governments are devoting resources to achieving a broader price export base. Absent additional distortions, these incentives will lead to a suboptimal export mix, as countries move into goods for which they have no comparative advantage.[14]

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[13] These usually took the form of collaborative price controls mechanisms. More recently, institutions like the World Bank have have encouraged the use of commodity derivatives as a means of reducing effective export price volatility. These issues are discussed in detail in Larson, Varangis, Yabunki (1998) and Larson and Varangis (1996). Note that this type of hedging is different, and more limited, than the one required to smooth financial shocks and amplification mechanisms, which is the issue that primarily concerns us in this paper (see below).

[14] Of course the perennial argument for these policies is some sort of learning-by-doing externality. We do not argue against this kind of justification. Instead, our argument focus on the volatility-reduction dimension of these polices.

3.3 Use of Contingent Instruments

Despite recent increases in the level of reserves in EMEs, existing data shows that use of contingent instruments in these reserves is very limited. In a recent IMF report on optimal reserve management (IMF 2003) all 20 countries surveyed recognize that liquidity and returns are both key in their reserve management strategy. However, *not one* of the 20 countries explicitly declared to having a policy to include assets that provide a hedge for external shocks, either to terms of trade or to external financing. Note also that the commodity stabilization funds put in place by several countries in our sample (Chile, Norway,Venezuela, see IMF 2001 for details) only establish contingent mechanisms for accumulating or running down international assets, and do not explicitly include assets that would serve to hedge against external shocks. Caballero and Panageas (2005) show quantitatively that were these countries to include such hedges (particularly indexed to events that trigger sudden stops, such as a rise in the VIX), they would significantly reduce the cost of current precautionary measures.[15]

Although available information is patchy (and outdated) it also appears that EMEs make little use of derivative contracts in their asset and liability management. At best, they hedge some of the income effect of terms of trade shocks, but even this is done in limited amount. For example, table (8) shows that the share of outstanding commodity derivative positions held by agents from developing economies is well below their share in the production of these commodities. For example, agents from Latin America, an important supplier of grain and soybeans in world markets, only accounted for 1.21% of derivative contracts in these commodities in 1991. Several reasons have been given for this limited use of derivatives, ranging from legal and regulatory barriers to limits that arise from EMEs borrowing constraints. In the model section, we explore some of these issues more formally and add a series of incentive considerations to the debate.

3.4 Summary of Facts

Relative to DEs, EMEs are hit by larger terms of trade shocks and face a more difficult external financing environment during downturns. Furthermore, in many cases financing shocks themselves are the source of the downturn. Despite this larger exposure to external shocks, gross liabilities

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[15]Caballero (2002, 2003) and Caballero and Panageas (2006a,b) have made similar points in contexts broader than reserves management, and so have Borensztein and Mauro (2004) in their GDP-indexed debt proposal (although, as we argue below, indexing to domestic variables carries other problems).

of EMEs currently provide little insurance. This is apparent in the higher reliance on "dollar" denominated foreign debt, the procyclicality of valuation changes, the scarce participation by EMEs in international derivative markets and the absence of contingent reserve policies.

Faced with this volatile external environment and well aware of the costs of financial crises, most EMEs are currently in a precautionary mode. They are limiting risky external financing and, more worrisome, they are limiting total external financing. Moreover, EMEs also allocate resources to reduce their exposure to real external shocks by diversifying their export base.

In the next sections we present a simple model that captures the main stylized facts of the EME external environment and allows us to discuss the inefficient nature of current country risk management practices more formally, as well as the reasons for and characteristics of optimal policy design.

4 A Simple Model of External Vulnerability and Constrained Insurance

This section presents a simple model of external vulnerability and country insurance decisions. It allows for three margins of insurance: self-insurance through savings, export diversification, and contingent markets. In the absence of frictions, only the latter should be used.

In practice, however, there are external and domestic factors that explain why complete contingent markets are not available and why the existing contingent options are underutilized. In this section we focus on domestic financial factors leading to incomplete insurance. In the next section we introduce a government and study its options and optimal policy. In the final section we briefly discuss the role of the IFIs in helping local governments implement these policies and in developing international contingent markets for EMEs

4.1 The Environment

There are two periods, 0 and 1. Agents consume at both dates and are born with X units of an export good and access to a random amount of importable goods W. Both, exports and the importable goods are received at date 1. One should think of W as a payment originating from an outstanding financial contract which is due at $t = 1$. As such, W is not restricted to be positive. For example, W could be some debt rollover or a debt payment

that is contingent on the short term interest rate – as is often the case for EM bonds. Alternatively, W could be the payments from a derivative contract on this same interest rate, or as an indicator of the country's external assets (real and perceived). As such, it proxies for shocks originating in financial markets. X will, in turn, expose the economy to shocks originating in the international goods markets. Together W and X capture the main external shocks hitting EMEs discussed in section 2.

Domestic agents are also born with a plant of size K which, after injecting I_0 unit of imports, produces $(I_0 + K)$ units of nontradables at date 0 and, after injecting I_1 units of imports at date 1, produces $RI_1 + \theta K$ units of nontradables, with R and θ equal to each other, greater than one, and fixed for now. Agents only consume nontradable goods, which are nonstorable.

The only sources of uncertainty are the terms of trade at date 1,

$$p = P_X/P_I$$

and the amount of available "dollars", W.

Let us write the total external resources (in units of tradable goods) at date 1 as:
$$M \equiv pX + W = m\overline{M}$$

with

$$\overline{M} = X + E[W]$$

and m a random variable that takes on two values with equal probability. It captures the variance of terms of trade and capital flows, as well as their correlation:

$$m = 1 \pm \sigma/h.$$

At date 0, the country has three ways of "insuring" against a negative shock at date 1. It can reduce investment and hence consumption at date 0, $I_0 + K$. It can increase h (diversify exports) at a cost c_h per unit beyond its minimum (or natural) level $\underline{h}$ (which we will set very close to 0 for convenience). Or it can purchase contingent claims (trade dollars in the good state for dollars in the bad state) incurring a transaction cost of μ per-unit of insurance purchased. The international interest rate for loans from 0 to 1 is r and equal to the discount rate δ, both equal to 0. At a first pass, the diversification cost c_h can be thought of as the resources devoted to expanding exports from sectors in which the country does not have a comparative advantage.

Assuming log utility, the representative agent's optimization problem is straightforward:

$$\max_{I_0,s,h} \ln(I_0 + K) + E \ln(RI_1 + \theta K)$$

$$I_1 = s\overline{M} + (1-s)m\overline{M} - \left(I_0 + \mu s \frac{\sigma}{h}\overline{M} + c_h(h - \underline{h})\right)$$

where s is the share of $\overline{M}$ insured in external markets. Accordingly, the first order conditions are:

$$I_0 \quad : \qquad \frac{1}{I_0 + K} = RE\left[\frac{1}{RI_1 + \theta K}\right]$$

$$s \quad : \qquad E\left[\frac{1}{RI_1 + \theta K}(1 - m - \mu\sigma/h)\right] = 0$$

$$h \quad : \qquad E\left[\frac{1}{RI_1 + \theta K}\left(\frac{(1-s)(1-m)}{h}\overline{M} + \mu s \frac{\sigma}{h^2}\overline{M} - c_h\right)\right] \leq 0$$

4.2 International Hedging Opportunities

Let us first develop a complete markets benchmark and then look at the polar opposite extreme, when no hedging markets exist. Recall that $R = \theta$ for now.

4.2.1 Complete Markets

If there are no frictions in insurance markets (i.e. $\mu = 0$) it follows immediately from the first order conditions that:

$$s = 1$$

$$h = \underline{h}$$

$$I_0^{fb} = I_1^{fb} = \frac{\overline{M}}{2}$$

The optimal outcome is to insure fully, spend no resources on diversification, and invest the same (constant) amount in both periods. As a result, consumption grows at the *deterministic* rate R, which corresponds to the return on non-tradable production in period 1.

4.2.2 Incomplete International Risk Markets

On the other extreme, when μ goes to to infinity, we have:

$$
\begin{aligned}
s &= 0 \\
h &= -\frac{\overline{M}}{c_h}(I_0 + K)cov\left(\frac{1}{I_1 + K}, m\right) \\
\frac{1}{I_0 + K} &= E\left[\frac{1}{I_1 + K}\right] \Rightarrow I_0^{in} < \frac{\overline{M}}{2} < E[I_1^{in}]
\end{aligned}
$$

From the resource constraint we know that $cov\left(\frac{1}{I_1+K}, m\right) < 0$, so that $h > 0$ and resources are spent in diversifying exports. Insurance is imperfect since I_1^{in} remains a random variable, which leads countries to self insure by reducing current consumption relative to the full insurance outcome.

In summary, the absence of international hedging markets against external shocks, leads to an increase in desired export diversification beyond its "natural" level, which entails a reduction in resources available for consumption. The optimal level of h trades off this reduction in resources against the utility gained by reducing the variance of consumption in period 1. In all cases consumption in period 0 and total welfare fall relative to the full insurance outcome.

4.3 Domestic Financial Factors for Incomplete Insurance

The previous subsection discussed the impact of *international* financial imperfections on consumption, export diversification and welfare. In addition, there is a long list of reasons for why *domestic* financial market imperfections can worsen the quality of the precautionary measures the country undertakes. We discuss these next.

4.3.1 Limited Intermediation Capital

Domestic financial intermediaries are the most natural link to international risk markets. If these intermediaries have a limited capacity to subscribe insurance contracts, then their ability to intermediate risk is reduced and the economy behaves *as if* μ was larger than it actually is.

We can model this feature as a collateral constraint such that:

$$
s\frac{\sigma}{h}\overline{M} \leq K^{intermediaries}.
$$

This constraint places a limit on the amount of insurance that a country can purchase that is decreasing in the risk of the contract ($\frac{\sigma}{h}$) and the size of

the economy relative to the collateral of intermediaries $\frac{K^{intermediaries}}{\overline{M}}$. Any pledge beyond this limit is not credible to foreign financiers. To see how this may operate in a concrete example, consider the case of a domestic bank entering a forward contract to purchase a commodity. If the spot price in $t+1$ is such that it exceeds the agreed price, then the bank simply collects the profit. If, on the other hand, the spot price falls below the forward price then the contract becomes a liability for the bank, and all the standard results limiting the banks ability to commit to repayment become relevant. Thus even if international capital markets are complete, in the sense of $\mu = 0$, we have

$$s = \frac{K^{intermediaries}}{\overline{M}\sigma/h} < 1$$

if the constraint is tight, and hence,

$$h > \underline{h}$$
$$I_0^{li} < \frac{\overline{M}}{2} < E[I_1^{li}].$$

Despite the resources spent on diversification, and partial external insurance, insurance is imperfect and I_1^{li} remains a random variable.

4.3.2 Limited Domestic Collateral

Suppose instead that financial intermediaries are well capitalized (so that the above constraints are not binding and they can therefore be merged with foreigners) but domestic firms have agency problems that limit their ability to pledge resources at date 1. Let us capture this financial friction with a collateral constraint such that agents can not credibly pledge to repay more than λK at date 1. Thus, considering that I_0 has already been committed to foreign lenders, s is restricted such that

$$s\frac{\sigma}{h}\overline{M} \le \lambda K - I_0$$

This simple collateral constraint captures the constraints often faced by firms in EMEs (specially small firms) regarding their use of specific types of financial derivatives, such as forwards. Because of collateral constraints, they are forced to trade-off credit against insurance.[16]

---

[16] These constraints seem to be behind recent iniciatives by the Central Bank of Chile to promote the development of a market for options in currency and interest rates, as an alternative to existing forward markets.

If λK is small (i.e., if the agency problem is severe), then even if $\mu = 0$ we have that

$$s < 1.$$

Let us study this problem in more detail. For convenience, let us fix $h = \underline{h}$ and focus on the other precautionary dimensions and their interactions with financial constraints. Moreover, assume λ is small enough that the financial constraint is binding. The optimization problem becomes:

$$\max_{I_0, s} \ln(I_0 + K) + E \ln(RI_1 + \theta K)$$
$$I_1 = s\overline{M} + (1-s)m\overline{M} - I_0$$
$$I_0 + s\frac{\sigma}{h}\overline{M} \leq \lambda K$$

Since the constraint is binding, we can rewrite the problem as:

$$\max_s \ln(\lambda K - s\frac{\sigma}{h}\overline{M} + K) + E \ln(RI_1 + \theta K)$$
$$I_1 = s\overline{M} + (1-s)m\overline{M} - \lambda K + s\frac{\sigma}{h}\overline{M}$$

The first order condition with respect to s is:

$$-\frac{1}{\lambda K - s\frac{\sigma}{h}\overline{M} + K}\frac{\sigma}{h}\overline{M} + E\left[\frac{R}{RI_1 + \theta K}(1 + \frac{\sigma}{h} - m)\overline{M}\right] = 0$$

Evaluating the left hand side of this first order condition at $s = 1$ and simplifying, we have:

$$-\frac{1}{\lambda K - \frac{\sigma}{h}\overline{M} + K}\frac{\sigma}{h}\overline{M} + \frac{1}{\overline{M} - \lambda K + \frac{\sigma}{h}\overline{M} + K}\frac{\sigma}{h}\overline{M}$$

Which is strictly negative iff:

$$\lambda K < \frac{\overline{M}}{2} + \frac{\sigma}{h}\overline{M}$$

but this inequality holds if the financial constraint is to be binding, which we have assumed.

This proves that the solution to this program must be to set $s < 1$, despite the fact that $\mu = 0$. The reason is that the opportunity cost of funding the collateral (margin) for insurance contracts forces agents to cut down on consumption at date 0, raising the opportunity cost above the riskless interest rate (which is set to zero)

4.3.3 Pecuniary externalities

So far we have shown the direct impact that domestic financial constraints – either at the firm or intermediary level – have on the insurance decision. However, the connections between domestic financial development and external insurance can get more intricate. Caballero and Krishnamurthy (2001, 2003, 2004) show that when domestic financial markets are underdeveloped, a pecuniary externality arises whereby agents undervalue the social contribution of their international liquidity provisions.

The intuition behind this undervaluation result is straightforward. Consider the case of a large firm in an emerging economy, that has direct access to the international capital market either through banking loans or bond issuance. If the domestic financial markets functioned perfectly, then this large firm would leave itself some "slack" in its capacity to access international financial markets so as to avoid having to finance itself domestically at all in those periods in which the domestic economy faces negative liquidity shock (due to falling terms of trade, for example). In these episodes, unconstrained domestic agents borrow to smooth the negative shock and therefore domestic interest rates rise sharply. If, however, domestic borrowing is severely limited by collateral constraints, effective interest rates for large firms with good collateral do not rise nearly as much, and hence the incentive for large firm to leave itself some "slack" capacity is lower, limiting its role as a provider of international liquidity.[17]

In order to capture this idea, let us introduce another reason for domestic financial transactions. We now assume that there is heterogeneity in firms' productivity at date 1, $\widetilde{R}$, which is uncorrelated to m shocks. Half of the domestic firms still produce $R > 1$ but the other half only have a productivity of 1. The firms know their productivity before investing at date 1 and there is an additional domestic inter-firm loan market that only opens at that date.

For simplicity let us still assume that h is fixed at $\underline{h}$, and that the international financial constraint $I_0 + s\frac{\sigma}{h}\overline{M} \leq \lambda K$ is binding. We thus use the same first order condition as in the previous section but replace R for $\widetilde{R}$ (and divide through by the constant $\overline{M}$ for convenience):

$$-\frac{1}{\lambda K - s\frac{\sigma}{h}\overline{M} + K}\frac{\sigma}{h} + E\left[\frac{\widetilde{R}}{\widetilde{R}I_1 + \theta K}(1 + \frac{\sigma}{h} - m)\right] = 0. \qquad (2)$$

---

[17]Note that this interest rate refers to the expected return on a loan against domestic collateral. The observed rate may behave quite differently as it involves a default risk as well.

Note first that if the inter-firm financial market works perfectly, then low productivity firms will not invest and instead they will lend all their resources at rate R to the high productivity firms. In such case the first order condition is exactly as in the previous section and so is s.

Suppose instead that the inter-firm loan market is closed, then all firms have to invest in their own projects. In this case it is apparent that for a given s the second term in the first order condition falls, which means that now firms cut back in their contingent claims purchases, s, in order to restore the first order condition. The reason is that firms no longer value their extra dollars in their bad idiosyncratic state at R but at 1.

In an intermediate range, where loans still take place but, because of limited borrower collateral the effective return received by the lender is less than R. To see this effect in our context, let us assume that limited domestic collateral implies that loans in the inter-firm market take place at an effective rate of $R - \Delta$ with

$$1 < R - \Delta < R.$$

Then all firms with low productivity lend their resources to high productivity firms $L = I_1$ and obtain a payoff of:[18]

$$(R - \Delta)I_1.$$

High productivity firms, on the other hand, get:

$$RI_1 + (R - (R - \Delta))L = RI_1 + \Delta L.$$

Studying the second expression in first order condition (2), we now have

$$
E\left[\frac{\widetilde{R}}{\widetilde{R}I_1 + \theta K}(1 + \frac{\sigma}{h} - m) \right] = \frac{1}{2}E\left[\frac{R}{RI_1 + \Delta L + \theta K}(1 + \frac{\sigma}{h} - m) \right]
$$
$$
+ \frac{1}{2}E\left[\frac{R - \Delta}{(R - \Delta)I_1 + \theta K}(1 + \frac{\sigma}{h} - m) \right]
$$

which in equilibrium can be written as:

$$
\Psi = \frac{1}{2}E\left[\left(\frac{R}{(R + \Delta)I_1 + \theta K} + \frac{R - \Delta}{(R - \Delta)I_1 + \theta K} \right)(1 + \frac{\sigma}{h} - m) \right]
$$

[18] As we mentioned earlier, note that the stipulated rate may rise with limited collateral. The point is that the effective rate, including default, necessarily must drop on average when agency problems rise since a fraction of marginal product is non-pledgeable.

Differentiating this expression with respect to Δ, for fixed s (and hence I_1) we have:

$$\frac{d\Psi}{d\Delta} = -\frac{1}{2}E\left[\left(\frac{RI_1}{((R+\Delta)I_1 + \theta K)^2} + \frac{\theta K}{((R-\Delta)I_1 + \theta K)^2}\right)\left(1 + \frac{\sigma}{h} - m\right)\right] < 0$$

That is, for fixed s, the second term in the first order condition (2) falls with Δ, and thus s must fall to restore the agents' first order condition.

It is important to realize that a change in Δ does not alter the *social value* of an extra dollar of precaution, which illustrates the importance of the pecuniary externality. As domestic financial development falls (captured by a rise in Δ), agents' undervaluation of the social contribution of increasing their contingent claims rises. That is, the country becomes more exposed to external shocks than is socially optimal, even when external risk markets are complete (i.e. $\mu = 0$).

Finally, note that the undersinsurance result extends to all margins available to private agents. In particular, if we were to allow for a diversification decision, private agents would choose a level of h below that of the second best (representative agent).

Summing up. In this section we have shown how several market failures lead to underinsurance, excess spending on export diversification and falling welfare. The first set of failures relate to international financial markets themselves, in particular to the cost (availability) of instruments contingent on terms of trade and the cost of financing faced by EMEs. The second set relate to domestic financial underdevelopment, and the degree in which it distorts private insurance decisions. We turn next to the public sector, and the role it may play complementing the private insurance decisions we have discussed so far.

5   Public Risk Management

Could and should the government interfere with the private sector hedging strategy? And if it should, which form should it take? Is the standard practice of accumulating noncontingent assets the right strategy? These are the type of questions we attempt to address in this section.[19]

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[19]Here we focus on public assets management rather than on macroeconomic policy issues. For the latter see, e.g., Caballero and Krishnamurthy (2005a,b) who discuss features of monetary policy rules that reduce the underinsurance problem created by the pecuniary externality identified in the previous section

For this discussion to be meaningful, however, we must break Ricardian Equivalence. Otherwise, all government policies will be fully offset by private sector portfolio rebalancing. Although there are many reasons why Ricardian Equivalence is not likely to hold in EMEs, the natural candidate in our model is the external financial constraint faced by the private sector (or at least by a significant share of it). We shall therefore assume this constraint to be binding throughout, as in section 4.3.2. More generally, the policies we describe here will be ineffective up to the point at which they force private agents against their external constraint.

Let us now introduce a government that has A units of the importable good available at date 0 (non-contingent reserves), which it collects from taxing the private sector. An alternative interpretation is that these resources correspond to extraordinary fiscal income, such as that accumulated in a stabilization fund, that is not distributed back to the economy. Assume that external financiers do not relax the private sector external constraint one-for-one with increased taxation so that a share $0 < \tau \leq 1$ of these resources tighten the private sector's financial constraint. The private sector's constraints are then:

$$
\begin{aligned}
I_1 &= s\overline{M} + (1-s)m\overline{M} - I_0 + G - A \\
I_0 + s\frac{\sigma}{h}\overline{M} &\leq \lambda K - \tau A.
\end{aligned}
$$

G, the resources injected by the government at date 1, will depend on the portfolio decision of the government:

$$
G = A + s^G(1-m)\overline{M}
$$

where s^G represents the amount of external insurance purchased –at actuarial cost– by the government.

As we did with the private sector, we also consider cases in which the government faces collateral constraints of the sort:

$$
s^G\frac{\sigma}{h}\overline{M} \leq \lambda^G A
$$

Under this constraint the government can increase its level of insurance by accumulating reserves which it can pledge as collateral.

5.1 Costly Reserves and Valuable Contingent Contracts

Let us first discuss the case of λ^G large and λ small (unconstrained government and constrained private sector). We shut down domestic idiosyncratic

risk for now so there is no pecuniary externality, and assume that international risk markets are complete ($\mu = 0$).

Welfare is simply the utility of the representative agent:

$$V(A, s^G) = \max \left[\ln \left(\lambda K - \tau A - s\frac{\sigma}{h}\overline{M} + K \right) + E \ln(RI_1 + \theta K) \right]$$

$$I_1 = s\overline{M} + (1-s)m\overline{M} - \lambda K + \tau A + s\frac{\sigma}{h}\overline{M} + s^G(1-m)$$

The objective of the government is to maximize this value function with respect to A and s^G. The other object of interest is the response of s to these policy changes. However, by the envelope theorem we can disregard the response of s for welfare evaluations as long as the changes in A and s^G are small.

We start by analyzing the welfare effects of increasing A. From the previous expression it follows that

$$V_A = \tau \left\{ E\left[\frac{1}{I_1 + K} \right] - \frac{1}{I_0 + K} \right\}$$

However, since the agent is constrained we know that

$$\frac{1}{I_0 + K} > E\left[\frac{1}{I_1 + K} \right]$$

which implies that

$$V_A < 0.$$

It follows that it makes no sense for the government to accumulate non-contingent reserves, as long as the margin constraint of the government is non-binding (see the next section). Because agents are constrained, taxing them translates into reductions in period 0 consumption and reductions in welfare.

This result shows that the cost of accumulating reserves must be calculated taking into consideration the borrowing cost of the marginal borrower, not that of the government. Therefore the commonly used practice of calculating the cost of carry of reserves using the spread on foreign government bonds can be misleading. With this observation in mind, table (9) reports alternative calculations of the cost of holding international reserves. Column (1) is the most common approach in the literature. It is based on the presumption that central banks borrow long term at a rate $r^* + \rho$ to finance reserves and deposit these reserves at r^*. The spread ρ is therefore often (miss-) interpreted as the cost of holding these reserves, measured in this

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case by the EMBI spread. The second and third columns reports a measure of reserves that moves closer to the cost of holding reserves to the marginal borrower. It assumes that the government, by accumulating reserves is fore-going socially profitable projects. In this case the cost of reserves is $r^* + \rho + \delta$, where δ is the spread between the borrowing cost of the government and that of the marginal agent. The cost of carry is therefore $\rho + \delta$. As data on δ are not readily available we use two proxies. Column (2) measures δ as the spread between the money market and bank lending rates in each country, column (3) uses data from the investment climate report surveys of the World Bank, where local firms are asked to report their borrowing costs. The differences between columns(1), and (2) and (3) are sizeable. The average cost of carry rises from 7.6% per year, to 15 and 20% respectively. That is, the cost of holding reserves is much higher than usually considered.

What about contingent contracts?

$$
\begin{aligned}
V_{sG} &= E\left[\frac{1}{I_1 + K}(1 - m)\right] \\
&= \left\{\frac{1}{I_0 + K} - E\left[\frac{1}{I_1 + K}\right]\right\}\frac{\sigma}{h}
\end{aligned}
$$

which is strictly positive since the agents are financially constrained:

$$
V_{sG} > 0
$$

The intuition is clear. With $\mu = 0$ and no domestic financial market imper-fections, the only reason the agent does not set $s = 1$ is that its external financial constraint binds. If the government faces no financial constraint, then it can supplement private insurance. The right way to do so is by *engaging in contingent contracts rather than by accumulating reserves*, as the latter have a high opportunity cost when (part of) the private sector is financially constrained:

$$
r^{shadow} = \frac{1/(I_0 + K)}{E\left[1/(I_1 + K)\right]} - 1 > r = 0.
$$

5.2 Reserves as Margin for Contingent Contracts

Let us now assume that both λ^G and λ are small, and explore the region where the government is constrained (i.e., where engaging in more contingent contract requires that it pledges more reserves as collateral):

$$
s^G\frac{\sigma}{h}\overline{M} = \lambda^G A
$$

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We now can write the value function for the private sector as:

$$
\begin{aligned}
V(A) &= \max \ln(\lambda K - \tau A - s\frac{\sigma}{h}\overline{M} + K) + E\ln(RI_1 + \theta K) \\
I_1 &= s\overline{M} + (1-s)m\overline{M} - \lambda K + \tau A + s\frac{\sigma}{h}\overline{M} + \frac{\lambda^G A}{\sigma/h}(1-m)
\end{aligned}
$$

and

$$
V_A = \left\{ \frac{1}{I_0 + K} - E\left[\frac{1}{I_1 + K}\right]\right\}(\lambda^G - \tau)
$$

Now the negative effect of accumulating reserves that follows from the tightening of the private sector's financial constraint, has to be traded off the gains from relaxing the government's financial constraint in contingent markets. This result has two immediate implications for optimal policy:

- Governments should only accumulate reserves if the public sector gains more in terms of market access than what the private sector loses ($\lambda^G > \tau$).

- Reserve accumulation must be *matched one-for-one with the purchase of contingent contracts* if it is to be welfare improving. Importantly, if this piece of the policy is not followed, then even if $\lambda^G > \tau$, we revert to the earlier result and reserves accumulation becomes welfare reducing.

5.3   Domestic Financial Underdevelopment and Reserves

Note, however, that if we add back the pecuniary externality due to domestic financial underdevelopment, then a new reason for accumulating A arises, which is to reduce excessive private consumption during the boom (Caballero and Krishnamurthy 2001, 2004, 2006). In other words, evaluated at the social return of the marginal dollar, the gap

$$
\frac{1}{I_0 + K} - E\left[\frac{\widetilde{R}}{\widetilde{R}I_1 + \theta K}\right]
$$

is reduced by the pecuniary externality and, in severe cases, it may even flip its sign. Still, this only means that in this extreme case there is also a reason to slowdown the boom by increasing A. It is *not* a reason for the public sector not to make an extensive use of contingent markets. Moreover, as A is raised, the private sector will not only reduce I_0 but s as well. Unlike the case without pecuniary externality, the latter reduction has a first order

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cost since the envelope condition argument does not apply for the welfare function when agents's first order condition does not coincide with that of the social planner. This cost further raises the value of a public sector contingent strategy.

6 Policy Discussion

Let us summarize our main policy conclusions and develop a few additional conjectures that follow from our analysis:

1. If international contingent markets are available, and domestic financial markets are deep, the private sector is likely to adopt the right contingent strategy from a social point of view. This strategy involves issuing liabilities and accumulating assets whose payoffs are negatively correlated with external conditions. For example, on average Chilean companies in the nontradable sector and consumers would short Copper and the VIX, Mexican export companies would short an index of US activity, and the list goes on. While this scenario is desirable, it is not yet a good description of EMEs' current reality. The bulk of the model is about understanding the different departures from that perfect environment and their implications.

2. Consider first the case where international markets are complete but domestic banks and agents' international collateral (credibility) is limited. Then we showed that the private sector will not be able to fully use the existing international risk markets. In this context, if the government is less constrained than the private sector, it is justified that it undertakes some external insurance to supplement private insurance. However, we showed that it should not do so by accumulating reserves (or by borrowing less) beyond what it may need to do in order to meet margin requirements, as that would further tighten the private sector's constraint to hedge in international markets. Instead, the government should hedge external shocks through contingent markets. That is, by adding contingent elements to its debt or taking derivative positions with its reserves and assets.

3. The government has a further role when domestic collateral (credibility among domestic agents) is limited, since in such case there is a reason to reduce private expenditure. However this does not alter the conclusion that the government should hoard a substantial share of its

assets in contingent instruments. This conclusion is reinforced by the fact that in this case the private sector purchases too little contingent insurance as well.[20]

4. A theme that we repeated throughout but cannot be stressed enough, is that the contingencies must be indexed to non-EMEs' specific instruments. Domestic currency denominated debt, or domestic GDP debt are valuable instruments to aggregate financial resources *within* the asset class, but are *not* useful instruments to bring new funds to the asset class during systemic events (see Caballero 2003 and Caballero and Panageas (2005, 2006a)). They require scarce informed capital able to deal with moral hazard and the host of idiosyncrasies that characterize EMEs. Ignoring this "securitization" point can yield unexpected capital flow reversals as in this case the marginal investor is most likely to be a specialist overexposed to the asset class risk rather than a buy-and-hold global investor.

5. Of course the cost of such strategy is that the correlation between the risk itself and the instrument weakens, and hence it becomes less appealing to individual countries. The counterpart of this is that the premium should be substantially lower. This, as well as other trade-offs, such as that between the number of instruments and the liquidity of these, are important design decisions that require multinational coordination.

6. Note that DEs do not face these trade-offs, as the investor basis willing to hold domestic currency bonds and instruments is deep and well diversified. However, exporting the lessons from these economies directly to EMEs, without solving the structural problem that led to market segmentation in the first place, may help on the face of small country-specific shocks but may not, or may even exacerbate, the impact of systemic shocks.

7. In practice governments do not use nearly as much contingent instruments as this analysis suggests they should. Why is this so? In general, any sort of myopic behavior by the government will lead to underinsurance. However, our concern here is not so much with underinsurance

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[20]Of course there are other, expenditure reduction reasons, to hoard non-contingent reserves, such as when dealing with an intergenerational allocation problem or, in some instances, with Dutch disease. Our emphasis in this paper is on that part of reserves and public savings which are accumulated to deal with severe external shocks, not with trends.

per-se, since our premise is that recently most governments in EMEs have revealed their preference for significant insurance. Instead, our concern is with inefficient forms of insurance. In the language of the model, the facts today are not that EMEs' governments are precautioning too little, but that they are behaving too closely to the case where there are no contingent external markets. That is, they are behaving as if μ was close to infinity.

8. The most obvious reason for this bias arises from a basic agency problem: since using contingent instruments is not considered *standard practice* for aggregate risk management, adopting such practice entails large personal risks for whoever implements them. This agency problem may explain the recent offshore issuance in local currencies by several Latin American governments. It has been argued that demand for these bonds has fed off the expected appreciation of the local currencies against the dollar, an argument that only follows through if (for some reason) lenders expect a larger appreciation than the government. An alternative explanation is that the expected appreciation provides a convenient way of "masking" the true expected cost of this debt, vis-a-vis, the dollar denominated alternatives. Prudent governments are therefore able to purchase insurance without bearing the immediate political cost of doing so. However, as we mentioned above, this strategy comes at an important cost, as local-currency debt keeps insurance within specialists and domestic investors, rather than bringing new resources into the asset class.

9. In the simple model of this paper, the political cost comes during good-times, when the insurance will appear as a waste of resources. In practice, these costs can also arise during bad times as perfect insurance instruments for a country's external conditions are nearly non-existent, and hence most of the insurance must be done by proxy-hedging using a subset of commodity prices and of external financial risk (see Caballero and Panageas 2005, 2006a), which opens the possibility to unlikely but costly situations where hedges' realized returns and external shocks do not align well.

10. In addition to the standard practice argument, there is another political economy reason for why countries accumulate reserves and devote resources to export diversification, rather than using the more efficient contingent strategy: both policies have a domestic constituency that stands to gain first hand from these measures. In the case of

reserve accumulation, tradable sectors shielded (in part) from the real appreciation due to reserve increases gain directly. In the second, it is those entrepreneurs that collect the diversification subsidies that gain directly. These constituencies do not exist for contingent instrument policies, tilting the political returns towards more "traditional" insurance approaches.

11. Of course, there are systemic —international financial architecture— factors to consider as well. While many contingent markets already exist, such as commodity futures and volatility indices, an abrupt rise in demand for these instruments by EMEs would meet many liquidity bottlenecks. There is a need for further financial development.

12. Having said this, it is important to keep in mind that the resources needed are not unmanageable. Table (10) illustrates this point. The table calculates the total reduction in capital inflows involved in recent capital account reversals. We identify a crisis episode as any year in which capital inflows over GDP ($ca_{i,t}$) were 2.5% below the average capital inflows over GDP per country over the period 1984-2004 ($\overline{ca}_i$). We then compute the total capital inflow reduction as $\sum_j CA_{j,t} - \overline{CA}_i$, where the upper case variables denote dollar values and j are those years during and immediately after the crisis episode in which capital inflows over GDP remain below the country average ($ca_{i,t} < \overline{ca}_i$). The first four columns of the table show the average cost of individual country crises after 1990. Considering the systemic nature of EME crisis, the last column aggregates all crisis that took place between 1997 and 1999. The calculated dollar cost are first scaled by average EME inflows in the 90s. Not surprisingly, considering the systemic nature of the crisis, it amounts to close to 100% of the inflows to EME in any given year of the 90s. However, when compared to total outstanding gross liabilities of EMEs, the share falls to below 5%. The next two lines carry out a similar comparison relative to the total outflows and external assets of DEs. Scaled against these variables, the crisis appears as a relatively minor event – despite the large costs for those EMEs affected by it. The final two lines compare the cost of reversals with the capital losses that originate from a 1 and 23% fall in the NYSE. The latter, which corresponds to the drop in the Dow Jones index in October 1987, swamps the cost of the 1997 emerging market crisis. Note that the entire reversal following the Asian crisis corresponds to a 0.5% fluctuation in the NYSE! Or, alternatively, the

EME crisis of the late 90s where less than 1/40th of the capital loss that occurred in October 1987.

13. We stress that both demand and supply considerations point to the need of an involvement by IFIs. It follows that international financial institutions have a significant role to play in changing the perception of what *standard practice* means. By doing so they would reduce the extent of local governments' agency problem. Moreover, an increased demand for contingent contracts and assets is likely to energize global financial markets to supply such contracts, effectively reducing μ for the private sector as well.

14. There are a few steps that the IFIs can take to help develop these markets. For example, they can create indices correlated with exogenous EMEs crises that can serve as benchmarks for new financial instruments. They can develop contingent credit lines indexed to these benchmarks, which eventually can be sold to the private sector. They also can issue their own contingent debt to help developing the pricing of such instruments. Or they can participate directly in the countries issuance by buying some of the riskier EME-specific tranches, when some pre-qualification justifies it. In many cases, these policies not only will help the countries involved, but will reduce the credit risk in the IFI portfolios.

15. Finally, we mention yet another political economy point, this time one that favors the adoption of a contingent strategy. The latter is a mechanism to offset the multiple pressures currently experienced by governments in countries benefiting from high commodity prices. In the absence of contingent contracts, prudent fiscal rules and reserve accumulation strategies lead to large asset accumulation, which raises the pressures on the government to increase expenditure (either directly or by, e.g., manipulating the reference price in the fiscal rules and stabilization funds). Instead, with contingent contracts such incentives are reduced substantially as the funds available to the government shrink during booms and expand during contractions. Moreover, with a contingent strategy, reference prices are not set by a team of local "experts" but, implicitly, by capital markets.

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8 Appendices

8.1 Sample

Industrial Countries (21)		Emerging Economies (28)	
AUS	Australia	ARG	Argentina
AUT	Austria	BRA	Brazil
BEL	Belgium	CHL	Chile
CAN	Canada	CIV	Cote d'Ivore
CHE	Switzerland	COL	Colombia
DEU	Germany	CRI	Costa Rica
DNK	Finland	DOM	Dominican Republic
ESP	Spain	DZA	Algeria
FIN	Finland	ECU	Ecuador
FRA	France	EGY	Egypt
GRB	United Kingdom	IDN	Indonesia
IRL	Ireland	IND	India
ISL	Iceland	JOR	Jordan
ITA	Italy	KOR	Korea
JPN	Japan	MAR	Morocco
NLD	Netherlands	MEX	Mexico
NOR	Norway	MYS	Malaysia
NZL	New Zealand	NGA	Nigeria
PRT	Portugal	PAK	Pakistan
SWE	Sweden	PAN	Panama
USA	United States	PER	Peru
		PHL	Philippines
		THA	Thailand
		TUN	Tunisia
		TUR	Turkey
		URY	Uruguay
		VEN	Venezuela
		ZAF	South Africa

Table 1: List of Countries (49)

The sample of countries includes 21 OECD countries and 28 emerging market countries. The second group is conformed by the same countries considered in the JP Morgan's EMBI (Emerging Markets Bond Index), excepting transition economies from East Europe.

8.2 Variables

The variables are described in the order they appear in the main text-

- Export price deflator $P_{x,t}$: annual dollar deflator of exports from national account data. Source World Development Indicators (WDI) World Bank (WB).

- Import price deflator $P_{m,t}$: annual dollar deflator of imports from national account data. Source WDI-WB.

- Terms of trade: $(P_{x,t}/P_{m,t})$

- Export price P_x^* : geometric average of the price of exports in period t. Weights correspond to the share of each good in the basket of exports in period 1985-2000. Good prices across countries correspond to the ratio between volume traded and total value. For each good, the median price of all countries is considered as the international price for this good (this procedure eliminates price outliers). All data is from Feenstra et al. (2005).

- Trading partner growth: weighted average of real GDP growth of each trading partner. Weights correspond to trade shares in $t - 1$. The average growth is then weighted by average export openness over the period. Formally the shock measure is constructed as follows:

$$S_{c,t} = \overline{S}_c \sum_{j=1}^{J} s_{ij,t-1} * g_{j,t}$$

where $S_{c,t}$ is the shock to country c at time t, $s_{ij,t-1}$ is the share of exports from country c to country j in t-1 , $\overline{S}_c$ is the average share of exports to GDP in country c during the sample period , and $g_{j,t}$ is the growth rate of real GDP of country j at time t. Source Galindo and Micco (2005), who in turn use the following sources: i) for s, the Direction of Trade Statistics database of the International Monetary Fund, ii) for $\overline{S}_c$ and $g_{j,t}$ the World Bank's World Development Indicators database.

- Herfindahl Index h: measure of export concentration, $h^2 = \sum \alpha_i^2$,where α_i is the share of good i in total exports. A higher h means higher concentration. h is built using 4 digit SITC (rev. 2) trade data from Feenstra et al (2005).

- TBill: annual dollar yield on 10 year US treasury bill. Source Bloomberg.

- EMBI Return: annual yield on the Emerging Market Bond Index (EMBI for period 91-96 and EMBI Global since 1997). Source: JP Morgan and Bloomberg.

- Financial Account over lagged GDP (nfa): Net financial account over previous period GDP. Source: International Financial Statistics (IFS) of the IMF.

- Growth g : real GDP growth. Source: IFS-IMF.

- Trade weighted terms of trade growth: annual change in $(P_{x,t}/P_{m,t})$ times exports+imports over GDP. Source: WDI for terms of trade and for trade data IFS-IMF.

- High equity: dummy variable that takes on a value of 1 if the share of foreign direct investment (FDI) and portfolio equity in total gross international liabilities over the period 1990-2004 is above the median country in the sample described in appendix 1.

- Current Account Surplus over current GDP (ca): current account surplus over current period GDP. Source: IFS-IMF and WDI-WB.

- Net Financial Account over current GDP($nfac$): net financial account over current period GDP. Source: IFS-IMF and WDI-WB.

- Investment over GDP (I): nominal gross fixed capital formation over nominal GDP. Source: WDI-WB.

- Net international reserves (rin): net international reserves over GDP. Source: IFS-IMF and WDI-WB.

- Short term debt (std): Total public and private external debt having an original maturity of one year or less and interest in arrears on long-term debt (as % of total external debt). Source: WDI-WB.

- Fiscal balance as % of GDP. Source: For developing countries: IFS complemented with ECLAC reports for LAC, and ADB indicators for Asian countries. For Industrial countries: OECD-WEO.

- Public Debt. Source: Jaimovich and Panizza (2006).

- High yield spread: spread between the yields on AAA rated corporate bonds and BBB rated corporate bonds in the US. Source: Federal Reserve Bank.

- Libo90 rate: 90 day rate in London interbank market for dollar loans. Source: Bloomberg.

- GDP per capita PPP (y). Source: WDI-WB.

- Domestic public debt over total public debt: debt issued in domestic markets or contracted with domestic banks as a ratio of total public debt. Source: Cowan at al (2006).

8.3 Export Diversification and Income

	Cross Country Regression	**Panel Regression**
Dependent Variable	Herfindahl Index in 2000	Herfindahl Index 1980-2000
Per capita income	-0.000017 **	-0.000016 ***
Per capita income^2	4.9 x 10^{-10}**	4.5 x 10^{-10}***
Total income	-8.4 x 10^{-9}	
R^2	0.28	0.7
N	48	1248
Fixed Effects?	No	Country

***, **, * indicate statistical significance at 1, 5 and 10%.

The table shows the results of regression a measure of export concentration against per capita income (ppp) for a cross section of countries in 2000 (first column) or a panel for 1980-2000. The panel estimation includes country fixed effects. The sample is detailed in appendix 1. The first column also includes a control for country size: total dollar GDP in 2000.

Appendix 8.4

Exogenous Changes in Gross International Liabilities 1990-2004

| | Mean | | EMEs/DEs |
	DEs	EMEs	
l_t	0.0971	0.0802	0.8257
r_t	0.0601	0.0632	1.0510
p_t	0.0369	0.0175	0.4726
Sdev (l_t)	0.1031	0.0863	0.8370
Sdev (r_t)	0.0194	0.0148	0.7645
Sdev (p_t)	0.1007	0.0822	0.8171

Notes: The table shows the sample stats for three measures of returns to gross liabilities. The exact definition of these returns is detailed in the text.

Source: Authors construction based on data from the IMF IFS, IMF Balance of Payment Statistics and Lane and Milessi-Ferretti (2003)

Table 1

Real and Financial Volatility 1985-2004

	Mean		EMEs-DEs
	EMEs	DEs	
Panel A: Real Shocks			
Variance (Δ% terms of trade)	94.23	12.79	81.45
Variance (Δ% Px)	134.07	82.84	51.23
Variance (Δ% Pm)	97.15	61.28	35.87
Variance (trading partner growth)	0.15	0.12	0.03
Panel B: Financing Shocks			
Variance (cost of financing)	3.30	1.10	2.20
Variance (financial account / GDP)	4.90	3.30	1.60

Notes: The sample of EMEs and DEs is detailed in the appendix. Nigeria, is excluded from this table. The cost of financing is the annual rate on the 10 year Tbill for DEs and the EMBI yield for EMEs.

Sources: Terms of trade data are from the World Bank WDI. Trading partner growth are from Galindo and Micco (2005). US-Tbill and EMBI are from Bloomberg. Financial account data are from the IMF IFS.

Table 2

Variance Decomposition 1985-2000

	Difference EMEs and DEs	% of variance explained
σ^2_x	**26**	
$\sum_{i=1}^{n} \alpha_i^2 (\sigma_i^2 - \sigma^2)$	14.4	55%
$\sigma^2 h^2$	12	46%
$2\sum_{i=1}^{n} \sum_{\substack{j=1 \\ j \neq i}}^{n} \alpha_i \alpha_j \sigma_{ij}$	-0.4	-2%
$\sigma^2 h^2$		
$\quad \sigma^2_{eme,ind} (h^2_{eme} - h^2_{ind})$	14.5	56%
$\quad h^2_{eme,ind} (\sigma^2_{eme} - \sigma^2_{ind})$	2.5	10%

Note: This table decomposes the differences in the variance of the log change of prices between the average economy in both regions. Data on prices and exports shares are from Feenstra (2005), so that the total variances of export prices differ from those reported in table 1. The exact decomposition is detailed in the text. For consistency with Table 1 Nigeria is excluded from the sample. Units are as in table 2.

Source: Authors calculations based on data from Feenstra et al (2005).

Table 3

Gross International Liabilities and Insurance

| | LHS: Exogenous change in international liabilities (lt) | | | |
	1	2	3	4
GDP growth	0.07	-0.166		
	[0.141]	[0.165]		
GDP growth x DE	0.812	0.692		
	[0.309]***	[0.310]**		
GDP growth x High Equity		0.574		
		[0.256]**		
Δ ln (terms of trade)			0.104	-0.051
			[0.086]	[0.116]
Δ ln (terms of trade) x DE			0.459	0.505
			[0.247]*	[0.243]**
Δ ln (terms of trade) x High Equity				0.275
				[0.147]*
Observations	699	699	693	693
R-squared	0.36	0.36	0.35	0.36
Year Dummies	Yes	Yes	Yes	Yes
Country Dummies	Yes	Yes	Yes	Yes

Notes: Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. The table reports the results of estimating the baseline specification described in the text for the sample of DEs and EMEs over the period 1990-2004. DE is a dummy for DEs. High Equity is a dummy for countries with equity shares in gross liabilities above the sample median. Δ ln (terms of trade) is the trade weighted change in the log of terms of trade.

Table 4

International Liabilities and Insurance

Estimated coefficients on (growth x DE) interactions

	growth corresponds to:	
	GDP Growth	Terms of Trade Growth
Exogenous change in liabilities (l)	0.812 [0.309]***	0.459 [0.247]*
Valuation Effects (p)	0.807 [0.299]***	0.472 [0.229]**
Returns (r)	0.006 [0.065]	-0.012 [0.048]

Notes: Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. The table reports the estimated coefficients on the interactions: growth x DE, terms of trade x DE. The specification corresponds to column 1 of table 3 for the sample of DEs and EMEs over the period 1990-2004. Terms of trade growth is the trade weighted growth in the terms of trade. DE is a dummy for industrial economies.

Table 5

Precautioning in the Current EME Cycle

Variable	Current Upturn	Avg. Previous Upturns
	Average EMEs	
Current Account Surplus (% GDP)	1.2	**-2.8**
Net Financial Account (% GDP)	-1.1	**2.2**
Investment (% GDP)	20.7	**23.7**
Net International Reserves (% GDP)	16.0	**9.5**
Short Term Debt (% Total Debt)	13.1	**16.8**
Fiscal Balance (% GDP)	-1.6	**-2.6**
Public Debt (% GDP)	58.1	**46.9**
	Median EMEs	
Current Account Surplus (% GDP)	-0.1	-2.7
Net Financial Account (% GDP)	0.0	2.1
Investment (% GDP)	21.2	22.7
Net International Reserves (% GDP)	13.8	6.7
Short Term Debt (% Total Debt)	11.7	14.8
Fiscal Balance (% GDP)	-2.0	-2.3
Public Debt (% GDP)	53.7	37.5

Notes: In bold if average significantly different from current cycle. The cycles are defined in terms of deviations from the average EME GDP growth rate. Recessions are therefore defined as reductions in growth more than 2 standard deviations below the average. The exact timing of the cycles is detailed in the main text and figure 3.

Sources: IMF IFS, World Bank WDI, Jaimovich and Panizza (2006).

Table 6

Precautionary Measures After Controlling for External Conditions

Dependent variables::	Fin. Acc. GDP	Current Acc. GDP	Investment GDP	Reserves GDP	ST Debt Total Debt	Fiscal Bal. GDP	Public Debt GDP
1999-2004 Cycle	**-2.218 ** **	**2.998 *** **	**-1.976 *** **	**3.03 *** **	**-3.555 *** **	**-0.067**	**-0.494**
	(1.014)	**(0.622)**	**(0.507)**	**(0.753)**	**(0.992)**	**(0.399)**	**(2.872)**
Controls:							
ln (trading partner GDP)	0.101	-0.795 **	2.271 ***	0.056	0.662	0.782 ***	-3.633 **
	(0.382)	(0.379)	(0.283)	(0.444)	(0.506)	(0.183)	(1.574)
ln (export Price)	-2.389	8.192 ***	4.677 ***	-0.889	0.218	1.828	-13.964
	(1.804)	(1.692)	(1.489)	(2.237)	(2.192)	(1.367)	(10.650)
ln (import Price)	7.799 ***	-9.798 ***	0.964	-2.523	1.849	0.64	-4.717
	(2.446)	(1.701)	(1.781)	(2.300)	(3.636)	(1.859)	(13.696)
High Yield Spread	-440.477 ***	101.888	-91.713	-254.742 **	-494.895 ***	-252.984 ***	703.369
	(110.806)	(73.484)	(65.222)	(104.264)	(130.126)	(56.958)	(506.382)
Libo90 rate	-45.193 ***	13.449	-44.373 ***	-67.635 ***	-43.356 **	-22.285 ***	64.234
	(17.435)	(10.639)	(10.538)	(15.721)	(18.667)	(7.157)	(65.001)
Regression statistics:							
R-squared:	0.332	0.363	0.683	0.674	0.566	0.655	0.676
Observations	499	499	511	511	483	451	426

Notes: Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. The table reports the results of regressing the main "precautionary" variables against a set of external conditions. "Last Cycle" is a dummy variable that takes on a value of 1 in the period 2000-2004. Country fixed effects are included but not reported. Trading partner GDP, export prices and imported prices are detrended using a country specific quadratic trend.

Sources: World Bank WDI, IMF IFS, Bloomberg and authors calculations.

Table 7

Export promotion policies

	Export insurance and guarantee programs	Tax reductions or exemptions on imported inputs incorporated used for exports	Credits with preferential interest rates	Fiscal subsidies to non-traditional exports	Other incentives for exports
EMEs with highly concentrated exports over 1990 - 2000	**Algeria**: only for non hydrocarbon exports. **Jordan**: The Export and Finance Bank (a public bank) provides commercial financing and loan guarantees.	**Chile:** Exporters may defer tariff payments on capital imports for a period of 7 years. Taxes can also be reduced if capital goods are used to produce exported products. **Egypt**: only for selected industries. **Nigeria**: duty free treatment for raw materials. **Venezuela**: duty rebates and duty drawback system.	**Jordan**: the Central Bank provides credits for exporters producing agricultural and/or manufactured exports with at least 25% of domestic value-added.	**Chile:** simplified duty drawback system for nontraditional exports. The system refunds exporters of specific products a percentage of the value of their exports, rather than refunding the actual duty paid on imported inputs to production.	**Chile**: simplified paperwork requirements non-traditional exporters. Export promotion agency (PROCHILE). **Chile**: quicker returns on value added taxes paid on inputs are available for exporters. **Nigeria**: favorable depreciation allowances for capital assets. Export Processing Zones where exemption from federal, state and local-government taxes, and repatriation of capital and profits are allowed.
EMEs with diversified exports over 1990 - 2000		**Brazil**: tax and tariff incentives for imported equipment and materials, tax rebates on materials used in manufacturing exports. Rebate on social security taxes. **Thailand**: taxes and import duty rebates for re-exported products. **India**: for raw materials and capital inputs.	**Brazil**: PROEX credit program tries to equalize domestic and international interest rates for exporting firms. **Thailand**: subsidized export credits.	**Thailand**: Preferential financing for exporters of manufactured and processed agricultural products. **Argentina**: Industrial exports produced in the Patagonia region. **Korea**: subsidies to shipbuilding, steel and semiconductor industries via state-sponsored credits.	**India**: subsidies for exports of wheat and rice. **Argentina**: Exporting companies receive an advantageous ER for foreign currency received for export products.
DEs with highly concentrated exports over 1990 - 2000					**Norway**: Indirect subsidies to chemical and metal exports through subsides to electricity. **Norway**: funds for export promotion. **Norway**: subsidies to cheese production, which may be exported. Some remaining agricultural subsidies. **Australia**: grants for marketing costs incurred when establishing new export markets. **Canada**: export subsidies on dairy products.
DEs with diversified exports over 1990 - 2000	**Austria**: export promotion loans and government guarantees (The Austrian Kontrollbank). **Italy**: export insurance to industrial and business firms.		**Netherlands**: interest rate subsidies for Dutch exports that compete with subsidized export transactions in third countries. **Italy**: interest rate subsidies for some industrial and business firms.		**Italy**: Export refunds for some agricultural products. Export promotion programs (funding for travel and market penetration programs).

Table 8

Share of Outstanding Commodity Derivative Positions by Region 1991 (%)

	Asian Developing	Middle East and North Africa	Sub-Saharan Africa	Latin America
Grain and soybean	0.19	0.12	-	1.21
Livestock products	-	-	-	0.39
Foodstuffs	0.30	0.18	0.68	2.09
Industrial material	-	0.14	0.03	1.58
Metals	0.07	0.90	-	1.19
Crude Oil	-	-	-	1.40
Financial Instruments	0.01	0.20	-	2.04
Currencies	-	0.27	-	3.17

Source: Debatisse et al (1993)

Table 9

Costs of Holding Reserves (annual %)

	Rate spread used to calculate cost of reserves:		
	EMBI	EMBI+lending spread IMF	EMBI+lending spread ICS
Algeria	6.7	11.9	
Argentina	35.1	41.5	
Brazil	7.9	48.2	21.7
Chile	1.4	5.3	6.4
Colombia	6.5	16.0	
Côte d'Ivoire	21.0		
Dominican Republic	4.2	15.4	
Ecuador	19.0		37.0
Egypt	4.0		18.5
Korea	1.5	4.2	7.5
Malaysia	1.6	5.5	
Mexico	2.8	2.8	
Morocco	4.7	13.7	14.2
Nigeria	16.1		37.1
Pakistan	10.6		
Panama	4.4	12.7	
Peru	6.1		23.1
Philippines	4.8	7.0	
South Africa	2.2	6.7	
Thailand	1.1	5.8	
Tunisia	3.1		
Turkey	5.7		25.7
Uruguay	6.3	35.7	
Venezuela, Rep. Bol.	9.5	20.8	
Average EMEs	**7.6**	**15.1**	**19.8**

Notes: The table reports estimates of the annual % the cost of holding reserves for EMEs. This cost is calculated as the spread between the yield on US Tbills and each country's EMBI bond index (=s1), as s1 plus the spread between average bank lending rates and money market rates, and as s1 + the spread between lending rates reported by firms surveyed in the World Bank investment climate report and the money market rates.

Source: Bloomberg, IMF-IFS, World Bank Investment Climate Report.

Table 10

Cost of Crisis

	Average cost crisis episode after 1990 in:				Total cost
	Latin America	Asia	Other	All EMEs	1997 Crisis
As a % of average total EME inflows in the 90s	-10.9	-21.3	-4.3	-10.4	-96.3
As a % of total EME external liabilities in 2004	-0.4	-0.7	-0.2	-0.4	-3.4
As a % of average total DE outflows in the 90s	-0.7	-1.4	-0.3	-0.7	-6.3
As a % of total DE external assets in 2004	0.0	-0.1	0.0	0.0	-0.2
As a % of a 1% fluctuation of the NYSE	-6.1	-11.8	-2.4	-5.8	-53.7
As a % of a 22.6% fluctuation of the NYSE	-0.3	-0.5	-0.1	-0.3	-2.4
Current US Dollars (000,000s)	-12750.8	-24879.3	-5037.7	-12140.1	-112689.0

Note: The table reports cumulative capital reversals during crisis episodes in EMEs after 1999, as defined in text.
Source: Data on capital account from IMF-IFS. Data on stock market capitalization Bloomberg.

Figure 1

Volatility of dlnPX and Export Concentration

Emerging market economies

Note: axes in log scale. NGA (0.92 , 24.2)

Industrial economies

Note: axes in log scale
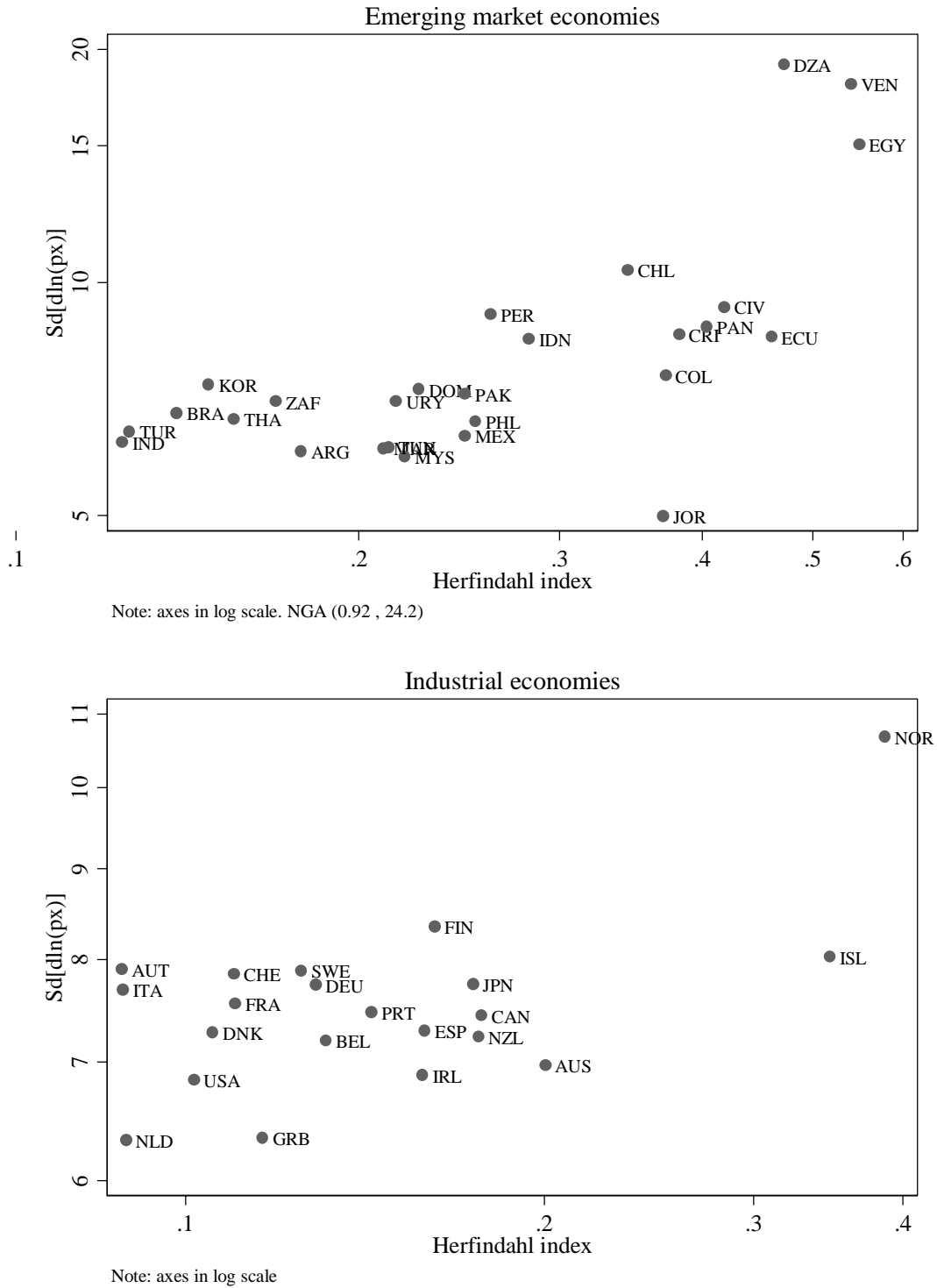
Source: Author's calculations based on trade data from Feenstra et al (2005)

Figure 2

Export Concentration and Per Capita Income

Note: NGA has been excluded
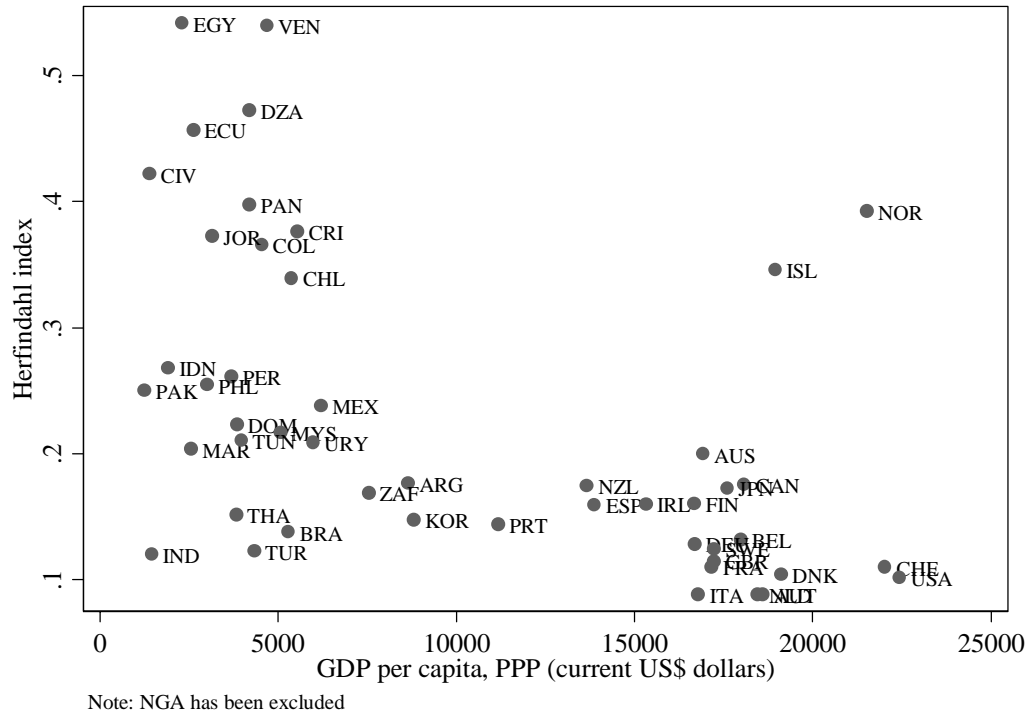
Source: Authors calculations based on Feenstra et al (2005) and World Bank WDI.

Figure 3

Export Concentration 1985-87 and 1998-00
Average over period of constant price Herfindahl index

Source: Authors calculations based on data from Feenstra et al (2005)

Figure 4

Export Price Volatility 1985-87 and 1998-00

Variance of % change in P_x

Industrial economies

Note: axes in log scale

Emerging market Economies

Note: axes in log scale
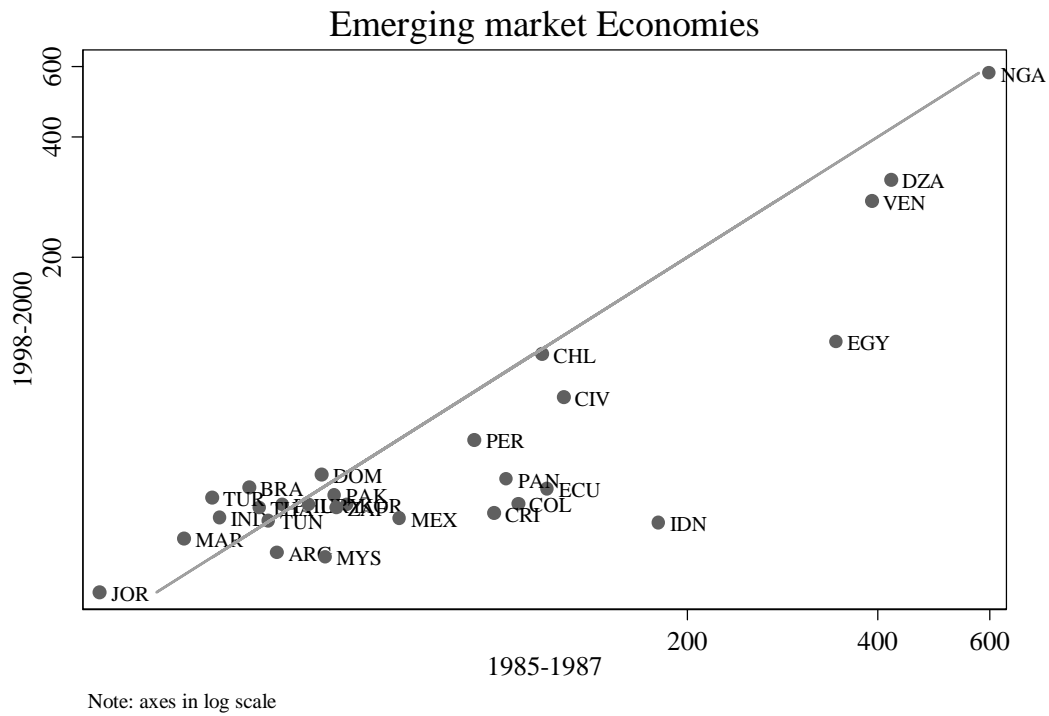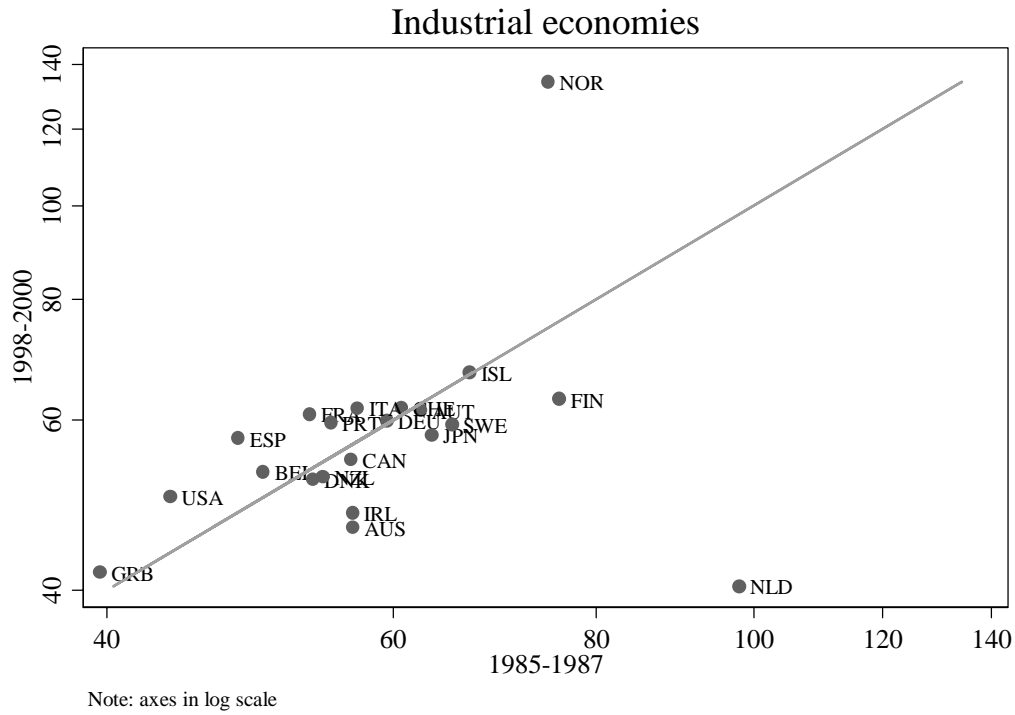
Source: Authors calculations based on data from Feenstra et al (2005)

Figure 5

Probability of Capital Account Reversals
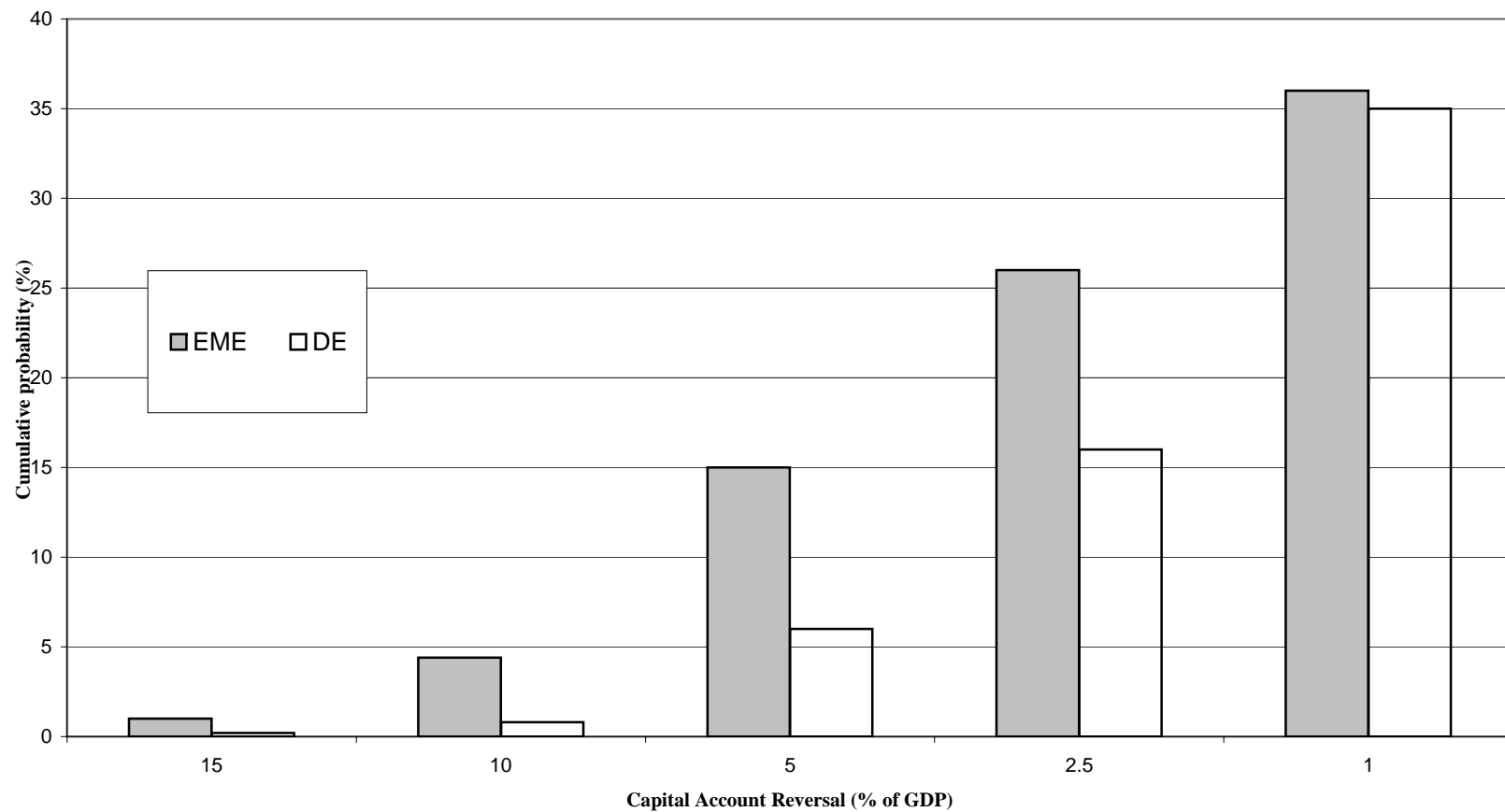
Note: The figure shows the cumulative probability of a capital account reversal of a give size. Reversals are measured as absolute deviations of the net financial account over GDP from the country average of this ratio for the period 1985-2004. Data are from IMF-IFS

Figure 6

Cycles in Market Access Economies
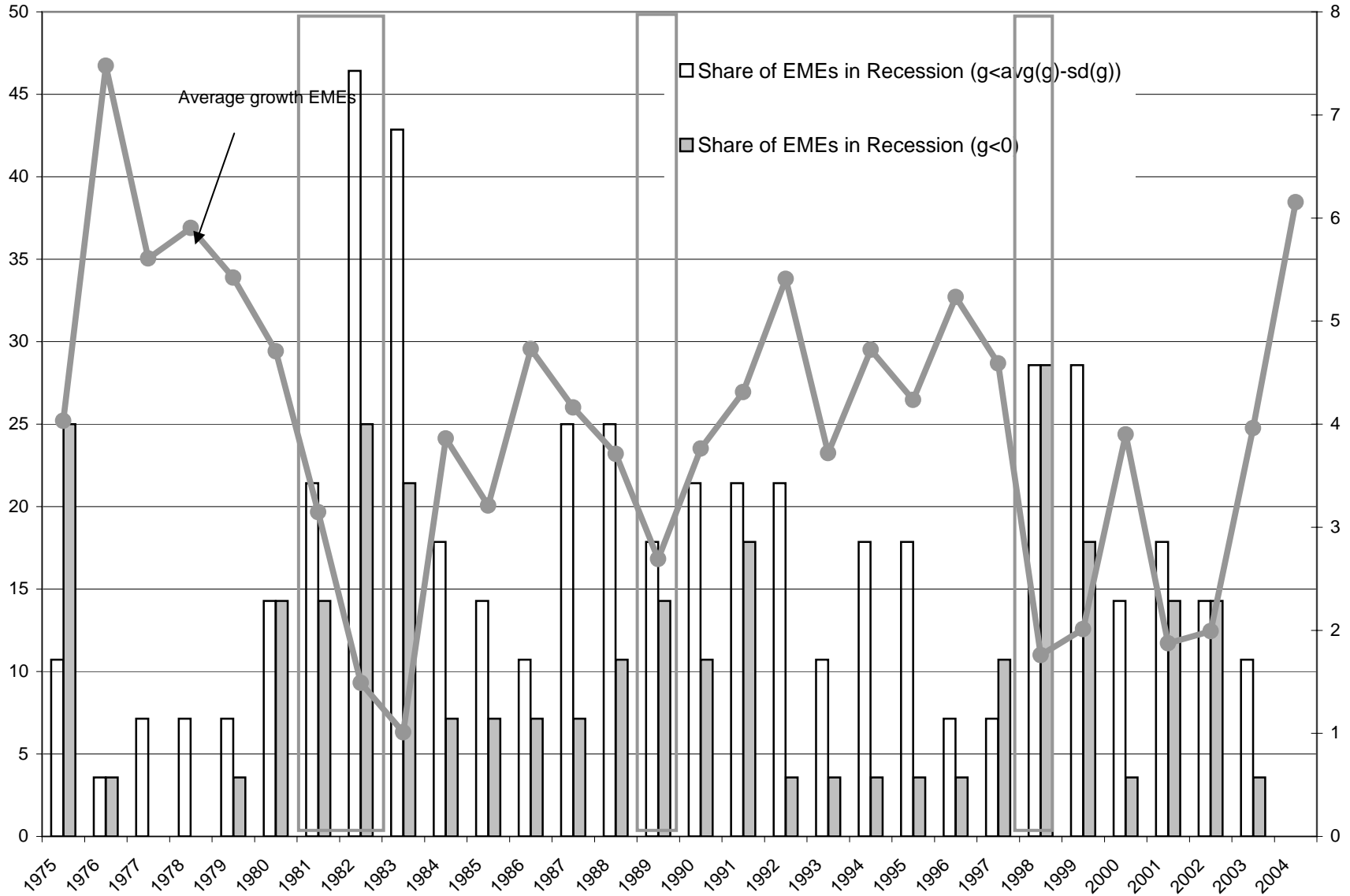
Source: Authors calculations based on data from World Bank WDI.
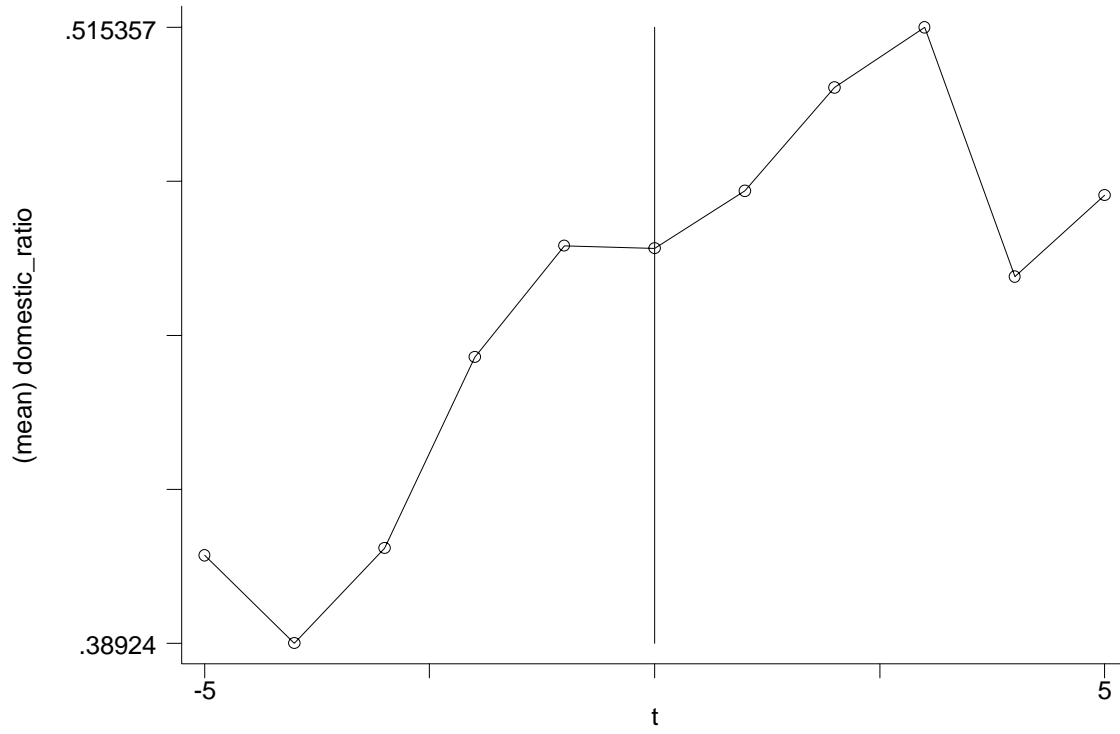
Figure 7

Precautioning in Current and Previous Recoveries
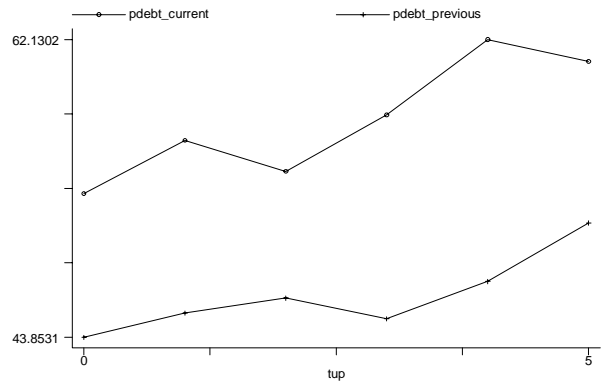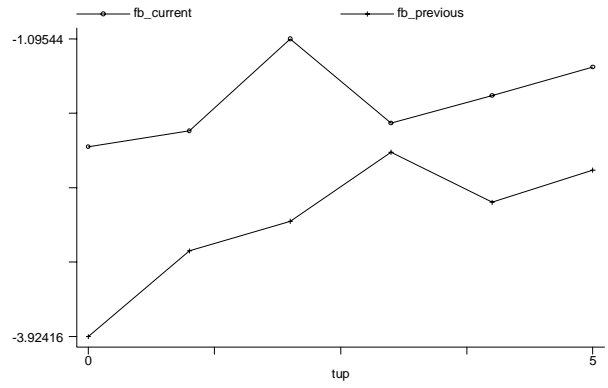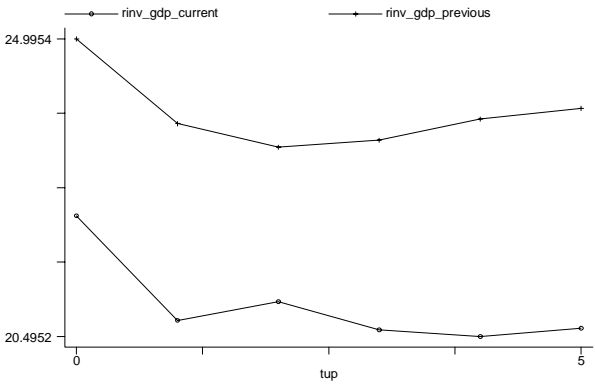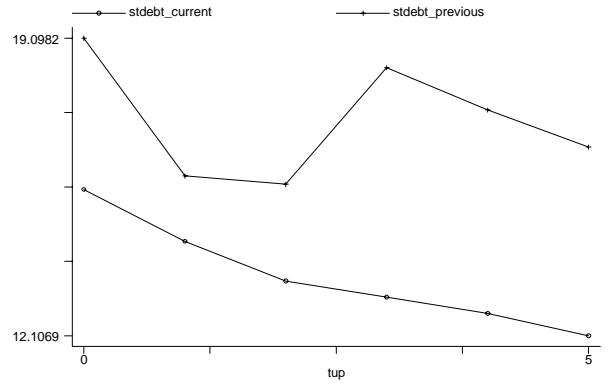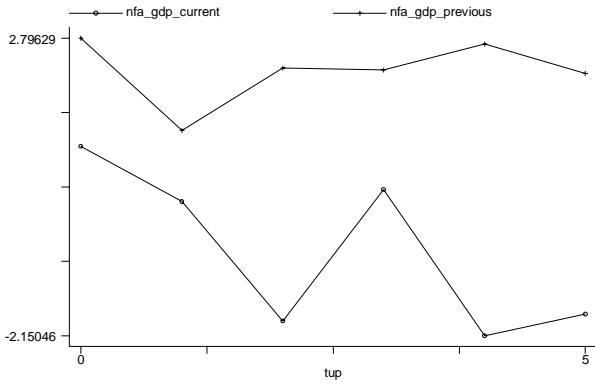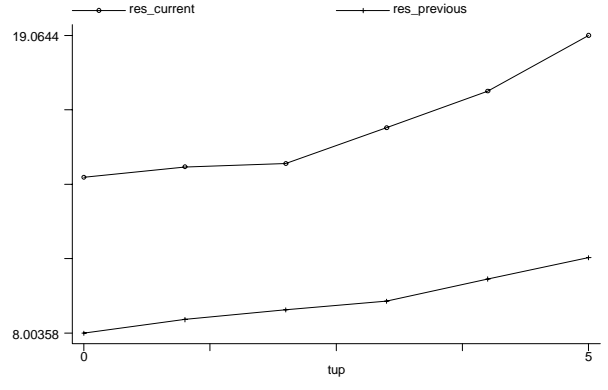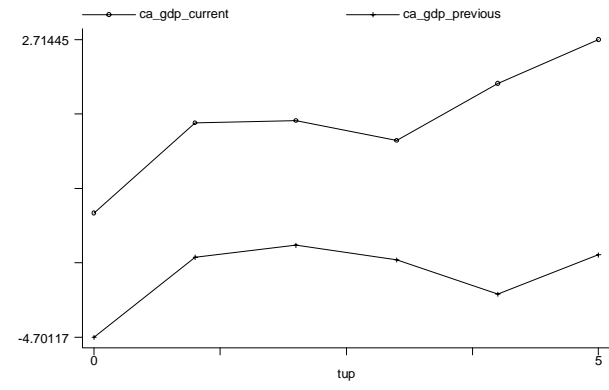
Source: Authors calculations. For details on sample and variables text and appendix.
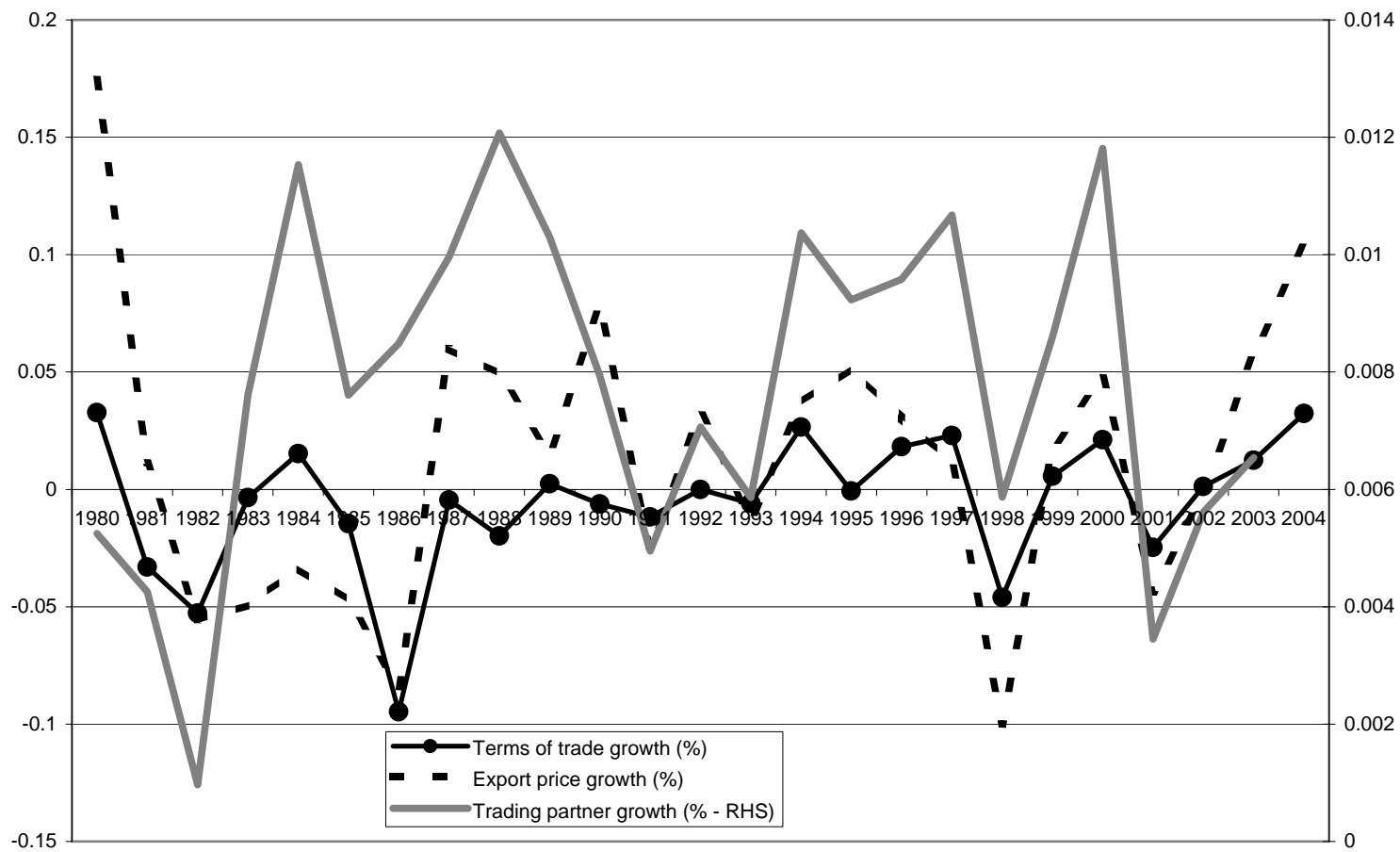
Figure8

Share of Domestic Debt in Total Debt (EMEs in Latin America and the Caribbean)

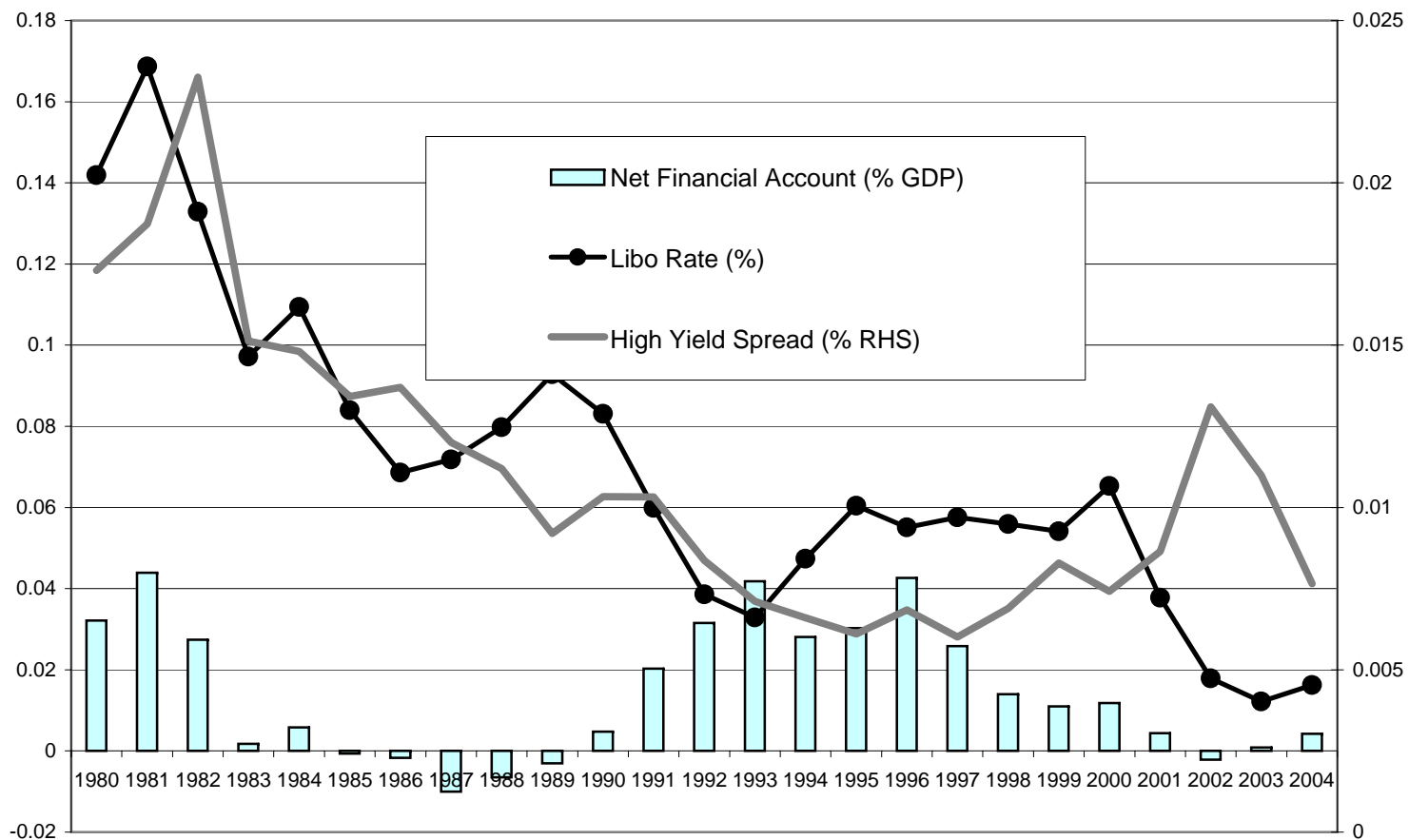Source: Cowan et al (2006) and authors calculations.

Figure 9

Real External Conditions EM Economies

Source: Data on Terms of Trade and export price growth from WB-WDI, data on Trading Partner growth from Galindo and Micco (2005).

Source: World Bank WDI, Galindo and Micco (2005).

Figure 10

External Financial Conditions EM Economies

Source: Data on Net Financial Account from IMF-IFS, data on rates from Bloomberg.

Sources: IMF IFS, Bloomberg.