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 can also be an important factor behind emerging markets' volatility, both as a source of shocks and as an amplification mechanism. 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.

1 Introduction

Integration to international capital markets should be one of the key pillars of development, allowing lower income economies to draw of foreign savings to raise income levels and smooth consumption. However, capital flows can also be 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

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poorly regulated domestic financial systems that open their economies to international capital flows systematically experience deep crises. Enough has been said about this set of economies. Instead, in this paper we focus on prudent emerging markets economies (EMEs) that still experience significant external volatility. By doing so, we are implicitly recognizing that the international financial market itself is a source of volatility for EMEs.

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. In particular, this question opens out into two key issues. The first is the optimal mix of self insurance and external insurance for an EME. The second, is the extent to which the private sector can be relied upon to implement this optimum. Closely related is the impact that public sector policy decisions have on private sector insurance outcomes.

Note that this is a second best question: we are taking as given that external shocks will take place in the future. It is also an international financial architecture question: Which markets should be developed to reduce the cost of insuring against exogenous (at least to an individual country) capital flow volatility? And related, which role can the IFIs play in helping to develop these markets?

We address these questions 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 conceptual framework to capture the main mechanisms described in recent literature which allows us to characterize optimal country behavior. The model shows that it is unlikely that the private sector will get us there 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 role of the IFIs.

Our main conclusions are that: i) EMEs looking to reduce vulnerability to external shocks typically do so by reducing their net external liability positions, often by accumulating substantial reserves. EMEs do not rely on external liabilities that are contingent on domestic or external shocks. ii) These self insurance practices are more costly than it is typically assumed. For example, the social opportunity cost of holding large stocks of international reserves and running primary surpluses is at least twice that of traditional calculations of reserve costs based on the marginal borrowing cost of governments, Table (1). Indeed, for several countries in our sample, the cost of carry (the difference between the returns on reserves and their social marginal cost) is above 20% per annum. iii) Current practices are inefficient as insurance arrangements. For example, Caballero and Panageas (2005) show that even indexing reserves to a single risk indicator, such as the VIX, would give on average about 30 percent and as much as 300 percent more reserves to countries at the times when they experience a sudden stop in capital inflows due to systemic factors[1]. In this paper we reinforce this point and extend it to a case where the central bank may need to accumulate reserves because it faces collateral constraints in the insurance market. The point, however, is that in such a case the main role of conventional reserves is to be used as margin for a contingent strategy, not as a substitute for such strategy. iv) Similarly, industrial policies aimed at diversifying exports are an inferior foreign income stabilization mechanism. v) The government (broadly defined) has a dual role to play. It has to provide the right incentives to foster an active private sector role in the collective insurance arrangement[2]. It also has to be a participant in the insurance arrangement because the private sector is unlikely to do the socially efficient amount of

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

[2] For example, Caballero and Krishnamurthy (2005b) show how inflation targeting systems in EMEs need to overweight nontradables in order to avoid over-stabilizing the exchange rate and hence inducing agents to dollarize their liabilities and underinsure more generally.

external insurance when domestic financial markets are underdeveloped.[3] vi) The IFIs have an important role to play in fostering these practices, as they can solve the natural agency problem that deters domestic policy makers from adopting risk management practices outside conventional practice, and they can help develop the required contingent markets.

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 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 Instability 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 that we include, while appendix 2 provides details of the construction of all variables used.

We argue that EMEs have a greater need of external financial markets than DEs to reduce the impact of high terms of trade volatility on consumption and welfare. We also show that export concentration and price volatility are slow moving variables, highly correlated with overall income levels, so that large reductions in the terms of trade volatility of EMEs are unlikely in the short term. On the other hand, we show that EME access to international financial markets is precarious, limiting their capacity to

[3] See Caballero and Krishnamurthy (2002, 2005a,b, 2006) for a discussion of different aspects of monetary policy and inflation targeting when sudden stops are prevalent.

accommodated these terms of trade shocks and exposing EMEs to shocks originating in the financial markets themselves.

2.1 Real Shocks

Table (2, panel A) shows that over the period 1985-2004 the standard deviation of the annual percertage change of the terms of trade of the average EME was more than twice that of the average developed economy in our sample.[4] 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.[5]

Henceforth we focus on the volatility of export prices, as this has been the concern of much policy discussion and prescriptions in the past.[6] 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

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

[5] The measures of terms of trade, export and import price volatility reported in table 2 are obtained from export and import deflators available in the WDI database of the World Bank. These are the terms of trade measure used most commonly in empirical literature on external vulnerability. The last row of 2) reports an complementary measure of $\widehat{p}_x$, which we build using 3 digit ISIC trade data from the Feenstra et al (2005) database on world trade flows. For details on how this measure was constructed see appendix 2. By using this measure of price volatility we ensure that the price volatility numbers are consistent with the measures of export diversification and decompositions used below. In addition, by using average prices across countries, it provides a better approximation to exogenous changes in the prices of goods faced by individual economies.

[6] 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).

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 Herfindhal concentration index h ($h = \sqrt{\sum \alpha_i^2}$). The last term captures correlations between good prices

Using this expression, table (3) 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: 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 Herfindhal 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 levels and price-volatility. This can be seen in figure (2), which plots the correlation between export concentration and income per capita[7]. This last result is important from a policy perspective: as we will discuss below, domestic financial development (highly correlated with per capita income) plays and 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. Despite the apparent high persistence in concentration, the figure also shows that there are some success stories in terms of reducing concentration. Egypt, Mexico and Indonesia all achieved substantial reductions in their degree of concentration in this time frame. The figure also shows that diversification is increasing across the board, and

[7] 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.

in particular in EMEs. Part of this is likely a side effect of growth. A simple panel regression of the Herfindhal index on GDP per capita and a country fixed effect shows a positive and significant negative correlation between income levels and export concentration.

Figure 4 shows that this increased diversification of exports has translated into lower export price volatility. Specifically, the figure holds the covariance matrix of 3 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, the changes shown in the figure are the result of real changes in the share of export products over time. The figure shows that volatility has been falling across the board, and in particular in EMEs. Once again Indonesia and Egypt show substantial "improvement." Despite these recent advances, however, the fact is that export price volatility remains high in many EMEs, and considerably above most DEs.

2.2 Financial Shocks

For EMEs capital flows are key for development. They are also a source of instability, both as a source of shocks and an amplification mechanism for other shocks – external or domestic.

Table (2), 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 net capital account outflows of different sizes over the period 1984-2004. The figure shows that the probability of a large reversal 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 outflow of more than 5% of GDP.[8]

Part of this financial vulnerability is due to the structure of gross international liabilities (table 4). There is an extensive literature arguing

[8] In principle, there is a severe identification issue since reversals of capital flows could be demand as well as supply driven. In practice this is not much 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.

that reliance on short term debt exposes EM to rollover risk. In turn it has been argued that "dollar" denominated debt exposes countries to the effects of currency mismatches. As data on the currency composition of external debt is not readily available we use data on the currency composition of bonds issued offshore collected by Eichengreen et al (2003), an combine it with debt stocks from Lane and Milessi-Ferreti (2003) to build a proxy for total foreign currency denominated external debt. The results are reported in column (d). Note that in recent years reliance on total foreign debt is similar in EMEs and DEs, however they differ significantly in the currency denomination: EMEs have substantially more foreign currency denominated debt.[9]

Ultimately, the reason why debt denomination and duration matter, and more generally why the overall structure of international liabilities matters, is one of risk management. Even in a world without financial market imperfections, contingent debt 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 negative output shock. Ideally, then, a country would want its financial burden to drop when terms of trade and external financial conditions deteriorate. In practice, this can take place either through changes in gross factor payments (GFPs) to these liabilities or through changes in their valuation. These valuation changes in turn affect the terms on which the country can access international financial markets because of aggregate balance sheet effects. In what follows we look at this issue directly, and investigate how liabilities are structured from this "insurance" perspective in both EMEs and DEs.

Aside from building large (and costly) reserve stocks as a buffer against transitory negative shocks, do EMEs "insure" more than DEs? We provide a partial answer to this question by documenting the degree of contingency embedded in gross international liabilities. Despite its partial nature, this exercise is informative for countries that have a net overall liability position, and that (as we discuss below) should be looking for mechanisms to reduce their vulnerabilities without having to reduce their use of foreign savings. Moreover, at this stage we do not take a stand as to what factors may distort insurance decisions by EMEs, as this issue is discussed in detail in the model section.

[9] Of course, it doesn't follow from this fact that a key policy goal ought to be the recomposition of debt denomination, as this may simply reflect an equilibrium outcome of deeper informational and institutional frictions. A similar argument applies to the duration of extenal debt (see Broner et al (2004)).

Since we want to study ex-ante contracts, we focus on changes in the valuation and payments that are *not* due to new financing decisions. These ex-ante changes have two components: accrued factor payments in the form of interest on debt and income from equity, and changes in the valuation of the stock of liabilities.[10] Our main finding is that these changes in gross liabilities are less correlated to output and terms of trade shocks in EMEs than in DEs, which is the opposite of what one would expect from a simple insurance perspective.

The movement in gross liabilities L_t (in dollars) is given by

$$\frac{L_t - L_{t-1}}{L_{t-1}} = \left(\frac{P_t}{P_{t-1}} - 1 + r_t\right) + \frac{(I_t - F_t)}{L_{t-1}}$$

where P_t is the price of the liabilities, r_t accrued interest and earnings, I_t gross inflows and F_t net factor payments. We are concerned with the exogenous change in liabilities, the first term on the RHS. The second term corresponds to payments and new inflows. Rearranging we have that

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

where $\widehat{p_t} = \frac{P_t}{P_{t-1}} - 1$ is the change in valuation. Moreover, if we assume that $F_t = r_t L_{t-1}$, so that GFP correspond to accrued interest and equity, then we can decompose $\widehat{l_t}$ into $\widehat{p_t}$ and r_t.

Table (5) reports descriptive statistics for $\widehat{l_t}$, r_t and $\widehat{p_t}$ for both EME and DEs economies in the period 1990-2004. The average and standard deviations of these variables are similar across both groups of countries. However, our main concern is with the correlation between these statistics and output or external demand shocks, which we estimate from the regression:

$$\begin{aligned} \widehat{l_t} &= \tau + \alpha_i g_{it} + u_i + \delta_t + \varepsilon_{it} \\ \alpha_i &= \varphi + \beta ind_i \end{aligned}$$

where g_{it} is either the growth rate of real GDP, the annual percentage change in terms of trade or the growth rate of trading partners GDP. The main

[10] The extent to which 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 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.

dependent variable is $\widehat{l}_t$, although we also present results for r_t, and $\widehat{p}_t$. 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.

In this specification α measures the extent to which $\widehat{l}_t$ provides insurance (which is essentially an issue of correlation) against GDP or external demand shocks. Countries in which external liabilities provide better insurance against shocks to the growth of output should have a larger (positive) estimated value of α. To capture these differences we allow α_i to vary across regions. 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 (6) reports the results for the exogenous changes in liabilities, $\widehat{l}_{it}$. As reported in column (1) the estimated coefficient for β shows that there is a significantly higher positive correlation between $\widehat{l}_{it}$ and GDP growth in DEs than in EMEs. Exogenous changes to gross liabilities in DEs provide better insurance than those of EMEs. Furthermore, the estimated value of φ (the correlation between g and $\widehat{l}$) for EMEs is not significantly different from zero.

One would expect that a higher equity share, either due to higher portfolio equity or foreign direct investment, leads to higher ex-post procyclicality of $\widehat{l}_{it}$, as profits themselves are procyclical. 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 exceeded 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 EME 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 the higher share of external debt in a foreign currency, discussed in table 7. Faced with a positive terms of trade shock, the currency appreciates, pushing up the dollar value of liabilities in those countries with domestic currency foreign debt. It is also consistent with shorter term debt and more extensive use of floating rate debt, if shocks to the cost of external financing lead to reductions in output (as suggested by table 2).

One possible explanation for the positive estimate of β in column (2) is that shocks to the supply of funding for EMEs (sudden stops, for example) are more positively correlated with $\widehat{l}_{it}$ and more negatively so than DEs with

g_{it} biasing the estimated value of α for EMEs downward. We explore this issue in two ways. First, as reported in column 3, we include region specific year dummies which control for different aggregate shocks across regions. The results remain unchanged. Next, as reported in columns (4) and (5) we repeat the previous analysis substituting GDP growth with the annual percentage change in the trade weighted terms of trade, $d\ln(TT)$ a variable exogenous to the financing shocks. This specification has the additional advantage that the estimated α provides a direct measure of insurance against real external shocks. Once again we find a significantly higher correlation between $\widehat{l}_{it}$ and $d\ln(TT)$ in DEs than in the EME sample. These two results suggest that the higher correlation between $\widehat{l}$ and g for DEs is not driven entirely by the negative correlation between financial shocks and growth. Note also that these results are robust to dropping the two largest countries from our sample (the US and Japan) for whom it is less reasonable to assume that $d\ln(TT)$ is not driven by domestic events.

The last two columns use the trade weighted average growth rate of each country´s trading partners as measure of external demand shocks. Estimates in this case are not statistically significant.

In the tables 7 and 8 we report an identical set of regressions for both components of $\widehat{l}_{it}$: the change in valuation and returns. Note that all of our differential effect is driven by differences across groups in the valuations effects. Indeed, although not significant, r is less procyclical in DEs than in EMEs.

All in all, we find that the portfolios of EMEs provide less hedging against external shocks than the portfolios of DEs.

3 Policy Responses

This section describes current precautionary measures 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 cy-

cle. 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 current 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 early 90s and the year 1998. The 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. For robustness, we also report averages for the five years preceding the current recession and the 1990-94 expansion period by itself. The results are shown in table (9). The first set of variables shows overall 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. Indeed, 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 current boom period, 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.

[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 $\overline{g}_{j,t} < \left(\mu^{\overline{g}}_{j,t} - 2\sigma^{\overline{g}}_{j,t}\right)$. 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.

The differences are less clear in the fiscal deficits. Compared to the average of previous booms, public deficits are smaller (although the difference is not significant and not robust to other comparison points) while public debt scaled by GDP is, if anything higher. Where the fiscal situation does differ considerably with previous periods is 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.

The concern also remains that this precautionary behavior is 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 (10) reports the results of regressing each of the variables discussed in table (9) 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 last cycle. The bottom line is that the increased precautionary behavior cannot 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. In addition to the significant coefficient on the dummy variable, 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 (11) 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 subpotimal export mix, as countries move into goods for which they have no comparative advantage.

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 the 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

[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 reducing effective export price volatility. These issues are discussed in detail in Larson, Varangis, Yabunki (1998) and Larson and Varangis (1996).

that trigger sudden stops, such as a rise in the VIX), they would significantly reduce the cost of current precautionary measures[14].

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 (12) 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. 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 below, we explore some of these issues more formally and add a series of incentive considerations to the debate.

To summarize, 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 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 commodity markets and the absence of contingent reserve policies.

Faced with this volatile external environment and well aware of the costs of financial crisis, on average EMEs are currently in a precautionary mode. Limiting risky external financing, and more worryingly also limiting total external financing. In addition many 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.

[14] 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.

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 for why complete contingent markets are not available and 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

The model starts from the main sources of external instability, namely shocks to the terms of trade (or to the demand for their basket of exported goods) and shocks to the supply of international capital. Terms of trade shocks relate closely to export concentration and reliance on commodity exports. International capital shocks relate to imperfect access to international capital markets – due largely to asymmetric information in these markets. The information asymmetry restricts the set of international financiers that participate in these markets, making financing vulnerable to changes in the net worth, risk perception or risk appetite of a limited number of specialists.[15] The result is that EMEs often experience large shifts in the supply of funds they face, which lead to "sudden stops" (and starts) in the flow of capital to these economies.[16]

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

[15] As a result a country may be 'contaminated' by a crisis event in another emerging market economy if they both belong to a particular asset class (Rigobon 2001), borrow from the same banks (Van Rijckeghem and Weder 2000) or share a set of overexposed mutual funds (Broner and Gelos 2003).

[16] For a discussion of Sudden Stops see Calvo et al (2004).

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. 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 produces K units of importables at date 0 and, after injecting I units of an importable good at date 1, produces $RI + \theta K$ units of a nontradable good, with R and θ equal to each other, greater than one, and fixed for now. Agents only consume importable goods at date 0, $(I_0 + K)$, and nontradables at date 1, $(RI + \theta K)$[17].

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

$$p = P_X/P_I$$

and the amount of dollars, W.

Let us write the total external resources (in units of importable 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.

[17] This production function is introduced so as to generate a market for imported goods in latter sections between firms with different productivities.

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

$$\begin{aligned} & \max_{I_0,s,h} \ln(I_0+K) + E\ln(RI_1+\theta K) \\ I_1 &= s\overline{M} + (1-s)m\overline{M} - \left(I_0 + \mu s\frac{\sigma}{h}\overline{M} + c_h(h-\underline{h})\right) \end{aligned}$$

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

$$\begin{aligned} I_0 &: \quad \frac{1}{I_0+K} = RE\left[\frac{1}{RI_1+\theta K}\right] \\ s &: \quad E\left[\frac{1}{RI_1+\theta K}(1-m-\mu\sigma/h)\right] = 0 \\ h &: \quad E\left[\frac{1}{RI_1+\theta K}\left(\frac{(1-s)(1-m)}{h}\overline{M} + \mu s\frac{\sigma}{h^2}\overline{M} - c_h\right)\right] \leq 0 \end{aligned}$$

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:

$$\begin{aligned} s &= 1 \\ h &= \underline{h} \\ I_0^{fb} &= I_1^{fb} = \frac{\overline{M}}{2} \end{aligned}$$

The optimal outcome is to insure fully, spend no resources on diversification and invest the same (constant) amount in both periods, thus 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 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 will trade-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,

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

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 in $t = 1$, s is restricted such that

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

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[18].

[18] These constraints are 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:

$$\begin{aligned} & \max \ln(I_0 + K) + E \ln(RI_1 + \theta K) \\ I_1 &= s\overline{M} + (1-s)m\overline{M} - I_0 \\ I_0 + s\frac{\sigma}{h}\overline{M} &\leq \lambda K \end{aligned}$$

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

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

with first order condition with respect to s is equal to:

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

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 $\mu = 0$.

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 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 is facing a negative liquidity shock (because of falling terms of trade for example). In these periods, unconstrained domestic agents are borrowing heavily so as to smooth the negative shock and therefore domestic interest rates are temporarily very high. If, however, domestic financial markets do not function well, then domestic borrowing will be limited by collateral constraints. The result is that the spike in domestic rates will be smaller, and the incentives of the large firm to leave itself some "slack" capacity will therefore be lower, limiting its role as a provider of international liquidity.

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. We can get the essence of the message by studying the two extremes, one where this market functions perfectly (firms can pledge to repay each other) and one where the market does not exist (firms' pledges are noncredible).

Furthermore, for simplicity let us still assume that h is fixed at $\underline{h}$, and that the international financial constraint $I_0 + s\frac{\sigma}{\underline{h}}\overline{M} \leq \lambda K$ 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):

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

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:[19]

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

High productivity firms, on the other hand, get:

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

Studying the second expression in the previous first order condition, we now have

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

which in equilibrium can be written as:

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

[19] 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:

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

That is, for fixed s, the second term in the first order condition 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 contigent 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[20].

[20] 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, 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:

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

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

$$G = A + s^G(1-m)$$

where s^G represents the amount of external insurance purchased –at actuarial cost– by the government. A corresponds to non contingent reserves, accumulated in period 0 and injected back into the economy in period 1.

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

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

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's 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 no frictions in international risk markets ($\mu = 0$).

Welfare is simply the utility of the representative agent:

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

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. 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 noncontingent reserves (set $A > 0$). Because agents are constrained, taxing them translates into reductions in period 0 consumption and reductions in welfare.

What about contingent contracts?

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

which is strictly positive since the agents are financially constrained:

$$V_{s^G} > 0$$

The intuition is clear. With $\mu = 0$ and no domestic financial market imperfections, the only reason the agent does not set $s = 1$ is that his 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's 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):

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

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 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.

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. We reinforced our conclusion by showing that in the case where domestic collateral (credibility among domestic agents) is limited, there is a reason to reduce private expenditure, but this does not alter the conclusion that the government should hoard its assets in contingent instruments.

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)).

5. 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 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.

6. 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 take-off of 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.

7. In the simple model above, 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.

8. 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.

9. Of course, there are systemic 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.

10. Having said this, it is important to keep in mind that the resources needed are not enormous. Table (13) 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 average 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 then scaled by: total DE external assets in 2004, total EME external liabilities in 2004, the annual average of total DEs (EMEs) outflows(inflows) since 1999. By all accounts, the reversals are small compared to total stocks, and total DE outflows. On the other hand, they are sizeable when compared with EME inflows – which is not surprising considering that 1997 episode involved a number of the larger EMEs. The next two lines scale the cost by the estimated costs of Hurricane Katrina. Granted, this is a large natural event, but it has definitely not led to the disappearance of the natural disaster insurance market in the US!. Finally, the last two columns 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.

11. To conclude, 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.

12. There are a few simple 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.

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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-

Table 1 and Figure 1

- 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.
- 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.

Table 2 and Figure 1

- Herfindal 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).

- Debt in Foreign Currency D^* : share of public and private bonds issued off-shore denominated in a currency other than the country of residence of the issuer. The source is Eichengreen et al (2003).

Tables 5-7

- Growth g : real GDP growth. Source: 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.

Tables 8 and 9

- 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.

Figure 2

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

Figure 5

- 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		Herfindhal Index in 2000	Herfindhal 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.

Table 1

Costs of Holding Reserves (annual %)

	Rate spread used to calculate cost of reserves:		
	EMBI	EMBI+lending sread IMF	EMBI+lending sread 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 spead 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 2

Volatility Measures 1985-2004

	Mean		EMEs/Des
	EMEs	DEs	
Panel A: Real Shocks			
SDev (Δ% terms of trade)	0.084	0.031	2.734
SDev (Δ% Px)	0.106	0.088	1.205
SDev (Δ% Pm)	0.091	0.075	1.202
SDev (trading partner growth)	0.003	0.003	0.967
Panel B: Financing Shocks			
SDev (Cost of financing)	0.033	0.011	3.000
SDev (financial account / GDP)	0.049	0.033	1.485
SDev (Δ% Px*)	8.967	7.556	1.187

Notes: The EME sample excludes Nigeria. The sample of EMEs and DEs is detailed in the appendix. P*x is built from trade data from Feenstra et al (2005) as detailed in the main text and appendix. 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 is from the IMF IFS.

Table 3

Variance Decomposition 1985-2000

	EMEs	DEs	Difference	%
σ_x^2	84.3	58.3	26	
$\sum_{i=1}^{n} \alpha_i^2 (\sigma_i^2 - \sigma^2)$	14.6	0.2	14.4	55%
$\sigma^2 h^2$	19.3	7.4	12	46%
$2\sum_{i=1}^{n} \sum_{\substack{j=1 \\ j \neq i}}^{n} \alpha_i \alpha_j \sigma_{ij}$	50.3	50.7	-0.4	-2%
$\sigma^2 h^2$				
$\sigma^2_{eme,ind} (h^2_{eme} - h^2_{ind})$			14.5	56%
$h^2_{eme,ind} (\sigma^2_{eme} - \sigma^2_{ind})$			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. The exact decomposition is detailed in the text. For consistency with Table 1 Nigeria is excluded from the sample.

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

Table 4

Composition of Gross International Liabilities (share of total liabs)

		Share of Total Liabilities					
Group	Period	FDI (a)	Portfolio Equity (b)	Fin. Deriv. (c)	Debt (d)	Debt in Foreign Currency (e)=(d)*(f)	Share of Offshore Bonds in For. Currency (f)
DEs	90-94	0.167	0.085	0.000	0.747	0.611	0.818
DEs	00-04	0.188	0.159	0.016	0.637	0.425	0.666
DEs	85-04	0.168	0.117	0.006	0.710	0.540	0.761
EMEs	90-94	0.176	0.038	0.000	0.786	0.784	0.997
EMEs	00-04	0.317	0.065	0.001	0.617	0.609	0.987
EMEs	85-04	0.216	0.044	0.000	0.740	0.735	0.993

Notes: Columns (a) through (d) decompose gross international liabilities into debt, equity, fdi and derivatives. Column (e) shows an estimated value of foreign currency denominated debt (as a share of total liabilities), based on the data on currency composition of bonds issued offshore reported in column (f)

Source: Lane and Milessi-Ferretti (2003). Eichengreen et al. (2003)

Table 5

Exogenous Changes in Gross International Liabilities 1990-2004

	Mean		EMEs/DEs
	DEs	EMEs	
Δ (value of liabilities)	0.0971	0.0802	0.8257
r	0.0601	0.0632	1.0510
valuation effect	0.0369	0.0175	0.4726
SDev [Δ (value of liabilities)]	0.1031	0.0863	0.8370
SDev [r]	0.0194	0.0148	0.7645
SDev. [valuation effect]	0.1007	0.0822	0.8171
coef. var [Δ (value of liabilities)]	1.0624	1.0769	1.0136
coef. var. [r]	0.3227	0.2347	0.7274
coef. var. [valuation effect]	2.7245	4.7103	1.7289

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 6

Gross International Liabilities and Insurance

	LHS: Exogenous Change in Liabilities						
	1	2		3	4	5	6
growth	0.07	-0.166	-0.13				
	[0.141]	[0.165]	[0.164]				
growth x DE	0.812	0.692	0.8				
	[0.309]***	[0.310]**	[0.337]**				
growth x High Equity		0.574	0.498				
		[0.256]**	[0.255]*				
dln TT				0.104	-0.051		
				[0.086]	[0.116]		
dlnTT x DE				0.459	0.505		
				[0.247]*	[0.243]**		
dlnTT x High Equity					0.275		
					[0.147]*		
trading partner growth						3.125	2.216
						[1.939]	[2.273]
trading partner growth x DE						2.553	2.669
						[1.999]	[2.023]
trading partner growth x High Equity							1.137
							[2.001]
Observations	699	699	699	693	693	642	642
R-squared	0.36	0.36	0.36	0.35	0.36	0.35	0.35
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Dummies	Yes	Yes	Yes	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. dlnTT is the trade weighted growth in the terms of trade. Trading partner growth is the weighted average of the growth rate of each country´s export destinations.

Table 7

Gross International Liabilities and Insurance

	LHS: Valuation Effects						
	1	2	3	4	5	6	7
growth	0.024	-0.197	-0.178				
	[0.132]	[0.156]	[0.155]				
growth x DE	0.807	0.695	0.764				
	[0.299]***	[0.299]**	[0.322]**				
growth x High Equity		0.537	0.449				
		[0.242]**	[0.237]*				
dln TT				0.096	-0.057		
				[0.082]	[0.111]		
dlnTT x DE				0.472	0.517		
				[0.229]**	[0.224]**		
dlnTT x High Equity					0.272		
					[0.137]**		
trading partner growth						2.633	1.827
						[1.776]	[2.166]
trading partner growth x DE						2.776	2.879
						[1.839]	[1.869]
trading partner growth x High Equity							1.008
							[1.876]
Observations	699	699	699	693	693	642	642
R-squared	0.35	0.36	0.36	0.35	0.35	0.34	0.34
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Dummies	Yes	Yes	Yes	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. dlnTT is the trade weighted growth in the terms of trade. Trading partner growth is the weighted average of the growth rate of each country´s export destinations.

Table 8

Gross International Liabilities and Insurance

	LHS: Gross Payments to Liabilities						
	1	2	3	4	5	6	7
growth	0.044	0.027	0.043				
	[0.027]	[0.018]	[0.020]**				
growth x DE	0.006	-0.002	0.038				
	[0.065]	[0.069]	[0.070]				
growth x High Equity		0.04	0.054				
		[0.049]	[0.050]				
dln TT				0.008	0.008		
				[0.013]	[0.021]		
dlnTT x DE				-0.012	-0.012		
				[0.048]	[0.049]		
dlnTT x High Equity					-0.001		
					[0.028]		
trading partner growth						0.483	0.378
						[0.329]	[0.355]
trading partner growth x DE						-0.219	-0.206
						[0.453]	[0.432]
trading partner growth x High Equity							0.131
							[0.415]
Observations	706	706	706	700	700	646	646
R-squared	0.59	0.59	0.59	0.59	0.59	0.59	0.59
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Dummies	Yes	Yes	Yes	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. dlnTT is the trade weighted growth in the terms of trade. Trading partner growth is the weighted average of the growth rate of each country´s export destinations.

Table 9

Precautioning in the Current EME Cycle

Variable	Current Upturn	Avg. Previous Upturns	Previous Upturn	Previous Downturn
		Average Emerging Economies		
Current Account Surplus (% GDP)	1.2	**-2.8**	**-2.8**	**-2.4**
Net Financial Account (% GDP)	-1.1	**2.2**	**2.7**	**2.1**
Investment (% GDP)	20.7	**23.7**	**23.8**	**23.5**
Net International Reserves (% GDP)	16.0	**9.5**	**12.1**	**11.0**
Short Term Debt (% Total Debt)	13.1	**16.8**	**18.0**	**16.7**
Fiscal Balance (% GDP)	-1.6	-2.6	**-0.6**	**-1.0**
Public Debt (% GDP)	58.1	**46.9**	54.2	58.7
		Median Emerging Economies		
Current Account Surplus (% GDP)	-0.1	-2.7	-2.6	-2.5
Net Financial Account (% GDP)	0.0	2.1	3.1	2.2
Investment (% GDP)	21.2	22.7	22.2	22.2
Net International Reserves (% GDP)	13.8	6.7	9.4	8.2
Short Term Debt (% Total Debt)	11.7	14.8	17.5	15.9
Fiscal Balance (% GDP)	-2.0	-2.3	0.1	-0.7
Public Debt (% GDP)	53.7	37.5	46.7	50.5

Notes: In bold if average significantly different from current cycle. The cycles are defined in terms of deviations from average EME GDP growth rate. Recessions are therefore defined as reductions in growth more than 2 SDevs below 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 10

Precautionary Measures After Controling for External Conditions

Depvar:	Fin. Acc. / GDP	Current Acc. / GDP	Investment / GDP	RIN / GDP	ST Debt / Total Debt	Fiscal Bal. / GDP	Public Debt / GDP
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)
Last 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)
R-sq:	0.332	0.363	0.683	0.674	0.566	0.655	0.676
# obs :	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 agaist 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 cuadratic trend.

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

Table 11

Export promotion policies

	Exports insurance and/or guarantee programs	Duty reduction/ exemptions on imported inputs incorporated into exports	Credits with preferencial interest rates	Fiscal subsidies to non-traditional exports	Other incentives for exports
EME: concentrated exports (h : 1990 - 2000)	***Algeria*** : only for non-hydrocarbon exports ***Jordan*** : The Export and Finance Bank (public corporation) provides commercial financing and loan guaratees.	***Chile:*** Exporters may defer tariff payments on capital imports for a period of 7 years. Deferred can also be reduced if capital goods are used to produce exported products. ***Egypt*** : only for some selected industries ***Nigeria*** : duty free for raw materials ***Venezuela*** : duty rebates and duty drawback system	***Jordan*** : Central Bank provides credits for exporters producing agricultural and/or manufactured exports with at least 25% of domestic value-added.	***Chile*** : % of the export value is refunded to exporters. Minimum value-added levels are required	***Chile*** : simplified paperwork requirements non-traditional exporters. Export promotion agency (PROCHILE). ***Chile*** : quicker returns of VAT paid on inputs for all exporters. ***Nigeria*** : favorable depreciation allowances for capital assets and foreign currency retention programs.
EME: diversified exports (h:1990-2000)		***Brazil*** : tax and tariff incentives for equipment and materials imported, tax rebates on materials used in the manufacture of export products. Rebate on social contribution taxes paid on locally production inputs. ***Thailand*** : rebates of taxes and import duties in products for re-export ***India:*** for raw materials and capital inputs	***Brazil*** : PROEX credit program tries to equalize domestic and international interest rates for export financing ***Thailand*** : interest rates on export credits below the prime rate offered by commercial banks .	***Thailand*** : Preferencial financing for exporters of manufactured and processed agricultural products. ***Argentina*** : Industrial exports and ports located in the Patagonia region. ***Korea*** : subsidies to shipbuilding, steel and semiconductors through 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
IND: concentrated exports					***Norway*** : Indirect subsidies to chemical and metal exports through subsides to electricity costs. ***Norway*** : funds for export promotion ***Norway*** : heavily subsidies to cheese production, which may be exported. Some remaining agricultural subsidies. ***Australia*** : grant to qualifying firms to assist in offsetting marketing costs incurred when establishing new export markets ***Canada*** : export subsidies on dairy products
IND: diversified exports	***Austria*** : export promotion loans and government guarantees (The Austrian Kontrollbank) ***Italia*** : export insurance to industrial and business firms		***Netherlands*** : the government provides interest dsubsidies for Dutch exports competing with subsidized export transactions in thir countries ***Italia*** : interest rate subsidies for some industrial and business firms		***Italia*** : Export refunds for some agriculture products. Export promotion programs (funding for travel and market penetration programs,)

Source: Country Reports on Economic Policy and Trade Practices. Bureau of Economic and Business Affairs, Feb. 2002

Table 12

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)

Table13

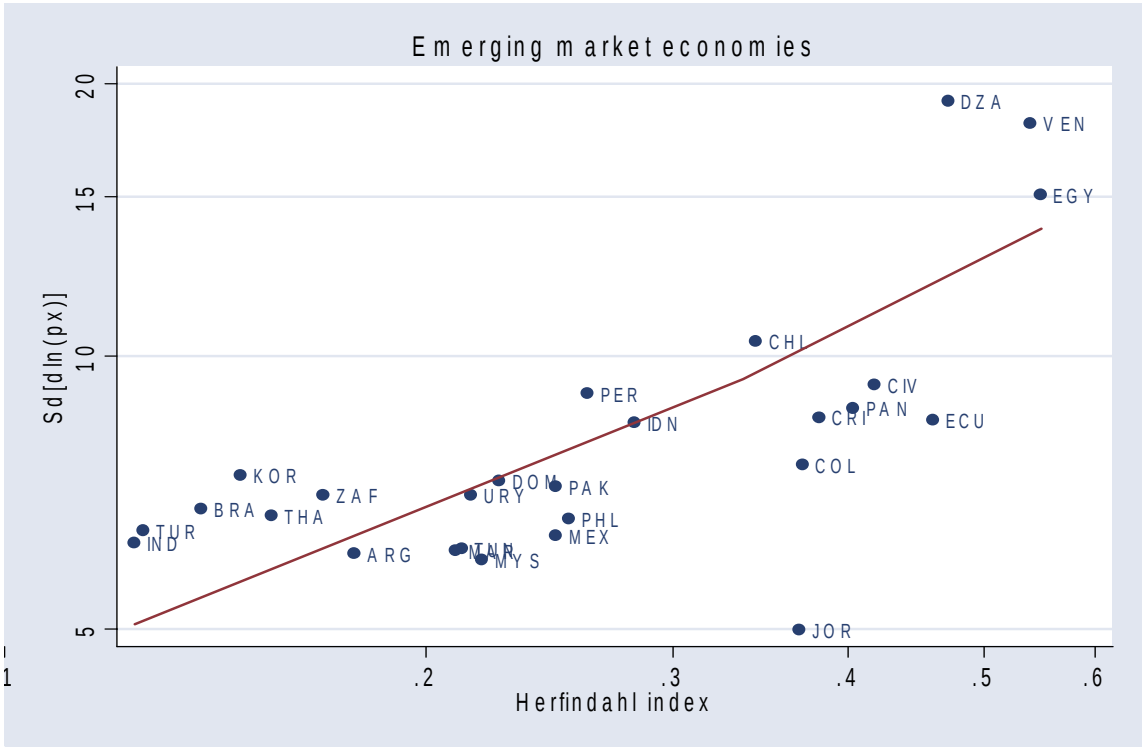
Cost of Crisis

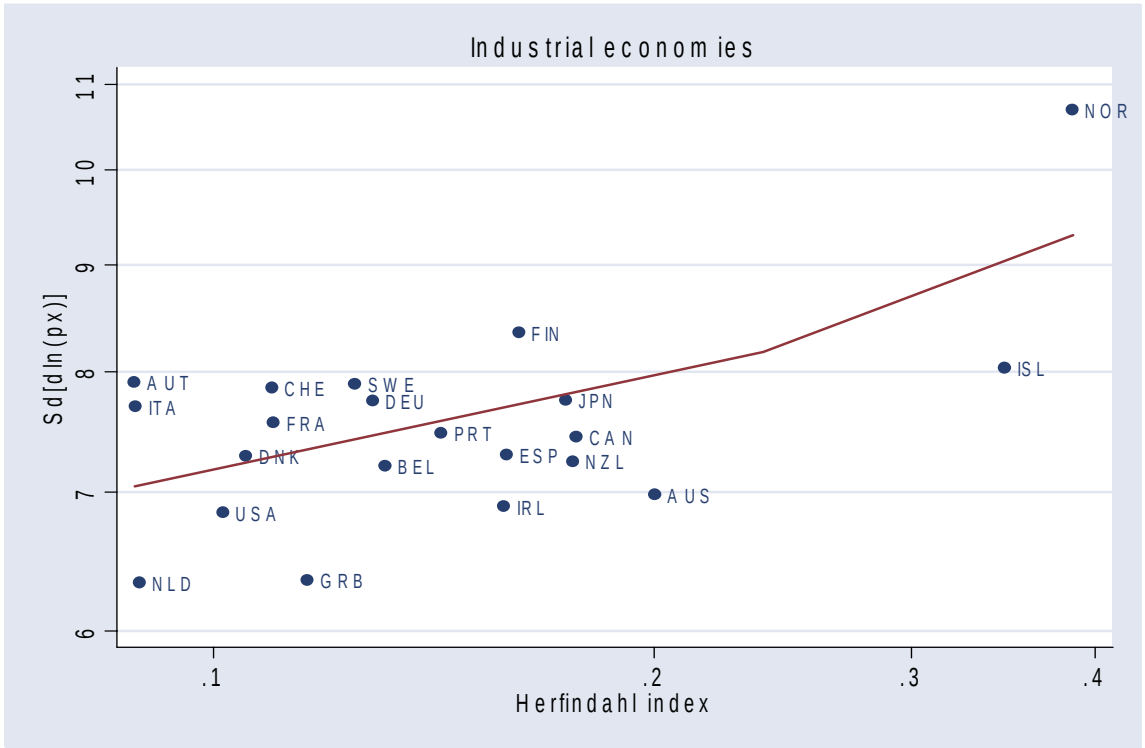
	Average cost crisis episode after 1990 in:				Total cost
	L.America	Asia	Other	All EMEs	1997 Crisis
As a % of total DE external assets in 2004	0.0	-0.1	0.0	0.0	-0.2
As a % of total EME external liabilities in 2004	-0.4	-0.7	-0.2	-0.4	-3.4
As a % of average total DE outflows in the 90s	-0.7	-1.4	-0.3	-0.7	-6.3
As a % of average total EME inflows in the 90s	-10.9	-21.3	-4.3	-10.4	-96.3
As a % of US government budget for Katrina reconstrucction	-11.8	-23.0	-4.7	-11.2	-104.3
As a % of Katrina insurance claims	-31.9	-62.2	-12.6	-30.4	-281.7
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 USD (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.

Figure 1

Volatility of dlnPX and Export Concentration

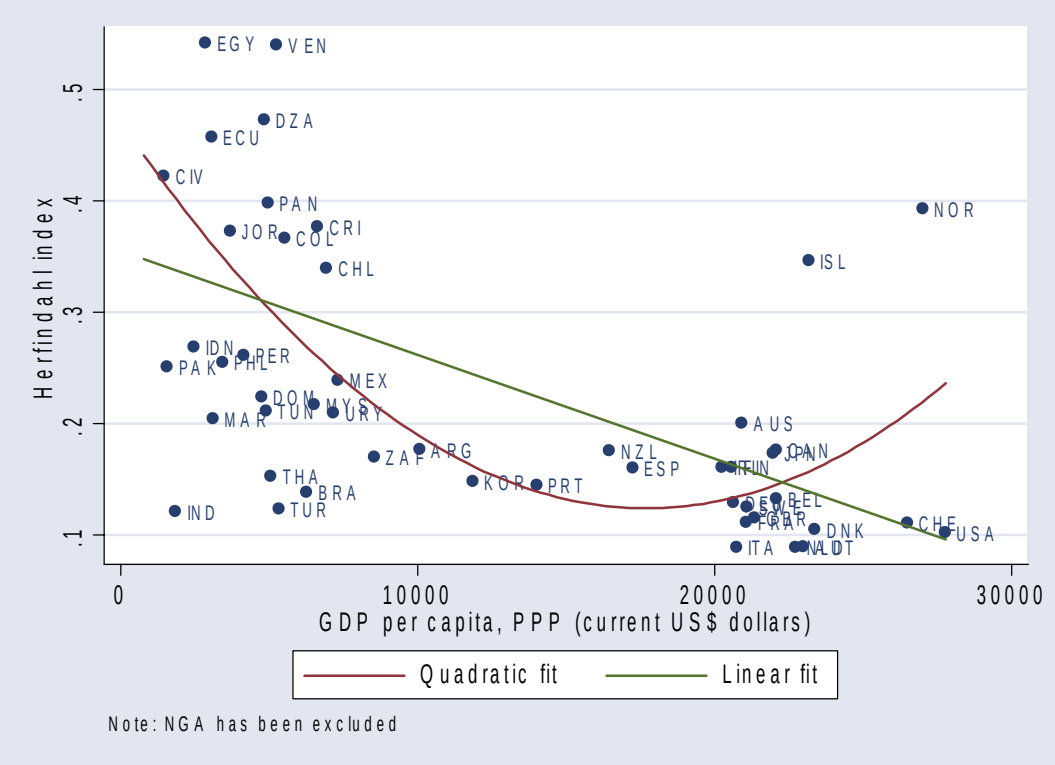




Source: Author's calculations based on trade data from Feenstra et al (2005)

Figure 2

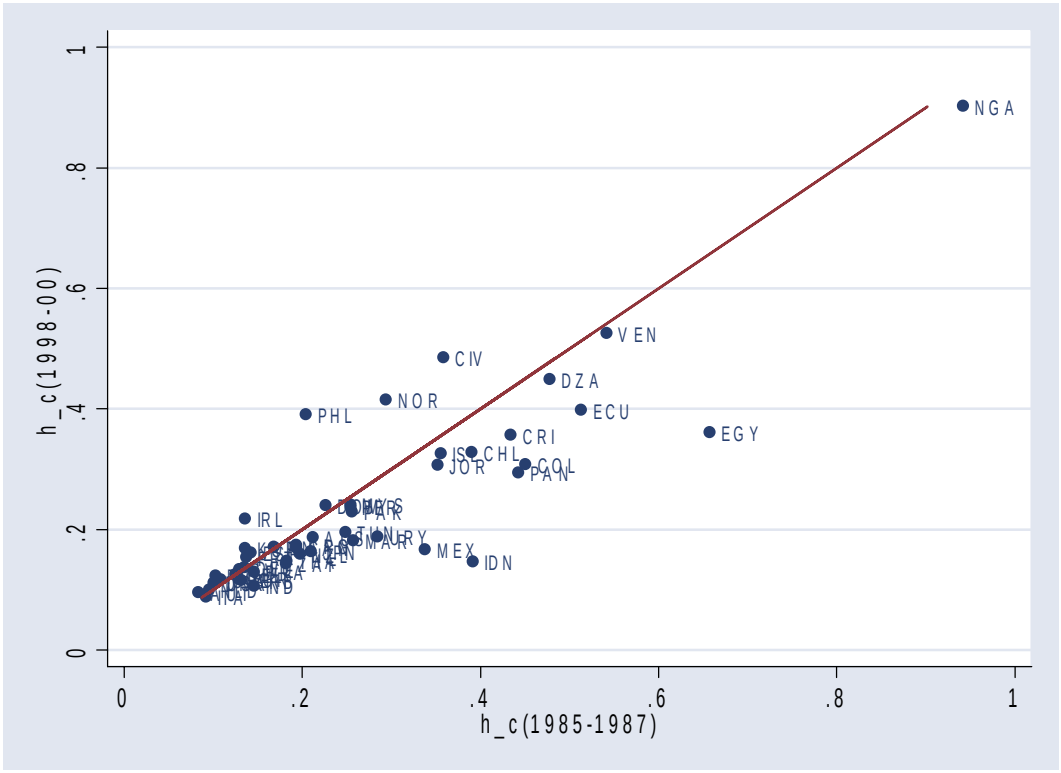
Export Concentration and Per Capita Income

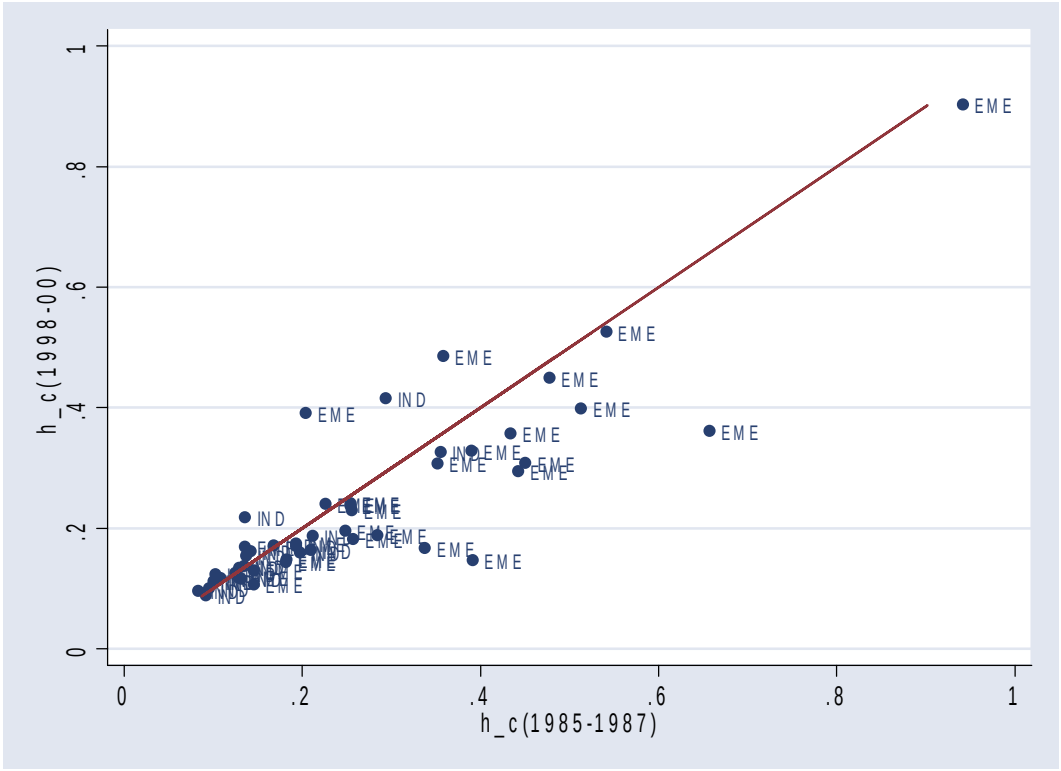


Source: Authors calculations based on Feenstra et al (2005) and World Bank WDI.

Figure 3

Export Concentration 1985-87 and 1998-00

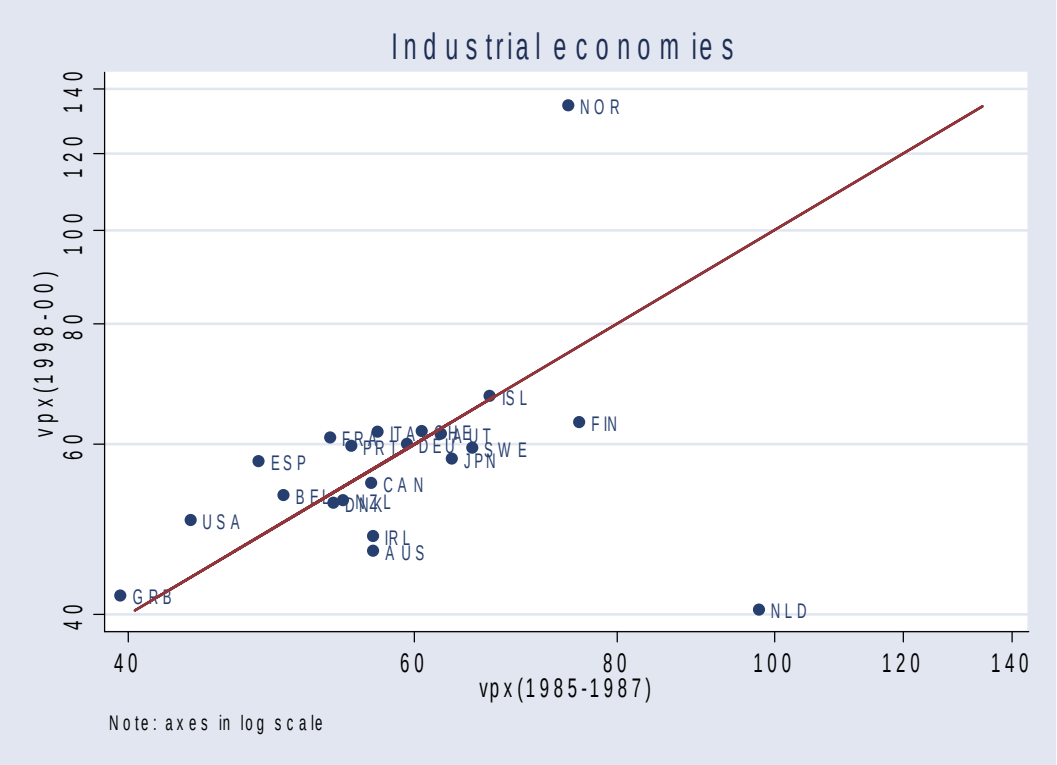


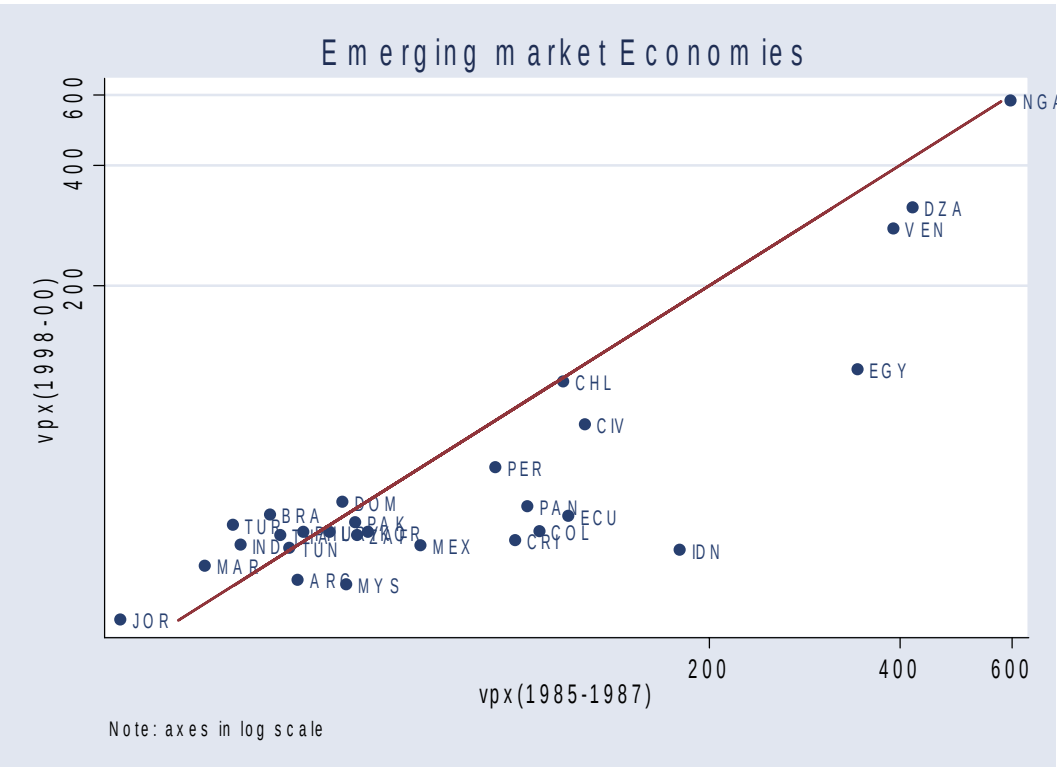


Source: Authors calculations based on data from Feenstra et al (2005)

Figure 4

Export Price Volatility 1985-87 and 1998-00

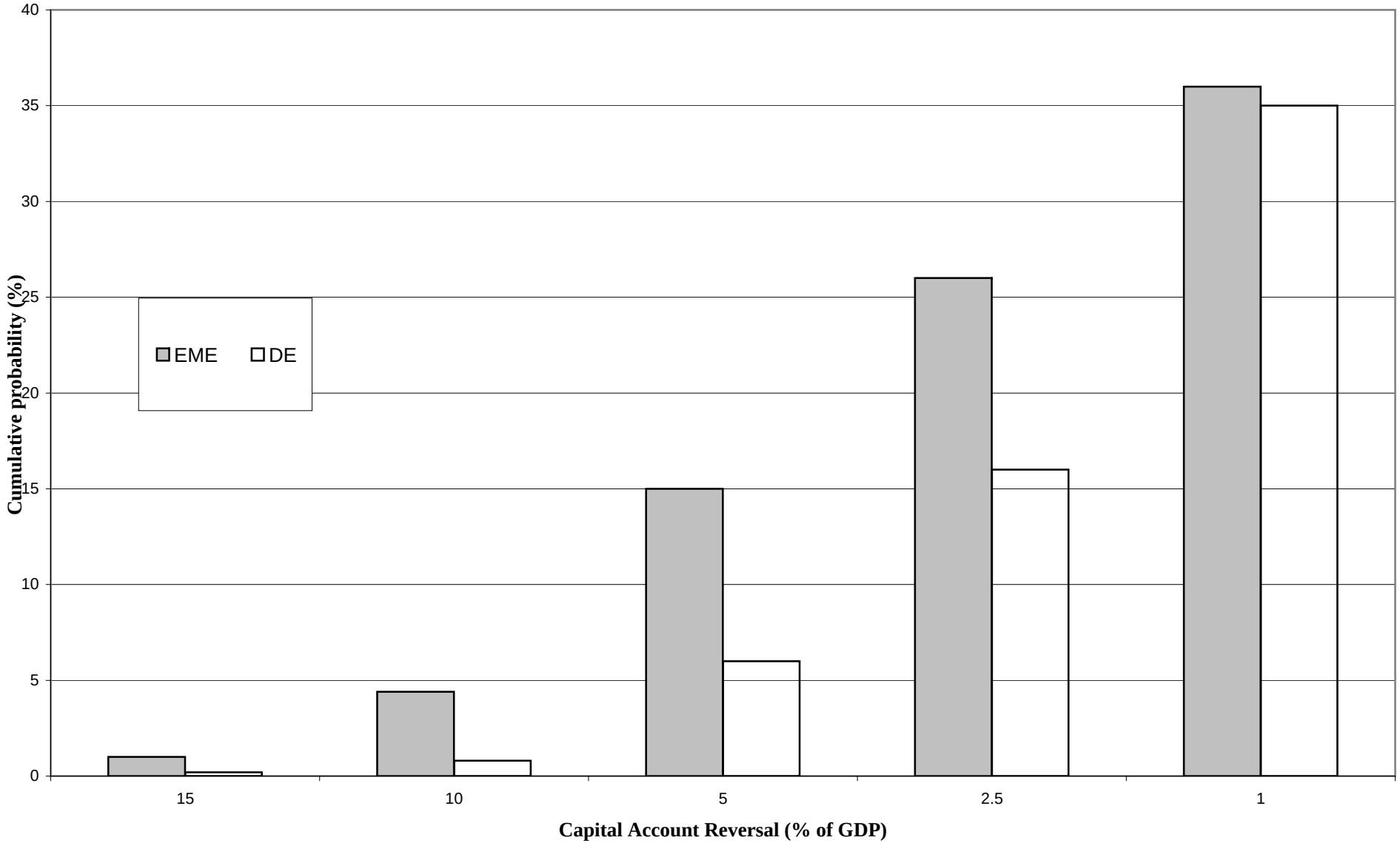




Source: Authors calculations based on data from Feenstra et al (2005)

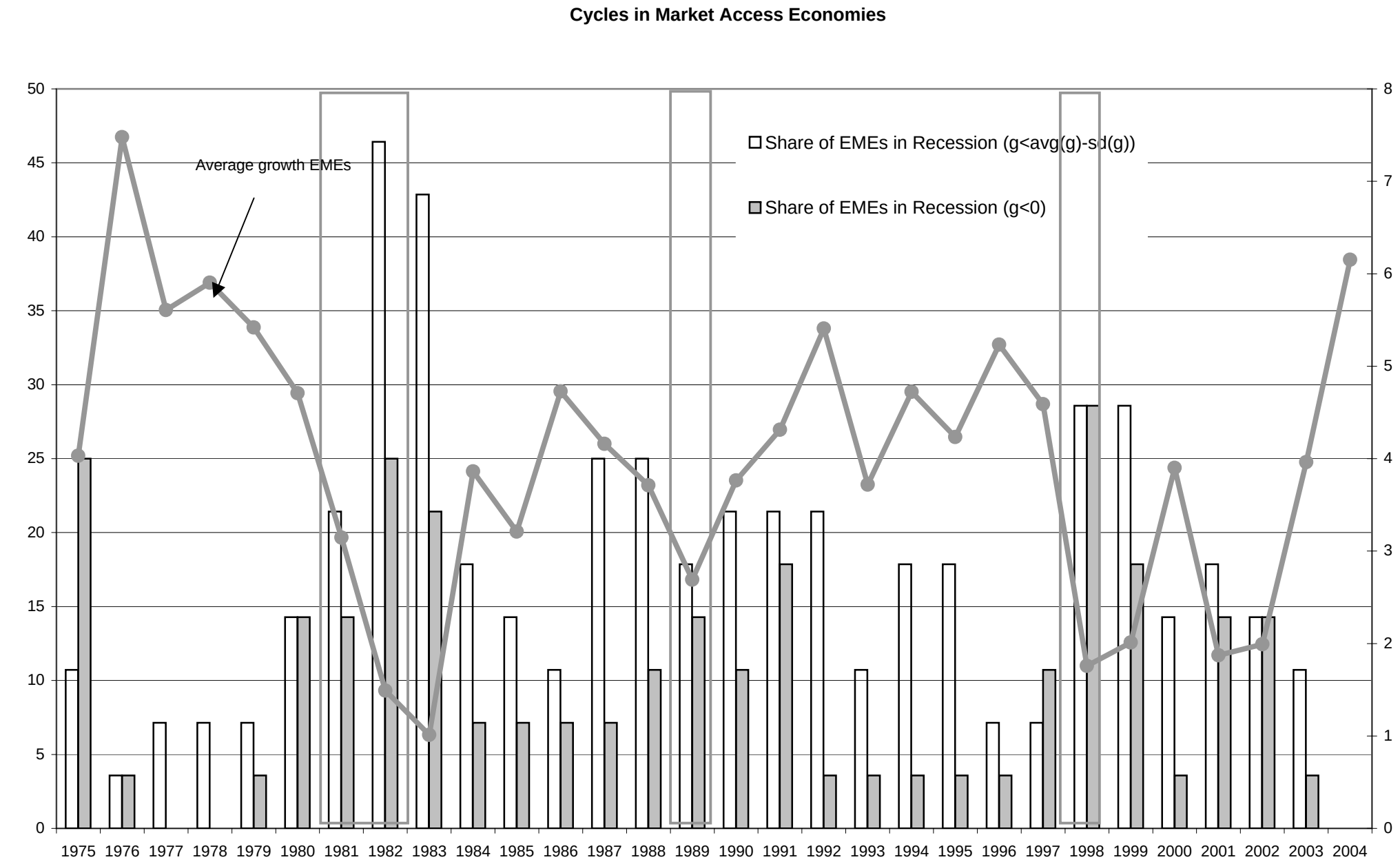
Figure 5

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 absolure 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

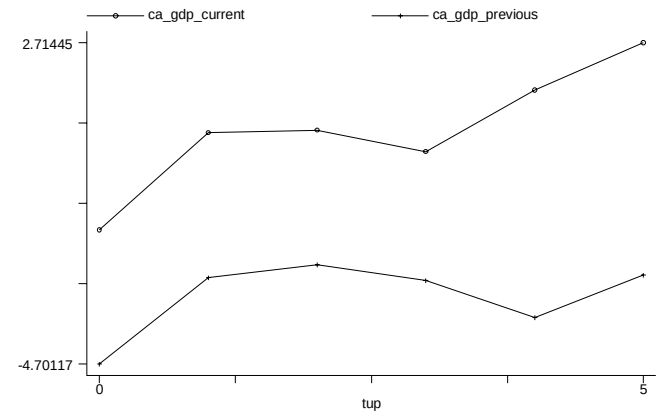
Figure 6

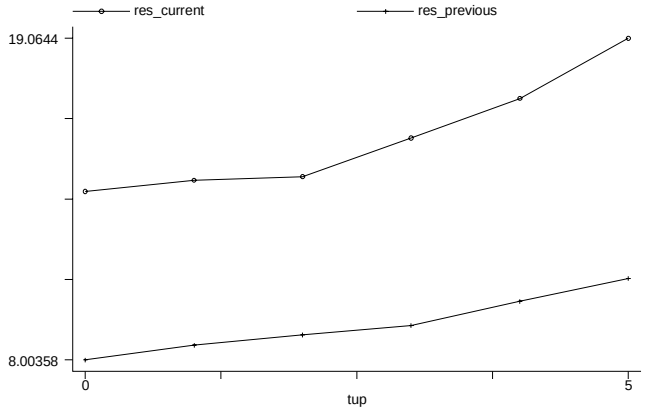


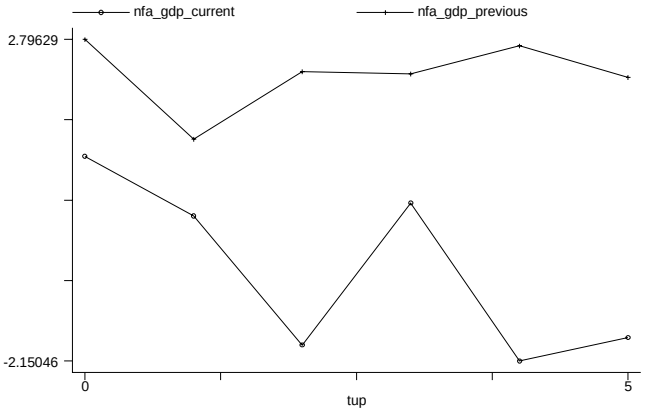
Source: Authors calculations based on data from World Bank WDI.

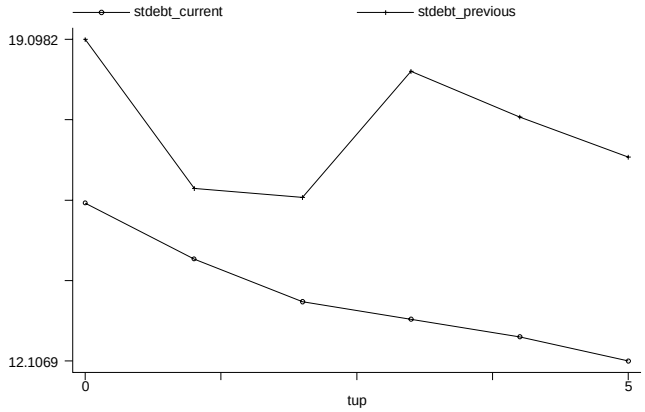
Figure 7

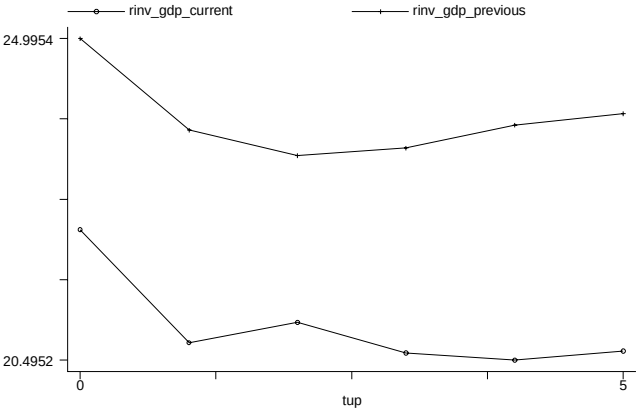
Precautioning in Current and Previous Recoveries

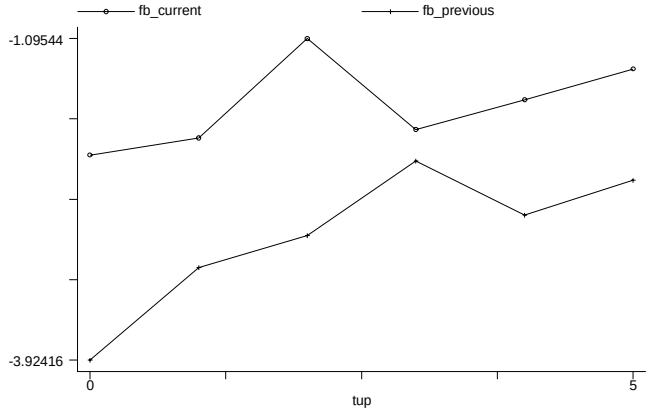


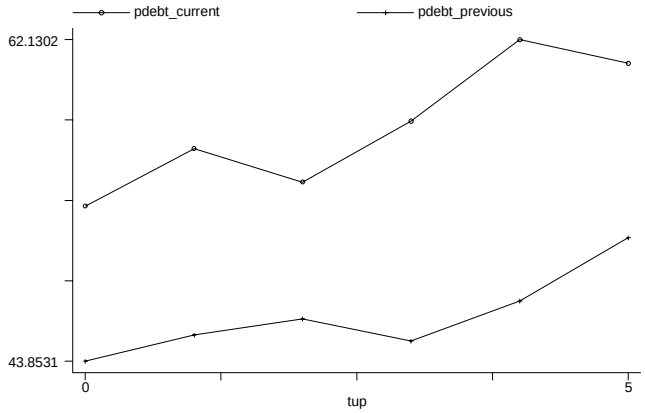








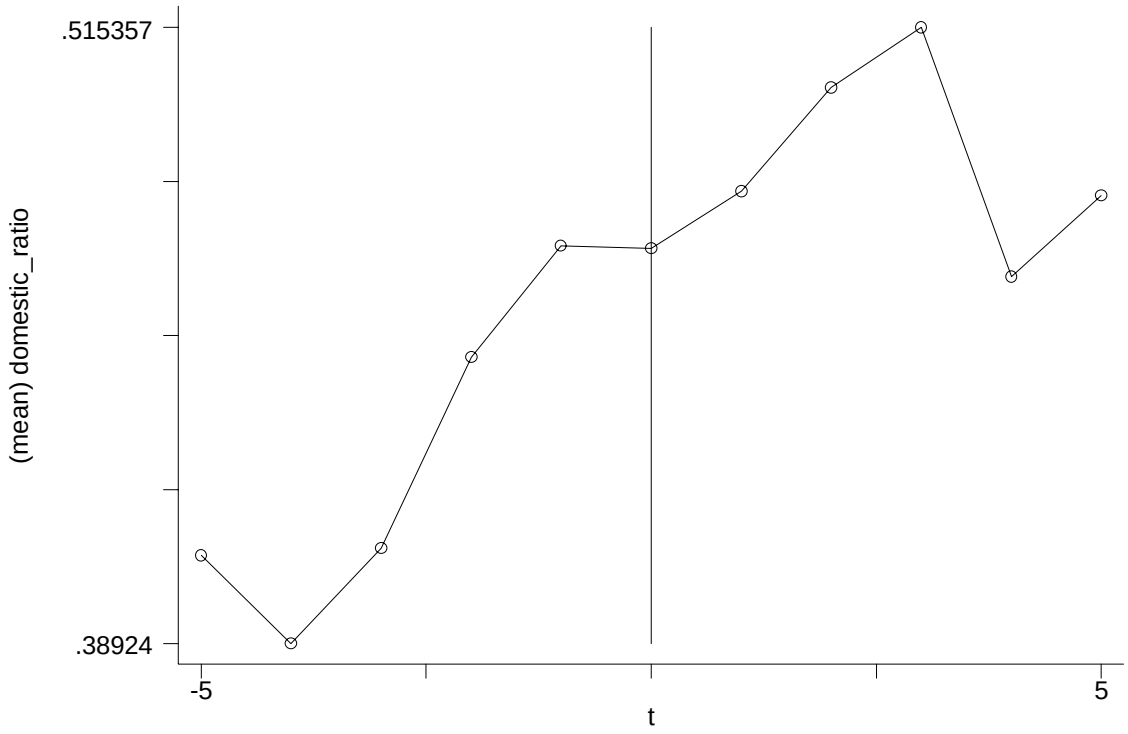




Source: Authors calculations. For details on sample and variables see Table 8 and text.

Figure8

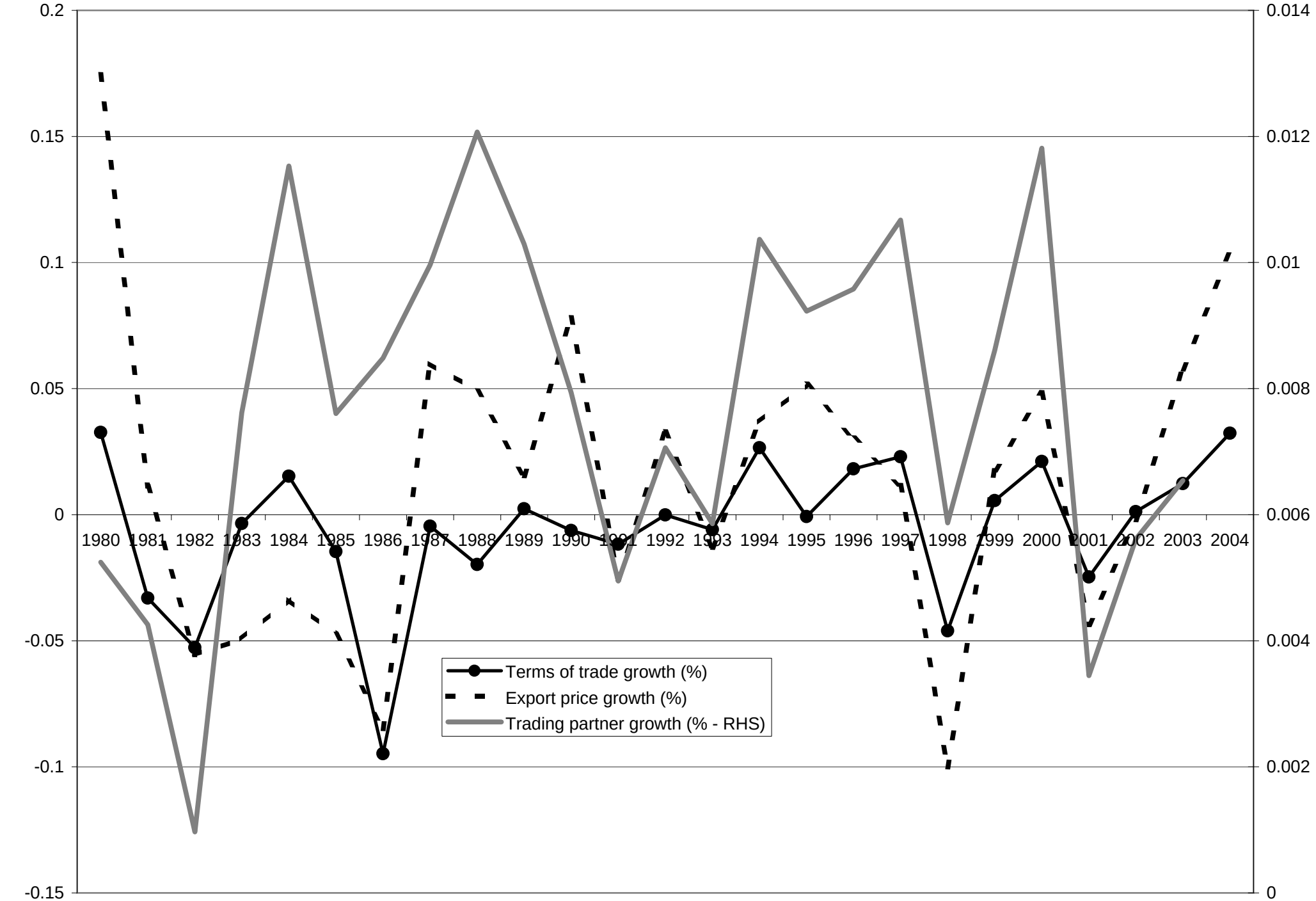
Share of Domestic Debt in Total Debt (EMEs in Latin America and the Caribean)



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

Figure 9

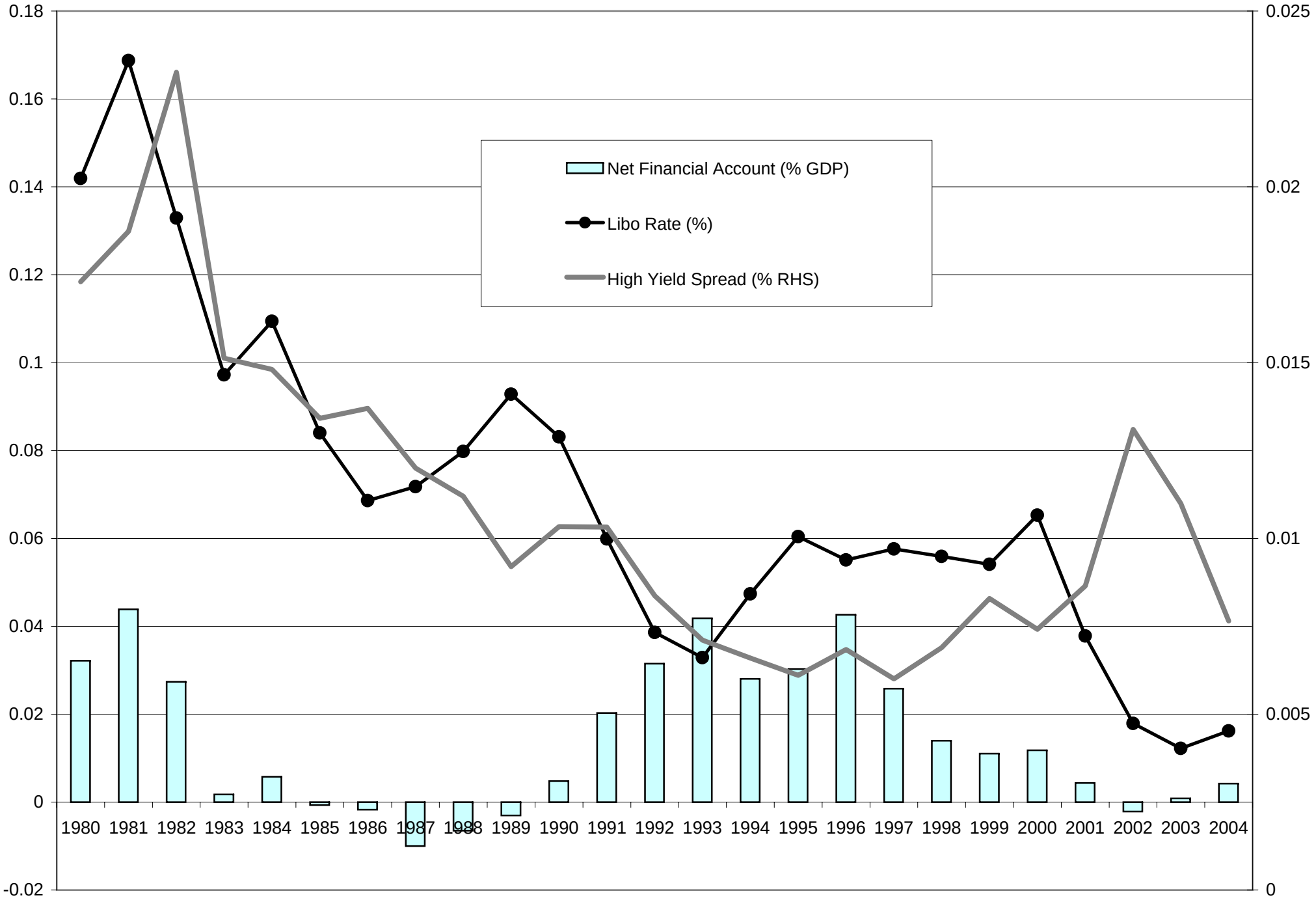
Real External Conditions EM Economies



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

Figure 10

External Financial Conditions EM Economies



Sources: IMF IFS, Bloomberg.