

**LOCAL DEBT EXPANSION...
VULNERABILITY REDUCTION?
AN ASSESSMENT FOR SIX
CRISES-PRONE COUNTRIES**

2007

Paloma Acevedo, Enrique Alberola
and Carmen Broto

**Documentos de Trabajo
N.º 0733**

BANCO DE ESPAÑA
Eurosistema



**LOCAL DEBT EXPANSION... VULNERABILITY REDUCTION? AN ASSESSMENT
FOR SIX CRISES-PRONE COUNTRIES**

LOCAL DEBT EXPANSION... VULNERABILITY REDUCTION? AN ASSESSMENT FOR SIX CRISES-PRONE COUNTRIES^(*)

Paloma Acevedo, Enrique Alberola and Carmen Broto^(**)

BANCO DE ESPAÑA

(*) This paper was prepared in the context of the CGFS WG on local debt markets and financial stability of the BIS. The opinions expressed in this document are solely responsibility of the authors and do not represent the views of the Banco de España. Contact authors: paloma.acevedo@bde.es, alberola@bde.es, carmen.broto@bde.es. The usual disclaimers apply.

(**) We would like to thank José Montero, Iikka Korhonen and participants in the “CGFS Workshop on Balance sheet effects and emerging markets bond spreads” at Bank of England (London), the emerging market workshop at the Austrian Central Bank, the BIS-Atlanta Fed meeting in Mexico and Banco de España for the helpful comments received.

The Working Paper Series seeks to disseminate original research in economics and finance. All papers have been anonymously refereed. By publishing these papers, the Banco de España aims to contribute to economic analysis and, in particular, to knowledge of the Spanish economy and its international environment.

The opinions and analyses in the Working Paper Series are the responsibility of the authors and, therefore, do not necessarily coincide with those of the Banco de España or the Eurosystem.

The Banco de España disseminates its main reports and most of its publications via the INTERNET at the following website: <http://www.bde.es>.

Reproduction for educational and non-commercial purposes is permitted provided that the source is acknowledged.

© BANCO DE ESPAÑA, Madrid, 2007

ISSN: 0213-2710 (print)

ISSN: 1579-8666 (on line)

Depósito legal: M.48355-2007

Unidad de Publicaciones, Banco de España

Abstract

In recent years, for most emerging markets, public debt has decreased and its composition has evolved toward domestic currency. This progress is remarkable in terms of reduced financial vulnerability, which has been underpinned by favourable financing conditions and related deepening of local debt markets. In this paper, we assess the vulnerability reduction —conveyed in the ratio of total debt to GDP— achieved for six selected emerging economies, focusing on the importance of exchange rate evolution relative to the proactive policies that fiscal authorities have implemented to reduce the external exposure of debt. We first disentangle both components in the current structure of debt to show that proactive debt management has been the dominant factor in the reduction of the forex debt share. We then perform a stress test within a debt sustainability analysis framework. The results show that proactive debt management policies have —somehow paradoxically— entailed a short-term cost, preventing a more dramatic reduction in the debt to GDP ratio, but this is more than compensated by the benefits in terms of financial vulnerability reduction in the face of financial turbulences, reducing simultaneously the probability of such contingency.

JEL Classification: H6, E6, F3.

Keywords: External debt, local debt markets, financial crises, debt sustainability analysis.

1 Introduction

The ratios of public and external debt to GDP constitute crucial indicators in assessing the financial and fiscal vulnerability of a country. On the one hand, high ratios of public debt jeopardise its sustainability and its solvency position. On the other hand, a high exchange rate exposure in debt may abruptly worsen its sustainability in times of financial stress, characterised by access problems to external markets or sharp exchange rate movements.

In most emerging markets, external debt and domestic debt denominated in foreign currency (both henceforth referred together as foreign exchange, or forex, debt) have played an important role in the structure of public sector financing because these markets could not issue debt locally or in local currency. This constraint is a phenomenon sometimes referred to in the literature as “the original sin” [Eichengreen and Hausman (1999)]. The decreasing trend in recent years of public debt over GDP has been accompanied simultaneously and more intensely in many countries by a decrease in the corresponding share of forex debt; this reduction has coincided with a period of widespread appreciation of exchange rates and the widening and change in preferences of the local savings base. This evolution is seen as signalling an important breakthrough: the financial prospects of emerging countries are improved because their financial vulnerability is reduced.

Our main goal in this paper is to evaluate, both qualitatively and quantitatively, the vulnerability reduction derived from the shift towards local currency debt. The IMF defines vulnerability as the risk of solvency (or liquidity) being violated as the borrower enters a crisis. This notion of vulnerability is closely related to the sustainability of the fiscal position. In this vein, we take as a gauge of vulnerability the public debt-to-GDP ratio, so that the difference changes in such ratio in a situation of financial stress under different debt structure is taken as the measure of vulnerability reduction. It could be argued that a focus on the level and composition of debt is a narrow view of fiscal vulnerability. There exist other aspects related to other factors such as maturity mismatches, liquidity crunches, foreign reserves etc. Indeed, the shift in the composition of debt is closely related to other developments —such as the increase in foreign reserves— driven by the objective to buy insurance against bad state of nature. Our point is that most of these factors tend to surface in the evolution and composition of debt, as experience suggests.

As a first step we describe in the paper the evolution and composition in public debt for a selected group of emerging economies —among those prone to financial crises in the last decade— to decompose the changes due to exchange rate evolutions and to discretionary changes in debt managements. The latter can be attributed among other factors —as the higher demand on local currency instruments by market participants— to the desire by authorities to reduce exposure to the swings in the exchange rate and external cost of financing. This decomposition is important in the rest of the analysis in order to assess which has been the impact of proactive policies by the authorities in the reduction of the vulnerability.

The empirical exercise builds upon the debt dynamics equation. This framework is customarily used by analysts and the IMF to assess the debt dynamics of a country through different scenarios. However, since our focus is in the impact of the debt structure shifts and the policies behind them, we take a somewhat different approach. First, we set up a counterfactual exercise in order to assess which would have been the evolution of public

debt in the absence of proactive debt policies. Second, we design a stress scenario for the period 2006-2008 to simulate the evolution of debt in a context of renewed financial turbulence analogous to those experienced by the individual countries in the past. The main aim of this exercise is to compare the increase in the ratio of debt to GDP under the current debt structure and compare it with the evolution without composition change, that is, the counterfactual situation.

The first part of the exercise, the counterfactual, shows that without a policy-induced change in the structure of debt, the ratios of debt to GDP would be currently lower, because the shift towards local debt has not allowed to take full advantage from the observed exchange rate appreciation. However, as shown in the stress test, the actual structure of debt is much less sensitive to a financial turbulence, implying that the increase in the debt ratios in the case of financial turbulences would increase by much less. Putting both results together, the overall conclusion is that debt vulnerability —measured by the debt to GDP ratio prevailing at the end of the simulated period— would be significantly lower only for some countries (Brazil and Uruguay), while the difference is negligible for the other four countries.

However, this result has to be qualified by an important caveat of our exercise: we assume throughout the paper that the evolution of the exchange rate (and other financial variables) is exogenous. But it is well known that perceptions on vulnerability are central to determine market expectations in emerging markets. Thus, it can be reasonably argued that the magnitude of the exchange rate appreciation and the favourable behaviour of the sovereign spreads in the last years has also been fostered by the perception that debt composition was being improved. Analogously, the stress test applied on the variables in the second part of the exercise is the same regardless on the debt composition; by the same token, we can argue that the size —and probability— of market volatility should be expected to be lower if the composition of debt is perceived to be safer. Measuring this endogenous effects falls beyond the scope of this analysis, since they are complex to tackle in a rigorous way, but they should be taken into account in the overall assessment. Therefore, we conclude that the estimates for vulnerability reduction derived from the exercise constitute a lower bound and that all in all, the shift towards domestic debt has significantly reduced financial vulnerability in the countries under study.

2 Debt evolutions

The analysis focuses in six emerging market economies which in the last decade have been prone to financial instability: Brazil, Colombia, Indonesia, Russia, Turkey and Uruguay. Figure 1 displays the ratio of public sector debt to GDP for six selected countries in 2005 and in the year of the highest outstanding debt during the last decade which, in most cases, coincides with episodes of financial turmoil [see Manasse and Nouriel (2005) or de Bolle *et al.* (2006) for a dating of financial crises]. The graph shows both the gross debt holdings and debt net of international reserves (quasi-gross public debt onwards), which will be our preferred measure in the analysis that follows. This type of measure has been chosen in order to reach a homogeneous sample of data across countries and to pick up in the data the effect of the accumulation of reserves in the analysed countries, which is a central consideration, too¹.

The criterion to the concept of debt used —quasi-gross public debt— has been mainly based on data availability among the group of countries undergoing crises in the last decade. The six selected countries —Brazil, Colombia, Indonesia, Russian Federation, Turkey and Uruguay— represent a rather adequate sample of emerging regions, trying to emphasize the generalization of the downward trend of public debt and forex debt. Due to the lack of existence of an homogeneous database that perfectly suits the period of time and disaggregation required by this research, data have been collected directly from the specific debt data release official institutions —except for Russia and Indonesia where data come from the IMF. We decompose quasi-gross debt into foreign (issued in international debt markets) versus local (issued in domestic debt markets) debt. Afterwards we have also distinguished between local debt linked to exchange rate and local debt linked to local currency in the cases where this second data distinction is available. Table 1 shows the sources and respective links used to create the database.

Russia is the most outstanding case of debt reduction. Quasi-gross public debt among the sample shrank about 99 percentage points (pp) of GDP between 1999 and 2005 to become negative, due to the large reserve accumulation². In Turkey and Indonesia the reduction was of 34 pp and 24 pp of GDP, respectively, from 2001 to 2005³. Also Brazil constitutes a good example of these dynamics as in 2002 the quasi-gross public sector debt was 74% of GDP, whereas in 2005 it decreased to around 68% of GDP. In Uruguay and Colombia, the quasi-gross public sector debt fell from 2003 to 2005 around 13% and 6%, respectively, in terms of GDP. It is further remarkable that the reduction in debt has been accompanied by an overall reduction in the share of forex debt (either external debt or domestic in foreign currency or linked to the exchange rate). The reduction of the proportion of forex debt can be stated more clearly in Figure 2. This last figure represents the evolution of the debt composition in terms of external debt, exchange rate linked domestic debt and domestic debt in local currency, for the same periods. The decline in the forex debt share is

1. The choice between gross debt, net debt or any alternative type of measure of debt is not trivial. As stated in IADB (2007), despite many countries provide measures of net debt, the netting strategies differ across countries, so that net debt does not constitute an homogeneous measure, whereas gross debt doesn't capture the effect of international reserves. See Cowan *et al.* (2006) or IMF (2003) "External Debt Statistics: Guide for Compilers and Users" for other alternative debt definitions different from quasi-gross public debt.

2. From this point on and only for the case of Russia we will develop the exercise of analysis of public debt in terms of gross public debt, instead of quasi-gross public debt. Otherwise, since quasi-gross debt is currently negative, the corresponding results for the rest of the analysis would be misleading.

3. In Indonesia, 2001 is considered as the previous peak of public debt, mainly because of data availability, although according to other papers [i. e. Bolle *et al.* (2006)] the most recent turmoil is traced back to 1998.

more dramatic in Brazil, Turkey and Colombia (40%, 28% and 18% respectively), and it is also noticeable the reduction in exchange rate linked domestic debt in both Latin American countries⁴, to the point that in Brazil by 2006 exchange rate linked domestic debt has been suppressed. Only in Indonesia the proportion of external debt has increased in the last years.

There are several reasons explaining the evolution of both the public debt and the forex debt but they can be summarized in two. First, as observed in the evolution of the nominal exchange rate and the sovereign spreads in Figure 3, the developments in public debt have been highly influenced by an international context of very favourable financial conditions, and second, the development of proactive policies to manage public debt, which is closely related to the first reason, as we will see.

Regarding the favourable international financial context, some aspects are worth qualifying. For instance, just as exchange rate crises makes debt explosive in countries with a large share of forex debt, real exchange rate appreciations can dramatically decrease debt ratios and impact on the structure of debt. This is precisely what happened after the crises. The exchange rate recoveries were generalised, as shown in the real exchange rate evolutions in Figure 4, where the magnitude of this appreciation for the Russian ruble (a 64% real appreciation between 1999 and 2005), the Turkish lira —with a 44% real appreciation between 2001 and 2005— and the Brazilian real (26% between 2002 and 2005), were the strongest movements. The Indonesian rupee is the only currency of the sample that depreciated from 2003 to 2005 (6%), precisely the only country where the share of forex debt has increased. The positive period for emerging financial markets is also confirmed by the dynamics of sovereign spreads that have narrowed in a context of increasing capital flows. In this sense, the EMBI Global Composite has decreased from January 1999 to October 2006 around 900 basis points and this reduction of sovereign spreads has been especially severe in emerging Europe, where in the same period it has narrowed around 2000 basis points.

Other factor contributing to this benign financial framework is the favourable behaviour of the growth rates of GDP in all emerging regions in a context of propitious world growth. For instance, the annual percent change of growth in 2005 for emerging countries regions as Developing Asia, Central and Eastern Europe and Latin America was 9.0%, 5.4% and 4.3%, well above the advanced economies data for 2005 (2.6%) and higher or similar to world growth (4.9%); see IMF (2006).

Concerning the proactive debt management, the evolution of public debt and forex debt is closely related to the development of local debt markets in local currency, mainly because of the increasing importance that fiscal authorities have recently attached to reduce vulnerability of public finances in a sustainable manner. This encouraged more proactive debt policies in order to manage public debt in this direction. The impulse by fiscal authorities was driven by lessons from the past concerning excessive exchange rate exposure. Also, the increase in the local savings base has played an important role. The important development of local pension funds —which entails an important captive demand of local paper— and the increased concern about balance sheet mismatches —which increases the relative demand for local currency instruments— have also contributed to endorse the higher relative supply of local debt instruments.

4. See Jeanneau and Tovar (2006) for a recent document on the evolution of domestic markets in Latin America and Tovar (2005) for a detailed analysis of debt denominated in local currency in the three Latin American countries of the sample (Uruguay, Colombia and Brazil).

Finally, it is important to stress that these factors —benign conditions, widened local demand and proactive policies— are closely linked, since the discretionary change of debt composition by the authorities is facilitated by the favourable financial conditions and the expected behaviour of the exchange rate, which increased the relative demand of local debt and the ability of the authorities to place it in the market. In turn, improvements in debt composition are bound to determine market expectations and therefore to intensify exchange rate appreciation. This point will be relevant to qualify the results in the counterfactual exercise below.

All in all, the move towards local currency debt has brought about an apparent paradox which is worth mentioning. In a context of currency appreciation, authorities attempting to maximise debt reduction focused in short term would have an incentives to maintain or increase the share of forex debt as this would decrease public debt on GDP, getting involved in some sort of “virtuous circles”. On the contrary, a reduction of forex debt as such experienced due to active debt management will tend to mitigate debt reduction driven by exchange rate appreciation. But, contingent on a financial turbulence, this ‘paradox of the local debt bias’ is expected to be solved: in such case, exchange rate is expected to sharply depreciate and if there has been previously a reduction in the proportion of forex debt on total debt then the country would be able to absorb better the impact of the negative scenario. The comparison between this short term costs of debt reduction and the long-term (contingent) benefits is one of the by-products of our analysis⁵.

In order to assess the effective vulnerability reduction in the debt composition and the precise contribution of proactive debt management we develop in this paper a quantitative approach to analyse the issue. As a first step, in Section 2, the contribution of the exchange rate to the shifts in debt structure is disentangled from other autonomous or genuine composition effects in the structure of debt. These second effects can be roughly attributed to the debt management strategies of the authorities. In Section 3, the theoretical framework of debt dynamics analysis is developed to perform in Section 4 a counterfactual exercise based on calculating public debt dynamics under the previous debt structure. In this way we can assess the change in vulnerability from the difference in percentage points of GDP between the actual debt and the debt resulting from this counterfactual exercise. Then, the scenario of economic and financial turbulence of the previous crises for the period 2006-2008 is replicated in order to perform a stress test analysis on debt sustainability. As a robustness test, alternative criteria to design the stress are used, too. This type analysis accounts for the expected deterioration of debt structure due to the exchange rate depreciation and other factors and is useful in order to check whether vulnerability —contingent on a stress test— has effectively been reduced after proactive debt management. As mentioned above —and the counterfactual may show—, proactive debt management may mitigate vulnerability reduction in good times but it is expected to engineer more favourable debt dynamics under financial turbulence. Thus, the compounded effect of the counterfactual and the stress test exercises will provide the net impact of the development of proactive policies in the sustainability-vulnerability framework. Finally, Section 5 sums up and concludes.

5. This paper is focused on the sustainability-vulnerability assessment concerning the exchange rate linked debt. Other topics on debt composition such as the long term versus short term debt or the nominal versus indexed debt are omitted, even though there is an intense debate on them. See, for instance, Alfaro and Kanczuk (2006).

3 Public debt composition: Disentangling price and composition effects

This section is focused on setting a framework for the analysis of the shifts in forex debt (the sum of external and domestic exchange rate indexed debt) on total public debt. The share of forex debt, α_t is defined as

$$\alpha_t = \frac{e_t D_t^*}{(D_t + e_t D_t^*)} \quad (1)$$

where e_t is the nominal exchange rate in the period t , D_t^* is the amount of outstanding forex debt, either external debt and exchange rate linked domestic debt, denominated in dollars in t ; and D_t is the outstanding domestic debt denominated in local currency in period t ⁶.

Within this framework, it is rather straightforward to evaluate the importance of the effect of the exchange rate and the effect due to the composition of debt on total variation of composition. The total variation of the ratios of forex debt on total debt between the final ($t=1$) and the initial ($t=0$) periods of reference, that is, $(\alpha_1 - \alpha_0)$, can be decomposed in these two effects, as follows,

$$\alpha_1 - \alpha_0 = EE + CE + \varepsilon \quad (2)$$

where the first part of the right hand side of (2) is the Exchange rate Effect (EE onwards) and CE is the composition effect. The residual term ε in the expression will be allocated between both effects as explained below.

The exchange rate effect EE, is the variation in the proportion of external debt and indexed to a foreign currency domestic debt due to variations in the exchange rate, obtained by keeping the amount of debt unaltered. Analytically:

$$EE = \frac{e_1 D_0^*}{D_0 + e_1 D_0^*} - \alpha_0, \quad (3)$$

where the first element in the right hand side of EE will be denoted as α_1^E .

The Composition Effect is the variation of α due to the changes of the relative volumes of the different types of debt, had the exchange rate not changed:

$$CE = \frac{e_0 D_1^*}{D_1 + e_0 D_1^*} - \alpha_0 \quad (4)$$

where, analogously to (3), the first element in the right hand side of (4) will be denoted as α_1^C .

6. See Calvo *et al.* (2002) for a pioneering paper that analyses fiscal sustainability incorporating the currency composition of debt.

In this last type of effect, the impact of proactive management policies arises, although other factors such as the relative demand and supply of debt instruments may be prominent.

The allocation of the residual change to each factor is made according to the scheme in Figure 5. Notice that, the whole variation in the forex debt share (that is, $\alpha_1 - \alpha_0$), is the area defined by coordinates $e_1 D_1^*$ minus $e_0 D_0^*$ (the area shadowed with vertical lines). The EE as stated in previous notation would be the area comprised by $\alpha_1^E - \alpha_0$ and the CE would be $\alpha_1^C - \alpha_0$ (the yellow and green shaded area, respectively). The remaining area should be equally distributed between EE and CE, in order to accurately represent the difference between the vectors α_1 and α_0 .

The factorial decomposition of EE and CE are represented in Figure 6 for the six countries in terms of the percentage points which each factor has contributed to the reduction in the share of foreign currency debt, considering that $t=1$ is 2005 and $t=0$ is the year of the corresponding debt crisis for each country. We use as reference for this exercise the public debt net of reserves (quasi-gross public debt), but for the case of Russia, where such magnitude is negative.

In spite of the strong exchange rate appreciation, the composition effect (CE) dominates in all countries but Indonesia, where it contributes to the increase in the share of forex debt. CE is largest in Brazil, in absolute terms (34% of the 40% reduction in the forex debt share is due to CE), but in relative terms it is even more important in Turkey (26% of the 28% reduction is CE); that is, more than 90% of the reduction is due to the composition effect). For the average of the five countries where the share of foreign currency debt is reduced, 85 per cent of the reduction can be attributed to the pure composition effect.

4 The framework of analysis. Debt dynamics

Public debt sustainability analysis (DSA) is an increasingly widespread tool to assess the vulnerability position of public finances. Debt sustainability analysis uses the debt dynamics equation. This equation has been widely used in the fiscal policy literature to assess the fulfilment of the intertemporal government budget constraint —see, for instance, Blanchard (1990). During the last years there has been an increasing attention paid to this approach in policy analysis, most notably in IMF country assessments. A growing amount of papers also handle DSA analysis —sometimes from a stochastic approach— see, for example, Celasun *et al.* (2006), Hostland and Karan (2005) or García and Rigobon (2004). The main advantage of this methodology for our objectives, apart from its simplicity, is that it can provide an explicit measure of vulnerability which can be traced throughout time and suits well the stress test analysis.

The dynamics of debt is determined —in a simplified framework— by a rather limited number of variables. Furthermore, forecasts for most of these variables are readily available in the market. These forecasts allow determining a base scenario of the future evolution of debt. The framework is also useful to see how debt would respond to a situation of stress by changing the forecasts by estimates of the variables under negative shocks. These stress tests compound alternative scenarios, which gives an idea of the resilience of debt and therefore of the vulnerability of the public finance position.

The starting point is the following debt dynamics equation:

$$D_t = -PB_t + \frac{(1+r_t)}{(1+g_t)}(1-\alpha_t)D_{t-1} + \frac{(1+r_t^*)(1+\Delta e_t)}{(1+g_t)}\alpha_t D_{t-1}, \quad (5)$$

where D_t is the stock of public debt at the end of time t and PB_t is the primary balance, both expressed as a ratio of GDP. The share of debt denominated in foreign exchange is α_t , as we already know, while $(1-\alpha_t)$ is the share of local currency debt; r_t^* and r_t are their corresponding real interest rates. Foreign denominated external debt can be in foreign currency —mostly external debt— or debt indexed to the exchange rate —mostly domestic debt. Finally, Δe_t is the variation in the nominal exchange rate —where a positive Δe_t means an exchange rate depreciation— and g_t is the real rate of growth.

After some algebra, the dynamics of public debt can be expressed as

$$\Delta D_t = -PB_t + \frac{(r_t - g_t)}{(1+g_t)}(1-\alpha_t)D_{t-1} + \frac{(r_t^* + \Delta e_t + r_t^* \Delta e_t)}{(1+g_t)}\alpha_t D_{t-1}, \quad (6)$$

This equation is the basis for the sustainability exercises performed in the DSA. Given the current level and composition of debt, for given forecasts of the primary balance, the growth rate, the nominal exchange rate and the real interest rates (domestic and foreign) it is possible to project debt trajectories. Increases in the ratio of debt to GDP derived from these exercises provide a measure of vulnerability, and a decrease in the ratio suggests a reduction in vulnerability.

Expression (6) can be transformed in a more convenient way by separating the effect of the exchange rate from the rest:

$$\Delta D_t = -PB_t + \frac{((1 - \alpha_t)r_t + \alpha_t r_t^*)}{(1 + g_t)} D_{t-1} - \frac{g_t}{(1 + g_t)} (1 - \alpha_t) D_{t-1} + \frac{\Delta e_t + r_t^* \Delta e_t}{(1 + g_t)} \alpha_t D_{t-1}. \quad (7)$$

For practical purposes, it is important to note that the real interest rates by instrument or currency are not usually available, so that we have to find a way to measure the approximate real cost of local and forex debt. There exists data on interest payments on public debt. IP_t which can be defined as

$$IP_t = ((1 - \alpha_t)r_t + \alpha_t(1 + \Delta e_t)r_t^*)D_{t-1} = \rho_t D_{t-1}, \quad (8)$$

where, for convenience, ρ_t denotes the average cost of debt at time t . ρ_t can be calculated in every country through the data of IP_t from this expression,

$$\rho_t = \frac{IP_t}{D_{t-1}} \quad (9)$$

For completeness and further convenience, also note that the implicit local debt real rate can be solved out from the definition of r_t

$$r_t = \frac{\rho_t - \alpha_t(1 + \Delta e_t)r_t^*}{(1 - \alpha_t)}. \quad (10)$$

so that if we are able to proxy the real foreign cost of debt —through the spread, as it turns out— an approximation to the respective real interest rate by currency.

Substituting ρ_t in (7) yields the basic equation for the empirical approach

$$\Delta D_t = -PB_t + [\rho_t - (1 - \alpha_t)g_t + \Delta e_t \alpha_t] \frac{D_{t-1}}{(1 + g_t)} \quad (11)$$

5 Empirics. Debt evolution, debt structure and vulnerability reductions

These expressions provide us with an adequate framework to analyse what has been going on in the considered countries. It is convenient to start with an illustrative example of how the different factors impinge on the evolution of debt and then move to a more detailed analysis of the impact of the shifts in debt structure on vulnerability.

5.1 Contributions to debt reduction

Computing the partial derivatives in expression (5) allows to determine the contribution of each factor to the de variation of D_t (ΔD_t) on an annual basis. To focus on the issues we are more interested in, we consider the decomposition of the annual variation of D_t in terms of PB (in this case there is a one-to-one relationship), and the annual variation of the share of forex debt on total public debt, α_t , the exchange rate, e_t and , for the sake of simplicity, the rest of contributions (interest rates and rates of growth) are aggregated in a residual.

Figure 7 illustrates the case of Brazil. The substantial magnitude of the primary balance is a powerful debt reduction driver throughout the period. But the interesting results regard the interaction between the exchange rate and the share of forex debt α_t . From 2001 to 2002 the currency depreciated, and there was an important positive contribution to debt of 9 pp of GDP. Thereafter, the appreciation of the exchange rate induced a negative contribution to public debt in terms of GDP has been negative. The accumulative decrease from 2002 to 2005 was of 4% in terms GDP. In parallel, α_t increased in the first, turbulent period; due to the contemporaneous exchange rate depreciation this added up 3 pp to the debt-to-GDP ratio (the green area in the figure). Both factors together amounted to 12 percentage points of GDP to the increase in debt in 2002. However in the following years of currency appreciation and reduction in forex debt interacted in a different way: the contribution of the dwindling share of forex debt is positive because it mitigates the effect of the exchange rate appreciation on debt reduction. Finally, the residual, picks up the combined contribution of interest rates, growth plus other adjustments.

5.2 A counterfactual exercise. Debt reductions without proactive management policies

The Brazilian example highlights that the interaction between exchange rate appreciations and reductions in the forex share can play against debt reduction. This is the 'paradox of the local debt bias' pointed out in the introduction. But we also noted in section 2, that the changes in debt structure (see Figure 6), are in part mechanically driven by the evolution of the exchange rate. Indeed, we showed there that a substantial part of the reduction in forex debt was not due to the exchange rate evolutions but to pure composition effects, where the proactive debt management policies of the authorities has had an central role.

Now, within the debt dynamics framework we can give a quantitative assessment of the (negative) impact of proactive debt management in the reduction of debt. The question is straightforward: Which would be the level of debt today netting out the net composition effect, that is, without proactive debt management?

Obtaining the computations of α_t^E as stated in (3) on a yearly basis, we can determine counterfactual debt paths, for the public debt ratio. This exercise is carried out for the six considered countries and is represented in Figure 8. The blue line

represents the actual public debt trajectory; netting out the pure composition effect delivers the path represented by the green line. The graph is completed with the opposite exercise —red line. In this case, we consider the pure composition effect but assuming that the impact brought about by the exchange rate evolutions disappears, that is the current debt level had the real exchange rate been kept constant.

Table 2 summarizes the outcomes of the counterfactual exercise for the six countries. In the case of Brazil, the actual path displays debt falling from 74% to 68% of GDP, but this fall is much wider to around 60% in 2005 when we net out the pure composition effect. The reason is that the dwindling forex debt does not fully capitalise the impact of the real exchange rate appreciation. To sum up, for Brazil, the implicit loss, in terms of percentage points of debt —to GDP— derived from the proactive debt management of the government, nowadays the level of debt would be a sizable 8 pp of GDP. This can be taken as a measure of the opportunity costs of substituting local debt in local currency for forex debt. On the contrary, if the nominal exchange rate would have remained in the levels of 2002, the quasi-gross public debt would have been in 2005 of around 79% of GDP.

In Turkey, these proactive policies have also been quite pronounced. There, netting the change in composition due to the debt management of the government the public debt would be in 2005 10 pp of GDP lower. In the rest of the countries where the reduction in the share of forex debt on total public debt has been relatively small or has not taken place (Colombia, Indonesia, Russian Federation and Uruguay), the difference between the actual path of public debt and the public debt under constant composition of the year of crisis is also small (this difference represents less than 1 pp of the GDP of each country).

Brazil or Turkey represent a clear example where the “opportunity costs” of diminishing the total amount of forex debt on total public debt are more evident, due both to the intense exchange rate appreciations and to the efforts by the fiscal authorities to recompose debt in favour of local and local currency denominated debt.

It should also be kept in mind that the observed shift towards local currency may have entailed other distortions and costs [BIS (2007)]. The most evident is the increase in the financial cost and the reduction in maturity of debt in some emerging markets during, at least during the transition process; also, the tapping of local markets may imply crowding out of the private sector⁷. Finally the increase in foreign reserves (a factor reducing debt in our definition) may foster inflationary pressures and it potentially entails monetary policy management challenges [see Alberola and Serena (2007)].

Some important caveats, though, give a more nuanced view of the mentioned opportunity costs of moving out of forex debt. Most important is that this is a partial equilibrium exercise. We are assuming that nothing else changes, but this is an extremely strong assumption. As mentioned above, the fiscal authorities could have not developed so swiftly the local debt markets under more stringent financial conditions. More importantly, the very same evolution of the exchange rate is not alien to the evolution of debt composition: the reduction in external debt, process deepened by very active policies in Brazil shapes the expectation of agents and it has probably contributed to put higher pressure on the exchange

7. It is also possible that foreign investors enter into the local market, and this has been increasingly the case. Note that these investors may be looking for high and rapid returns and that they may retrench if circumstances change, implying that the foreign exposure is not reduced.

rate and to foster a higher accumulation of reserves (and thus a bigger reduction of quasi-gross debt).

From the second type of exercise, where the exchange rate is kept unaltered, some interesting conclusions also follow. As expected, the numbers show that debt dynamics would have been much less favourable under exchange rates of the year of crises for the six countries —except for Indonesia and Russia, where nominal exchange rate has appreciated with respect to their years of crises. The more damaged country in case of maintaining the same nominal exchange rate would have been Uruguay that would have increased its debt in 18 pp of GDP.

All in all, under the perspective taken in this section, it might seem that having performed proactive policies in order to reduce the share of forex debt on total GDP has entailed costs in terms of limited debt reduction. Nevertheless, this short-term cost must be measured up with the prospective benefits derived from a less forex dependent debt structure in the case of financial turbulence.

5.3 Stress test: The resilience in debt vulnerability

The standard DSA framework based on stress testing consists of designing a situation of turbulence (or stress) comparable with the last crises to check whether vulnerability has effectively been reduced and contrast it with a base scenario.

Therefore, the first step is to define the base scenario. With forecasts from the respective IMF's Article IV reports, LatinFocus and Consensus Forecast on a three year horizon (2006, 2007 and 2008) the raw data to project the debt paths are obtained⁸. This methodology is useful in order to improve homogeneity of the analysis and in order to check out the different outcomes with those provided by IMF. Second, the stress scenario is designed so as to replicate the most recent financial turmoil that these countries have suffered —coinciding as seen above with the previous peak in debt. The data underlying the base and the stress scenarios are displayed in Table 3. The changes therein are applied to all variables in the debt dynamics equation (5)⁹.

The results for the six countries appear in Figure 9 and Table 4. Let us take again Brazil as illustrative case. The blue dotted line represents the base scenario, whereas the orange dotted line stands for debt dynamics under the stress scenario. In both debt evolutions it is employed the path of α under debt composition of 2005. As expected under the base scenario —conveying the continuation of favourable conditions— quasi-gross debt gently decreases towards 60% of GDP, while under the stress scenario debt increases and then stabilises above 70%.

What would have been the impact of the turmoil if the debt structure been kept unaltered relative to the year of the crisis? A first —but inadequate— approximation is given by the red line. It represents the impact of the stress test with the debt structure net of the pure composition effect (but letting the exchange rate effect operating) and the current level of debt. Notice that the evolution is much more explosive that under the current debt structure

8. The two last data sources are needed for exchange rates forecast, the rest of forecast are mostly based on the respective Article IV of IMF for each country.

9. In those punctual cases where there is no data availability for the period of crisis the negative shock was obtained by adding to the data in the base scenario one standard deviation of the available data.

(plus the stress scenario-orange line). Had the debt management not been proactive¹⁰, the increase would have been much larger (to over 95%) —red line— and set the debt in a explosive path. The gap between both lines (more than 20 pp of GDP in a 3-year horizon) is indicative of the importance of a less forex-exposed debt structure in order to reduce vulnerability and reinforce the sustainability of debt.

Why is the red line misleading? We have seen in the counterfactual exercise that netting out pure composition effects would have resulted in a lower debt ratio in the case of Brazil because of the sustained real exchange rate appreciation. Thus, the effective lower reduction in debt due to the proactive debt management policies has to be compared with the prospective gains in the case of a financial crisis. More precisely, the green line represents the debt dynamics assuming no pure composition effect —as in the red line— plus the level of debt resulting from the counterfactual exercise. This, in our view, is the right gauge to measure vulnerability reduction due to proactive debt management. In practical terms, this amounts to take the end-point of the green line as reference and project if forward under the stress scenario.

The so-extended green line has a similar path than the red line, but it starts from a lower level. As a consequence, the difference in the ratio of debt is very small in the first year, and then widens up to around 10 pp of GDP. This figure can be taken as the net gain from the debt management policy by Brazil. In other words, the “short-term cost” of implementing proactive policies in order to decrease the share of forex debt on total debt is more than compensated by “long-term gains” of implementing them.

For the other five countries the forecasts under the base scenario are as follows. Colombia, Turkey and Uruguay decrease its debt towards 40%, 45% and 60% of GDP, respectively (blue line). Despite the evolution of its currency and the composition of its debt, Indonesia also reduces its debt to 25% of GDP. Finally, the forecast for Russia are especially favourable, as the forecast for the gross debt decrease sharply to —25% of GDP— that is not only quasi-gross debt is negative, but also gross debt!

The stress scenario for rest of the countries can also be analysed in the same manner as Brazil, although the results are less clearcut. Recall that the more interesting conclusions arrive from the comparison of the evolution of debt under the debt composition of the year of crisis (green line) and under the debt composition of 2005 (orange line). The comparison only favours the case of debt recomposition in Russia —where the debt level is not currently a problem and Uruguay, to a lesser extent than in Brasil (gap 5 pp of GDP, see Table 4). Nevertheless, in some countries as Colombia, the benefit of the performed proactive policies until 2005 gives rise to an scant average decrease of debt of 1 pp of GDP accumulated in the forecasted period, and in the case of Turkey the accumulated differences after three years are negative (-1 pp GDP) although they are previously positive. In the case of Indonesia the gap is negligible, throughout the forecast scenario.

Here underscoring the caveats is even more relevant because the direct inference from these results is that, with the exception of Brazil, the debt recomposition effort, do not seem to pay off in terms of vulnerability reduction under stress. Again, the caveats are based on the impact of these debt trajectories on expectations. It is difficult to assume that the reaction of the markets would be the same comparing the mild deterioration implied by

10. To be more precise the ‘2002 debt composition’ lets the exchange rate effect impact on the structure but nets out the pure composition effect.

the orange line with the sharp increase in debt under a less favourable debt structure. As a consequence, the evolution of the financial variables is reasonably expected to be worse in the second case. This endogeneity implies that the computation of net gains is rather a floor than a mid-point estimate.

In order to check the robustness of the results under different scenarios of stress, the exercise is repeated considering two alternative assumptions for the design of the stress scenarios. First, following the methodology employed in most IMF's Article IV, two standard deviations on the sample series are added to the corresponding data of the base scenario —this is denoted as 2SD in the table—¹¹; second, a scenario is built on the average stress scenario (average stress, for short) for each variable of the six countries based on the historical criterion of previous subsection.

Table 4 shows the outcomes corresponding to these two new criteria. The results in general are quite robust under the three different alternatives, both in terms of size of the shock and direction to the two new stress scenarios designed. Two are the main exceptions: Indonesia and Turkey. In the case of Indonesia the results of the exercise change under the assumption of average stress, as public debt on GDP is lower under the stress scenario than under the base scenario. In the case of Turkey, under these two new assumptions, the gap between the stress under the debt structure of the year of crisis —that is, the counterfactual— and the stress under the debt structure of 2005 becomes negative, implying less resilience to a negative shock. For the other simulations results are almost equivalent, and even in some cases, such as the results of the scenario based on averages for Colombia gives rise to a lower debt under current composition than under previous composition.

11. It is added to each variable from 2006 to 2008 (both inclusive) two standard deviations of the sample of each variable from the year of the crisis to 2005.

6 Conclusions

In this paper we have evaluated the impact of the shift of public debt away from foreign currency on the vulnerability of a group of selected emerging countries which, not so long ago, underwent deep financial turbulences.

We have first underscored that, the ratio of public debt to GDP and, even more dramatically, the share of forex debt have been reduced in emerging markets in a context of favourable financial conditions. The exchange rate appreciations in this context have helped to reduce both ratios. However, the proactive debt management strategies of the authorities —aimed at reducing the vulnerability of the debt composition— has been the dominant factor in quantitative terms in most countries. Clearly, a favourable external environment and exchange rate evolutions have facilitated this process, since expected exchange rate appreciation favours issuing debt in domestic currency. The development of local debt markets has both benefited from and facilitated this proactive debt management.

The changes in the structure of debt are expected to have important implications for the reduction of financial vulnerability in public finances. However, our approach to this issue has first uncovered a paradox related to the recent bias towards local debt. By reducing forex debt through proactive policies governments have not taken full advantage of the real exchange appreciation enjoyed by their economies after the crises. Otherwise, the debt ratios in the analysed countries would have been lower than they currently are, and the difference is sizable in certain cases.

In our view, this opportunity cost underscores the dramatic shift in debt management strategies in most of these countries. In the past, government used the periods of benign external financial conditions to issue external debt, most of the times beyond what it would be advisable and prudent from a fiscal point of view, setting the stage for future financial problems and crises. Now they are ready to refrain from this temptation and even to dismiss part of the impact of the exchange rate appreciation on the debt ratios in the short term in order to strengthen their underlying financial position. The change in strategy is thus contributing to a structural reinforcement of public finances and help countries to redeem themselves from the original sin.

This short term 'opportunity cost' of shifting towards local debt has to be taken into account in order to assess the net benefits of the proactive debt management policies. The stress tests suggests that even after controlling for these short-term costs there is a reduction in vulnerability derived from the proactive shift towards local debt —measured by the difference in the ratio of debt to GDP in a situation of stress— in most cases, although the magnitude is some of them is small.

One important caveat reinforces these results. A central assumption of the exercise is taken into account: the evolution of the variables which drive the debt to GDP ratio is independent of the ratio or structure of debt. However, the behaviour of the financial variables is very much influenced by perceptions on debt vulnerability. This applies both in the counterfactual and in the stress tests. More precisely, with a higher share of forex debt the exchange rate appreciations would have presumably been lower in the recent years and the deterioration of the financial variables in the stress would have been higher. Finally,

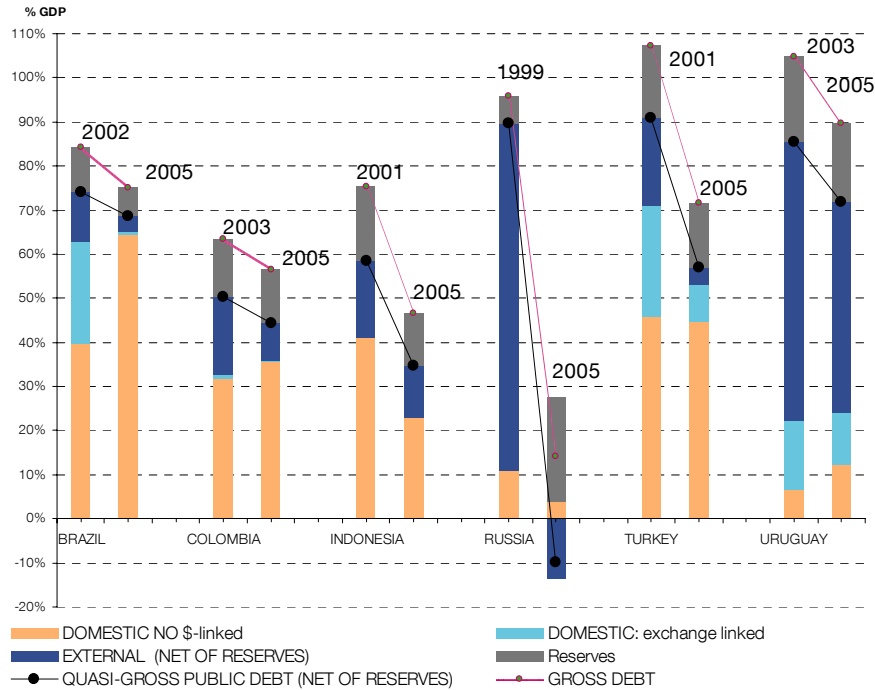
the probability of a turbulence is expected to increase under a debt structure very sensitive to financial volatility. These caveats taken together imply that the estimated reduction in vulnerability is a minimum bound, and therefore the effective vulnerability reduction is higher.

All in all, the move to local debt has been shown to be positive from the point of view of the vulnerability reduction. This can be considered an important breakthrough in emerging markets in order to improve their resilience in the face of eventual financial shocks and also to reduce their occurrence.

REFERENCES

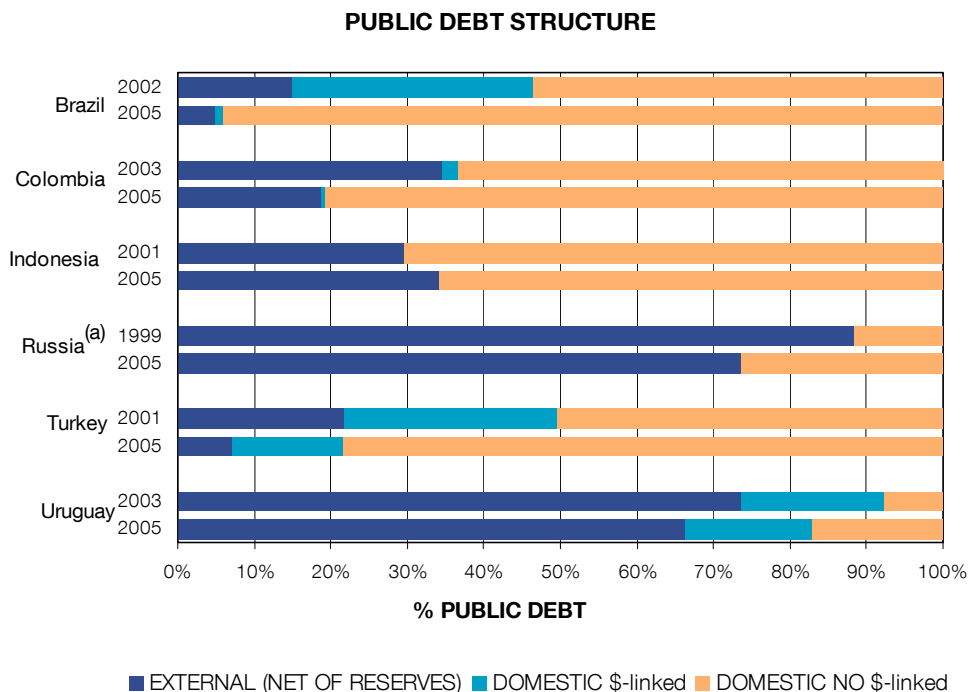
- ALBEROLA, E., J. M. SERENA (2007). "Global financial integration, monetary policy and reserve accumulation. Assessing the limits in emerging economies", *Moneda y Crédito*, 224, pp. 105-148.
- ALFARO, L., and F. KANCZUK (2006). *Sovereign debt: Indexation and maturity*, Inter-American Development Bank, Working Paper No. 560.
- BANCO DE ESPAÑA (2006). "La reducción de la deuda vinculada al tipo de cambio", *Boletín Económico*, marzo, pp. 101-102.
- BIS (2007). *Financial stability and local currency bond markets*, Working Group by the Committee on the Global Financial System, CGFS Publications No 28.
- BLANCHARD, O. J. (1990). *Suggestions for a new set of fiscal indicators*, OECD, Economic Department, Working Paper No. 79.
- CALVO, G., A. IZQUIERDO and E. TALVI (2002). *Sudden stops, the real exchange rate and fiscal sustainability: Argentina's lessons*, NBER Working Paper No. 9828.
- CELASUN, O., X. DEBRUN and J. D. OSTRY (2006). *Primary surplus behaviour and risks to fiscal sustainability in emerging market countries: a "fan-chart" approach*, IMF Working Paper No. 06/67.
- COWAN, K., E. LEVY YEVATI, U. PANIZZA and F. STURZENEGGER (2006). *Sovereign debt in the Americas: New data and stylized facts*, Inter-American Development Bank, Working Paper No. 577.
- DE BOLLE, M., B. ROTHER and I. HAKOBYAN (2006). *The level and composition of public sector debt in emerging market crises*, IMF Working Paper No. 06/186.
- EICHENGREEN, B., and R. HAUSMANN (1999). "Exchange Rates and Financial Fragility", in Federal Reserve Bank of Kansas City (Ed.), *New Challenges for Monetary Policy*, pp. 329-368.
- GARCÍA, M., and R. RIGOBON (2004). *A risk management approach to emerging market's sovereign debt sustainability with an application to Brazilian data*, NBER Working Paper series, No. 10336.
- HAUSMANN, R., and U. PANIZZA (2003). "On the determinants of Original Sin: an empirical investigation", *Journal of International Money and Finance*, 22, pp. 957-990.
- HOSTLAND, D., and P. KARAM (2005). *Assessing debt sustainability in emerging market economies using stochastic simulation methods*, IMF Working Paper, 05/226.
- IDB (E. BORENSSZTEIN, E. LEVY and U. PANIZZA coordinators) (2006). *Living with debt. How to limit the risks of sovereign finance. Economic and social progress in Latin America. 2007 report*, Inter-American Development Bank.
- IMF (2003). *External Debt Statistics: Guide for Compilers and Users*, June.
- (2006). *World Economic Outlook (Financial Systems and Economic Cycles)*, September.
- JEANNEAU, S., and C. TOVAR (2006). "Domestic bond markets in Latin America: achievements and challenges", *BIS Quarterly Review*, June.
- MANASE, P., and N. ROUBINI (2005). *Rules of thumb' for sovereign debt crises*, IMF Working Paper No. 05/42.
- TOVAR, C. (2005). "International government debt denominated in local currency: recent developments in Latin America", *BIS Quarterly Review*, December, pp. 109-118.

Figure 1: Gross and quasi-gross public sector debt for six selected countries



Source: National statistics and own calculations

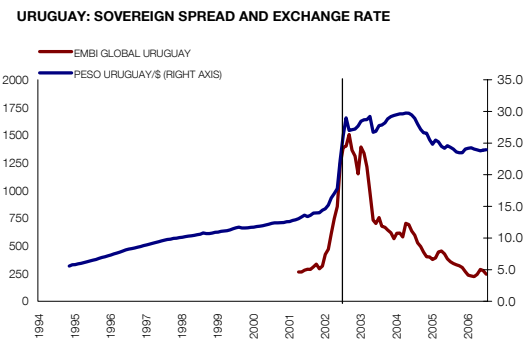
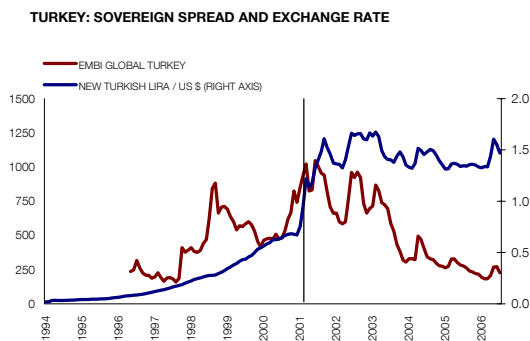
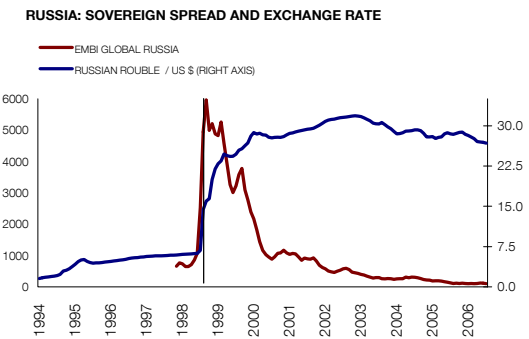
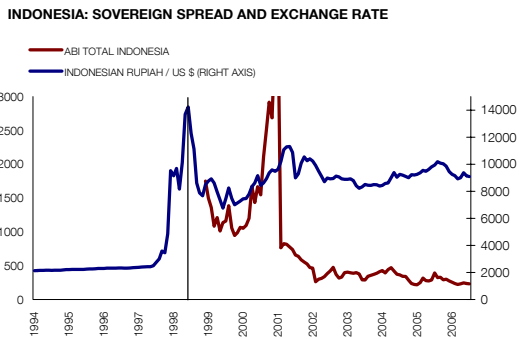
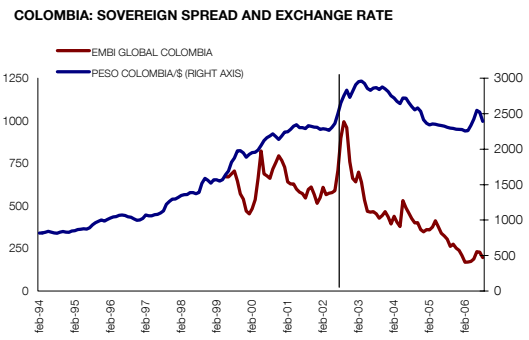
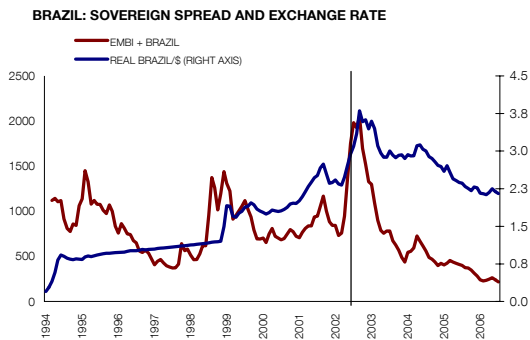
Figure 2: Public debt composition (quasi-gross public debt) in six selected countries



SOURCE: National Statistics and own calculations

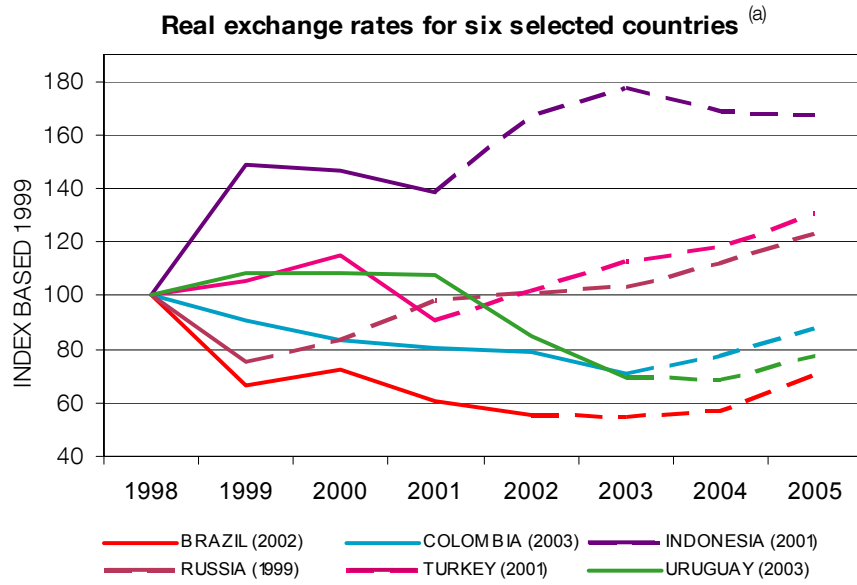
(a) Reserves not excluded.

Figure 3: Identification of sovereign crisis episodes in selected countries (together with sovereign spreads and nominal exchange rates)



Source: Datastream

Figure 4: Real exchange rates for six selected countries



(a) Year of major outstanding debt in brackets and dotted line from this year.
 Source: EIU.

Figure 5: Public debt decomposition

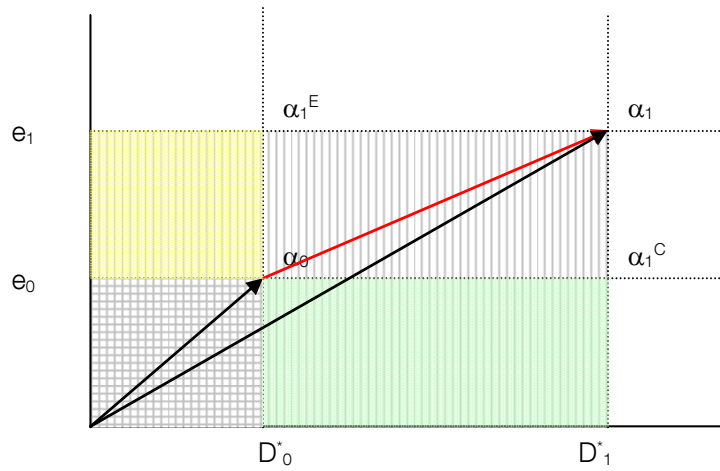


Figure 6: EE and CE (quasi-gross public debt) in six selected countries

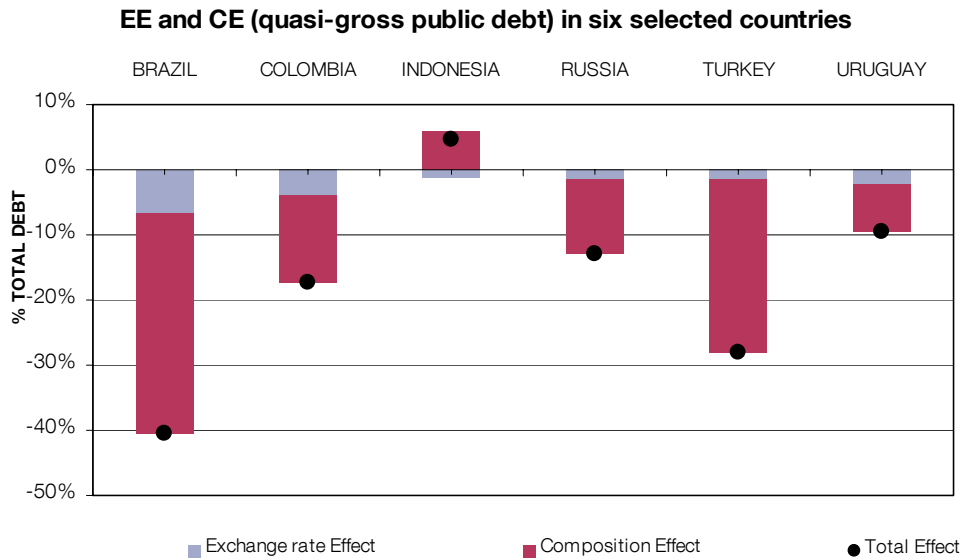


Figure 7: Brazil: Annual variation of public debt on GDP disaggregated in terms of contributions

**Brazil: Annual variation of public debt on GDP
disaggregated in terms of contributions**

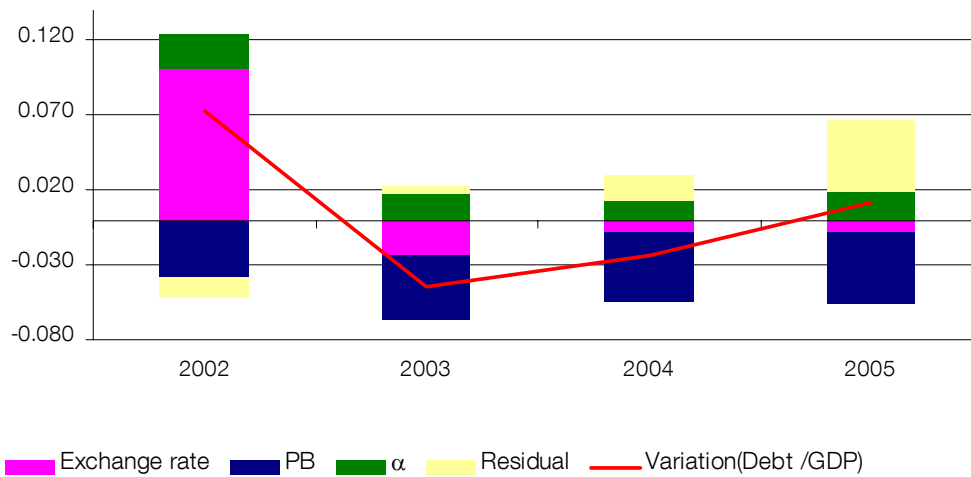
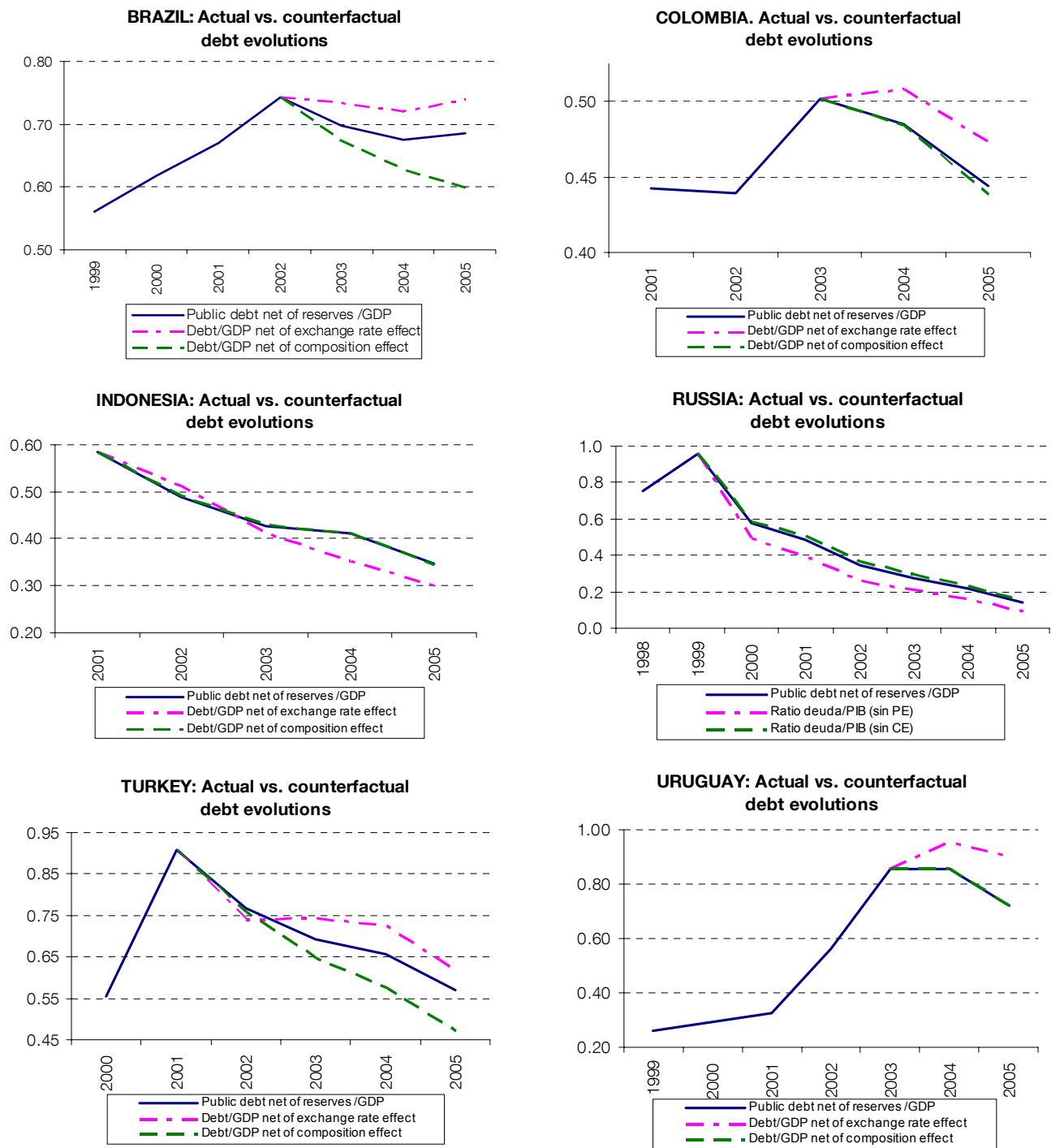
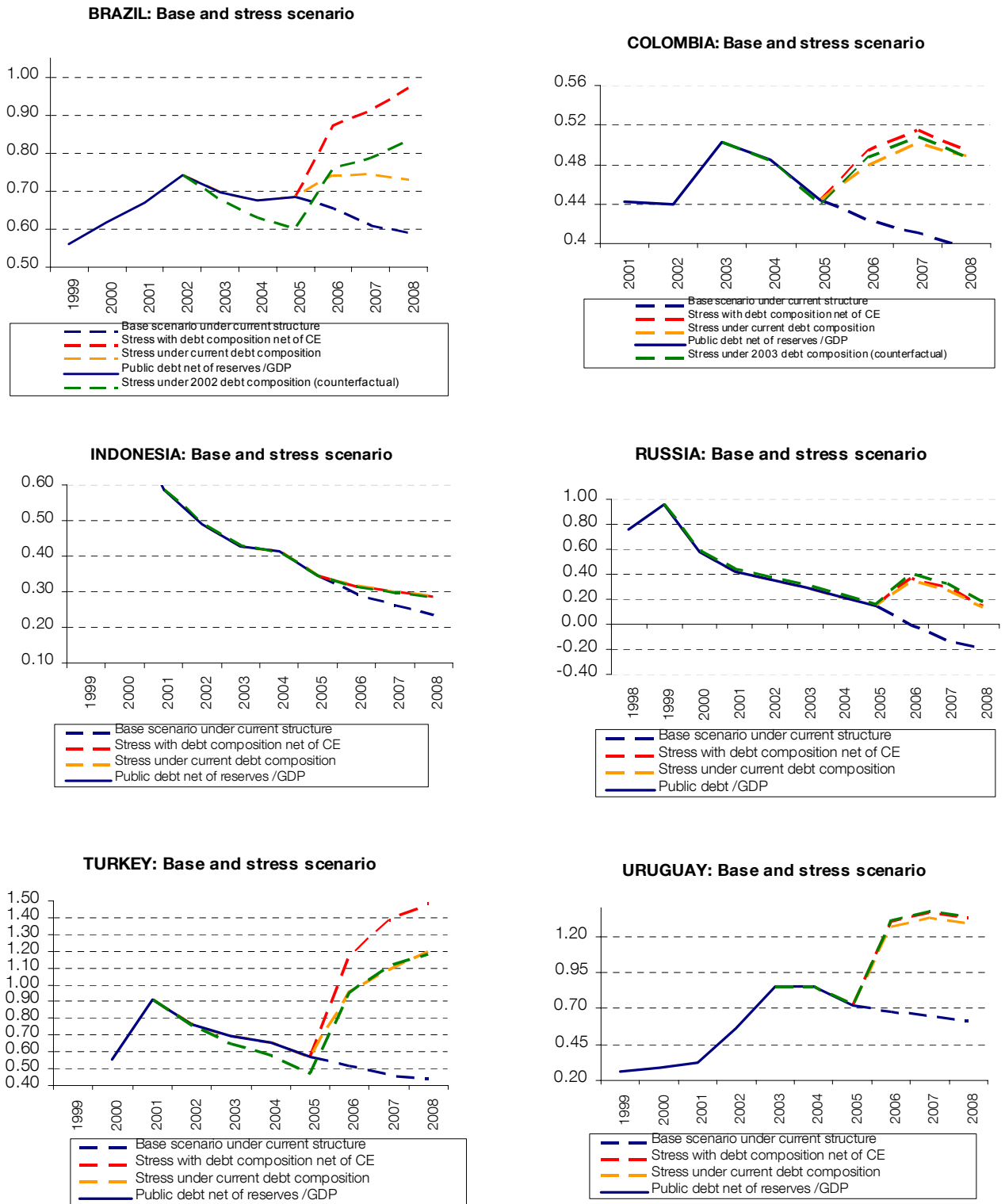


Figure 8: Actual vs. counterfactual in six selected countries



Source: Own calculations

Figure 9: Base and stress scenario in six selected countries



Source: Own calculations

Table 1: Database construction

Country	Year of the Debt crisis	Availability of data	Description	Source	Web link
Brazil	2002	1999	General Government Gross Debt ^(a)	Banco Central do Brasil	http://www.bcb.gov.br
			Public Sector Domestic Debt ^(b)	Ministerio de Fazenda	http://www.stn.fazenda.gov.br/estatistica/est_divida.asp
Colombia	2003	2001	Public Sector Debt ^(a)	Banco de la República	http://www.banrep.gov.co/economia/deuda/BoletinDePu18.pdf
			National Government Domestic Debt ^(b)	Ministerio de Hacienda	http://www.minhacienda.gov.co/
Indonesia	2001	2001	Central Government Gross Debt	Art.IV	
Russia	1999	1998	General Government Gross Debt	Art.IV	
Turkey	2001	1998	Public Sector Debt ^(a)	Turkish Treasury	http://www.treasury.gov.tr/
Uruguay	2003	1999	Public Sector Debt ^(a)	Banco Central de Uruguay	http://www.bcu.gub.uy/autoriza/pepmaf/deudapublica/dbspg2.xls

^(a) Domestic and External

^(b) Used to do the breakdown of the Domestic Public Debt

Table 2: Counterfactual exercise results for 2005

COUNTERFACTUAL (2005)	BRAZIL	COLOMBIA	INDONESIA	RUSSIA	TURKEY	URUGUAY
Public debt net of reserves /GDP	68.5%	44.4%	34.6%	14.5%	57.1%	71.9%
Debt/GDP net of exchange rate effect	74.0%	47.3%	30.4%	54.6%	65.7%	90.3%
Debt/GDP net of composition effect	60.0%	43.8%	34.4%	14.7%	47.3%	72.3%
Points of Debt/GDP due to composition effect	5.5	2.9	-4.2	40.1	8.6	18.4
Points of Debt/GDP due to exchange rate effect	-8.5	-0.5	-0.2	0.2	-9.7	0.5

Source: own calculations.

Source: Own calculations

Table 3

Base scenario and stress scenario for the simulation of debt dynamics

In per cent

	Base scenario				Stress scenario			
	2005	2006	2007	2008	2005	2006	2007	2008
Brazil								
Exchange rate ¹	-12.2	-4.3	3.6	0.0	-12.2	50.3	7.9	18.5
Real GDP growth	2.3	3.5	4.0	3.5	2.3	-0.8	-0.3	3.3
GDP deflator	7.2	4.0	4.2	4.4	7.2	7.5	7.7	7.9
Interest rate (i) ²	13.5	14.3	12.9	12.4	13.5	14.9	15.5	12.3
Interest rate (i*) ³	7.5	7.5	7.5	7.5	7.5	11.6	11.6	11.6
Primary balance ⁴	4.8	4.3	4.3	4.2	4.8	0.0	3.2	3.5
Implicit liabilities ^{4,5}	-0.5	3.0	3.0	0.0	-0.5	3.0	3.0	0.0
Colombia								
Exchange rate ¹	-5.4	6.5	3.4	0.0	-5.4	24.0	-2.6	-13.3
Real GDP growth	5.2	5.2	4.5	4.0	5.2	2.3	-2.4	4.7
GDP deflator	5.5	4.7	4.1	3.5	5.5	5.3	7.4	6.4
Interest rate (i) ²	8.6	12.2	11.6	10.2	8.6	13.1	12.7	11.2
Interest rate (i*) ³	6.8	6.8	6.8	6.8	6.8	8.8	8.8	8.8
Primary balance ⁴	3.5	3.1	2.4	2.2	3.5	0.9	0.9	-0.3
Implicit liabilities ^{4,5}	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Indonesia								
Exchange rate ¹	6.0	0.0	0.0	0.0	6.0	15.6	-3.1	2.2
Real GDP growth	5.6	5.2	6.0	6.5	5.6	4.5	4.9	5.7
GDP deflator	13.7	13.2	6.5	6.5	13.7	16.7	6.0	4.4
Interest rate (i) ²	6.1	5.7	5.5	5.7	6.1	-3.1	3.4	5.6
Interest rate (i*) ³	7.4	7.4	7.4	7.4	7.4	25.8	16.6	7.4
Primary balance ⁴	2.2	1.2	1.3	1.1	2.2	0.4	0.5	0.3
Implicit liabilities ^{4,5}	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0

1. Variation of national currency per US dollar.

2. Nominal domestic interest rate.

3. Nominal external interest rate.

4. As a percentage of GDP.

5. Recognition of implicit or contingent liabilities.

Source: Author's calculations based on IMF data.

Table 3 (cont)

Base scenario and stress scenario for the simulation of debt dynamics

In per cent

	Base scenario				Stress scenario			
	2005	2006	2007	2008	2005	2006	2007	2008
Russia								
Exchange rate ¹	-1.8	0.0	0.0	0.0	-1.8	153.3	14.4	3.7
Real GDP growth	6.4	6.5	6.5	6.1	6.4	-0.3	11.4	15.0
GDP deflator	19.6	15.6	8.9	6.2	19.6	32.5	27.8	25.1
Interest rate (i) ²	7.7	10.8	9.2	17.4	7.7	38.8	19.9	22.8
Interest rate (i*) ³	5.6	5.6	5.6	5.6	5.6	23.5	13.9	7.6
Primary balance ⁴	9.2	10.0	8.7	7.8	9.2	-3.6	2.9	7.5
Implicit liabilities ^{4,5}	-0.5	3.0	3.0	0.0	0.0	0.0	0.0	0.0
Turkey								
Exchange rate ¹	0.7	0.0	0.0	0.0	0.7	116.4	13.1	-14.6
Real GDP growth	7.4	5.0	5.0	5.0	7.4	-7.4	8.0	5.9
GDP deflator	5.4	7.0	5.0	5.0	5.4	26.8	42.2	56.8
Interest rate (i) ²	24.6	22.9	22.2	22.4	24.6	90.1	112.4	122.9
Interest rate (i*) ³	6.6	6.6	6.6	6.6	6.6	9.5	9.5	9.5
Primary balance ⁴	6.5	6.5	6.5	6.5	6.5	5.5	5.5	5.5
Implicit liabilities ^{4,5}	-0.5	3.0	3.0	0.0	-0.5	3.0	3.0	0.0
Uruguay								
Exchange rate ¹	-10.2	2.7	2.8	0.0	-10.2	84.2	7.8	-9.9
Real GDP growth	6.6	4.6	4.2	2.8	6.6	-1.1	0.2	1.2
GDP deflator	1.7	5.1	3.8	4.0	1.7	15.0	14.8	3.8
Interest rate (i) ²	-6.9	6.5	6.3	8.6	-6.9	9.9	9.5	19.8
Interest rate (i*) ³	7.4	7.4	7.4	7.4	7.4	15.0	15.0	15.0
Primary balance ⁴	3.9	3.7	4.0	4.0	3.9	0.1	2.7	3.8
Implicit liabilities ^{4,5}	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

1. Variation of national currency per US dollar.

2. Nominal domestic interest rate.

3. Nominal external interest rate.

4. As a percentage of GDP.

5. Recognition of implicit or contingent liabilities.

Source: Author's calculations based on IMF data.

Table 4

Comparison of stress scenarios

	Brazil				Colombia				Indonesia			
	2005	2006	2007	2008	2005	2006	2007	2008	2005	2006	2007	2008
Base scenario ¹	0.69	0.65	0.61	0.59	0.44	0.42	0.41	0.40	0.35	0.29	0.26	0.24
Replica												
Under current structure	0.69	0.74	0.74	0.73	0.44	0.48	0.50	0.49	0.35	0.32	0.30	0.29
Under counterfactual	0.60	0.76	0.79	0.83	0.44	0.49	0.51	0.49	0.34	0.31	0.30	0.28
Gap ²	-0.09	0.02	0.04	0.10	-0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
Two standard deviations												
Under current structure	0.69	0.73	0.69	0.68	0.44	0.48	0.50	0.53	0.35	0.29	0.23	0.19
Under counterfactual	0.60	0.76	0.74	0.73	0.44	0.50	0.52	0.55	0.34	0.28	0.23	0.19
Gap ²	-0.09	0.04	0.04	0.05	-0.01	0.01	0.02	0.02	0.00	0.00	0.00	0.00
Aggregated stress												
Under current structure	0.69	0.81	0.84	0.83	0.44	0.55	0.54	0.51	0.35	0.43	0.37	0.29
Under counterfactual	0.60	0.89	0.95	0.93	0.44	0.59	0.59	0.56	0.34	0.41	0.35	0.28
Gap ²	-0.09	0.08	0.11	0.10	-0.01	0.04	0.05	0.05	0.00	-0.02	-0.02	-0.02

1. Under current debt composition.

2. Represents the difference between the stress under 2002 debt composition (counterfactual) and the stress under current debt composition.

Source: Author's calculations based on national data.

Table 4 (cont)

Comparison of stress scenarios

	Russia				Turkey				Uruguay			
	2005	2006	2007	2008	2005	2006	2007	2008	2005	2006	2007	2008
Base scenario ¹	0.15	-0.01	-0.12	-0.20	0.57	0.52	0.46	0.44	0.72	0.68	0.65	0.62
Replica												
Under current structure	0.15	0.35	0.28	0.13	0.57	0.96	1.09	1.20	0.72	1.27	1.33	1.30
Under counterfactual	0.16	0.41	0.33	0.18	0.47	0.95	1.11	1.18	0.72	1.31	1.37	1.34
Gap ²	0.02	0.06	0.05	0.04	-0.10	0.00	0.03	-0.01	0.00	0.04	0.05	0.04
Two standard deviations												
Under current structure	0.15	0.18	0.09	-0.01	0.57	0.82	1.18	1.77	0.72	0.93	1.01	1.09
Under counterfactual	0.16	0.21	0.11	0.00	0.47	0.69	0.99	1.47	0.72	0.95	1.03	1.11
Gap ²	0.02	0.03	0.02	0.01	-0.10	-0.13	-0.19	-0.30	0.00	0.02	0.02	0.03
Aggregated stress												
Under current structure	0.15	0.25	0.18	0.06	0.57	0.72	0.69	0.12	0.72	1.18	1.14	0.98
Under counterfactual	0.16	0.29	0.22	0.09	0.47	0.68	0.66	0.11	0.72	1.21	1.18	1.01
Gap ²	0.02	0.04	0.03	0.03	-0.10	-0.04	-0.03	-0.01	0.00	0.03	0.04	0.03

1. Under current debt composition.

2. Represents the difference between the stress under 2002 debt composition (counterfactual) and the stress under current debt composition.

Source: Author's calculations based on national data.

BANCO DE ESPAÑA PUBLICATIONS

WORKING PAPERS¹

- 0626 CRISTINA BARCELÓ: A Q-model of labour demand.
- 0627 JOSEP M. VILARRUBIA: Neighborhood effects in economic growth.
- 0628 NUNO MARTINS AND ERNESTO VILLANUEVA: Does limited access to mortgage debt explain why young adults live with their parents?
- 0629 LUIS J. ÁLVAREZ AND IGNACIO HERNANDO: Competition and price adjustment in the euro area.
- 0630 FRANCISCO ALONSO, ROBERTO BLANCO AND GONZALO RUBIO: Option-implied preferences adjustments, density forecasts, and the equity risk premium.
- 0631 JAVIER ANDRÉS, PABLO BURRIEL AND ÁNGEL ESTRADA: BEMOD: A dsge model for the Spanish economy and the rest of the Euro area.
- 0632 JAMES COSTAIN AND MARCEL JANSEN: Employment fluctuations with downward wage rigidity: The role of moral hazard.
- 0633 RUBÉN SEGURA-CAYUELA: Inefficient policies, inefficient institutions and trade.
- 0634 RICARDO GIMENO AND JUAN M. NAVE: Genetic algorithm estimation of interest rate term structure.
- 0635 JOSÉ MANUEL CAMPA, JOSÉ M. GONZÁLEZ-MÍNGUEZ AND MARÍA SEBASTIÁ-BARRIEL: Non-linear adjustment of import prices in the European Union.
- 0636 AITOR ERCE-DOMÍNGUEZ: Using standstills to manage sovereign debt crises.
- 0637 ANTON NAKOV: Optimal and simple monetary policy rules with zero floor on the nominal interest rate.
- 0638 JOSÉ MANUEL CAMPA AND ÁNGEL GAVILÁN: Current accounts in the euro area: An intertemporal approach.
- 0639 FRANCISCO ALONSO, SANTIAGO FORTE AND JOSÉ MANUEL MARQUÉS: Implied default barrier in credit default swap premia. (The Spanish original of this publication has the same number.)
- 0701 PRAVEEN KUJAL AND JUAN RUIZ: Cost effectiveness of R&D and strategic trade policy.
- 0702 MARÍA J. NIETO AND LARRY D. WALL: Preconditions for a successful implementation of supervisors' prompt corrective action: Is there a case for a banking standard in the EU?
- 0703 PHILIP VERMEULEN, DANIEL DIAS, MAARTEN DOSSCHE, ERWAN GAUTIER, IGNACIO HERNANDO, ROBERTO SABBATINI AND HARALD STAHL: Price setting in the euro area: Some stylised facts from individual producer price data.
- 0704 ROBERTO BLANCO AND FERNANDO RESTOY: Have real interest rates really fallen that much in Spain?
- 0705 OLYMPIA BOVER AND JUAN F. JIMENO: House prices and employment reallocation: International evidence.
- 0706 ENRIQUE ALBEROLA AND JOSÉ M.ª SERENA: Global financial integration, monetary policy and reserve accumulation. Assessing the limits in emerging economies.
- 0707 ÁNGEL LEÓN, JAVIER MENCÍA AND ENRIQUE SENTANA: Parametric properties of semi-nonparametric distributions, with applications to option valuation.
- 0708 ENRIQUE ALBEROLA AND DANIEL NAVIA: Equilibrium exchange rates in the new EU members: external imbalances vs. real convergence.
- 0709 GABRIEL JIMÉNEZ AND JAVIER MENCÍA: Modelling the distribution of credit losses with observable and latent factors.
- 0710 JAVIER ANDRÉS, RAFAEL DOMÉNECH AND ANTONIO FATÁS: The stabilizing role of government size.
- 0711 ALFREDO MARTÍN-OLIVER, VICENTE SALAS-FUMÁS AND JESÚS SAURINA: Measurement of capital stock and input services of Spanish banks.
- 0712 JESÚS SAURINA AND CARLOS TRUCHARTE: An assessment of Basel II procyclicality in mortgage portfolios.
- 0713 JOSÉ MANUEL CAMPA AND IGNACIO HERNANDO: The reaction by industry insiders to M&As in the European financial industry.
- 0714 MARIO IZQUIERDO, JUAN F. JIMENO AND JUAN A. ROJAS: On the aggregate effects of immigration in Spain.
- 0715 FABIO CANOVA AND LUCA SALA: Back to square one: identification issues in DSGE models.
- 0716 FERNANDO NIETO: The determinants of household credit in Spain.
- 0717 EVA ORTEGA, PABLO BURRIEL, JOSÉ LUIS FERNÁNDEZ, EVA FERRAZ AND SAMUEL HURTADO: Actualización del modelo trimestral del Banco de España.
- 0718 JAVIER ANDRÉS AND FERNANDO RESTOY: Macroeconomic modelling in EMU: how relevant is the change in regime?

1. Previously published Working Papers are listed in the Banco de España publications catalogue.

- 0719 FABIO CANOVA, DAVID LÓPEZ-SALIDO AND CLAUDIO MICHELACCI: The labor market effects of technology shocks.
- 0720 JUAN M. RUIZ AND JOSEP M. VILARRUBIA: The wise use of dummies in gravity models: Export potentials in the Euromed region.
- 0721 CLAUDIA CANALS, XAVIER GABAIX, JOSEP M. VILARRUBIA AND DAVID WEINSTEIN: Trade patterns, trade balances and idiosyncratic shocks.
- 0722 MARTÍN VALLCORBA AND JAVIER DELGADO: Determinantes de la morosidad bancaria en una economía dolarizada. El caso uruguayo.
- 0723 ANTON NAKOV AND ANDREA PESCATORI: Inflation-output gap trade-off with a dominant oil supplier.
- 0724 JUAN AYUSO, JUAN F. JIMENO AND ERNESTO VILLANUEVA: The effects of the introduction of tax incentives on retirement savings.
- 0725 DONATO MASCIANDARO, MARÍA J. NIETO AND HENRIETTE PRAST: Financial governance of banking supervision.
- 0726 LUIS GUTIÉRREZ DE ROZAS: Testing for competition in the Spanish banking industry: The Panzar-Rosse approach revisited.
- 0727 LUCÍA CUADRO SÁEZ, MARCEL FRATZSCHER AND CHRISTIAN THIMANN: The transmission of emerging market shocks to global equity markets.
- 0728 AGUSTÍN MARAVALL AND ANA DEL RÍO: Temporal aggregation, systematic sampling, and the Hodrick-Prescott filter.
- 0729 LUIS J. ÁLVAREZ: What do micro price data tell us on the validity of the New Keynesian Phillips Curve?
- 0730 ALFREDO MARTÍN-OLIVER AND VICENTE SALAS-FUMÁS: How do intangible assets create economic value? An application to banks.
- 0731 REBECA JIMÉNEZ-RODRÍGUEZ: The industrial impact of oil price shocks: Evidence from the industries of six OECD countries.
- 0732 PILAR CUADRADO, AITOR LACUESTA, JOSÉ MARÍA MARTÍNEZ AND EDUARDO PÉREZ: Proyecciones de la tasa de actividad.
- 0733 PALOMA ACEVEDO, ENRIQUE ALBEROLA AND CARMEN BROTO: Local debt expansion... vulnerability reduction? An assessment for six crises-prone countries.

BANCO DE ESPAÑA
Eurosistema

Unidad de Publicaciones
Alcalá, 522; 28027 Madrid
Telephone +34 91 338 6363. Fax +34 91 338 6488
e-mail: publicaciones@bde.es
www.bde.es