DOCUMENTO DE TRABAJO

BALANCE SHEET EFFECTS AND THE COUNTRY RISK PREMIUM: AN EMPIRICAL INVESTIGATION

Documento de Trabajo n.º 0316

Juan Carlos Berganza, Roberto Chang
and Alicia García Herrero

BANCO DE ESPAÑA
SERVICIO DE ESTUDIOS

BALANCE SHEET EFFECTS AND THE COUNTRY RISK PREMIUM: AN EMPIRICAL INVESTIGATION (1)

Documento de Trabajo nº 0316

Juan Carlos Berganza (2), Roberto Chang (3)
and Alicia García Herrero (4)

(1) We would like to thank Raquel Carrasco for her valuable suggestions and Lucía Cuadro for her excellent research assistance. We are also grateful for comments from Guillermo Le Fort, Klaus Schmidt-Hebbel, Ugo Panizza, Javier Valles, an anonymous referee, and participants to seminars in the Kiel Institute of World Economics, Banco de España, and the Euro-Latin IADB network on regional integration. Remaining errors are only ours. Finally, the opinions expressed are those of the authors' and do not necessarily reflect those of the Banco de España.
(2) Banco de España (jcberganza@bde.es)
(3) Rutgers University.(chang@econ.rutgers.edu). Much of Chang's work for this project was completed while a visiting scholar at Banco de España, whose hospitality he acknowledges with gratitude. He also thanks the National Science Foundation for financial support.
(4) Banco de España (alicia.garcia-herrero@bde.es)

BANCO DE ESPAÑA
SERVICIO DE ESTUDIOS

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

ISSN: 0213-2710 (print)
ISSN: 1579-8666 (online)
Depósito legal: M. 55150-2003
Imprenta del Banco de España

Abstract

This paper investigates empirically whether there is a negative relationship between a country's risk premium and the balance sheet effect, as implied by recent theories emphasizing financial imperfections. We find evidence that balance sheet effects, stemming from the increase in the external debt service after an unexpected real depreciation, significantly raise the risk premium. We also show that the increase in the risk premium is not due to the debt service as such. While the result holds for the whole sample, we show that it is mainly driven by those countries with the largest financial imperfections, as argued by imperfect capital market theories. Particularly large real depreciations also seem to be disproportionately important, meaning that the balance sheet effects may be strongest at times of economic crisis, when large devaluations occur.

1. INTRODUCTION

Conventional open economy models, and in particular the influential Mundell-Fleming model, imply that a real devaluation switches demand towards domestic production and is expansionary. But recent theories on credit constraints and balance sheet effects have challenged this view. The argument starts with the observation that if a country has a large debt with the rest of the world, and the value of the debt depends on the real exchange rate, a devaluation causes a fall in the country's net worth. In the presence of financial imperfections, the balance sheet effect of a devaluation implies an increase in the cost of credit, a fall in aggregate demand, and hence a contraction in economic activity[5]. This mechanism may be particularly strong in emerging countries since these countries generally borrow in foreign currency and are subject to sharp real exchange rate depreciations (or devaluations).

Recent theoretical studies have developed the above argument in some detail; noteworthy contributions include Aghion, Bacchetta and Banerjee (2001), and Céspedes, Chang and Velasco (2000). The empirical evidence is, however, scarce at this point, although sorely needed since the theory by itself cannot determine whether the balance sheet effect of a devaluation is strong enough to reverse conventional wisdom.

This paper is an attempt to investigate the issue empirically. Our approach is to test whether balance sheet effects that emerge when the value of the external debt burden changes due to a real exchange depreciation significantly increase country risk in emerging countries. An affirmative answer is supported by our evidence.

For a panel of emerging economies in the last decade, we construct a "balance sheet" variable by computing the change in the value of the debt service associated with unanticipated real depreciations. We find that this variable is significant in explaining the variation of the cost of credit in those economies. We argue that our findings are not due to the effect of the amount of debt owed, and that the impact of the balance sheet effects of a real depreciation are stronger during economic crises and in countries with higher degrees of financial imperfections. These results should obviously be corroborated by further work, but seem highly stimulating and relevant to current debates.

[5] Country risk excludes the changes that might occur in US interest rates, which are obviously exogenous. The external cost of credit includes both.

The only paper that attempts an empirical exercise similar to ours is Bleakley and Cowan (2002) but it differs from ours in substantial ways. Bleakley and Cowan investigated a panel of firms from Latin America countries, and hence focused on micro data, as opposed to our work which is based on macro data. Bleakley and Cowan focused on investment, not the cost of credit. And, finally, their results are quite different: they found that firms with a larger amount of debt in dollar tend to invest more after a real depreciation, which runs contrary to the implications of the recent literature on credit constraints although the authors do not control for the degree of constraints for each firm. Our results, in turn, are much more supportive of that literature.

Section 2 offers a simple theoretical framework for our empirical test. Section 3 describes the data used and the empirical challenges. Section 4 offers the findings. Finally, Section 5 draws some preliminary conclusions and points to venues of future research.

2. THEORETICAL AND EMPIRICAL FRAMEWORK

This section illustrates with a very simple theoretical framework the implications of recent theories on the interaction between balance sheet effects, dollarized liabilities, and exchange rates that justify our empirical focus. Consider a small open economy, indexed by i, whose residents borrow in the international capital markets. One may assume that the borrowing amount is fixed in terms of an international currency (henceforth called *dollar*). We denote by η_{it} the spread between the interest rate charged to that borrower and the world interest rate, or *risk premium* for short. The key question we address is whether there is an inverse relation between the risk premium and the value of the borrower´s own funds available for investment:

$$1 + \eta_{it} = \Psi(\omega_{it}) \qquad (1)$$

where Ψ is a strictly decreasing function and ω_{it} denotes real net worth, that is, net worth measured in terms of the country´s final (consumption or investment) goods. Final goods are assumed to be a composite of tradables and nontradables.

Equation (1) is the hallmark of recent theories of balance sheet effects and financial imperfections and can be justified in at least two different but related ways. The first one, associated with the work of Cespedes, Chang and Velasco (2000), and Gertler, Gilchrist and Natalucci (2001), and others, stresses the effects of a devaluation on the financial agency costs

due to asymmetric information or imperfect enforcement: the smaller a borrower´s net worth, the more he or she needs to rely on external finance, which increases agency costs. Since the international capital market is assumed to be competitive and foreign lenders base their decisions on their opportunity cost of funds, higher expected agency costs raise the risk premium. A slightly different view, associated with Hart and Moore (1994) and Kiyotaki and Moore (1997), is that the costs of borrowing decrease in the value of the collateral that the borrower can post against the loan. If collateral is given by the real value of the borrower´s net assets, (1) follows.

Recent international macro models take the above formulation as a starting point, and add the observation that international debt obligations are very often "dollarized", that is, denominated in foreign currency. Under such circumstances, which are typical of emerging economies, a real exchange depreciation can easily reduce the dollar value of domestic net worth so that, under (1), the cost of credit must increase relative to the world interest rate (i.e., the country risk must rise). To see how that implication is derived, let us assume that the net worth can be expressed as

$$\omega_{it} = Z_{it} - D^*_{it} X_{it} \qquad (2)$$

where D^*_{it} is the country´s debt, in dollars, due in period t, X_{it} is the *real exchange rate* (the price of dollars in terms of the country´s final good), and Z_{it} denotes other determinants of net worth in period t. Let $\bar{\eta}_i$ and $\bar{\omega}_i$ denote the mean values of η_{it} and ω_{it}. Then, taking a linear approximation to (1) around $\bar{\omega}_i$,

$$\begin{aligned} 1 + \eta_{it} &\approx \Psi(\bar{\omega}_i) + \Psi' \ (\omega_{it} - \bar{\omega}_i) \\ &\equiv \alpha \ - \beta \omega_{it} \\ &= \alpha - \beta Z_{it} + \beta \ D^*_{it} X_{it} \qquad (3) \end{aligned}$$

where $\beta = -\Psi'$ denotes the negative of the first derivative of Ψ evaluated at $\bar{\omega}_i$, α is a constant, and the last equality follows from (2).

The value of β is of particular interest, as it is crucial for the recent debate on the implications of a real exchange depreciation. If country *i* has a substantial debt burden in dollar, a real depreciation (an increase in X_{it}) will make *i's* net worth fall, ceteris paribus. Then, if β is

significantly positive, the risk premium η_{it} must increase. This reasoning, however, is based on the crucial assumption of a positive β. In reality, these theories do not necessarily predict that β should be different from zero: in the absence of financial imperfections, there should be no connection between the cost of credit and *i's* net worth, and β should be zero. In turn, β should be larger than zero if there are financial imperfections. Our empirical work will, therefore, focus on testing whether β is significantly positive and in which circumstances, in terms of financial imperfections. This requires further elaboration of the basic relationship (3).

The immediate empirical problem is that the net worth is not directly observable: while it depends on the external debt burden, it may also depend on other variables, such as the amount of current resources available to reduce the need for external finance. In practice, these other variables (which we have collapsed into the variable Z_{it}) are very difficult to observe. So we proceed in a slightly different direction.

A convenient assumption to reach a testable equation is that D^*_{it} is predetermined as of period t. Then, taking the expectation of (3) conditional on information available at $t-1$, and subtracting the result from (3), we get:

$$\eta_{it} = E_{t-1}\eta_{it} + \beta\, D^*_{it}(X_{it} - E_{t-1}X_{it}) + \varepsilon_{it} \qquad (4)$$

where $E_{t-1}(\cdot)$ denotes the conditional expectation operator, and $\varepsilon_{it} = \beta\,(Z_{lt} - E_{t-1}Z_{lt})$ is the unexpected component of $\beta\ Z_{it}$.

Equation (4) simply decomposes the unexpected change in *i's* country risk into two components. The first is the impact of an unanticipated increase in the external debt burden, given by a linear function of the debt burden times the unexpected real depreciation. The second component is the effect of unanticipated changes in other components of net worth. If we treated the latter as an unobservable shock, we could estimate equation (4) provided that ε_{it} is uncorrelated with $D^*_{it}(X_{it} - E_{t-1}X_{it})$. Since D^*_{it} is assumed to be predetermined, the latter condition would imply that ε_{it} be uncorrelated with $X_{it} - E_{t-1}X_{it}$. As a first step, we assume this to be the case,

but we will test for omitted variables in the empirical part. There, we shall also relax the assumption that the debt burden is predetermined.

To implement equation (4) econometrically, we resort to two further approximations. First, we replace the expectation of the country risk in t-1, $E_{t-1}\eta_{it}$, with a linear function of predetermined variables, $\gamma_i' Y_{i,t-1}$ (where $Y_{i,t-1}$ and γ_i are conformable vectors). Second, we replace the term $E_{t-1}X_{it}$ with $X_{i,t-1}$; this is likely to entail little loss, since real exchange rates are usually very close to random walks, at least in the case of pure floats or fixed exchange regimes[6]. In the case of intermediate regimes, the lack of hedging opportunities in many emerging countries could make this assumption less restrictive than thought at first sight.

The resulting equation to estimate is:

$$\eta_{it} = \beta S_{it} + \gamma' Y_{i,t-1} + \varepsilon_{it} \qquad (5)$$

where $S_{it} = D_{it}^{*}(X_{it} - X_{it-1})$ is interpreted as the change in the value of country's *i's* external debt burden due to an unanticipated real exchange depreciation in period *t*. As already mentioned, our key concern is whether the impact of the balance sheet effects on the cost of credit, the coefficient β, is significantly positive and whether this depends on the degree of financial imperfections.

3. THE DATA

The empirical implementation of equation (5) involves several data difficulties, the main one being related to measuring the risk premium variable (η_{it}). That variable represents, in theory, the cost of credit on the marginal funding for country *i* during year *t*. In practice, unfortunately, available measures of the cost of credit seem very far from that ideal. The best available proxy, and the most widely used in the literature, are the returns implicit in the Emerging Markets Bonds Indices (EMBI), provided by JP Morgan. For each country and year in that dataset we construct a credit spread measure (COSTBORROWING) by subtracting total returns on US Treasury bonds from that country's EMBI returns. We limited our sample to countries with at least four observations of EMBI returns, which reduces the sample to twenty-seven countries. Ten of them

[6] The exception would be crawling pegs.

have data from 1993, when the EMBI started being produced and all countries have data for the last year, 2002. Given this data constraints, the total sample is composed of 203 yearly observations. Table 1 in Appendix 1 lists the countries and the data availability while Appendix 2 offers a detailed description of the variable definitions and sources.

To proxy for the balance sheet term S_{it} in equation (5), we construct a variable called BALANCESHEET, which is an interaction term, namely the product of EXSURPRISE and DEBT*. EXSURPRISE equals the change in *i's* real exchange rate (EX as defined in Appendix 2) between year *t* and year *t-1*, and DEBT* is the US dollar value of i's debt service due in year *t* divided by *i's* GDP in 1995 prices. The latter is done to avoid country's size determining the results.

Finally, (5) includes the vector Y_{it-1} of predetermined variables that help predict the risk premium in t. In principle, any variable available in period *t-1* may be included in that vector, as long as it helps predicting η_{it}. We limited attention, however, to the level of the risk premium in t-1 (COSTBORROWING_1), given its high persistence and the real GDP in t-1 (RGDP_1). We also include other control variables, which are: the global JP Morgan index for emerging countries (EMBIWORLD), as a proxy for the cost of borrowing for all emerging countries as asset class; and the level of international reserves in real terms (RRES). At a later stage, we shall also include the increase in the dollar value of exports (ΔEXPORT) to control for changes in other aspects of net wealth related to the real exchange depreciation. This will reduce the probability of a bias when estimating β because of omitted variables.

As a first step, in estimating β via OLS, we assume that the error term ε_{it} is uncorrelated with S_{it} or, in other words, that unexpected changes in net worth, other than the balance sheet effect of a real depreciation, are uncorrelated with the latter. Given the potential restrictiveness of this hypothesis, we test that the coefficient β does not change when potentially relevant variables (such as ΔEXPORT) is included in the regression. The fact that β does not change can be taken as tentative confirmation that the potential omitted variables problem is not biasing the coefficient of our objective variable (BALANCESHEET). In any event, we do include ΔEXPORT as additional regressors since they are found significant and add useful information.

Table 2 in Appendix 1 presents some descriptive statistics, and Table 3 the matrix of correlations between the different variables. Observe the relatively high correlation (0.43) between COSTBORROWING and BALANCESHEET; interestingly, COSTBORROWING has a lower correlation with the total amount borrowed, proxied by the debt service in current prices (DEBT*). Although no firm conclusions can be drawn from simple bi-variate correlations, it suggests, as emphasized in the theory, that it is not the amount borrowed that influences the external cost of borrowing but rather unexpected changes in net wealth. On the other hand, the correlation between COSTBORROWING and the change in real exchange rate, EXSURPRISE, is the highest of the three. Finally, the correlation of the dependent variable in t and in t-1 is very high (0.71), showing that stationarity may be an issue. Also in line with the literature, the two control variables related to positive wealth effects (ΔEXPORT and RRES) are negatively correlated with the dependent variable (-0.12 and -0.06, respectively).

Graphs 1-3 in Appendix 1 depict the evolution of COSTBORROWING against BALANCESHEET, EXSURPRISE, and DEBT from 1993 to 2002. COSTBORROWING and BALANCESHEET show a positive co-movement in a number of years, stronger in the period 1994-95 and weaker in 1997-98 and 2001-02. There is a positive co-movement between COSTBORROWING and EXSURPRISE and DEBT*, respectively, although in both cases there are clear exceptions in 1995-96, 1999 and 2000.

4. ECONOMETRIC RESULTS

4. 1. Basic Findings

The results are obtained by estimating equation (5) with pooled data. In the first regression, which is given by the middle column of Table 1, the coefficient of BALANCESHEET is positive and significant at the one percent level. Its magnitude is also reasonable in economic terms: it implies that if there is an unexpected devaluation that makes a country's debt service increase by one percent of its 1995 GDP, the cost of credit will increase by about 61 basis points, ceteris paribus. The coefficients of the control variables have the expected sign. The level of reserves reduces the cost of borrowing and is significant at the 5% level. The coefficients of EMBIWORLD and COSTBORROWING_1 are positive.

In a second regression, given by the rightmost column in Table 1, we included the year to year change in exports (ΔEXPORT) as an explanatory variable. As stressed earlier, our aim is to test whether the significance of BALANCESHEET in the regression hinges on an omitted variable problem, stemming from the effect of an unexpected variation in the real exchange rate on components of net wealth other than the value of the debt service. The most obvious such component is the increase in exports due to the impact of a real devaluation on competitiveness. While the inclusion of ΔEXPORT results in a lower estimate for the BALANCESHEET coefficient, the fall is relatively small: in fact a Wald test, shown at the bottom of Table 1, cannot reject the hypothesis of equal BALANCESHEET coefficients in the two regressions in the table at conventional significance levels. This favors the view that the significance of BALANCESHEET is not due to omitted variables bias. On the other hand, ΔEXPORT turns out to be significant in explaining the country risk premium, with the expected negative sign, so we keep it in the remaining regressions.

Table 1. Baseline regression

Number of obs	177	177
R-squared	0.5733	0.5909
Dependent variable: COSTBORROWING		
COSTBORROWING_1	0.7480 ***	0.7713 ***
	(0.0618)	*(0.0613)*
EMBIWORLD	0.4373 **	0.5259 **
	(0.2142)	*(0.2129)*
RGDP_1	330.4769	219.9883
	(250.1205)	*(248.9829)*
BALANCESHEET	6093.6530 ***	4945.7070 ***
	(1375.477)	*(1415.688)*
RRES	-48.4515 **	-47.1219 **
	(23.3747)	*(22.9589)*
ΔEXPORT		-566.2357 ***
		(209.1413)
CONS	-484.3599	-387.5060
	(328.3529)	*(324.4174)*
Wald test		0.03
(p-value)		0.8689

OLS estimation
Standard errors in parenthesis
* significant at 10% ; ** significant at 5%; *** significant at 1%

Note: The Wald test assesses the equality of the coefficient of the variable balancesheet in both regressions. It is destributed as a χ^2

The next question we address is whether the significance of the BALANCESHEET variable is really due to the impact of debt accumulation on the cost of credit and not to the presence of balance sheet effects. In a way, we are testing whether the assumption of debt being predetermined is key for the results. To this end, in Table 2 we ask what, if any, is the impact of including measures of the accumulation of debt as explanatory variables in our regression. Column I reproduces our basic regression for convenience. In column II, the change in debt service in US dollar (ΔDEBT*) is included as an additional regressor. We find that ΔDEBT* is not significant and that the coefficient of BALANCESHEET is not significantly affected. The same happens when we include the real value of the debt service (DEBT*), as indicated in column III. Hence the evidence is supportive of the view that, an increase in the amount borrowed is not as relevant for the risk premium as unexpected changes in the debt service due to the variation in the real exchange rate (the balance sheet effect).

Table 2. Testing for the role of indebtness

Number of obs	177	177	177
R-squared	0.5909	0.5955	0.5909
Dependent variable: COSTBORROWING			
	(I)	**(II)**	**(III)**
COSTBORROWING_1	0.7713 ***	0.7712 ***	0.7713 ***
	(0.0613)	*(0.0598)*	*(0.0601)*
EMBIWORLD	0.5259 **	0.5263	0.5259 **
	(0.2129)	*(0.2075)*	*(0.2087)*
RGDP_1	219.9883	219.6566	219.9884
	(248.9829)	*(242.6493)*	*(244.0073)*
DEBT*			-0.0010
			(3.52476)
ΔDEBT*		(-1.7149)	
		(11,4414)	
BALANCESHEET	4945.7070 ***	4947.757 ***	4945.708 ***
	(1415.688)	*(1379.687)*	*(1387.399)*
RRES	-47.1219 **	-47.1273 **	-47.1219 **
	(22.9589)	*(22.3739)*	*(22.5001)*
ΔEXPORT	-566.2357 ***	-565.8555 **	-566.2357 ***
	(209.1413)	*(203.8285)*	*(204.9618)*
CONS	-387.5060	-387.2029	-387.506
	(324.4174)	*(316.1583)*	*(317.9343)*
Wald test		0.00	0.00
(p-value)		0.9889	0.9654

OLS regression.
Standard errors in parenthesis

* significant at 10% ; ** significant at 5%; *** significant at 1%

Note: The Wald test assesses the equality of the coefficient of the variable balancesheet in regressions II vs I and III vs I. It is destributed as a χ^2

4.2. Robustness Issues

An obvious objection to these results is that there may be a simultaneity bias. Our regression equation (5) may be only one of the equations determining equilibrium; other equations may imply that variations in the cost of borrowing affect exchange rates contemporaneously. In such a case, our estimate of the coefficient of BALANCESHEET can only be interpreted as a reduced form one, and not as giving the impact of balance sheet effects on the cost of credit.

To determine whether a simultaneity bias is a significant concern, we perform a Hausman test, which requires finding an adequate instrument for BALANCESHEET. But this implies finding an instrument for EXSURPRISE only, as the debt service is assumed to be predetermined. Of the available alternatives, the inflation rate (INFLATION) seems to be best suited to act as an instrument for EXSURPRISE. In theory, INFLATION and EXSURPRISE should be highly correlated if exchange rate pass through coefficients are constant. On the other hand, it is plausible to believe that the cost of credit does not react strongly to inflation rates. This is corroborated by Graphs 4 and 5, which show that there is a significant correlation between EXSURPRISE and INFLATION but a much weaker one between INFLATION and COSTBORROWING.

Using INFLATION as an instrument for EXSURPRISE, we run a regression with this instrumental variable, and conduct a Hausman test on the differences between the coefficients of the balance sheet variable. The basic and parallel regressions are both given in Table 3, as well as the value of the Hausman test, which does not reject the hypothesis of equality of coefficients at conventional levels. Hence, one cannot reject the hypothesis of no simultaneity bias. However, this result must be taken with some caution, since the coefficient of BALANCESHEET in the instrumental variable regression is estimated very imprecisely. It is, therefore, not clear whether the low value of the Hausman test reflects the absence of a simultaneity bias or just the large variance of the estimate of the BALANCESHEET coefficient.

Table 3. Testing for the simultaneity bias

Number of obs	177		177	
R-squared	0.5909		0.5714	
Dependent variable: COSTBORROWING				
	OLS		**IV**	
COSTBORROWING_1	0.7713	***	0.8257	***
	(0.0613)		*(0.0674)*	
EMBIWORLD	0.5259	**	0.5078	**
	(0.2129)		*(0.2181)*	
RGDP_1	219.9883		108.2206	
	(248.9829)		*(259.7695)*	
BALANCESHEET	4945.7070	***	919.8002	
	(1415.688)		*(2322.362)*	
RRES	-47.1219	**	-53.8454	**
	(22.9589)		*(23.6933)*	
ΔEXPORT	-566.2357	***	-744.3636	***
	(209.1413)		*(228.6243)*	
CONS	-387.5060		-207.7844	
	(324.4174)		*(341.7857)*	
Hausman test			4.78	
(p-value)			0.31	

IV regression: DEBT*×INFLATION used as an instrument for the variable BALANCESHEET.

Standard errors in parenthesis

* significant at 10% ; ** significant at 5%; *** significant at 1%

Note: The Hausman test assesses the equality of the coefficient of the variable balancesheet in both regressions. It is destributed as a χ^2

Note: Instrument for the variable "balancesheet" is Debt * Inflation

Another possible objection to our basic regressions is that the dependent variable, COSTBORROWING, may not be stationary. From Table 3 in Appendix 1, we know that COSTBORROWING is very persistent. On the other hand, it is hard to believe that credit spreads are integrated of order greater than zero. In any case, we run the baseline regression with COSTBORROWING in differences. As Table 4 shows, the results are not significantly affected, and BALANCESHEET remains significant at a 5% level.

Table 4. Controlling for the order of integration of the dependent variable

Number of obs	177	177
R-squared	0.5733	0.1631
Dependent variable	**COSTBORROWING**	**∆COSTBORROWING**
COSTBORROWING_1	0.7713 ***	
	(0.0613)	
EMBIWORLD	0.5259 **	0.5123 **
	(0.2129)	*(0.2208)*
RGDP_1	219.9883	378.2230
	(248.9829)	*(254.4276)*
BALANCESHEET	4945.7070 ***	3299.6270 **
	(1415.688)	*(1394.921)*
RRES	-47.1219 **	-60.0196 **
	(22.9589)	*(23.5376)*
∆EXPORT	-566.2357 ***	-676.0843 ***
	(209.1413)	*(214.7257)*
CONS	-387.5060	-627.5390 *
	(324.4174)	*(329.7444)*
Wald test		0.10
(p-value)		0.7529

OLS regression.
Standard errors in parenthesis
* significant at 10% ; ** significant at 5%; *** significant at 1%

Note: The Wald test assesses the equality of the coefficient of the variable balancesheet in both regressions. It is destributed as a χ^2

Unfortunately, the number of observations per country is too low to apply the asymptotic properties needed for a panel regression, with random or fixed effects. However, a panel regression with fixed effects is conducted with our unbalanced panel data to test for the role of unobserved heterogeneity. As shown in Table 5, the coefficient of the control variable COSTBORROWING_1 shows that the countries' idiosyncratic factors are very important to explain the persistence of the coefficient in the pooled regressions. For the rest of the coefficients, the results are very similar except for the variable ΔEXPORT which is not significant.

Table 5. Testing for the role of unobserved heterogeneity.

Number of obs	177		177	
R-squared	0.5733		0.3517	
Dependent variable: COSTBORROWING				
	Pooled data		**Fixed effects**	
COSTBORROWING_1	0.7713	***	0.3296	***
	(0.0613)		*(0.0918)*	
EMBIWORLD	0.5259	**	0.5146	***
	(0.2129)		*(0.1942)*	
RGDP_1	219.9883		652.9439	**
	(248.9829)		*(305.5127)*	
BALANCESHEET	4945.7070	***	9147.4290	***
	(1415.688)		*(1714.155)*	
RRES	-47.1219	**	-176.9099	***
	(22.9589)		*(52.7997)*	
ΔEXPORT	-566.2357	***	-206.5469	
	(209.1413)		*(215.6765)*	
CONS	-387.5060		-4951.7310	
	(324.4174)		*(344.9654)*	

OLS estimation

Standard errors in parenthesis

* significant at 10% ; ** significant at 5%; *** significant at 1%

4.3. On the Impact of Crises and Financial Development

As shown in Table 2, BALANCESHEET has a large variance. It may therefore be of interest to check whether its significance in explaining the credit spread is due to the impact of outliers. This may also be noteworthy, given the prominence of crises episodes in the recent debate and in the generation of the theory.

In Table 6 we exclude observations associated with 5% of the extreme values of EXSURPRISE (column II), DEBT* (column III) and BALANCESHEET (column IV). The coefficient of BALANCESHEET drops to the 10% level when the extreme values of BALANCESHEET or EXSURPRISE are excluded but remains significant at the 1% level when those of DEBT* are excluded. These results show that large real exchange rate surprises (treated here as outliers) are particularly detrimental in terms of an increase in the external cost of borrowing. This suggests that the balance sheet effects may be greatest at times of crisis, when large devaluations occur. Large amounts of debt do not appear to be as nearly as important.

Table 6. OLS without extreme values

Number of obs	177	168	168	168
R-squared	0.5909	0.5956	0.5907	0.5651
Dependent variable: COSTBORROWING				
	(I)	**(II)**	**(III)**	**(IV)**
COSTBORROWING_1	0.7713 ***	0.7454 ***	0.7636 ***	0.7227 ***
	(0.0613)	*(0.0540)*	*(0.0635)*	*(0.0583)*
EMBIWORLD	0.5259 **	0.5352 ***	0.5644 **	0.5185 ***
	(0.2129)	*(0.1915)*	*(0.2229)*	*(0.1863)*
RGDP_1	219.9883	41.4915	272.3117	54.5201
	(248.9829)	*(225.6729)*	*(262.8171)*	*(228.8350)*
BALANCESHEET	4945.7070 ***	2338.6970 *	6055.9660 ***	3059.9090 *
	(1415.688)	*(1365.009)*	*(1645.485)*	*(1702.886)*
RRES	-47.1219 **	38.3002 *	-46.2490 ***	-35.7364 *
	(22.9589)	*(20.3438)*	*(23.3018)*	*(20.5379)*
ΔEXPORT	-566.2357 ***	-619.7141 ***	-522.5837 **	-602.7257 ***
	(209.1413)	*(184.6994)*	*(215.8192)*	*(185.9734)*
CONS	-387.5060	-167.4934	-478.0692	-173.2618
	(324.4174)	*(291.0600)*	*(341.5268)*	*(295.3951)*

Standard errors in parenthesis

* significant at 10% ; ** significant at 5%; *** significant at 1%

Note: Regression I: OLS with all the data. Regression II: OLS excluding 5% extreme values of EXSURPRISE variable. Regression III: OLS excluding 5% extreme values of DEBT* variable. Regression IV: OLS excluding 5% extreme values of BALANCESHEET variable.

Finally, it is important to recall that the theory assigns primary importance to the degree of financial imperfections in explaining why a reduction in net worth increases the country risk premium. So far we have implicitly assumed that countries are similar in the degree of their financial imperfections, but it is interesting to explore the consequences of dropping that assumption.

As a first exercise, a measure of creditor rights, compiled by the *International Country Risk Guide* (ICRG), is used as a proxy for the degree of financial imperfections. This variable has yearly variation. CREDITORIGHTS_TOTAL is the original ICRG classification, which can vary from 0 to 12, while CREDITORIGHTS is a simplified version composed of 3 possible levels to classify countries. As Table 7 shows, both variables negatively, and significantly, affect the sovereign risk premium, other things given.

Table 7. Controlling for financial imperfections

Number of obs	177	177	177
R-squared	0.5909	0.5955	0.5948
Dependent variable: COSTBORROWING			
COSTBORROWING_	0.7713 ***	0.7235 ***	0.7448 ***
	(0.0613)	*(0.0611)*	*(0.0612)*
EMBIWORLD	0.5259 **	0.3915 *	0.3955 *
	(0.2129)	*(0.2125)*	*(0.2177)*
RGDP_1	219.9883	438.3407 *	384.3926
	(248.9829)	*(249.7730)*	*(252.9829)*
BALANCESHEET	4945.7070 ***	4458.5970 ***	4322.8080 ***
	(1415.688)	*(1382.293)*	*(1414.765)*
RRES	-47.1219 **	-43.1622 *	-46.6392 **
	(22.9589)	*(22.3129)*	*(22.6138)*
ΔEXPORT	-566.2357 ***	-520.4036 **	-573.4242 ***
	(209.1413)	*(203.4031)*	*(205.9993)*
CREDITORIGHTS		-47.0503 ***	
		(13.3174)	
CREDITORIGHTS_ TOTAL			-96.4687 ***
			(35.7396)
CONS	-387.5060	-170.1404	-267.8797
	(324.4174)	*(323.5910)*	*(325.3788)*

Standard errors in parenthesis

* significant at 10% ; ** significant at 5%; *** significant at 1%

In a second exercise, we divide the sample into three groups, from worst to better financial imperfections (proxied by the CREDITORIGHTS), and estimate our basic regression for each group. As shown in Table 8, only in the group with the worst creditor rights do balance sheet effects significantly increase the risk premium, other things given. This result expected from our theoretical framework, where changes in net worth affect the risk premium only in the presence of financial imperfections.

Table 8. Controlling for financial imperfections per country group

Number of obs	177	56	58	62
R-squared	0.5909	0.6163	0.6291	0.6989
Dependent variable: COSTBORROWING				
	(I)	**(II)**	**(III)**	**(IV)**
COSTBORROWING_1	0.7713 ***	1.0141 ***	0.5579 ***	0.6256 ***
	(0.0613)	*(0.1442)*	*(0.0645)*	*(0.0762)*
EMBIWORLD	0.5259 **	0.4603	0.3264	0.5886 **
	(0.2129)	*(0.5154)*	*(0.2547)*	*(0.2377)*
RGDP_1	219.9883	283.1467	490.0614	-239.6217
	(248.9829)	*(947.0221)*	*(306.6608)*	*(167.3363)*
BALANCESHEET	4945.7070 ***	7837.3830 **	1005.2180	341.4880
	(1415.688)	*(3251.488)*	*(1743.933)*	*(1143.936)*
RRES	-47.1219 **	-33.2864	-39.0033	-32.4217 *
	(22.9589)	*(58.6459)*	*(27.2231)*	*(17.1944)*
ΔEXPORT	-566.2357 ***	469.3215	-759.0974 ***	-234.5716
	(209.1413)	*(472.8350)*	*(273.3566)*	*(197.8651)*
Cons	-387.5060	-553.2324	-464.2393	118.5409
	(324.4174)	*(1106.189)*	*(386.3817)*	*(203.6649)*

OLS estimation

Standard errors in parenthesis

* significant at 10% ; ** significant at 5%; *** significant at 1%

Note: We have divided the sample into three subsamples according to the quality of CREDITORIGHTS. Regression I: all countries included. Regression II: only countries with worst CREDITORIGHTS Regression III: only countries with average CREDITORIGHTS. Regression IV: only countries with best CREDITORIGHTS.

5. FINAL REMARKS AND FURTHER RESEARCH

This paper tests empirically whether, as implied by recent theories of imperfect capital markets, there is a negative relationship between a country's risk premium and balance sheet effects, in the presence of financial imperfections. We find evidence that balance sheet effects (i.e., the increase in the debt service because of an unexpected real depreciation) significantly raise the risk premium, other things given. On the whole, the evidence is supportive. However, further research should be directed at confirming or refuting our results.

If one accepts our evidence that balance sheet effects are significant for the cost of credit, the policy implications are severe. There is an argument to avoid sharp changes in the real exchange rate unless financial imperfections are small, in the line suggested by Hausmann, Panizza and Stein (2000) in the literature of original sin.

Given the frequency of large real exchange rate depreciations in emerging countries, this issue is clearly worth a deeper look. There are several venues for further research. First, an analysis of the net effect of a real depreciation seems warranted, which includes both balance sheet effects and competitiveness into one single coefficient. In our study both coefficients are significant (except when fixed effects are included which takes away the significance of the competitiveness factor) and with the expected opposite sign but we cannot say which one is larger. Second, the impact of domestic dollarization and its interrelation with external dollarization needs further theoretical analysis. Third, it would be interesting to test whether a particular exchange rate regime reduces the impact of balance sheet effects on country risk, as argued by Céspedes, Chang and Velasco (2000). Finally, the definition of financial imperfections, key in these types of models, would also need to be expanded from creditor rights to broader measures.

REFERENCES

AGHION, BACCHETTA and BANERJEE, (2001). "A Corporate Balance-Sheet Approach to Currency Crises", *Working Paper* Nº 01-5, Study Center Gerzensee.

BLEAKLEY and COWAN, (2002). "Corporate dollar debt and depreciations: much ado about nothing?", *Working Papers,* Nº 02-5, Federal Reserve Bank of Boston.

BERNANKE and GERTLER,(1989). "Agency Costs, Net Worth, and Business Fluctuations", *The American Economic Review,* Vol. 79, Nº 1, pp. 14-31.

CÉSPEDES, CHANG and VELASCO (2000). "Balance Sheet Effects and Exchange Rate Policy", NBER *Working Paper* Nº 7840.

GERTLER, GILCHRIST and NATALUCCI (2001). "External Constraints on Monetary Policy and the Financial Accelerator", mimeo.

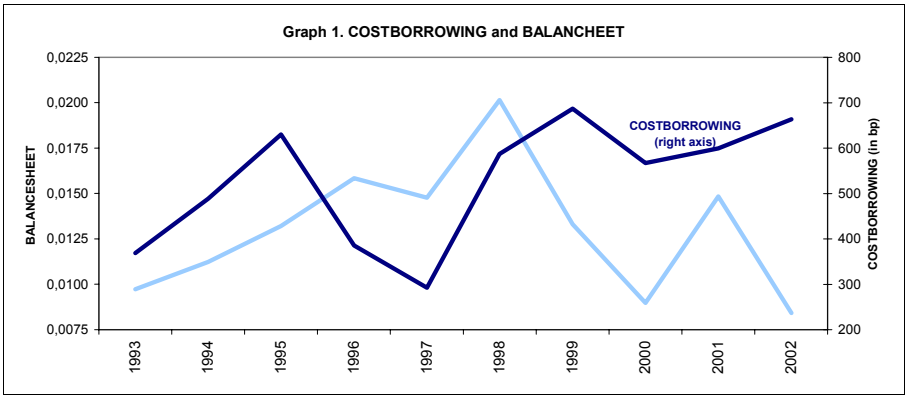
HART and MOORE (1994). "A Theory of Debt Based on the Inalienability of Human Capital". *The Quarterly Journal of Economics,* Vol. 109, Nº 4, pp. 841-879.

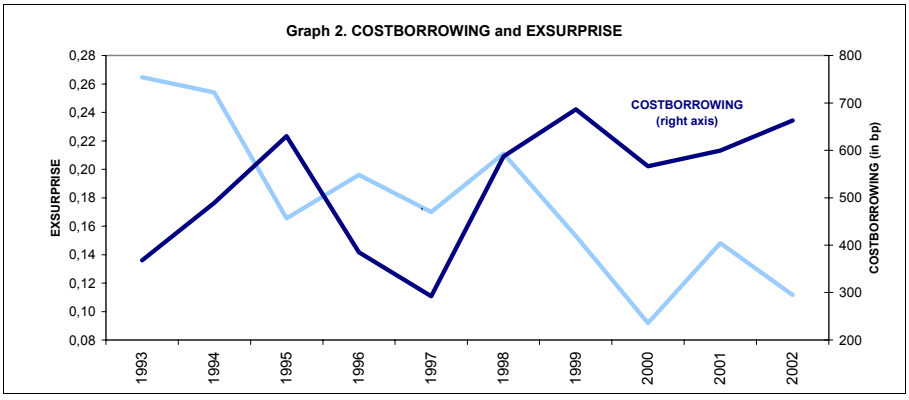
HAUSMANN, PANIZZA and STEIN (2000), "Why do Countries Float the Way They Float?", Research Department Inter-American Development Bank *Working Paper* Nº 418.

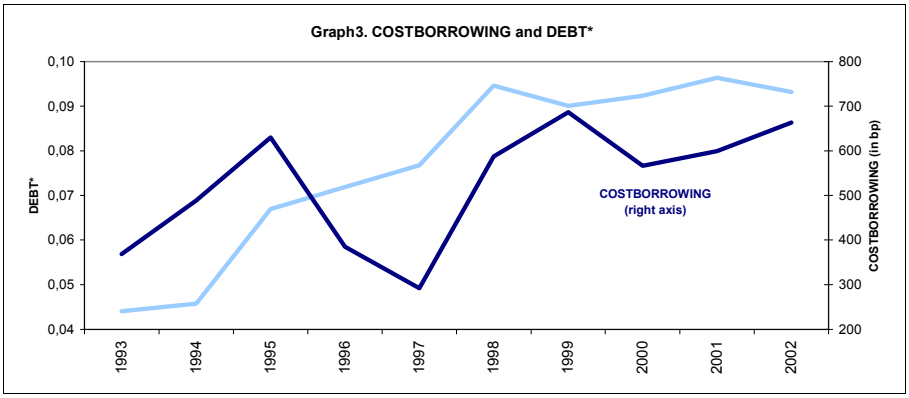
KIYOTAKI and MOORE, (1997). "Credit Cycles", *Journal of Political Economy,* 1997, Vol. 105 Nº 2, pp. 211-248.

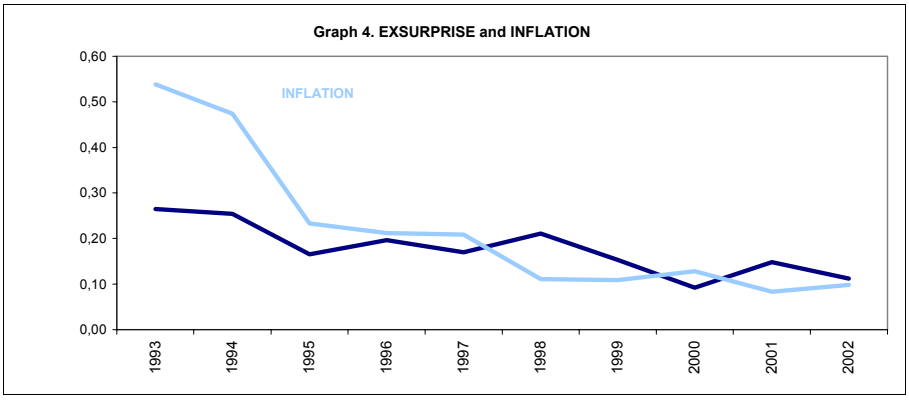
Appendix 1

Stylized facts and robustness tests






Graph3. COSTBORROWING and DEBT*
0,10
0,09
0,08
0,07
0,06
0,05
0,04
DEBT*
800
700
600
500
400
300
200
COSTBORROWING (in bp)
COSTBORROWING
(right axis)
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002


Graph 4. EXSURPRISE and INFLATION
0,60
0,50
0,40
0,30
0,20
0,10
0,00
INFLATION
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002

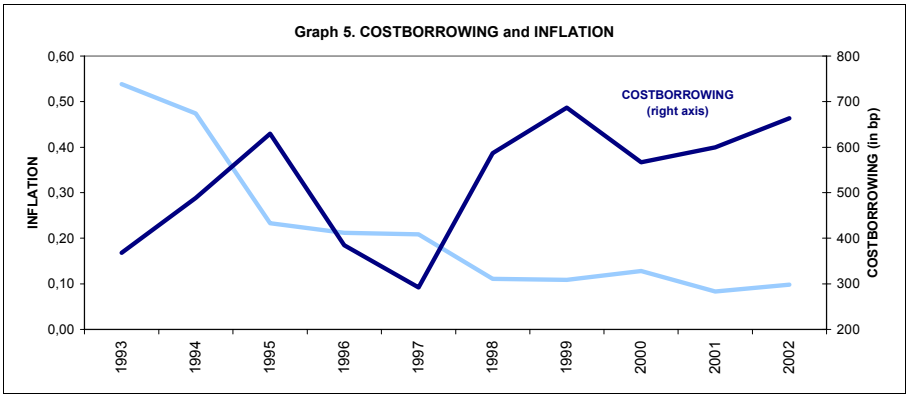

Graph 5. COSTBORROWING and INFLATION
INFLATION
COSTBORROWING (in bp)
COSTBORROWING
(right axis)
0,60
0,50
0,40
0,30
0,20
0,10
0,00
800
700
600
500
400
300
200
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002

Table 1. Countries and years included

Country name	*Years*	*Number of years*
Algeria	1999-2002	4
Argentina	1993-2002	10
Brazil	1993-2002	10
Bulgaria	1994-2002	9
Chile	1999-2002	4
China	1994-2002	9
Colombia	1997-2002	6
Cote D´Ivoire	1998-2002	5
Croatia	1996-2002	7
Ecuador	1995-2002	8
Malaysia	1996-2002	7
Mexico	1993-2002	10
Morocco	1997-2002	6
Nigeria	1996-2002	7
Panama	1996-2002	7
Peru	1997-2002	6
Philippines	1993-2002	10
Poland	1994-2002	9
Republic of Lebanon	1998-2002	5
Russian Federation	1997-2002	6
Slovakia	1993-2002	10
South Africa	1994-2002	9
South Korea	1993-2002	10
Thailand	1997-2002	6
Turkey	1996-2002	7
Venezuela	1993-2002	10
Zimbabwe	1997-2002	6
No. of observations		203

Table 2. Descriptive Statistics of the regression variables

Variable	*No. Obs.*	*Mean*	*Std. Deviation*	*Minimun*	*Maximun*
COSTBORROWING	203	548.7588	516.3456	60.233	3925.75
EMBIWORLD	203	615.4016	138.0896	352.7197	1007.554
RGDP	203	1.086323	0.1193713	0.8032234	1.595363
DEBT*	203	0.0838068	0.0397401	0.0157412	0.2695656
∆DEBT*	203	0.0531654	0.2448129	-0.8825761	1.247985
EXSURPRISE	203	0.1615187	0.2293617	-0.1386505	1.400133
BALANCESHEET	203	0.0132571	0.0198881	-0.0122493	0.1159719
∆EXSURPRISE	203	0.1963108	0.3884993	-0.0945891	2.943017
DEBT95	203	0.0890805	0.0430229	0.0175663	0.2826906
INFLATION	203	0.168791	0.37033	-0.0432768	3.152852
RRES	203	1.475911	1.149342	0.1228686	9.046
∆EXPORT	203	0.0597161	0.1334132	-0.4543486	0.5876541
CREDITORIGHTS	203	7273632	2123617	2	12

Table 3. Matrix of Correlation

	COSTBOR-ROWING	*COSTBOR-ROWING_1*	*EMBI WORLD*	*RGDP*	*DEBT**	*∆DEBT**	*EXSUR-PRISE*	*BALANCE SHEET*	*∆SURPRISE*	*DEBT95*	*INFLATION*	*RRES*	*∆EXPORT*	*CREDITO RIGTHS*
COSTBORROWING	1.0000													
COSTBORROWING_1	0.7062	1.0000												
	0.0000													
EMBIWORLD	0.1580	0.0456	1.0000											
	0.0244	0.5469												
RGDP□	-0.2331□	-0.2384□	-0.0512□	1.0000										
	0.1033	0.0030	0.6009											
DEBT*	0.2023	0.1849	0.0002	0.1578	1.0000									
	0.0038	0.0137	0.9975	0.0245										
∆DEBT*	-0.1661	-0.1345	0.0078	-0.0682	0.1544	1.0000								
	0.0178	0.0742	0.9119	0.3334	0.0278									
EXSURPRISE	0.4838	0.3513	-0.0205	-0.3857	-0.0308	-0.0082	1.0000							
	0.0000	0.0000	0.7716	0.0000	0.6627	0.9070								
BALANCESHEET	0.4290	0.3036	-0.0072	-0.2780	0.2948	0.0204	0.8278	1.0000						
	0.0000	0.0000	0.9183	0.0001	0.0000	0.7724	0.0000							
∆SURPRISE	0.2644	0.2353	0.0346	-0.3331	-0.0615	0.0765	0.8582	0.6227	1.0000					
	0.0001	0.0016	0.6243	0.0000	0.3835	0.2781	0.0000	0.0000						
DEBT95	0.3245	0.2351	0.0162	0.1266	0.8762	0.1258	0.1488	0.4554	0.0024	1.0000				
	0.0000	0.0016	0.8181	0.0719	0.0000	0.0738	0.0341	0.0000	0.9732					
INFLATION	0.2060	0.2844	-0.0404	-0.3354	-0.0519	0.0121	0.6802	0.4249	0.7278	-0.0147	1.0000			
	0.0032	0.0001	0.5669	0.0000	0.4623	0.8641	0.0000	0.0000	0.0000	0.8348				
RRES	-0.0633	0.0608	-0.0391	0.3386	0.1969	-0.0759	-0.1827	-0.1100	-0.1116	0.0087	-0.1229	1.0000		
	0.3695	0.4212	0.5799	0.0000	0.0049	0.2818	0.0091	0.1182	0.1128	0.9015	0.0807			
∆EXPORT	-0.1242	0.0929	0.1387	-0.0797	-0.1114	0.0930	-0.1986	-0.2381	-0.1266	-0.1810	0.0601	0.1017	1.0000	
	0.0774	0.2189	0.0485	0.2584	0.1136	0.1867	0.0045	0.0006	0.0719	0.0097	0.3944	0.1487		
CREDITORIGTHS	-0.3829	-0.3040	-0.1474	0.4764	0.0827	-0.0116	0.2864	-0.2236	-0.1926	0.0533	-0.1874	1.607	-0.0611	1.000
	0.0000	0.0000	0.0368	0.0000	0.2431	0.8706	0.0000	0.0014	0.0061	0.4521	0.0077	0.0227	0.3892	

Appendix 2

Data sources and definitions of variables

Below we list the variables and sources used for this study, as well as the transformations we have made to the data . The data are annual and cover the periods and countries shown in Table 1.

Dependent variable:

* ***Country risk premium or spread in the external cost of borrowing (COSTBORROWING):*** equals returns for U.S. dollar-denominated Brady bonds, loans, Eurobonds, and U.S. dollar-denominated local markets instruments for emerging markets minus total returns for U.S. Treasury bonds with similar maturity (the stripped yields of the Emerging Markets Bond Index, EMBI, for each country).

Source: JP Morgan.

Objective variables:

*** *Total debt service index (DEBT*):*** equals the sum of gross interest payments due on external debt and amortization paid on medium/long-term external debt in U.S. dollars divided by the nominal GDP in 1995 U.S. dollars to take into account the relative size of the country.

Source: The Institute of International Finance.

*** *Real exchange rate in 1995 local currency index (EX):*** equals the average number of units of local currency per U.S. dollar during the year in real terms (that is, divided by GDP deflator of the country with 1995=1) divided by the nominal exchange rate in 1995 (in order to make more similar very different figures). Thus, in 1995, EX is equal to 1 and an increase (decrease) in EX is a depreciation (appreciation).

Source: The Institute of International Finance

*** *EXSURPRISE:*** equals the changes in EX between the year t and year t-1.

*** *BALANCESHEET:*** equals the product of DEBT***** and EXSURPRISE.

*** *Real GDP in 1995 local currency (RGDP):*** This variable is divided by the real GDP in 1995 in local currency of the year 1995. The objective of this transformation is to take into account the relative size of the country. Hence, this variable takes the value 1 for all countries in year 1995.

Source: The Institute of International Finance.

Control variables and instruments:

**** Average emerging country risk premium or spread in the external cost of borrowing for the emerging market asset class (EMBIWORLD)***: equals the stripped yields of the Emerging Markets Bond Index, EMBI.

Source: JP Morgan.

*** *Exports (EXPORT)***: equals the total value of transactions arising from the export of goods and services to nonresidents, valued at market prices in millions of U.S. dollars.

Source: The Institute of International Finance.

*** *Reserves excluding gold in 1995 U.S. dollars (RRES):*** equals official international reserves at the end of the reporting year in millions of U.S. dollars, excluding gold, but including foreign exchange, SDRs, and the reserve position in the IMF divided by the nominal GDP in 1995 U.S. dollars (again, to take into account the relative size of the country).

Source: International Monetary Fund, International Financial Statistics.

*** *Factors affecting the risk to investment (CREDITORIGHTS)***: measure the quality of the institutional setting affecting the risk of investment. The rating assigned is the sum of three subcomponents, each with a maximum score of 4 and a minimum score of 0. A score of 4 indicates a very good environment for creditors and 0 a very poor. The subcomponents are: contract viability/expropriation, profits repatriation and payment delays.

Source: International Country Risk Guide.

*** Inflation (INFLATION)**: equals the yearly percentage change in the GDP deflator.

Source: The Institute of International Finance.