Balance Sheet Effects and the Country Risk Premium: An Empirical Investigation

Juan Carlos Berganza, Roberto Chang and **Alicia García Herrero**

Banco de España, Madrid; Rutgers University, New Brunswick; Banco de España, Madrid

Abstract: This paper is, suggested by recent theories emphasizing financial imperfections, an empirical investigation of the link between a country's risk premium and the balance sheet effect of a devaluation. In a panel of emerging economies, balance sheet effects, due to increased external debt service after an unexpected real depreciation, significantly raise the risk premium. This result is robust to various checks and appears driven by those countries with the largest financial imperfections. Also, particularly large real depreciations turn out to be disproportionately important, meaning that balance sheet effects may be strongest at times of economic crisis. JEL no. F34, F41
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1 Introduction

Conventional open economy models, and in particular the influential Mundell–Fleming model, imply that a real devaluation switches demand toward 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

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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. As emphasized by Calvo (2001) and others, 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.

Recent theoretical studies have developed the above argument in some detail; noteworthy contributions include Aghion et al. (2001) and Céspedes et al. (2004). 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. We ask whether balance sheet effects, associated with changes in the value of the external debt burden due to a real exchange depreciation, significantly increase country risk in emerging countries. Our evidence supports an affirmative answer.

Specifically, 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 is 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.

Our main estimation equation is similar to that in Bleakley and Cowan (2002). However, our papers differ in substantial ways. Bleakley and Cowan investigated a panel of firms from Latin American countries, while our paper analyzes on macro data. Also, while Bleakley and Cowan focused on investment, our dependent variable is the cost of credit. And, finally, their results are quite different: they found that firms with a larger amount of dollar denominated debt tend to invest *more* after a real depreciation. This is somewhat counterintuitive and contradicts the conjecture, critical in the recent literature,[1] that devaluations are contractionary in the presence of

[1] See Calvo (2001), Céspedes et al. (2004), Devereux and Lane (2003), Gertler et al. (2003), among others.

liability dollarization. Our results, in turn, are much more supportive of that conjecture.

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

2 Theoretical and Empirical Framework

This section develops a very simple theoretical framework to illustrate 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 are net borrowers in international capital markets. We assume that the country's liabilities are "dollarized," that is, that the borrowing amount is fixed in terms of an international currency (henceforth called "dollar"). We denote by η_{it} the spread or *risk premium* between the interest rate charged to that country's typical borrower and the world interest rate. The key question we address is whether there is an inverse relationship between the risk premium and the value of the borrower's own funds available for investment:

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

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 Céspedes et al. (2004), Gertler et al. (2003), 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 country *i*'s net worth can be expressed as

$$\omega_{it} = Z_{it} - D^*_{it} X_{it}, \tag{2}$$

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 $\overline{\eta}_i$ and $\overline{\omega}_i$ denote the mean values of η_{it} and ω_{it}. Then, taking a linear approximation to (1) around $\overline{\omega}_i$,

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

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

The value of β is of particular interest, as it turns out to be crucial for the recent debate on the implications of a real exchange depreciation.[2] If country *i* has a substantial debt burden denominated in dollars, 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. Existing theory, in fact, does 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

[2] In particular, Céspedes et al. (2004) emphasize that the sign of β determines whether a country is financially *robust* or *vulnerable*, which in turn affects its response to exogenous shocks.

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 a country's 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.

Assume 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 βZ_{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, which is proportional to 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 treat the latter as an unobservable shock, (4) becomes a regression equation 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 later test for omitted variables in the empirical part. There, we shall also relax the assumption that the debt burden is predetermined.

To implement (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 it is well known that real exchange rates are usually very close to random walks and very weakly, if at all, related to other economic fundamentals.[3]

As a result, the key equation to be estimated is:

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

[3] The difficulty of finding better predictors of future real exchange rates than just the current rate has been known since Meese and Rogoff (1983). See Obstfeld and Rogoff (2000) for references and a recent discussion of the robustness of this result.

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

3 The Data

The empirical implementation of (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 a marginal loan for country i during year t. In practice, unfortunately, available measures of the cost of credit seem very far from that ideal. We are then restricted to using the best available proxy, and the most widely used in the literature: the returns implicit in the Emerging Markets Bonds Indices (EMBI), provided by JP Morgan. Hence, for each country and year in that data set we construct a credit spread measure, COST, by subtracting total returns on U.S. 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 27 countries. Ten of them have data since 1993, when the EMBI started being produced, and all countries have data for the last year, 2002. Given these data constraints, the total sample is composed of 203 yearly observations. Table A2 in the Appendix lists the countries and the data availability while the second section of the Appendix offers a detailed description of the variable definitions and sources.

To proxy for the balance sheet term S_{it} in (5), we construct a variable called BALA, which is an interaction term, namely the product of EXSU and DEBT*. EXSU equals the change in i's real exchange rate (*Ex* as defined in the second part of the Appendix) between year t and year $t-1$, and DEBT* is the U.S. dollar value of i's debt service due in year t divided by i's GDP in 1995 prices.

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 $t-1$, COST_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, EMBI, 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 also include the increase in the dollar value of exports, ΔEXPO, to control for changes in other aspects of net wealth related to the real exchange depreciation. This reduces the probability of omitted variable bias when estimating β.

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 ΔEXPO, are 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, BALA. In any event, we do include ΔEXPO as an additional regressor since it turns out to be significant and adds useful information.

Table A3 presents some descriptive statistics, and Table A1 the matrix of correlations between the different variables. Observe the relatively high correlation (0.43) between COST and BALA; interestingly, COST 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 bivariate correlations, they suggest, as emphasized in the theory, that it is not the amount borrowed but, rather, unexpected changes in net wealth that influences the external cost of borrowing. On the other hand, the correlation between COST and the change in real exchange rate, EXSU, is the highest of the three. Finally, the correlation of the dependent variable in t and in $t - 1$ is very high (0.71), although considerably less than unity. Also in line with the literature, the two control variables related to positive wealth effects (ΔEXPO and RRES) are negatively correlated with the dependent variable (−0.12 and −0.06, respectively).

Figures A1–A3 depict the evolution of COST against BALA, EXSU, and DEBT* from 1993 to 2002. COST and BALA show a positive comovement in a number of years, stronger in the period 1994–1995 and weaker in 1997–1998 and 2001–2002. There is a positive comovement between COST and EXSU and DEBT*, respectively, although in both cases there are clear exceptions in 1995–1996, 1999 and 2000. Finally, Figure A4 is a plot of COST and BALA. Visual inspection quickly suggests a positive association between the two variables. This is confirmed by more formal procedures, to which we now turn.

4 Econometric Results

4.1 Basic Findings

The results are obtained by estimating (5) with pooled data. In the first regression, which is given by Column I of Table 1, the coefficient of BALA is positive and significant at the 1 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 1 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 percent level. The coefficient of COST_1 is significantly positive but less than 1, suggesting that the response of the risk premium to shocks is persistent

Table 1: *Baseline Regression*

Dependent variable:	COST	
	(I)	(II)
COST_1	0.7480***	0.7713***
	(0.0618)	(0.0613)
EMBI	0.4373**	0.5259**
	(0.2142)	(0.2129)
RGDP_1	330.4769	219.9883
	(250.1205)	(248.9829)
BALA	60.9365***	49.4570***
	(13.7547)	(14.1568)
RRES	−48.4515**	−47.1219**
	(23.3747)	(22.9589)
$\Delta EXPO$	–	−5.6623***
		(2.0914)
CONS	−484.3599	−387.5060
	(328.3529)	(324.4174)
No. of observations	177	177
R-squared	0.5733	0.5909
Wald test[a]		0.03
(p-value)		0.8689

, * significant at the level of 5 and 1 percent, respectively.
Note: OLS estimation. Standard errors in parenthesis.
[a] The Wald test assesses the equality of the coefficient of the variable BALA in both regressions. It is distributed as a chi-square.

but transitory, as in existing theoretical models. Finally, the coefficient of EMBI is positive and significant. This is in line with the recent findings of Neumeyer and Perri (2004).

In a second regression, given by Column II in Table 1, we included the year-to-year change in exports (ΔEXPO) as an explanatory variable. As stressed earlier, our aim is to test whether the significance of BALA 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 of such components is the increase in exports due to the impact of a real devaluation on competitiveness. While the inclusion of ΔEXPO results in a lower estimate for the BALA coefficient, the fall is relatively small: in fact a Wald test, shown at the bottom of Table 1, cannot reject the hypothesis of equal BALA coefficients in the two regressions in the table at conventional significance levels. This favors the view that the significance of BALA is not due to an omitted variables bias. On the other hand, ΔEXPO turns out to be significant in explaining the country risk premium, with the expected negative sign, so we keep it in the remaining regressions.[4]

The next question we address is whether the significance of the BALA variable is really due to the impact of debt accumulation on the cost of credit and not to the presence of balance sheet effects. 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 U.S. dollar, ΔDEBT*, is included as an additional regressor. We find that ΔDEBT* is not significant and that the coefficient of BALA 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).

4.2 Robustness Issues

An obvious objection to our results is that there may be a simultaneity bias. Our regression (5) may be only one of the equations determining equilib-

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[4] In contrast, the change in net exports is insignificantly different from zero when added as a regressor.

Table 2: *Testing for the Role of Indebtness*

Dependent variable:		COST	
	(I)	(II)	(III)
COST_1	0.7713***	0.7552***	0.7717***
	(0.0613)	(0.0622)	(0.0619)
EMBI	0.5259**	0.5545	0.5253**
	(0.2129)	(0.2133)	(0.2138)
RGDP_1	219.9883	190.3760	223.2117
	(248.9829)	249.2362	(255.3909)
DEBT*	–	–	−46.8924
			(778.8844)
ΔDEBT*	–	(−1.5308)	–
		(1.1062)	
BALA	49.4570***	51.2867***	49.7561***
	(14.1568)	(14.1807)	(15.0427)
RRES	−47.1219**	−47.6038**	−46.9043**
	(22.9589)	(22.9000)	(23.3085)
ΔEXPO	−5.6623***	−5.3229***	−5.6564***
	(2.0914)	(2.1002)	(2.0998)
CONS	−387.5060	−360.4504	−387.6526
	(324.4174)	(324.1385)	(325.3814)
No. of observations	177	177	177
R-squared	0.5909	0.5955	0.5909
Wald test[a]		0.00	0.00
(p-value)		0.9889	0.9999

, * significant at the level of 5 and 1 percent, respectively.
Note: OLS regression. Standard errors in parenthesis.
[a] The Wald test assesses the equality of the coefficient of the variable BALA in regressions (II) versus (I) and (III) versus (I). It is distributed as a chi-square.

rium; 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 BALA 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 simultaneity bias is a significant concern, we perform a Hausman test, which requires finding an adequate instrument for BALA. But this implies finding an instrument for EXSU only, as the debt service is assumed to be predetermined. Of the available alternatives, the inflation rate, INFL, seems to be best suited to act as an instrument for EXSU. In theory, INFL and EXSU should be highly correlated if exchange rate pass-through coefficients are constant. On the other hand, it is plausible

Table 3: *Testing for the Simultaneity Bias (A), Controlling for the Order of Integration of the Dependent Variable (B), and Testing for the Role of Unobserved Heterogeneity (C)*

	A. Simultaneity Bias		B. Order of Integration		C. Unobserved Heterogeneity	
Dependent variable:	COST		COST	ΔCOST	COST	
					Pooled data	Fixed effects
Method	OLS	IV[a]	OLS		OLS	
Independent variable:						
COST_1	0.7713***	0.8257***	0.7713***	–	0.7713***	0.3296***
	(0.0613)	(0.0674)	(0.0613)		(0.0613)	(0.0918)
EMBI	0.5259**	0.5078**	0.5259**	0.5123**	0.5259**	0.5146***
	(0.2129)	(0.2181)	(0.2129)	(0.2208)	(0.2129)	(0.1942)
RGDP_1	219.9883	108.2206	219.9883	378.2230	219.9883	652.9439**
	(248.9829)	(259.7695)	(248.9829)	(254.4276)	(248.9829)	(305.5127)
BALA	49.4570***	9.1980	49.4570***	32.9962**	49.4570***	91.4743***
	(14.1568)	(23.2236)	(14.1568)	(13.9492)	(14.1568)	(17.1415)
RRES	−47.1219**	−53.8454**	−47.1219**	−60.0196**	−47.1219**	−176.9099***
	(22.9589)	(23.6933)	(22.9589)	(23.5376)	(22.9589)	(52.7997)
ΔEXPO	−5.6623***	−7.4436***	−5.6623***	−6.7608***	−5.6623***	−2.0655
	(2.0914)	(2.2862)	(2.0914)	(2.1472)	(2.0914)	(2.1567)
CONS	−387.5060	−207.7844	−387.5060	−627.5390*	−387.5060	−495.1731
	(324.4174)	(341.7857)	(324.4174)	(329.7444)	(324.4174)	(344.9654)
No. of obs.	177	177	177	177	177	177
R-squared	0.5909	0.5714	0.5733	0.1631	0.5733	0.3989
	Hausman test[b]	4.78	Wald test[c]	0.10		
	(p-value	0.31)	(p-value	0.7529)		

*, **, *** significant at the level of 10, 5, and 1 percent, respectively.
Note: Standard errors in parenthesis.
[a] IV regression: DEBT* × INFL used as an instrument. – [b] The Hausman test assesses the equality of the coefficient of the variable BALA in both regressions. It is distributed as a chi-square. – [c] The Wald test assesses the equality of the coefficient of the variable BALA in both regressions. It is distributed as a chi-square.

to believe that the cost of credit does not react strongly to inflation rates. This is corroborated by Figures A5 and A6, which show that there is a significant correlation between EXSU and INFL but a much weaker one between INFL and COST.

Using INFL as an instrument for EXSU, we run a regression with this instrumental variable, and conduct a Hausman test on the differences between the coefficients of the balance sheet variable.[5] The basic and parallel regressions are both given in Table 3, as well as the value of the Hausman

[5] Our procedure is standard and follows Maddala (1988: 435–48).

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 BALA 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 BALA coefficient.

Another possible objection to our basic regressions is that the dependent variable, COST, may not be stationary. From Table A3 we know that COST is very persistent. On the other hand, as already noted, its first-order autocorrelation seems substantially below 1; it is also implausible that credit spreads are integrated of order greater than 0. In any case, we run the baseline regression with COST in differences and, as Table 4 shows, the results are not significantly affected: BALA remains significant at the 5 percent level.

Table 4: *OLS without Extreme Values*

Dependent variable:	COST			
	(I)[a]	(II)[b]	(III)[c]	(IV)[d]
COST_1	0.7713***	0.7454***	0.7636***	0.7227***
	(0.0613)	(0.0540)	(0.0635)	(0.0583)
EMBI	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)
BALA	49.4570***	23.3869*	60.5596***	30.5990*
	(14.1568)	(13.6501)	(16.4548)	(17.0288)
RRES	−47.1219**	38.3002*	−46.2490***	−35.7364*
	(22.9589)	(20.3438)	(23.3018)	(20.5379)
ΔEXPO	−5.6623***	−6.1971***	−5.2258**	−6.0272***
	(2.0914)	(1.8469)	(2.1581)	(1.8597)
CONS	−387.5060	−167.4934	−478.0692	−173.2618
	(324.4174)	(291.0600)	(341.5268)	(295.3951)
No. of observations	177	168	168	168
R-squared	0.5909	0.5956	0.5907	0.5651

*, **, *** significant at the level of 10, 5, and 1 percent, respectively.
Note: OLS estimation. Standard errors in parenthesis.
[a] Regression I: OLS with all the data. – [b] Regression II: OLS, excluding 5 percent extreme values of *EXSU* variable. – [c] Regression III: OLS, excluding 5 percent extreme values of DEBT* variable. – [d] Regression IV: OLS, excluding 5 percent extreme values of BALA variable.

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 COST_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 ΔEXPO, which becomes not significant.

Table 5: *Controlling for Financial Imperfections*

Dependent variable:		COST	
COST_1	0.7713***	0.7235***	0.7448***
	(0.0613)	(0.0611)	(0.0612)
EMBI	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)
BALA	49.4570***	44.5859***	43.2281***
	(14.1568)	(13.8229)	(14.1476)
RRES	−47.1219**	−43.1622*	−46.6392**
	(22.9589)	(22.3129)	(22.6138)
ΔEXPO	−5.6623***	−5.2040**	−5.7342***
	(2.0914)	(2.0340)	(2.0599)
CRED	–	−47.0503***	–
		(13.3174)	
CRED_TOTAL	–	–	−96.4687***
			(35.7396)
CONS	−387.5060	−170.1404	−267.8797
	(324.4174)	(323.5910)	(325.3788)
No. of observations	177	177	177
R-squared	0.5909	0.6183	0.6070

*, **, *** significant at the level of 10, 5, and 1 percent, respectively.
Note: OLS estimation. Standard errors in parenthesis.

4.3 The Impact of Crises and Financial Development

As shown in Table 2, BALA 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 percent of the extreme values of EXSU (Column II), DEBT* (Column III), and BALA (Column IV). The coefficient of BALA drops to the 10 percent level when the extreme values of BALA or EXSU are excluded but remains significant at the 1 percent 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.

Finally, 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

Table 6: *Controlling for Financial Imperfections per Country Group*

Dependent variable:	COST			
	(I)[a]	(II)[b]	(III)[c]	(IV)[d]
COST_1	0.7713***	1.0141***	0.5579***	0.6256***
	(0.0613)	(0.1442)	(0.0645)	(0.0762)
EMBI	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)
BALA	49.4570***	78.3738**	10.0521	3.4148
	(14.1568)	(32.5148)	(17.4393)	(11.4393)
RRES	−47.1219**	−33.2864	−39.0033	−32.4217*
	(22.9589)	(58.6459)	(27.2231)	(17.1944)
ΔEXPO	−5.6623***	4.6932	−7.5909***	−2.3457
	(2.0914)	(4.7283)	(2.7335)	(1.9786)
CONS	−387.5060	−553.2324	−464.2393	118.5409
	(324.4174)	(1106.189)	(386.3817)	(203.6649)
No. of observations	177	56	58	62
R-squared	0.5909	0.6163	0.6291	0.6989

*, **, *** significant at the level of 10, 5, and 1 percent, respectively.
Note: OLS estimation. Standard errors in parenthesis.
[a] Regression I: all countries included. – [b] Regression II: only countries with worst CRED. – [c] Regression III: only countries with average CRED. – [d] Regression IV: only countries with best CRED.

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. CRED_TOTAL is the original ICRG classification, which can vary from 0 to 12, while CRED is a simplified version composed of three possible levels to classify countries. As Table 7 shows, both variables negatively and significantly, affect the sovereign risk premium, other things given.

In a second exercise, we divide the sample into three groups, from worst to better financial imperfections (proxied by the CRED), 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 is the result expected from recent theories where changes in net worth affect the risk premium only in the presence of financial imperfections.

5 Final Remarks

The evidence just reviewed is, on the whole, supportive of the view 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. Our findings thus underscore the relevance of recent theoretical attempts at modeling the links between balance sheets, liability dollarization, and financial imperfections. Of course, further research is needed to confirm or refute our results.

If one accepts the view 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, as suggested by Hausmann et al. (2001) in the literature of original sin. On the other hand, Céspedes et al. (2004) argue that the existence of balance sheet effects, even if they are strong, do not necessarily justify an exchange rate peg. Given the frequency of large real exchange rate depreciations in emerging countries, this issue is clearly worth a deeper look.

There are several avenues for further research. In particular, the impact of domestic dollarization and its relation to external dollarization warrant further theoretical analysis. Another significant task is to test whether particular exchange rate regimes reduce the impact of balance sheet effects on country risk, as investigated theoretically by Céspedes et al. (2004). Finally, the definition of financial imperfections, key in these types of models, needs to be sharpened and may also need to be expanded from creditor rights to broader measures.

Appendix

1 Stylized Facts and Robustness Tests

Figure A1: *COSTBORROWING and BALANCESHEET*

Figure A2: *COSTBORROWING and EXSURPRISE*

Figure A3: *COSTBORROWING and DEBT**

Figure A4: *COSTBORROWING and BALANCESHEET*

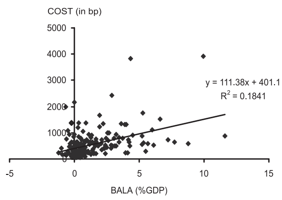

Figure A5: *EXSURPRISE and INFLATION*

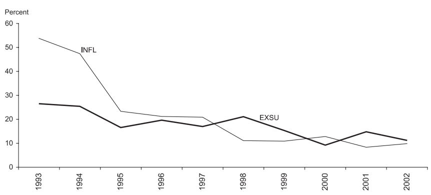

Figure A6: *COSTBORROWING and INFLATION*

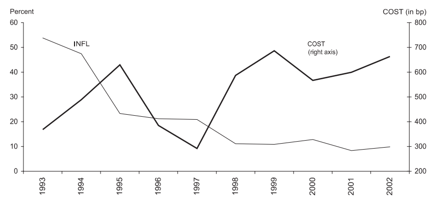

Table A1: *Matrix of Correlation*

	COST	COST_1	EMBI	RGDP	DEBT*	ΔDEBT*	EXSU	BALA	INFL	RRES	ΔEXPO	CRED
COST	1.00											
COST_1	0.71	1.00										
	0.00											
EMBI	0.16	0.05	1.00									
	0.02	0.55										
RGDP	−0.23	−0.24	−0.05	1.00								
	0.10	0.00	0.60									
DEBT*	0.20	0.18	0.00	0.16	1.00							
	0.00	0.01	1.00	0.02								
ΔDEBT*	−0.17	−0.13	0.01	−0.07	0.15	1.00						
	0.02	0.07	0.91	0.33	0.03							
EXSU	0.48	0.35	−0.02	−0.39	−0.03	−0.01	1.00					
	0.00	0.00	0.77	0.00	0.66	0.91						
BALA	0.43	0.30	−0.01	−0.28	0.29	0.02	0.83	1.00				
	0.00	0.00	0.92	0.00	0.00	0.77	0.00					
INFL	0.21	0.28	−0.04	−0.34	−0.05	0.01	0.68	0.42	1.00			
	0.00	0.00	0.57	0.00	0.46	0.86	0.00	0.00				
RRES	−0.06	0.06	−0.04	0.34	0.20	−0.08	−0.18	−0.11	−0.12	1.00		
	0.37	0.42	0.58	0.00	0.00	0.28	0.01	0.12	0.08			
ΔEXPO	−0.12	0.09	0.14	−0.08	−0.11	0.09	−0.20	−0.24	0.06	0.10	1.00	
	0.08	0.22	0.05	0.26	0.11	0.19	0.00	0.00	0.39	0.15		
CRED	−0.38	−0.30	−0.15	0.48	0.08	−0.01	0.29	−0.22	−0.19	0.16	−0.06	1.00
	0.00	0.00	0.04	0.00	0.24	0.87	0.00	0.00	0.01	0.02	0.39	

Table A2: *Countries and Years Included*

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

Table A3: *Descriptive Statistics of the Regression Variables*

Variable	No. of obs.	Mean	Std. deviation	Minimun	Maximun
COST	203	548.76	516.35	60.23	3925.75
EMBI	203	615.40	138.09	352.72	1007.55
RGDP	203	1.09	0.12	0.80	1.60
DEBT*	203	0.08	0.04	0.02	0.27
ΔDEBT*	203	5.32	24.48	–88.26	124.80
EXSU	203	16.15	22.94	–13.87	140.01
BALA	203	1.33	1.99	–1.22	11.60
INFL	203	16.88	37.03	–4.33	315.29
RRES	203	1.48	1.15	0.12	9.05
ΔEXPO	203	5.97	13.34	–45.43	58.77
CRED	203	7.27	2.12	2.00	12.00

2 Data Sources and Definitions of Variables

Below we list the variables and sources used for this study, as well as the transformations made to the data. The data are annual and cover the periods and countries shown in Table A1.

Dependent variable

Country risk premium or spread in the external cost of borrowing* (COST)*: 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 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.

EXSU*:* equals the changes in EX between the year t and year $t-1$ (in percent).

BALA*:* equals the product of DEBT* and EXSU.

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* (EMBI)*: equals the stripped yields of the EMBI.
Source: JP Morgan.

Exports* (EXPO)*: 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* (CRED_TOTAL)*: 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 one. The subcomponents are: contract viability/expropriation, profits repatriation, and payment delays. CRED is a simplified version of the classification composed of just 3 possible levels.
Source: International Country Risk Guide.

Inflation* (INFL)*: equals the yearly percentage change in the GDP deflator.
Source: The Institute of International Finance.

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