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Sovereign default and the structure of private external debt

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Abstract: While the literature on determinants of sovereign default is voluminous, the links between private indebtedness and the probability of public bankruptcy have not been studied extensively. In this paper we aim to fill this gap and to shed more light on the influence of the size and structure of private debt on sovereign default probability. We focus on developing and emerging market economies over the years 1970–2012. The main conclusions are that both the size and the structure of private borrowings affect the probability of a sovereign default.

Keywords: Private external debt, sovereign default

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1 Introduction

‘Private and public debts cannot be looked at only in isolation’ (Jordà *et al.*, 2013, p. 1); nevertheless, most studies treat sovereign and private external liabilities as distinct phenomena, possibly only loosely linked. In this paper, we want to shed light on the selected aspects of the public and private sector interdependencies in the international financial market. More specifically, we look at the relationship between the level and structure of private external debt and the probability of sovereign default.

The theoretical perspective does not give a clear guidance on whether this relationship is positive or negative. On one hand, sovereign default may increase the costs of external borrowing for the private sector, adding another element to the economic and political costs associated with bankruptcy, and consequently, increasing the public sector’s incentives to honor its obligations. On the other hand, an opposite result is also possible—private borrowing might create additional vulnerabilities, increasing the costs of honoring public obligations and increasing the probability of sovereign default (Celasun and Harms, 2011).

Although the impact of private external borrowing public debt default is not only an interesting research question, but is also important from the policy perspective, we know of only one paper by Celasun and Harms (2011) that studies this issue empirically and shows that higher private external debt decreases the probability of sovereign bankruptcy.

In this paper, we extend their analysis in two directions. First, by showing not only size, but also the breakdown of private sector debt into loans and bonds matters. Second, by modelling a non-linear relationship between private external debt and sovereign default. This allows us to draw interesting insights regarding the role of private debt in affecting the behavior of the public sector.

The paper is structured as follows. Next section is devoted to the literature review concerning the nexus between the private sector’s liabilities and public sector default. Section 3 delivers the empirical evidence on the effect of private sector liabilities on the default probability and the last section concludes.

2 Literature review and hypotheses

The literature on sovereign default is abundant and uniformly admits that since the government cannot be forced to repay its debts, the explanation of why in spite of this it usually honors its obligations, is not straightforward. The literature that aims to explain this phenomenon points to several factors that affect the probability of sovereign default.

A thorough summary of the literature on sovereign default can be found for example in Panizza *et al.*, (2009); hence, we provide below just a very brief recapitulation of the main arguments, pointing to the possible influence of the impact of private sector’s foreign liabilities on the public sector’s willingness to repay its debts.

As already hinted above, an important consideration that emerges out of the existing works is the proposition that public debt default is not a result of ‘inability’ to service and repay the debt, but an outcome of a rational decision of the public sector. The government compares the costs of default with the costs of repayment and if repayment costs outweigh the costs of bankruptcy, the government chooses to default. Consequently, the literature concentrates on modelling the costs associated with repudiation and contrasting them with the costs of repayment.

As the literature shows, reneging on its obligations might be costly for the government, because a default might preclude it not only from the international credit markets (Eaton and Gersovitz, 1981), but also from other segments of international financial markets, making it impossible to conduct most international financial transactions (Cole and Kehoe, 1995; Eaton, 1996). Another element that may keep the government from reneging is the threat of direct sanctions imposed by the lenders on the defaulting country (Bulow and Rogoff, 1989). The costs of default are also increased by the loss of credibility, which makes it impossible to conduct transactions that require any deferred payments, and a certain level of reputation of both parties (Cole and Kehoe, 1998). There are also works that show that repudiation serves as a source of new information for the creditors about the characteristics of the economy, what can induce investors to reassess the risks associated with crediting the government and drives up the costs of any future borrowing (Catão *et al.*, 2007).

The literature has concentrated on the relationships between the government and its creditors; hence,

the influence of foreign private debt on sovereign default has not received too much attention. An explicit discussion on the link between the likelihood of sovereign default and the amount of private external debt is provided by Celasun and Harms (2011). They argue that private agents with external obligations are particularly vulnerable to sovereign default, and hence, they may exert political pressure on the government to keep it from defaulting. On the other hand, private external debt might decrease public sector creditworthiness through implicit bailout guarantees, constituting an additional burden on the government and leading it to bankruptcy. Therefore, the impact of private debt on the probability of sovereign default may be far from straightforward. The empirical evidence provided by Celasun and Harms (2011) indicates that private external debt decreases the likelihood of sovereign default.

There is also a related literature that models the costs of private borrowing and provides evidence that the costs of private foreign loans are a function of sovereign default premium (Ağca and Celasun, 2012; Cavallo and Valenzuela, 2010; Dailami, 2010; Klein and Stellner, 2014; Peter and Grandes, 2005). To the extent that a history of public default increases the costs of future loans for the public sector (as in Catão *et al.*, 2007), the above mentioned works suggest that it will also drive up the costs of private borrowing (see also Yue and Mendoza, 2011). There are also works that show that as a result of public sector default, the private sector's access to credit might be restricted or completely blocked (Arteta and Hale, 2008; Kohlscheen and O'Connell, 2007; Mendoza and Yue, 2012; Trebesch, 2009). All these works provide evidence that public sector default is costly for private borrowers and that these costs are a function of the size of private debt. Hence, it cannot be excluded that higher private external debt leads to higher default costs and consequently to a lower probability of public sector default.

In this paper, we reinvestigate the relationship between private external debt and the probability of sovereign default. We follow Celasun and Harms (2011), and hypothesize that the private external debt might be yet another factor that contributes to the costs of government repudiation and decreases the probability of default. However, we extend their work to allow for a diversified and nonlinear impact of different forms of private external indebtedness.

The first hypothesis states that there is a relation between the probability of default on public debt and the amount of private sector liabilities, yet this relation

may display a complex nonlinear pattern. This is due to the operation of two countervailing forces. On one hand, larger private external debt is associated with higher costs of sovereign bankruptcy; while on the other hand, private sector's external indebtedness might imply a higher fiscal burden associated with implicit bailout costs.

According to the second hypothesis, two categories of private external liabilities—that is, loans and bonds—may exert a different influence on the probability of default on public debt. There is an abundant literature on the firm's choice between different forms of debt that shows that the structure of private external debt depends among others on the firms' characteristics. More exactly, Chemmanur and Fulghieri (1994) in a theoretical paper argue that firms with a higher probability of experiencing financial distress choose bank loans over publicly traded bonds. In an empirical study, Denis and Mihov (2003) show that the firms' choice between debt from bonds and loans depends on the credit history and current credit quality of the issuer, with the highest quality firms showing a preference for issuing bonds and the middle-quality firms borrowing from banks. Cantillo and Wright (2000) provide evidence that firms that are less likely to default, with high and stable cash flow and high profitability will choose debt from bonds rather than from banks.

Since private companies that rely on bond financing as opposed to bank financing, might be different, their vulnerability to increased sovereign risk might be different as well, and therefore, the impact of the debt of these different groups on the overall costs of sovereign default may not be uniform.

3 Is private debt decreasing the likelihood of sovereign default?

In this section, we verify empirically the proposition that government sector is more reluctant to declare bankruptcy when the stock of private external debt is substantial, we also aim to uncover the possible non-linear and diversified impact of different private liabilities. We follow a standard approach to modelling sovereign default and estimate a logistic regression, where the regressand is a binary variable that takes on the value of 1, if the government has defaulted and zero otherwise

(see, for example, Celasun and Harms, 2011). The information on sovereign default understood as all debt restructurings 'at terms less favourable than the original bond or loan terms' was taken from Trebesch *et al.* (2012).

Firstly, following the literature (see, Celasun and Harms, 2011), we estimate a standard logistic regression, where all the right hand side variables enter in a linear fashion. However, in line with the first hypothesis formulated in section 2, the relationship between the stock of external private debt and the probability of sovereign default is likely to be nonlinear. Hence, to check the robustness of the results and to deal with nonlinearity, we rely on regression models based on fractional polynomials functions, which allow for more flexibility compared to the quadratic or cubic functions popular in data analysis. Fractional polynomial of degree m has m integer or fractional powers $p_1 < \dots < p_m$ and can be written as:

$$\beta_0 + \beta_1 x^{(p_1)} + \beta_2 x^{(p_2)} + \dots + \beta_m x^{(p_m)}$$

$$x^{(p)} = \begin{cases} x^p & \text{if } p \neq 0 \\ \log x & \text{if } p = 0. \end{cases} \quad (1)$$

The permitted powers are usually restricted to $\{-2, -1, -0.5, 0, 0.5, 1, 2, 3\}$ and they can be repeated. The powers are estimated from the data and are selected on the basis of minimization of the deviance, which is defined as minus twice the log likelihood. Royston and Sauerbrei (2008) suggest that a fractional polynomial of second degree is usually sufficient. Thus, the impact of the level of private debt is modeled by means of equation (1) with unique or repeated powers that yield the lowest deviance.

The main explanatory variables are the private long term non-guaranteed debt, expressed in percent of GDP, denoted by *debt_png*, which is further decomposed into the outstanding long term private nonguaranteed debt from bonds and commercial bank loans, both in % of GDP, which are denoted by respectively *bond_png* and *bank_png*.

The annual data on the external debt levels comes from the Joint External Debt Hub—jointly developed by the Bank for International Settlements, the International Monetary Fund, the Organization for Economic Cooperation and Development and the World Bank.

In the choice of the remaining right hand side variables, we follow the existing empirical literature that suggests that the factors that affect the probability of debt default can be divided into few broad groups.

The first group encompasses characteristics that increase long-term costs of servicing debt, such as the size and structure of public debt, especially the size of the public external debt. These factors increase the cost of honoring the commitments, thereby increasing the likelihood of bankruptcy. Most empirical studies confirm that one of the most significant factors in this group is the amount of external debt (Detragiache and Spilimbergo, 2001; Pescatori and Sy, 2007, Schimmelpfennig *et al.*, 2003).

The second group of factors collects those that affect the short-term debt servicing costs, such as the size of short-term debt or the size of foreign exchange reserves (Catão and Sutton, 2002; Detragiache and Spilimbergo, 2001).

The third group includes indicators reflecting the state of macroeconomic fundamentals and institutional characteristics of the country. Among them are GDP growth, exchange rate fluctuations, size of investments, quality of institutions, government accountability, the shape of political scene and so on (Catão and Kapur, 2004; Catão and Sutton, 2002; Kohlscheen, 2007; Kraay and Nehru, 2006; Rijckeghem and Weder, 2009; Manasse and Roubini, 2009b).

To control for long-term debt servicing cost, we have included the measure of external public and publicly guaranteed debt, in percent of GDP (*debt_ppg*). To increase our understanding of the impact of the structure of sovereign external indebtedness on the probability of default, we have also disaggregated public external debt and utilized the amounts of public and publicly guaranteed bank loans, measured in % GDP (*banks_ppg*) and public and publicly guaranteed bonds, in % GDP (*bonds_ppg*). To measure private indebtedness, we use the already described amount of private, non-guaranteed debt, in percent of GDP (*debt_png*) and the distinction between private, non-guaranteed bank loans (*banks_png*), and private non-guaranteed bonds (*bonds_png*).

To measure the short run debt servicing costs, we include the ratio of short term total external debt to reserves (*shdebt_res*). To control for economic fundamentals, we include the measures of GDP growth rate (*growth*), inflation (*infla*), exchange rate stability index (*ers*), and trade openness (*trade*) defined as the ratio of exports plus imports to GDP.

All right-hand-side variables are lagged one period, so that the default in period t is explained by the variables from period $t-1$. Using lagged regressors mitigates the likely problem of reverse causality.

Tab. 1. Determinants of the probability of public sector default

VARIABLES	(1)	(2)	(3)	(4)	(5)
debt_ppg	0.00473*** (0.00130)			0.00309*** (0.000879)	0.00175** (0.000855)
debt_png	-0.0469** (0.0199)				
debt_png_1				0.992*** (0.239)	
debt_png_2				-0.207*** (0.0576)	
bonds_ppg		0.0348* (0.0205)	0.0295 (0.0188)		
banks_ppg		0.0686*** (0.0125)	0.0811*** (0.0111)		
bonds_png		-0.852*** (0.322)	-0.642** (0.319)		
bonds_png_1					-0.000458 (0.000333)
bonds_png_2					-1.121** (0.497)
banks_png		-0.0316 (0.0208)	0.000372 (0.0129)		0.0177 (0.0111)
growth	-0.0340* (0.0175)	-0.0225 (0.0178)	-0.0335** (0.0148)	-0.0510*** (0.0139)	-0.0448*** (0.0120)
Infla	-0.00105*** (0.000392)	-0.00171*** (0.000458)	-0.00165*** (0.000387)	-0.000267 (0.000262)	-0.000180 (0.000219)
Trade	-0.00550 (0.00584)	0.00157 (0.00596)	-0.00816** (0.00366)	-0.00224 (0.00357)	-0.00472 (0.00437)
shdebt_res	-4.80e-05 (5.31e-05)	-6.43e-05 (5.75e-05)	-7.31e-05 (5.08e-05)	-5.61e-06 (9.16e-06)	-5.62e-06 (7.75e-06)
Ers	-0.828** (0.382)	-0.707* (0.395)	-0.716** (0.306)	-0.537* (0.313)	-0.738** (0.331)
Constant			-2.706*** (0.294)	-2.399*** (0.383)	-3.227*** (0.520)
Observations	1,987	1,987	3,873	3,873	3,873
Country fixed effects	Yes	Yes	No	No	No
Best powers				0,5; 1	-2; 0,5

Notes: Standard errors in parentheses; *** p < 0.01, ** p < 0.05.

The sample consists of emerging and developing countries in the 1970–2012 period. The data on private and government borrowing is taken from the Joint External Debt Hub; most of the remaining data comes from World Bank, World Development Indicators database and the exchange rate stability index is from Aizenman *et al.* (2008). The list of variables and a more detailed description of the sample are provided in the Appendix.

All equations were estimated using logistic regressions, either with standard errors robust to the clustering of observations by countries or with country fixed effects. We start by estimating more standard estimations, without the fractional polynomials and then we proceed to model the possible non-linearity.

Tab. 1 reports the results of estimations. Columns 1 and 2 show the results of fixed effects estimations, while column 3 report the results with standard errors robust

to the clustering of observations by countries. Columns 4 and 5 present the results of non-linear estimations.

From the linear specifications, we can deduce that the share of private debt exerts a negative impact on the probability of sovereign default, in line with Celasun and Harms (2011). Consistent with expectations, public sector debt increases the likelihood of default. Introducing the distinction between the share of public loans and bonds in GDP, as well as private liabilities stemming from bonds and credit allows to conclude that both public bonds and public bank credit exert a negative and significant impact on the probability of sovereign default; while in case of private sector liabilities, bonds enter with a statistically significant negative sign (these results are shown in column 2).

Most control variables turned out to be insignificant, with the exception of GDP growth, which decreases the probability of default in all estimations and exchange rate stability; this indicates that more stable exchange rate regimes are associated with lower probability of default.

In column 3, to check the robustness of the results, we leave off panel data techniques, but report the standard errors that are robust to the clustering of observations by countries. The results are similar and show that only the share of private debt from bonds decreases the likelihood of sovereign default.

As a final step, we estimate the logistic regressions using fractional polynomial functions, to allow for a non-linear effect of private debt. These estimations are shown in columns 4 and 5. The significance of each type of the external private debt was tested separately, that is, we included alternatively one fractional polynomial function of each type of external private debt in each regression equation. Since each polynomial function is of second degree, we have two terms with the level of external public debt denoted with ‘_1’ and ‘_2’. For instance *bond_png_1* and *bond_png_2* stand for the level of public debt from bonds raised to, respectively, the first and the second power, where the values of powers are guided by the deviance minimization and are reported in the bottom row of Tab. 1.

The estimates with the fractional polynomial terms confirm the validity of both hypotheses advanced in this paper. First, there seems to be a negative but non-linear relationship between private debt and the likelihood sovereign default. The precise shape of the relationship is depicted in Fig. 1 in the appendix.

The structure of private debt matters as well—the amount of private external debt from bonds is signif-

icant and affects the probability of default in a non-linear way. The share of private debt from loans turned out to be insignificant.

Overall, these results suggest that private debt does indeed affect nonlinearly the likelihood of public sector default, but the strength of this impact is different for private debt from loans and bonds. Our estimations allow to draw a conclusion that a robust association exists between the share of private bonds and default, while the share of loans seems to be insignificant.

4 Conclusions

Using data on emerging and developing countries over the 1970–2012 period, we scrutinized the factors behind a state’s declaration of bankruptcy putting emphasis on the influence of various types of private external debt. We reach interesting conclusions.

We uncovered the existence of a non-linear relation between the private sector participation in the international financial market and the probability of sovereign default. Second, the structure of private debt matters: higher share of private debt from bonds is a factor that affects the probability of default, while the share of private debt from loans turned out to be insignificant for the probability of sovereign default.

In terms of policy recommendations, these results indicate that private sector’s dependence on foreign debt from bonds can contribute to establishing public sector’s creditworthiness in international financial markets. It can be argued that larger share of private debt from bonds in total external debt deters public sector from repudiating its external debt.

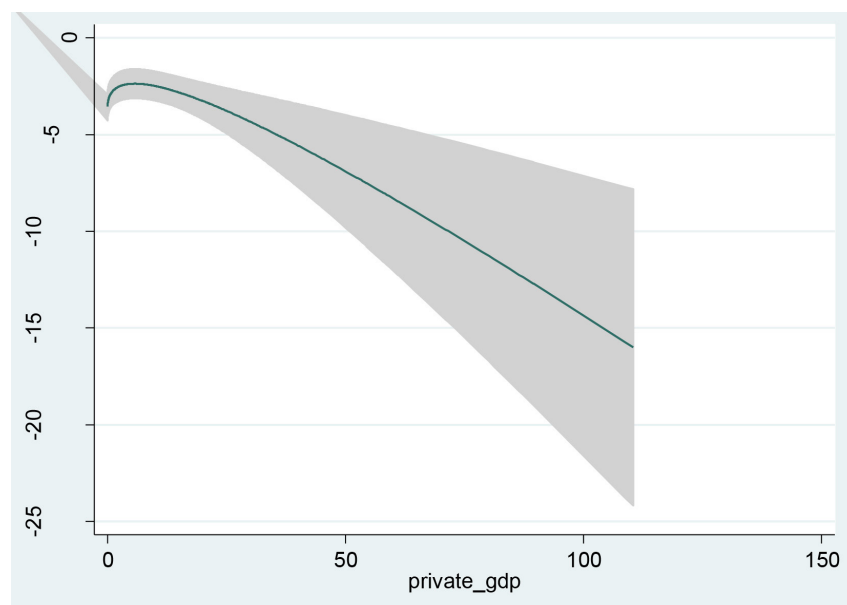
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Appendix: Tables and figures

Fig. 1. The fractional polynomial models fits, against the private, non-guaranteed debt, in % of GDP (*debt_png*), with 95% confidence bands (adjusted for covariates)



Tab.A1. List of variables used in regressions

Variables	Definition	Source
debt_ppg	External public and publicly guaranteed debt, in percent of GDP	Joint External Debt Hub
bonds_ppg	and public and publicly guaranteed bonds in percent of GDP	Joint External Debt Hub
banks_ppg	the amounts of public and publicly guaranteed bank loans in percent of GDP	Joint External Debt Hub
debt_png	private, non-guaranteed external debt, in percent of GDP	Joint External Debt Hub
bonds_png	private non-guaranteed bonds	Joint External Debt Hub
banks_png	private, non-guaranteed bank loans	Joint External Debt Hub
growth	GDP growth rate	World Bank, World Development Indicators database
infla	inflation	World Bank, World Development Indicators database
trade	trade openness	World Bank, World Development Indicators database
shdebt_res	the ratio of short term total external debt to reserves	World Bank, World Development Indicators database
ers	exchange rate stability index	Aizenman et al. (2008)

Full list of countries used in regression analysis:

Afghanistan, Albania, Algeria, Angola, Argentina, Armenia, Azerbaijan, Bangladesh, Belarus, Belize, Benin, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Burkina Faso, Burundi, Cabo Verde, Cambodia, Cameroon, Central African Republic, Chad, China, Colombia, Comoros, Costa Rica, Cote d'Ivoire, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Eritrea, Ethiopia, Fiji, FYR Macedonia, Gabon, Georgia, Ghana, Grenada, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hungary, India, Indonesia, Islamic Republic of Iran, Jamaica, Jordan, Kazakhstan, Kenya, Kyrgyz Republic, Lao P.D.R., Lebanon, Lesotho, Liberia, Madagascar, Malawi, Malaysia, Maldives, Mali, Mauritania, Mauritius, Mexico, Moldova, Mongolia, Montenegro, Morocco, Mozambique, Myanmar, Nepal, Nicaragua, Niger, Nigeria, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Republic of Congo, Rwanda, Samoa, Senegal, Serbia, Seychelles, Sierra Leone, Solomon Islands, South Africa, Sri Lanka, St. Lucia, St. Vincent and the Grenadines, Sudan, Swaziland, Syria, Tajikistan, Tanzania, Thailand, The Gambia, Togo, Tonga, Tunisia, Turkey, Turkmenistan, Uganda, Ukraine, Uzbekistan, Vanuatu, Venezuela, Vietnam, Yemen, Zambia, Zimbabwe.