

ABSTRACT

Title of dissertation: ESSAYS ON THE
 ROLE OF THE SOVEREIGN
 IN INTERNATIONAL FINANCE

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This dissertation investigates the role that the sovereign plays in the international economy, from two different aspects: the first chapter deals with the important role that institutional quality plays in the official accumulation of net foreign assets in emerging-market and developing economies, using a small-open economy model to account for the variation shown across economies in this regard; the second chapter shows the effects that the European Sovereign Debt Crisis that followed the Great Recession has had in the depressed investment rates in small and large firms in the euro area.

The first chapter shows that institutional quality has an important role in explaining differences in net sovereign foreign asset position and sovereign risk, while highlighting the importance of mercantilist strategies, understood as the strategies governments follow to exploit growth externalities in their tradable sectors. This framework allows the understanding of the vast accumulation of foreign assets that emerging-market and developing economies' governments have amassed during the

current period of globalization, which has played a key role in generating the global imbalances.

The second chapter focuses on the advanced economies of the euro area, showing how increased sovereign risk depresses investment in the corporate sector through the bank balance-sheets. Using an enormous dataset linking firm, banks, and sovereigns, it can identify the effects that corporate overhang and rollover risk have in deterring firms from investing, and how sovereign risk worsen this problems but making difficult for firms to keep borrowing necessary for investment. This dataset includes many small firms, which are dependent on internal and banking sources of financing, as opposed to large firms, which can diversify and raise additional resources through issuance of bonds and stocks.

ESSAYS ON THE ROLE OF THE SOVEREIGN IN
INTERNATIONAL FINANCE

by

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Dedication

To my family and friends

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I am grateful to all the people that has helped me on the journey to finish this thesis, which signals the culmination of my experience as a Ph.D. student.

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Chapter 1: Institutional Quality and Sovereign International Flows

1.1 Introduction

Global imbalances are an important feature of the international economy: high-growth emerging-market economies export capital to advanced economies.¹

These capital inflows are rooted in sovereign-to-sovereign flows, mostly international reserve accumulation and foreign public debt consolidation (Alfaro, Kalemli-Özcan, and Volosovych, 2014; Gourinchas and Jeanne, 2013; Krishnamurthy and Vissing-Jørgensen, 2007). The literature has dealt with three main reasons for this phenomenon: precautionary savings (Durdu, Mendoza, and Terrones, 2009; Jeanne and Rancière, 2011), mercantilism (Benigno and Fornaro, 2012; Korinek and Servén, 2010), and expropriation risk (Aguiar and Amador, 2011). However, none of these three explanations alone can explain the extent and diversity of this phenomenon, and focusing in one mechanism at the time does not allow the assessment of their relative importance.²

In this respect, this paper shows the great importance of mercantilism and sudden stops in emerging market economies in explaining the existence of net posi-

¹For a specific definition and discussion on global imbalances, see Gourinchas and Rey (2014).

²More recently, Bianchi, Hatchondo, and Martínez (2012) have proposed a fourth motive, rollover risk, which will not be dealt with in the present work.

tive international public assets, while political economy frictions can account for the varying degrees that asset accumulation is achieved across economies with similar characteristics. An increase of 50 percent in these frictions implies a reduction of almost 20 percentage points of GDP in net foreign public assets, in the context of economies with growth externalities, so there is a motive for mercantilism. On the other hand, if mercantilism is not taken into account, sovereigns accumulate net foreign liabilities, which dampens their access to international markets. In a model without mercantilism, political-economy frictions have less power to explain differences in net foreign positions (5 percentage points of GDP), but can explain differences in sovereign risk: a reduction of 70 percent in political-economy frictions can reduce the sovereign spread by 800 basis points.

As far as I know, this is the first paper providing a plausible framework for a small open economy where the government builds a positive net foreign asset position, while stressing the important differences that political-economy frictions and mercantilist strategies can generate among the net foreign-asset positions of governments in emerging-market and developing economies.³

The present work builds a two-sector small-open-economy model featuring political-economy frictions, sovereign default, exogenous sudden stops affecting firms' working capital, and learning-by-trade externalities. Political-economy frictions con-

³Most papers yield a positive stock of foreign reserves (Benigno and Fornaro, 2012; Jeanne and Rancière, 2011) but without considering the stock of public debt; Benigno and Fornaro (2012) manages to explain jointly a positive net foreign asset position of the overall economy, but is silent about foreign public debt. Bianchi, Hatchondo, and Martínez (2012) manages to achieve a joint explanation of the existence of public debt and reserve assets, although the net balance is still negative. Aguiar and Amador (2011) explains why economies reduce their foreign liabilities in order to reduce expropriation risk and promote growth, but the net foreign position of the government is still negative.

sist of time-inconsistent preferences originating in the differences in consumption valuation of incumbent versus opposition parties, which increases the risk that the government expropriates foreign assets in the country. For this paper, instead of modeling the nationalization of foreign capital, a sovereign default is introduced, as default has been far more common during this era of globalization than nationalization, as shown by Tomz and Wright (2010). Sovereign default risk can be interpreted as expropriation risk, since the risk is that the government appropriates future debt payments belonging to their creditors.

In this setting, firms in the tradable sector face occasional exogenous sudden stops, which affect their working capital. In practical terms, they face financing shortages when purchasing imported goods to be used in their production processes. When this happens, the government may step in and provide credit, but in an inefficient and limited way, since it is usually subject to sudden stops as much as their firms (Bianchi, Hatchondo, and Martínez, 2012). This provides a strong precautionary savings motive.

The presence of externalities in the tradable sector is due to the fact that the aggregate stock of knowledge utilized to produce a modern tradable good has a positive covariance with the amount of imported inputs utilized. However no firm can exploit this covariance privately. The government cannot provide direct subsidies to the tradable sector to exploit these externalities, since such subsidies are forbidden by international trade law. The only instrument she has to exploit this externality is the accumulation of net foreign assets. This motive of net foreign asset accumulation by the government is called “mercantilism” and is still subject to

debate in policy and academic research, both on the empirical and theoretical front.

The next section features a literature review, which is followed by a discussion of the empirical facts, the quantitative model and its properties, and the final results and conclusions.

1.2 Literature

The closest strand of literature to this chapter is that on small open economies with political-economy frictions. The political-institutional setting in this paper comes directly from Aguiar and Amador (2011). The authors propose a theory of political-economy frictions causing governments to vary their net foreign assets to reduce the *expropriation risk*. This expropriation consists of nationalizing the capital brought in by foreign investors, enduring autarky forever as a punishment. Hence, economies with better institutions (less political-economy frictions) secure foreign investors' property rights by increasing public foreign savings. This also promotes faster convergence to the steady state. However, my paper is different in that it models sovereign default, as it considers the fact that expropriation of foreign creditors to the sovereign are far more frequent than nationalizations of foreign physical capital; it also considers the presence of sudden stops that arrive from abroad and reduces access to finance by the overall economy, and adds a growth trend which is affected by the externalities present in the tradable sectors.

Other papers focus on the government's gross positions. As for gross debt, Amador (2003, 2012) and Aguiar and Amador (2014) assume that politicians de-

mand debt ex-post due to their inability to save stemming from political-economy frictions similar to those in Aguiar and Amador (2011), so the desire to borrow again in the future enforces repayment today. D’Erasmus (2008), using a different political structure, shows that a benevolent government transiting between two states of patience replicates the observed default frequency and the ratio of gross sovereign debt to gross national product at the moment of default.

For foreign gross sovereign assets (for which reserve accumulation is the main component), literature linking reserves and institutions is rather scant. Aizenman and Marion (2004) show both empirically and theoretically that corruption and short-term incentives reduce the demand for foreign reserves, which is qualitatively consistent with papers addressing gross foreign sovereign debt.

Our paper leaves as a future extension to consider gross positions of the government, both for ease of modeling and exposition, and the impact on gross and net asset positions with respect to measures of institutional quality are the same empirically, as expected.

Another literature worth mentioning is that studying institutional quality and fiscal counter-cyclicity. Governments from countries with strong, savvy institutions tend to lower fiscal spending during booms and increase it during busts, as shown in Frankel, Végh, and Vuletin (2013). Fiscal countercyclicity depends on the level and changes in the measures of institutional quality. Also, there is a literature linking institutional quality and private capital flows: Gourio, Simer, and Verdelhan (2015) shows that the VIX forecasts political risk, and that when it increases, capital inflows decrease and outflows increase. The *expropriation risk* in their model is a stochastic

tax on capital inflows, i.e. a nationalization of foreign capital. Despite the fact that *expropriation risk* is not endogenous, their work highlights the mechanisms by which institutional quality influences private capital inflows, as found previously by Alfaro, Kalemli-Özcan, and Volosovych (2008) and Papaioannou (2009).

Also, there is a vast literature on foreign reserve accumulation that addresses the basic economic motives for governments to accumulate assets. Precautionary savings is one important motive. International reserves provide a defense against sudden stops under increasing financial globalization (Durdu, Mendoza, and Terrones, 2009). Other aspects are explored in Aizenman and Lee (2007), Choi, Sharma, and Strömquist (2007), Alfaro and Kanczuk (2009), and Caballero and Panageas (2008). Despite its importance, the precautionary motive in isolation fails to account for a positive net foreign asset position, which has been very common during the last decades, as governments increased their net reserve hoarding and decreased their international sovereign debt positions. Explaining a positive net foreign asset position is an important achievement of my paper.

Another important motive for reserve accumulation is mercantilism.⁴Some economies do not let their currencies appreciate in order to promote economic growth through exports (Dooley, Folkerts-Landau, and Garber, 2004; Eichengreen, 2004). Accumulating reserves, hence, is a result of preventing real appreciation, and this is how reserve accumulation can be related to output growth (Rodrik, 2008).⁵ Models

⁴Mercantilism refers to the prevalent economic doctrine in Europe during the XVII-XIX centuries, where countries accumulated monetary reserves (mainly gold) by running trade balance surpluses of finished goods. For a reference, see Ekelund and Hébert (2013).

⁵This view, however, has been challenged by Reinhart, Reinhart, and Tashiro (2016), as reserve accumulation seems to crowd out private investment in East-Asian economies, excluding China and India (which coincidentally feature strict capital controls.) Woodford (2009) argues, on the

of mercantilist reserve accumulation rely on endogenous growth with externalities present in the tradable sector. To exploit these externalities, the central planner hoards reserves as a second best mechanism to direct subsidies (Korinek and Servén, 2010). As a by-product, these reserves also provide foreign working-capital flow during sudden stops (Benigno and Fornaro, 2012).⁶

These models describe the mechanisms by which mercantilism works, but explaining why successful cases of mercantilism are so few requires looking at political and institutional factors. There are well-studied cases of failed export-led growth strategies, such as Latin America between 1870 and 1930 (Catão, 1992; Cortés-Conde, 1992; Gómez-Galvarriato and Williamson, 2009), where political issues were connected with the failure of these policies.^{7,8} In this paper, I show that political-economy frictions can account for differences in the amount of foreign savings across government. Also, political economy frictions can explain significant differences in the output per capita in the long run.

Other motives for hoarding reserves which I do not address are their role in enhancing domestic policies by allowing exchange-rate manipulation (Alfaro and Kanczuk, 2013), and the prevention of rollover risk in long-term sovereign foreign

other hand, that undervaluation is just a consequence of excess savings and strict capital controls, instead of means to promote growth by exporting.

⁶An important matter is why reserves are held despite yielding lower returns compared to other instruments. One reason is its imperfect substitutability with private foreign debt (Benigno and Fornaro, 2012). Intermittent access to international capital markets leaves reserves as the sole backstop to tradable-goods producing firms. Under perfect substitutability, it is optimal to reduce debt holdings and hold no foreign reserves (Alfaro and Kanczuk, 2009).

⁷After the Great Depression, most countries in Latin America embarked in Import-Substitution strategies, following the “Prebisch Doctrine” (Prebisch and Martínez-Cabañas, 1949). For a contrast with Emerging Asia, see Baer (1984).

⁸For a description of the prevailing international monetary system prevailing during 1870-1930 see Eichengreen (1992) and Obstfeld and Taylor (2003).

debt (Bianchi, Hatchondo, and Martínez, 2012). The former requires a monetary model, which is beyond the scope of this paper, while the latter requires modeling gross positions, which is left to future extensions.

In a broader sense, the current paper relates to the global imbalances literature, which has been prolific and well-cited. The first theories emphasized the presence of a global *savings glut* (Bernanke, 2005) –although with no regard to which sectors actually engaged in saving– while connecting this to the *conundrum* of low long-term interest rates in the United States (Greenspan, 2005). On the other hand, Dooley, Folkerts-Landau, and Garber (2004) and Eichengreen (2004) explain global imbalances instead using mercantilism, by comparing the current global imbalances (1996 to present) to those of the Bretton Woods era (1946-1973). Countries pursuing export-led growth strategies –such as Germany and Japan at that time– resisted depreciation of their currencies, just as Emerging Asia is thought as doing recently.⁹

Another view is financial sector development, which is low in economies less able to diversify away idiosyncratic risk (Angeletos and Panousi, 2011; Buera and Shin, 2009; Mendoza, Quadrini, and Ríos-Rull, 2009), which explains why firms in less financially developed countries export capital to firms in more financially developed economies. Although some supporting evidence exists for advanced economies (Mendoza, Quadrini, and Ríos-Rull, 2009), for the rest of the world Alfaro, Kalemli-Özcan, and Volosovych (2014) and Gourinchas and Jeanne (2013) show that these savings were channeled abroad by the public sector rather than the private sec-

⁹For a general review on possible causes of global imbalances, refer to Eichengreen and Park (2006) and Eichengreen (2006).

tor. Moreover, Chinn, Eichengreen, and Ito (2014) shows that government budget deficits in advanced economies and public savings in emerging-market economies are related under global imbalances. This is reserve accumulation in form of safe instruments such as Treasuries, Gilts, BTFs and *Bunds*. As shown in my paper, emerging-market countries with better institutional will demand more foreign reserve assets. This demand increase the extent to which global safe assets are scarce (Caballero, Farhi, and Gourinchas, 2008), and hence strengthen global imbalances.

Although less directly, this paper relates to work on the economic effect of institutions such as Acemoglu, Robinson, and Johnson (2001), Acemoglu et al. (2014), Alesina and Dollar (2000), Jones and Olken (2005), Jones and Olken (2009), Lindqvist and Östling (2010) and Azzimonti and Talbert (2014), among other works.

The following section will show stylized facts on the relation between institutional quality and foreign public assets in the data.

1.3 Stylized Facts

This section shows the relationship between institutional quality and public net and gross foreign assets. Data come primarily from the World Development Indicators Database Archive. Net foreign savings is measured as the difference between stock of international reserves (excluding gold) and the stock of Public and Publicly Guaranteed Debt. To extend data availability, I use vintages of the World Development Indicators (WDI) and Global Development Finance (GDF) issues dating back to 1989, as some countries are dropped from the dataset as soon as they

become high-income economies, according to the World Bank classification.

Data on national accounts, purchasing-power-parity (PPP) measures and foreign exchange rates come from the Penn World Tables (PWT) version 8.1 (Feenstra, Inklaar, and Timmer, 2015). This new version makes available data on national accounts at current and constant local-currency prices in addition to the PPP-adjusted series.

Another important set of indicators for this topic are the capital account openness measures from Chinn and Ito (2008), and the Political Risk Index and its subcomponents, from International Country Risk Guide (ICRG), available monthly since 1984.¹⁰ I will particularly use the *investment profile* subcomponent as a measure of expropriation risk. The *investment profile* category is an assessment of factors affecting the risk to investment that are not covered by other political, economic and financial risk components in the total ICRG index of Political Risk, and it is composed of three subcategories: contract viability/expropriation, profits repatriation, and payment delays. The first measures the risk of unilateral contract modification or cancellation and, at worst, outright expropriation of foreign owned assets; the second measures to what extent can profits be transferred out of the host country (impediments include exchange controls, excessive bureaucracy, a poor banking system, etc.); and the latter is the risk associated with receiving and exporting payments from the country (impediments include poor liquidity, exchange controls, an inadequate banking system, etc.). Although the first subcomponent is the most di-

¹⁰Another set of indices widely used in the literature are those related to political structure and are much longer dated, for example, Polity IV, Freedom House, Keefer and Stasavage (2003), and Beck et al. (2001). However, they do not measure expropriation risk as directly as some subcomponents of ICRG.

rect measure of expropriation risk, it is available only starting 2001. For this reason I use the broader investment profile time series, dating back to 1984.

Ideally, we would like to make series as comparable as possible, both internationally and intertemporally. Following Gourinchas and Jeanne (2013), I use an implicit trade deflator Q_{ct}^T for country c and year t ,¹¹ from PWT 8.1, as a combination of the export and import deflators,¹² weighted by their shares in GDP:

$$Q_{ct}^T = \frac{X_{ct}}{X_{ct} + M_{ct}} Q_{ct}^X + \frac{M_{ct}}{X_{ct} + M_{ct}} Q_{ct}^M \quad (1.1)$$

where X and M corresponds to the average-of-period shares in current PPP-adjusted exports and imports, respectively. In previous versions, this trade deflator is not available, so the investment deflator is used to compare across countries; however, to compare across periods, the investment deflator is adjusted further with the GDP deflator:

$$\hat{Q}_{ct}^T = Q_{ct}^T \times \frac{CGDP_{ct}}{RGDP_{ct}} \quad (1.2)$$

where $CGDP$ ($RGDP$) is the GDP in current (chained) PPP-adjusted 2005 dollars. The adjusted stocks of foreign assets and liabilities, which I denote as real stocks, are scaled by GDP in chained PPP 2005 dollars. The results are reserves and PPG debt adjusted across period and country, and scaled by real GDP.

¹¹They use version 7.1 of PWT, which does not report deflators for exports and imports, so the authors deflate series using the price of investment; however, they recommend the use of trade deflators for capital flows whenever possible.

¹²These deflators are normalized such that the price level of GDP in the United States in 2005 is equal to 1.

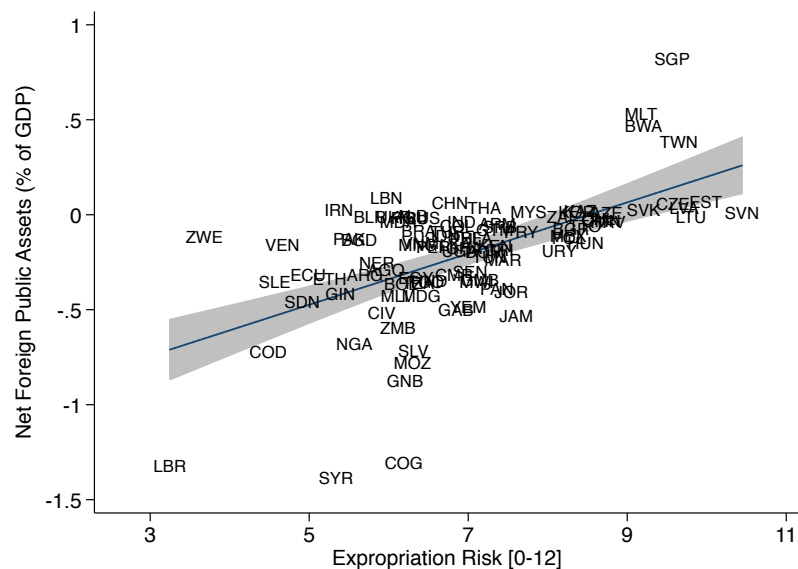
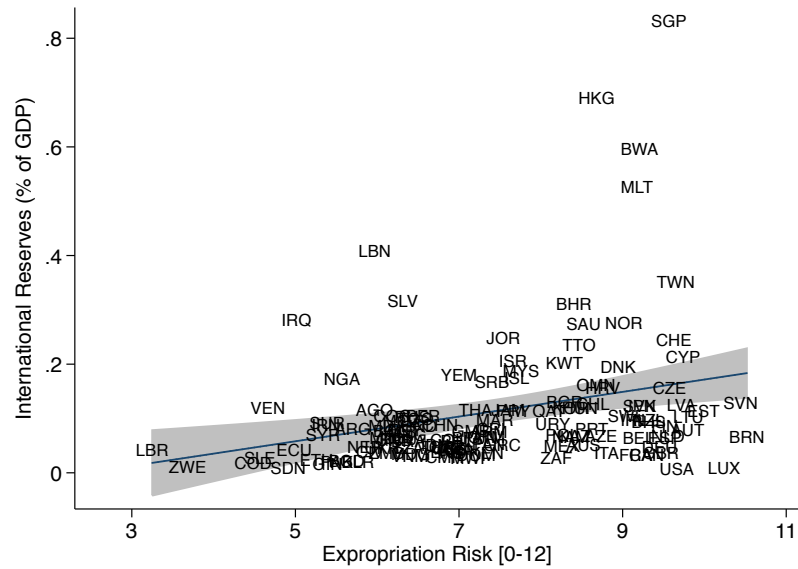
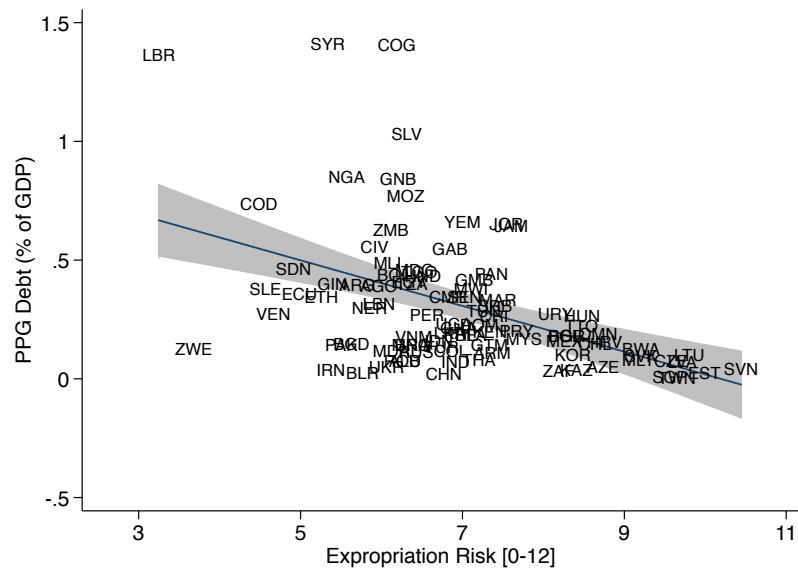


Figure 1.1: Correlation between Net Public Foreign Assets and Expropriation Risk. Plot shows average real reserves stock as share of real GDP against the average level of the *investment profile* subcomponent of the ICRG political risk index, which measures Expropriation Risk. In the figure, a high value in the Expropriation Risk measure implies a low expropriation risk. Averages are taken over available data between 1980 and 2011. Source: Own elaboration on WDI Database Archive and ICRG.

In Figure 1.1 I depict the relation between net sovereign foreign assets and expropriation risk (as measured by *investment profile* component of the ICRG Political Risk Index.) The relation is significant and positive. When decomposing the net foreign public assets into foreign reserves and PPG debt, as shown in Figure 1.2, it is clear PPG debt is negatively correlated with the index of expropriation risk, while foreign reserves are positively correlated. All of these relations are maintained when controlling for outliers.



(a) International Reserves



(b) Public and Publicly Guaranteed Debt

Figure 1.2: Correlation between Foreign Reserves and PPG Debt, and Expropriation Risk. In the top panel, the plot shows average real reserves stock as share of real GDP against the average level of expropriation risk, as measured by the *investment profile* variable in ICRG. In the bottom panel, the plot shows average real PPG debt as share of real GDP against the average level of expropriation risk. Averages are taken over available data between 1980 and 2011. Source: Own elaboration on WDI Database Archive and ICRG.

It is important, however, to control for other determinants of the public international investment position. I will follow the empirical strategy of Gourinchas and Jeanne (2013). This strategy follows from a neoclassical model that, although differing from the model I build in this chapter, features also a small open economy.

Their right hand side variables consist of international capital flows, both private and public. These are accumulated flows between 1980 and 2000, scaled by GDP. I will focus on the public flows, which are composed of Public and Publicly Guaranteed (PPG) Debt and International Reserves, as explained in previous paragraphs. On the left hand side I will control for productivity catch-up with the United States, the ratio of initial capital to GDP and the ratio of foreign public debt to GDP, the growth of the 15-64 year-old population, capital openness (as measured by Chinn and Ito (2008)) and the expropriation risk measure from ICRG.¹³

The results are shown in Table 1.1. The results from columns 1 to 4, reproduce the original results. The coefficients must be interpreted with the opposite sign, this is, an increase in productivity catch-up will increase the outflows of the public flows (recall that in the Balance of Payment Manual 5 an outflow is indicated with a negative sign), as does an increase in capital account openness.

Columns 5 to 8 add the expropriation risk measure as independent regressor, where results suggests that expropriation risk is a fundamental factor for public flows, affecting the public foreign savings mainly through reserve accumulation. An increase of one standard deviation in the measure of expropriation risk, the

¹³These regressions use the original data, available from their publisher, except for the investment profile variable from ICRG. For a description on these variables, data, and countries included in the sample, refer to Gourinchas and Jeanne (2013).

investment profile subcomponent of the ICRG political risk index increases net foreign assets in 20 pp of GDP. In other words, an increase in the investment profile subcomponent, which corresponds to a lower expropriation risk, implies a greater accumulation of public net foreign assets of 20 pp of GDP.

Columns 9 to 12 show the results adding an interaction between the productivity catch-up and expropriation risk, which is significant at the 10 percent level, while the result is only significant at levels of 5 percent through foreign reserves. This indicates that lower expropriation risk by the government magnifies the effect of higher productivity catch-up in the accumulation of public net foreign assets.

The next section describes the model I use to account for the expropriation risk effects on net foreign public savings, under sudden stops and default risk.

1.4 Model

I consider an infinite-horizon small open economy, where time is discrete and indexed by t , populated by a continuum of mass 1 of households and by a large number of firms. The firms are owned by the households. Some produce tradable goods, and the rest, nontradable consumption goods. The government is run by one of several political parties, which is elected at the beginning of each period t . A political-economy friction leads political parties to value consumption more as an incumbent rather than as opposition, generating less-than-optimal policies. The government is the only agent engaged in borrowing/saving in the international capital markets with foreign investors. In every period the government can repay

Table 1.1: Results of Gourinchas and Jeanne (2013) controlling for expropriation risk

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Public flows	Public flows	PPG debt	Reserves	Public flows	Public flows	PPG debt	Reserves	Public flows	Public flows	PPG debt	Reserves
Productivity catch-up (π)	-0.843*** (0.185)	-1.182*** (0.185)	-0.037 (0.097)	-1.145*** (0.149)	-0.784*** (0.209)	-1.120*** (0.209)	-0.037 (0.101)	-1.083*** (0.168)	1.075 (0.831)	0.700 (0.743)	0.162 (0.380)	0.538 (0.586)
Initial capital abundance	-0.177+ (0.103)	-0.112 (0.093)	-0.085+ (0.049)	-0.027 (0.075)	-0.125 (0.112)	-0.068 (0.101)	-0.084+ (0.049)	0.016 (0.081)	-0.060 (0.111)	-0.006 (0.099)	-0.078 (0.051)	0.072 (0.078)
Initial debt	0.001 (0.003)	-0.002 (0.003)	-0.001 (0.002)	-0.002 (0.002)	-0.000 (0.003)	-0.003 (0.003)	-0.000 (0.001)	-0.003 (0.002)	-0.002 (0.003)	-0.005 (0.003)	-0.000 (0.001)	-0.004+ (0.002)
Population growth	-0.208* (0.087)	-0.148+ (0.079)	0.070+ (0.041)	-0.218** (0.063)	-0.201* (0.091)	-0.142+ (0.083)	0.069+ (0.040)	-0.211** (0.067)	-0.220* (0.088)	-0.161* (0.079)	0.067 (0.041)	-0.228*** (0.063)
Openness (Chinn-Ito)	-0.155* (0.060)	-0.131* (0.054)	0.030 (0.028)	-0.161*** (0.043)	-0.145* (0.061)	-0.122* (0.055)	0.033 (0.027)	-0.155*** (0.044)	-0.136* (0.059)	-0.114* (0.053)	0.034 (0.027)	-0.148*** (0.041)
Openness $\times \pi$		-0.693*** (0.174)	-0.003 (0.091)	-0.691*** (0.140)		-0.655*** (0.180)	0.004 (0.087)	-0.660*** (0.144)		-0.649*** (0.171)	0.005 (0.087)	-0.654*** (0.135)
Investment profile					-0.097 (0.061)	-0.076 (0.055)	0.000 (0.027)	-0.076+ (0.044)	-0.099+ (0.059)	-0.078 (0.052)	-0.000 (0.027)	-0.078+ (0.041)
investment profile $\times \pi$									-0.303* (0.131)	-0.296* (0.116)	-0.032 (0.060)	-0.264** (0.092)
Intercept	0.668* (0.271)	0.504* (0.244)	0.206 (0.128)	0.298 (0.196)	1.180** (0.413)	0.888* (0.379)	0.198 (0.182)	0.690* (0.304)	1.252** (0.398)	0.961* (0.360)	0.206 (0.184)	0.755* (0.284)
Number of observations	62	62	62	62	57	57	57	57	57	57	57	57
Adjusted- R^2	0.37	0.50	0.11	0.59	0.40	0.52	0.10	0.62	0.45	0.57	0.09	0.67

Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Notes: All data is taken from Gourinchas and Jeanne (2013), except for Expropriation Risk, which is the *investment profile* subcomponent of ICRG index, averaged over 1984-2000. The dependent variables are the flows of the mentioned category scaled by GDP. π is productivity catch-up with United States, $(k/y)_0$ is the initial capital ratio, $(d/y)_0$ is the initial stock of assets/debt, n is the average growth of population between 15-64 years old. $KAOPEN$ is the capital openness from Chinn and Ito (2008).

its debt or default on it. The following subsections provide further detail on each aspect of the model.

1.4.1 Political Environment

The political environment of this economy follows Aguiar and Amador (2011). There is a set $\mathcal{I} = \{1, 2, 3, \dots, N + 1\}$, where $N + 1$ is the number of parties. The government is controlled by an incumbent party, chosen at the beginning of every period from the set \mathcal{I} . This party may lose and come back into power eventually. The key assumption is that the incumbent party strictly prefers consumption occurring under its rule.

Assumption 1 (Political Economy Friction). *A party enjoys a utility flow $\tilde{\theta}u(C_t)$ when in power and a utility flow $u(C_t)$ when out of power, where C is the per-capita consumption basket by the domestic households and where $\tilde{\theta} > 1$.*

There are several possible interpretations for the parameter $\tilde{\theta}$. In principle, this parameter captures difference in intertemporal comparisons between the party in office and the opposition. One interpretation is disagreement regarding government expenditures. Another one is corruption where the ruling party captures a disproportionate share of consumption per-capita.

The transfer of power is modeled as an exogenous Markov process. Denote p as the probability that the party in office retains power. If the party in office loses, each party in the opposition has an equal probability of gaining power. Denote q as the probability of regaining power, i.e. $q \equiv (1 - p)/N$. In particular,

$(p - q) \in [-N^{-1}, 1]$ represents the incumbent advantage on elections. Denote $p_{t,s}$ as the probability in period t that the incumbent will be in office in period $s > t$. A Markov political process can be represented as:

$$p_{t,s+1} = p \times p_{t,s} + q \times (1 - p_{t,s}) \quad (1.3)$$

Starting from $p_{t,t} = 1$, this equation has the following solution:

$$p_{t,s} = \bar{p} + (1 - \bar{p})(p - q)^{s-t} \quad (1.4)$$

where $\bar{p} = \lim_{s \rightarrow \infty} p_{t,s}$ is the unconditional probability of taking office. For $p < 1$, $\bar{p} = (N + 1)^{-1}$, while for $p = 1$, $\bar{p} = 1$.

As a consequence of the political process and the political-economy friction, the utility of the incumbent can be written as:

$$\tilde{W}_t = \mathbb{E}_t \left[\sum_{s=t}^{\infty} \beta^{s-t} p_{t,s} \tilde{\theta} u(C_s) + \sum_{s=t}^{\infty} \beta^{s-t} (1 - p_{t,s}) u(C_s) \right] \quad (1.5)$$

For ease of analysis, let us define the following ratios:

$$\theta \equiv \frac{\tilde{\theta}}{\bar{p}\tilde{\theta} + (1 - \bar{p})} \quad (1.6)$$

$$\delta \equiv p - q = \frac{p - \bar{p}}{1 - \bar{p}} \quad (1.7)$$

The parameter θ is the ratio of the conditional valuation of consumption flow during incumbency over the unconditional valuation when in the opposition. The param-

eter δ will represent the incumbency advantage, and can also be interpreted as the persistence of θ in the planning horizon of the incumbent. Using these new parameters, Equation (1.5) can be rescaled using equations (1.6) and (1.7), yielding the following representation of the incumbent preferences:

$$W_t \equiv \frac{\tilde{W}_t}{\bar{p}(\tilde{\theta} + N)} = \mathbb{E}_t \left[\sum_{s=t}^{\infty} \beta^{s-t} (\theta \delta^{s-t} + 1 - \delta^{s-t}) u(C_s) \right] \quad (1.8)$$

The differences between the incumbent's and the opposition's preferences stem from the discounting processes. The intertemporal discount factor varies over periods, which is different from the case of a constant discount rate β . Between t and $t + 1$ the discount factor is $\beta(\theta\delta + 1 - \delta)/\theta$ and between $t + 1$ and $t + 2$ it's $\beta(\theta\delta^2 + 1 - \delta^2)/(\theta\delta + 1 - \delta)$. Only as $t \rightarrow \infty$ does the intertemporal discount rate converge to β . This is a feature of quasi-hyperbolic discounting à la Laibson (1997), and the comparison is exact when $\delta = 0$ and $p = q = (1 + N)^{-1}$ (no incumbency advantage), in which case preferences are given by:

$$W_t = u(C_t) + \frac{1}{\theta} \mathbb{E}_t \sum_{s=t+1}^{\infty} \beta^{s-t} u(C_s) \quad (1.9)$$

where the discount factor between period t and $t + 1$ is β/θ , and afterwards $\beta > \beta/\theta$. The parameter $\delta > 0$ makes the differences in discount rates persist over time, given $\tilde{\theta} > 1$. Notice as well that autocratic governments, where $\delta = 1$, will yield the same results as the case where $\theta = 1$, so any differences in consumption/saving behavior of their economies will come from the degree of impatience they exhibit, represented

by parameter β .

The following sections will describe the production and household sectors of the economy, and then will add further details to the public sector settings.

1.4.2 Households

The representative household derives utility from consumption C_t and supplies labor inelastically each period. The household's lifetime expected utility is given by

$$\mathbb{E}_t \left[\sum_{s=t}^{\infty} \beta^{s-t} \frac{C_s^{1-\sigma}}{1-\sigma} \right] \quad (1.10)$$

In this expression, \mathbb{E}_t is the expectation operation conditional on information available at time t , $\beta < 1$ is the subjective discount factor, $\sigma > 0$ is the coefficient of relative risk aversion and C_t denotes a consumption basket. This consumption basket is a constant-elasticity-of-substitution (CES) combination of tradable C_t^T and nontradable C_t^N goods. The parameters are a , which is the share of income destined to buy tradable goods, and ζ , which is the inverse of one minus the elasticity of substitution between tradable and non tradable goods:

$$C_t = \left[a (C_t^T)^{-\zeta} + (1-a) (C_t^N)^{-\zeta} \right]^{-1/\zeta} \quad (1.11)$$

Each period the household faces the following flow budget constraint:

$$C_t^T + P_t^N C_t^N = W_t + \Pi_t^T + P_t^N \Pi_t^N + T_t \quad (1.12)$$

The budget constraint is expressed in units of the tradable good. The left-hand side represents the household's expenditure, where P_t^N represents the relative price of the nontradable good in terms of the tradable good, so $C_t^T + P_t^N C_t^N$ is the household's consumption expenditure expressed in units of the tradable good. The right-hand side represents the income of the household. W_t denotes the household's labor income. Π_t^T and Π_t^N are the dividends the households receives from firms operating in the tradable and in the nontradable sector, respectively. T_t represents the net tax/transfers to/from the government after its net asset decisions are made. For simplicity, domestic households do not trade directly with any foreign investors. Each period the representative household chooses C_t^T and C_t^N to maximize expected utility (1.10) subject to the budget constraint (1.12). The first order condition is:

$$\left(\frac{1-a}{a}\right) \left(\frac{C_t^T}{C_t^N}\right)^{1+\zeta} = P_t^N \quad (1.13)$$

where P_t^N will be considered as a proxy for the real exchange rate. The consumer-price index is given then by

$$P_t = \left[a^{-\zeta} + (1-a)^{-\zeta} (P_t^N)^{1+\zeta} \right]^{\frac{1}{1+\zeta}} \quad (1.14)$$

which is the composite price-index of the consumption basket C_t .

1.4.3 Firms in the tradable sector

Firms in the tradable sector produce the final tradable good Y_t^T using labor L_t^T and imported intermediate goods M_t . The production function is Cobb-Douglas with labor share α , a labor-augmenting productivity factor Γ_t , and a temporary technology shock z_t .

$$Y_t^T = z_t(\Gamma_t L_t^T)^\alpha M_t^{1-\alpha} \quad (1.15)$$

The labor-augmenting productivity factor Γ_t is the knowledge used to produce the tradable good, which is public and non-rival, and the transitory technology shock z_t has its logarithm autocorrelated of first order with persistence ρ and white noise innovations ε_t , whose mean is 0 and its standard deviation, σ_ε .

$$\log z_t = (1 - \rho) \log \mu_z + \rho \log z_{t-1} + \varepsilon_t, \quad \mathbb{E}\varepsilon_t = 0, \quad \mathbb{E}\varepsilon_t^2 = \sigma_\varepsilon^2 \quad (1.16)$$

A constant fraction ϕ of the purchases of imported intermediate goods must be financed with foreign intra-period loans every period, up to a stochastic borrowing limit κ_t . In addition, the government can provide public loans D_t in case the constraint binds, and foreign financing is not sufficient to purchase the intermediate imported inputs:

$$\phi P_t^M M_t \leq \kappa_t \Gamma_t + D_t \quad (1.17)$$

This borrowing limit κ_t can take two values: κ_L and $\kappa_H > \kappa_L$; and follows a Markovian discrete process with transition probability $\mathbb{F}(\kappa_t|\kappa_{t-1})$. The higher value κ_H is enough to ensure that the borrowing constraint is never binding, while κ_L makes the borrowing constraint bind under certain states. Whenever the latter arises, the government will provide public loans, subject to its availability of funds. The profit function for the entrepreneurs is given then by:

$$\Pi_t^T = z_t (\Gamma_t L_t^T)^\alpha M_t^{1-\alpha} - P_t^M M_t - W_t L_t^T + \mu_t (\phi P_t^M M_t - \kappa_t \Gamma_t - D_t) \quad (1.18)$$

where μ_t stands for the multiplier of the borrowing constraint. The first order conditions for the tradable firms are:

$$z_t \alpha (\Gamma_t)^\alpha (L_t^T)^{\alpha-1} (M_t^T)^{1-\alpha} = W_t \quad (1.19)$$

$$z_t (1 - \alpha) (\Gamma_t L_t^T)^\alpha (M_t^T)^{-\alpha} = P_t^M (1 + \phi \mu_t) \quad (1.20)$$

$$\mu_t (\phi P_t^M M_t - \kappa_t \Gamma_t - D_t) = 0 \quad (1.21)$$

It is important to highlight that even if the government had the resources to step in, the multiplier μ_t would still be positive unless it can restore the full first-best choice of the firm.

1.4.4 Knowledge accumulation process

The stock of knowledge available to firms in the tradable sector evolves according to the following process:

$$\Gamma_{t+1} = v\Gamma_t + M_t^\xi \Gamma_t^{1-\xi} \quad (1.22)$$

where $v \geq 0$ and $0 \leq \xi \leq 1$. This formulation captures the idea that imports of foreign capital goods represent an important transmission channel through which discoveries made in developed economies spill over to developing countries. As mentioned before, knowledge is assumed non-rival and non-excludable. This, along with the large number of firms assumed in the tradable sector, implies that firms do not internalize the impact of their actions on the evolution of the economy's stock of knowledge. We can rewrite the equation of the evolution of knowledge as follows:

$$g_{t+1} \equiv \frac{\Gamma_{t+1}}{\Gamma_t} = v + \left(\frac{M_t}{\Gamma_t}\right)^{1-\xi} \quad (1.23)$$

where g_{t+1} is the growth rate of the knowledge stock.

1.4.5 Firms in the nontradable sector

The nontradable sector represents a traditional sector that does not engage in international trade. Its output is produced using labor according to the function:

$$Y_t^N = \Gamma_t (L_t^N)^\gamma \quad (1.24)$$

where Γ_t is the growth of the stock of knowledge in the economy, and $0 \leq \gamma \leq 1$ is the share of labor in profits. The first order condition for labor is:

$$\gamma P_t^N \Gamma_t (L_t^N)^{\gamma-1} = W_t \quad (1.25)$$

In addition, the labor market must clear $L_t^T + L_t^N = 1$, as must the market of non-tradable goods $C_t^N = Y_t^N$.

1.4.6 Private Sector Equilibrium

Definition 1 (Private Sector Equilibrium). *A Private Sector Equilibrium is characterized by a set of allocations $\{C_t^T, C_t^N, L_t^T, L_t^N, M_t\}_{t=0}^\infty$, and prices $\{W_t, P_t^N\}_{t=0}^\infty$ such that, taking as given government policies $\{T_t, D_t\}_{t=0}^\infty$, knowledge process $\{\Gamma_t\}_{t=0}^\infty$, and stochastic processes $\{\kappa_t, z_t\}_{t=0}^\infty$:*

- (i) *Households satisfy Equation (1.12) and Equation (1.13), taking as given prices, profits from tradable firms Π_t^T , profits from nontradable firms Π_t^N , and government lump sum net transfers T_t .*

(ii) Firms satisfy Equation (1.19), Equation (1.20), Equation (1.21) and Equation (1.25) and satisfy labor and non-tradable goods market clearing, taking as given prices, the knowledge process, and government policies.

For a solution of the private sector equilibrium, see Appendix A.

1.4.7 The Government Budget Constraint

The sovereign can issue one-period, non-contingent discount bonds, so contingent claims markets are incomplete. Alternatively, it can buy other one-period, non-contingent discount bonds in the foreign market, which are risk-free. The face value of these bonds specifies the amount to be repaid/received in the next period, B_{t+1} . The government borrows if $B_{t+1} < 0$ and saves if $B_{t+1} > 0$. The set of the net government savings is thus $\mathcal{B} \subset \mathbb{R}$.

The lower bound \underline{b} is usually set to be higher than $-\overline{GDP^T}/r^*$, an annuity of tradable value added, which is the largest debt that the country could repay under full commitment. Alternatively, the upper bound \bar{b} can be set lower than $\overline{GDP^T}/r^*$, which is the largest savings that the country can accumulate. Hence $\mathcal{B} = [\underline{b}, \bar{b}]$, and $0 \in \mathcal{B}$. The price of these bonds is q_t^B which is a function $q^B(B_{t+1}, \Gamma_t, z_t, \kappa_t)$ set by foreign investors.

In addition, the government can provide tradable-goods producing firms with intraperiod working capital loans D_t when they are under distress. However, when providing these loans, the government incurs an efficiency loss, which amounts to $\psi/(1 - \psi) D_t$ (Gertler and Karadi, 2011). Therefore, the government budget con-

straint is given by:

$$B_t = T_t + q_t^B B_{t+1} + \frac{\psi}{1 - \psi} D_t \quad (1.26)$$

where T_t is the amount of net transfers to the households. The loans to the private sector cannot exceed the net savings the government has at the moment, so:

$$D_t \in [0, (1 - \psi) B_t]$$

The public loans to the private sector are thus the minimum between the amount that tradable-goods producing firms need to finance the unconstrained imported inputs purchases, and the total amount of resources the government can provide to this sector. Hence, the rule is given by the following equation:

$$D_t = \max \{ \min \{ \phi P_t^M M_t^u - \kappa_t \Gamma_t, (1 - \psi) B_t \}, 0 \} \quad (1.27)$$

where M_t^u is the unconstrained level of imported inputs used by the firms in tradable sector, ϕ is the fraction of imported inputs financed with short-term foreign loans, and κ is a credit shock to the foreign borrowing limit the tradable firms face, scaled by the technology long-term trend Γ_t . An additional assumption, common in the literature (see Bianchi, Hatchondo, and Martínez, 2012) is that the government cannot borrow in the international markets during a sudden stop.¹⁴

¹⁴A sudden stop in this paper is defined as a situation where government resources are not enough to restore first-best levels of unconstrained imported inputs. In other words, when $\kappa_t = \kappa_L$, the government may have to intervene but will not have enough resources.

1.4.8 Default

The sovereign cannot commit to repay its debt. As in Eaton and Gersovitz (1981), when the country defaults it does not repay at date t and is excluded from the world credit markets starting the same period. The country may re-enter into the international capital market with an exogenous probability η , starting with a fresh record and zero debt.

The government chooses a saving/borrowing policy and whether to default or not, taking the private sector decisions as given, according to the following rule:

$$W_t^o = \max \{W_t^c, W_t^d\} \quad (1.28)$$

where W_t^c is the expected utility for the incumbent at t of not defaulting, and W_t^d is the expected utility of defaulting; W_t^o is the maximum between the expected utilities of defaulting and not defaulting. The government will default whenever $W_t^c \leq W_t^d$. These expected utilities are given by:

$$W_{t,t}^c = \theta u(C_t) + \beta \mathbb{E}_t [W_{t,t+1}^o] \quad (1.29)$$

$$W_{t,t}^d = \theta u(C_t^d) + \beta \mathbb{E}_t [\eta W_{t,t+1}^o + (1 - \eta) W_{t,t+1}^d] \quad (1.30)$$

Notice that $W_{t,t+1}^o$ corresponds to the value function of the incumbent in period $t+1$ but from the perspective of period t . Since the government does not commit and has naïve hyperbolic discounting (as explained in section 1.4.1), it is very likely that

$W_{t,t+1}^o \neq W_{t+1,t+1}^o$. We can write down the value functions for any horizon $h \geq 0$ as follows:

$$W_{t,t+h}^o = \max \{W_{t,t+h}^c, W_{t,t+h}^d\} \quad (1.31)$$

$$W_{t,t+h}^c = (\theta\delta^h + 1 - \delta^h) u(C_{t,t+h}) + \beta\mathbb{E}_{t+h} [W_{t,t+h+1}^o] \quad (1.32)$$

$$W_{t,t+h}^d = (\theta\delta^h + 1 - \delta^h) u(C_{t,t+h}) + \beta\mathbb{E}_{t+h} [\eta W_{t,t+h+1}^o + (1 - \eta) W_{t,t+h+1}^d] \quad (1.33)$$

Hence the probability of default depends on the likelihood that $W_{t,t+h}^c < W_{t,t+h}^d$. Denote this probability $\Upsilon_{t,t+h} \equiv \Pr [W_{t,t+h}^c < W_{t,t+h}^d]$. This probability will be used by foreign investors to assess the value of the government portfolio.

1.4.9 Foreign investors

International creditors are risk-neutral and have complete information. They invest in one-period sovereign bonds and in within-period private working capital loans. Foreign lenders behave competitively and face an opportunity cost of funds equal to r^* . Competition implies zero expected profits at equilibrium and full arbitrage between the sovereign debt and the world's risk-free asset. Hence, the price of the sovereign net international investment position is given by:

$$q_t^B = \begin{cases} 1/(1+r^*) & \text{if } B_{t+1} \geq 0 \\ (1 - \Upsilon_{t+1})/(1+r^*) & \text{if } B_{t+1} < 0 \end{cases} \quad (1.34)$$

where Υ_{t+1} is the probability of sovereign default in the next period. This result assumes that in sovereign default, all assets and liabilities are seized, while whenever foreign assets are greater than foreign liabilities, the sovereign does not default, as it can repay debt using those assets. This provides an important simplification, although the confiscation of foreign assets seldom occurs (Wright, Forthcoming).

1.4.10 A Recursive Formulation

For a recursive formulation, we first denote $s = \{\kappa, z\}$ as the vector of exogenous state variables, while B and Γ are the endogenous state variables. At any given horizon $h \in \mathbb{N}_0$, the value functions for continuation W_h^c , default W_h^d , and for the default option W_h^o are given below:

$$W_h^c(B, \Gamma, s) = \max_{B'} \Omega_h u(C_h) + \beta \mathbb{E}_h W_{h+1}^o(B', \Gamma', s') \quad (1.35)$$

$$W_h^d(\Gamma, s) = \Omega_h u(C_h^d) + \beta \mathbb{E}_h [\eta W_{h+1}^o(0, \Gamma', s') + (1 - \eta) W_{h+1}^d(\Gamma', s')] \quad (1.36)$$

$$W_h^o(B, \Gamma, s) = \max \{W_h^c(B, \Gamma, s), W_h^d(\Gamma, s)\} \quad (1.37)$$

where we define $\Omega_h \equiv \delta^h \theta + 1 - \delta^h$. For a tractable recursive representation it is important to consider that as t goes to infinity, the discount rate between consecutive periods, $\beta \Omega_{h+1} / \Omega_h$, tends to β . By using the definition of limits, it is possible to find a horizon τ such that for any $h > \tau$, the discount rate between any two consecutive periods is always β as in a classical sovereign default problem.

Proposition 1. For a sufficiently small ϵ , $\theta > 1$, and $\delta \in (0, 1)$, there exists τ such that for $h > \tau$:

$$\left| \frac{\Omega_{h+1}}{\Omega_h} - 1 \right| < \epsilon$$

and hence $\lim_{h \rightarrow \infty} \Omega_{h+1}/\Omega_h = 1$.

Proof. Define $\tau = \log_{\delta} \epsilon - \log_{\delta} [(\theta - 1)(1 - \delta - \epsilon)]$. Hence for $h > \tau$ the intertemporal discount rate in subsequent periods is close enough to β . \square

Note that also τ is such that $W_h = V$ for any $h \geq \tau$, where V is the value function of households. Note that if $\delta = 0$, then $\tau = 0$, and $W_1 = V$; if $\delta = 1$ and $\theta \geq 1$, $W_h = V, \forall h \in \mathbb{N}_0$.

As an illustration, in fig.1.3 the discount rate $\beta^h \Omega_h(\delta, \theta)$ is depicted for various values of δ , given parameters $\beta = 0.95$ and $\theta = 1.5$. Note that the discount rate for the first period converges in $h = 1$ if $\delta = 0$, to the value that a benevolent sovereign would discount. When $\delta = 0.25$, Ω_h converges after $h = 10$ for $\epsilon = 10^{-6}$, and after $h = 41$ for $\delta = 0.75$. The importance of this discount function discussion is that it allows us to solve the problem by using backward induction. We solve for a benevolent sovereign for $h \geq \tau$ and then solving backwards using the corresponding factor Ω_h . Using this result, for horizons $h > \tau$ we can solve a classical sovereign-default recursive problem:

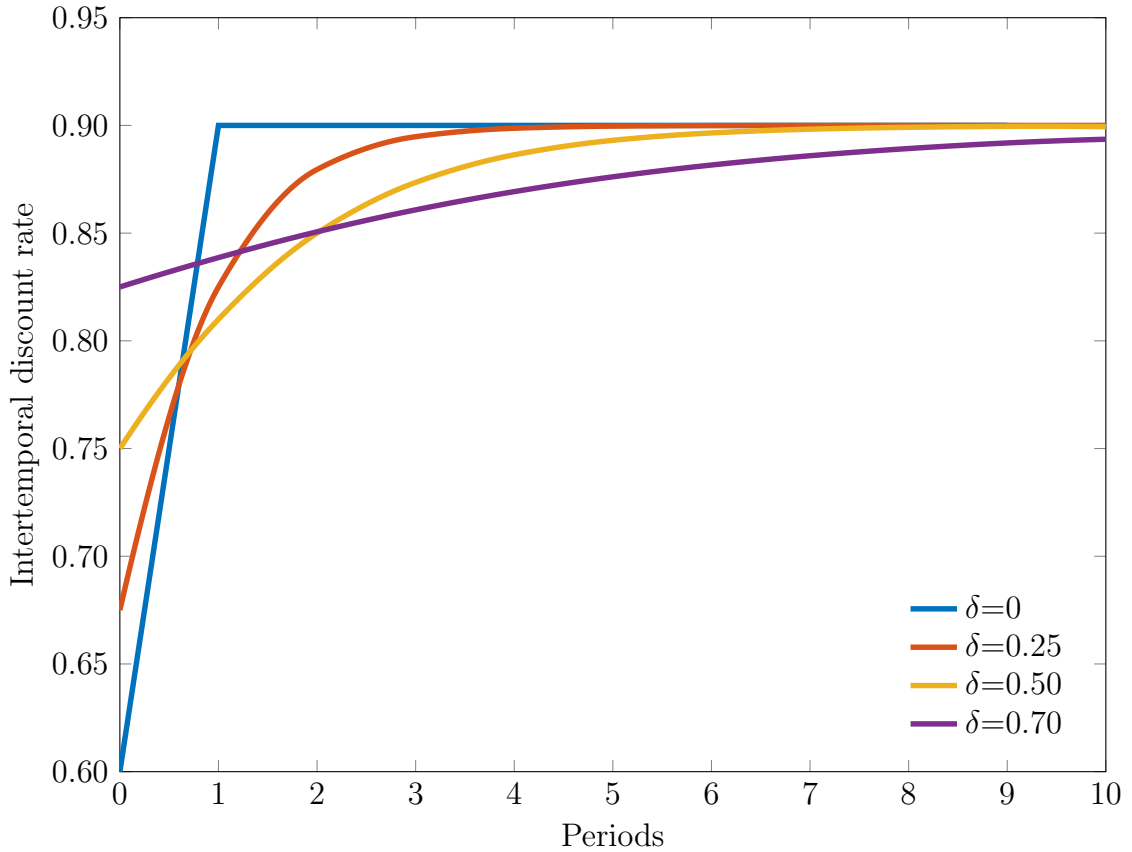


Figure 1.3: Quasi-hyperbolic discounting. The figure shows the one-period discount function for different horizons, given $\beta = 0.9$, and $\theta = 1.5$. Traditional models feature $\theta = 1$ and $\delta = 0$, so there are no political-economy frictions. If θ increases to 1.5 as in this figure, the discount rate between periods 0 and 1 is lower than the standard case, but in the following period is the same as in a benevolent government. This also the case under standard quasi-hyperbolic discounting à la Laibson (1997), due to the fact that the distortions are not expected to last due to lack of incumbency advantage, i.e. $\delta = 0$. If incumbency advantage is higher (recall $\delta \in [0, 1]$), the difference in discounting is less abrupt than in the case of $\delta = 0$, but persists longer.

$$V^c(B, \Gamma, s) = \max_{B'} u(C) + \beta \mathbb{E} V^o(B', \Gamma', s') \quad (1.38)$$

$$V^d(s) = u(C^{\text{def}}) + \beta \mathbb{E} [\eta V^o(0, \Gamma', s') + (1 - \eta) V^d(\Gamma', s')] \quad (1.39)$$

$$V^o(B, \Gamma, s) = \max \{V^c(B, \Gamma, s), V^d(\Gamma, s)\} \quad (1.40)$$

The definitions of the default set and the probability of default are standard from Eaton-Gersovitz models (Arellano, 2008). For a debt position $B < 0$, default is optimal for the set of realizations of s for which $V^d(B, \Gamma, s)$ is at least as high as $V^c(B, \Gamma, s)$:

$$\mathcal{D}(B) = \{s : V^c(B, \Gamma, s) \leq V^d(B, \Gamma, s)\} \quad (1.41)$$

The probability of default at $t + 1$ perceived as of date t , $\Upsilon(B', \Gamma, s)$, can be induced from the default set and the transition probability function F of productivity shocks z and credit shocks κ , as follows:

$$\Upsilon(B', \Gamma, s) = \int_{\mathcal{D}(B')} dF(s', s) \quad (1.42)$$

The transition probability for technology shocks z is continuous $G(z', z)$, given by Equation (1.16), while that for credit shocks κ is discrete, and given by $H(\kappa', \kappa)$:

$$\Upsilon(B', \Gamma, s) = \sum_{\kappa' \in \mathcal{D}(B')} \int_{z' \in \mathcal{D}(B')} h(\kappa', \kappa) g(z', z) dz' \quad (1.43)$$

With this probability in mind, the price function of the sovereign portfolio is calculated as:

$$q^B(B', \Gamma, s) = \frac{1 - \Upsilon(B', \Gamma, s)}{1 + r^*} \quad (1.44)$$

where $\Upsilon = 0$ for all $B' \geq 0$.

After having solved the “terminal” problem, we proceed to iterate backwards until we arrive to horizon $h = 0$. An important assumption is that foreign investors know whether the government behaves hyperbolically or not, so they will calculate the default rule as:

$$\mathcal{D}_0(B) = \{s : W_0^c(B, \Gamma, s) \leq W_0^d(B, \Gamma, s)\} \quad (1.45)$$

$$\Upsilon_0(B', \Gamma, s) = \sum_{\kappa' \in \mathcal{D}_0(B')} \int_{z' \in \mathcal{D}_0(B')} h(\kappa', \kappa) g(z', z) dz' \quad (1.46)$$

$$q^B(B', \Gamma, s) = \frac{1 - \Upsilon_0(B', \Gamma, s)}{1 + r^*} \quad (1.47)$$

which is possible, because bonds are issued at one-period maturity.

1.4.11 Detrended Form

To solve the recursive formulation numerically, it is important to remove the productivity trend Γ , as to reduce the number of states in the economy. This is a feasible procedure, given that the value functions are homogeneous of degree $1 - \sigma$ in Γ , and that the price function of the sovereign portfolio is homogeneous of degree zero in Γ and B' . This derives from the utility function specification and the fact

that the budget and borrowing constraints are homogeneous of degree one in Γ . The detrended form is given hence by:

$$v^c(b, s) = \max_{b'} u(c) + \beta (g')^{1-\sigma} \mathbb{E} v^o(b', s') \quad (1.48)$$

$$v^d(s) = u(c^{\text{def}}) + \beta (g')^{1-\sigma} \mathbb{E} [\eta v^o(0, s') + (1 - \eta) v^d(s')] \quad (1.49)$$

$$v^o(b, s) = \max \{v^c(b, s), v^d(s)\} \quad (1.50)$$

and $g' \equiv \Gamma'/\Gamma = v + m^\xi$ is the future growth rate of the economy, which is known in current period, although not internalized by the private sector. It is important to add that the constraints for the private sector equilibrium are also scalable:

$$c_T + P_N c_N = z m^{1-\alpha} L_T^\alpha + P_N (1 - L_T)^\gamma - P_M m + b - q^B(b', s) b' g' - \frac{\psi}{1 - \psi} d \quad (1.51)$$

$$\phi P^M m \leq \kappa + d \quad (1.52)$$

$$d = \max \{ \min \{ \phi P^M m^u - \kappa, (1 - \psi) b \}, 0 \} \quad (1.53)$$

The resource constraint of the economy is given by equation (1.51), while the borrowing constraint is given by (1.52).

The solution of the model is equivalent to a constrained-centralized solution where the central planner (the sovereign) takes the growth rate of the economy g' as given, yielding the same first order conditions of the private sector equilibrium. Once the *terminal* value functions and policy rules are solved, we iterate backwards and find the solutions for shorter horizons, starting in period $h = \lfloor \tau \rfloor$ until $h = 0$:

$$w_h^c(b, s) = \max_{b'} \Omega_h u(c_h(b, s)) + \beta (g')^{1-\sigma} E_h w_{h+1}^o(b', s') \quad (1.54)$$

$$w_h^d(s) = \Omega_h u(c_h^d(s)) + \beta (g')^{1-\sigma} E_h [\eta w_{h+1}^o(0, s') + (1 - \eta) w_{h+1}^d(s')] \quad (1.55)$$

$$w_h^o(b, s) = \max \{w_h^c(b, s), w_h^d(s)\} \quad (1.56)$$

where the private sector constraints are:

$$\begin{aligned} c_h^T + P_h^N c_h^N &= z m_h^{1-\alpha} (L_h^T)^\alpha + P_N (1 - L_h^T)^\gamma - P_M m_h + b - q_h^B(b', s) b'_h g' - \\ &\quad - \frac{\psi}{1 - \psi} d_h \end{aligned} \quad (1.57)$$

$$\phi P^M m_h \leq \kappa + d_h \quad (1.58)$$

$$d_h = \max \{ \min \{ \phi P^M m_h^u - \kappa, (1 - \psi) b \}, 0 \} \quad (1.59)$$

1.5 Economy-Wide Equilibrium

Definition 2 (Recursive Equilibrium). *A Recursive Equilibrium is characterized by a set of value functions $\{w_h^o(b, s), w_h^c(b, s), w_h^d(s)\}_{h=0}^\tau$ and $v^o(b, s)$, $v^c(b, s)$, and $v^d(s)$; a default rule $\{\Upsilon_h(b, s)\}_{h=0}^\tau$, $\Upsilon(b, s)$, a sovereign portfolio rule $\{b'_h(b, s)\}_{h=0}^\tau$, $b'(b, s)$, a sovereign portfolio price function $\{q_h^B(b, s)\}_{h=0}^\tau$, $q^B(b, s)$, a credit policy $\{d_h(b, s)\}_{h=0}^\tau$, $d(b, s)$, and a transfer policy $\{t_h(b, s)\}_{h=0}^\tau$, $t(b, s)$, such that:*

- (i) *Policy rules $\{b'_h(b, s)\}_{h=0}^\tau$, $b'(b, s)$ and $\{d_h(b, s)\}_{h=0}^\tau$, $d(b, s)$ solve the problem in (1.48)-(1.59), given the price function $\{q_h^B(b, s)\}_{h=0}^\tau$, $q^B(b, s)$. That is the government's default and borrowing decisions are optimal given the interest*

rates on sovereign debt.

- (ii) Private consumption and factor allocations are feasible and consistent with the equilibrium private market defined in Section 1.4.6.*
- (iii) The transfer policies $\{t_h(b, s)\}_{h=0}^\tau$, $\{d_h(b, s)\}_{h=0}^\tau$, $t(b, s)$, and $d(b, s)$ satisfy the budget constraints of the government.*
- (iv) Given default regions $\{\mathcal{D}(b, s)\}_{h=0}^\tau$ and $\mathcal{D}(b, s)$, and probabilities of default $\{\Upsilon(g, s)\}_{h=0}^\tau$, and $\Upsilon(g, s)$, the bond price functions $\{q_h^B(b', s)\}_{h=0}^\tau$, and $q^B(b', s)$ satisfy the arbitrage condition of investors in equation (1.34).*

A solution to the recursive equilibrium includes solutions for sectoral factor allocations and production during normal periods and default, and sudden stops as well. Solutions for equilibrium wages, profits, and the price of domestic inputs follow then from the firms' optimality conditions and the definition of profits described earlier.

1.6 Parametrization

The parameters chosen are shown in Table 1.2. Parameters σ , β , and r^* have standard RBC values of 2, 0.9 and 4 percent (annual), respectively; for consumption, the parameters a and ζ are taken from Schmitt-Grohé and Uribe (2016), although a has the same value as in Benigno and Fornaro (2012). A value of $\zeta = 0.2$ corresponds to a value of the constant elasticity of substitution of $5/6$.

For the trend process in the tradable sector, I set $v = 0.17$ so as to match the growth rate in a non-stochastic steady state to 3.4 percent, which is the average growth of emerging and developing economies. The elasticity of growth to imported inputs is 0.1 and is slightly lower than in Benigno and Fornaro (2012), although allows for the benchmark economy to have 30 percent of GDP in public net foreign assets. For the transitory process $\rho = 0.96$ and $\sigma_\varepsilon = 1.21\%$, and $\mu_z = 0.49$ is set so total GDP in the non-stochastic steady state is equal to 1. These parameters were calibrated for the Chilean economy, although they are very close to those in Mendoza and Yue (2012) for the Argentinian economy.

For the firms, the share of labor in tradable and nontradable sectors, namely α and γ , are both set to 0.6, which is a standard value. The price of imported inputs is normalized to 1. The share of imported inputs that is financed with imported inputs, ϕ , is set to 0.7 (Mendoza and Yue, 2012), while the social loss parameter ψ when the government provides credit, is 0.5 (Benigno and Fornaro, 2012).

The transition probabilities for the borrowing limit κ are such that the economy enters into a bad shock every 10 years, and stays there for 2 years (Benigno and Fornaro, 2012). The low value κ_L is set to 0.12, which yields a trend growth rate of -2.5 percent during its occurrence.

If the sovereign defaults, the probability of reentry is $1/3$, which means that the economy stays an average of 3 years without accessing the international capital markets (Bianchi, Hatchondo, and Martínez, 2012). The political-economy friction parameter θ is set to different values, ranging from 1 to 1.5, while I consider that the incumbency advantage is 0, as in Aguiar and Amador (2011), for ease of calculation.

Table 1.2: Main parameters

Parameter	Value	Description	Source/Target
σ	2	CRRA coefficient	Standard values
a	0.31	Share of tradables in consumption	Schmitt-Grohé and Uribe (2016)
ζ	0.2	CES parameter	Schmitt-Grohé and Uribe (2016)
β	0.90	Intertemporal discount factor	Standard values
r^*	0.04	International interest rate (% , annual)	Standard values
η	$1/3$	Probability of redemption	Bianchi, Hatchondo, and Martínez (2012)
α	0.6	Share of labor in tradable output	Standard values
γ	0.6	Share of labor in nontradable output	Standard values
P^M	1	Price of imported inputs	Benigno and Fornaro (2012)
ψ	0.5	Share of public FC loans lost	Benigno and Fornaro (2012)
ϕ	0.7	Share of foreign-financed imported inputs	Mendoza and Yue (2012)
ξ	0.1	Elasticity of knowledge to imports	Benigno and Fornaro (2012)
ν	0.17	Trend growth rate of knowledge	Average annual growth of 3.4%.
θ	1-1.5	Political-economy friction	Aguiar and Amador (2011)
δ	0	Incumbent advantage	Aguiar and Amador (2011)
κ_L	0.12	Low value of κ	Trend growth rate of -2.5%

1.7 Computation strategy

To solve the model in de-trended recursive form, I perform value function iteration using a discrete state-space for b and $s = \{z, \kappa\}$. The values for the policy functions, such as $b'(b, s)$, can lie outside the discrete grids. For this purpose, I use piecewise cubic-hermite interpolation polynomials (PCHIP), which solve the problems of using splines on monotonic functions, such as the bond-price function, by incorporating its first derivatives.¹⁵

The discrete grid for b is constructed by setting 41 equally spaced points between the hyperbolic tangent of b_{\min} and b_{\max} , and then transforming back using the inverse-hyperbolic tangent. This allows a greater number of points to be close to $b = 0$. The limits are set to $b_{\min} = -0.75$ and $b_{\max} = 1.5$.

¹⁵For a reference, see Fritsch and Carlson (1980), which provides the algorithm used in this chapter.

The discrete grid for z is constructed using the Tauchen (1986) method using 15 points and an amplitude parameter equal to 3. The discrete grid of κ consists of only 2 points, as mentioned before.

For ease of computation, I collapse for the points $z \in \mathcal{Z}$ and $\kappa \in \boldsymbol{\kappa}$ into $s \in \mathcal{S}$, where $\mathcal{S} = \mathcal{Z} \times \boldsymbol{\kappa}$ and $s = (z, \kappa)$. The number of points will be 30. The transition probability of s , $\Pr(s', s)$, is a Kronecker product of $\Pr(\kappa', \kappa)$ and $\Pr(z', z)$, and allows calculations of expectations and probabilities.

The stop rule for the value function iteration follows Chatterjee and Eyigungör (2014), which consists of iterating on $V^o(b, s)$ and $q^B(b', s)$ at the same time, until the criterion of convergence falls below a tolerance of 10^{-6} . The criterion of convergence is the maximum between that of the value function and that of the sovereign portfolio price.

Once the *terminal* recursive formulation results are obtained, then I iterate backwards to obtain the results with political-economy frictions, following the steps described in previous sections.

Using the *initial* recursive formulation policies, I proceed to simulate the values for the variables of the system for 11,000 periods, using the last 10,000 to calculate the moments of the model.

1.8 Results

In this section I show the results for several characterizations of the economy under study. First, I review the mercantilist economy without political-economy fric-

tions, and then I address the effects of political-economy frictions. Next, I review the results for economies without mercantilism, and the effect of political economy frictions for this group of economies. For comparisons with the data, we refer to National Accounts data in Penn World Tables 8.1 for emerging market and developing economies, which are the upper-middle, middle, and low income ones as classified by the World Bank in the year 2000, to incorporate economies that now have moved to the upper bracket of national income.

1.8.1 The mercantilist economy without political-economy frictions

In Table Table 1.3 I show the moments of the model of the economy with mercantilism ($\xi > 0$) and without political economy frictions ($\theta = 1$), which will be our benchmark. This model yields a volatility of consumption which is greater than that shown in the data, while the volatility of gross domestic product is even greater, which is also the case for the trade balance. On the other hand, the volatility of net foreign assets is lower than that of the data. In terms of cyclicity, the trade balance is highly countercyclical compared to the data where it is mildly procyclical, while consumption and net foreign assets are less procyclical than in the data.

Regarding average moments, this economy features a net public savings to GDP ratio of 30.1 percent, which would be in the 95-99 percentiles in the data, comparable to China during the 2000s. The economy of this model never defaults, and suffers sudden stops in which its tradable firms access public credit 0.8 percent of the time. This economy grows on average 3.6 percent a year, which is slightly

higher than the average for an emerging market economy according to data. When the government intervenes in the tradable sector it provides credit equivalent to 9.9 percent of tradable output.

1.8.2 The political-economy frictions

The effect of the political-economy frictions is clearly depicted in Figure 1.4. These frictions can explain differences in reserve accumulation of up to 20 percentage points of GDP when the political-economy friction parameter θ is 40 percent or more. This is a vast difference in reserve accumulation, comparable to the impact of an increase of one standard deviation in the expropriation risk measure in the data. The effect on real GDP growth is milder, as an increase of 40 percent in the political economy friction leads to a decrease of around 0.35 percentage points in annual average growth, which is lower than the distribution shown in data. This result is mostly due to the growth trend rate of knowledge coupled with a low elasticity of imported inputs to growth, and persistent effects of lack of access to international credit.¹⁶

The average real exchange rate is mildly appreciated in the benchmark economy compared to economies with political-economy frictions. For values of θ of 0.4 or above, the real exchange rate is depreciated by almost 1.5 percent. Public credit to tradable firms in times of stress, which is almost 10 percent of tradable output

¹⁶For a review on these effects, refer to Gornemann (2014), which presents an endogenous growth model with a government that is more impatient than their households and can default on its debt. In theory, an economy with political-economy frictions is expected to show more sovereign defaults, and hence, much lower average growth if the type of time-inconsistent preferences shown in this paper are present.

Table 1.3: Results for mercantilist economy without political-economy frictions

	Model ¹		Data ^{1,2}	
	Standard deviation	Correlation with GDP	Standard deviation	Correlation with GDP
Tradable output	0.0997	-0.6466	...	...
Tradable consumption	0.1297	0.9335	...	...
Nontradable consumption	0.0511	0.8333	...	...
Consumption	0.0768	0.8951	0.067	0.396
GDP	0.0695	1.0000	0.038	1.000
Imported inputs	0.0745	0.4286	...	...
Wages	0.0682	0.9927	...	...
Net foreign assets/GDP	0.1833	0.1539	0.397	0.092
Trade Balance / GDP	0.0723	-0.8025	0.227	0.027
Domestic interest rate	0.0000	0.0000	...	...
Real exchange rate	0.1506	0.8056	...	...
Number of episodes				
Sovereign Default	0			
Sudden stops ³	823			
Average statistics (percent)				
Public savings/GDP ⁴	30.1			
GDP growth ⁵	3.6			
Real exchange rate	97.3			
Public credit/tradable output ⁶	9.9			

¹ Series are detrended using HP filter with parameter $\lambda = 6.25$, and statistics are calculated using the deviations from the trend.

² Uses national accounts data from Penn World Tables 8.1, for countries classified as upper-middle, middle and low income, according to the World Bank Organization for the year 2000.

³ Includes only those episodes where the borrowing limit is binding.

⁴ Compared over periods when there is full access to international capital markets.

⁵ Real GDP is computed deflating nominal GDP by the consumer price index of the economy.

⁶ Compared over episodes where the borrowing limit has a low realization.

in the benchmark economy, falls to 7 percent at the higher levels of the political-economy friction, which makes growth lower during periods of sudden stops. This is due to the fact that the economy enters these episodes with lower amounts of public savings to backstop the tradable firms.

It is important to highlight that within the mercantilist economy, further increases in θ beyond 1.5 do not increase the differences from the benchmark economy, as the cost of not saving becomes prohibitively high for a given level of the mercantilist parameters v and ξ . As this model does not engineer endogenous growth in the traditional sense, as there is no capital accumulation, it is very likely that the degree of mercantilism can be also affected by the degree of political-economy frictions, an issue that remains unaddressed in this paper.

More information on the moments of economies with political-economy friction is shown in Table 1.4. Two important features are that the volatility of macroeconomic aggregates and the number of periods under sudden stops decrease with the increase in political-economy frictions. The former can be explained by the fact that during normal periods, the benchmark economy achieves very high growth rates, increasing the volatility compared to the political-economy friction economies; the latter is explained by the fact that demand for imported inputs increases with the savings the government enters the period with, so the chances of having a binding borrowing limit are higher for the benchmark economy than for the economies with political economy frictions.

The next section will show the models with trend growth but no mercantilism, i.e., the learning-by-trading parameter $\xi = 0$.

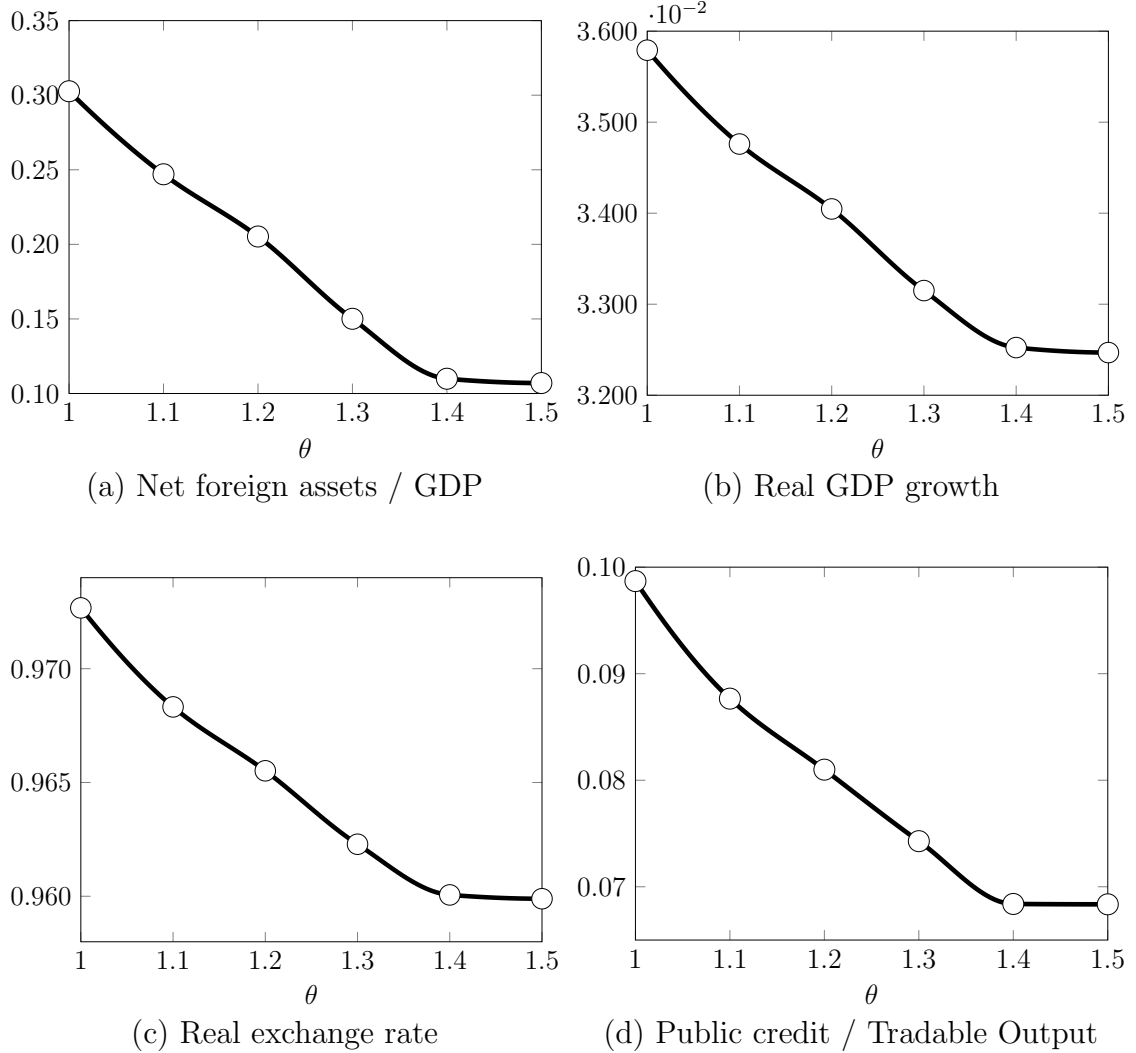


Figure 1.4: The effects of political-economy frictions θ on key variables of the mercantilist economy. Panel (a) shows the average net foreign assets over GDP accumulated by the government during normal times. Panel (b) shows the average real growth of GDP during all periods. Panel (c) shows the average real exchange rate during all periods. Panel (d) shows the public credit given to the firms in the tradable sector by the government, scaled by the tradable output, during low borrowing limit shocks.

Table 1.4: Results for mercantilist economy with political-economy frictions

	$\theta = 1$	$\theta = 1.1$	$\theta = 1.2$	$\theta = 1.3$	$\theta = 1.4$	$\theta = 1.5$				
	σ_x	$\sigma_{x,GDP}$	σ_x	$\sigma_{x,GDP}$	σ_x	$\sigma_{x,GDP}$				
Tradable output	0.0997	-0.6466	0.0816	0.0689	-0.2650	0.0529	0.0485	0.3888	0.0480	0.4131
Tradable consumption	0.1297	0.9335	0.1075	0.0897	0.8605	0.0656	0.8187	0.7236	0.0482	0.7202
Nontradable consumption	0.0511	0.8333	0.0449	0.7664	0.6941	0.0288	0.5866	0.3728	0.0226	0.3579
Consumption	0.0768	0.8951	0.0654	0.8451	0.7920	0.0407	0.7227	0.5709	0.0305	0.5625
GDP	0.0695	1.0000	0.0557	1.0000	1.0000	0.0378	1.0000	1.0000	0.0319	1.0000
Imported inputs	0.0745	0.4286	0.0744	0.4949	0.5701	0.0682	0.6958	0.7682	0.0687	0.7774
Wages	0.0682	0.9927	0.0542	0.9886	0.9840	0.0354	0.9755	0.9664	0.0291	0.9659
Net foreign assets/GDP	0.1833	0.1539	0.1368	0.2035	0.1051	0.2409	0.0731	0.2750	0.0488	0.2989
Trade Balance / GDP	0.0723	-0.8025	0.0621	-0.7445	0.0524	-0.6776	0.0384	-0.5642	0.0287	-0.3543
Domestic interest rate	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Real exchange rate	0.1506	0.8056	0.1227	0.7327	0.1068	0.6569	0.0920	0.5432	0.0844	0.4302

Number of episodes

Sovereign default	0	0	0	0	0	0
Sudden stops ¹	823	823	820	770	763	756
Average statistics (%)						
Public savings/GDP ²	30.3	24.7	20.5	15.0	11.0	10.7
Real GDP growth ³	3.6	3.5	3.4	3.3	3.3	3.2
Real exchange rate	97.3	96.8	96.6	96.2	96.0	96.0
Public credit/tradable output ⁴	9.9	8.8	8.1	7.4	6.8	6.8

Series are detrended using HP filter with parameter $\lambda = 6.25$, so statistics are calculated using the deviations from the trend.

¹ Considers those episodes where the borrowing limit is binding.

² Considers the periods when there is full access to international capital markets.

³ For this statistic, the GDP is deflated by the consumer price index of the economy.

⁴ Considers those episodes where the borrowing limit has a low realization.

1.8.3 “Non-mercantilist” economies

It is important to compare the behavior of an economy where there is no mercantilism present, i.e. $\xi = 0$, and the trend growth rate of the economy is constant. As can be noticed in Figure 1.5, the government now has net foreign liabilities. This is due to the fact that the economy does not perceive important costs of not having enough savings to withstand sudden stops. For an economy without political economy frictions, the difference in reserve accumulation between mercantilist and non-mercantilist economies amounts to 46 percentage points of GDP.¹⁷ Additionally, liabilities do not increase monotonically with the degree of political-economy frictions. This stems from the fact that access to international capital markets is curtailed more often than in the mercantilist economies, as shown in panel (c) of Figure 1.5. This does not correspond to the relation in the data because PPG debt contains also aid flows and official loans. In Alfaro, Kalemli-Özcan, and Volosovych (2014), PPG debt with private lenders is an increasing function of growth, which points out to the effect of access to capital markets in setting a limit to the public borrowing abroad of the government.

The real exchange rate, shown in panel (b), also shows important differences between mercantilist and non-mercantilist economies. The latter shows an appreciated level compared to the former, which is consistent with the view that mercantilist economies should show more depreciated exchange rates; and moreover, the relative

¹⁷A pending exercise is to vary the degree of mercantilism, by using values of $\xi \in (0, 0.1)$. This is expected to change the amount of savings the public sector amasses. The range of public sector savings would fall in between the values shown in this paper for the mercantilist and non-mercantilist economies.

appreciation is higher the higher the political-economy frictions.

It is important to notice that political-economy frictions, as shown in panel (d), can explain large differences in sovereign risk: a reduction of 70 percent in political-economy frictions can reduce the sovereign spread by 800 basis points.

In Table 1.5 shows more detail regarding the moments of the model for different degrees of political-economy frictions. In contrast with the mercantilist economy, the volatility of macroeconomic aggregates increases with higher political-economy frictions for low levels of θ , then increases for higher levels of θ . As shown before, there is an increase in the number of periods without access to international capital markets, due either to sudden stops or sovereign default.

1.9 Conclusions

This paper shows the role of mercantilism and sudden stops in emerging market economies in explaining the existence of net positive international public assets, while political economy frictions can account for the varying degrees of asset accumulation across economies with otherwise similar characteristics. An increase of 50 percent in these frictions implies a reduction of almost 20 percentage points of GDP in net foreign public assets, in the context of economies with growth externalities, i.e. mercantilism. On the other hand, if mercantilism is not taken into account, sovereigns accumulate net foreign liabilities, which dampens their access to international markets. For this reason, political-economy frictions explain differences in net foreign positions to a lesser extent (5 percentage points of GDP), but can explain

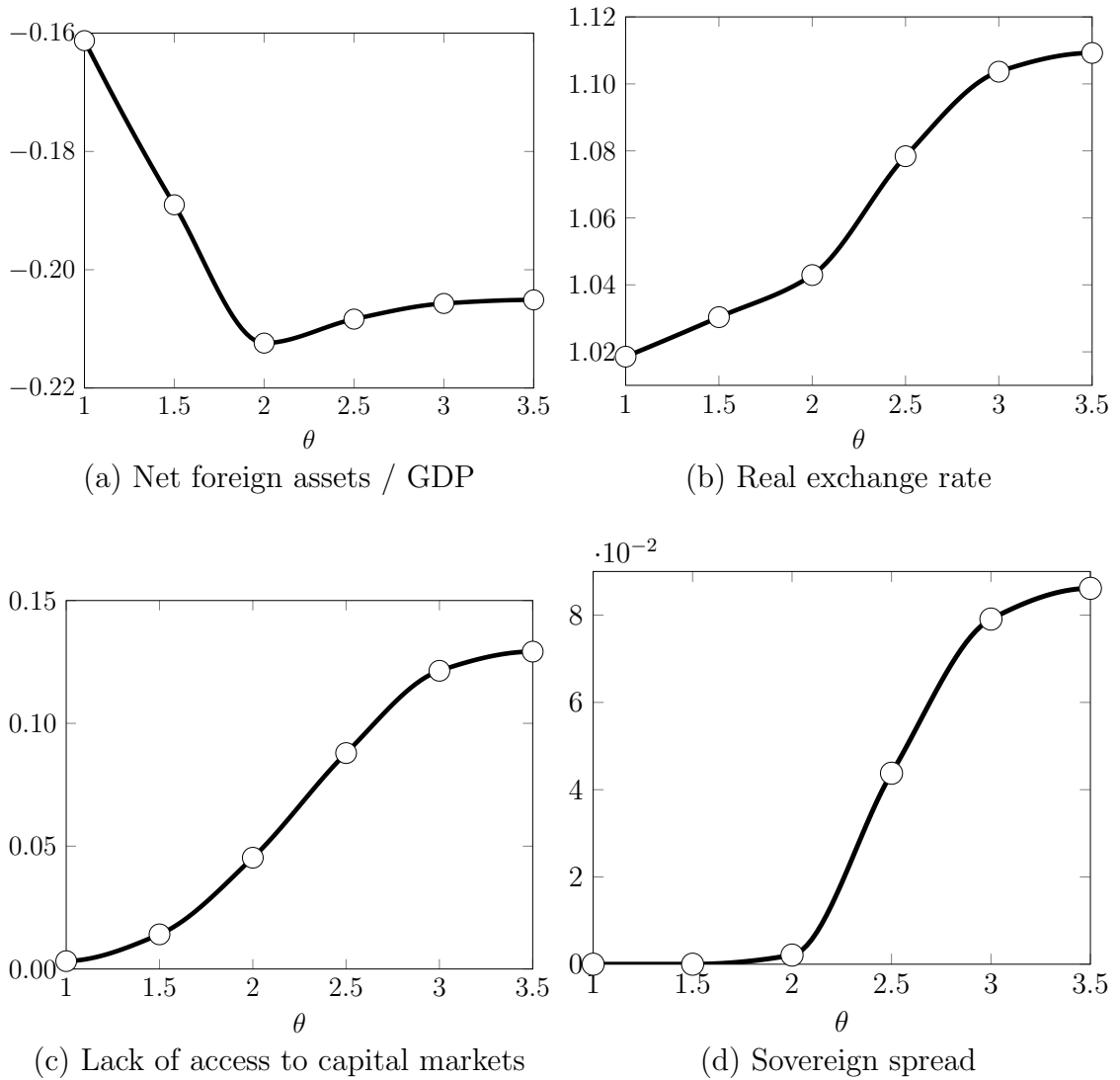


Figure 1.5: The effects of political-economy frictions θ on key variables of the non-mercantilist economy. Panel (a) shows the average net foreign assets over GDP accumulated by the government during normal times. Panel (b) shows the average real exchange rate during all periods. Panel (c) shows the share of periods that the economy spends under sudden stops and sovereign default. Panel (d) shows the average sovereign spread over the foreign sovereign bonds.

Table 1.5: Results for non-mercantilist economy with political-economy frictions

	$\theta = 1$	$\theta = 1.5$	$\theta = 2$	$\theta = 2.5$	$\theta = 3$	$\theta = 3.5$
	σ_x	σ_x	σ_x	σ_x	σ_x	σ_x
	$\sigma_{x,GDP}$	$\sigma_{x,GDP}$	$\sigma_{x,GDP}$	$\sigma_{x,GDP}$	$\sigma_{x,GDP}$	$\sigma_{x,GDP}$
Tradable output	0.042	-0.483	0.053	-0.578	0.060	-0.141
Tradable consumption	0.134	0.963	0.160	0.963	0.138	0.897
Nontradable consumption	0.052	0.887	0.066	0.896	0.088	0.110
Consumption	0.080	0.935	0.098	0.937	0.091	0.528
GDP	0.061	1.000	0.067	1.000	0.069	1.000
Imported inputs	0.060	0.891	0.059	0.829	0.063	0.450
Wages	0.051	0.988	0.055	0.989	0.058	0.391
Net foreign assets/GDP	0.070	0.315	0.082	0.338	0.088	0.046
Trade Balance / GDP	0.070	-0.890	0.084	-0.896	0.072	-0.677
Domestic interest rate	0.000	0.000	0.000	0.000	0.051	-0.015
Real exchange rate	0.135	0.729	0.147	0.756	0.219	0.757
	σ_x	σ_x	σ_x	σ_x	σ_x	σ_x
	$\sigma_{x,GDP}$	$\sigma_{x,GDP}$	$\sigma_{x,GDP}$	$\sigma_{x,GDP}$	$\sigma_{x,GDP}$	$\sigma_{x,GDP}$
Tradable output	0.058	0.058	0.058	0.058	0.058	0.058
Tradable consumption	0.101	0.101	0.101	0.101	0.101	0.101
Nontradable consumption	-0.309	-0.309	-0.309	-0.309	-0.309	-0.309
Consumption	0.071	0.071	0.071	0.071	0.071	0.071
GDP	1.000	1.000	1.000	1.000	1.000	1.000
Imported inputs	0.066	0.066	0.066	0.066	0.066	0.066
Wages	0.058	0.058	0.058	0.058	0.058	0.058
Net foreign assets/GDP	-0.189	-0.189	-0.189	-0.189	-0.189	-0.189
Trade Balance / GDP	0.053	0.053	0.053	0.053	0.053	0.053
Domestic interest rate	-0.033	-0.033	-0.033	-0.033	-0.033	-0.033
Real exchange rate	0.250	0.250	0.250	0.250	0.250	0.250
	Number of episodes					
Sovereign default	0	0	28	492	830	923
Sudden stops ¹	32	141	425	387	384	369
	Avg. statistics					
Public savings/GDP ²	-16.1	-18.9	-21.2	-20.8	-20.6	-20.5
Real GDP growth ³	3.5	3.5	3.5	3.6	3.7	3.7
Real exchange rate	101.9	103.0	104.3	107.8	110.4	110.9
Public credit/tradable output ⁴	0.0	0.0	0.0	0.0	0.0	0.0

Series are detrended using HP filter with parameter $\lambda = 6.25$, so statistics are calculated using the deviations from the trend.

¹ Considers those episodes where the borrowing limit is binding.

² Considers the periods when there is full access to international capital markets.

³ For this statistic, the GDP is deflated by the consumer price index of the economy.

⁴ Considers those episodes where the borrowing limit has a low realization.

differences in sovereign risk: a reduction of 70 percent in political-economy frictions can reduce the sovereign spread by 800 basis points.

As far as I know, this is the first paper providing a plausible framework for a small open economy where the government builds a positive net foreign asset position, while stressing the important differences that political-economy frictions and mercantilist strategies make between the net foreign-asset positions of the governments in emerging-market and developing economies. This is important to consider in the perspective of global imbalances: the pursuit of growth externalities in tradable sectors and the improvement in institutional quality in emerging-market and developing markets may exacerbate the savings-glut problem in the world economy.

Further extensions may need to be considered to improve on the explanation of GDP growth outcomes. As mentioned before, it may be necessary to embed models of endogenous growth, such as growth due to increased varieties of tradable goods, and add capital accumulation. This way, growth trends will depend to a greater extent on institutional quality, as a vast literature has shown.

On the other hand, it may be important to study the accumulation of public net foreign asset positions under the lens of monetary and exchange rate arrangements. Recently, small open economies such as Denmark and Switzerland have amassed vast amounts of foreign reserves under pressure during the European Debt Crisis, and many economists have pointed out the use of foreign reserves in order to control exchange rate movements finally, one could explore the use of foreign reserves in mitigating possible banking and currency crises in emerging-market and developing economies.

Chapter 2: Debt Overhang, Rollover Risk and Investment in the
Euro Area (co-authored with Şebnem Kalemli-Özcan and
Luc Laeven)

2.1 Introduction

Investment expenditure in Europe collapsed in the aftermath of the 2008 global financial crisis. Figure 2.1 shows that, by 2014, corporate investment as a share of GDP across the euro area had fallen by more than 50 percent from its peak in 2008, with higher declines in the most crisis-affected countries. The decline of investment in Europe has been about double that in the US over the same period, and the decline has been more persistent, with investment as a share of GDP recovering since 2010 in the US but not (yet) in Europe. These same patterns hold when using net instead of gross investment (see figure 2.2).

This collapse in investment followed a boom period during which the corporate sector borrowed heavily. Figure 2.3 shows that indebtedness of the euro area non-financial corporations, measured as debt liabilities to GDP, increased 30 percent during the 2000s on average, where the increase for the periphery country firms was almost 60 percent. This increase in indebtedness was driven by favorable lending

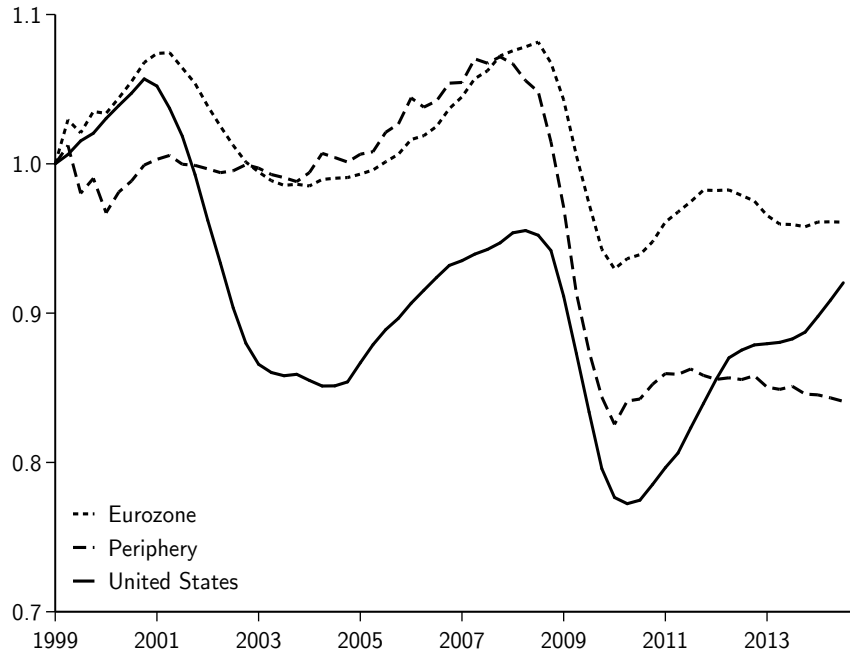


Figure 2.1: Evolution of gross investment: gross fixed capital accumulation of non-financial corporations. Periphery includes Greece, Ireland, Italy, Spain, and Portugal. Sources: Eurostat and Bureau of Economic Analysis.

conditions, both low interest rates and lax lending standards, during the boom years (Dell’Ariccia et al., 2014).

We investigate whether corporate debt is holding back private-sector investment in the aftermath of the crisis during a period of tightening in lending conditions. Specifically we ask whether high levels of corporate indebtedness at the onset of the crisis and the financing of investment using short term debt pre-crisis are important contributing factors to the observed decline in investment in the aftermath of the crisis. We refer to this situation where high levels of corporate debt are holding back

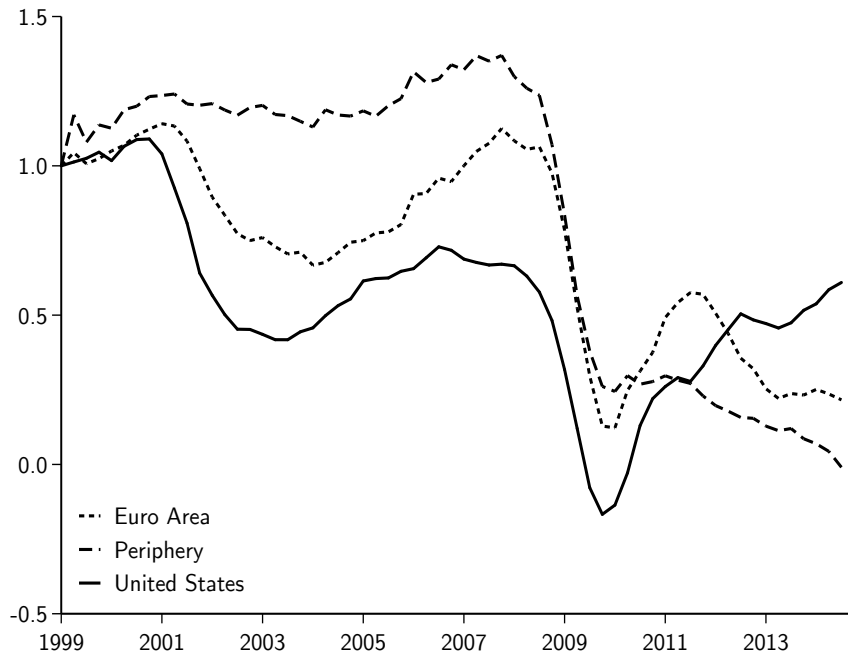


Figure 2.2: Evolution of net investment: Net-of-consumption fixed capital accumulation of non-financial corporations. Sources: Eurostat and Bureau of Economic Analysis.

investment as *debt overhang*.¹ Our data set allows us to distinguish between short-term and long-term debt, and hence we can assess the influence of debt maturity on firm investment and evaluate the role of *rollover risk*. Short-term debt can be problematic during crises since firms with short-term debt might experience increased rollover risk as lenders are often unwilling to renew expiring credit lines during a

¹This is a generalization compared to more specific uses of the term debt overhang in the literature. In the finance literature, debt overhang is typically defined as high levels of debt that are curtailing investments because the benefits from additional investment in firms financed with risky debt accrue largely to existing debt holders rather than shareholders (Myers, 1977). This reduced incentive to invest implies that firms with high levels of debt face an underinvestment problem. In the macro literature, however, debt overhang is often more loosely referred to as a situation where high levels of public debt are crowding out private investment. See for example Aguiar, Amador, and Gopinath (2009). Krugman (1988) analyzes the choice between financing and forgiving the debt from the perspective of creditors. Bulow and Rogoff (1991) show that a country cannot gain by openly repurchasing its debt at market prices.

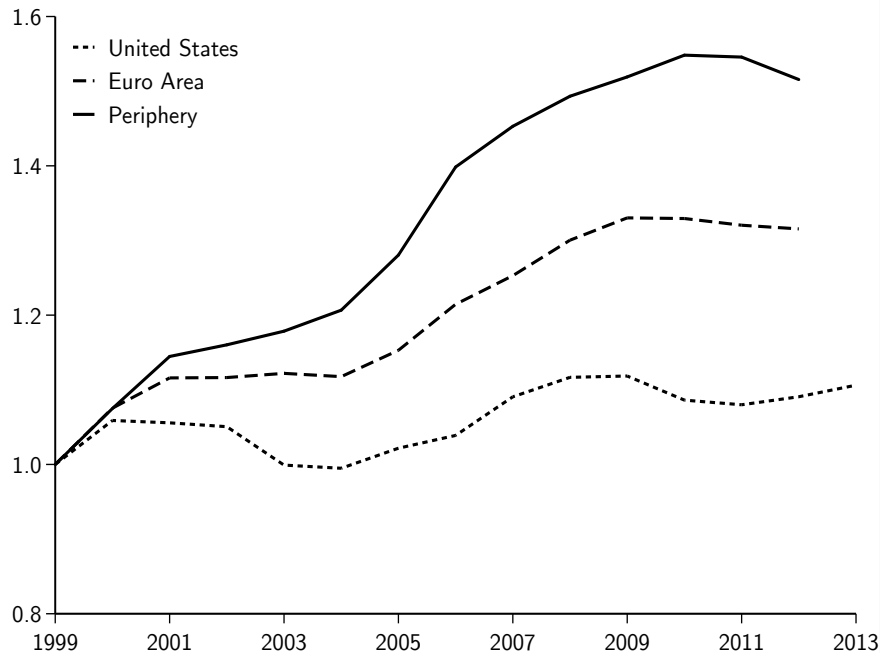


Figure 2.3: Evolution of corporate debt to gross domestic product. Includes credit to non financial corporations. Sources: Organisation of Economic Cooperation and Development and World Development Indicators.

crisis when collateral values drop and lenders' own financing conditions deteriorate (Diamond, 1991).² Similarly, firms with expiring debt contracts will find it more difficult to issue new short-term bonds when interest rates rise due to heightened sovereign risk, when banks also face liquidity problems.³

²Acharya, Gale, and Yorulmazer (2011) show that even small changes in collateral values can lead to dramatic changes in debt capacity when firms' short-term debt needs to be frequently rolled over, potentially leading to a collapse in the market for short-term lending.

³Debt maturity may also affect the debt overhang by altering incentives to invest. According to Myers (1977), short-term debt reduces the debt overhang problem because the value of shorter debt is less sensitive to the value of the firm and thus receives a much smaller benefit from new investment. In the extreme, if all debt matures before the investment decision, then the firm without debt in place can make investment decisions as if an all-equity firm. Thus, according to Myers (1977) firms with a shorter maturity of debt are expected to experience reduced debt overhang and invest more. However Diamond and He (2014) spell out conditions under which reducing maturity can increase debt overhang. They show that while for immediate investment, shorter-term debt typically imposes lower overhang, for firms with future investment opportunities,

We argue that a firm-bank matched dataset is necessary to investigate the effects of debt overhang and rollover risk on firms' real outcomes, since the deterioration in both firms' and banks' balance sheets needs to be measured at the same time. It is important that our sample is composed of small firms (small and medium enterprises, SMEs) since these firms are informationally opaque and hence subject to bank financing and debt overhang. These firms cannot obtain non-bank finance. And the impact of debt on corporate investment will depend partly on the ability of firms to substitute bank financing for other sources of financing, which only big firms can do (Kashyap, Lamont, and Stein, 1994a,b; Kashyap, Stein, and Wilcox, 1993). Banks need to invest time in acquiring knowledge about each SME. This leads to *relationship banking*. Previous research shows that these relationships are sticky even in developed financial markets such as the U.S. (Chodorow-Reich, 2014). These relationships are valuable, especially for small firms for which monitoring costs tend to be high (Bae, Kang, and Lim, 2002; Hoshi, Kashyap, and Scharfstein, 1990). Such relationship lending may be a good or a bad thing in a crisis, depending on the nature of shocks.

Given the situation in Europe, we focus on the effect of a deterioration in bank balance sheets from exposure to sovereign risk. Why does sovereign risk matter for corporate debt overhang and rollover risk? There is a direct and an indirect effect, and we measure both in our paper. In any economy, government bond yields are an important driver of corporate bond yields and bank lending rates, either through shorter-term debt may impose stronger debt overhang in bad times. The reason is that sharing of less risk by shorter-term debt implies more volatile earnings and equity, and hence more debt overhang.

standard interest arbitrage conditions or through sovereign bonds directly serving as a benchmark for the pricing of loans and other assets. Moreover to the extent that banks hold sovereign bonds and firms depend on banks for their lending, sovereign risk can affect firm investment through bank-sovereign linkages via bank lending channel. The effect of a weakening in banking conditions from exposure to sovereign risk on corporate investment through debt overhang and rollover risk channels is theoretically ambiguous. On the one hand, a deterioration in the balance sheets of banks could reduce the supply of loans to firms, leading to an increase in debt overhang and rollover risk (Peek and Rosengren, 2000). On the other hand, weak banks may continue to lend to risky borrowers in an effort to preserve relationships, consistent with loan evergreening (Caballero, Hoshi, and Kashyap, 2008; Peek and Rosengren, 2005).

We use a comprehensive firm-level data set including small private firms that matches firm balance sheet information from the Orbis/Amadeus database with information on the firm's main relationship bank from Kompass and information on the holdings of sovereign bonds of each banks from Bankscope. As an alternative source of information on the sovereign holdings of banks we use confidential data from the European Central Bank (ECB) which has more detailed information on sovereign exposure for a subset of banks in our sample. By linking firms to their banks and sovereigns, and using information on each bank's exposure to sovereign risk, we can exploit differences in conditions across firms, sovereigns, and banks to identify more accurately the underlying channels of the effect of corporate indebtedness on investment. As argued above, the advantage of including small firms is

that a more precise estimate of debt overhang can be obtained, because small firms make up a large fraction of economic activity in Europe⁴ and because debt overhang is likely to be more pronounced in small firms than in large firms. In addition to the role of weak bank balance sheets, the effects of banking distress on firms' access to financing are likely to weigh more heavily in Europe than in the United States, because Europe consists primarily of bank-dominated economies dominated by bank-dependent, small firms (Mayer and Vives, 1995).

The closest antecedent to our paper, which also uses a matched firm-bank level data set from Europe, is Acharya et al. (2014). These authors match Amadeus data to syndicated loans and estimate the effect of shocks to periphery banks (using a periphery bank dummy) on investment of firms who borrow from these banks in the syndicated loan market. However these authors have a firm sample composed of much bigger firms, since smaller firms do not access syndicated loan markets, and hence do not focus on debt overhang and rollover risk as we do. They also do not focus on the underlying sources of shocks to periphery banks, where we explicitly measure these shocks as exposure to periphery banks' own sovereign debt.

We use a difference-in-difference approach to identify the effect of corporate debt overhang on investment, assessing the differential impact on highly leveraged firms as opposed to low leverage firms of being located in a country that experienced sovereign stress versus being located in countries without sovereign stress. We do the same for rollover risk and the weak bank effect, where we measure the firm

⁴Firms with less than 250 employees make up 70 percent of employment and value added in Europe. See official statistics as of 2013 from Eurostat's Structural Business Statistics.

rollover risk as the share of short term debt in total debt, and the weak bank effect as the bank's exposure to *own* country sovereign debt when the *own* country is a high sovereign-risk country. We capture the differential effect from the crisis using a simple crisis dummy starting in the year 2008 and we measure sovereign risk using the country's sovereign spread relative to German bonds. We measure debt overhang, rollover risk, and bank-firm relationships prior to the crisis in order to mitigate concerns about reverse causality.

A key challenge for identification is to account for the role of changes in unobserved demand shocks. It might be possible that firms are decreasing investment due to idiosyncratic negative demand or productivity shocks rather than the debt overhang and rollover risk channels we focus on that are also linked to firms' banks' conditions. To control for aggregate demand and productivity shocks we use four-digit industry-country-year fixed effects. These effects will absorb the impact of changes in credit demand for the four-digit sector that our firms operate in, and also country-level demand conditions including those arising from changes in sovereign risks and general uncertainty conditions. We assume that most of the fluctuations in aggregate demand derive from country and narrowly defined industry-specific factors, not firm-specific factors. We are not the first to control for demand using industry fixed effects in general (e.g., Nanda and Nicholas, 2013 and Acharya et al., 2014) but to the best of our knowledge we are the first to allow these effects to vary at a very granular level (four-digit) of industry classification and also across countries and over time. While the inclusion of four-digit industry-country-year fixed effects may not capture all firm-specific demand shocks, all we need for our identification

approach to be valid is that any remaining ex-post variation in firm specific demand conditions, does not vary systematically with the level of firm indebtedness or the firm's debt maturity ex-ante. Moreover the analysis controls for bank fixed effects to capture the time invariant role of pre-existing bank relationships. We limit the analysis to firms in the euro area which were subject to the same monetary policy but experienced diverging sovereign risk and banking conditions during the crisis.

Consistent with theories of debt overhang and rollover risk, and the significance of bank-sovereign linkages, our findings are threefold. First, high debt levels depress investment during crisis times, consistent with debt overhang. Second, firms with a shorter maturity of debt reduce investment more during the crisis when those firms are located in countries with weak sovereigns, consistent with an increase in rollover risk associated with increased sovereign risk. An increase in sovereign risk increases default risk, raises borrowing costs and makes it more difficult to refinance maturing debt. Third, the debt overhang and rollover effects are in large part driven by sovereign-bank linkages. Firms whose main bank's balance sheet deteriorated because of large exposure to sovereign risk experience a larger effect from debt overhang during the crisis. Moreover, rollover risk from weak banks is more pronounced in peripheral countries, highlighting the role of sovereign-bank linkages in affecting firm investment. In fact, for firms located in the other euro area countries, rollover risk is lower for firms with weak banks, suggesting evergreening of loans by weak banks in non-periphery countries. Our results imply strong economic effects. Given a one standard deviation change in firm's leverage, their investment ratio during the crisis is 0.4 percentage points relative to its pre-crisis mean. A one

standard deviation increase in rollover risk via short-term debt adds another 0.1 percentage point reduction in investment ratio. These reductions comprise almost 20 percent of the reduction in the investment ratio after the crisis. A one standard-deviation deterioration in firm's bank's balance sheet due to exposure to peripheral-country sovereign debt results in an investment ratio that 46.8 percent lower than the pre-crisis mean in the aftermath of the crisis.

Our paper proceeds as follows. Section 2.2 presents a literature review. Section 2.3 presents the data set used in the paper. Section 2.4 describes the identification methodology. Section 2.5 presents our main results, extensions and robustness tests of our main results. Section 2.6 concludes.

2.2 Literature

While there has been some work on debt overhang in the sovereign and banking sectors (Becker and Ivashina, 2014b; Philippon and Schnabl, 2013) and the household sector (Melzer, 2012),⁵ debt overhang in the corporate sector has received less attention, in part because of data limitations. An exception is Giroud and Mueller (2015) who study the impact of leverage, not debt overhang, on employment in a sample of US firms. However, that paper does not consider the role of the maturity structure of debt and sovereign-bank linkages, and its focus is on employment, not investment. Another paper studying real effects of firm's financing conditions dur-

⁵For instance, Melzer (2012), using US microdata on household expenditures, shows that debt overhang plays an important role in household financial decisions, as negative equity homeowners cut back substantially on home improvements and mortgage principal payments during the recent financial crisis.

ing the recent crisis is Chodorow-Reich (2014), who shows that financial conditions deteriorated markedly for firms that had pre-crisis relationships with less healthy lenders, with adverse implications for firm employment. However the focus of his study is on employment outcomes rather than firm investment and his work does not explicitly consider firm leverage.

Our paper relates to a large literature on the role of financial factors in investment decisions. At the macro level, Bernanke and Gertler (1989) were the first to show theoretically that financial frictions, such as those arising from borrowing constraints, have a bearing on corporate investment. Lamont (1995) is one of the first to incorporate corporate debt overhang in a macroeconomic model. His model shows that the effect of debt overhang varies with economic conditions. When the economy is booming, debt overhang will not bind because investment returns are high. If the economy is in a downturn, however, debt overhang will bind because investment returns are low. Debt overhang thus creates a threshold value for investment returns below which the firm cannot attract funds and invest. As a result, high levels of debt can create multiple equilibria in which the profitability of investment varies with economic conditions. More recently, Occhino and Pescatori (2010) calibrate a model with debt overhang. They show that the debt overhang effect is counter-cyclical, increasing during recessions when default risk is higher, and find that debt overhang improves the fit of their model to data, compared to a model where debt overhang is absent. Empirically, at the firm level, Whited (1992) shows that adding debt-capacity variables to a standard investment model improves the model fit, suggesting that financial factors do play an important role in the firms'

investment decisions. Similarly, Bond and Meghir (1994) finds an empirical role for debt in standard investment models. More specifically, a number of papers have documented the significance of debt overhang on corporate investment by listed firms from the US. For example, Lang, Ofek, and Stulz (1996) document a negative relationship between debt and investment for firms without valuable growth opportunities. Hennessy (2004) shows that debt overhang distorts the level and composition of investment, with a severe problem of underinvestment for long-lived assets. A significant debt-overhang effect is found, regardless of firms' ability to issue additional secured debt. Hennessy, Levy, and Whited (2007) corroborate large debt-overhang effects of long-term debt on investment, especially for firms with high default risk.

Closer to our paper is the literature identifying the role of credit conditions in firm investment by using exogenous bank shocks. For instance, Hoshi, Kashyap, and Scharfstein (1990) shows that Japanese firms tied to banks through ownership links fared better during the 1990s Japanese crisis. Along the same lines, Bae, Kang, and Lim (2002) shows that the valuation of Korean firms with durable lending relationships suffered less during the 1997-98 financial crisis. Furthermore, Kalemli-Özcan, Kamil, and Villegas-Sánchez (2010), using data from six Latin-American countries during 1990-2008, shows that only during banking crises –when banks get a liquidity shock– do foreign-owned firms invest more than domestic firms, and not during recessions or balance-of-payments crises. In this regard, Amiti and Weinstein (2014), employing matched bank-firm loan-level data from Japan, corroborates that banking shocks to the supply of credit have large effects on corporate investment.

Our work also relates to recent empirical literature on sovereign-bank linkages. Sovereign-bank linkages can arise through different channels. One direct channel, which is the one we focus on, arises from banks holding significant amounts of sovereign debt. As sovereign default risk increases and sovereign ratings get downgraded, the net worth of banks holding such sovereign debt will be negatively affected (Baskaya and Kalemli-Özcan, 2014; Gennaioli, Martin, and Rossi, 2014). A second sovereign-to-bank linkage arises from the role of the government in (explicitly or implicitly) backstopping the financial system, through guarantees and bank bailouts (Laeven and Valencia, 2013). Such bailouts can add significantly to sovereign debt, increasing sovereign risk (Acharya, Drechsler, and Schnabl, 2014). Weaknesses in the banking sector can reinforce these sovereign-bank linkages. First, as banks' profits decline, government tax revenues from the financial sector are likely to decline, increasing sovereign risk. Second, the financial condition of banks will most likely have a bearing on banks' demand for sovereign bonds. For instance, banks, being protected on the downside by limited liability, have strong incentives to game the regulatory system that places zero-risk weights on domestic sovereign holdings by borrowing in cheap funding currencies to increase their holdings of domestic sovereign debt. Such carry-trade incentives increase as the banks approaches distress, reinforcing the loop between weak bank and weak sovereigns (Acharya and Steffen, 2015). Gennaioli, Martin, and Rossi (2013) shows that banks tend to hold large amounts of sovereign paper on their balance sheets, and that they increase these exposures during crises, reinforcing bank-sovereign linkages. Using the Turkish 1999 earthquake as an exogenous fiscal shock, Baskaya and Kalemli-Özcan

(2014) shows that banks which had higher exposure to government debt reduced their lending more after the earthquake, while Adelino and Ferreira (2014) finds that as sovereign ratings are downgraded, bank ratings are negatively affected as well, increasing banks' funding costs and reducing their credit supply. Focusing on Europe, Popov and Van Horen (2015), using data on syndicated loans, shows that banks with exposure to stressed sovereign debt cut back on lending, especially cross-border lending. Similarly, also using syndicated loans, Becker and Ivashina (2014a) shows that the increase in holdings of sovereign bonds led to a crowding out of corporate lending, while Acharya et al. (2014), also using syndicated loans, shows that firms borrowing from banks in peripheral Europe decreased their investment more.

2.3 Data and Measurement

2.3.1 Firm-Level Data

Our firm-level data comes from the Orbis database (compiled by Bureau van Dijk Electronic Publishing, BvD). Orbis is an umbrella product that provides firm-level data that covers around 100+ countries worldwide, developed and emerging, since 2005. Certain country subsets of the database that cover different countries (such as Europe) go back to 1996. This is a commercial data set, which contains administrative data on 130 million firms worldwide. The financial and balance-sheet information is initially collected by local Chambers of Commerce, and in turn is relayed to BvD through some 40 different information providers including official

business registers.

The data set has financial accounting information from detailed, harmonized balance sheets, income statements and profit/loss accounts of financial and non-financial firms. This data set is crucially different from other data sets that are commonly used in the literature, such as COMPUSTAT for the United States, Compustat Global, and Worldscope databases, since 99 percent of the companies in Orbis are private, whereas the former data sets contain mainly information on large listed companies. In Orbis, less than 2 percent of the firms are publicly listed (data for which is separately marketed under the product called OSIRIS). Our sample is mainly composed of small and medium sized enterprises with less than 250 employees. These firms account for almost 70 percent of the value added and employment in Europe, both in the manufacturing sector and in the aggregate economy.⁶ Given our paper's focus we use the European subset of the Orbis umbrella, the database known as Amadeus. One advantage of focusing on European countries is that company reporting is a regulatory requirement (as opposed to firms operating in the US), and therefore firm coverage is superior.

The main financial variables used in the analysis are total assets, sales, operating revenue (gross output), tangible fixed assets, intangible fixed assets, liabilities, and cash flow. We transform financial variables to real terms using the national CPI with 2005 base and converting to dollars using the end-of-year 2005 dollar/local currency exchange rate. The data set has a detailed sector classification

⁶See Eurostat's Structural Business Statistics (SBS) presented according to NACE Rev. 2 classification.

Table 2.1: Euro Area Firm Coverage

Country	Firm-year	Firms	Share of Output
Austria	616,324	110,348	0.75
Belgium	2,021,149	230,975	0.78
Germany	4,677,260	840,016	0.47
Finland	567,860	98,438	0.51
France	8,111,300	1,129,085	0.81
Greece	321,505	37,921	0.44
Ireland	173,858	25,924	0.40
Italy	4,920,374	753,351	0.61
Luxembourg	11,635	2,309	0.72
Netherlands	1,130,866	220,342	0.28
Portugal	1,611,023	350,533	0.93
Spain	6,165,752	968,441	0.81
Total	30,328,906	4,767,683	

Notes: Share of gross output comes from Kalemli-Özcan et al. (2015), Table 6.1, for year 2012.

(up to four-digit NACE Rev. 2 industry classification). We drop financial firms and government-owned firms, and use all the other sectors.

Table 2.1 summarizes the coverage of our data across euro area countries. The coverage of our firms in terms of share of output ranges from roughly 50 to over 90 percent. The exception is the Netherlands, where small companies do not have to file their accounts.

2.3.2 Matching Firm- and Bank-Level Data

Our analysis makes use of a novel data set of bank-firm relationships in Europe. Our database includes, for each firm, a variable called BANKER showing the name of the firm's main bank(s) relationship, which, following the literature, we assume to be the main bank(s) that the firm borrows from. We obtain this information

through the Amadeus database but the original source is Kompass. This data has been used by Giannetti and Ongena (2012), among others, to study bank-firm relationships. Kompass provides the bank-firm connections in 70 countries including firm address, executive names, industry, turnover, date of incorporation and, most importantly the firms' primary bank relationships. Kompass collects data using information provided by chambers of commerce and firm registries, but also conducts phone interviews with firm representatives. Firms are also able to voluntarily register with the Kompass directory, which is mostly sold to companies searching for customers and suppliers. We use the 2013 vintage of the database, Kompass as built in the Amadeus 2013 vintage and take both the primary and secondary firm-bank relationship. We examined data from the 2015 vintage and confirmed (as have many others in the literature) that firm-bank relationships are sticky and do not change over short periods of time.⁷

We combine firm-level data from Amadeus with bank-level data from Bankscope. Bankscope is a data set, also from BvD, containing balance sheet information for about more than 30,000 banks spanning most countries for up to 16 years. A significant hurdle is to match bank information to firm data, since the name of the bank is the only information available to do so, and there is no standardized procedure to match Bankscope bank names. We make use of the programs *OpenRefine* and *OpenReconcile* that offer several approximate-matching algorithms. We use these programs to match the BANKER variable to the bank names in Bankscope. Our

⁷Giannetti and Ongena (2012) use both 2005 and 2010 vintages, confirming the same result on sticky bank-firm relationships.

Table 2.2: Multiple and Cross-Border Firm-Bank Relationships
(% out of total number of firms of respective sample)

Country	More than one banker	No foreign banker
Austria	24.4	80.0
France	0.0	99.1
Germany	33.6	92.4
Greece	75.3	99.0
Ireland	0.0	98.0
Netherlands	20.3	99.9
Portugal	46.8	78.4
Spain	44.2	77.6
Total	29.7	90.2

Note: First column shows the share of firms in matched firms sample that report having more than one bank relationship. Second column reports the share of firms that report having only domestic-banks relationships.

match rate is very high, covering 87.6% of all bank name observations. Most of the unmatched observations correspond to small cooperative banks for which data is not available in Bankscope.

Table 2.2, focusing on euro area countries again, describes how many of these firm-bank relations are multiple relationships (with more than one bank) and cross-border (with banks whose parent company is foreign). Having more than one banker is not very common across the euro area countries with the exception of Greece. Having a foreign bank is even less common in this sample since we do not have Eastern European countries. In the case where multiple bank relationships are reported, the first listed bank is the main bank. We use this information to link each firm to its main bank.

We match firms and banks for all countries in Europe. We focus only on euro area countries in our regressions to keep monetary policy constant across countries.

Table 2.3: Euro Area Summary Statistics

Panel A: All Firms						
Variables	Obs.	Mean	St. Dev.	Min.	Median	Max.
Net investment/Capital ¹	24,115,248	0.097	0.625	-0.539	-0.064	2.383
Debt/Capital	30,314,689	11.048	19.846	0.430	2.898	80.463
Long-Term Debt/Debt	30,286,998	0.230	0.320	0.000	0.037	1.000
Sales Growth ²	19,025,315	0.018	0.380	-1.410	0.002	1.595
Capital (in logs.)	30,328,906	11.256	2.288	-0.089	11.299	26.841
Sovereign Spread (%) ³	30,328,906	0.642	1.363	-1.193	0.203	21.003

Panel B: Matched Firms						
Variables	Obs.	Mean	St. Dev.	Min.	Median	Max.
Net investment/Capital ¹	13,193,920	0.100	0.603	-0.539	-0.056	2.383
Debt/Capital	15,907,059	11.807	20.742	0.430	3.158	80.463
Long-Term Debt/Debt	15,891,047	0.317	0.374	0.000	0.133	1.000
Sales Growth ²	9,174,596	0.010	0.326	-1.410	-0.003	1.595
Capital (in logs)	15,920,596	11.743	2.526	0.018	11.824	26.841
Sovereign Spread (%) ³	15,920,596	0.551	1.730	-0.024	0.059	21.003
Sov. Holdings/Total Assets:						
Banks' Total	8,009,688	0.043	0.041	0.000	0.031	0.382
Banks' Domestic	3,955,326	0.030	0.025	0.000	0.023	0.175
Periphery Banks' Total ⁴	8,009,688	0.021	0.038	0.000	0.000	0.382
Periphery Banks' Domestic ⁴	3,955,326	0.021	0.030	0.000	0.000	0.175

¹ Increase in real capital stock over lagged real capital stock.

² Logarithmic change of real sales.

³ Sovereign spread is the spread of the 10-year government bond at constant maturity of the country of the firm, over the German Bund.

⁴ These are adjusted, being equal to 0 if the country of the banker is in the core euro area, and equal to the actual value if the country is in the periphery.

Since our firm-level sample is representative, we worry less about the selection issue caused by the reporting bias in bank names by firms. Some firms report their banks and some do not. For example, in Italy and Norway no firm reports their banker names so the firms from these countries will be in our “all-firms sample” but not in our “matched-firms sample”. We compare key statistics across both these samples and observe that they are not statistically different, as shown in Table 2.3.

2.3.3 Matching Bank-Level Data to Banks' Sovereigns

To determine the country of origin of each bank in our sample, we need to trace its ownership information to the ultimate owner. We set the country of origin of each bank equal to the country of origin of the ultimate owner of the bank, even if this entity is incorporated in a foreign country, under the assumption that it is the strength of the parent bank and the safety net provided by the home country of the parent bank that together determine the strength of each subsidiary rather than that of the host country. Banks in the Bankscope database are all recorded as domestic legal entities, including the subsidiaries of foreign parent companies. We therefore need to take an extra step to identify the ultimate sovereign country of each bank, i.e., the sovereign country of the entity that is the ultimate owner of the bank. We trace this information using the Global Ultimate Owner (GUO) variable. Then, we use the ultimate owner's consolidated balance sheet, reported directly in Bankscope. This is important to capture the internal capital markets of the bank.

Whenever the GUO information is missing, a couple of criteria are used. First, some of the banks listed are actually branches of foreign banks. These are matched by hand to their GUO abroad. Second, some banks are reported to be independent or "single location" (i.e., they have only one branch). For these banks, the GUO is the bank itself. And finally, using the independence indicator provided by BvD, for banks with a high degree of independence (i.e., values B-, B or B+), the GUO will be also the bank itself, as in the previous case.

2.3.4 Data Cleaning

In terms of cleaning the matched data set, we drop central banks and governmental credit institutions, which represent less than 2% of all firm-banker relations. On the firm side, we work only with unconsolidated accounts. We clean the data in four steps, as explained in greater detail in Appendix B.1. First, we clean the data of basic reporting mistakes. Second, we verify the internal consistency of balance sheet information. The first two steps are implemented at the level of each country. Third, we do a more specific quality control on variables of interest for firms. Finally, we winsorize the variables at least at 1 and 99 percentiles.

2.3.5 Construction of Variables and Descriptive Statistics

Investment in real capital can be measured on a gross or net basis (i.e., with or without depreciation). If investment expenditures just match the depreciation of capital equipment, then gross investment is positive, but net investment is zero and the capital stock remains unchanged. Therefore, net investment matters most regarding future productivity. Consequently, we use the net investment rate in our empirical work, computed as the annual change in fixed tangible assets.⁸ An additional advantage of using net investment is that we retain observations that otherwise would be lost due to missing data on depreciation.⁹ As the dependent variable in our empirical work, we use the investment rate, computed as the ratio

⁸Using net investment is common in the literature; see for example Lang, Ofek, and Stulz (1996).

⁹Despite the resulting loss of such observations, results are robust to using gross investment instead of net investment.

of investment to the one-period lagged capital stock.

We measure debt overhang using the ratio of total debt to fixed capital as a proxy for firm indebtedness, as in Bond and Meghir (1994). Fixed capital is measured as the firm's gross capital stock minus depreciation, and total debt is measured as the sum of long-term debt, loans, credit, and other current liabilities.¹⁰

Figure 2.4 plots this debt to capital ratio aggregated from our firm level data and shows a similar increase prior to the crisis as the debt to GDP ratio that we plotted earlier. We normalize this series to 1 in 2000 to observe the percent change over time clearly. The difference in the debt-to-capital ratio relative to the debt to GDP ratio is that euro area firms had a bigger increase in this ratio compared to periphery country firms, while the debt to GDP ratio rose more in periphery countries.

To capture rollover risk we use the share of long-term debt in total debt, which in the tables we refer to as "Maturity". Long-term debt comprises all borrowing from credit institutions (loans and credits) and bonds whose residual maturities are longer than one year. Short-term debt comprises all current liabilities, i.e. loans, trade credits and other current liabilities with residual maturities shorter than one 1 year. An increase in short-term debt (i.e., a decrease in Maturity) poses increased rollover risk during bad times. Moreover, small firms finance investment predominantly with short-term debt, and hence there is an inherent negative correlation between the long-term debt share in total debt and investment during regular times. It is

¹⁰We use the level of debt rather than debt service, i.e. interest paid on debt, because debt-repayment capacity is not only about interest payments but also principal repayment.

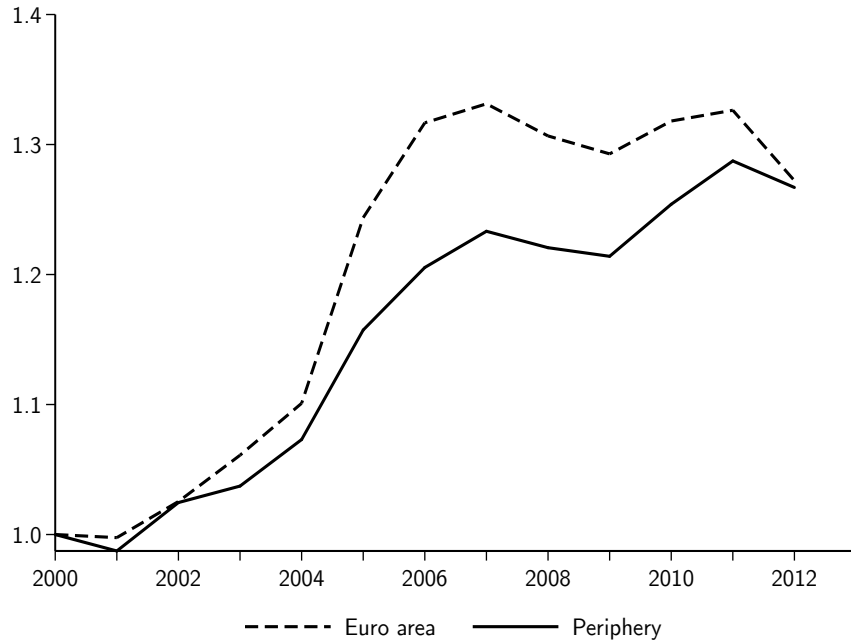


Figure 2.4: Evolution of total debt to capital. Average from firm-level data. Source: Own elaboration on Amadeus database.

therefore important to also control for firm size to assess the independent effect of debt maturity on firm investment. We thus use log of capital to control for firm size, labeled as “Size.”

Figure 2.5 demonstrates the importance of studying small firms when focusing on the maturity structure of debt. Most of the total debt in the euro area is held by large firms but small firms hold a large fraction, 41 percent of the short term debt on average.

We control for sales growth as a proxy for growth opportunities. We do not separately control for cash flow given the fact that we already have better measures of financial constraints through our debt and maturity variables and the high

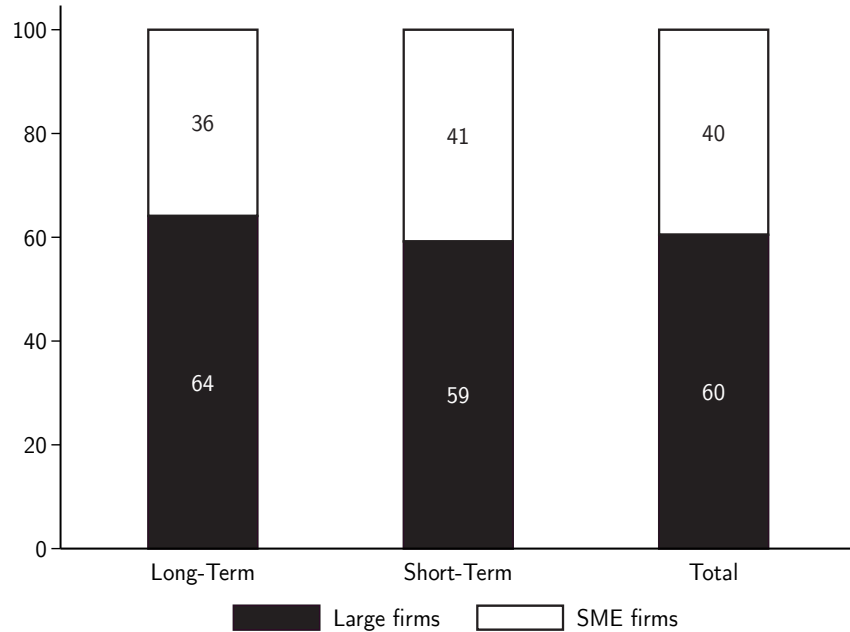


Figure 2.5: Debt by maturity and firm size. Aggregated from firm-level data. SMEs are firms with less than 250 employees and/or firms with total assets less than 43 million euros at 2005 prices.

correlation between cash flow and sales growth.¹¹

We measure sovereign risk based on the country of the firm's location. Hence, we use the sovereign spread between the firm's country's long-term government bond and German *Bunds*. In alternative specifications we also use a periphery dummy variable taking a value of one if the firm is located in a peripheral country.

We measure bank weakness of the firm's main bank using the share of total sovereign holdings of the bank over total assets of the bank. Total sovereign holdings come from Bankscope without indicating the nationality of the sovereign. Hence,

¹¹See Gomes (2001) for a critique of using cash flow to measure financial constraints when used along with other growth measures such as sales growth and/or Tobin's Q.

we also measure the bank's holdings of *own* sovereign debt using the proprietary database IBSI on domestic sovereign bond holdings from the European Central Bank (ECB). The difference between the two variables is that the Bankscope-based variable captures total bonds while the IBSI-based variable captures domestic bonds only. In practice, the difference between the two variables should be small, since most of a bank's total sovereign bond holdings are domestic bonds. Indeed, according to the IBSI data for our sample of banks, around 70% of euro area banks' sovereign bond holdings are domestic, with an even higher percentage in peripheral countries.

We use both Bankscope and ECB data since ECB data starts later in the last quarter of 2007 and covers fewer banks. We use these data as it is and also by an adjustment such that if the bank is not in a periphery country we set the sovereign holdings to zero in both datasets.

We also explored alternative measures of bank weakness based on bank leverage and the total capital ratio. However given that most bank assets and liabilities are not marked to market, these balance sheet variables do not register large enough movements to qualify as reliable measures of bank weakness. Moreover, the sovereign bond holdings are a more direct measure of exposure to sovereign risk of each bank, and therefore more directly capture bank-sovereign linkages.

All firm-level variables are winsorized such that kurtosis falls below a threshold of 10. Net investment to lagged capital, the debt to capital ratio, sales growth and the logarithm of capital stock are winsorized at the 5%, 6%, 2%, and 1% levels respectively.

Table 2.3 shows descriptive statistics for all variables for all firms in Panel

A. In general, there is a good deal of variation that allows the identification of the econometric effects of interest. For instance, while the average net investment ratio is 9.7 percent, it varies widely with a standard deviation of 62.5 percent and a minimum value of -53.9 percent. Firms' debt-to-capital ratio also varies widely, with a large fraction of firms holding close to zero or no long-term debt and with short-term debt on average being much larger than long-term debt. Sovereign-risk variation comes from the later part of the sample when sovereign-debt crisis intensifies.

Panel B of Table 2.3 reports descriptive statistics for the matched firm-bank sample. As argued above, there are no systematic differences between the all-firms and matched firms samples, easing concerns about selection on firms reporting banks' names. Bank's holdings of sovereign bonds as a share of total assets vary markedly from a low of zero to a high of 38.2 percent, averaging about 4.3 percent. Banks' own sovereign's holdings show similar statistics.

2.4 Identification

To identify the effects of debt overhang and rollover risk on firm investment, we use a difference-in-difference investment specification, saturating regressions fully with country-sector-year, bank, and firm fixed effects. These absorb the direct impact on investment of changing country (including sovereign) and sector conditions, and aggregate demand. As a result we can focus on heterogeneous effects of pre-crisis debt accumulation. Specifically, firm and bank fixed effects control for unobserved, time-invariant heterogeneity across firms and banks, while four-digit-level industry-

country-year fixed effects absorb time-varying demand conditions, since most of aggregate demand fluctuations derive from country- and industry-specific factors.

We first run the following difference-in-difference regression of investment on debt, starting without interactions and then interacting all variables with the variable $Post_t$. This is a binary variable equal to 1 starting in the year 2008, which we take as the beginning of the global financial crisis.¹² For most countries in our sample, this is also the starting year of a major recession. The baseline econometric model is:

$$\begin{aligned} \left(\frac{\text{Investment}}{\text{Capital}} \right)_{isct} &= \beta \text{Debt}_{isc,t-1} \times Post_t + \lambda \text{Debt}_{isc,t-1} + & (2.1) \\ &+ \delta \text{Maturity}_{isc,t-1} \times Post_t + \kappa \text{Maturity}_{isc,t-1} + \\ &+ Post_t \times \mathbf{X}_{isc,t-1} \prime \zeta + \mathbf{X}_{isc,t-1} \prime \gamma + \alpha_i + \alpha_{cst} + \varepsilon_{isct} \end{aligned}$$

where α_i is a firm-specific fixed effect and α_{cst} is a country-sector-year fixed effect. The vector $\mathbf{X}_{isc,t-1}$ contains the control variables, including sales growth, measured as the change in the logarithm of sales, and firm size, measured as logarithm of the capital stock. The ratio of total debt to capital measures firm indebtedness (Debt) and ratio of long-term debt to total debt measures the maturity structure (Maturity).

We then allow the crisis effect to differ between peripheral and core countries by including an interaction term between $POST_t$ and $PERIPHERY_c$ which is a

¹²Changing the POST variable to take on a value of 1 for the years 2010 onwards and zero otherwise does not materially affect our results. Our results are also robust to excluding Greece, which experienced the sharpest increase in sovereign risk of all countries in the sample.

dummy variable indicating whether the firm is located in a peripheral country:

$$\begin{aligned}
\left(\frac{\text{Investment}}{\text{Capital}}\right)_{isct} &= \beta \text{Debt}_{isc,t-1} \times \text{Post}_t \times \text{Periphery}_c & (2.2) \\
&+ \eta \text{Debt}_{isc,t-1} \times \text{Post}_t + \theta \text{Debt}_{isc,t-1} \times \text{Periphery}_c \\
&+ \lambda \text{Debt}_{isc,t-1} + \mu \text{Maturity}_{isc,t-1} \times \text{Post}_t \times \text{Periphery}_c \\
&+ \delta \text{Maturity}_{isc,t-1} \times \text{Post}_t + \nu \text{Maturity}_{isc,t-1} \times \text{Periphery}_c \\
&+ \kappa \text{Maturity}_{isc,t-1} + \text{Post}_t \times \text{Periphery}_c \times \mathbf{X}_{ics,t-1} \times \boldsymbol{\xi} \\
&+ \text{Post}_t \times \mathbf{X}_{ics,t-1} \times \boldsymbol{\zeta} + \text{Periphery}_c \times \mathbf{X}_{ics,t-1} \times \boldsymbol{\pi} \\
&+ \alpha_i + \alpha_b + \alpha_{cst} + \varepsilon_{isct}
\end{aligned}$$

Subsequently we replace the variable *Periphery_c* with weak-bank (or weak-sovereign) variables as shown in the following equation. We add lender (bank) fixed effects, labeled as α_b in these regressions. *Weak Bank* variable itself captures the direct lending channel:

$$\begin{aligned}
\left(\frac{\text{Investment}}{\text{Capital}}\right)_{isct} &= \beta \text{Debt}_{isc,t-1} \times \text{Post}_t \times \text{Weak Bank}_{t-1} & (2.3) \\
&+ \eta \text{Debt}_{isc,t-1} \times \text{Post}_t + \theta \text{Debt}_{isc,t-1} \times \text{Weak Bank}_{t-1} \\
&+ \lambda \text{Debt}_{isc,t-1} + \mu \text{Maturity}_{isc,t-1} \times \text{Post}_t \times \text{Weak Bank}_{t-1} \\
&+ \delta \text{Maturity}_{isc,t-1} \times \text{Post}_t + \nu \text{Maturity}_{isc,t-1} \times \text{Weak Bank}_{t-1} \\
&+ \kappa \text{Maturity}_{isc,t-1} + \text{Post}_t \times \text{Weak Bank}_{t-1} \times \mathbf{X}_{ics,t-1} \times \boldsymbol{\xi} \\
&+ \text{Post}_t \times \mathbf{X}_{ics,t-1} \times \boldsymbol{\zeta} + \text{Weak Bank}_{t-1} \times \mathbf{X}_{ics,t-1} \times \boldsymbol{\pi} \\
&+ \text{Weak Bank}_{t-1} + \alpha_i + \alpha_b + \alpha_{cst} + \varepsilon_{isct}
\end{aligned}$$

In the following section we will describe the results obtained from the econometric regressions shown before.

2.5 Regression Results

Table 2.4 shows our benchmark results. The first three columns correspond to the unbalanced panel sample of all firms (matched and unmatched) starting on 1999 and for alternative time periods. The next three columns correspond to the continuous firms sample for the same time periods. In this continuous-firms sample, we do not allow entry and exit so as to follow the same firms throughout the period. All regressions include sector-country-year effects at the four-digit sector classification level. As shown in all columns, debt is positively associated with investment, suggesting that much of investment is financed with debt. On the other hand, investment is negatively associated with the average maturity of debt, meaning investment is mainly financed by short-term debt accumulation. These findings hold across both samples and during all time periods.

The control variables such as firm size and productivity enter with the expected signs. Sales growth enters positively, signifying the positive effect of growth opportunities on firm investment. Firm size enters negatively, capturing decreasing returns to scale.

Table 2.5 shows results from estimating equation (2.1), which allows for differential effects of all variables during the crisis period 2008–2012, which we capture using the *Post* dummy variable. The first column shows our preferred specifica-

Table 2.4: Benchmark Results

Dependent variable: Net investment _t / Capital _{t-1}	(1)		(2)		(3)		(4)		(5)		(6)	
	All Firms All Periods	All Firms Until 2008	All Firms All Firms After 2008	All Firms Until 2008	All Firms All Firms After 2008	All Firms All Firms After 2008	Continuous All Periods	Continuous Until 2008	Continuous Until 2008	Continuous Until 2008	Continuous After 2008	Continuous After 2008
Debt _{t-1}	0.0029*** (0.0000)	0.0031*** (0.0001)	0.0014*** (0.0001)	0.0014*** (0.0001)	0.0014*** (0.0001)	0.0014*** (0.0001)	0.0240*** (0.0001)	0.0015*** (0.0002)	0.0015*** (0.0002)	0.0015*** (0.0002)	0.0011*** (0.0001)	0.0011*** (0.0001)
Maturity _{t-1}	-0.0689*** (0.0011)	-0.0927*** (0.0021)	-0.0706*** (0.0015)	-0.0706*** (0.0015)	-0.0706*** (0.0015)	-0.0706*** (0.0015)	-0.0940*** (0.0019)	-0.1466*** (0.0068)	-0.1466*** (0.0068)	-0.1466*** (0.0068)	-0.0770*** (0.0023)	-0.0770*** (0.0023)
Sales _{t-1}	0.0590*** (0.0005)	0.0521*** (0.0008)	0.0425*** (0.0007)	0.0425*** (0.0007)	0.0425*** (0.0007)	0.0425*** (0.0007)	0.0567*** (0.0009)	0.0130*** (0.0024)	0.0130*** (0.0024)	0.0130*** (0.0024)	0.0478*** (0.0011)	0.0478*** (0.0011)
Size _{t-1}	-0.3314*** (0.0006)	-0.4709*** (0.0010)	-0.4849*** (0.0010)	-0.4849*** (0.0010)	-0.4849*** (0.0010)	-0.4849*** (0.0010)	-0.3886*** (0.0011)	-0.9443*** (0.0052)	-0.9443*** (0.0052)	-0.9443*** (0.0052)	-0.4930*** (0.0016)	-0.4930*** (0.0016)
Obs.	14,653,425	6,296,848	7,901,245	6,296,848	7,901,245	7,901,245	5,037,584	1,175,616	1,175,616	1,175,616	3,738,087	3,738,087
R ²	0.34	0.42	0.47	0.42	0.47	0.47	0.34	0.72	0.72	0.72	0.42	0.42
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector-Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Banker FE	No	No	No	No	No	No	No	No	No	No	No	No

Standard errors in parentheses. Clustered errors at the firm level. Debt is total debt scaled by total capital. Maturity is the ratio of long-term debt to total debt. Sales is the change in the logarithm of sales. Size is measured by total capital. The continuous sample comprises firms reporting a financial statement every period between 2005 and 2012. The beginning date of the sample is chosen as to avoid losing an important amount of observations as compared to starting 2004 or earlier. Uses four-digit level sector classification.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

tion, which include firms as well as country-sector-year fixed effects. The results show that during the marginal effect of debt on investment turns negative during the crisis period. This depicts a situation of debt overhang where high levels of debt are depressing investment during the crisis. Furthermore, having short term debt becomes a drag on investment during the crisis, pointing to rollover risk. Sales growth has a more positive effect on investment during the crisis as does firm size, suggesting that bigger firms are less financially constrained during the crisis.

Our results are economically significant. According to the estimates in column (1) of Table 2.5, during regular times, a one standard-deviation increase in the debt to capital ratio increases investment by 6 percentage points, whereas the partial effect of a similar increase during crisis times decreases this effect on investment by 0.4 percentage points, yielding a total effect of 5.6 percentage points increase in investment. A one standard deviation increase in the maturity decreases investment by 2.3 percentage points during regular times and but increases this effect on investment by 0.1 percentage points during crisis times due to heightened rollover risk via short-term debt. Then total effect of this variable is a 2.2 percentage points decrease in investment. These are large effects relative to the pre-crisis mean investment ratio of 11.5% during our sample period for the euro area. It generates an almost 20 percent of decline in the investment ratio relative to its pre-crisis mean.

Table 2.5 also shows the importance of controlling for demand shocks via the use of four digit sector-country-year fixed effects. Column (1) relative to other columns shows that there will be an omitted variable bias if these fixed effects are not controlled for. Since omitted demand shocks are positively correlated with

Table 2.5: Role of Aggregate Demand Shocks

Dependent variable: Net investment _t / Capital _{t-1}				
	(1)	(2)	(3)	(4)
	All Firms	All Firms	All Firms	All Firms
Post _t × Debt _{t-1}	-0.0002*** (0.0000)	-0.0002*** (0.0000)	-0.0003*** (0.0000)	-0.0004*** (0.0000)
Post _t × Maturity _{t-1}	0.0037** (0.0017)	-0.0007 (0.0017)	-0.0035** (0.0017)	-0.0211*** (0.0017)
Post _t × Sales _{t-1}	0.0226*** (0.0010)	0.0229*** (0.0010)	0.0237*** (0.0010)	0.0242*** (0.0010)
Post _t × Size _{t-1}	0.0195*** (0.0003)	0.0198*** (0.0003)	0.0195*** (0.0003)	0.0193*** (0.0003)
Debt _{t-1}	0.0030*** (0.0000)	0.0031*** (0.0000)	0.0031*** (0.0000)	0.0032*** (0.0000)
Maturity _{t-1}	-0.0721*** (0.0015)	-0.0695*** (0.0015)	-0.0685*** (0.0015)	-0.0607*** (0.0015)
Sales _{t-1}	0.0465*** (0.0008)	0.0472*** (0.0008)	0.0475*** (0.0008)	0.0487*** (0.0008)
Size _{t-1}	-0.3444*** (0.0006)	-0.3429*** (0.0006)	-0.3419*** (0.0006)	-0.3398*** (0.0006)
Obs.	14,653,425	14,662,551	14,663,232	14,663,299
R ²	0.34	0.34	0.34	0.34
F-Test: Debt	0.00	0.00	0.00	0.00
F-Test: Maturity	0.00	0.00	0.00	0.00
F-Test: Sales Growth	0.00	0.00	0.00	0.00
F-Test: Size	0.00	0.00	0.00	0.00
Firm FE	Yes	Yes	Yes	Yes
4d-Sector-Country-Year FE	Yes	No	No	No
2d-Sector-Country-Year FE	No	Yes	No	No
1d-Sector-Country-Year FE	No	No	Yes	No
Country-Year FE	No	No	No	Yes

Standard errors in parentheses. Clustered errors at the firm level. Columns have differing number of observations due to removal of singletons whose number varies across specifications. Post is a dummy variable equal 1 for $t \geq 2008$. Debt is total debt scaled by total capital. Maturity is the ratio of long-term debt to total debt. Sales is the change in the logarithm of sales. Size is measured by total capital.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

investment and negatively correlated with the maturity variable, because firms that financed themselves more with long-term debt are exposed to lower demand during the crisis, not controlling for demand shocks leads to a wrong signed coefficient on

the maturity variable during crisis given the negative bias.

Table 2.6 shows that the debt overhang and rollover risk results are driven by firms in the peripheral countries. The coefficient on $\text{Periphery} \times \text{Post} \times \text{Debt}$ is negative and significant and the coefficient on $\text{Periphery} \times \text{Post} \times \text{Maturity}$ is positive and significant. The coefficient on the triple interaction of $\text{Periphery} \times \text{Post} \times \text{Debt}$ implies a 45 percent lower investment for a one standard deviation increase in debt for firms from peripheral countries during the crisis, relative to the pre-crisis mean of investment ratio. The coefficient on $\text{Post} \times \text{Debt}$ is positive and the coefficient on $\text{Post} \times \text{Maturity}$ is negative, showing that debt overhang and rollover risk did not limit investment as much during the crisis for firms outside the periphery.

Column (3) of this table runs the same regression in the matched firm-bank sample using bank fixed effects and hence shows that the results for periphery country firms continue to hold even when we condition on time invariant bank fixed effects. Notice that the number of observations are higher when we include bank fixed effects since now we use a data set that is at the firm-bank-time level rather than the firm-time level. Size still has a positive role in this matched sample with banker fixed effects but sales has no more role.

Next, we want to understand what drives these changes from regular to crisis times, and between periphery and core countries. In other words, we want to understand what is the key shock underlying the crisis. Therefore, we investigate the role of weak sovereigns and weak banks as potential drivers of these changes in the effects of debt overhang and rollover risk.

Table 2.6: Periphery and Crisis Results

Dependent variable: Net investment _t /Capital _{t-1}			
	(1)	(2)	(3)
	All Firms	Matched	Matched
Periphery×Post _t ×Debt _{t-1}	-0.0015*** (0.0001)	-0.0023*** (0.0001)	-0.0028*** (0.0001)
Periphery×Post _t ×Maturity _{t-1}	0.0181*** (0.0034)	0.0140** (0.0056)	0.0243*** (0.0051)
Periphery×Post _t ×Sales _{t-1}	-0.0275*** (0.0022)	-0.0178*** (0.0039)	-0.0070* (0.0040)
Periphery×Post _t ×Size _{t-1}	0.0081*** (0.0006)	0.0103*** (0.0010)	0.0131*** (0.0009)
Periphery×Debt _{t-1}	-0.0007*** (0.0001)	0.0001 (0.0002)	0.0003** (0.0001)
Periphery×Maturity _{t-1}	-0.0284*** (0.0031)	-0.0585*** (0.0052)	-0.0755*** (0.0048)
Periphery×Sales _{t-1}	-0.0149*** (0.0016)	-0.0196*** (0.0030)	-0.0158*** (0.0031)
Periphery×Size _{t-1}	0.0214*** (0.0012)	0.0469*** (0.0021)	0.0630*** (0.0020)
Post _t ×Debt _{t-1}	0.0006*** (0.0001)	0.0009*** (0.0001)	0.0012*** (0.0001)
Post _t ×Maturity _{t-1}	-0.0071*** (0.0024)	-0.0069* (0.0040)	-0.0141*** (0.0039)
Post _t ×Sales _{t-1}	0.0418*** (0.0018)	0.0371*** (0.0031)	0.0307*** (0.0034)
Post _t ×Size _{t-1}	0.0151*** (0.0004)	0.0075*** (0.0007)	0.0043*** (0.0007)
Debt _{t-1}	0.0033*** (0.0001)	0.0030*** (0.0001)	0.0028*** (0.0001)
Maturity _{t-1}	-0.0559*** (0.0021)	-0.0344*** (0.0037)	-0.0212*** (0.0036)
Sales _{t-1}	0.0564*** (0.0013)	0.0550*** (0.0024)	0.0511*** (0.0027)
Size _{t-1}	-0.3565*** (0.0009)	-0.3441*** (0.0014)	-0.3529*** (0.0016)
Obs.	14,653,425	5,049,070	6,415,367
R ²	0.34	0.34	0.36
F-Test: Debt	0.00	0.00	0.00
F-Test: Maturity	0.00	0.00	0.00
F-Test: Sales Growth	0.00	0.00	0.00
F-Test: Size	0.00	0.00	0.00
Firm FE	Yes	Yes	Yes
Sector-Country-Year FE	Yes	Yes	Yes
Banker FE	No	No	Yes

Standard errors in parentheses. Clustered errors at the firm level. Post is a dummy variable equal 1 for ≥ 2008 . Periphery is a dummy variable equal to 1 if the firm is in a country of Peripheral euro area. Weak Sovereign is the spread between the 10-year constant maturity sovereign bond minus that of German Bund. Debt is total debt scaled by total capital. Maturity is the ratio of long-term debt to total debt. Sales is the change in logarithm of sales. Size is measured by total capital. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

2.5.1 Role of Weak Sovereigns and Weak Banks

We ask whether the decline in investment is due to debt overhang and rollover risk during the crisis is due to weak banks (a firm-bank-specific credit supply shock), weak sovereigns, or both.

Table 2.7 shows that debt overhang is stronger during the crisis if the firm is associated with a weak bank. This table also shows a very strong direct supply effect of weak banks (lending channel), as a result of higher exposure to sovereign debt, as this variable has a strong negative coefficient. We measure the weak bank as total sovereign holdings of periphery banks as a share of bank assets. The coefficients imply an investment ratio that is 46.8 percent lower than its pre-crisis mean. Notice that the effect is even bigger in the continuous sample of firms as shown in column (2) since now entry of strong firms is not allowed and also exit of weak firms. However, it seems to be the case that rollover risk does not get worse if the firm is borrowing from a weak bank.

Table 2.8 presents results using the own sovereign bond-holdings instead of the total sovereign bond-holdings as the proxy for weak banks. This table shows also a very strong direct supply effect of weak banks on investment (lending channel), as a result of higher exposure to their own sovereign debt, where this variable has a coefficient of similar magnitude as in Table 2.7. Again, it seems that rollover risk does not get worse if the firm is borrowing from a weak bank. Due to the time limitation (this sample starts in 2007), POST variable is equal to 1 starting in 2009, but nonetheless results on POST interactions and direct effects show similar

magnitudes and significance on coefficients as Table 2.7.

Overall, the results highlight the importance of sovereign risk in intensifying the debt overhang effect, which operates in part through a deterioration in banks' balance sheets from exposure to sovereign bonds.

Table 2.7: Role of Weak Banks (Periphery Sovereign Holdings)

Dependent variable: Net investment _t /Capital _{t-1}		
	(1) All Firms	(2) Continuous
Periphery Sov. Holdings _{t-1} × Post _t × Debt _{t-1}	-0.0225*** (0.0020)	-0.0326*** (0.0030)
Periphery Sov. Holdings _{t-1} × Post _t × Maturity _{t-1}	-0.1565** (0.0786)	-0.3970*** (0.1021)
Periphery Sov. Holdings _{t-1} × Post _t × Sales _{t-1}	0.0278 (0.0599)	0.0954 (0.0878)
Periphery Sov. Holdings _{t-1} × Post _t × Size _{t-1}	0.1145*** (0.0132)	0.1156*** (0.0171)
Periphery Sov. Holdings _{t-1} × Debt _{t-1}	-0.0078*** (0.0018)	-0.0121*** (0.0027)
Periphery Sov. Holdings _{t-1} × Maturity _{t-1}	-0.3085*** (0.0713)	-0.3270*** (0.0929)
Periphery Sov. Holdings _{t-1} × Sales _{t-1}	0.0273 (0.0514)	0.0039 (0.0765)
Periphery Sov. Holdings _{t-1} × Size _{t-1}	0.0661*** (0.0122)	0.1015*** (0.0163)
Post _t × Debt _{t-1}	0.0015*** (0.0001)	0.0022*** (0.0002)
Post _t × Maturity _{t-1}	-0.0316*** (0.0051)	-0.0349*** (0.0063)
Post _t × Sales _{t-1}	0.0378*** (0.0043)	0.0358*** (0.0062)
Post _t × Size _{t-1}	-0.0009 (0.0009)	-0.0088*** (0.0011)
Debt _{t-1}	0.0020*** (0.0001)	0.0017*** (0.0002)
Maturity _{t-1}	-0.0219*** (0.0050)	-0.0236*** (0.0062)
Sales _{t-1}	0.0097** (0.0038)	0.0149*** (0.0055)
Size _{t-1}	-0.4048*** (0.0020)	-0.3900*** (0.0027)

Standard errors in parentheses. Clustered errors at the firm-banker level. Post is a dummy variable equal 1 for $t \geq 2008$. Periphery Sov. Holdings is the share of total sovereign bond-holdings of total assets in peripheral euro area banks (0 for core euro area banks). Debt is total debt scaled by total capital. Maturity is the ratio of long-term debt to total debt. Sales is the change in the logarithm of sales. Size is measured by the logarithm of total capital. Uses 4-digit level sector classification.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

	(1) All Firms	(2) Continuous
Periphery Sov. Holdings _{t-1} × Post _t	-1.1388*** (0.1827)	-1.0704*** (0.2431)
Periphery Sov. Holdings _{t-1}	-0.6574*** (0.1695)	-1.1483*** (0.2305)
Obs.	3,343,511	1,681,957
R ²	0.46	0.41
F-Test: Debt	0.00	0.00
F-Test: Maturity	0.00	0.00
F-Test: Sales Growth	0.00	0.00
F-Test: Size	0.00	0.00
Firm FE	Yes	Yes
Sector-Country-Year FE	Yes	Yes
Banker FE	Yes	Yes

Standard errors in parentheses. Clustered errors at the firm-banker level. Post is a dummy variable equal 1 for $t \geq 2008$. Periphery Sov. Holdings is the share of total sovereign bond-holdings of total assets in peripheral euro area banks (0 for core euro area banks). Debt is total debt scaled by total capital. Maturity is the ratio of long-term debt to total debt. Sales is the change in the logarithm of sales. Size is measured by the logarithm of total capital. Uses 4-digit level sector classification.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

2.5.2 Threats to Identification

One worry is the possibility that firms with high and low debt were already on different investment paths before the crisis, and hence the heterogenous investment effects we find for high and low debt firms are not due to the crisis. To check for this possibility, we plot in Figure 2.6 investment dynamics for high and low debt firms throughout our sample period and show that there is no significant difference in investment patterns of these firms.

Table 2.8: Role of Weak Banks (Periphery Domestic Sovereign Holdings)

Dependent variable: Net investment_t/Capital_{t-1}

	(1) All Firms	(2) Continuous
Periphery Dom. Sov. Holdings _{t-1} × Post _t × Debt _{t-1}	-0.0224*** (0.0050)	-0.0247*** (0.0064)
Periphery Dom. Sov. Holdings _{t-1} × Post _t × Maturity _{t-1}	0.0844 (0.2079)	-0.1470 (0.2454)
Periphery Dom. Sov. Holdings _{t-1} × Post _t × Sales _{t-1}	0.1794 (0.1901)	0.1051 (0.2564)
Periphery Dom. Sov. Holdings _{t-1} × Post _t × Size _{t-1}	0.1145*** (0.0405)	0.0757 (0.0524)
Periphery Dom. Sov. Holdings _{t-1} × Debt _{t-1}	-0.0061 (0.0051)	-0.0197*** (0.0065)
Periphery Dom. Sov. Holdings _{t-1} × Maturity _{t-1}	-0.6017*** (0.2106)	-0.7097*** (0.2480)
Periphery Dom. Sov. Holdings _{t-1} × Sales _{t-1}	-0.2209 (0.1829)	-0.1070 (0.2482)
Periphery Dom. Sov. Holdings _{t-1} × Size _{t-1}	-0.0134 (0.0445)	0.0827 (0.0578)
Post _t × Debt _{t-1}	0.0014*** (0.0001)	0.0018*** (0.0002)
Post _t × Maturity _{t-1}	-0.0160** (0.0064)	-0.0216*** (0.0083)
Post _t × Sales _{t-1}	0.0258*** (0.0066)	0.0233** (0.0094)
Post _t × Size _{t-1}	-0.0044*** (0.0011)	-0.0105*** (0.0014)
Debt _{t-1}	0.0018*** (0.0002)	0.0015*** (0.0003)
Maturity _{t-1}	-0.0391*** (0.0066)	-0.0400*** (0.0086)
Sales _{t-1}	0.0134** (0.0060)	0.0175** (0.0085)
Size _{t-1}	-0.4387*** (0.0030)	-0.4366*** (0.0040)

Standard errors in parentheses. Clustered errors at the firm-banker level. Post is a dummy variable equal 1 for ≥ 2009 . Periphery domestic sovereign bond-holdings are scaled by total assets, and equal to zero if the bank has a parent from a core euro area country. Debt is total debt scaled by total capital. Maturity is the ratio of long-term debt to total debt. Sales is the change in the logarithm of sales. Size is measured by the logarithm of total capital. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

	(1) All Firms	(2) Continuous
Periphery Dom. Sov. Holdings _{t-1} × Post _t	-1.3576** (0.5604)	-0.7562 (0.7345)
Periphery Dom. Sov. Holdings _{t-1}	0.5562 (0.6102)	-0.6177 (0.8031)
Obs.	1,868,334	963,978
R ²	0.48	0.44
F-Test: Debt	0.00	0.00
F-Test: Maturity	0.00	0.00
F-Test: Sales Growth	0.00	0.00
F-Test: Size	0.00	0.00
Firm FE	Yes	Yes
Sector-Country-Year FE	Yes	Yes
Banker FE	Yes	Yes

Standard errors in parentheses. Clustered errors at the firm-banker level. Post is a dummy variable equal 1 for ≥ 2009 . Periphery domestic sovereign bond-holdings are scaled by total assets, and equal to zero if the bank has a parent from a core euro area country. Debt is total debt scaled by total capital. Maturity is the ratio of long-term debt to total debt. Sales is the change in the logarithm of sales. Size is measured by the logarithm of total capital. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

2.6 Conclusion

We analyze a comprehensive dataset of European firms – including both small (SMEs) and large firms – to study the determinants of corporate investment prior to and during the European sovereign debt crisis. We find evidence consistent with debt overhang, defined as corporate indebtedness relative to capital, holding back investment in Europe especially during the crisis. We also show that rollover risk lowered investment during the crisis as evidenced by a negative impact of shorter debt maturity on investment, but had a positive effect during normal times.

The heightened rollover risk during the crisis might be linked to an increase in sovereign risk as seen in Table 2.6, which reflects both a direct effect from the reduction in creditworthiness of the sovereign on corporate. We also find that debt overhang effect on firm investment got worse during crisis for firms who had a prior

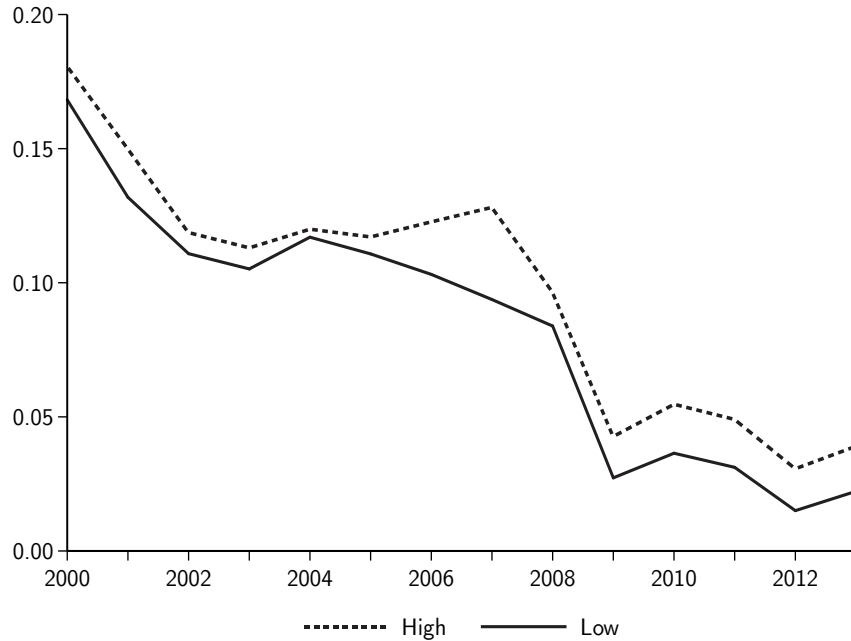


Figure 2.6: Average Net Investment Rate by Level of Indebtedness. High Debt firms are those whose average short-term debt between 2005-07 is greater than the average 2005-07 median of its country.

relationship with weak banks.

We identify these results using a difference-in-difference estimation approach, comparing investment of high debt overhang firms with low debt-overhang firms across crisis and normal times, and absorbing demand shocks through country-industry-year fixed effects, with industry measured at a fine four-digit level. Furthermore we use confidential ECB data on the exposures of banks to (own) sovereign debt together with information on the main bank relation of each firm to identify the role of sovereign-bank linkages in driving the effects of debt overhang and rollover risk. These regressions also include banker fixed effects alongside firm fixed effects to control for sticky bank-firm relationship and also to identify from firms who have relationships with more than one bank.

In quantitative terms, the debt overhang and rollover risk channels are impor-

tant. Our estimated coefficients imply that, given a one standard deviation increase in rollover risk via short-term debt, the investment ratio is almost 11.7 percent lower relative to its pre-crisis mean. A one standard deviation deterioration in the balance sheet of the firm's bank due to exposure to periphery country debt, results in an investment ratio that 46.8 percent lower than the pre-crisis mean in the aftermath of the crisis.

These results highlight that debt overhang played a significant role in holding back corporate investment during the European debt crisis, despite unprecedented monetary policy measures that brought interest rates down to the zero lower bound. Debt overhang turned into rollover risk during the crisis since most of the debt accumulation that was used to finance investment during the boom years was short-term debt. A key role is due to bank-sovereign linkages since firms who borrowed from banks who had deteriorating balance sheets during crisis via their sovereign holdings fared worse. Our findings suggest that low interest rates by themselves are not a panacea and that other growth-enhancing policies, such as the asset purchase program recently implemented by the European Central Bank, are needed to reduce the corporate debt overhang and stimulate investment and the real economy.

Appendix A: Appendix for Chapter 1

In this appendix, I will provide further details in the solution of the benchmark model, with mercantilism, sovereign default and sudden stops.

A.1 Competitive equilibrium

To solve the competitive equilibrium for the private sector, I use the detrended first order conditions of the households and firms to obtain an equilibrium equation as a function of labor in the tradable sector, taking as given the net foreign asset decisions of the government.

A.1.1 Unconstrained solution

Starting from the first order conditions of the tradable sector firms', we can find an expression of imported inputs as a function of parameters and tradable labor:

$$m_t = \chi_t^{\frac{1}{\alpha}} L_t^T \tag{A.1}$$

where $\chi_t = [(1 - \alpha) z_t / P_t^M]$. Using this expression, we can find an expression for the equilibrium wage of the economy:

$$w_t^* = \alpha z_t \chi_t^{\frac{1}{\alpha} - 1} \tag{A.2}$$

Using the first order condition of nontradable sector firms' and that of households, plus the resource constraint and the nontradable market clearing condition, I arrive to an expression to calculate the equilibrium labor in the tradable sector:

$$F(L_t^T) = \left[\frac{aw_t^*}{(1-a)\gamma} \right]^{\frac{1}{1+\nu}} (1 - L_t^T)^{\frac{1+\gamma\nu}{1+\nu}} - w_t^* L_t^T - b_t + q_t \left[v + \chi_t^{\frac{\xi}{\alpha}} (L_t^T)^\xi \right] b_{t+1} \quad (\text{A.3})$$

This equation has the possibility of having more than one root in the interval $[0, 1]$. For this matter, the algorithm to solve the equation uses 41 Chebyshev collocation points, and brackets the function for the highest root, as to keep the monotonicity of the relation between tradable labor and next-period sovereign net foreign assets.

Once a solution for labor in tradable sector is calculated, using the resource constraint and the nontradable market clearing conditions, is straightforward to calculate the rest of the variables.

A.1.2 Unconstrained solution under sovereign default

This case is directly solvable by using $b_t = b_{t+1} = 0$ allows for a straightforward solution:

$$F(L_t^T) = \left[\frac{aw_t^*}{(1-a)\gamma} \right]^{\frac{1}{1+\nu}} (1 - L_t^T)^{\frac{1+\gamma\nu}{1+\nu}} - w_t^* L_t^T \quad (\text{A.4})$$

It is important to highlight that for a sovereign default, the firms are subject to sudden stops with the same parameter κ under no sovereign default, i.e. $\kappa = 0.12$, and there is an symmetrical loss of 10% in tradable and nontradable consumption units.

A.1.3 Constrained solution

When the realization of borrowing limit κ is a low level, we need to check whether $\phi P^M m_t^u > \kappa_t$, where m_t^u is the unconstrained level of imported inputs. If the sovereign has enough resources, it could finance the gap and restore the first-best equilibrium, or get closer to it:

$$m_t = \frac{\kappa + \max[\min(\phi P_M m_t^u - \kappa_t, (1 - \psi) b_t), 0]}{\phi P_M} \quad (\text{A.5})$$

Even if the government can help achieve m_t^u , there is a social cost for such credits which impacts transfers to households. Hence, we need to recalculate the level of labor in the tradable sector under this situation, by solving the following:

$$F(L_t^T) = a \alpha z_t (L_t^T)^{\alpha-1} m_t^{1-\alpha} - (1-a) \gamma [\alpha z_t (L_t^T)^\alpha m_t^{1-\alpha} + b_t - \frac{\psi}{1-\psi} d_t]^{1+\nu} (1-L_t^T)^{-\gamma\nu-1} \quad (\text{A.6})$$

In the case of sovereign default, the firms are always subject to a borrowing limit of $\kappa = 0.12$. Since they default on debt, cannot access debt and cannot provide credit to tradable firms, the calculation is much simpler by substituting $b_t = d_t = 0$ into the previous equation.

Appendix B: Appendix for Chapter 2

B.1 AMADEUS Data Cleaning

We work only with unconsolidated accounts. We clean the data in four steps. First, we clean the data of basic reporting mistakes. Second, we verify the internal consistency of balance sheet information. The first two steps are implemented at the level of each country. Third, we do a more specific quality control on variables of interest for firms. Finally, we winsorize variables.

B.1.1 Cleaning of Basic Reporting Mistakes

We implement the following steps to correct for basic reporting mistakes:

1. We drop firm-year observations that have missing information on total assets and operating revenues and sales and employment.
2. We drop firms if total assets are negative in any year, or if employment is negative or greater than 2 million in any year, or if sales are negative in any year, or if tangible fixed assets are negative in any year.
3. We drop firm-year observations with missing, zero, or negative values for materials and operating revenue or sales and total assets.
4. We drop firm-year observations with missing information regarding their industry of activity.

B.2 Internal Consistency of Balance Sheet Information

We check the internal consistency of the balance sheet data by comparing the sum of variables belonging to some aggregate to their respective aggregate. We construct the following ratios:

1. The sum of tangible fixed assets, intangible fixed assets, and other fixed assets as a ratio of total fixed assets.
2. The sum of stocks, debtors, and other current assets as a ratio of total current assets.
3. The sum of fixed assets and current assets as a ratio of total assets.
4. The sum of capital and other shareholder funds as a ratio of total shareholder funds.
5. The sum of long term debt and other non-current liabilities as a ratio of total non-current liabilities.
6. The sum of loans, creditors, and other current liabilities as a ratio of total current liabilities.
7. The sum of non-current liabilities, current liabilities, and shareholder funds as a ratio of the variable that reports the sum of shareholder funds and total liabilities.

After we construct these ratios, we estimate their distribution for each country separately. We then exclude from the analysis extreme values by dropping observations that are below the 0.1 percentile or above the 99.9 percentile of the distribution of ratios.

B.3 Further Quality Checks

1. **Liabilities.** As opposed to listed firms, non-listed firms do not report a separate variable "Liabilities." For these firms we construct liabilities as the difference between the sum of shareholder funds and liabilities ("SHFUNDLIAB") and shareholder funds or equity ("SHFUNDS"). We drop observations with negative or zero values.

We could also have computed liabilities as the sum of current liabilities and non-current liabilities. However, we find that there are more missing observations if we follow this approach. Nevertheless, for those observations with non-missing information we compare the value of liabilities constructed as the difference between SHFUNDLIAB and SHFUNDS and the value of liabilities constructed as the sum of current and non-current liabilities. We look at the ratio of the first measure relative to the second measure. Due to rounding differences the ratio is not always exactly equal to one and so we remove only firm-year observations for which this ratio is greater than 1.1 or lower than 0.9.

We drop firm-year observations with negative values for current liabilities, non-current liabilities, current assets, loans, creditors, other current liabilities, and long term debt. Finally, we drop observations for which long term debt exceeds total liabilities.

2. **Sector Classification** We drop financial and government firms, by dropping those with sector codes K and O in the 1 digit NACE Rev.2 Classification. In addition, we drop firm-year observations in four-digit sector and years with less than 10 observations.

Bibliography

- Acemoglu, Daron, Suresh Naidu, Pascual Restrepo, and James A. Robinson. 2014. “Democracy Does Cause Growth.” Working Paper 20004, National Bureau of Economic Research.
- Acemoglu, Daron, James A. Robinson, and Simon Johnson. 2001. “The Colonial Origins of Comparative Development: An Empirical Investigation.” *The American Economic Review* 91 (5):1369–1401.
- Acharya, Viral, Itamar Drechsler, and Philipp Schnabl. 2014. “A Pyrrhic Victory? Bank Bailouts and Sovereign Credit Risk.” *Journal of Finance* 69 (6):2689–2739.
- Acharya, Viral, Tim Eisert, Christian Eufinger, and Christian Hirsch. 2014. “Real Effects of the Sovereign Debt Crisis in Europe: Evidence From Syndicated Loans.” Mimeo.
- Acharya, Viral, Douglas Gale, and Tanju Yorulmazer. 2011. “Rollover Risk and Market Freezes.” *The Journal of Finance* 66 (4):1177–1209.
- Acharya, Viral and Sascha Steffen. 2015. “The ‘Greatest’ Carry Trade Ever: Understanding Eurozone Bank Risks.” *Journal of Financial Economics* 115 (2):215–236.
- Adelino, Manuel and Miguel Ferreira. 2014. “Sovereign Rating Downgrades and Bank Lending Supply.” Mimeo.
- Aguiar, Mark and Manuel Amador. 2011. “Growth in the Shadow of Expropriation.” *The Quarterly Journal of Economics* 126 (2):651–697.
- . 2014. “Sovereign Debt.” In *Handbook of International Economics, Handbooks in Economics*, vol. 4, edited by Elhanan Helpman, Kenneth Rogoff, and Gita Gopinath, chap. 11. Oxford, United Kingdom: Elsevier, 647–688.
- Aguiar, Mark, Manuel Amador, and Gita Gopinath. 2009. “Investment Cycles and Sovereign Debt Overhang.” *Review of Economic Studies* 76 (1):1–31.
- Aizenman, Joshua and Jaewoo Lee. 2007. “International Reserves: Precautionary Versus Mercantilist Views, Theory and Evidence.” *Open Economies Review* 18 (2):191–214.

- Aizenman, Joshua and Nancy Marion. 2004. "International Reserve Holdings With Sovereign Risk and Costly Tax Collection." *Economic Journal* 114 (497):569–591.
- Alesina, Alberto and David Dollar. 2000. "Who Gives Foreign Aid to Whom and Why?" *Journal of Economic Growth* 5 (1):33–63.
- Alfaro, Laura, Şebnem Kalemli-Özcan, and Vadym Volosovych. 2008. "Why Doesn't Capital Flow From Rich to Poor Countries? an Empirical Investigation." *The Review of Economics and Statistics* 90 (2):347–368.
- . 2014. "Sovereigns, Upstream Capital Flows and Global Imbalances." *Journal of the European Economic Association* 12 (5):1240–1248.
- Alfaro, Laura and Fabio Kanczuk. 2009. "Optimal Reserve Management and Sovereign Debt." *Journal of International Economics* 77 (1):23–36.
- . 2013. "Carry Trade, Reserve Accumulation, and Exchange-Rate Regimes." Working Paper 19089, National Bureau of Economic Research.
- Amador, Manuel. 2003. *A Political Economy Model of Sovereign Debt Repayment*. Ph.D. thesis, Stanford Graduate School of Business.
- . 2012. "Sovereign Debt and the Tragedy of Commons." Mimeo.
- Amiti, Mary and David E. Weinstein. 2014. "How Much Do Banks Affect Investment? Evidence From Matched Bank-Firm Loan Data." Working Paper 18890, NBER.
- Angeletos, George-Marios and Vasia Panousi. 2011. "Financial Integration, Entrepreneurial Risk and Global Dynamics." *Journal of Economic Theory* 146 (3):863–896.
- Arellano, Cristina. 2008. "Default Risk and Income Fluctuations in Emerging Economies." *The American Economic Review* 98 (3):690–712.
- Azzimonti, Marina and Matthew Talbert. 2014. "Polarized Business Cycles." *Journal of Monetary Economics* 67:47 – 61.
- Bae, Kee-Hong, Jun-Koo Kang, and Chan-Woo Lim. 2002. "The Value of Durable Bank Relationships: Evidence From Korean Banking Shocks." *Journal of Financial Economics* 64:181–214.
- Baer, Werner. 1984. "Industrialization in Latin America: Successes and Failures." *The Journal of Economic Education* 15 (2):124–135.
- Baskaya, Yusuf Şoner and Şebnem Kalemli-Özcan. 2014. "Sovereign Risk and Bank Lending: Evidence From 1999 Turkish Earthquake." Mimeo.

- Beck, Thorsten, George Clarke, Alberto Groff, Philip Keefer, and Patrick Walsh. 2001. "New Tools in Comparative Political Economy: The Database of Political Institutions." *The World Bank Economic Review* 15 (1):165–176.
- Becker, Bo and Victoria Ivashina. 2014a. "Cyclicality of Credit Supply: Firm Level Evidence." *Journal of Monetary Economics* 62:76–93.
- . 2014b. "Financial Repression in the European Sovereign Debt Crisis." Mimeo, Harvard University.
- Benigno, Gianluca and Luca Fornaro. 2012. "Reserve Accumulation, Growth and Financial Crisis." Working paper, London School of Economics.
- Bernanke, Ben and Mark Gertler. 1989. "Agency Costs, Net Worth, and Business Fluctuations." *The American Economic Review* 79 (1):14–31.
- Bernanke, Ben S. 2005. "The Global Saving Glut and the U.S. Current Account Deficit." Remarks by Chairman Ben S. Bernanke at the Sandridge Lecture, Virginia Association of Economists, Richmond, Virginia, March 10th.
- Bianchi, Javier, Juan Carlos Hatchondo, and Leonardo Martínez. 2012. "International Reserves and Rollover Risk." Working Paper 18628, National Bureau of Economic Research.
- Bond, Stephen and Costas Meghir. 1994. "Dynamic Investment Models and the Firm's Financial Policy." *The Review of Economic Studies* 61 (2):197–222.
- Buera, Francisco J. and Yongseok Shin. 2009. "Productivity Growth and Capital Flows: The Dynamics of Reforms." Working Paper 15268, National Bureau of Economic Research.
- Bulow, Jeremy and Kenneth Rogoff. 1991. "Sovereign Debt Repurchases: No Cure for Overhang." *The Quarterly Journal of Economics* 106 (4):1219–1235.
- Caballero, Ricardo J, Emmanuel Farhi, and Pierre-Olivier Gourinchas. 2008. "An Equilibrium Model of 'Global Imbalances' and Low Interest Rates." *American Economic Review* 98 (1):358–393.
- Caballero, Ricardo J., Takeo Hoshi, and Anil K. Kashyap. 2008. "Zombie Lending and Depressed Restructuring in Japan." *American Economic Review* 98 (5):1943–1977.
- Caballero, Ricardo J and Stavros Panageas. 2008. "Hedging Sudden Stops and Precautionary Contractions." *Journal of Development Economics* 85 (1):28–57.
- Catão, Luis. 1992. "The Failure of Export-Led Growth in Brazil and México, C. 1870-1930." Research Papers 31, University of London Institute for the Study of the Americas.

- Chatterjee, Satyajit and Burcu Eyigungör. 2014. “Continuous Markov Equilibria With Quasi-Geometric Discounting.” Working Paper 14-6, Research Department, Federal Reserve Bank of Philadelphia.
- Chinn, Menzie and Hiro Ito. 2008. “A New Measure of Financial Openness.” *Journal of Comparative Policy Analysis* 10 (3):309–322.
- Chinn, Menzie D, Barry Eichengreen, and Hiro Ito. 2014. “A Forensic Analysis of Global Imbalances.” *Oxford Economic Papers* 66 (2):465–490.
- Chodorow-Reich, Gabriel. 2014. “The Employment Effects of Credit Market Disruptions: Firm-Level Evidence From the 2008–9 Financial Crisis.” *The Quarterly Journal of Economics* 129 (1):1–59.
- Choi, Woon Gyu, Sunil Sharma, and Maria Strömqvist. 2007. “Capital Flows, Financial Integration, and International Reserve Holdings: The Recent Experience of Emerging Markets and Advanced Economies.” Working Paper 151, International Monetary Fund.
- Cortés-Conde, Roberto. 1992. “Export-Led Growth in Latin America: 1870-1930.” *Journal of Latin American Studies* 24:163–179.
- Dell’Ariccia, Giovanni, Deniz Igan, Luc Laeven, and Hui Tong. 2014. “Policies for Macroeconomic Stability: Dealing With Credit Booms and Busts.” In *Financial Crises: Causes, Consequences, and Policy Responses*, edited by Stijn Claessens, Ayhan Kose, Luc Laeven, and Fabián Valencia, chap. 11. International Monetary Fund, 325–364.
- D’Erasmus, Pablo N. 2008. *Essays in Dynamic Macroeconomics*. Ph.D. thesis, University of Texas at Austin.
- Diamond, Douglas W. 1991. “Debt Maturity Structure and Liquidity Risk.” *The Quarterly Journal of Economics* 106 (3):709–737.
- Diamond, Douglas W. and Zhiguo He. 2014. “A Theory of Debt Maturity: The Long and Short of Debt Overhang.” *The Journal of Finance* 69 (2):719–762.
- Dooley, Michael, David Folkerts-Landau, and Peter Garber. 2004. “The Revived Bretton Woods System.” *International Journal of Finance and Economics* 9 (4):307–313.
- Durdu, Ceyhan Bora, Enrique G. Mendoza, and Marco E. Terrones. 2009. “Precautionary Demand for Foreign Assets in Sudden Stop Economies: An Assessment of the New Mercantilism.” *Journal of Development Economics* 89 (2):194–209.
- Eaton, Jonathan and Mark Gersovitz. 1981. “Debt With Potential Repudiation: Theoretical and Empirical Analysis.” *The Review of Economic Studies* 48 (2):289–309.

- Eichengreen, Barry. 1992. *Golden Fetters: The Gold Standard and the Great Depression, 1919-1939*. Oxford University Press.
- . 2004. “Global Imbalances and the Lessons of Bretton Woods.” Working Paper 10497, National Bureau of Economic Research.
- . 2006. “Global Imbalances: The New Economy, the Dark Matter, the Savvy Investor, and the Standard Analysis.” *Journal of Policy Modeling* 28 (6):645–652.
- Eichengreen, Barry and Yung Chul Park. 2006. “Global Imbalances and Emerging Markets.” Paper Prepared for the Conference on European and Asian Perspectives on Global Imbalances in Beijing, July 13th-14th.
- Ekelund, Robert B. Jr. and Robert F. Hébert. 2013. *A History of Economic Theory and Method*. Waveland Press.
- Feenstra, Robert C., Robert Inklaar, and Marcel P. Timmer. 2015. “The Next Generation of the Penn World Table.” *American Economic Review* 105 (10):3150–3182.
- Frankel, Jeffrey, Carlos Végh, and Guillermo Vuletin. 2013. “On Graduation From Fiscal Procyclicality.” *Journal of Development Economics* 100 (1):32–47.
- Fritsch, Frederick N and Ralph E Carlson. 1980. “Monotone Piecewise Cubic Interpolation.” *SIAM Journal on Numerical Analysis* 17 (2):238–246.
- Gennaioli, Nicola, Alberto Martin, and Stefano Rossi. 2013. “Banks, Government Bonds, and Default: What Do the Data Say?” Mimeo.
- . 2014. “Sovereign Default, Domestic Banks, and Financial Institutions.” *The Journal of Finance* 69 (2):819–866.
- Gertler, Mark and Peter Karadi. 2011. “A Model of Unconventional Monetary Policy.” *Journal of Monetary Economics* 58 (1):17–34.
- Giannetti, Mariassunta and Steven Ongena. 2012. “‘Lending by Example’: Direct and Indirect Effects of Foreign Banks in Emerging Markets.” *Journal of International Economics* 86 (1):167–180.
- Giroud, Xavier and Holger M Mueller. 2015. “Firm Leverage and Unemployment During the Great Recession.” Working paper, MIT Sloan.
- Gomes, João F. 2001. “Financing Investment.” *American Economic Review* 91 (5):1263–1285.
- Gómez-Galvarriato, Aurora and Jeffrey G. Williamson. 2009. “Was It Prices, Productivity or Policy? Latin American Industrialisation After 1870.” *Journal of Latin American Studies* 41 (4):663–694.

- Gornemann, Nils. 2014. "Sovereign Default, Private Investment, and Economic Growth." Mimeo.
- Gourinchas, Pierre-Olivier and Olivier Jeanne. 2013. "Capital Flows to Developing Countries: The Allocation Puzzle." *The Review of Economic Studies* 80 (4):1484–1515.
- Gourinchas, Pierre-Olivier and Hélène Rey. 2014. "External Adjustment, Global Imbalances and Valuation Effects." In *Handbook of International Economics, Handbooks in Economics*, vol. 4, edited by Elhanan Helpman, Kenneth Rogoff, and Gita Gopinath, chap. 10. Oxford, United Kingdom: Elsevier, 585–645.
- Gourio, François, Michael Simer, and Adrien Verdelhan. 2015. "Uncertainty and International Capital Flows." Mimeo, Federal Reserve Bank of Chicago.
- Greenspan, Alan. 2005. "Testimony of Chairman Alan Greenspan." *Federal Reserve Board's Semiannual Monetary Policy Report to the Congress* before the Committee on Banking, Housing, and Urban Affairs, U.S. Senate., Federal Reserve Board.
- Hennessy, Christopher A. 2004. "Tobin's Q, Debt Overhang, and Investment." *The Journal of Finance* 59 (4):1717–1742.
- Hennessy, Christopher a, Amnon Levy, and Toni M Whited. 2007. "Testing 'Q' Theory With Financing Frictions." *Journal of Financial Economics* 83 (3):691–717.
- Hoshi, Takeo, Anil Kashyap, and David Scharfstein. 1990. "The Role of Banks in Reducing the Costs of Financial Distress in Japan." *Journal of Financial Economics* 27 (1):67–88.
- Jeanne, Olivier and Romain Rancière. 2011. "The Optimal Level of International Reserves for Emerging Market Countries: A New Formula and Some Applications*." *The Economic Journal* 121 (555):905–930.
- Jones, Benjamin F. and Benjamin A. Olken. 2005. "Do Leaders Matter? National Leadership and Growth Since World War II." *The Quarterly Journal of Economics* 120 (3):835–864.
- . 2009. "Hit or Miss? the Effect of Assassinations on Institutions and War." *American Economic Journal: Macroeconomics* 1 (2):55–78.
- Kalemli-Özcan, Şebnem, Herman Kamil, and Carolina Villegas-Sánchez. 2010. "What Hinders Investment in the Aftermath of Financial Crises: Insolvent Firms or Illiquid Banks?" Working paper, National Bureau of Economic Research.
- Kalemli-Özcan, Şebnem, Bent E. Sørensen, Carolina Villegas-Sánchez, Vadym Volosovych, and Sevcan Yeşiltaş. 2015. "How to Construct Nationally Representative Firm Level Data From the Orbis Global Database." Working Paper 21558, National Bureau of Economic Research.

- Kashyap, Anil, Owen Lamont, and Jeremy C. Stein. 1994a. "Monetary Policy and Bank Lending." In *Monetary Policy, Studies in Business Cycles*, vol. 29, edited by Gregory Mankiw, chap. 7. The University of Chicago Press, 221–261.
- Kashyap, Anil K., Owen A. Lamont, and Jeremy C. Stein. 1994b. "Credit Conditions and the Cyclical Behavior of Inventories." *The Quarterly Journal of Economics* 109 (3):565–92.
- Kashyap, Anil K., Jeremy C. Stein, and David W. Wilcox. 1993. "Monetary Policy and Credit Conditions: Evidence From the Composition of External Finance." *American Economic Review* 83 (1):79–98.
- Keefer, Philip and David Stasavage. 2003. "The Limits of Delegation: Veto Players, Central Bank Independence, and the Credibility of Monetary Policy." *American Political Science Review* 97 (3):407–423.
- Korinek, Anton and Luis Servén. 2010. "Undervaluation Through Foreign Reserve Accumulation: Static Losses, Dynamic Gains." Policy Research Working Paper 5250, The World Bank.
- Krishnamurthy, Arvind and Annette Vissing-Jørgensen. 2007. "The Demand for Treasury Debt." Working Paper 12881, National Bureau of Economic Research.
- Krugman, Paul. 1988. "Financing vs. Forgiving a Debt Overhang." *Journal of Development Economics* 29 (3):253–268.
- Laeven, Luc and Fabián Valencia. 2013. "Systemic Banking Crises Database." *IMF Economic Review* 61 (2):225–270.
- Laibson, David. 1997. "Golden Eggs and Hyperbolic Discounting." *The Quarterly Journal of Economics* 112 (2):443–477.
- Lamont, Owen. 1995. "Corporate-Debt Overhang and Macroeconomic Expectations." *American Economic Review* 85 (5):1106–1117.
- Lang, Larry, Eli Ofek, and René M. Stulz. 1996. "Leverage, Investment, and Firm Growth." *Journal of Financial Economics* 40 (1):3–29.
- Lindqvist, Erik and Robert Östling. 2010. "Political Polarization and the Size of Government." *American Political Science Review* 104 (3):543–565.
- Mayer, Colin and Xavier Vives. 1995. *Capital Markets and Financial Intermediation*. Cambridge University Press.
- Melzer, Brian. 2012. "Reduced Investment by Homeowners With Negative Equity." Mimeo.
- Mendoza, Enrique G., Vincenzo Quadrini, and Jose-Víctor Ríos-Rull. 2009. "Financial Integration, Financial Development, and Global Imbalances." *Journal of Political Economy* 117 (3):371–416.

- Mendoza, Enrique G. and Vivian Z. Yue. 2012. "A General Equilibrium Model of Sovereign Default and Business Cycles." *The Quarterly Journal of Economics* 127 (2):889–946.
- Myers, Stewart C. 1977. "Determinants of Corporate Borrowing." *Journal of Financial Economics* 5 (2):147–175.
- Nanda, Ramana and Tom Nicholas. 2013. "Did Bank Distress Stifle Innovation During the Great Depression?" Working paper, Harvard Business School.
- Obstfeld, Maurice and Alan M. Taylor. 2003. "Sovereign Risk, Credibility and the Gold Standard: 1870-1913 Versus 1925-31." *The Economic Journal* 113 (487):241–275.
- Occhino, Filippo and Andrea Pescatori. 2010. "Debt Overhang and Credit Risk in a Business Cycle Model." Working Paper 1003, Federal Reserve Bank of Cleveland.
- Papaioannou, Elías. 2009. "What Drives International Financial Flows? Politics, Institutions and Other Determinants." *Journal of Development Economics* 88 (2):269–281.
- Peek, Joe and Eric S. Rosengren. 2000. "Collateral Damage: Effects of the Japanese Bank Crisis on Real Activity in the United States." *American Economic Review* 90 (1):30–45.
- . 2005. "Unnatural Selection: Perverse Incentives and the Misallocation of Credit in Japan." *The American Economic Review* 95 (4):1144–1166.
- Philippon, Thomas and Philipp Schnabl. 2013. "Efficient Recapitalization." *The Journal of Finance* 68 (1):1–42.
- Popov, Alexander and Neeltje Van Horen. 2015. "Exporting Sovereign Stress: Evidence From Syndicated Bank Lending During the Euro Area Sovereign Debt Crisis." *Review of Finance* 19 (5):1825–1866.
- Prebisch, Raúl and Gustavo Martínez-Cabañas. 1949. "El Desarrollo Económico De América Latina Y Sus Principales Problemas." *El Trimestre Económico* 16 (63):347–431.
- Reinhart, Carmen M, Vincent Reinhart, and Takeshi Tashiro. 2016. "Does Reserve Accumulation Crowd Out Investment?" *Journal of International Money and Finance* 63:89–111.
- Rodrik, Dani. 2008. "The Real Exchange Rate and Economic Growth." *Brookings Papers on Economic Activity* 2008 (2):365–412.
- Schmitt-Grohé, Stephanie and Martín Uribe. 2016. "Is Optimal Capital-Control Policy Countercyclical in Open-Economy Models With Collateral Constraints?" Working Paper 22481, National Bureau of Economic Research.

- Tauchen, George. 1986. "Finite State Markov-Chain Approximations to Univariate and Vector Autoregressions." *Economics Letters* 20 (2):177–181.
- Tomz, Michael and Mark L. J. Wright. 2010. "Sovereign Theft: Theory and Evidence About Sovereign Default and Expropriation." In *The Natural Resources Trap: Private Investment Without Public Commitment*, edited by William Hogan and Federico Sturzenegger, chap. 3. MIT Press, 69–118.
- Whited, Toni M. 1992. "Debt, Liquidity Constraints, and Corporate Investment: Evidence From Panel Data." *The Journal of Finance* 47 (4):1425–1460.
- Woodford, Michael. 2009. "Is an Undervalued Currency the Key to Economic Growth?" Department of Economics Discussion Papers 0809-13, Columbia University.
- Wright, Mark L.J. Forthcoming. "The Theory of Sovereign Debt and Default." In *Encyclopedia of Financial Globalization*, edited by Gerard Caprio. Oxford, United Kingdom: Elsevier.