External and Public Debt Crises *

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April 3, 2015

Abstract

In recent years, the members of two advanced monetary and economic unions—the nations of the Eurozone and the states of the United States of America—experienced debt crises with spreads on government borrowing rising dramatically. Despite the similar behavior of spreads on public debt, these crises were fundamentally different in nature. In Europe, the crisis occurred after a period of significant increases in government indebtedness from levels that were already substantial, whereas in the USA state government borrowing was limited and remained roughly unchanged. Moreover, whereas the most troubled nations of Europe experienced a sudden stop in private capital flows and private sector borrowers also faced large rises in spreads, there is little evidence that private borrowing in US states was differentially affected by the creditworthiness of state governments. In this sense, we can say that the US States experienced a *public debt crisis*, whereas the nations of Europe experienced an *external debt crisis* affecting both public and private borrowers. Why did Europe experience an external debt crisis and the US States only a public debt crisis? And, why did the members of other economic unions, such as the provinces of Canada, not experience a debt crisis at all despite high and rising provincial public debt levels? In this paper, we construct a model of default on domestic and external public debt and

interference in private external debt contracts and use it to argue that these different debt experiences result from the interplay of differences in the ability of governments to interfere in the private external debt contracts of their citizens, with differences in the flexibility of state fiscal institutions. We also assemble a range of empirical evidence that suggests that the US States are less fiscally flexible but more constrained in their ability to interfere in private contracts than the members of other economic unions, which simultaneously exposes the states to public debt crises while insulating them from an external debt crisis affecting private sector borrowers within the state. In contrast, Eurozone nations are more fiscally flexible but have a greater ability to interfere with the contracts, which together allow for more public borrowing at the cost of a joint public and private external debt crisis. Lastly, Canadian provincial governments are both fiscally flexible and limited in their ability to interfere, which allows both for more public borrowing and limits the likelihood of either a public or external debt crisis occurring. We draw lessons from these findings for the future design of Eurozone economic and legal institutions.

1   Introduction

At the end of the first decade of the 21st Century, the members of two advanced monetary and economic unions, the nations of the Eurozone and the states of the United States of America, experienced debt crises with spreads on government borrowing rising dramatically: in a short period of time, Californian spreads rose six-fold, Italian rose ten-fold, Illinois fifteen-fold, and Portuguese twenty-five-fold. Despite the similar behavior of spreads on public debt, these crises were fundamentally different in nature. In Europe, the crisis occurred after a period of significant increases in government indebtedness from levels that were already substantial, whereas in the USA state government borrowing was limited and remained roughly unchanged. Moreover, whereas the most troubled nations of Europe experienced a sudden stop in private capital flows and private sector borrowers also faced large rises in spreads, there is little evidence that private borrowing in US states was differentially affected by the creditworthiness of state governments. In this sense, we can say that the US States experienced a *public debt crisis*, whereas the nations of Europe experienced an *external debt crisis* affecting both public and private borrowers.

Why did Europe experience an external debt crisis and the US States only a public debt crisis? And, why did the members of other economic unions, such as the provinces of Canada, not experience a debt crisis at all despite high and rising provincial public debt levels? In this paper, we argue that these different experiences result from the interplay of the ability of governments to interfere in the private external debt contracts of their citizens with the flexibility of state fiscal institutions. The US States, for example, are less fiscally flexible than the members of other economic unions as a result of state and federal limitations on their ability to change taxes and borrow, but are prevented by the US Constitution from interfering in private contracts. Together, these factors result in extreme public debt intolerance and yet also limit the likelihood of an external debt crisis affecting private sector borrowers within the state. Eurozone nations are more fiscally flexible but have a greater ability to interfere with the contracts of their citizens, particularly if one of them exits the Euro, which together allow for more public borrowing, but also opens up the possibilities for external debt crises. Canadian provincial governments are both fiscally flexible and limited in their ability to interfere in private contracts, which allows both for more public borrowing and limits the likelihood of either a public or external debt crisis occurring.

We establish this argument both empirically and theoretically. Empirically, we document variation in both concerns regarding government interference in private contracts and fiscal flexibility across economic unions. First, we show that interference in private

contracts—which can include direct interference such as moratoria on repayments of external debt or the imposition of controls on capital outflows, as well as indirect interference such as deposit freezes which hinder the ability of private borrowers to repay their external debts—is a common occurrence in debt crises. Government interference has occurred both throughout history in some of the states that we study as well as in more recent defaults by emerging market economies. We also show that ratings agencies incorporate the risk of sovereign interference when rating private sector bonds in both emerging markets and in Europe, but do not consider the risk of state and provincial government interference when rating private borrowers in the US and Canada. Second, we show that fiscal flexibility of the governments of members of economic unions—the ability to vary their tax rates and levels of public expenditure in response to economic shocks—also varies across unions.

Theoretically, we model the decisions of a benevolent government to spend, tax, borrow, default on public debts and interfere in private debt contracts in a world where the private sector can also issue external debt but cannot independently default on their own debts. In our economy, the efficient benchmark under full commitment and full fiscal flexibility has the country borrowing externally to smooth both public and private consumption, and setting public expenditures to equate their marginal social utilities within each period. We examine how with limited commitment to repay public debt and not interfere in private debts, and potential constraints on fiscal flexibility the private and public sectors might find themselves unable to borrow enough to smooth consumption over time and across the public and private sectors.

First, we show that if the government is unconstrained in its ability to vary taxes and if it can commit not to interfere with private contracts (which we think of as the Canadian case), then neither public debt crises nor external debt crises can occur. The reason no public debt crisis can occur is that, if the government can vary taxes, it prefers to close fiscal gaps with taxes rather than with default on domestically held public debt. As a result, the government can always tax the private sector in such a way as to replicate its optimal borrowing strategy while allowing the private sector to borrow externally. With commitment not to interfere in private external debt constraints, this private external borrowing is unconstrained.

Second, we show that if the government can tax flexibly but cannot commit not to interfere in private debt contracts (the European case), all crises are external debt crises that affect both the private sector and the public sector. As in the Canadian case, with tax flexibility governments can credibly borrow from their own private sector. Hence, the government should not find itself constrained in its borrowing unless the private sector is also constrained. In contrast to the Canadian case, if the government is tempted to

interfere with private external debt contracts, the external borrowing of the country may be constrained. If this occurs, the country is constrained in both its public and external borrowing.

Third, and finally, we show that when taxes are inflexible but the government can commit not to interfere in private contracts (the American case), it is possible to have a public debt crisis without an external debt crisis. The reason is that, when taxes are inflexible, the government may be tempted to default on domestically held public debts so as to finance the desired level of public expenditure. As a result of this risk of default on all forms of public debt, the public sector may be constrained in its borrowing even when the private sector faces no constraint on its external borrowing.

The rest of this paper is organized as follows. Section 2 documents our claims about the different experiences of Eurozone members, the states of the USA and the members of other economic unions such as Canada. Section 3 presents our empirical and institutional evidence on the occurrence of sovereign interference, while Section 4 discusses fiscal flexibility. Section 5 presents our model and Section 6 concludes. References to the literature are discussed as they arise throughout the text.

2   Debt Crises in the Eurozone and U.S. States

In this section we document the debt crises in the Eurozone countries and U.S. States during late 2000s. We show that during these crises the governments faced increases in spreads on their borrowing related to default risk. We document that this increase in spreads occurred even though current public debt levels for U.S. states are quite low relative to those observed in European nations and Canadian provinces. We also show that U.S. states did not increase their public borrowing during the crisis. In contrast, Canadian Provinces did not experience a debt crises and were able to increase their public borrowing at low spreads. We also show that in the Eurozone the debt crisis was external as these countries experienced reversals in their international private capital inflows and significantly increased spreads on private sector external borrowing.

2.1   Spreads

During late 2008 countries in the Eurozone including Greece, Ireland, Italy, Portugal, and Spain experience increases in the yields and spreads at which they borrow reflecting a higher probability of default. Figure 1 plots the 10-year spreads for these five countries. The spreads peaked in 2012 reaching for example 500 basis points for Spain. Greece

actually defaulted in 2012 on their public debt.

U.S. States and Canadian provinces are similar to Eurozone countries in that there is no bankruptcy process for handling state defaults. U.S. State governments are sovereign in that can repudiate their debts without recourse for creditors.[1] Historically, in the 1840's many U.S. states did repudiate their debts, but no U.S. states have defaulted on their general obligation debt since the Great Depression.[2]

Several U.S. States such as California, Illinois and Michigan have experienced a debt crisis since 2008 in the sense that they face spreads on the general obligation debt of the State Government similar to those faced by several Eurozone sovereign borrowers. Figure 2 shows the 5-year CDS spreads on the debts of California, Illinois, Michigan, Virginia, and New York from 2008 through 2014. The CDS spreads on the debts of California, for example, reached about 500 basis and have been high for much of this period.[3] While these CDS spreads for California are not as high as the peak sovereign spreads shown for Eurozone countries in Figure 1, these spreads are still sizable.

Ang and Longstaff (2013) perform a more systematic comparison of the levels and comovements of the sovereign spreads for U.S. States and Eurozone countries. Table 1, reproduced from their paper, shows mean, median, minimum, and maximum 5-year CDS spreads for 10 U.S. States and 11 Eurozone countries over the period May 2008 through January 2011. As is evident in the table, the mean and median spreads for several U.S. state governments over this time period are high relative to the comparison group of Eurozone countries.[4]

This observation of high credit spreads for U.S. State governments is not unique to the financial crisis of 2008. California in particular has had a history of budgetary difficulties reflected in heightened credit spreads. In particular, in the period of the early 2000's after the stock market crash of 2001, the state government of California faced considerable fiscal pressure caused by the loss of capital gains tax revenue after the stock market crash. As shown in Figure 3, credit spreads on California's state government debt, here measured as spreads on state government general obligation tax free bonds relative to and index of yields on AAA rated tax free municipal bonds, rose considerably in 2003 and 2004.

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[1]The Eleventh Amendment of the U.S. Constitution restricts suits in Federal courts against states. See, for example, Johnson and Young (2012). In contrast, municipalities, such as Detroit, can undergo a court supervised bankruptcy process under Chapter 9 of the U.S. bankruptcy code.

[2]See Mysak (2010) for a description of Arkansas' default on its debt during the Great Depression.

[3]As shown in the case of Virginia, this was not the case for all U.S. States. The spreads shown for Virginia are relatively low and stable.

[4]The most severe period of pressure on Eurozone sovereigns came after January 2011. Spreads on state bonds also reflect tax advantages and illiquidity considerations. Schwert (2014) shows that default risk is an important component in state bonds.

In contrast to the experiences of the Eurozone countries and U.S. States, Canadian provinces did not experience a debt crisis during the Great Recession. Figure 4 shows the 10-year bond spreads on the debts of British Columbia, Ontario, and Quebec, which are the three most populous provinces in Canada. These spreads have been quite stable since 2008 with modest rises in 2009 and 2013. As discussed in Bird and Tassonyi (2003) and Wong and Raimes (2013), Canadian provincial governments have a great deal of fiscal autonomy from the Canadian central government, no central restrictions on their borrowing, and they have broad responsibilities for social services in the province making them a good comparison group with Eurozone countries and U.S. States. Thus, the Canadian provinces appear to serve as examples of relatively independent regional governments in a monetary union that have been able to avoid a public debt crisis.

2.2 Debt Levels: U.S. States are Debt Intolerant

We now present evidence that the current public debt levels for U.S. States are quite low, particularly in comparison with public debt levels for the governments of Eurozone countries and the regional governments of Canadian provinces. We document that broader measures of public indebtedness for U.S. States including obligations for employee pensions and healthcare are also low in comparison with similar broader measures of public indebtedness for most Eurozone countries and Canadian provinces. We also document that the fiscal response of U.S. states to the Great Recession was strikingly different from the fiscal responses of the provincial governments of the largest Canadian provinces. U.S. States did not increase their borrowings while Canadian provinces increased their borrowings substantially over this time period without a significant deterioration of their credit ratings.

What we find most remarkable is that U.S. states governments faced high sovereign spreads during the debt crisis despite very low levels of indebtedness. We argue that these U.S. State Governments are *public debt intolerant*: the thresholds of public debt to GDP at which the public debt is considered safe by the market are extraordinarily low.[5]

The median U.S. State has an extraordinarily low level of public debt relative to GDP and revenue in comparison to other regional and national governments. The first panel of Table 3 reports the 2012 ratio of net debt to state GDP for the 10 most populous states of the U.S. These public debt to GDP ratios lie in a narrow range from a little over 1%

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[5]Reinhart et al. (2003) introduced the term *Debt Intolerance* to describe the combination of high spreads at low external-debt to GDP levels observed for many emerging market economies. We borrow this term here to refer to the combination of high spreads at low public-debt to GDP levels observed for several U.S. State governments. Pouzo and Presno (2014) also apply this term to public debt.

for Texas to a little under 5.5% for New York. The second panel of the table reports the net debt for the most populous Canadian provinces. Net debt to GDP ratios in Canada are on average 8 times larger than in the U.S. states reaching 48% for Quebec. The third panel, reports net debt to GDP for countries in the Eurozone which are 10-20 times larger than is the case for U.S. State governments. As shown in third column of Table 3, the debts for Canadian provinces and Eurozone countries relative to government revenues are also larger than for U.S. states by a factor of 2 in many cases. [6]

The creditworthiness of governments is impacted by their total level of indebtedness measured on a comprehensive basis, including explicit and implicit liabilities for employees' pensions and healthcare.[7] The second column of Table 3 reports the total level of debt for U.S. State, Canadian provinces and Eurozone countries taking into account estimates for unfunded liabilities including employee pension liabilities and employee healthcare obligations.

For U.S. States these unfunded liabilities increase debt to GDP by a factor of 3 on average. Nevertheless, we see that for most states, with the exception of Illinois, the total debt including unfunded liabilities are relatively modest averaging 10%. The pension and healthcare liabilities for Canadian provinces and Eurozone countries are substantially larger than those for most U.S. states governments. For Canadian provincial governments estimates indicate that the total liabilities are typically on the order of three times the net indebtedness of the provincial government. [8] In Figure 5 we summarize these findings by plotting the net debt (with and without unfunded liabilities) to GDP ratio of selected Eurozone countries, U.S. States, and Canadian provinces. U.S. States have remarkably low levels of total liabilities when compared with these these other regional and national governments.

The Great Recession of 2008 had an important fiscal impact on almost all of the regional and national governments discussed in this paper. The fiscal response of the U.S. State governments was to adjust revenue and expenditures on a year by year basis without increasing outstanding debt. In the first panel of Table 4 we show the history of the ratio of state net debt to personal income over the period 2008-2012 for U.S. states and, as is clear in the table, these indebtedness levels are little changed. By way of contrast, in the

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[6]The data for net debt for U.S. States and Canadian Provinces is for 2012 from Moody's estimates in Larson (2013). The fiscal data for Eurozone net debt is for 2013 and comes from IMF (2014).

[7]As discussed in Novy-Marx and Rauh (2011), the unfunded pension liabilities for several U.S. State governments are sizable, with estimates of their value depending critically on the discount rate used to compute present values of the pension and healthcare liabilities.

[8]The data for pension/healtcare liabilities estimates for U.S. States are from Moody's estimates from Lombardi and Van Wagner (2014), for Canadian Provinces are from Palacios et al. (2014) and for Eurozone countries are from IMF (2014).

second panel of Table 4 we show that the provincial governments in Canada responded to the fiscal crisis by issuing substantial additional debt relative to GDP, particularly in the case of Ontario.

The choice by the governments of U.S. States to refrain from issuing more debt in response to their fiscal crisis following the Great Recessions was not due solely to their self-imposed legal fiscal constraints on state borrowing.[9] Instead, as is clear from the data in Table 1 and Figure 2, it appears that many U.S. states were charged considerable spreads on their debts once the crisis began.[10]

2.3 External Debt Crisis in Eurozone

The public debt crises in Eurozone countries and U.S. States documented above were associated with strikingly different responses in private sector external borrowing. We document that in several Eurozone countries, private capital markets experienced a *sudden stop* defined as a a sharp reversal of private capital inflows.[11] We also document strong comovement in private and sovereign spreads. In sharp contrast to the experience of Eurozone countries we are aware of no evidence linking the borrowing costs of private borrowers domiciled in California (or any other state) to the borrowing costs of the state government. In this sense, we argue that several state governments of the United States have had a public debt crisis without facing an external debt crisis.

Sudden stops have been common in emerging market economies and are typically associated with a sharp reversal in the affected country's trade balance and current account. In the affected Eurozone countries, the sudden stop of cross border private capital flows has not been accompanied by a sharp reversal of trade balances for the affected countries because private capital flows have largely been replaced by public capital flows financed through the European Central Bank and, in some cases, through government-to-government public capital flows.

As discussed in Lane (2013), the introduction of the Euro was associated with a large increase in the volume of cross border capital flows among the Eurozone countries leading

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[9]Almost all U.S. State governments face self-imposed legal restrictions on the issuance of state debt following the wave of state government defaults on that debt in the 1840's. See, for example, Henning and Kessler (2012). On top of these restrictions on debt, many states have restrictions on expenditures and revenues. In the case of California, these are seen as being particularly binding. See, for example, Wong and Raimes (2013).

[10]This experience of US State governments in the period following the Great Recession is consistent with the earlier findings of Bayoumi et al. (1995). They estimate the spreads charged on debt of US State governments over the period 1981-1990 as a function of various determinants including the overall debt level. They estimate a Laffer curve for levels of state indebtedness with a peak at indebtedness of 8.7% of state GDP.

[11]See Calvo (1998) for a discussion of the genesis of this term.

to the accumulation of large gross and net stocks of international indebtedness. With the crisis that started in 2007-2008, there was a dramatic reduction in both the gross and net volume of private capital flows. We now document the disparate impact of this reversal of private capital flows on different Eurozone countries.

In Figure 6, taken from de Sola Perea and Van Niewenhuyze (2014), we show the decomposition of net capital flows over the period 2002-2013 for Portugal, Spain and Germany as a percentage of each country's GDP. The solid line for each country in the figure is the total net capital flow. Portugal and Spain experienced sustained net capital inflows over this time period, peaking at roughly 10% of GDP, while Germany experienced sustained net capital outflows. Colored bars are used to show the decomposition of these net capital flows into private capital flows, official capital flows (accomplished though the European Central Bank Target II program primarily and various new government-to-government lending programs instituted since 2008), and capital flows accomplished through transactions in reserve assets. The blue bars indicate the components of the total net capital flow due to net private capital flows. As is clear in the figures for all three countries, there is an abrupt reversal of these net private capital flows, from positive to sharply negative for Portugal and Spain, and from negative to zero or slightly positive, for Germany. This sudden stop of net private capital flows for Portugal and Spain was not accompanied by a dramatic reversal of the trade or current account balance (corresponding to the total net capital flow shown by the solid lines), because of a combination of official capital flows financed by the ECB and various official programs shown in the light green and red bars. Much of the source of this ECB financing is due to Germany as shown by the light green negative bars in the German figure.

In Figure 7, taken from Pisani-Ferry et al. (2013), we offer an alternative presentation of the same data for Greece, Portugal, Spain, and Italy. This figure cumulates the net capital flows into these three countries over the period 2002-2012 and presents the cumulative total as a percentage of 2007 GDP. Again, the solid lines in each frame of the figure show the cumulative net capital inflow into these countries. For both Greece and Portugal, the cumulative net capital inflow over this decade rose to over 70% of 2007 GDP, and for Spain, this cumulative inflow rose to over 50% of 2007 GDP. The red bars in each frame of the figure show the cumulative total net private capital inflow. For each of these countries, in the earlier part of the this time period, the cumulative net capital inflows were primarily private. Since the crisis began, however, in each case, this private capital has been withdrawn (as indicated by the diminished height of the red bars) and been replaced by official net capital inflows from the ECB and other official programs. In the case of Greece and Portugal, the cumulative net private capital flow over the 2002-2012

time period is essentially zero and these countries are left with external indebtedness to official lenders well over 70% of GDP. In the case of Spain and Italy, the withdrawal of private capital since the crisis began is substantial as well. As noted in IMF (2012a), in the twelve months from June 2011 - June 2012, Spain experienced a net private capital outflow of 27% of 2011 GDP and Italy experienced a net private capital outflow of 15% of 2011 GDP.[12]

We now discuss the comovement of sovereign and private bonds spreads. Gilchrist and Mojon (2014) document a strong comovement by constructing indices of non-financial corporate spreads in the four largest Eurozone countries.[13] These are bonds issued by large non-financial corporates in European securities markets. We reproduce these data in Figure 8. We can see that for the period from mid 2006 to 2009, these bonds markets appear to be tightly integrated in that the the nationality of the bond issuer does not appear to impact its spread. In contrast, however, the heterogeneity in the movement in private non-financial spreads is readily evident in the figure after mid-2010. This heterogeneity in private spreads was tightly linked to the heterogeneity in sovereign spreads. For example, thee comovement of non-financial corporate credit spreads, measured using either bond spreads or CDS spreads, with sovereign CDS spreads in Italy and Spain starting in 2011 can be seen in our Figures 9 and 10 reproduced from Figure 6 in Gilchrist and Mojon (2014). Klein and Stellner (2014) also find a strong comovement of private and sovereign spreads in their sample of Eurozone bonds in regressions with individual bond spreads on the left hand side and, on the right hand side, a country sovereign spread, a vector of firm specific controls using accounting data, a vector of country specific macroeconomic variables, and time, country, and industry dummies.[14] Bedendo and Colla (2013) and Bai and Wei (2014) find similar evidence on the comovement of private and sovereign CDS spreads in both Eurozone countries and emerging markets.[15]

In contrast to the experience of Eurozone countries, in the U.S. we are aware of no evidence linking the borrowing costs of private borrowers domiciled in a state to the borrowing costs of the state government. We first illustrate this disconnect by comparing

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[12]IMF (2012a) also presents data on the components of these flows due to the exit of foreign private investors from these countries bond markets and that due to movement of bank deposits across national boundaries.

[13]These authors construct indices of credit spreads in Eurozone countries using data on a comprehensive panel of bonds issued by both financial and non-financial firms in Germany, France, Italy, and Spain over the period 1999-2013.

[14]ECB (2014) runs similar regressions and presents similar results on page 22.

[15]Bedendo and Colla (2013) examine the CDS spreads for 118 non-financial companies and their respective sovereigns in eight Eurozone countries over the time period January 2008 through December 2011. Bai and Wei (2014) examine CDS spreads for 3202 entities in 30 countries over the time period January 2002 through February 2010.

the ample borrowing possibilities for Los Angeles Country in July 2009, at the same time that the state of California experienced very high borrowing costs. As described in Taylor (2009), the state of California regularly engages in substantial short-term borrowing over the course of its fiscal year (July 1 - June 30) to deal with the regular seasonal pattern of cash outflows in the first part of the fiscal year and cash inflows due to tax collections late in the fiscal year. Starting in the fall of 2008, the gap between cash inflows and outflows turned out to be much larger than expected due to the dramatic decline in tax revenues for the state. For the 2008-2009 fiscal year, the state's expenditures exceeded revenues by $17.9 billion (roughly 1% of state GDP and 17% of 2007-2008 state revenues). The state faced tremendous difficulty raising the cash necessary to fund this gap. The State controller resorted to a 30-day delay of $4.2 billion in payments in February and issuing registered warrants (IOU's) in lieu of state payments that were not redeemed until September 2009. In July of 2009, the Wall Street Journal estimated[16] that California would have to pay over 5% tax free for further short term borrowing while at the same time Los Angeles County was able to borrow short term at 0.8% and short term Treasury bills paid 0.5%.

A similar disconnect appears to apply to the borrowing of Californian corporates. To establish this point, we must confront the fact that it is quite difficult to find a corporate that is both large enough to issue bonds in the US market, and that can be identified as purely Californian. As a consequence, we first restricted attention to corporates in the utility industry, as the geographical areas of operations for utility companies are typically much easier to define. We then divide the sample into those utilities that are either incorporated in California, or consider themselves domiciled in California, and those that are not, using data from Bloomberg. It is important to stress that there are relatively few bonds issued by Californian utility companies (never more than 60 in our sample at any one time as compared with over 400 issued by non-Californian utilities) and that some of them have operations outside of the state of California. We then computed indices of borrowing rates for the Californian and non-Californian samples of utilities using data on option adjusted spreads over US Treasuries from the dataset used to construct the Bank of America-Merrill Lynch Index Spreads. The results are presented in Figure 11. The figure shows that Californian utilities were typically able to borrow at lower rates than non-Californian utilities, although we believe the difference predominantly reflects corporate specific factors in our small sample of Californian utilities. Most importantly for our point, there is no tendency for Californian utility spreads to rise relative to the spreads for non-Californian utilities in the years of the state public debt crisis, indicating

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[16]See Petruno (2009).

that there was no spillover from the Californian state government to corporates within the state.

In summary, many of Eurozone member countries experienced an external debt crises with sudden stops of net private capital inflows and rising spreads on both sovereign and private debt. The debt crises in U.S. States, and especially California, was distinct as it was restricted to public debt.

3 Government Interference with Private Contracts

We now review evidence that the perceived risk of sovereign interference with domiciled private debt contracts plays an important role in linking private and public borrowing in Eurozone countries. We also review the institutional environment that governs protections against government interference, contrasting the strong protections embodied in the United States and Canadian Constitutions with the much weaker protections available in Europe.

We start by documenting that the credit ratings agencies cite the risk of sovereign interference as an important factor in rating private borrowers in emerging markets economies and now in Eurozone countries as well. They do so because in practice episodes of sovereign interference with private contracts, which have imposed substantial haircuts for creditors, are correlated with public default. We review this history of episodes and document how these concerns for Eurozone countries have risen. We document that the sovereign rating is, in fact, binding on the private credit ratings and has economic impact by affecting the cost and availability of international credit for private borrowers in both emerging market and Eurozone economies.

We then review how the Contract Clause in the U.S. Constitution has insulated private borrowers and creditors in U.S. States from crises in the public debts of state governments. We provide a historical account of various rulings which have repeatedly upheld the protection of private creditors against potential cases of sovereign interference, and contrast this with the widespread government interference that occurred prior to ratification of the Constitution. We also show how similar protections are available to creditors in the Canadian provinces, while pointing to the weaknesses in European protections.

3.1 The Sovereign Credit Ceiling

The term *sovereign credit ceiling* refers to the policies of the main credit rating agencies to restrict the credit ratings that they give to private borrowers to be no greater than the

credit rating of the sovereign government of the country in which the private borrower is located. The sovereign credit ceiling has long been a feature of credit ratings for private borrowers in emerging market economies. More recently, it has become a feature of credit rating agency policies for credit ratings for private borrowers in Eurozone countries.[17]

The three credit rating agencies, Fitch Ratings, Moody's Investors Service, and Standard and Poor's, typically invoke three reasons for their policies of linking sovereign and private credit ratings.[18] The first reason is that both sovereign and private borrowers face common macroeconomic shocks. The second is that a sovereign default would lead to (or coincide with) a financial crisis that would affect the terms of credit available to private borrowers.[19]

The third reason, and the focus of our analysis, is the *the risk of sovereign interference with private contracts.* These credit rating agencies point to a long history of experience with sovereign interference with private debt contracts in emerging market economies. The interference has typically taken the form of imposition of bank deposit freezes and/or capital or exchange controls in a public or external debt crisis. Because deposit freezes and capital controls directly interfere with a private borrower's ability to transfer the foreign exchange necessary to service his or her external debt, this risk of sovereign interference is often termed *transfer and convertibility risk.* This concept captures the risk that a foreign creditor might not get paid on his or her loan to a private borrower because the government of the borrower's country enacts policies that make it difficult for the private borrower to obtain the foreign exchange necessary to repay his or her debts. In the past several years, the credit rating agencies have pointed to the risk that a Eurozone member country would enact such policies upon exiting the Euro as a significant risk restricting the ratings offered to private borrowers in several Eurozone countries.[20]

The three main ratings agencies make an effort to quantitatively evaluate the impact

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[17] As described in Borensztein et al. (2013), prior to 1997, this sovereign credit ceiling was applied to all private borrowers in emerging market countries. During the mid-2000's, this policy was somewhat relaxed, and, in the case of Eurozone countries, it was removed altogether in 2005 by both Standard and Poor's and Moody's Investors Service. See, for example, Beers et al. (2005), Truglia (2005), and Cavanaugh and Feinland-Katz (2009), as well as Stendevad (2007). As we discuss in this section, the main credit rating agencies reconsidered this policy of relaxing the Sovereign Credit Ceiling for private borrowers in Eurozone countries following the recent concerns about possible exit of countries from the Euro.

[18] See, for example, Fox and Renwick (2014), Gates et al. (2012) and Feinland-Katz and Chu (2013). See Loh and Frey (2011) and Chu (2014) discussions of the impact of the Eurozone sovereign credit crisis on the ratings for structured finance transactions.

[19] There is a large literature on the linkage between sovereign debt spreads and financing difficulties for banks both emerging market economies and in the Eurozone. See, for example, Reinhart and Rogoff (2013).

[20] See, for example, IMF (2012a), page 39.

of sovereign interference in private contracts on the ratings given to private entities separately from the risk of the sovereign's default. Standard and Poor's, for example, provides a *Transfer and Convertibility Rating* to each country in addition to a sovereign credit rating for both the local currency and foreign currency debt of the sovereign government to attempt to measure the likelihood of sovereign interference with private contracts as distinct from the likelihood of a default on domestic and external public debts. This transfer and convertibility rating is incorporated into the ceiling that Standard and Poor's applies to the credit ratings given to private borrowers in the relevant country. Likewise, Moody's Investors Service and Fitch Ratings provide *Country Ceilings* which are similar to Standard and Poor's Transfer and Convertibility Ratings in that they "capture the risk of capital and/or exchange controls being imposed that would prevent or materially impede the private sector's ability to convert local currency into foreign currency and transfer the proceeds to non-resident creditors—transfer and convertibility (T&C) risk. Country Ceilings are not ratings but rather a key analytical input and constraint on the ratings of entities and transactions originating in the sovereign's jurisdiction".[21]

Cavanaugh (2013) provides a history of Standard and Poor's sovereign credit ratings for domestic and foreign currency debt as well as their transfer and convertibility ratings for a large number of countries over the past several decades. We show the status of these ratings for selected economies as of December 2012 in Table 6.[22] In most instances, the transfer and convertibility rating is aligned with the sovereign credit rating. There are, however, several instances in this historical record of countries with a higher transfer and convertibility rating than sovereign foreign currency ratings, indicating that Standard and Poor's assessment of the risk of sovereign interference with private contracts is lower than their assessment of the risk of default on the government's foreign currency debt.[23]

3.1.1 Transfer and Convertibility Risk in Emerging Markets

There is a substantial historical record of sovereign interference with private debt contracts in emerging market economies. In Duggar (2008), Moody's Investors Service surveys the post-1960 history of sovereign bond defaults and the extent to which sovereign defaults have been accompanied by government interference with domiciled borrower's foreign currency debt service.

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[21]See Fox and Renwick (2014) page 1 and Moody's (2009)

[22]See Table 5 for a description of Moody's and Standard and Poor's ratings scales. A rating of 'Baa' or 'BBB' is the lowest rating considered *investment grade*. The lower ratings are considered speculative grade or *junk*.

[23]Croatia and the Czech Republic are examples in the Table6 with higher T&C ratings and Ecuador is an example with lower T&C rating. For a discussion of this point, see, for example, Cavanaugh and Feinland-Katz (2009) and Heinrichs and Stanoeva (2013).

The Moody's survey covers 38 episodes of sovereign bond defaults. It finds 27 episodes of deposit freezes, with all but two of these (Korea 1998 and Ukraine 2004) accompanied by a sovereign bond default. It finds that "the most frequent deposit interference measure employed has been the imposition of prolonged deposit freezes, with several freezes lasting one year or longer, followed by outright deposit expropriations, forced deposit conversions into bonds, and forced deposit conversions into local currency." Depositor losses in a freeze have been severe, with haircuts often as high as 70%.

Moody's also finds that since 1960, about 26% of public bond defaults have been accompanied by controls on private sector debt service payments, with all but one of these also coinciding with a deposit freeze. Of these events of controls on private debt service payments, 44% were full moratoria in which either all external private sector payments were explicitly banned, or purchases of foreign currency were blocked (e.g. Peru 1985, Venezuela 1994, Russia 1998). Another 28% of these events included a selective moratorium in which the ability to make private sector external debt payments were limited to favored sectors or companies, or required a case-by-case authorization by the central bank and/or the ministry of finance (e.g. Costa Rica 1981, the Philippines 1983, Brazil 1990, Argentina 2001). The other 28% of events included the imposition of exchange controls or regulations that have severely affected external private sector payments and that have encouraged, implicitly or explicitly, the rescheduling of private foreign debt payments (Mexico 1982, Argentina 1982).

3.1.2 Transfer and Convertibility Risk in the Eurozone

Prior to the most recent financial crisis in the Eurozone, the three main credit ratings agencies had essentially eliminated the sovereign credit ceiling for private borrowers in Eurozone countries.[24]. As described in Cavanaugh and Feinland-Katz (2009) and Fox and Renwick (2014), writing for Standard and Poor's and Fitch Ratings respectively, prior to this crisis, all countries in the Eurozone were assigned either a Transfer and Convertibility rating or a Country Ceiling of 'AAA', indicating that considerations of transfer and convertibility risk were not relevant in constraining the credit ratings for private entities in the Eurozone. The thinking expressed in these documents was that the legal structure of the European Union and the Eurozone in particular would make it difficult for a sovereign to interfere with cross border private debt contracts. In the wake of the recent sovereign debt crisis in the Eurozone, and in particular, in the wake of events in Iceland, Greece, and Cyprus, all three of the main credit ratings agencies have revised

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[24]See, for example, Beers et al. (2005) and Truglia (2005)

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their ratings methodology to reflect heightened perceptions of transfer and convertibility risks for Eurozone countries.[25]

As discussed in Feinland-Katz (2013), Standard and Poor's has since revised its assessment of the link between sovereign and private credit ratings in the Eurozone to recognize that the transfer and convertibility risk for several Eurozone countries is higher than they previously thought. Standard and Poor's describes this risk as tail risk—that is, low-probability but high-severity event risk—such as the risk of exit from the Eurozone (which, in their view, reached significant levels in Greece), or the imposition of a deposit freeze and capital controls (as in Cyprus), when a country is experiencing severe economic stress or upon a sovereign default.

As described in Fox and Renwick (2014), Fitch Ratings has revised its procedure for setting Country Ceilings for Eurozone Countries for the following reasons:

"The experience of sovereign crises since the criteria were introduced in 2004 confirms that where governments do default, they generally refrain from actively interfering with the private sector's ability to service its own obligations, local and foreign. However, the experience of the eurozone crisis did lead Fitch to change its treatment of currency unions in 2013. As a result, eurozone members rated in the 'BBB' category or below cannot achieve a 'AAA' Country Ceiling." As described in the appendix to Fox and Renwick (2014), Fitch Ratings set the country ceilings for Greece from 'AAA' to 'B-' in May of 2012 and for Cyprus the country ceiling was set to 'B' in June of 2013.

Pitman (2012) indicates that Moody's also reassessed the risk of sovereign interference with private external debt contracts in Eurozone countries. Focusing on the potential for transfer and convertibility risk associated with a Euro exit, Moody's pointed to a number of legal acts that would likely be required of an exiting country including a deposit freeze, the imposition of capital controls, and the redenomination of financial obligations. As described in Pitman (2012), in June of 2012, Moody's lowered the ceiling for private

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[25]Thinking about the legal basis for sovereign interference with private contracts in the Eurozone is rapidly evolving. Slaughter and May (2012) presents a summary of the legal issues a company operating in the Eurozone would face in the wake of a sovereign default crisis and possible Euro exit. Pykett et al. (2013) provides a discussion of the legal foundations for capital and exchange controls for Eurozone countries following the imposition of such controls in Cyprus. In its press release regarding the imposition of capital controls in Cyprus on March 28, 2013, the European Commission noted that "Member States may introduce restrictions on capital movement, including capital controls, in certain circumstances and under strict conditions on grounds of public policy or public security. In accordance with the case law of the European Court of Justice, measures may also be introduced for overriding reasons of general public interest." It noted furthermore that "Such restrictions may include bank holidays, limits on withdrawals, freezing of assets, prohibition of terminating fixed term deposits, prohibition on certain payment orders, restrictions in using credit/ debit/prepaid cards, restrictions on other banking operations as well as execution of certain transactions subject to the approval of the Central Bank and other measures." See Commission (2013).

borrowers in Greece to 'Caa2' because of the risk that creditors would not receive payments in the originally contracted currency.[26] Moody's also describes the downgrades of the country ceilings for Spain and Italy in August 2012 for similar reasons (Pitman (2012), page 6).

Table 7 lists Moody's Government Bond Ratings and Country Ceilings for Eurozone countries as of November 2014 (these are drawn from Wilson (2014) Appendix A). As we can see in this table, the country ceilings for Greece and Cyprus are both below investment grade, and the country ceilings for Ireland, Italy, Spain and Portugal are all relatively low. As described in Wilson (2014), as of November 2014, Moody's is considering revising its policies on setting Country Ceilings for Eurozone countries to reflect the steps that have been taken to reduce the risk of an exit from the Euro by member countries.

3.1.3   Does the sovereign credit ceiling bind ratings?

There is considerable evidence that the credit rating agencies' policy of imposing a sovereign credit ceiling does substantially restrict the credit ratings of private borrowers in emerging market and Eurozone economies. Moreover, this link between private and sovereign credit ratings appears to have broader economic consequences in the sense that private borrowers' cost of and access to foreign credit appears to be restricted by their sovereign's credit rating.

There is a large body of work that examines the interaction of sovereign credit ratings with domestic credit rating and credit terms both in emerging markets and in the Eurozone.[27] The first finding in this literature is that the credit rating agencies' policies of imposing a sovereign credit ceiling does, in fact, constrain the distribution of private

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[26]To illustrate the application of this country ceiling, on page 5 of Pitman (2012), Moody's reprints its press release describing the impact of this rating change for the Hellenic Telecommunications Organisation, S.A. (OTE plc), a private borrower located in Greece. As indicated in this release, the legal uncertainty surrounding a Euro exit is considerable.

> The terms of the rated instruments issued through OTE plc contain a choice of English law, submission to the courts of England, a clear definition of 'euro' as the single currency and payment provisions that were not tied to Greece. However, OTE itself is the borrower under a bank facility governed by Greek law that we consider as being at significant risk of redenomination. The size of the facility relative to the OTE family's total debt outstanding was sufficiently material to justify the risk of a default for redenomination being reflected in OTE's rating. As a consequence, whilst we positioned the corporate family rating one notch above the Greek country ceiling at Caa1(negative) — reflecting (amongst other factors) a lower expected loss for the debt issued by OTE plc — the exposure of the bank facility to a change in currency pushed OTE's probability of default rating to the Greek country ceiling of Caa2 (negative).

[27]See, for example, IMF (2012a) Chapter 2, Special Feature B, on page 85 of ECB (2014), and Adelino and Ferreira (2014).

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credit ratings assigned by the rating agencies. Borensztein et al. (2013) and Almeida et al. (2014) both examine the empirical distribution of the gap between non-financial corporate credit ratings and the associated sovereign credit rating for a large number of emerging market and Eurozone foreign bonds.[28] Both papers find a striking spike in the distribution of ratings gaps at zero (i.e. with the private firm and the respective sovereign having the same rating), with very few firms rated higher than the sovereign (that is, with positive ratings gaps) relative to the number of firms rated below the sovereign (negative ratings gaps). This finding is illustrated in our Figure 12 which reproduces the distribution of ratings gaps between corporate and sovereign ratings shown in Almeida et al. (2014). More specific to the recent developments in the Eurozone, Klein and Stellner (2014) examine a sample of 897 bonds from Eurozone countries all denominated in Euros covering the period March 2006 through June 2012. Figure 3 in that paper confirms that the vast majority of these private sector bonds in the Eurozone carry ratings that are below the rating of the sovereign.

The second finding in this literature is that changes in sovereign ratings appear to drive changes in the associated private ratings. To evaluate the impact of changes in sovereign ratings on private bond ratings, Borensztein et al. (2013) run regressions of individual firms' bond ratings on the country rating, a vector of firm specific controls using accounting data, a vector of country specific macroeconomic variables, and time, country, and industry dummies. They find a significant correlation of sovereign credit rating changes with changes in the credit ratings of private borrowers even after controlling for these other factors, particularly for borrowers in emerging market economies. Klein and Stellner (2014) find the same result in their sample of Eurozone bonds using a similar methodology. Almeida et al. (2014) take a non-parametric approach to establishing this point. In Figure 2 of their paper (reproduced here in Figure 13) these authors show that when a sovereign downgrade occurs, a large fraction of firms that are initially rated at or above the sovereign receive a downgrade of the same number of steps as the sovereign either in the same month as the sovereign or one month later, while only a very small fraction of firms initially rated below the sovereign experience the same downgrade. They argue that this asymmetry of responses is indicative of a causal impact of the sovereign downgrade on the highly rated firms in that country.

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[28]Borensztein et al. (2013) puts together a data set of sovereign and private credit ratings as well as accounting data for every publicly traded non-financial corporate borrower with a rating from Standard and Poors as of June 2005. The final sample is an unbalanced panel of 478 non-financial corporations from 29 countries, including 14 developed and 15 emerging economies for the time period 1995-2009. Almeida et al. (2014) examines a sample of bonds of non-financial firms from 80 countries over the 1990-2012 time period. Their sample has 3,605 unique firms with a credit rating.

The third and fourth findings in this literature are that the price of private external borrowing tends to rise, while the quantity of private external borrowing tends to fall, when sovereign credit spreads rise and/or ratings fall. In addition, there is evidence, chiefly for emerging market economies, that sovereign downgrades also reduce firm investment (see Areta and Hale (2008) and Das et al. (2010)). Almeida et al. (2014) look to identify the impact of sovereign downgrades on private firm investment by taking advantage of their observation that it is those private firms that are rated at or above the sovereign that get downgraded when the sovereign is downgraded while those that are rated below the sovereign typically are not downgraded when the sovereign is downgraded. By dividing firms into treatment and control groups based on their rating gap with the sovereign at the time of the sovereign downgrade and comparing the responses of firm investment, they argue that sovereign downgrades have a substantial negative impact on firm investment for firms initially rated at the same level of the sovereign in comparison to firms initially rated substantially below the sovereign.

3.2   Institutional Constraints on Government Interference

The governments of sovereign states have a long history of interfering in private financial contracts, particularly in relation to contracts between the citizens of the state and non-citizens. Such interference can take a variety of forms ranging from the extremes of nationalization and expropriation through changes in legal tender for the payment of debts (redenomination risk) to the imposition of capital and exchange controls (transfer and convertibility risk). In this section, we review the limits placed upon the ability of a government to interfere in private contracts, placing these limits within the context of previous attempts at interference in the histories of the U.S. states, Canadian provinces, and Eurozone nations.

We make two main points. First, we show that the legal institutions protecting debtors and creditors from government interference in their contracts is far weaker in Europe than amongst the states of the U.S. or the provinces of Canada. Second, we argue that these institutional constraints are frequently binding, even in the U.S. and Canada, by documenting this history of attempted government interference in both countries.

3.2.1   The United States of America

In the United States, the ability of state governments to interfere in the contracts signed by their citizens is limited by a number of clauses within the U.S. Constitution. The first is The Commerce Clause (Article 1, Section 8, Clause 3), which gives Congress the power

"to regulate commerce ... among the several states" and hence prevents state governments from introducing capital controls. The second is the The Takings Clause (the last clause of the Fifth Amendment) which limits the power of state governments to expropriate private property without "just compensation".[29]

The third and arguably most important set of protections are contained in The Contract Clause (Article I, Section 10, Clause 1) which reads in full:

> No State shall enter into any Treaty, Alliance, or Confederation; grant Letters of Marque and Reprisal; coin Money; emit Bills of Credit; make any Thing but gold and silver Coin a Tender in Payment of Debts; pass any Bill of Attainder, ex post facto Law, or Law impairing the Obligation of Contracts, or grant any Title of Nobility.

This clause serves to limit redenomination risk by preventing the state governments from issuing coins or paper money ("bills of credit") and making them (or anything else) legal tender in the repayment of debts. The clause also limits the risk of a range of other forms of government interference by preventing state governments from impairing the obligations of private debt contracts.

The Contract Clause was explicitly drafted as a counter to the long history of state (and, colonial) government interference in private contracts prior to the passage of the U.S. Constitution. Some of the earliest examples arose during the War of Independence and took the form of colonial laws that seized the real property of British loyalists. For example, in 1777 Virginia passed a law that appropriated all debts owed to British subjects (chiefly on behalf of tobacco growers), and in 1779 passed a law that declared that British subjects could not own real property (Ely (2008) pp.34-5). Virginia, North Carolina and Maryland, all closed their courts to suits by British creditors against colonial borrowers. Seizures of property continued after the cessation of hostilities and the signing of the Treaty of Paris which had promised an end to seizures (for example, North Carolina continued to seize loyalist land until 1790) and the states largely ignored Congress' recommendation (required under the treaty) that they should compensate those affected by past seizures. It was only after the Supreme Court ruled in *Ware v Hylton, 1796*, that the Treaty of Paris superseded Virginia's sequestration statute that some British creditors were able to recover debts owed to them by American citizens in Federal Courts. These precedents, and the potential for them to lead to wider interventions in private contracts,

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[29]The Takings Clause was not initially intended to apply to state governments. However, in 1897 the federal court in Chicago, B. & Q. Railroad Co. v. Chicago (1897) held that the Fourteenth Amendment extended the effects of that provision to the states.

were of great concern to a number of the Founding Fathers: In 1784, Alexander Hamilton represented a British merchant in a New York case about compensation for seizures that would come to serve as a precedent for Congress's legal authority over the states (*Rutgers vs Waddington*, 1784); In the same year, James Madison successfully sponsored bill to halt confiscation of British property in Virginia.

In the years that followed the revolution, state governments widened their interference in private debt contracts by passing a range of debtor relief laws. These laws took four basic forms. The first were changes that made paper money, often significantly depreciated, legal tender in the repayment of debts. The colonial governments had experimented with issuing paper money, in the form of bills of credit, since at least 1690 when the Commonwealth of Massachusetts began issuing bills of credit—debts intended to circulate as a media of exchange—and made them legal tender in the payment of taxes. New Hampshire, Rhode Island, Connecticut, New York and New Jersey all quickly followed suit, with South Carolina, Pennsylvania, Maryland, Delaware, Virginia and Georgia doing likewise at various points over the next half century (Dewey (1902), pp.21-4).

Following the revolutionary war, this practice arose again. In one of the best known cases, Rhode Island issued paper money in 1786 and made it legal tender for the repayment of debts. The money soon traded between 25% to 50% of par and had fallen to 1/12 of par by 1789. In response, Massachusetts and Connecticut legislated to prevent Rhode Island residents from collecting debts owed by their own residents (Nevins (1924), pp.539-40, 571). Similar acts occurred in other states: In 1785 North Carolina issued paper money that was used to repay debts in Sterling at a 50% discount (Nevins (1924), p.524); in 1786, both New Jersey and Georgue issued paper money and made it legal tender for all private and public debts (Nevins (1924), p.523-524). In cases in which the state legislatures refused to issue paper money as legal tender in repaying debts, popular uprisings prevented the execution of judgments against debtors. A prominent example of this is Shay's Rebellion in western Massachusetts in 1786-7, when farmer protests closed courts in the west of state to prevent executions of judgments against debtors, after having unsuccessfully petitioned the state government to issue paper currency for the repayment of debts (Ely (2008), p.39).

The second form of debtor relief laws were changes that made commodities or land legal tender in the repayment of debts, often on terms quite unfavorable to creditors. The most famous of these was South Carolina's Pine Barren Act of 1785 which permitted debtors to tender property to discharge debts. The land was to be appraised and could be used to repay debts at two-thirds of the land's value. However, the lands tendered were often very distant from creditors making it difficult to challenge their appraised value.

South Carolina also allowed payment in kind (such as cattle) with the creditor to pay the costs of driving the animals to market (Ely (2008), p.37, Nevins (1924), pp.404-5 and 525-6). Likewise, in 1782 Massachusetts passed a law allowing payment of debt in cattle and other commodities, while in 1785 New Hampshire allowed debtors to repay debts in either real or personal property (Nevins (1924), p.537).

The third form of debtor relief law were stays in the repayments of debts, or alterations in the timing of required repayments. As one example, South Carolina passed a stay law in 1782 that remained in place until 1786 when only one-quarter of the outstanding debt became payable (Nevins (1924), p.525). The fourth and final form of debtor relief law involved the closure of the courts to suits by creditors, or the diminution of the penalties for default. For example, in 1783 North Carolina passed a law suspending suits against debtors (Nevins (1924), p.386). Likewise, in 1781, while repealing laws that had made paper money legal tender in the repayment of debts, South Carolina prohibited suits for the recovery of debts until the next General Assembly (Nevins (1924), p.390). Maryland passed a law in 1787 allowing insolvent debtor to pass through bankruptcy without prison (Nevins (1924), p.532).

The history of state interference in debt contracts framed the thinking of delegates to the Constitutional Congress. The Founding Fathers objected to these debtor relief laws both out of a concern about property rights *per se*, but also, in light of the Rhode Island paper money dispute, because it had the potential to generate interstate conflict. On the former, Madison wrote in The Federalist No. 44 that "Bills of attainder, ex post facto laws, and laws impairing the obligation of contracts, are contrary to the first principles of the social compact, and to every principle of sound legislation." On the latter, writing in *The Federalist No. 7*, Hamilton argued "Laws in violation of private contracts, as they amount to aggressions on the rights of those States whose citizens are injured by them, may be considered as another probable source of hostility."[30]

Whether as a result of memories of past state interference in contracts, or due to the arguments of Madison and Hamilton, support for the clause was widespread. There was no debate on the contract clause for the first three months of the Congress and, notwithstanding some modifications by the Style Committee, no amendments to the clause were ever proposed (Wright (1938), p.9,12, and 15). There was also very little debate on the clause as part of state ratification proceedings, with most discussions viewing the clause in a positive light. Even in the ratification proceedings for South Carolina,

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[30]Madison expressed similar sentiments when describing the importance of a strong union in *The Federalist No. 10*: "a rage for paper money, for an abolition of debts, for an equal division of property, or for any other improper and wicked project, will be less apt to pervade the whole body of the union than a particular member of it."

which as discussed above had frequently interfered in private contracts, most views were positive with Charles Pinckney trumpeting that "no more shall paper money, no more shall tender-laws, drive their commerce from our shores, and darken the American name in every country where it is known", while David Ramsey argued that the contract clause and the prohibition of state issued paper money "will doubtless bear hard on debtors who wish to defraud their creditors, but it will be a real service to the honest part of the community" (Ely (2008) p.50). One of the few exceptions was Luther Martin of Maryland who stated that state governments should have the power to assist debtors "in times of great public calamities and distress" (Ely (2008) p.51).

In the years following ratification, state government interference in private contracts was greatly reduced. Debtor relief legislation occasionally arose in response to financial panics and the courts vigorously applied the contract clause to strike this legislation down. In *Champion and Dickason v Casey*, 1792, a federal circuit court found a 1791 Rhode Island law granting debtors exemptions from attachments for a period three years unconstitutional. In *Jones v Crittendon*, 1814, the Supreme Court of South Carolina invalidated a law suspending execution of judgments against debtors. Even more modest legislation was struck down; In *Sturges v Crowninshield*, 1819, the U.S. Supreme Court held that states could enact bankruptcy statutes as long as the Federal government failed to enact one, but struck down a New York bankruptcy law because it applied to contracts signed before law was passed. Importantly, the Court allowed that states could regulate the legal remedies for a breach of contract, as long as they did not modify the contractual obligations themselves, and as long as they did not apply retrospectively. A New York bankruptcy statute that was enacted after the panic of 1819 and applied only to new debts was held constitutional in *Ogden v Saunders* 1827.

The panic of 1837 led to similar efforts to relieve debtors that were also struck down because of their retrospective application. In both Illinois and Alabama, laws allowing a debtor to redeem previously foreclosed property were struck down (*Bronson v Kinzie* 1843; *Howard v Bugbee*, 1860). A similar fate befell Illinois and Indiana legislation that prohibited the sale of mortgaged property at prices below some fraction of its appraised value (*McCracken v Hayward*, 1844; *Lessee of Gantley v Ewing*, 1845; see also Wright (1938) p.70). A further series of laws were passed and struck down following the Civil War including laws allowing a mortgagor to redeem property and statutes exempting homesteads from attachment (see *Gunn v Barry* and *Edwards v Kearzy*; Wright (1938), p.105).

The contract clause was also used to place limits on the abilities of states and municipalities to abrogate clauses in their own debt contracts. The Southern states repudiations

of debts were protected by sovereign immunity under the 11th amendment of the Constitution. However, in the Virginia Coupon Cases, 1885, it was ruled that a subset of Virginian bonds that contained a clause allowing interest coupons to be used for payment of state taxes must be accepted even though the debt was repudiated. Local governments, which could not claim shelter under the 11th amendment, were forced by the courts to honor large numbers of bonds during this period (Ely (2008), pp.97-8, Wright (1938), pp.81-82). In *Gelpcke v City of Dubuque* 1864, the US Supreme Court further ruled that a bond cannot be impaired by a change in interpretation of state law; in that case, the city was forced to honor a series of city issued railway bonds, despite the Iowa Supreme Court ruling them unlawful.

The largest wave of debtor relief laws were passed during the Great Depression; in an 18 month period between 1933 and 1934, mortgage foreclosure moratorium legislation was enacted in 27 states. Typically, the laws authorized stays of foreclosure proceedings and/or extended redemption periods. Concerned about the constitutionality of these laws under the contract clause, the statues were designed to be qualitatively different from previous debt relief laws; the new laws were designed to be temporary, targeted, subject to judicial review, and limited in the costs imposed on creditors. For example, one of the first statutes passed was in Iowa which allowed debtors to apply to a court to continue a pending foreclosure action during which they were required to make payments to the creditor. In New York, courts were to review the income and expenses of the debtor every six months with surplus income paid to the creditor in addition to interest and taxes. In California, a borrower could apply to a court for a stay of foreclosure or an extension of the redemption period, in return for which they would make a court determined payment to the creditor.

The most famous example concerned a 1933 Minnesota statute that came before the US Supreme Court in *Home Building and Loan Association v Blaisdell, 1934*. In this case, a 5-to-4 majority of the Supreme Court ruled that a 1933 Minnesota statute imposing a limited moratorium on the foreclosure of farm mortgages was constitutional. The court described in some detail what made this statute qualitatively different from previous debtor relief legislation that had been ruled unconstitutional. First, it was temporarily enacted in response to an emergency: the law was set to expire once the emergency was over, and in no case later than 1935. Second, it was a conditional moratorium subject to judicial review: debtors in need were allowed to appeal to state courts to have the existing period of redemption from foreclosure sales extended. Finally, it placed limits on the losses imposed on creditors; debtors were required to pay rents to creditors while they remained in possession (see Wright (1938), pp.109-119; Olken (1993)).

The special nature of the statute at issue in the *Blaisdell* case was emphasized in succeeding cases. In *W.B. Worthen Company v Thomas*, 1934, an Arkansas law exempting life insurance payments from attachment was struck down because it did not limit the sacrifice of contract rights (it applied indefinitely), nor discriminate on basis of the needs of the debtor. In the words of the Supreme Court the relief was "neither temporary or conditional ...[and contains] no limitations as to time, amount, circumstances or need". In *WB Worthen v Kavanaugh*, 1935, an Arkansas law modifying the default provisions on municipal bonds was struck down for the same reasons Wright (1938), p.115; Ely (2008), p.127).

Following the Great Depression, state courts have continued to strike down debtor relief laws on these grounds. For example, following the recession of the early 1980s, foreclosure moratorium acts were struck down by the Oklahoma Supreme Court (*Federal Land Bank of Wichita v. Story*, 1988), the Kansas Supreme Court (*Federal Land Bank of Wichita v. Bott*, 1987), and the Iowa Supreme Court (*Federal Land Bank of Omaha v. Arnold*).

Only modest debtor relief laws, such as those requiring mediation between debtors and creditors, have been upheld (Walsh (2011)). In the recent crisis, legislation was passed in 11 states affecting the mortgage foreclosure process, but in each case the laws served only to require some form of meeting between the borrower and lender before foreclosure. California, Indiana, Massachusetts, Michigan and Oregon all now require a pre-foreclosure conference between the debtor and lender aimed at mitigating losses. Connecticut, Maine, Maryland, Nevada, New York and Vermont now require some form of mediation between the borrower and the lender.

Together, these strong protections from government interference are why, in contrast to the case for private borrowers in emerging markets and in the Eurozone, credit rating agencies impose no linkage between the local sovereign rating and that for private borrowers in US states. That is, in modern times, the credit ratings of private borrowers in US states are not directly linked to the credit ratings of their respective state governments.[31] Much the same rationale exists for private sector borrowers in Canada which, as we will

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[31]Moody's rationale for this delinking of private and U.S. state government credit ratings is explained in Wilson (2014), Appendix B, as follows:

"States that are part of a strong economic, banking and currency union have the potential to share a common domestic currency ceiling—which may be higher than the ceiling their debt issuers would be subject to if not part of the union—because an issuer domiciled in one state might derive its revenues and obtain its banking services and common currency anywhere within the union. This explains why, for example, issuers domiciled in the United States are all subject to the same currency ceiling, regardless of the debt rating of the individual state in which they reside."

We also verified that US state government credit ratings are not a constraint on private credit ratings for US corporates with S&P personnel in private communication.

see next, enjoy similar protections from provincial government interference as their US counterparts.

3.2.2 Canada

Protections against provincial government interference in private contracts in Canada are similar to those available in the United States, and stem from a similar place: the Canadian Constitution. Paragraph 91 of the Constitution Act, 1982 (formerly the British North America Act, 1867) vests in the Parliament of Canada the exclusive legislative authority over the regulation of trade and commerce, currency and coinage, the issuance of paper money, bills of exchange and promissory notes, legal tender, and bankruptcy and insolvency. That is, like US States, Canadian provinces cannot change legal tender, issue money, nor interfere in interprovincial (and international) trade and commerce.

However, paragraph 92 of the Constitution Act, 1982 does vest the provincial governments with the exclusive legislative authority over property rights within their own province. More than a Century of jurisprudence has interpreted this expansively to include laws regarding contracts resulting in some overlap between federal and provincial laws regarding the treatment of debts[32]. As a result, although the provinces have no *de jure* power over interprovincial debts, they were able to exercise some *de facto* power over such debts and often used this power to favor local creditors over creditors from other provinces.

In the early years of the Dominion, the Parliament of Canada attempted to impose a federal insolvency law guaranteeing equal treatment of creditors both within and across provinces[33]. The Insolvency Acts of 1869 and 1875, although limited in scope to "traders", both provided for a pro rata distribution of a debtors assets among all unsecured creditors. Preferential payments or transfers of property to a creditor in advance of bankruptcy were prohibited, and during bankruptcy court proceedings were stayed. However, the prohibitions against preference in repayments were often ignored while local courts typically interpreted the laws in favor of the preferred creditor. This was possible because the laws prohibited only an "unjust preference" made in "contemplation of insolvency" with the required proof being an intention to prefer one creditor over another. Under the English legal "doctrine of pressure," payments made following a creditor's request for repayment were viewed as involuntary and hence not an unjust preference. Even after the 1886 case of *Davidson v. Ross*, in which the Upper Canada Court of Error and Appeal overturned

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[32]In *Citizen's Insurance Co. v. Parsons, 1881*, a case which involved insurance contracts, the Privy Council ruled that the property and civil rights clause included the power to regulate contracts.

[33]Much of our discussion of the history of Canadian insolvency and bankruptcy law is drawn from Telfer (2014) and Telfer (1999).

the doctrine of pressure, courts continued to allow preferential payments to creditors citing either a lack of intent to prefer, or that the preferential payment was not made in contemplation of bankruptcy (see Telfer (2014) p.51). As a result, there existed a *de facto,* if not *de jure,* preference in favor of local creditors—often family members and friends—who first observed signals of a debtors distress and could submit early requests for repayment.

The federal Insolvency Acts were unpopular, especially in rural areas where local credit arrangements were common as the law was seen as threatening a desirable preference in favor of local creditors. After repeated efforts, the Insolvency Act was repealed in 1880. This led to a period in which a common law "race to courthouse" governed insolvent debtors, a situation which typically favored local creditors who could often initiate and obtain judgments before more distant creditors were informed of the debtor's distress. Preferential settlements with local creditors were further enabled as courts, in the absence of federal legislation, revived the doctrine of pressure with the Supreme Court of Canada overturning *Davidson v. Ross* in 1883 with *McCrae v. White.* The provincial governments were slow to legislate to restrict the granting of preferences. An early Ontario law was passed in 1880 at the time of the federal repeal, but did not come into force until 1884 and in any event was regarded as ineffective at limiting creditor preference. And although Manitoba passed similar legislation in 1885, the Maritime provinces were especially slow to follow; New Brunswick only passed legislation in 1895 while Nova Scotia took until 1898.

With the passage of the federal Bankruptcy Act of 1919, any *de facto* or *de jure* preference in favor of local debtors was eliminated. This situation remains in force today.

3.2.3 The European Union

Set against the legal protections against state and provincial government interference available to private creditors in the United States and Canada, the protections offered amongst the nations of the European Union are typically substantially weaker. One exception that holds only for those members in the Eurozone is in regard to changes in legal tender; Article 128 (1) of the *Treaty on the Functioning of the European Union* (TFEU) makes Euro denominated banknotes and coins, and only such notes and coins, legal tender[34]. Hence, short of abandoning the Euro—a possibility that appears to be explicitly ruled out in the TFEU—the members of the Eurozone are unable to change

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[34]Strictly, the TFEU concerns only Euro banknotes, while Article 11 of Regulation EC/974/98 on the introduction of the Euro applies to Euro coins.

legal tender[35].

Other protections from government interference in European treaties and conventions are typically weakened by the presence of clauses allowing any such protection to be suspended where necessary. For example, Articles 63 and 65 of the TFEU, although designed to limit the use of capital controls by Member States, allow capital controls that are "justified on grounds of public policy or public security" and that do "not constitute a means of arbitrary discrimination or a disguised restriction on the free movement of capital and payments". With the imposition of capital and exchange controls in Cyprus, the European Commission proactively issuing its opinion that the Cyprus capital controls were lawful both as a result of the "public policy "exemption as well as the case law of the European Court of Justice allowing interventions "for overriding reasons of general public interest"(see Commission (2013)).

The only other potential source of protection against government interference comes from Article 1 of Protocol to the Convention for the Protection of Human Rights and Fundamental Freedoms (CPHRFF). However, this clause does not prohibit government interference in private contracts *per se*; rather, it simply requires that such interference be "in the public interest"and subject legal principles: "Every ... person is entitled to the peaceful enjoyment of his possessions. No one shall be deprived of his possessions except in the public interest and subject to the conditions provided for by law and by the general principles of international law."Moreover, Article 15 of CPHRFF allows any government to suspend any Human Right or Fundamental Freedom in the event of a public emergency:

> In time of war or other public emergency threatening the life of the nation any High Contracting Party may take measures derogating from its obligations under this Convention to the extent strictly required by the exigencies of the situation, provided that such measures are not inconsistent with its other obligations under international law.

In summary, investors in Europe lack the extensive protections against government interference enjoyed by investors in the U.S. states and Canadian provinces today. Moreover, the experience of investors in emerging markets today, as well as in the U.S. states and Canadian provinces throughout history, indicates that governments can be expected to interfere in contracts each time some public emergency, such as a debt crisis, allows them to justify interference "in the public interest."

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[35]The TFEU refers to the irrevocable fixing of exchange rates in Articles 46(3), 49, and 140(3). However, there is a provision in Article 50 of the TFEU that envisages a Member State leaving the European Union altogether.

4   Fiscal Flexibility

We now briefly review the theoretical and empirical literatures on the link between fiscal flexibility and public debt sustainability. We first discuss the theoretical literature's finding that a governments decision to raise taxes as opposed to default on debt as a way of filling fiscal gaps is determined by the range of tax instruments available to them, consistent with our notion of fiscal flexibility. We then discuss the empirical literature on debt sustainability which relies on estimates of a governments ability to vary primary surpluses in response to debt levels and macroeconomic shocks, and the widespread finding that US states are less fiscally flexible than Canadian provinces or European nations. Lastly, we turn to a discussion of how ratings agencies assess fiscal flexibility when rating state and provincial governments.

Following the theoretical work of Kydland and Prescott (1977), Fischer (1980), and Lucas and Stokey (1983), we see the sustainability of public debt as being determined by a government's ability to commit to use taxes and spending to generate the primary surpluses needed to repay the public debt rather than choose to default on that debt. In much of the literature, the tradeoff the government faces when public debt is due is between the costs of current distortions connected with adjusting tax rates or levels of public expenditure with the reputational and/or resource costs of default on the public debt. This literature has found that whether or not the tradeoff leads to a default on public debt depends on the range of tax instruments available to the government. If the government has access to taxes that impose only small distortions on the economy, then it will not be tempted to default on public debt held by domestic agents because closing fiscal gaps through increased taxation will generally be preferable to doing so through costly default on public debt. In contrast, if tax instruments are limited, then default on public debt can become a more attractive option.[36] In this sense, this literature has emphasized a strong connection between fiscal flexibility as measured by the range of tax instruments available and the incentives to default on public debt.

This theoretical literature has led to a large recent literature on the sustainability of public debt that uses empirical estimates of the response of primary surpluses to debt lev-

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[36]Lucas and Stokey (1983) study the incentives to use the inflation tax to reduce the real value of public debt ex-post in an economy with nominal public debt. Chari et al. (1994) note the equivalence of state contingent capital taxation and state contingent public debt as fiscal instruments in a model of optimal taxation in a stochastic environment. Aiyagari, Marcet, Sargent and Seppala XXXX examine the optimal cyclicality of government expenditure and taxation in an economy with limited tax instruments and full commitment to repay government debt. Pouzo and Presno (2014) examine the role of fiscal inflexibility in generating optimal default in a stochastic closed economy in which a government is restricted to proportional taxes and uncontingent debt.

els and macroeconomic shocks as a reduced form measure of the ability of governments to adjust primary surpluses to repay public debts that can be an input in debt sustainability calculations.[37] Along this dimension, there is considerable evidence that U.S. states have a strongly procyclical fiscal response to macroeconomic shocks, suggesting fiscal rigidities caused by the nature of fiscal institutions in these states. For example, Poterba (1994), Bohn and Inman (1996), Fatas and Mihov (2006), IMF (2012b), Aizenman and Pasricha (2010), Aizenman and Pasricha (2011), and Aizenman and Gunnarsson (2014) among others examine the impact of fiscal restrictions in U.S. States on their fiscal adjustment to macroeconomic shocks. More relevant for our thesis, Poterba and Rueben (1999), Lowry and Alt (2001), Poterba and Rueben (2001), and Johnson and Kriz (2005) estimate the extent to which legal restrictions on increasing revenue raise the cost of U.S. state borrowing, both in terms of overall levels and in response to fiscal shocks. These modern findings complement the findings of historical studies of public debt in the U.S. For example, Sargent (2012) discusses the role of fiscal inflexibility in shaping public debt crises in early U.S. history. Similarly, Wallis (2000) discusses the importance of flexible revenue sources for determining the equilibrium level of public debt at the local, state, and Federal levels of U.S. governments' public debts throughout American history. He shows how changes in institutions restricting the revenue sources available to local, state, and Federal levels of U.S. government have had a dramatic impact on these governments' abilities to sustain public debt at different points in history.

In practice, considerations of fiscal flexibility are also an important part of credit ratings agencies methodologies for the general obligation bonds issued by US states. When rating US states, Moody's makes an assessment of the role of constitutional constraints in reducing what they call the "Financial Flexibility" of each state. They argue that "[t]he constitutions of some states include provisions that limit financial flexibility and weaken the institutional governance framework. The initiative and referendum process can particularly constrain flexibility over time. California, Oregon, and Washington are among the states with the most active voter initiative processes, and in all three there have been long-run budgetary effects. Some states are constitutionally blocked from increasing revenues unless they put a referendum to the voters. Those states often can only look to the expenditure side of their budgets to close deficits when a two-pronged approach would offer more flexibility" (Raimes (2013)). Similarly, Standard and Poor's provide each US state with a "Revenue Structure Score" that reflects both institutional constraints and the track record of state policymakers with regard to raising revenue. The S&P score takes on one of the four following values (see Prunty and Aldrete-Sanchez (2011)):

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[37]See, for example, Bohn (1998) and Ghosh et al. (2013).

1. The state has autonomy to raise taxes and other revenues (rate and base); in addition, there is no constitutional constraint or extraordinary legislative threshold for approval (a simple majority requirement for approval of new taxes, for example) and state policymakers have, in our view, a proven track record of implementing tax increases as one of the alternatives to address budget imbalances.

2. The state has autonomy to raise most but not all taxes and revenues. In addition, in our view, the track record of implementing tax increases as a policy alternative to address budget imbalances is uneven, thus effectively reducing the state's revenue flexibility.

3. There are in our view significant constraints to adjusting taxes or revenues. These constraints can include constitutional prohibitions on tax increases, an above majority legislative threshold for approval , or the need to have voter approval for tax and revenue increases.

4. The state is both legally and, in our view, politically constrained in its ability to increase all key revenue sources. We view revenue flexibility as practically limited to the potential growth of the existing revenue base.

Considerations of relative fiscal flexibility also play a major role in determining the relative credit ratings of US states relative to Canadian provinces. As Moody's explains "California's legal and political environment creates obstacles to timely budget management and revenue raising, which restricts its freedom of action relative to other US states and some sub-sovereigns, including Ontario. Constitutional constraints on budgeting flexibility continue in California, although modest governance changes have helped the state achieve three years of on-time budget passage. California's reliance on highly progressive income taxes creates recurring revenue volatility and financial pressure and constrains California's rating. In comparison, Ontario has relatively stable revenues and like other Canadian provinces, has strong fiscal flexibility, on both the revenue and expenditure sides of the ledger" (Wong and Raimes (2013)).

The finding that US states are less fiscally flexible than Canadian provinces and the subnational units of other federal systems is widespread. Rodden and Wibbels (2010) study seven federal systems and conclude that US states engage in far less expenditure smoothing than do the provinces of Canada, as well as the subnational governments of several other countries. Looking at the most recent business cycle, Jonas (2012) also concludes that "[e]ven though a similar procyclical fiscal tightening has been observed at the subnational level during the latest crisis in a number of advanced economies, the U.S.'s tightening appears to have been among the most pronounced." In contrast to the US, Canada is viewed as one of the most decentralized countries in the world in which the provinces "have a virtual free hand in levying taxes" (Bird and Tassonyi (2003)).

The extent of expenditure smoothing for US states documented by Rodden and Wibbels (2010) also seems low relative to estimates computed for members of the European Union Hallerberg and Strauch (2002).

5 Model

We now present a theory of external debt constraints and public debt constraints based on the interaction of the risk of sovereign interference with private debt contracts and fiscal flexibility. We use a simple two period model to illustrate our main points.

5.1 Environment

Consider a model of a small open economy with two time periods, $t = 1$ and $t = 2$. This small open economy has access to opportunities to borrow from risk neutral international creditors. These international creditors have a time discount rate equal to one and hence the equilibrium (net) international riskless interest rate is equal to zero.

This economy is populated by a representative household and a government that chooses policies to maximize the welfare of the representative household subject to constraints on the government's ability to commit to policies in period $t = 2$. The household has utility over private consumption C_t and public expenditure G_t of the form

$$u(C_1) + u(G_1) + u(C_2) + u(G_2)$$

The household is endowed with Y_t units of the consumption good at time $t = 1, 2$, with $Y_1 < Y_2$. These assumptions ensure that the household and the government have a motivation to borrow from the international creditors in period $t = 1$ so as to smooth private and public expenditure over time.

Unconstrained Optimal Allocation: If all actors in this small open economy could fully commit to repay their private and public debts, then, given the international gross interest rate of one, the unconstrained optimal allocation would set

$$C_t^* = G_t^* = \frac{1}{4}(Y_1 + Y_2) \tag{1}$$

To implement this unconstrained optimal allocation, this small open economy would incur external debt

$$D^* = \frac{1}{2}(Y_2 - Y_1) \tag{2}$$

in period $t = 1$ and repay this amount of external debt in period $t = 2$. The optimal external debt to GDP ratio D^*/Y_1 in period 1 is clearly increasing in the ratio Y_2/Y_1.

The optimal level of public debt in this small open economy in period $t = 1$ is not pinned down without further specification of the timing of taxes chosen by the government. If the government has full flexibility in setting taxes, then the small open economy displays Ricardian Equivalence and the optimal mixture of public and private (dis)saving in period $t = 1$ that leads to external debt of D^* is indeterminate.

Costs of Government Default and Interference: We model the government in this small open economy as unable to commit not to default on its public debts (both domestically held and held by foreigners) and not to interfere with private external debt contracts. Specifically, we assume that in period $t = 2$, the government chooses default and/or sovereign interference so as to maximize the welfare of households in that period, taking as given the outstanding stocks of debts of both the public and private sector and the costs of default and/or sovereign interference. We model the costs of default on public debt and/or interference with private contracts directly in resource terms.

We let D^p denote the payments due on private external debts to the foreign creditors at the start of period 2. Likewise, we let B^g and D^g denote the payments due on domestically held public debts and public debts due to foreign creditors at the start of period 2. Let $D = (D^p, B^g, D^g)$ denote the vector of these debts due at the start of period 2.

We assume that government default or interference with private external debt contracts imposes a resource cost on the economy in terms of reducing the household's period 2 endowment. We index the costs of government interference with its citizen's private debt contracts with foreigners in period 2 by a parameter $\Delta^p \geq 0$. We index the costs of government default on its domestically held public debts in period 2 by $\Delta^{bg} \geq 0$, and the costs of default on its external public debts in period 2 by a parameter $\Delta^{dg} \geq 0$.

These resource costs of default on public debt and interference with private external debt contracts are potentially stochastic. We denote the realized value of these costs in period 2 by the vector $\Delta = (\Delta^{dg}, \Delta^{bg}, \Delta^p)$. We assume that the CDF of these costs is given by $F(\Delta)$. Since these costs are stochastic, equilibrium private and public consumption in period $t = 2$ are also potentially stochastic. We include notation for the dependence of these variables on Δ as needed.

Binding External Debt Constraint: In the unconstrained optimal allocation, we have that the households' intertemporal marginal rate of substitution $u'(C_1^*)/u'(C_2^*)$ is equal to the international riskless (gross) interest rate of 1. We say that the commitment problem on the part of the government leads to the households facing a *binding external debt constraint* in equilibrium if, in that equilibrium, $u'(C_1) > Eu'(C_2)$. That is, we say that the country faces a binding external debt constraint if households are constrained from doing the borrowing needed to finance the unconstrained optimal timing of consumption. Taking the household's intertemporal marginal rate of substitution $Eu'(C_2)/u'(C_1) = 1/R$ as the inverse equilibrium domestic riskless interest rate in this small open economy, we then have, equivalently, that the households face a binding external debt constraint if the equilibrium domestic riskless interest rate in this small open economy exceeds the international riskless interest rate.

Binding Public Debt Constraint: In parallel with our definition of a binding external debt constraint, we say that the commitment problem on the part of the government leads to the government facing a *binding public debt constraint* in equilibrium if, in that equilibrium, $u'(G_1) > Eu'(G_2)$. In this case, household welfare would be increased if the government were able to raise more resources (through borrowing or taxation) in period $t = 1$ to finance increased government expenditure relative to the government expenditure in period $t = 2$.

5.2   Definition of Equilibrium:

We now describe government policies and our equilibrium decentralization of private and public borrowing decisions in this environment.

Government Policy In period 1 the government chooses a level of taxes τ_1 to be paid by domestic households, public expenditure G_1, and domestic and external public indebtedness B^g and D^g due in period 2. The prices paid for these public debts in period 1 are determined endogenously as a function of the aggregate choices of private external debts and public domestic and external debts $D = (D^p, B^g, D^g)$ taking into account the government's inability to commit not to default on public debts and/or interfere with private external debt contracts in period $t = 2$. Government policies in period 1 must satisfy the budget constraint

$$G_1 = \tau_1 + q^{bg}(D)B^g + q^{dg}(D)D^g \tag{3}$$

where $q^{bg}(D)$ and $q^{dg}(D)$ are the prices for domestic and external public debt respectively.

In period $t = 2$, the government chooses whether to repay domestically held public debt ($I^{bg} = 1$) or not ($I^{bg} = 0$), whether to repay external public debt ($I^{dg} = 1$) or not ($I^{dg} = 0$) and whether to interfere with private external debt contracts ($I^p = 0$) or not ($I^p = 1$), taking the realized costs of default and/or interference Δ as given. For simplicity, we assume that default and interference can be partial by allowing $I^j \in [0, 1]$ for $j = bg, dg, p$. The resource costs of partial default and/or interference are partial and in proportion to the default and/or interference.

The government then chooses taxes τ_2 and public expenditures G_2 contingent on these default and interference decisions. We let $I = (I^{bg}, I^{dg}, I^p)$ denote the government's default and interference decisions. We write government policy in period $t = 2$ as functions of private and public debts D and the realized resource costs of default and interference with private external debt contracts Δ as needed.

Fiscal Flexibility: We consider two possible regimes restricting government's choice of taxes τ_2 in period 2. In the first regime, which we term the *Flexible Tax Regime*, we assume that government can choose taxes τ_2 and spending G_2 freely as a function of debts D, the realized costs of default and interference Δ, and the default and/or interference decisions I, subject to the government's budget constraint in period 2 given by

$$G_2(D, \Delta) = \tau_2(D, \Delta) - I^{bg}(D, \Delta)B^g - I^{dg}(D, \Delta)D^g \tag{4}$$

In the second regime, which we term the *Inflexible Tax Regime*, we assume that taxes τ_2 in period 2 are predetermined as a parameter that cannot be altered. In this regime, government policy in period 2 is restricted to choices of default and/or interference decisions I and the level of government spending G_2, subject to the government's budget constraint in period 2.

Pricing of External Debts: The international creditors take as given government default and interference decisions as functions of the country's aggregate indebtedness D and the default costs Δ and set prices for external borrowing by the government $q^{dg}(D)$ and the domestic private agents $q^p(D)$ to ensure that they receive expected gross return of one on their lending to the public and private sector in this country. Thus, these prices for external borrowing are given by

$$q^{dg}(D) = \int I^{dg}(D, \Delta)dF(\Delta) \tag{5}$$

and

$$q^p(D) = \int I^p(D, \Delta) dF(\Delta) \tag{6}$$

Given that the international riskless interest rate is equal to one, we define the *spread on public external debt* as

$$S^{dg}(D) = \frac{1}{q^{dg}(D)} - 1 \tag{7}$$

and the *spread on private external debt* as

$$S^p(D) = \frac{1}{q^p(D)} - 1 \tag{8}$$

We discuss below that our definition of a binding external debt constraint does not correspond directly into measures of spreads on private or public external borrowing. Below we show that the equilibrium spread depends on the distribution of costs of default Δ. We show that it is possible to have equilibria in which the external debt constraint is binding but in which the spread on private external debt relative to the international riskless interest rate is zero. This can occur when the costs of default and sovereign interference Δ are deterministic. In this case, external and/or public borrowing is quantity constrained but default and interference do not occur in equilibrium. Conversely, it also possible to have equilibria with spreads on external borrowing but without binding external or public debt constraints. This can occur when the costs of default and sovereign interference Δ are stochastic with support that includes very low costs. In this case, default and/or sovereign interference does occur in equilibrium but the country may be able to borrow enough from foreign creditors in period 1 to drive the domestic riskless interest rate down to the international riskless interest rate.

We now discuss how we model the decentralization of the private sector's borrowing decisions.

Decentralization with domestic financial intermediaries: In our model, the private sector in our small open economy borrows from international creditors in a decentralized manner. At the same time, the government's policy decisions to interfere with its citizens' private debt contracts to foreigners and/or default on its public debts in period $t = 2$ are endogenous and determined by considerations of aggregate welfare. As discussed in Wright (2006), there is an important conceptual issue that arises in modeling competitive equilibria in such an environment because of the disconnect between the decentralized decision to borrow from abroad made by individual private actors and the collective decision to interfere with those debts made by the government. As a result of

this disconnect, individual private actors in a competitive equilibrium do not fully internalize that their own borrowing decisions alter aggregate private external indebtedness and hence the probability that the government will interfere with private external debt contracts and/or default on public debts. The difficulty with defining a competitive equilibrium in such an environment with potentially binding external debt constraints is how to decentralize the quantity restrictions on aggregate external borrowing that must be imposed as part of the definition of equilibrium with decentralized private external borrowing when the domestic riskless interest rate exceeds the international riskless interest rate.

To address this issue when we model the decentralized decision of the private sector to interact with international creditors in our small open economy, we assume that all credit to households is intermediated through the domestic financial intermediaries[38] that are oligopolistic. Hence, individual intermediaries do, at least partially, internalize the impact that their external borrowing has on the probability of government interference with private debt repayment of external debt. Because these financial intermediaries each individually perceive that their borrowing at the margin impacts the price at which foreign creditors are willing to lend, they each choose endogenously to limit their foreign borrowing in equilibria in which the external debt constraint is binding, thus allowing for a decentralized equilibrium consistent with an aggregate constraint on external borrowing.[39]

Specifically, we assume that there are N equally sized financial intermediaries that each choose a portfolio of loans to domestic households, b^p and the domestic government b^g as assets and debts from abroad d^p as liabilities. In a symmetric equilibrium, the total (domestic) borrowing by households is $B^p = Nb^p$, the total domestic borrowing by the government is $B^g = Nb^g$, and the total private external indebtedness of the country is $D^p = Nd^p$.

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[38]This assumption is analytically convenient. As discussed in Lane and McQuade (2013), this assumption is also realistic for countries in the Eurozone in that they find that most domestic corporates and households in Eurozone countries only indirectly engage with international financial system. Instead most international claims and liabilities are intermediated by the domestic banking system. Accordingly, non-financial corporates and households are mainly affected by international capital flows to the extent that these flows influence the provision of credit by domestic banks.

[39]Kehoe and Perri (2004) develop a model with decentralized private external borrowing with a centralized default decision made by the government. A key assumption is that domiciled private borrowers always repay their foreign debts and default on those debts occurs when the government confiscates those repayments on their way to the foreign creditors. Hence, the spread that international creditors charge to private borrowers as a result of the risk of sovereign interference is paid in full by these private borrowers giving rise to a gap between the domestic riskless interest rate and the international riskless interest rate in a decentralized competitive equilibrium. Kim and Zhang (2012) develop an alternative model with decentralized private external borrowing with a centralized default decision made by the government. A key assumption in their model is that there is no private domestic capital market in which individual agents might attempt to arbitrage any difference between domestic and foreign interest rates.

We assume that these domestic financial intermediaries are able to perfectly enforce repayment of their loans to domestic households. We also assume that the households own the domestic financial intermediaries and hence recover any profits earned by these intermediaries.

Problem of the Household: The household chooses consumption C_1 and $C_2(D, \Delta)$ together with borrowing from domestic financial intermediaries B^p taking the domestic riskless interest rate R and government policies as given to maximize utility

$$u(C_1) + \int u(C_2(D, \Delta)) dF(\Delta)$$

subject to the budget constraints

$$B^p = R(C_1 + \tau_1 - Y_1)$$

$$C_2(D, \Delta) = Y_2 - \sum_{j=bg,dg,p} (1 - I^j(D, \Delta))\Delta^j - \tau_2(D, \Delta) + \Pi(D, \Delta) - B^p \qquad (9)$$

where $\Pi(D, \Delta)$ are the profits that the households receive as owners of the domestic financial intermediaries and $\sum_{j=bg,dg,p} (1 - I^j(D, \Delta))\Delta^j$ are the realized resource costs of the government's default and/or interference decisions.

Problem of the Domestic Financial Intermediaries: The domestic financial intermediaries take as given the domestic riskless interest rate R and the price for private external borrowing $q^p(D)$ and the government decisions to default on public domestic debt and to interfere with private external debt contracts as a function of the borrowing decisions of households, government, and all other financial intermediaries, where $D = (D^p, B^g, D^g)$.

We assume that the total stocks of domestic and external public borrowing by the government B^g and D^g in the vector D are fixed by government policy. Thus, if an individual intermediary chooses to increase his lending to the domestic government b^g at the margin, he does not cause a change in the total stock of domestic public debt B^g outstanding and hence he does not perceive a direct impact of his lending on the price of that debt.

In contrast, the total stock of private external borrowing is a function of the decentralized borrowing decisions of the N individual domestic financial intermediaries. If we let d^p denote the private external borrowing of an individual intermediary and $\frac{N-1}{N} D^p$ denote the total private external borrowing of the other $N - 1$ intermediaries, then the total

external private borrowing is $\frac{N-1}{N}D^p + d^p$. Thus, if an individual intermediary chooses to increase his external borrowing d^p at the margin, he does cause a change in the total stock of private external debt outstanding and hence he does perceive a direct impact of his lending on the price of that debt.

In the domestic economy, each of these financial intermediaries engages in Bertrand competition in providing funds to households and governments in the domestic capital market. Hence, each intermediary perceives a demand function for domestic loans to households that is kinked at the equilibrium value of R. That is, an intermediary makes no loans to households if it offers an interest rate greater than R and it captures the entire domestic market for such loans if it offers an interest rate less than R. Likewise, each intermediary perceives a demand function for loans to the domestic government that is kinked at the equilibrium value of $q^{bg}(D)$.

The profits for each intermediary in the second period as a function of government policy and its lending decisions are

$$\pi(b^p, b^g, d^p; D, \Delta) = b^p + I^{bg}((\frac{N-1}{N}D^p + d^p, B^g, D^g), \Delta)b^g - \tag{10}$$

$$I^p((\frac{N-1}{N}D^p + d^p, B^g, D^g), \Delta)d^p$$

where $\frac{N-1}{N}D^p$ denotes the external borrowing of the other $N-1$ financial intermediaries.

The intermediaries cash flow constraint in the first period is

$$\frac{1}{R}b^p + q^{bg}(\frac{N-1}{N}D^p + d^p, B^g, D^g)b^g = q^p(\frac{N-1}{N}D^p + d^p, B^g, D^g)d^p \tag{11}$$

Each intermediary chooses b^p, b^g, and d^p to maximize expected profits in the second period

$$\int \pi(b^p, b^g, d^p; D, \Delta)dF(\Delta)$$

subject to the cash flow constraint in the first period.

To have the domestic financial intermediaries be indifferent between lending to government or households, we must have in equilibrium

$$q^{bg}(D) = \frac{1}{R}\int I^{bg}(D, \Delta)dF(\Delta) \tag{12}$$

Definition of an Equilibrium: A symmetric (across financial intermediaries) equilibrium is private consumption $(C_1, C_2(D, \Delta))$, financial variables $(B^p, B^g, D^p, D^g, \Pi)$, a domestic interest rate R, price functions for privately issued external debt $q^p(D)$ as well as

domestically held and foreign held public debt, $q^{bg}(D)$, $q^{dg}(D)$, and government policies for public expenditures $(G_1, G_2(D, \Delta))$, taxes $(\tau_1, \tau_2(D, \Delta))$, default decisions $I^p(D, \Delta)$, $I^{bg}(D, \Delta)$, and $I^{dg}(D, \Delta)$ such that the household's utility maximization problem is solved given taxes, profits, and the domestic interest rate, the financial variables solve the financial intermediaries' profit maximization problems given the domestic interest rate and the international private external bond price and domestic public debt bond price functions, these bond price functions satisfy equations (5), (6), and (12), government policy satisfies budget constraints (3) and (4), and government policy in period 2 maximizes household welfare.

5.3 Characterization of Equilibria with Flexible Taxes:

We now characterize equilibria when the government has flexibility in setting taxes in period 2. We first show that the government can credibly commit not to default on domestically held public debts if it has flexibility in setting taxes in period 2. This is true regardless of the costs of such a default. As a consequence of this result, this economy displays a form of Ricardian Equivalence with respect to the government's decision to issue domestically held public debt. We then use this result to show that a country with flexible taxes and a government that *can* commit not to interfere with external private debt contracts (due to high costs of such interference) can implement the unconstrained optimal allocation as an equilibrium allocation and hence will face neither a binding public debt constraint nor a binding external debt constraint regardless of the costs of default on public debts, either domestic or external. We identify this case with the experience of Canadian provinces.

We then characterize the equilibrium private external borrowing decisions of the financial intermediaries and the equilibrium constraint on private external indebtedness when the government *cannot* commit not to interfere with private external debt contracts. This constraint, together with the constraint on public external indebtedness then determines the aggregate external debt constraint for this economy. We present conditions under which a country with flexible taxes and a commitment problem not to interfere with private external debt contracts faces a binding public debt constraint only if it also faces a binding external debt constraint. We identify this case with the experience of the southern countries of the Eurozone.

In the next section we then turn to the case of inflexible taxes which we identify with the experience of California.

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The default and/or interference decision of the Government with flexible taxes: In the second period, the government chooses its policies to maximize the welfare of the household

$$u(C_2) + u(G_2)$$

taking as given the outstanding debts of all parties and the realized values of the three default costs Δ.

The private consumption of the household is given as a function of government policies and default costs by equation (9). Plugging in the profits of financial intermediaries as a function of policies from (10) gives private consumption as

$$C_2(D, \Delta) = Y_2 - \sum_{j=bg,dg,p} (1 - I^j(D, \Delta))\Delta^j - \tau_2 + I^{bg}(D, \Delta)B^g - I^p(D, \Delta)D^p \quad (13)$$

It is clear that in period $t = 2$, the government will choose to interfere with private external debt contracts if $D^p > \Delta^p$ since, from equation (13) such interference directly raises the resources available to the household for private consumption and/or paying taxes. Thus, in equilibrium, we have the decision to interfere with private external debts is given by $I^p(D, \Delta) = 1$ if $D^p \leq \Delta^p$ and 0 otherwise.

If the government is fully free to set taxes as it pleases in period 2, then it maximizes welfare by setting taxes τ_2 to equalize private and public expenditure ($C_2 = G_2$) and it chooses to default on external public debt if $D^g > \Delta^{dg}$ as this default would raise the resources available for combined private and public consumption. Thus, we have that in equilibrium with fully flexible taxes, we have that the decision to default on external public debt is given by $I^{dg}(D, \Delta) = 1$ if $D^g \leq \Delta^g$ and 0 otherwise.

Note as well that if government has full flexibility to choose taxes τ_2 in period $t = 2$, then there is no benefit to default on domestically held public debt because such a default imposes a cost Δ^{bg} reducing resources available for private and public consumption that does not need to be incurred if taxes rather than domestic default is used to finance government expenditures. Thus, when taxes are fully flexible, we have that in equilibrium $I^{bg}(D, \Delta) = 1$ for all (D, Δ). Putting this together gives us that private and public consumption in period 2 are given by

$$C_2(D, \Delta) = G_2(D, \Delta) = \frac{1}{2} \left(Y_2 - \min\{D^p, \Delta^p\} - \min\{D^g, \Delta^{dg}\} \right) \quad (14)$$

Equilibrium Pricing of Debt: Given the default and/or interference decisions found above, we have that

$$q^p(D) = Prob(\Delta^p \geq D^p) \quad (15)$$

and

$$q^{dg}(D) = Prob(\Delta^{dg} \geq D^g) \tag{16}$$

Since $I^{bg}(D, \Delta) = 1$ for all (D, Δ) with flexible taxes in period 2, we have from equation (12) that the price in period 1 of domestically held government debt q^{bg} is equal to the inverse of the domestic riskless interest rate R.

Private External Borrowing in Equilibrium: With flexible taxes, there is no default on domestically held public debt, so all domestic loans by the financial intermediary are riskless. Each individual financial intermediary takes as given the pricing function $q^p(D)$ for private external debt and chooses its external borrowing d^p to maximize expected profits taking as given the aggregate of the external borrowing decisions of the other intermediaries $(N-1)D^p/N$. Using equation (15) describing the equilibrium price international creditors charge for loans to financial intermediaries, the result that domestic public debt is priced at $1/R$, and equation (11) describing financial intermediaries' constraint on first period domestic lending and external borrowing, we can express equilibrium profits of each financial intermediary as

$$\int \pi(b^p, b^g, d^p; D, \Delta) dF(\Delta) = (R-1)\,Prob(\Delta^p \geq \frac{N-1}{N}D^p + d^p)d^p \tag{17}$$

Given that each financial intermediary chooses d^p in a decentralized manner to maximize profits, there are two possible configurations of private external debt chosen in equilibrium. In one configuration, the country faces a binding external debt constraint, so that $R > 1$. In the other, it does not, so $R = 1$.

In the case that the country faces a binding external debt constraint so that $R > 1$, to maximize profits, each financial intermediary borrows as much as possible from the international creditors in terms of maximizing the price times the quantity of his individual external borrowing in period 1. In a symmetric equilibrium, the aggregate level of such borrowing is the solution $(\bar{d}^p, \bar{D}^p)$ of the following two equations in two unknowns

$$\bar{d}^p \in arg \max_{d^p \in [0, Y_1 + Y_2]} Prob(\Delta^p \geq \frac{N-1}{N}\bar{D}^p + d^p)d^p \tag{18}$$

and $\bar{d}^p = \bar{D}^p/N$. The magnitude of this maximal private external indebtedness $\bar{D}^p$ depends on the distribution of the resource cost Δ^p. For example, if Δ^p is deterministic, then the debt pricing function given by its distribution $Prob(\Delta^p \leq D^p)$ is discontinuous dropping from 1 to 0 at $D^p = \Delta^p$ and $\bar{D}^p$ occurs at this point of discontinuity. On the other hand, if Δ^p is stochastic and its CDF $D(\Delta^p)$ has density $h(\Delta^p)$, then $\bar{D}^p$ occurs at

a point at which

$$1 - H(\bar{D}^p) - \frac{\bar{D}^p}{N}h(\bar{D}^p) = 0 \tag{19}$$

(recall that we use $d^p = D^p/N$ in deriving this expression).

In the case that the country does not face a binding external debt constraint, so that $R = 1$, the domestic financial intermediaries are willing to obtain $D^p \in [0, \bar{D}^p]$ in private external debt to finance domestic borrowing $B^p + B^g$ desired by households and government at domestic riskless interest rate of $R = 1$.

This analysis makes clear that our model's implications for spreads on private external borrowing are determined by the distribution of the default cost Δ^p. Specifically, this spread is given by $S(D^p) = 1/Prob(\Delta^p \geq D^p) - 1$. For example, if this cost is deterministic, then the function $Prob(\Delta^p \geq D^p)$ is a step function that drops from 1 to 0 as D^p rises above $\bar{D}^p$. In this case, since equilibrium $D^p \leq \bar{D}^p$, the equilibrium spread on private external borrowing is always equal to zero because there is no default in equilibrium. In contrast, if $Prob(\Delta^p \geq D^p)$ is smoothly differentiable and has support with a lower bound of zero, then the equilibrium spread on private external borrowing is positive for any positive level of private external borrowing. In equilibria in which the country is not constrained in its external borrowing, so $R = 1$, this spread is a smooth function of the level of external borrowing $D^p \leq \bar{D}^p$ driven by the savings decisions of the households and government. In equilibria in which the country is constrained in its external borrowing, the level of such borrowing is given by the external constraint $\bar{D}^p$ and the corresponding spread is given as above.

Flexible Taxes and commitment not to interfere with private external debt contracts is enough to ensure that neither external nor public borrowing constraints bind We now derive our key results regarding equilibrium in the version of the model in which the government is free to choose taxes fully flexibly.

We first show that with flexible taxes, if the government can commit not to interfere with private external debt contracts, then neither the external nor the public debt constraint can bind in the first period. That is, as long as the costs of sovereign interference with private contracts are large enough, then the country is able to achieve the unconstrained first best allocation borrowing abroad as necessary. This result holds independently of the resource costs Δ^{bg} and Δ^{dg} of defaulting on domestic and external public debt.

Proposition 1: Assume that $\Delta^p \geq \frac{1}{2}(Y_2 - Y_1)$ with probability 1 and taxes are fully flexible. Then neither the external debt constraint nor the public debt constraint bind.

Proof: We prove this result by showing that the unconstrained optimal allocation in equation (1) can be implemented as an equilibrium. Recall that D^* denotes the level of external debt needed to fund the unconstrained optimal allocation for the country. By assumption, we have that

$$Prob(\Delta^p \geq D^*) = 1$$

so that the domestic financial intermediaries are able to borrow the unconstraint optimal level of external debt D^* abroad privately at the international riskless interest rate of 1.

To show that the unconstrained socially optimal allocation (1) can actually be implemented as an equilibrium allocation, we must show that the government is able to obtain the resources it needs in each period to pay for the optimal level of public good provision $G_1^* = G_2^* = \frac{1}{4}(Y_1 + Y_2)$. If we assume that the government has no constraints on its choice of taxes, then this can be accomplished simply be setting taxes $\tau_1 = \tau_2 = (Y_1 + Y_2)/4$ and having the government run a balanced budget with $G_1 = \tau_1$ and $G_2 = \tau_2$. With a balanced budget, it is clear that both domestic and external public debt are equal to zero $(B^g = D^g = 0)$. Thus, from equations (13) and (4) we have that the government has no incentive to default on public debts held domestically or abroad.

Note that with these taxes, the household then has after tax wealth of $(Y_1 + Y_2)/2$ and faces a domestic interest rate of $R = 1$. In equilibrium, the household then consumes the socially optimal levels of private consumption $C_1 = C_2 = (Y_1 + Y_2)/4$ and borrows internationally through the domestic financial intermediaries $D^p = C_1 + \tau_1 - Y_1 = (Y_2 - Y_1)/2$. Note since the domestic interest rate $R = 1$ and the price at which the domestic financial intermediaries are able to borrow from abroad is $q^p(D) = 1$, the equilibrium profits of these intermediaries are $\Pi = 0$. Thus this allocation can be implemented as an equilibrium. $\square$

We next show that a form of Ricardian Equivalence concerning domestically held public debt holds.

Ricardian Equivalence with Flexible Taxes and Commitment not to interfere with private external debt contracts   Note that it is not necessary for the government to run a balanced budget to implement the unconstrained socially optimal allocation when the government can commit not to interfere with private external debt contracts $(\Delta^p \geq \frac{1}{2}(Y_2 - Y_1)$ with probability 1) and taxes are fully flexible. Instead, as we have shown above, with flexible taxes, the government can credibly commit not to default on domestic public debt regardless of the costs of such a default. As a result, as we show in the next proposition, the equilibrium satisfies a particular form of Ricardian equivalence with regard to domestically issued public debt.

Proposition 2: Assume that $\Delta^p \geq \frac{1}{2}(Y_2 - Y_1)$ with probability 1 and taxes in the second period τ_2 are fully flexible. Then it is possible to implement the unconstrained socially optimal allocation as an equilibrium with any values of government borrowing from domestic financial intermediaries $B^g \leq \frac{1}{4}(Y_1 + Y_2) = G_1^*$ even if the costs of defaulting on public debt Δ^{dg} and Δ^{bg} are arbitrarily low.

Proof: The proof of this proposition relies on the observation from equations (13) and (4) that, in period 2, default on domestically held public debt has the equivalent impact on the resources available for private and public expenditure as an increase in taxes, except that it entails a reduction in resources available for private and public consumption in period 2 of Δ^{bg}. Thus, as long as the costs of default on public debt $\Delta^{bg} > 0$, the government will strictly prefer to raise taxes to repay domestically held public debt rather than choosing to default on that debt. Even if these costs are zero, the government will weakly prefer to use taxes rather than default on domestic debt in period $t = 2$ to finance government expenditure. $\qquad\square$

Note that our Ricardian Equivalence result does not apply to public external borrowing. That is, if low realizations of the resource cost Δ^{dg} are possible, then public external borrowing may lead to costly default in equilibrium which would imply that it would not be possible to implement the unconstrained socially optimal allocation.

We interpret Propositions 1 and 2 as appropriate for Canadian Provinces with commitment not to interfere with private debt contracts and flexible taxes. We argue that these provincial governments are able to issue a substantial amount of public debt held by domestic residents with little apparent risk of binding external or public debt constraints.

Flexible taxes and binding external and public debt constraints Up to this point, we have shown that in an economy with flexible taxes and in which the costs of interfering with private external debt contracts Δ^p are always high enough so that the government can credibly commit not to do so at the unconstrained optimal level of external debt D^*, neither the external nor the public debt constraint can be binding in period 1. We now turn to consider the case in which the costs of interfering with private contracts may be low enough such that the government does wish to interfere with these contracts for at least some realizations of Δ^p. What possible patterns of binding external and public debt constraints can be observed in equilibrium? The answer to this question depends in part on the distribution of default costs Δ.

We first show that if the resource costs of sovereign interference and/or default Δ are deterministic, if the government has the flexibility to set taxes in period 2 as they please, and if the government has chosen its mix of domestically held and foreign held public

debt optimally in period 1, then we have that if the public debt constraint is binding in equilibrium, then the external debt constraint must be binding as well.

Proposition 3: Assume that the resource costs of sovereign interference and/or default Δ are deterministic. If the government has full flexibility in setting taxes and if the government chooses its financial and fiscal policies in period 1 to maximize household welfare, then in any equilibrium, if the public debt constraint is binding in period 1, then the external debt constraint is binding as well.

Proof: As we have shown above, when the costs of default are deterministic, the equilibrium price of private external debt is then $q^p(D) = 1$ if $D^p \le \Delta^p$ and zero otherwise. Likewise, the equilibrium price of public external debt is $q^{dg}(D) = 1$ if $D^g \le \Delta^{dg}$ and zero otherwise. Thus, the total combined amount of resources that this country can borrow from abroad in period 1 is $q^p(D)D^p + q^{dg}(D)D^g \le \Delta^p + \Delta^{dg}$.

Clearly, if this limit on external debt $\Delta^p + \Delta^g$ is exceeds the external debt D^* required to implement the unconstrained socially optimal allocation, then it will be possible to implement that allocation as an equilibrium outcome. This result follows from the logic of Proposition 2. That is, government can set is external borrowing to its upper limit $D^g = \Delta^{dg}$ and then the financial intermediaries maximize profits by borrowing $D^p = D^* - \Delta^g$ and lending to households and government as necessary at domestic riskless interest rate $R = 1$ to finance the unconstrained optimal levels of private and public consumption.

Now consider the case in which the limit on external debt $\Delta^p + \Delta^g < D^*$ so that it is not possible to implement the unconstrained optimal allocation. By adding up the budget constraints of the household and the government in period 1 and imposing the constraints on external debt imposed by Δ^p and Δ^{dg}, we have $C_1 + G_1 < Y_1 + D^* = \frac{1}{2}(Y_1 + Y_2)$. From equation (14), we have that $C_2 = G_2 \ge \frac{1}{4}(Y_2 - \Delta^p - \Delta^{dg}) \ge \frac{1}{4}(Y_1 + Y_2)$. Hence, in equilibrium, we must have either the external debt constraint binding ($u'(C_1) > u'(C_2)$) or the public debt constraint binding ($u'(G_1) > u'(G_2)$) or both.

To show that both the public and the external debt constraints must bind at the same time, we must use the assumption that the government has also chosen fiscal policy in period 1 to maximize welfare subject to its limited power of commitment. What the government would like to do in period 1 to maximize welfare is to choose taxes τ_1 and/or domestic public borrowing B^g to equate private and public consumption $C_1 = G_1$ in period 1 as well as in period 2. Given the constraint on overall external borrowing given by $\Delta^p + \Delta^g < D^*$, this means that in an equilibrium in which financial and fiscal policies are chosen optimally in period 1 as well as in period 2, we have both the external debt

constraint and the public debt constraint binding. This requires that

$$C_1 = G_1 = \frac{1}{2} \left(Y_1 + \Delta^p + \Delta^{dg} \right),$$

$$C_2 = G_2 = \frac{1}{2} \left(Y_2 - \Delta^p - \Delta^{dg} \right),$$

The corresponding domestic interest rate $R = u'(C_1)/u'(C_2) > 1$, and taxes τ_1 and τ_2 and domestic private and public borrowing B^p, B^g are set as needed to finance these expenditures. It is sufficient to set taxes at $\tau_1 = G_1 - D^g$ and $\tau_2 = G_2 + D^g$ with $B^g = 0$. Alternative configurations are also feasible due to the Ricardian Equivalence in domestically held debt. $\square$

In this case with deterministic costs of sovereign interference and default, it is straightforward to find the constrained optimal equilibrium because no default occurs in equilibrium. We now discuss the case with stochastic default costs Δ. Specifically, consider a case in which the costs of interference with private external debt contracts Δ^p has CDF $H(\Delta^p)$ and density $h(\Delta^p)$ and the costs of default on external public debts Δ^{dg} has CDF $J(\Delta^{dg})$ and density $j(\Delta^{dg})$. (Recall that with flexible taxes we do not need to make assumptions about the distribution of the costs of default on domestically held public debts.)

In this case, the maximum level of external private debt that the domestic financial intermediaries will borrow in any equilibrium is given by $\bar{D}^p$ found as a solution to equation (19). In any equilibrium in which $R > 1$, the intermediaries will borrow this full amount from abroad raising funds $(1 - H(\bar{D}^p))\bar{D}^p$ in period $t = 1$. The government will then choose its external borrowing D^g to be repaid in period $t = 2$ facing bond price $(1 - J(D^g))$ in period $t = 1$. To maximize ex ante welfare, the government will choose taxes and/or domestic public borrowing to set period 1 public and private consumption as a function of its public external borrowing D^g

$$C_1(D^g) = G_1(D^g) = \frac{1}{2} \left(Y_1 + (1 - H(\bar{D}^p))\bar{D}^p + (1 - J(D^g))D^g \right)$$

and

$$C_2(D^g, \Delta^p, \Delta^{dg}) = G_2(D^g, \Delta^p, \Delta^{dg}) = \frac{1}{2} \left(Y_2 - \min\{\Delta^p, \bar{D}^p\} - \min\{\Delta^{dg}, D^g\} \right)$$

to maximize welfare given by

$$2 \left[u(C_1(D^g)) + \int \int u(C_2(D^g, \Delta^p, \Delta^{dg}))h(\Delta^p)j(\Delta^{dg})d\Delta^p d\Delta^{dg} \right]$$

Clearly, because the government maximizes welfare by setting taxes and/or domestic borrowing to equate private and public consumption in each date and state of nature, we again have in this case that if the external debt constraint binds in period 1, then the public debt constraint also binds.[40] That is, when the equilibrium domestic riskless interest rate in period 1 exceeds the international riskless interest rate, then the marginal social utility of government expenditure in period 1 also exceeds the expected marginal social utility of government expenditure in period 2.

We now turn to a comparison of the spread on private external borrowing and public external borrowing in an equilibrium in which the country faces a binding external borrowing constraint. We do so in the next proposition.

Proposition 4: Assume that the costs of sovereign interference with private external debt contracts Δ^p and the costs of default on public external debt Δ^{dg} are stochastic with distributions with densities h and j and that these distributions functions $H(\Delta^p)$ and $J(\Delta^{dg})$ are identical with monotone increasing hazard $h(\Delta)/(1 - H(\Delta))$. Then, the spread on private external debt $S^p(D)$ exceeds the spread on external public debt $S^{dg}(D)$.

Proof: From equation (8), the spread on private external borrowing is given by

$$S^p(D) = \frac{1}{1 - H(\bar{D}^p)} - 1$$

and from equation (7), the spread on public external borrowing is given by

$$S^{dg}(D) = \frac{1}{1 - J(\tilde{D}^g)} - 1$$

where $\tilde{D}^g$ is the government's welfare maximizing choice of public external debt D^g. Under the assumption that the distribution functions are identical (so $H(D) = J(D)$), then we have that the spread on external private debt exceeds the spread on public external debt if and only if $\tilde{D}^g < \bar{D}^p$. We now prove that the equilibrium level of external public debt is indeed smaller than the equilibrium level of external private debt when the distribution function of the costs of default has a monotone increasing hazard function.

When the distribution of the cost of default on public external debt has density $j(\Delta^g)$, then the optimal choice of public external debt solves the first order condition

$$u'(G_1) \left[1 - J(\tilde{D}^g) - \tilde{D}^g j(\tilde{D}^g) \right] = \int_{\tilde{D}^g}^{\infty} \int u'(G_2(\tilde{D}^g, \Delta^p, \Delta^{dg})) h(\Delta^p) j(\Delta^{dg}) d\Delta^p d\Delta^{dg}$$

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[40]We have not proved the converse that if the public debt constraint binds, then the external debt constraint must also bind in this case.

Hence

$$\left[1 - J(\tilde{D}^g) - \tilde{D}^g j(\tilde{D}^g)\right] > 0 = \left[1 - H(\bar{D}^p) - \frac{\bar{D}^p}{N} h(\bar{D}^p)\right]$$

This inequality implies that

$$\frac{1 - J(\tilde{D}^g)}{j(\tilde{D}^g)} - \tilde{D}^g > \frac{1 - H(\bar{D}^g)}{h(\bar{D}^g)} - \frac{\bar{D}^g}{N} \geq \frac{1 - H(\bar{D}^g)}{h(\bar{D}^g)} - \bar{D}^g$$

The result then follows from the assumption that the hazards $j(D)/(1 - J(D))$ and $h(D)/(1 - H(D))$ are equal and monotone increasing. $\qquad\square$

The proposition shows that the model generates private overborrowing, $\tilde{D}^g < \bar{D}^p$, with private spreads exceeding public spreads. Such overborrowing occurs because of two reasons. The first reason, which is similar to that in Wright (2006), is that private intermediaries do not internalize the resource costs associated with default. Intermediaries internalize that debt prices change with their borrowing due to higher default probability but they take the domestic interest rate (and hence consumption) as given. The government, on the other hand, internalizes not only that larger borrowing increases default probability but also that default carries resource costs which are costly for private and public consumption.The second reason, is the oligopolistic nature of intermediaries which makes them only partially internalize that higher borrowing increases default probability. As N grows, private borrowing relative to public borrowing increases.

5.4 Inflexible fiscal policy and binding public debt constraints:

We now consider a modified version of this economy in which the government has constraints on its ability to set taxes in period $t = 2$. In particular, assume that τ_2 is fixed at a given level as a parameter. We now show that when the government is unable to alter taxes to finance its desired level of public expenditures in period $t = 2$ because of some constraint on raising taxes, then it may be tempted to default on outstanding public debts, both external and domestic, as a substitute for taxation for raising revenue. This temptation arises when public expenditure is constrained by rigid low taxes relative to private consumption. This incentive to default on both domestic and external public debts in period 2, can lead to a binding public debt constraint in period 1, with the government unable to raise additional resources through public borrowing either domestically or abroad, even if the private sector is unconstrained in its external borrowing. We interpret this outcome as characteristic of California.

Consider the government's incentives to default on its public debts in period $t = 2$ when taxes are rigid at τ_2. As is the case in the economy with flexible taxes, the government is

tempted to default on externally held foreign debt to allow for increased public expenditure as long as the resource cost of such a default is low relative to the amount of debt outstanding (with proper adjustments of the default threshold for the marginal social utility of public expenditure relative to the marginal social utility of private expenditure). What is different in the case of inflexible taxes is that now the government may also be tempted to default on domestically held public debt even if such a default entails a resource cost that reduces private expenditure over and above the reduction due to the default on the debt itself. This is because, with inflexible taxes, the government has no alternative means of raising revenue other than default on its public debts. Thus, in this environment with fiscal inflexibility, in contradiction to the case with fiscal flexibility, it is possible for the country to face a binding public debt constraint without facing a binding external debt constraint.

These incentives for government to default on its public debts can be seen more clearly as follows. Note from the consumer's budget constraint after substituting out for the profits of financial intermediaries in equation (13), for any realized values of debt and costs of default (D, Δ), we have

$$C_2(D, \Delta) = Y_2 - \tau_2 - \Delta^{bg} - \Delta^{dg} - \Delta^p + I^{bg}(B^g + \Delta^{bg}) + I^{dg}\Delta^{dg} - I^p(D^p + \Delta^p)$$

and, likewise from the government budget constraint (4), we have

$$G_2(D, \Delta) = \tau_2 - I^{bg}B^g - I^{dg}D^g.$$

Given realized values of (D, Δ), government's equilibrium default decisions on domestically and externally held public debt are the choices of I^{bg} and I^{dg} in the interval $[0, 1]$ that maximize welfare $u(C_2) + u(G_2)$ with private and public consumption given by the expressions above.

This characterization of the government's default decision implies that it is optimal for government to default on its external public debts when

$$u'(G_2)D^g > u'(C_2)\Delta^{dg}$$

This result is a simple generalization of the default rule on external public debts that we found with flexible taxes since, with flexible taxes, $G_2 = C_2$, and hence, $I^{dg}(D, \Delta) = 0$ if $D^g > \Delta^{dg}$ and 1 otherwise. Here we see that if taxes are rigid and constrained to be low, so that, in equilibrium, $G_2 < C_2$, then the government will default on external debts D^g even if the costs of such a default Δ^{dg} are somewhat in excess of the amount D^g owed on

these debts because, in this case, the marginal social utility of public expenditures strictly exceeds the marginal social utility of private expenditures.

The same logic also can be used to understand the government's decision to default on domestically held public debts. Now the necessary condition for optimality of the default decision requires that default occurs when

$$u'(G_2)B^g > u'(C_2)(B^g + \Delta^{bg})$$

Note that this condition cannot be satisfied in the economy with flexible taxes because, with flexible taxes, $G_2 = C_2$ and hence $u'(G_2) = u'(C_2)$. This logic delivered us the result that a government with flexible taxes could credibly commit to repay its domestically held public debts in period $t = 2$ regardless of the costs of default on these debts. With rigid taxes, however, it is possible that in equilibrium, we have that $G_2 < C_2$ and hence we may have that in equilibrium, the marginal social utility of public expenditures strictly exceeds the marginal social utility of private expenditures. In this case, we have that government will wish to default on its domestically held public debts whenever those debts are large enough relative to the costs of default so that

$$\frac{B^g}{B^g + \Delta^{bg}} > \frac{u'(C_2)}{u'(G_2)}$$

To develop an example economy in which the government does in fact face a binding public debt constraint in equilibrium with inflexible taxes, assume that τ_2 be fixed as a parameter and assume that all possible realizations of Δ satisfy

$$\Delta^{bg} + \Delta^{dg} < Y_2 - 2\tau_2. \tag{20}$$

This inequality (20) implies that $C_2(D, \Delta) > G_2(D, \Delta)$ for all values of D and Δ even if government defaults on all of its public debt both domestic and external. We can then say that the government must necessarily default on its external public debts whenever

$$\frac{D^g}{\Delta^{dg}} > \frac{u'(Y_2 - \tau_2 - \Delta^{bg} - \Delta^{dg})}{u'(\tau_2)}$$

and that it must necessarily default on its domestically held public debts whenever

$$\frac{B^g}{B^g + \Delta^{bg}} > \frac{u'(Y_2 - \tau_2 - \Delta^{bg} - \Delta^{dg})}{u'(\tau_2)}.$$

We can develop an example of a binding public debt constraint most simply in an

economy with inflexible taxes τ_2 in which the default costs Δ are deterministic. In this case, the government is able to raise up $\bar{D}^g$ in external public debts in period 1 at price $q^{dg}(D) = 1$ for $D^g \leq \bar{D}^g$ and zero otherwise, where

$$\bar{D}^g = \frac{u'(Y_2 - \tau_2 - \Delta^{bg} - \Delta^{dg})}{u'(\tau_2)} \Delta^{dg}.$$

Furthermore, as long as inequality (20) is satisfied, the government is able to raise domestically held public debts up to $\bar{B}^g$ at price $q^{bg}(D) = 1$ for $B^g \leq \bar{B}^g$ and zero otherwise, where $\bar{B}^g$ solves

$$\frac{\bar{B}^g}{\bar{B}^g + \Delta^{bg}} = \frac{u'(Y_2 - \tau_2 - \Delta^{bg} - \Delta^{dg})}{u'(\tau_2)}.$$

The government then faces a binding public debt constraint in period 1 if the implied public debt limit $\bar{B}^g + \bar{D}^g$ together with the rigid taxes τ_1 in period 1 are not large enough to finance public expenditure $G_1 = G_2$.

6   Conclusions

When the member countries of the Eurozone established their monetary union, neither academics nor policymakers anticipated that member states might experience external debt crises.[41] Policymaker's optimism is nicely captured in The European Commission's One Market, One Money report (1990) which posits that "a major effect of EMU is that balance-of-payments constraints will disappear [..]. Private markets will finance all viable borrowers, and savings and investment balances will no longer be constraints at the national level." As described in Merler and Pisani-Ferry (2012) policymakers made no explicit provisions for addressing external debt crises among Eurozone member states. Rather, policymakers focused on constraining public debt through provisions in the Maastricht Treaty. As a result of this lack of attention to external debt, solutions to the current crisis have had to be improvised.

The academic literature has not provided clear cut guidance on how to address external debt crises within the Eurozone. In part this is because the literature is typically segmented. Most models of the risk of default on external debt consider the domestic government and private sector as a unified actor, while most models of the sustainability of public debt are conducted within closed economies. Our contribution to this literature is to integrate the analysis of default incentives on external and public debt in a simple

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[41]See, for example, Blanchard and Giavazzi (2002) who spoke of the end of the Feldstein-Horioka puzzle. See Garber 1998 for one of the rare challenges to this optimistic view.

unified model.

What lessons for addressing debt crises within the Eurozone do we draw from our analysis? First, the experiences of Canada and the United States indicate that stronger institutional foundations are needed to mitigate the risk of government interference with private contracts. The freedom of private capital flows within the US and Canada benefits from a strong legal foundation of protection under constitutional law together with federal bankruptcy law and uniform laws governing securities markets. The freedom of these capital flows has also been enhanced over time, particularly in the US, by the development of stronger federal foundations underpinning the banking system. While we have not discussed banking explicitly in this paper, the development of an integrated continent wide banking system in the US has been a gradual process carried out over two Centuries marked by repeated crisis and reform. In contrast, as discussed in Bordo et al 2011, Canada has had a strong nationwide banking system from relatively early on in its history and has been largely free of banking crises. Of course, one often noted potential benefit of establishing a stronger banking system in the Eurozone would be to reduce the risk of member government interference with private contracts in times of crisis.

Second, the institutional features governing fiscal flexibility for state and provincial governments in the US and Canada also provide lessons for the development of new fiscal institutions in Europe. As described in Sargent (2012) and Henning and Kessler (2012), US states have chosen somewhat distinctive fiscal institutions that result in equilibrium in relatively tight constraints on state government borrowing. In contrast, Canadian provincial governments enjoy much greater fiscal flexibility and as a result are able to sustain substantially higher levels of public debt. These starkly different outcomes suggest that Europe should carefully consider the implications of restrictions on the fiscal flexibility of member states for the future sustainability of public debt.

One final implication that should be developed in future work is our theoretical finding of excessive private sector external borrowing in the presence of the risk of government interference. Since Europe is proceeding with unified banking regulation in advance of developing the institutional structure to eliminate the risk of government interference in private debt contracts, regulators should be concerned that the dynamics of private external borrowing may drive future external debt crises in the Eurozone.

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Table 1: Summary Statistics for U.S. and Eurozone 5-year sovereign CDS spreads in basis points. Weekly observations from May 14, 2008 to January 5, 2011

Sovereign	Mean	Median	Min	Max
California	243.57	268.00	63.00	402.00
Texas	86.82	79.00	20.00	180.00
New York	176.95	196.00	33.00	337.00
Florida	137.10	135.00	39.00	240.00
Illinois	187.61	191.00	25.00	369.00
Massachusetts	120.93	124.00	21.00	243.00
Ohio	122.04	125.00	35.00	251.00
New Jersey	179.06	196.00	33.00	337.00
Michigan	207.45	218.00	45.00	394.00
Nevada	171.76	183.00	42.00	329.00

Sovereign	Mean	Median	Min	Max
Austria	82.78	77.82	6.80	260.90
Belgium	75.63	62.01	10.00	227.68
Finland	31.04	28.98	5.30	88.33
France	47.49	43.78	6.75	108.84
Germany	33.56	33.75	4.40	90.61
Greece	353.34	230.25	32.19	1055.41
Ireland	205.94	162.48	17.30	613.43
Italy	121.86	113.68	24.75	241.03
Netherlands	44.58	41.27	6.30	123.33
Portugal	155.43	93.84	21.33	500.02
Spain	126.61	98.83	24.25	349.90

Source: Ang and Longstaff (2013) Table 2

Table 2: Average Estimated Tax and Liquidity Adjusted 5- year Bond Spreads and CDS spreads 2011-2012

State	Default Spread	CDS Spread
Illinois	277.36	227.13
Nevada	189.85	191.14
California	182.59	268.00
Michigan	156.01	135.17
New Jersey	135.34	143.75
New York	115.86	113.29
Ohio	114.37	127.75
Massachusetts	105.38	112.63
Wisconsin	98.96	96.25
Pennsylvania	95.25	116.75
Connecticut	93.91	129.50
Minnesota	89.35	80.63
North Carolina	88.57	74.63
Maryland	74.32	86.50
Florida	138.71	
Mississippi	123.03	
Hawaii	121.49	
Maine	98.59	
South Carolina	95.02	
Tennessee	83.56	
Georgia	83.00	
New Hampshire	78.76	
Deleware	77.85	
Oklahoma	77.27	
Virginia	73.99	
Utah	71.60	

Source: Schwert (2014) Tables 6 and 7

Table 3: Indebtedness in the United States, Canada, and the Eurozone 2012

| | Liabilities to GDP | | | |
	Net Debt	Plus Unfunded	Rating	Revenue/GDP
United States				
California	5%	11%	A1	9%
Texas	1%	11%	Aaa	7%
New York	5%	7%	Aa2	11%
Florida	3%	6%	Aa1	8%
Illinois	5%	32%	A2	9%
Pennsylvania	3%	14%	Aa2	10%
Ohio	3%	6%	Aa1	10%
Georgia	3%	5%	Aaa	8%
Michigan	2%	6%	Aa2	12%
North Carolina	2%	5%	Aaa	9%
MEAN	**3%**	**10%**		**9%**
Canada				
Ontario	40%	102%	Aa2	17%
Quebec	48%	197%	Aa2	19%
British Columbia	17%	73%	Aaa	19%
Alberta	2%	68%	Aaa	19%
MEAN	**27%**	**110%**		**19%**
Europe				
Greece	170%	229%	Caa1	44%
Italy	111%	131%	Baa2	52%
Ireland	92%	147%	Baa1	34%
Portugal	119%	171%	Ba1	44%
Spain	61%	134%	Baa2	38%
MEAN	**110%**	**162%**		**42%**

Sources: United States: Larson (2013) Table 5 for net debt. Lombardi and Van Wagner (2014) Tables 3 and 7 for pension liabilities and government revenues. Moody's (2013) for ratings. Europe: IMF (2014) for net debt and government revenues. IMF (2014) Table 23a for pensions. Wilson (2014) for ratings which are for 2014. Canada: Moody's (2013) for net debt and ratings. Palacios et al. (2014) for pensions liabilities. Government/GDP series from fiscal reference tables (Department of Finance Canada).

Table 4: Net Debt to Income in U.S. States and Canadian Provinces 2008-2012

State	2008	2009	2010	2011	2012
California	4.3%	4.4%	5.6%	6.0%	6.0%
Texas	1.4%	1.4%	1.4%	1.6%	1.5%
New York	6.3%	6.3%	6.5%	6.7%	6.6%
Florida	2.8%	2.9%	2.9 %	3.0%	3.0%
Illinois	5.2%	4.6%	4.4%	5.7%	6.0%
Pennsylvania	2.4%	2.5%	2.4%	2.7%	2.8%
Ohio	2.9%	2.8%	2.6 %	2.8%	2.8%
Georgia	3.0%	3.0%	3.3%	3.3%	3.1%
Michigan	2.2%	2.2%	2.1%	2.2%	2.2%
North Carolina	2.8%	2.5%	2.3%	2.3%	2.3%
Canada					
Alberta	0.6%	2.1%	2.1%	2.1%	2.4%
British Columbia	13.4%	14.7%	14.9%	15.6%	16.8%
Ontario	27.4%	34.0%	36.1%	37.8%	40.4%
Quebec	43.4%	45.4%	47.2%	47.7%	48.3%

Sources: Larson (2013) and Moody's (2013). Data on U.S states is relative to personal income. Data on Canadian provinces is relative to gross domestic product.

Table 5: Moody's and S&P Ratings Scales

Moody's	S&P	Description
Aaa	AAA	minimal credit risk.
Aa	AA	very low credit risk.
A	A	low credit risk.
Baa	BBB	moderate credit risk. May possess certain speculative characteristics.
Ba	BB	Speculative elements, subject to substantial credit risk.
B	B	Speculative and subject to high credit risk.
Caa	CCC	Poor standing and subject to very high credit risk.
Ca	CC	Highly speculative and are likely in, or very near, default.
C	C-D	Typically in default, with little prospect for recovery of principal or interest.

Source: Moody's (2013). Moody's appends numerical modifiers 1, 2, and 3 to each generic rating classification from Aa through Caa. The modifier 1 indicates that the obligation ranks in the higher end of its generic rating category; the modifier 2 indicates a mid-range ranking; and the modifier 3 indicates a ranking in the lower end of that generic rating category. Standard and Poors uses '+' and '-' as equivalent modifiers for each generic ratings classification. ADD SOURCE S& P

Table 6: Standard and Poor's Sovereign Ratings and Transfer and Convertibility Risk Assessments for Selected Emerging Market Countries as of December 2012

Country	Local Currency Rating	Foreign Currency Rating	T&C Rating
Argentina	B-	B-	B-
Brazil	A-	BBB	A-
Bulgaria	BBB	BBB	A
Chile	AA+	AA-	AA+
China	AA-	AA-	AA-
Croatia	BB+	BB+	BBB+
Czech Republic	AA	AA-	AA+
Ecuador	B	B	B
Hungary	BB	BB	BBB
Iceland	BBB-	BBB-	BBB-
India	BBB-	BBB-	BBB+
Indonesia	BB+	BB+	BBB-
Israel	AA-	A+	AA
Korea	AA-	A+	AA-
Latvia	BBB	BBB	A
Lithuania	BBB	BBB	A
Mexico	A-	BBB	A
Peru	BBB+	BBB	A-
Poland	A	A-	A+
Russia	BBB+	BBB	BBB
Taiwan	AA-	AA-	AA+
Thailand	A-	BBB+	A
Turkey	BBB-	BB	BBB-

Source: Cavanaugh (2013)

Table 7: Moody's Sovereign Ratings and Country Ceilings for Eurozone Countries as of November 2014

Country	Government Bond Rating	Country Ceiling
Austria	Aaa	Aaa
Belgium	Aa3	Aaa
Cyprus	B3	B1
Estonia	A1	Aa2
Finland	Aaa	Aaa
France	Aa1	Aaa
Germany	Aaa	Aaa
Greece	Caa1	Ba3
Ireland	Baa1	Aa3
Italy	Baa2	A2
Latvia	Baa1	A1
Luxembourg	Aaa	Aaa
Malta	A3	A1
Netherlands	Aaa	Aaa
Portugal	Ba1	A3
Slovakia	A2	Aa2
Slovenia	Ba1	Baa1
Spain	Baa2	A1

Source: Wilson (2014)
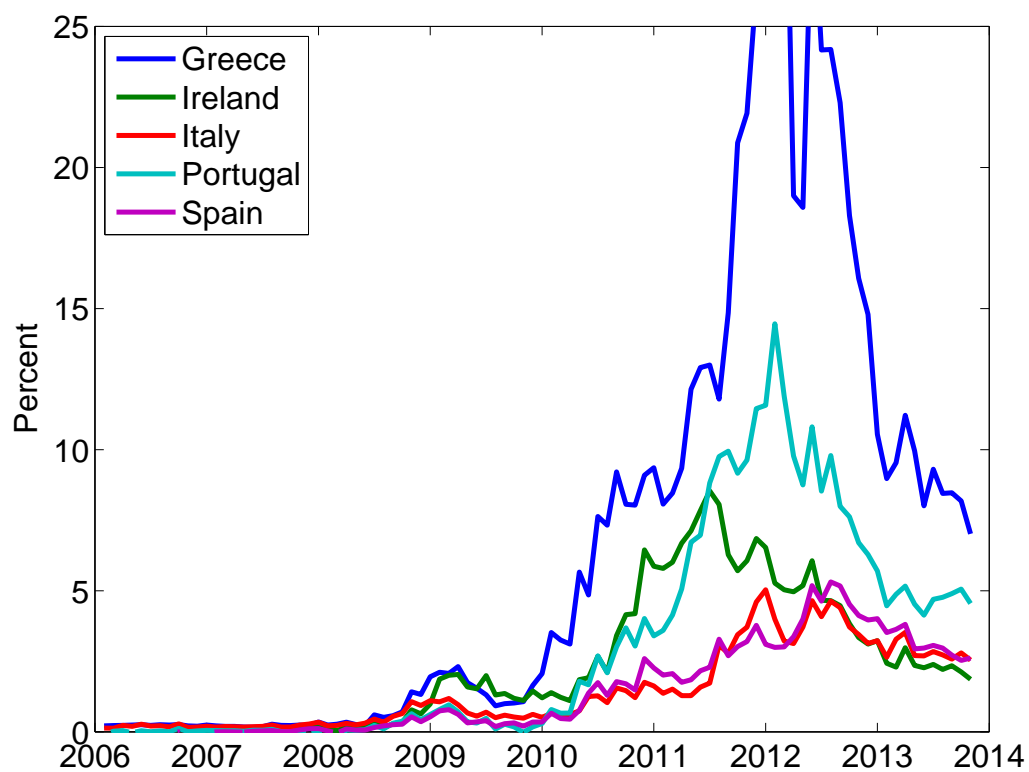
Figure 1: Spreads on Government Bonds for Eurozone Countries

Notes: Spreads are calculated as the difference between the 10-year government bond yield and each country and the German 10-year yield using monthly data. Source: Global Financial Database
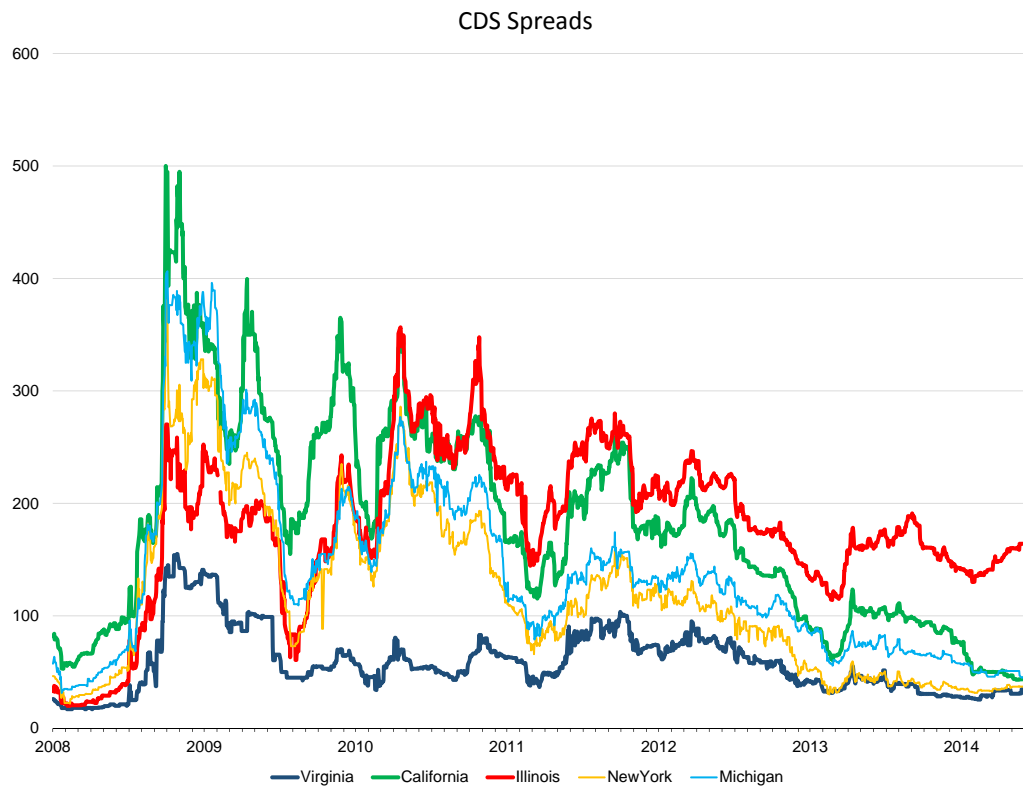
Figure 2: Credit Default Swap Spreads for U.S. States

Notes: Markit
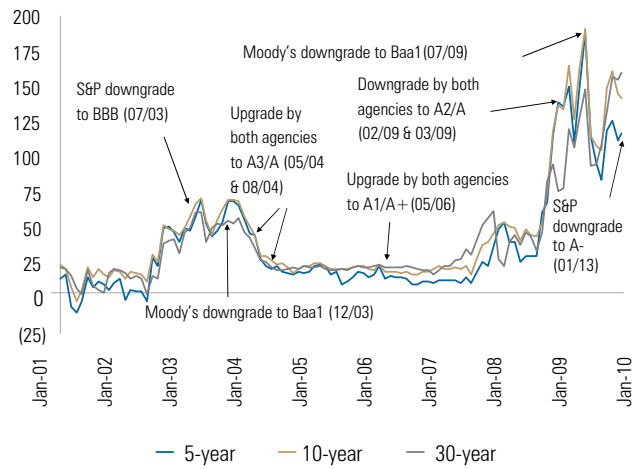
Figure 3: California Historical GO Sovereign Spreads over AAA Munis

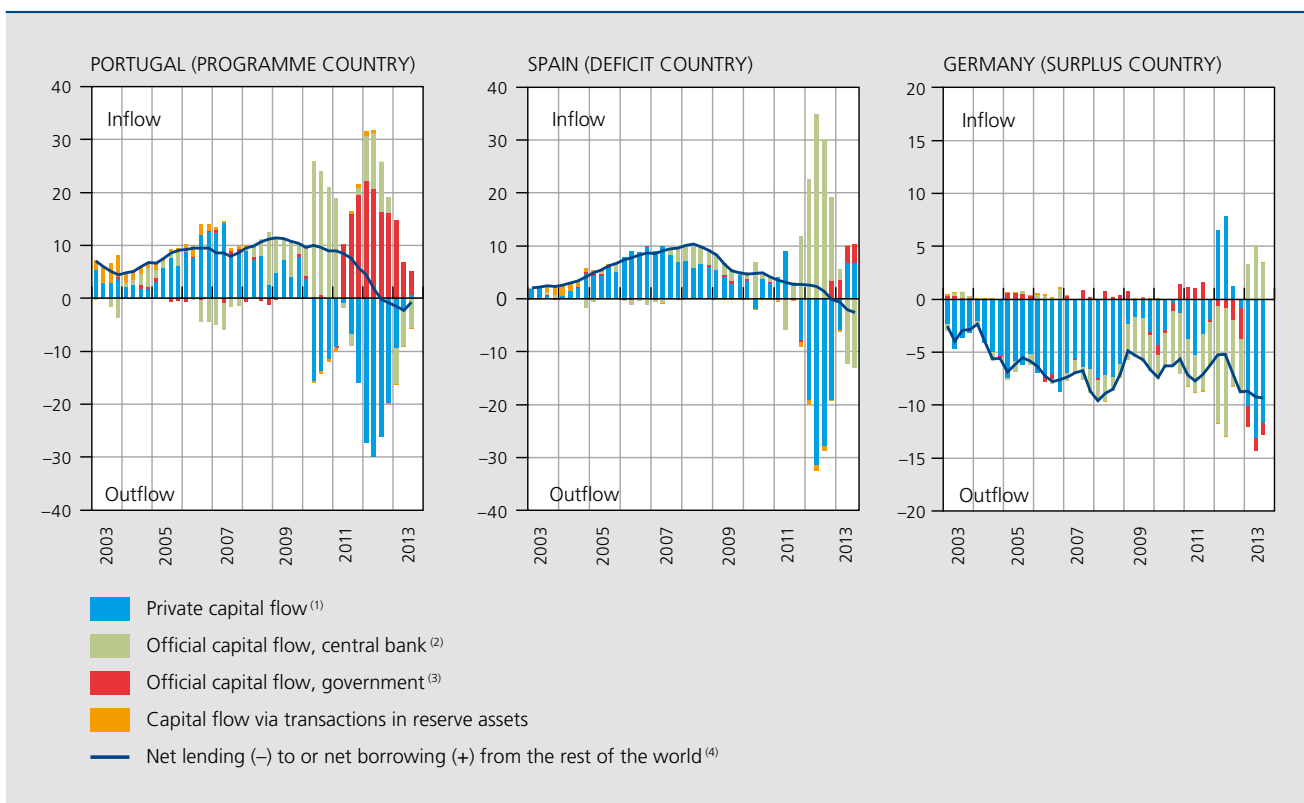Sources: WellsCap (2010) Exhibit 1 and Lockyer (2014) Figure 1

Historical 10Yr Bond Spreads
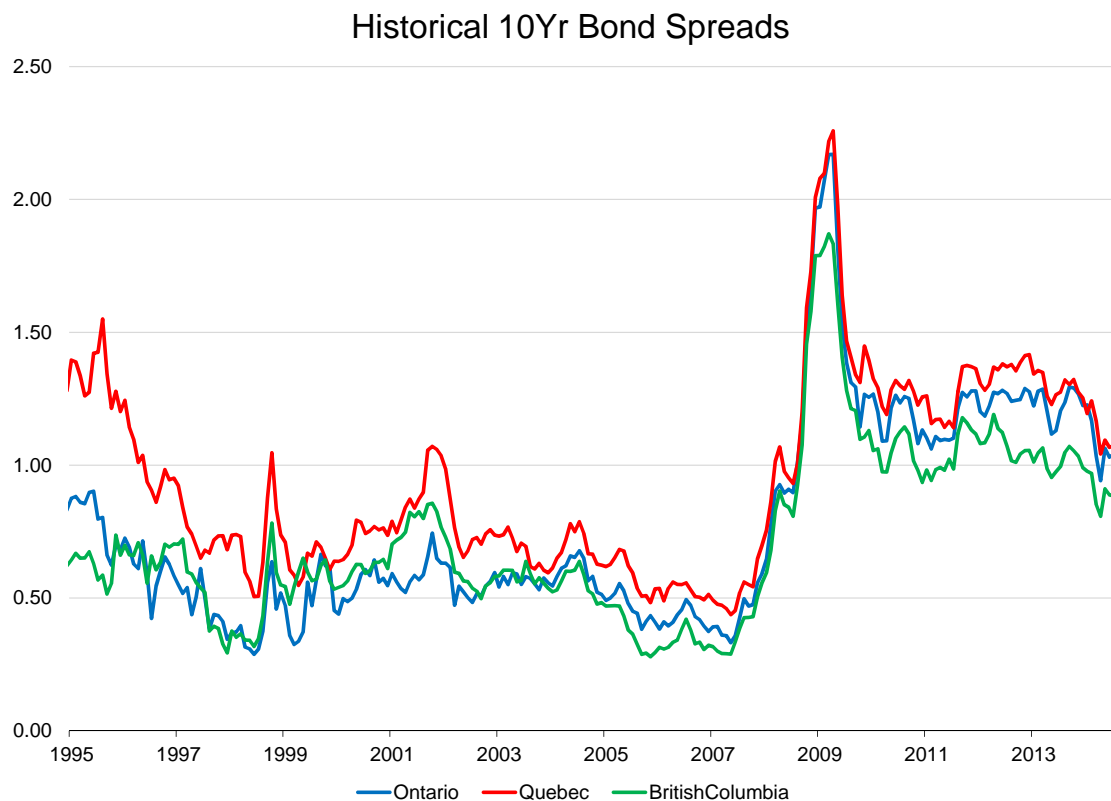
Figure 4: Spreads on Government Bonds for Canadian Provinces

Notes: Spreads are calculated as the difference between the 10-year provincial government bond yield and each country and the Canadian 10-year yield using monthly data. Source: Bank of Canada

Net Debt + Pension/Healthcare as Percentage of GDP
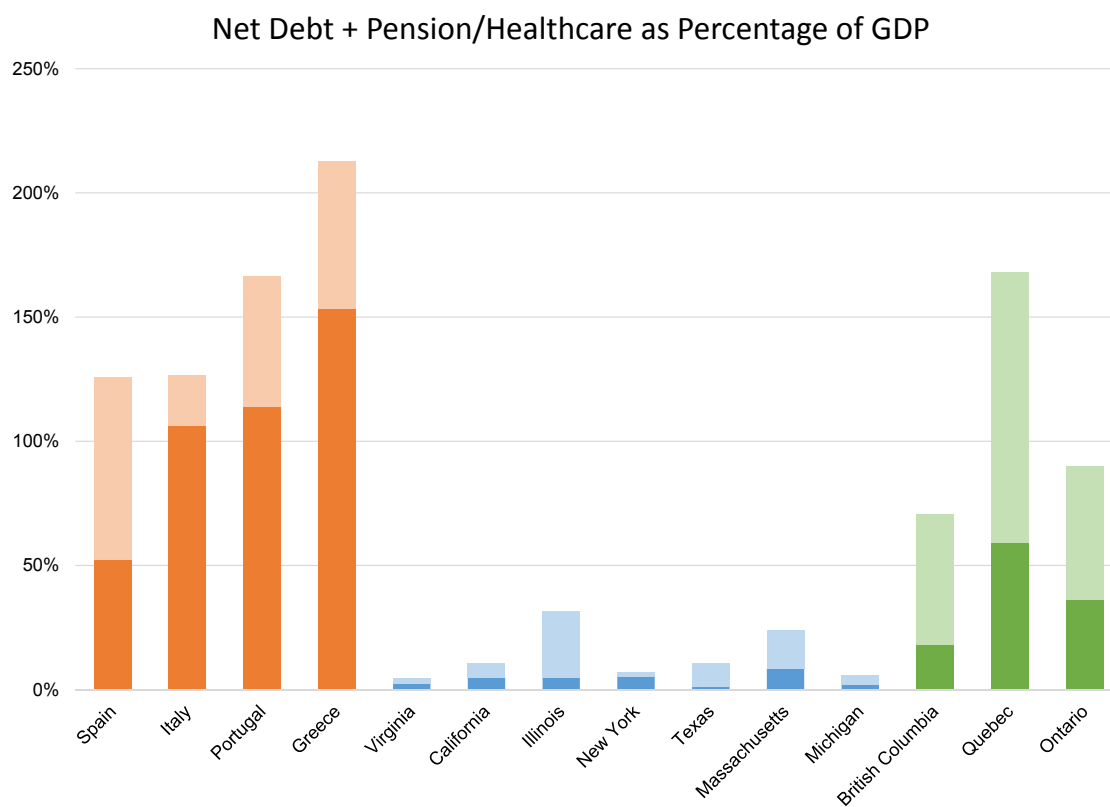
Figure 5: Net Debt and Pension/Healthcare Liabilities to GDP

Notes: See Table 3.

PORTUGAL (PROGRAMME COUNTRY)   **SPAIN (DEFICIT COUNTRY)**   **GERMANY (SURPLUS COUNTRY)**

Legend:
- Private capital flow [1]
- Official capital flow, central bank [2]
- Official capital flow, government [3]
- Capital flow via transactions in reserve assets
- Net lending (–) to or net borrowing (+) from the rest of the world [4]

Figure 6: Net Inflow and Outflow of Capital and Financing Sources (in percent of GDP)

Notes: (1) Net capital flows calculated as the difference between the financial account balance of the balance of payments and the official capital flows (via the central bank and the government, including transactions in reserve assets). (2) Net capital flows which the central bank records under "other investment" (mainly loans and deposits) in the balance of payments. (3) Net capital flows which the government records under "other investment" (mainly loans and deposits) in the balance of payments. (4) As indicated by the financial account balance. Net lending to the rest of the world is recorded as a net capital outflow (-) and net borrowing from the rest of the world is recorded as a net capital inflow (+).

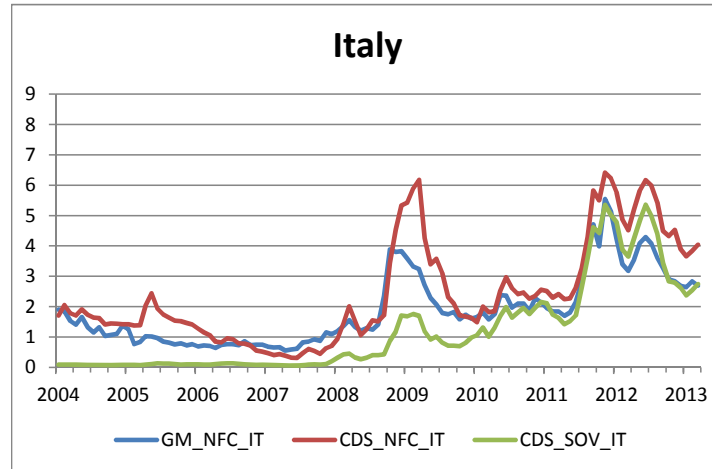Source: de Sola Perea and Van Niewenhuyze (2014) Chart 8.
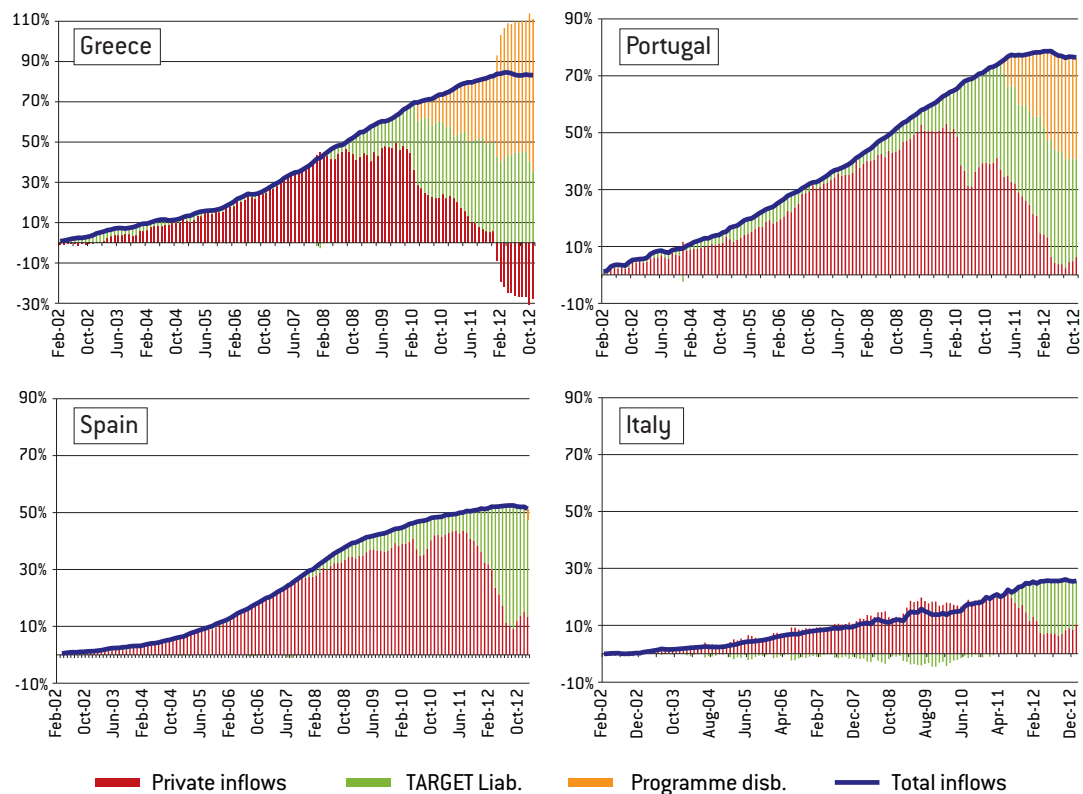
Figure 7: Private Capital Flows, Programme Financing, and Eurosystem Financing, Greece, Portugal, Italy and Spain, 2002-12 (% of 2007 GDP)

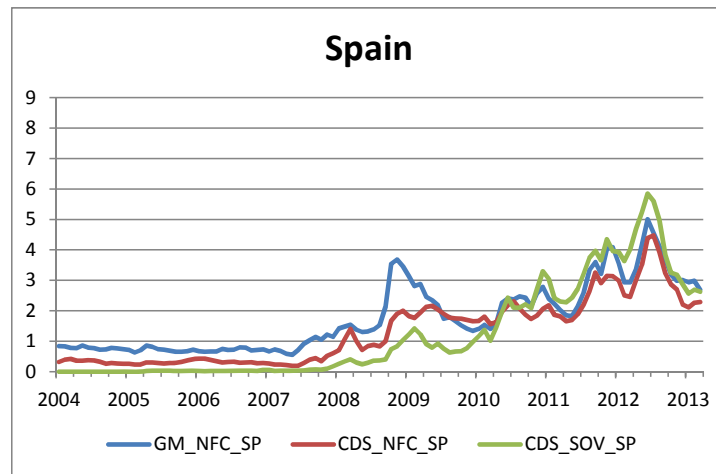Source: Pisani-Ferry et al. (2013) Figure 1.
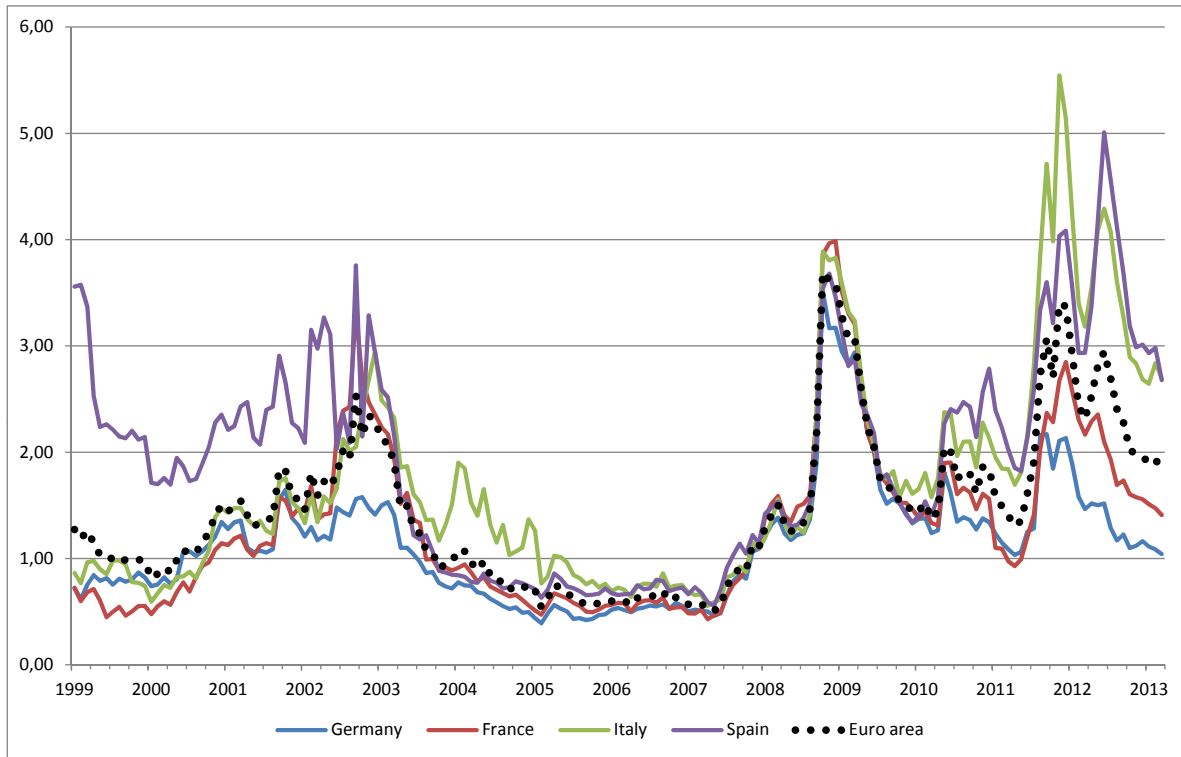
Figure 8: Euro Area Non-Financial Corporate Credit Spreads
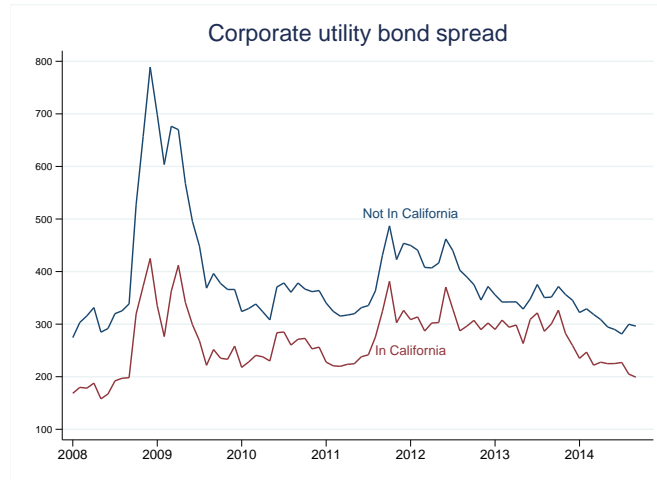
Source: Gilchrist and Mojon (2014) Figure 2

**Figure 9:** Italy Sovereign and Non-Financial Corporate Credit Spreads

Figure 10: Spain Sovereign and Non-Financial Corporate Credit Spreads

Source: Gilchrist and Mojon (2014) Figure 6

**Figure 11:** Spreads of Utility Companies Bonds

Source: Authors' calculations using data from Bloomberg and Bank of America-Merrill Lynch Index Spreads Database. Californian utilities are those utilities that are registered in California, or declare themselves domiciled in California. For each pair of years, we construct a Fisher Ideal Index of the change in option weighted adjusted spreads over US Treasuries for all bonds in the dataset in both periods. These are then chained together to form the spreads index.
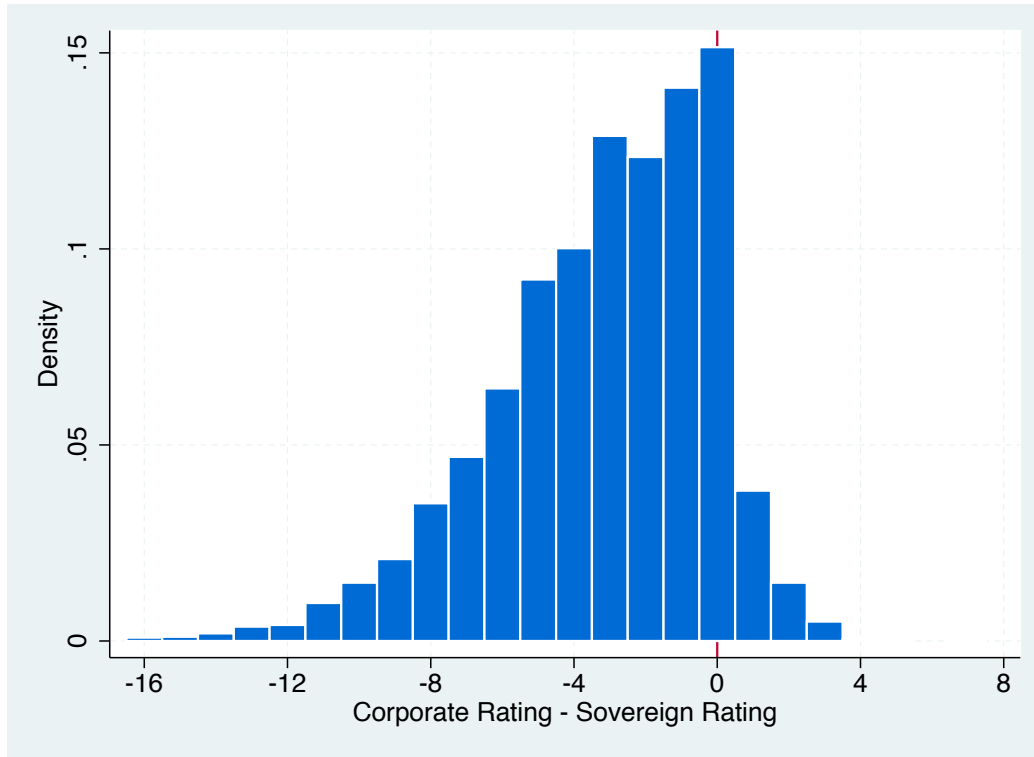
Figure 12: The Distribution of Gaps between Corporate and Sovereign Ratings

Source: Almeida et al. (2014) Figure 1 Panel B.
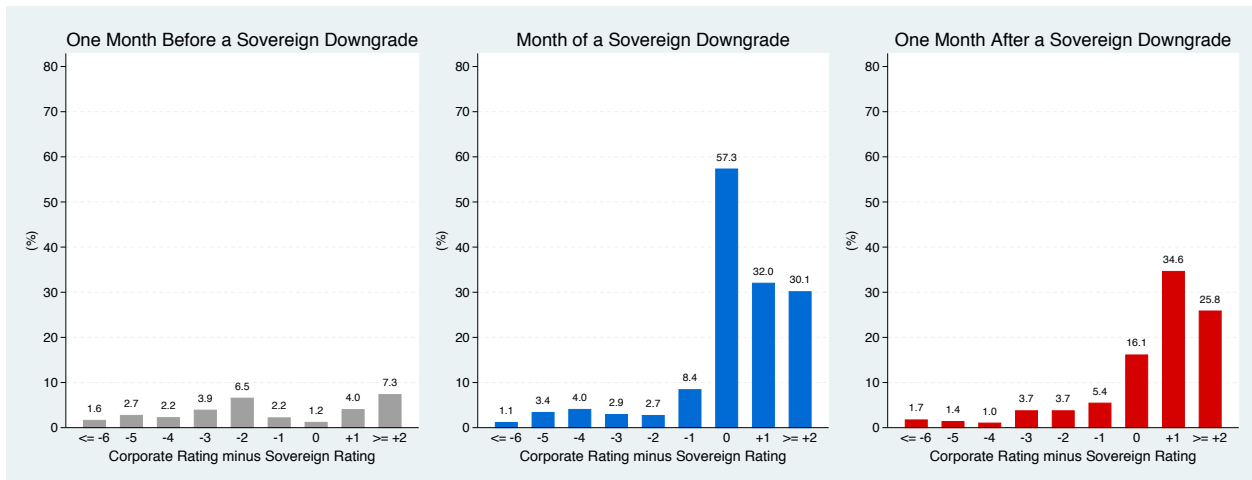
Figure 13: Proportion of Corporate Rating Changes Around a Sovereign Downgrade

Source: Almeida et al. (2014) Figure 2