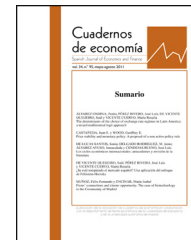




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## ARTICLE

# The literature on the interaction of fiscal risk and financial stability – A survey



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**Abstract** This article presents a review of the literature on aspects of fiscal and financial crises. Firstly, an analysis is made on how fiscal policy may become unsustainable, whether it is due to a worsening of the fundamentals of a country, or to increasing international financial turmoil. Particular attention is paid to the literature on the role of financial institutions and their sovereign links in a crisis context. This link may mean that sovereign stress is transferred to the banks, via holdings of sovereign debt or vice versa, on account of the implicit (or explicit) guarantee that banks may have from the sovereign. Secondly, a review is made of the determining factors of the connectedness amongst financial institutions and between sovereign banks. The indicators of connectedness can help understand how systemic risk builds up. Finally, an analysis is made on how the debate on macro-prudential policy has evolved to tackle the issue of system-wide financial stress.

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### CÓDIGOS JEL

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### PALABRAS CLAVE

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### La literatura sobre la interacción del riesgo fiscal y la estabilidad financiera: una revisión

**Resumen** Este artículo repasa la literatura académica sobre crisis fiscales y financieras. En primer lugar, se analiza cómo la política fiscal de un país puede acabar siendo insostenible, ya sea por un deterioro de los fundamentales del país o por un aumento de las turbulencias financieras internacionales. Prestamos especial atención a la literatura sobre el papel de las instituciones financieras y su vinculación con el soberano en un contexto de crisis. Este vínculo puede provocar que el estrés del soberano se traslade a las entidades financieras mediante las tenencias de bonos soberanos. La dirección de la transmisión del riesgo puede ser también la

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contraria, debido a la garantía que ejerce el soberano sobre las entidades financieras de su país. Asimismo, se repasa la literatura sobre la conectividad de instituciones financieras entre sí y entre bancos y soberanos. Los indicadores permiten comprender cómo surge el riesgo sistémico. Finalmente, analizamos cómo el debate sobre la política macroprudencial ha evolucionado en los últimos tiempos.

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## 1. Introduction

This survey analyses the literature on the interaction between fiscal risk and financial risk. The issue has gained prominence in the recent crisis, as the combination of a deterioration of the credit quality of sovereigns and a credit crunch led to heightened financial fragmentation and deepened the downturn in stress countries.

The relationship between fiscal policy, debt sustainability and financial crises has been around for a long time. In the 1980s, the key mechanism for developing a financial crisis was through unsustainable fiscal policies that would lead to monetary financing, and so, an unsustainable exchange rate (Flood and Marion, 1998). The seminal papers on the government's intertemporal budget constraint are part of this strand of literature (Trehan and Walsh, 1988).

This survey analyzes first the literature on fiscal sustainability, from the perspective of the formulation of fiscal policy. Second, we study the interaction between the fiscal balance and the cycle, and the role of institutions. However, fiscal policy does not always hold the key for the sustainability of debt. In the third section, we study the role played by sovereign spreads: an increase in the cost of finance can worsen fiscal sustainability. This could be due to exogenous factors, not related to the fiscal policy. Also, the role played by the banking sector is studied in the following section. Finally, we study the role of macro-prudential policy in addressing the build-up risk both within the financial sector and the interactions of this risk with sovereign risk.

The survey is organized as follows. Section 1 reviews the literature on fiscal sustainability, from the perspective of the formulation of fiscal policy. In Section 2, we study the interaction between the fiscal balance and the business cycle, the role of institutions, sovereign spreads and the banking sector. Section 3 analyses the role of macro-prudential policy in addressing the build-up risk both within the financial sector and the interactions of this risk with sovereign risk. Finally, in Section 4, some concluding remarks are offered.

## 2. Fiscal sustainability: main aspects

Bohn (1998) analyzed whether fiscal policy in the US was sustainable, in the sense that it reacts to an economic shock that raises the debt to Gross Domestic Product (GDP) ratio by increasing its primary balance, which would eventually

stabilize debt. A large part of the literature that has examined the issue is empirical.

Several studies have addressed this question via single country analysis (Bohn, 2008) and panel analysis, while others, employ a Vector Autoregressive (VAR) approach. In general, for developed countries, the literature finds that the primary balance reacts positively to an increase in the debt-GDP ratio.

Much of the literature deals with country or region-specific fiscal response functions. For instance, Ballabriga and Martinez-Mongay (2005) show that primary balances increase as a response to higher government debt in the European Union (EU).

Bohn's (1998) paper showed that the reaction of the primary balance to a rise in government debt could be considered an indicator of the sustainability of the fiscal stance. If an economic shock that leads to an increase in the debt stock is followed by a strengthening of the primary balance, fiscal policy can be deemed sustainable.

Bohn (1998) results go in line with the finding in later research regarding developed countries; he finds that fiscal policy in the United States of America (USA) in the 20th century reacted positively to rises in public debt, and so concludes that fiscal policy was, by that measure, sustainable.

Several authors have used the same methodology for European countries, see for instance Wyplosz (2006) and Staehr (2008). Piergallini and Postigliola (2012) use the methodology for Italy and De Mello (2008) for Brazil. They all find that fiscal policy reacted responsibly, in that it rose in response to an increase in debt.

### 2.1. Fiscal policy and the business cycle

One of the main determinants of fiscal policy is the business cycle. A classic result of this literature has been that fiscal policy usually is counter-cyclical in developed economies, while it is pro-cyclical in emerging economies (Afonso, 2008). Staehr (2008) finds a similar result within Europe; according to his paper, fiscal policy is much more anti-cyclical in Western Europe than in Eastern Europe.

Égert (2014) confirms that fiscal policy is counter-cyclical in the Organisation for Economic Co-operation and Development (OECD), although this is less clear in the case of highly indebted countries. Similarly, others find that the size of the counter-cyclical response of discretionary fiscal policy depends on the initial fiscal stance and debt level.

According to Wyplosz (2006), the cyclically adjusted balance reacted more strongly to the business cycle before the countries entered the euro area than afterwards, while the

discretionary component was pro-cyclical prior to entry, as countries tried to meet the accession criteria, but became a-cyclical once countries joined the single currency.

Others argue that to the extent that tax revenues have a cyclical component, this introduces an automatic comovement between government balances and the business cycle. As a result, the pro-cyclicality finding for developing countries may not reflect policy intentions but rather the fact that the structure of tax revenues is more cyclical there. They use a component analysis, looking at government consumption and revenues and correcting for the fact that tax revenues are endogenous to the business cycle by using tax rates as instruments. They conclude that fiscal policy in emerging economies is less pro-cyclical than had been found earlier.

Afonso (2008), using an EU panel, finds a counter-cyclical response of fiscal policy, with the primary balance improving with increases in the output gap. He also highlights that electoral budget cycles play a role in the determination of fiscal policy.

Other studies have found that the reaction to the business cycle is often asymmetric while counter-cyclical in downturns; it is either a-cyclical or mildly pro-cyclical in upswings. As a result, debt accumulated during downturns is not fully paid back during good times (see e.g., Lee and Sung, 2007; Leigh and Stehn, 2009).

Many empirical studies have looked at the cyclical movements of fiscal variables in industrial and developing countries, such as Alesina and Tabellini (2005), Gavin and Perotti (1997), Kaminsky et al. (2004) or Talvi and Vegh (2005). These studies document that primary balances are counter-cyclical in developed countries, and tend to be more pro-cyclical in developing countries (Mendoza and Ostry, 2008).

## 2.2. Taking into account government decisions

Alternatively, fiscal reaction functions can be understood as a problem where policymakers minimize a loss function subject to constraints afforded by the economy, such as the reaction of other agents (the private sector) to different government policies. The key issue then is to determine whether the change in the fiscal balance triggered by debt or another event is intentional.

One aspect to take into account when assessing government's policy intentions is the existence of persistence, over time, in the fiscal balance. This persistence component may be due to rigidities in the budget procedures, for instance stemming from the fact that part of a government's spending in a given year has been pre-committed. This seems to be greater in advanced economies (Fatas and Mihov, 2001, 2008). Paloviita (2012) finds that persistence has been lower in the peripheral countries than in the rest of the euro area. According to Afonso and Furceri (2010), persistence is determined by country income and public sector size.

In order to test for the importance of the government's intentions, as opposed to realized outcomes that may be affected by contemporaneous shocks to the economy, a part of the literature has distinguished between planned and realized fiscal balances, using the former as an indicator of government intentions.

Some studies do this by isolating variables that reflect policy decisions such as tax rates or discretionary spending categories (Ilzetzki and Vegh, 2008; Darvas, 2010). Others use real-time data to provide a more realistic picture of fiscal policy-making (e.g. Bernoth and Wolff, 2008).

## 2.3. Discretionary fiscal policy and automatic stabilizers

In order to obtain a measure of government's policy intentions, the cyclical component must be removed from tax revenue and primary spending items, thus obtaining the cyclically adjusted primary balance. One approach consists in regressing the fiscal policy variable on a measure of the business cycle and to interpret the residuals as the discretionary policy component. For instance, Fatas and Mihov (2003) use this approach and find that the residuals of the fiscal policy reaction functions of euro area countries diminished over time, indicating less reliance on discretionary fiscal policy in the run up to entry into the Eurozone.

This strategy was criticized by Galí and Perotti (2003); in their view, this only captured the non-systematic part of discretionary policy. Instead, using cyclically adjusted spending and revenue by category (Giorno et al., 1995; André and Girouard, 2005) would provide a more reliable overall picture of the fiscal policy stance. In line with the results mentioned earlier, they conclude that discretionary fiscal policy became more counter-cyclical in the 1990s in most advanced countries. He discovers that the introduction of the euro led member countries to use a more counter-cyclical policy.

Fatas and Mihov (2009) notice that discretionary policy was slightly pro-cyclical in the euro area countries, while the United States pursued a strongly counter-cyclical discretionary policy. Auerbach (2009) confirms their result, and finds that fiscal policy in the US was counter-cyclical. In his study, this result holds for both the expenditure and revenue side for a long time period (between 1984 and 2009). He suggests that spending responded more strongly than revenues. In contrast, the automatic stabilizers are found to react more strongly to the business cycle in the euro area than in the United States.

Some authors show that discretionary fiscal policy intentions are counter-cyclical in OECD countries, especially during expansions, by looking at ex-ante forecasts of cyclically adjusted primary government balances. He also shows that the outcome of discretionary fiscal policy is pro-cyclical ex post. Beetsma et al. (2008) find that planned fiscal policy is counter-cyclical in non-EU OECD countries while it is a-cyclical in EU countries. Bernoth and Wolff (2008) show for euro area countries that fiscal policy is usually planned to be counter-cyclical, but biases in the execution of planned policies lead the fiscal stance to become pro-cyclical. Golinelli and Momigliano (2009) point out that the results reported above are sensitive to robustness checks, such as alternative measures of the output gap; in their setting, the finding that fiscal policy plans in the euro area are more counter-cyclical than final outcomes still holds.

Jaimovich and Panizza (2007) use foreign partners' GDP growth as an instrument of the domestic business cycle, given the feedback loops between fiscal policy and the

business cycle. Their result overthrows the finding of a pro-cyclical fiscal policy for developing countries. Ilzetzki and Vegh (2008) assess the robustness of the finding that developing countries pursue pro-cyclical fiscal policies while developed OECD countries are less pro-cyclical or a-cyclical by controlling for endogeneity of the business cycle variable through various methods (instrumental variables (IV), generalized method of moments (GMM), simultaneous equations and VAR models). Lee and Sung (2007), by also using an IV approach also find that government spending is strongly counter-cyclical in most OECD economies, with a few a-cyclical exceptions.

Strawczynski and Zeira (2009) take a different perspective and analyze the reaction of fiscal policy to temporary and permanent output shocks rather than to cyclical fluctuations. They show that the reaction of general government deficits and spending to a temporary output shock is counter-cyclical. However, the reaction to a permanent shock is a-cyclical.

Based on an event study approach, Leigh and Stehn (2009) argue that the Group of Seven (G7) countries eased discretionary fiscal policy during downturns in a timely manner on a number of occasions. Nevertheless, they also show that fiscal policy in non-Eurozone countries responded quicker and more often to downturns than in Eurozone members of the G7. A further difference between the Eurozone and other countries is that discretionary fiscal easing occurs more often during economic recoveries in the former than in the latter.

#### 2.4. Political economy and fiscal policy

Golinelli and Momigliano (2009) report similar results for those countries before the adoption of the euro. Elections seem to influence general government balances in other OECD countries over longer periods as well while government spending is not found to be influenced by electoral cycles (Strawczynski and Zeira, 2009). The main specification in Afonso and Hauptmeier (2009) also shows that elections are associated with a deterioration in primary government balances. Nevertheless, their result is not robust to alternative model specifications in which the coefficients either switch sign or become insignificant.

#### 2.5. Cyclical behavior of the components

Lee and Sung (2007) report that total government revenues of OECD economies are counter-cyclical with respect to GDP growth and total government expenditure is mildly pro-cyclical. At a higher level of disaggregation, current and capital expenditure and subsidies and transfers are found to be a-cyclical. On the revenue side, income and commodity taxes react counter-cyclically whereas social security contributions appear insensitive to the business cycle.

Lane (2003) shows that the cyclical behavior of overall government spending in OECD countries hides a heterogeneous response of the different spending components to the business cycle. While public transfers and debt interest payments are counter-cyclical, current spending is pro-cyclical and government investment is pro-cyclical. In particular, government wages are more pro-cyclical than non-wage

government consumption whereas government employment is a-cyclical. The cross-country variation in cyclical reactions is mostly explained by output volatility and institutional variables, in particular weak government support. Public sector wages are the main channel through which higher output volatility and lower government support lead to more pro-cyclical government spending.

#### 2.6. Debt sustainability: the fiscal limit

The relationship between the fiscal reaction function and debt sustainability was originally related to the debate on the interactions between monetary and fiscal policy. Leeper (2013) postulated that to the extent that governments issue substantial debt, when such economies are approaching their fiscal limits, debt can be devalued through higher inflation. Based on this insight, he develops a model that suggests that the source of inflation is fiscal policy. Once the fiscal limit is approached, the government must finance its deficit by printing money. These dynamics may lead to episodes of hyperinflation.

As a result of his contribution, a body of the literature analyzed how the fiscal limit could be determined. In Bi (2012), the fiscal limit depends mainly on the size of the government, the degree of counter-cyclicality of the policy responses, economic diversity, and political uncertainty. They justify non-linearities in the behavior of sovereign risk premia; once they are on the rise, they rise quickly. This, in turn, justifies the non-linearities in fiscal adjustment; little adjustment is carried out at low levels of debt, when the cost of additional adjustment does not seem to be justified, and then a rapid adjustment as the debt limit is approached.

#### 2.7. The determinants of sustainability: sovereign spreads

For all the importance of the determinants of the primary balance, and the determinants of debt sustainability from fundamentals, a body of the literature has found that risk premia are often determined by factors not related to fiscal fundamentals. To the extent that adverse shocks, not related to a given country's fiscal policy, can lead to shocks on the sovereign premia, and so alter debt sustainability dynamics, this can be thought of as a case of the interaction between financial markets and fiscal policy, and how the former can impact debt sustainability, even if the fiscal policy stance (and, possibly, the underlying macro-economic conditions) remains unchanged.

Sovereign spread determinants are typically decomposed into the default risk (which is dependent on the assessment of the fiscal health of a given sovereign) and risk aversion, which tends to be related to market perception not related to actual debt sustainability dynamics of a given country. Sovereign risk can also be measured by sovereign credit ratings, credit default swap (CDS) premia and other rankings of the country risk or sovereign creditworthiness. At first, this literature focused on emerging economies, in particular following the 1980s. However, the advent of the Euro, and in particular the euro sovereign debt crisis, brought about renewed attention to the issue from the perspective of developed countries.



### 2.7.1. Studies on emerging countries

[Min \(1998\)](#) finds that for the early 90s there is a positive and significant effect of debt to GDP, debt service to exports, net foreign assets, exports growth, the real exchange rate, and inflation on one side, and negative effects of the terms of trade, foreign exchange reserves to GDP, maturity and imports growth on sovereign spreads.

[Eichengreen and Mody \(1998\)](#) conclude that a higher ratio of debt service to exports is associated with higher bond spreads. They also show the negative significance of the GDP growth rate, the issue size and the residual of a regression of the credit rating from fundamentals. The latter is one of the pioneering efforts to capture issues that are not related to country-specific macro-fundamentals.

Much like [Edwards \(1986\)](#) and [Min \(1998\)](#), [Eichengreen and Mody \(1998\)](#) do not control for global risk aversion individually as opposed to variables that relate to the state of world financial markets. In the early stages of this literature, the main concern seemed to be which fundamentals were better determinants of sovereign spreads, rather than the interactions between sovereign stress and financial markets.

[Arora and Cerisola \(2000\)](#) estimate the determinants of secondary market sovereign bond spreads for a sample of 11 large emerging countries in 1994–1999. They find a positive impact of the short-term US interest rate and of market volatility on spreads across all countries, in what can be considered a proxy for the effect of global risk aversion. Also, spreads are in large part explained by country-specific fundamentals, pertaining in particular to the external and fiscal position. They find that a significant impact of the net foreign asset position, lower fiscal deficits and lower ratios of debt service to exports and debt service to GDP help decrease sovereign spreads.

[Aronovich \(1999\)](#) uses daily data on sovereign spreads to assess the determinants in the 1997–1998 period for three large Latin American countries. These are the implicit probability of default and the 30-year USTB rate, where the latter is used as a proxy of an exogenous change in global financial conditions.

### 2.7.2. Contagion and spreads

[Baig and Goldfajn \(2000\)](#) test whether there was contagion from the Russian crisis to Brazil in the late 1990s. They find evidence supporting the contagion hypothesis and report a negative impact of the long-term American interest rate on spreads. [Nogués and Grandes \(2001\)](#) also find a negative effect on sovereign spreads for Argentina in the late 1990s. In their paper, there is evidence of not only contagion but also of the relevance of country-specific factors, like fiscal deficits, GDP growth, the debt service to exports ratio, and institutional priorities.

[Ferrucci \(2003\)](#) investigates the empirical relationship between emerging market sovereign spreads and a set of common macro-economic fundamentals, using Emerging Markets Bonds Index (EMBI spreads over the period December 1991–March 2003). The estimation technique posits a dynamic error correction model that allows short-run parameters to vary across groups, while restricting long-run elasticities. Their results point to markets pricing in macro-conditions in sovereign risk. In particular, indicators

like external debt, openness and current account balance affect the pricing of sovereign spreads.

However, non-fundamental factors like global liquidity conditions and US equity prices also play a role. This result is obtained by controlling for global risk aversion by using the spread between low- and high-rating US corporate bonds and finds a negative impact on emerging market sovereign spreads; higher junk bond spreads lead to lower emerging market spreads.

[González-Rozada and Yeyati \(2008\)](#) analyze the impact of interest rates of bonds issued by developed countries on emerging market spreads in 1993–2005. They find that a large part of the emerging market bond spreads is explained by global factors like risk appetite (the spread of high yield corporate bonds in developed markets), global liquidity and contagion from other financial crises. The link between emerging country spreads and global factors is shown to remain relatively stable since 1993. This finding is robust to the inclusion of country-specific factors, asymmetries, alternative risk appetite indicators or adjusted ratings, and helps provide accurate long-run predictions. Overall, the results highlight the critical role played by exogenous factors in the evolution of the borrowing cost faced by emerging economies. This is in line with [García-Herrero and Ortiz \(2005\)](#) conclusions on the influence of global risk aversion on Latin American sovereign spreads.

[Remolona et al. \(2007\)](#) analyze the components of sovereign CDS spreads, decomposing the expected loss from default and the risk premium. They find that risk premia account for much of the spread (ranging from two-thirds to four-fifths of the change in the spread).

They also estimate the determinants of sovereign default risk using the rating-implied probability of default for a sample of emerging countries, on which they run a panel regression with fixed effects, using annual data from 1990 to 2005. They find a significant relationship with country size, inflation, development, the current account deficit, and external debt. These results hold when considering debt intolerance, original sin and currency mismatch. In their framework, country fundamentals do improve access to foreign financing.

There are other areas of study that can be mentioned. The first is on the determinants and dynamics of other measures of sovereign creditworthiness such as “distance to default”, sovereign credit ratings, and probabilities of default, analyzed by [Rowland and Torres \(2004\)](#) or [Weigel and Gemmill \(2006\)](#). Second, the strand of the literature that studies the relationship between sovereign spreads and currency risk ([Domowitz et al., 2001](#); [Ahumada and Garegnani, 2005](#); [Powell and Sturzenegger, 2000](#); [Philippon et al., 2001](#)). Third, the pass-through from US interest rates to emerging market spreads ([Frankel, 1999](#); [Frankel and Rose, 2000](#); [Kamin and Von Kleist, 1999](#)).

### 2.7.3. Spreads in the euro area

While the main issue studied before the existence of the euro was the spreads in emerging countries, the creation of the single currency, and in particular, the sovereign debt crisis, led to an increase in the academic interest on sovereign spreads in the European Economic and Monetary Union (EMU). The setup is similar to that used previously

for emerging economies, where the determinants used are country-specific risk factors, global risk aversion conditions and financial market-specific issues, like liquidity.

Some authors find a relevant role for monetary policy on risk aversion and spreads. [Maltritz \(2012\)](#) considers the effect of openness and the terms of trade.

For example, [Attinasi et al. \(2009\)](#) find a role for bank rescue packages and the ensuing shifting of risk from the private sector to the public sector has played a key role. However, the elasticity of credit premia to fiscal fundamentals (a measure of the price of credit risk) also increased during the crisis, partly owing to an increase in the degree of global risk aversion. [Gerlach et al. \(2010\)](#) find that global risk interacts with country specific fundamentals. This interaction and its impact on spread changes over time.

#### 2.7.4. The impact of liquidity

The last broad category of determinants of sovereign bond spreads relates to liquidity conditions in bond markets, usually proxied by overall outstanding amount of public debt, bid-ask spreads and trading volumes.

[Beber et al. \(2009\)](#) find that credit premia are generally more relevant than liquidity premia for euro area sovereign bonds but, in moments of heightened market uncertainty, liquidity considerations may prevail.

#### 2.7.5. The euro area

Euro area sovereign bond markets initially attracted attention from academia as a way to assess whether the adoption of the single currency was leading to increased financial integration, as studied by [Baele et al. \(2004\)](#), or [Gómez-Puig \(2006, 2008\)](#). In these first studies, the standard definition of sovereign risk included its two main domestic components, market liquidity and credit risk, and an international risk factor, which reflected investors' risk aversion. Some of the research then focused on systemic versus idiosyncratic risk. [Geyer \(2004\)](#) and [Pagano and Von Thadden \(2004\)](#) stressed the importance of systemic risk in the behavior of yield differentials in EMU countries, while others showed that the idiosyncratic risk component in the movements of spreads was generally more important than the systemic risk, as shown in [Gómez-Puig \(2009\)](#), [Dötz and Fischer \(2010\)](#) and [Favero and Missale \(2012\)](#). Some studies suggested that co-movements across the Eurozone were a key determinant ([Abad et al., 2010](#)).

However, the sovereign debt crisis in Europe, which began in late 2009, has revived the literature on euro area sovereign spread drivers and attributed increasing importance to uncertainty and variables reflecting country-specific confidence and indicators of real activity (see e.g. [Georgoutsos and Migiakis, 2013](#)). [Favero and Missale \(2012\)](#) find that credit risk has increased in importance as a determinant of sovereign bond spreads. Similar arguments can be found in other recent studies using data that extend beyond the crisis period such as [Palladini and Portes \(2011\)](#) or [Beirne and Fratzscher \(2013\)](#).

Many authors have stressed the importance of other fundamentals beyond the country's fiscal position to explain yield spread behavior after the outbreak of the crisis, as expressed in [Mody \(2009\)](#), [Barríos et al. \(2009\)](#), [Bolton and Jeanne \(2011\)](#) and [Allen et al. \(2011\)](#). Some studies have

looked at the dynamic properties of sovereign spreads over time, testing whether there was a change in behavior during the crisis, as [Pozzi and Wolswijk \(2008\)](#), [Gerlach et al. \(2010\)](#), [Aßmann and Boysen-Hogrefe \(2012\)](#) and [Bernoth and Erdogan \(2012\)](#).

[Sgherri and Zoli \(2009\)](#) find that euro area sovereign risk premium differentials are mainly driven by a common factor, in line with the finding on the importance of global risk aversion. They do however highlight a change starting in October 2008, with markets becoming progressively more concerned about the fiscal stability of countries and in particular, reacting to the impact of the contingent liabilities arising from problems in the national banking sectors.

[Gómez-Puig et al. \(2014\)](#) similarly show that the rise in sovereign risk in central countries can only be partially explained by the evolution of local macro-economic variables in those countries. They find that the importance of global variables increased in this period.

So the fiscal balance may be important, but is not the only factor that can lead to financial stress, as shown in particular by recent research. In this context, the behavior of banks during periods of sovereign stress plays a central role in the propagation of the latter and as such has been studied amply by the literature.

### 3. The dynamics of financial crises

A key area of study is how such crises unfold. While the first generation of the literature emphasized the role played by sovereign debt sustainability, later on, triggered particularly by the Asian crisis in the late 90s, a large body of the literature has been devoted to analyze market panic and the behavior of financial institutions in this context.

Some authors ([Radelet et al., 1998](#)) emphasize the role of financial panic as an essential element of the Asian crisis. At the core of the crisis were bubble-like large foreign capital inflows into financial systems without the necessary regulatory and supervisory tools to manage them and so became vulnerable to panic.

In a similar vein, some authors have explained financial crises through the Minsky ([Arestis and Glickman, 2002](#)) explanation of instability inherent to the financial sector. This view is supported by the finding that threats to growth and employment from the financial sector are much intensified in open, liberalized and, especially, developing economies.

When financial crises unfold, financial sector vulnerability and sovereign debt vulnerability may reinforce each other. Some authors have emphasized how not having your own monetary policy can lead to more fragile bond markets. In particular, [De Grauwe and Ji \(2013\)](#) show that part of the rise in sovereign bond spreads was not related to fundamentals. Secondly, some fundamentals, like sovereign debt, ignored before the crises, became significant during the crisis. However, this is a usual finding even for countries with their own central bank, as shown above.

[De Grauwe and Ji \(2013\)](#) compare that analysis with that of countries that had their own currency but similar fundamentals in terms of debt and fiscal space as Eurozone countries. In these countries, however, they do not find evidence of heightened significance of fiscal fundamentals.

Therefore, this may be a sign that, indeed, markets were priced in the absence of a lender of last resort; in the presence of such a lender, one would expect the capital outflow to have materialized in other aspects, like a further currency depreciation, which in turn could have more expansionary effects than the rise in yields.

### 3.1. Interactions between banks and sovereigns

The interactions of banks and sovereigns were first studied in the context of defaults by developing countries. Some authors have modeled debt rescheduling as a game where the two players are the banks and the sovereign. In [Bulow and Rogoff \(1989\)](#), debt rescheduling arises as the result of bank impatience because the lost present value of their investments undermines their solvency and compromises their future, thus makes them willing to accept haircuts on debt payments. In this setting, strategic default arises naturally out of financial sector weakness and the corresponding lack of bargaining power by banks.

### 3.2. Banking and fiscal crisis

[Reinhart and Rogoff \(2009, 2011\)](#) find that financial crises are followed by fiscal crises. They conclude that sovereign debt ratios typically rise after a banking crisis. However, their use of annual data may hide more subtle interactions amongst the variables, as the interaction between banking risk and sovereign risk may take place within a year, and may change shape in that year.

In their setting, the rise in sovereign debt is not primarily due to the cost of rescuing the financial system, but the slower growth after a financial crisis leads to a rapid rise in the public debt ratios. The fact that slower growth follows financial crises has been documented by [Abiad et al. \(2011\)](#); low growth stems from the scarcity of credit which typically follows banking crises.

The approach of [Acharya \(2009\)](#) is slightly different; he considers slow growth as the result of a credit boom pre crisis, which masked the underlying low potential growth. Also, their use of annual data could explain the fact that they do not find a feedback loop from public debt to banking crises. This may downplay the effect that bank bailouts and the subsequent rise of public debt can have on the reinforcement of bank and sovereign weaknesses.

At the core of this literature lie the links between the financial sector and fiscal sustainability. The relationship between both has been extensively documented by [Reinhart and Rogoff](#). However, somewhat contrary to [Reinhart and Rogoff \(2009, 2011\)](#), the results of [Mohanty and Scatigna \(2005\)](#) show that it is not just public debt that causes a financial crisis. Rather, large private debt and a deterioration of the credit quality of the sovereign can also cause the financial panic.

### 3.3. Sovereign bank feedback loops

The characterization of sovereign bank feedback loops has been studied by a large literature. The evidence on the links is quite varied.

[Thukral \(2013\)](#) uses a panel to study the role of financial sector variables on the determination of sovereign CDS spreads, and the results trigger his conclusion that there is bank dominance of sovereign financing conditions. [Mody and Sandri \(2012\)](#), using sub-periods similar to those in [Acharya and Steffen \(2015\)](#), find that the feedback between sovereign and bank risk changed. Instead of comparing CDS spreads, [Mody and Sandri \(2012\)](#) use sovereign spreads as the manifestation of sovereign fiscal risk, and the level of stock market capitalization of banks as a measure of banking system risk. They show that the euro crisis traces back to the Bear Stearns crisis. As bailouts of banks began to be priced in the market, sovereign spreads started to reflect higher fiscal solvency risk, especially in countries where growth was expected to slow down and had, as a starting point, high debt levels.

According to [Honohan \(2008\)](#), the link between banking crisis and sovereign risk may arise from the slowdown and the credit shortage that usually follows a banking crisis. Such events tend to be long crises (lasting 2.5 years on average), and lead to sharp rises in public debt. The authors estimate that the median fiscal cost of a banking crisis stands at 15.5% of GDP.

[Kollmann and Roeger \(2012\)](#) also study the macro-economic effect of financial sector rescues. They find that bank rescue operations can help cut short a financial crisis and improve macro-economic performance. A key avenue of the recovery is that bank bailouts can help investment recover, consistent with [Broner et al. \(2014\)](#) or [Popov and Van Horen \(2014\)](#). However, they find evidence of a negative impact, as sovereign debt purchases by banks lead to a crowding out of private investment. In contrast, [Gray and Jobst \(2011\)](#) show the potentially high impact on fiscal risk associated to the existence of contingent liabilities.

A key transmission mechanism is that domestic banks tend to be particularly vulnerable to restructuring. [Noyer \(2010\)](#) argues that by holding non-performing government bonds, capital could be compromised and so threaten the solvency of weaker and more exposed institutions.

[Erce \(2013\)](#) suggests that the degree of bank intermediation and the banking system exposure to the sovereign strongly influence a debt crisis ripple effect on the real economy. In addition, the moral suasion of authorities may lead to excessive holdings of sovereign debt by domestic creditors at below market yields ([Díaz-Cassou et al., 2008](#)). While this helps the government keep financing conditions more favorable, a government default in this context would trigger a banking crisis.

There are other channels by which sovereign stress leads to banking stress, although many papers emphasize the role played by the holdings of sovereign debt by banks. In [Darracq Pariès et al. \(2014\)](#), the positive connection between sovereign and bank risk is due to banks investing in government securities. Along these lines, [Angeloni and Wolff \(2012\)](#) assess the impact of sovereign bond holdings on the performance of banks during the euro area crisis using individual bank data and sovereign bond holdings. They find that peripheral sovereign bonds affect banks' stock market valuations heterogeneously. While Italian, Irish and Greek debt appear to have negatively affected the market valuation of the banks holding them, such an effect is not significant for other peripheral sovereign debt of countries like Spain,

suggesting that the specific characteristics of the banking sector (like its international presence) may also play a role.

Acharya et al. (2012) document the high exposure of their sample banks to their own sovereign, which according to their theory should be a main channel through which stress feeds back from the sovereign to banks.

Popov and Van Horen (2014) focus on the feedback from sovereign risk into banking risk by assessing the extent to which holdings of sovereign bonds detract the resources available for lending to the private sector. This channel enhances the feedback loop by limiting growth and so further weakening the health of the sovereign. They find evidence that this was particularly relevant in the periphery.

Finally, sovereign rating downgrades further limit banks' access to foreign financing, leading to sudden stops or higher borrowing costs (Reinhart and Rogoff, 2011).

Bank for International Settlements (2010) shows four main channels through which a deterioration in the creditworthiness of a sovereign can pass through to the banking system. One channel of transmission is banks' holdings of sovereign government debt. Second, higher sovereign risk reduces the value of collateral that domestic banks can be used for funding. Third, sovereign downgrades normally translate into lower ratings for banks located in the downgraded country. Lastly, increased sovereign risk reduces the value of the implicit/explicit government guarantees to banks.

Mody and Sandri (2012) show that sovereign spreads are affected by the domestic vulnerabilities of national banking sectors. Fiscal fundamentals can worsen the loop; the relationship seems stronger for countries showing large public debt.

Similarly, Pisani-Ferry (2012) shows that one reason that sovereigns may be sensitive to the domestic banking sector is that the sector's size has become large relative to tax revenues. As a result, small problems in the banking system can become an issue for government solvency.

In periods of financial crisis, the implicit public guarantee on bank solvency is likely to become effective, so markets may price in this higher probability of payout by the sovereign (Gray and Jobst, 2011; Gerlach et al., 2010; Pisani-Ferry, 2012), thus enhancing the link between the sovereign and banks.

Reinhart and Rogoff (2009) show that historically public debt-to-GDP ratios are higher following a country's banking crisis. The deterioration of sovereign creditworthiness is, however, only partly due to the cost of rescuing troubled banks. The main explanation is the economic slowdown caused by the banking crisis.

Merler and Pisani-Ferry (2012), for example, establish that the rise in domestic government debt raise the potential for negative feedback loops between sovereign and banking stress. Mody and Sandri (2012) show that the supposed link between holdings of sovereign debt and banks' market valuations was not significant in the period July–October 2011 in Italy, Spain, Portugal and Ireland. Only a clear relationship between Greek holdings and bank market valuation was established.

Arghyrou and Tsoukalas (2010) posit that the mechanics of the EMU debt crisis are similar to those of a currency crisis: in this case, the systemic risk that would be seen in currency markets is diverted into the markets for sovereign bonds. As

a result, sovereign bond spreads can be taken as an indication of stress that would eventually lead to abandonment of the currency regime.

Illing and König (2014) show that the absence of lender of last resort (LLR) can lead to self-fulfilling crises even when fundamentals are good. The perceived weakness of the sovereign can lead to a deterioration of the quality of the guarantee that it has given banks and so would justify the transfer of risk from the sovereign to banks.

The dynamics presented by the literature suggest that the absence of a central bank that is willing to act as a lender of last resort increases the likelihood, in stress, of sovereign defaults. In turn, the perceived lack of fiscal muscle leads investors to price in a bank default. While sovereign bond holdings may reinforce this loop, the transmission of stress can exist even if there are no sovereign bond holdings by the domestic banking sector.

### 3.4. Regulation and the sovereign bank nexus

Banking regulation has been blamed partially for reinforcing the bank-sovereign feedback loop. As is explained in chapter 3, bank holdings of sovereign debt are generally not subject to a risk weight in banks' capital requirement ratio.

To the extent that sovereign debt's riskiness arises from the expansionary bias in fiscal policy over the business cycle, it can be avoided through more responsible fiscal policy in the upturn, as described in Breton et al. (2012). A source of instability in the financial sector can be the fact that public debt is perceived as not being sustainable, which can lead to a sell off and a resulting vicious cycle (Acharya and Steffen, 2015; Merler and Pisani-Ferry, 2012). This has been a particular concern recently, when the recent developments in the Eurozone crisis questioned the Reinhart and Rogoff (2009) concept of graduation from serial default.

The sovereign stress has led to a number of proposals to change the regulatory treatment of sovereign debt; Hannoun (2012) argues that highly rated sovereign assets should receive a treatment consistent with their low risk. This would entail a differentiation amongst the different sovereign assets according to their creditworthiness.

However, instead of doing away with the Basel standards that use the 0 risk weight on domestic debt holdings, Hannoun (2012) calls for the introduction of enhanced supervision of sovereign risk through instruments like further and stricter stress tests.

Praet (2013) highlighted that a regulation that treats banks' holdings of sovereign debt according to the risk they pose to banks' capital will prevent said banks from excessive use of central bank liquidity, which, in a currency union, according to Uhlig (2014), can lead to perverse incentives. Weidmann (2013) suggests that by biasing the demand toward sovereign bonds, the regulation distorts the relative prices of assets signaled by interest rates. However, others have considered that some shortcomings of the introduction of a risk weight on sovereign exposures, such as the procyclicality associated with capital requirement ratios, call for a different treatment of sovereign exposures. In particular, Nouy (2012) considers using a Pillar II approach to extend sovereign risk, along the lines of Hannoun (2012),



not least because the pro-cyclicality of capital regulation can be especially problematic for sovereign bonds.

A key concern on this treatment is that the 0 risk weight has provided additional incentive to the exploitation of the carry trade (Acharya and Steffen, 2015). The absence of a capital requirement lowered incentives to lend to the real economy, particularly amongst the low-capitalized banks. As a result, the zero risk weight lets zombie banks continue operating, detracts resources from the economy and leads to perverse incentives in a currency union.

In this vein, Blundell-Wignall (2012) considers that the key may lie in the series of fiscal and structural policy measures being followed in the EU and aimed at tackling the underlying weaknesses of sovereign bond credit quality, which would eliminate the riskiness of those holdings and so the need for increasing its risk weight. The measures include credible fiscal consolidation plans, the enhancement of the European Central Bank (ECB)'s role as liquidity provider of last resort, and the creation of effective backstops.

Of course, the findings of the literature on fiscal fatigue and fiscal sustainability are particularly important to this end. As such, countries that present the fiscal, institutional and growth strategies that allow them to avert fiscal fatigue can have a virtuous cycle by which their debt can safely be considered a risk-free asset, relieving the balance sheet of domestic banks and allowing public debt to play its role as a safe asset in times of distress.

The need for a safe asset is inherent to the workings of a financial system. As Nakaso (2013) showed, this impact can be seen through several avenues; for instance, sovereign bonds act as a benchmark for other assets, as mentioned by Dunne et al. (2007), thus used as a reference rate from which the additional risk factors are compounded to determine the price of other assets. By serving as a safe and stable source of collateral in financial transactions, attracting lower haircuts and margin requirements, they allow markets to function smoothly (Giovannini et al., 2015).

Their role as an accepted source of collateral allows sovereign debt to play a similar role to that of fiat money in economies (Singh, 2013). In this way, sovereign debt posted as collateral can be used in other transactions, creating an effect which is similar to the monetary multiplier effect (Singh, 2013). Without an accepted, liquid, risk free asset, some financial transactions that require the use of collateral may never happen.

### 3.5. Connectedness: amongst financial firms and with sovereigns

Finally, and as expected, given its key role in the work of financial markets, safe assets are also integral to prudential regulation. Prudential requirements use safe assets in order to limit or prevent excessive risk taking in normal times. One can think that to the extent that both sovereign debt and money are backed by a country's central bank, they should be exchangeable assets. Debt only becomes risky when a country stops being backed by its central bank.

Given the importance of financial stress, many resources have been devoted to understanding the workings of this event. A key area of analysis is how stress can propagate from one financial institution to the system, or to

other institutions, or from the sovereign to financial system and vice versa. This played a key role in the start of the global financial crisis in 2008–2009; understanding which institutions are systemic and which are not is essential to understand the costs and benefits of the resolution of a given institution.

As a result, much literature and policy effort has gone into determining what a systemically important institution is and how it should be dealt with. The Basel Committee on Banking Supervision (BCBS) has been a key player. In order to enhance the regulation of SIFIs, the first step was to identify them. To this end, the BCBS selected a number of indicators as follows that reflect many dimensions of a bank: size, interconnectedness, the lack of readily available substitutes for the services they provide, their global (cross-jurisdictional) activity and their complexity. The size, interconnectedness and substitutability categories are in line with the guidelines of the International Monetary Fund (IMF)/Bank for International Settlements (BIS)/Financial Stability Board (FSB) report submitted to the Group of Twenty (G20) Finance Ministers and Central Bank Governors (Bank for International Settlements, 2010).

A part of the literature has analyzed the need for such a regulation from a particular perspective: the implicit subsidy in being too big to fail. Some authors find that the subsidy is large enough to distort firms' decisions, even beyond the banking sector (Baker and McArthur, 2009).

Others (Thomson, 2009) take a more policy-oriented approach and not only propose a framework for identifying and supervising such institutions, but they also attempt to remove the advantages from being systemically important financial institutions (SIFIs) and the perverse incentives that may arise. Size and interconnectedness would be the basic determinants for being considered a SIFI, and firms that are such by these two counts would be subject to the strictest regulations. In contrast, if a firm is highly correlated, it may not be subject to additional capital controls, but only to more strict disclosure arrangements. Finally, institutions that are neither large nor interconnected or correlated but have a particular impact on the workings of a particular region would be subject to enhanced supervision.

## 4. Macro-prudential policy

The recent financial crisis has shown the need for new instruments to deal with the global build-up of financial imbalances, which can eventually have severe macro-economic consequences. In particular, a major shortcoming in the run up to the crisis was the lack of understanding on how systemic risk builds up even when, from a micro-prudential perspective, the risks to the financial system may seem, ex ante, limited.

This lack of understanding was in part due to the confidence that the financial system would be able to adjust itself automatically. As a result, growing debt and leverage before the crisis, often related to house price booms, were not tackled. As a result, low volatility and risk premia and the excessive risk taking they could entail were not considered as large a risk to the system as they turned out to be. In this context, the role of financial innovation, deregulation and disintermediation in the creation of bubbles was not

sufficiently recognized. In particular, the avenues through which the fallout from the bubble would spread were not identified.

The need to understand how interactions across firms develop means there is a need to complement the traditional, micro-approach with a macro-approach in regulation and surveillance. This need for a macro-prudential approach has led to several policy initiatives to implement macro-prudential policies (see [Gorton and Winton, 2003](#)).

The policy debate is, as a result, evolving around the range of macro-prudential tools available, how they can be implemented and their effectiveness. The effectiveness has been analyzed both in terms of the economic impact of the new tools and the interactions with other policies, in particular monetary policy.

A key issue is the interaction between monetary policy and other prudential policies. In particular, part of the reasoning focuses on the impact of monetary policy on financial stability, and so, the role that may be played by macro-prudential policy as a complement to monetary policy. These interactions are not well understood, on account of the still nascent knowledge regarding interactions between the real economy and the financial system. Macro-prudential policy and the related literature can be seen as an attempt to bridge that gap.

[Borio \(2009\)](#) shows that the term was used to emphasize the links between financial regulation and supervision and the economic status quo. [Tucker \(2009\)](#) and [McCauley et al. \(1999\)](#) also show the purpose of macro-prudential policy when it started, and, in particular, its focus on managing the risks that arise from an increase in leverage.

In [Bank for International Settlements \(1986\)](#), one can find references to the effect of regulation on the aggregate payments system and the financial system. This was followed by the insight that what appear as prudent from an individual perspective may be dangerous from a systemic perspective ([Blunden, 2007](#)).

However, the focus on macro-prudential issues has rocketed after the current crisis, as can be seen in the references to the issue coming from policymakers (e.g. [Shirakawa, 2009](#); [Nijathaworn, 2009](#); [Tumpel-Gugerell, 2009](#); [Bini Smaghi, 2009](#); [Kohn, 2009](#); [Brouwer, 2010](#)). Some of the issues, in particular regarding the interaction of prudential policy and monetary policy, can be traced back to [Borio et al. \(2003\)](#), as acknowledged by [Orphanides and Williams \(2012\)](#).

The emergence of the macro-prudential debate came at a time when the academic literature seemed to have reached an agreement on what the target of monetary policy should be. The key target for central banks should be price stability over the medium term. In some cases, central banks had a dual mandate, such as for example the Federal Reserve, and maximum sustainable employment. Given these targets, operative objectives were typically defined in terms of CPI inflation or some other measure of underlying price dynamics.

As of now, there is still little agreement on what the target of macro-prudential policy should be. Financial stability is seen as a key target, but an operational definition of it remains elusive. There are two main camps on this matter: First, those that define financial stability as the resilience of the financial system when faced with exogenous shocks

(e.g. [Allen and Wood, 2006](#); [Padoa-Schioppa, 2003](#)). Second, those who think that financial distress can be endogenous and so consider that the essence of financial stability lies in the ability to manage the imbalances within the system (e.g. [Schinasi, 2004](#)) or how those imbalances can make the system vulnerable even in the face of relatively usual shocks ([Borio and Drehmann, 2009](#)). At the heart of the debate lies on whether policymakers should prioritize ex-ante supervision and regulation or ex-post resolution and crisis management policies.

Regarding the specific targets of macro-prudential policy, [Brunnermeier and Pedersen \(2009\)](#) suggest that it acts to limit the financial system's tendency to underestimate risk in the downturn and overestimate it in the upturn. By leveling the measurement of risk through the business cycle, regulation and policy may limit the magnitude of booms and busts. [Bank of England \(2009\)](#) shares this view and highlights that in avoiding such boom bust cycles, it will help the financial system provide services to the economy. As a result, if the boom bust cycle is not related to the provision of financial services and the supply of credit, it would be beyond the scope of macro-prudential policy. [Landau \(2009\)](#), however, asserts that in practical terms it would probably be appropriate for macro-prudential policies to take into account the creation of bubbles.

[Borio and Drehmann \(2009\)](#) contend that the main role of macro-prudential policy is to limit the materialization of system-wide risk that can have a significant macro-economic cost. Table 2.1 lists the differences between macro-prudential and micro-prudential perspectives suggested by [Borio \(2004\)](#).

From a more theoretical perspective, [Perotti and Suarez \(2009\)](#) consider that macro-prudential policy should tackle negative externalities of individual banks on the financial system: strategies that may be optimal from a bank's individual perspective may end up being detrimental to the system as a whole.

[Hanson et al. \(2011\)](#) think macro-prudential policy can complement micro-prudential policies, whose aim is to protect depositors by having banks internalize the losses they may incur in their assets. This behavior must be regulated because deposit guarantee schemes are subject to moral hazard. Alternatively, macro-prudential policy should be designed to minimize the social costs of a general decline in the provision of banking services. The manifestation of this shrinkage of balance sheets can be found in credit crunches and fire sales of assets.

## 5. Conclusion

The recent financial crisis has shed light on the importance on the interactions between fiscal stability, financial sector and the policies related. The intellectual apparatus used to deal with these issues remains, in spite of the fruitful and vast work of recent years, in a relatively early stage. In order to improve it, work remains to be done on different areas: (1) the improved understanding of the role of indicators to assess systemic risk and the determinants of connectedness of financial institutions and the sovereign; (2) the channels through which central bank policy and communication can lead to financial stability, by stabilizing financial markets,

and the interaction of the safeguarding of financial stability and guaranteeing that the goals of monetary policy are met.

To sum up, while rapidly developing, some aspects of the literature on the interaction of fiscal and financial risk remain in its early stages. More research is needed to understand the channels of transmission of stress, the changing nature of this interaction, the best indicators of stress and the appropriate policy response.

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