

SAPIENZA UNIVERSITY OF ROME



DOCTORAL THESIS

**Debt Overhang and Sovereign Debt
Restructuring**

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SUMMARY

After the huge debt increases in the 1940s, due to the WWII, and in the 1980s due to the emerging markets' debt crises, the debt overhang problem is once again at the center of the academic and political debate because of the recent debt crisis that affected the European countries in 2009. The debt overhang theory explains how a high level of debt distorts the optimal investment decisions and reduces government's incentives, in the debtor country, to undertake the necessary "adjustment policies". A huge literature focuses on the negative effects deriving from a debt overhang condition. In particular, this kind of literature has been mostly used to describe and to study poor and less developed countries. Nowadays instead, the situation is quite different with the Greek case that represents a very peculiar and never experienced situation.

Chapter 1 of the thesis starts with an introduction of the sovereign debt overhang problem. Then, since the aim is to study the possible policy interventions able to solve it, the focus is posed on sovereign debt restructuring as a resolution mechanism. A relief intervention can be considered, indeed, as a way to reduce the debt burden for a country struggling with a high level of debt. Descriptions of the restructuring process, of the macroeconomic consequences and of the Greek case are then provided in this chapter in addition to some stylised facts useful to communicate the main messages.

In the past, several different strategies of debt restructuring have been implemented and the consequences that they produced were often different case by case. It is then interesting to study the effectiveness of the several options that can be used to restructure public debt. For this reason, a very simple theoretical model is developed in *Chapter 2* in order to study three different strategies that can be used to solve a sovereign debt overhang problem. In particular, two strategies are based on a debt restructuring process, via face value reduction or rescheduling, whereas a third one is based on conditional-additional official lending. This strategy relies on the idea that the debtor country can benefit of new lending from the official sector, in order to undertake a larger amount of investment. The aim of the model is to represent schematically the functioning of the three restructuring processes to gain insights into their differences and to study their consequences in term of incentives to invest in a "troubled country".

An empirical evidence of the debt overhang hypothesis, coming from a joint work with Willem Vanlaer, is then provided in *Chapter 3*. The combination of the sovereign debt crisis of 2009 and the fiscal consolidation policies implemented as a result, makes indeed interesting to study this hypothesis in Europe. The Chapter exploits then a panel dataset for the European countries, between 1995 and 2015, in order to examine the extent to which increased levels of public debt have led to reduced public investment. We start our analysis from basic POLS models and then we expand it gradually to FE, IV and GMM estimation models. Our results validate the debt overhang hypothesis and remain robust across various model specifications.

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Dedicated to my family for its unconditional support

Chapter 1

Sovereign Debt Restructuring: a Literature Review

1.1 Introduction

In the past, debt accumulation and consequent default problems were considered an issue only for developing and poor countries. Recently instead also some advanced economies have started to suffer from an extensive debt accumulation (Figure 1.1). The last decade indeed, due to the financial crisis of 2007 and the following sovereign debt crisis of 2009, has been characterized by a huge increase in debt in several countries especially in the European Union.

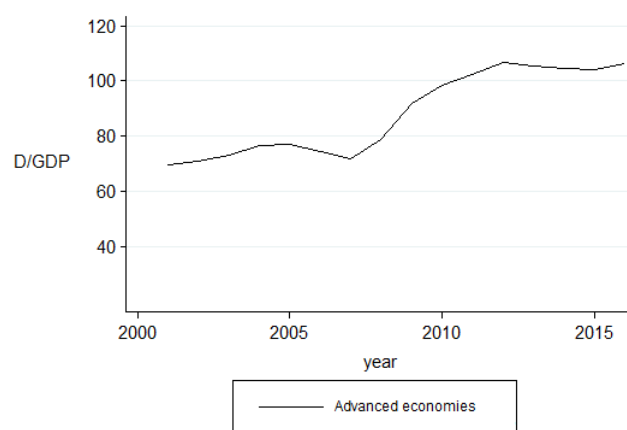


FIGURE 1.1: General Government Gross Debt as a percent of GDP: Advanced Economies (35), 1997-2016. Source: IMF Fiscal Monitor.

As we can see from the Figure 1.2, the increase in public debt in the advanced countries (here the focus is just on the Eurozone countries) has been impressive since the eruption of the financial crisis in 2007 and the following recession. Figure 1.3 shows the debt burden also in term of private debt for the Eurozone (i.e. EZ) countries.

Because of these huge amounts of debt, attention has been re-focused on problems related to an excessive debt accumulation and on the possible policy interventions able to solve them.

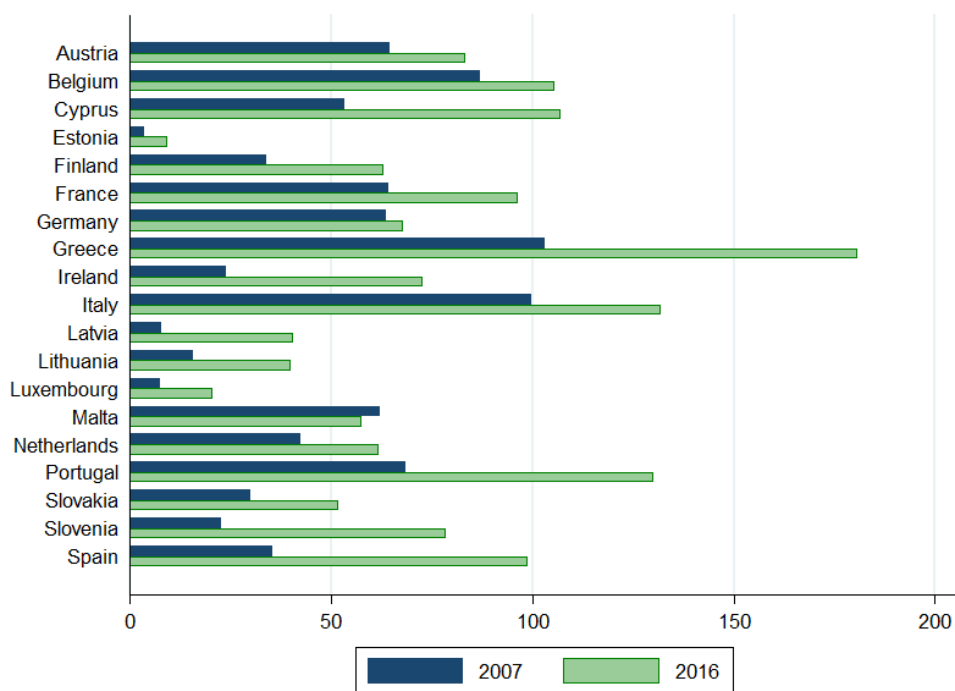


FIGURE 1.2: General Government Consolidated Gross Debt as a percent of GDP in 2007 and 2016 for the EZ countries. Source: Eurostat.

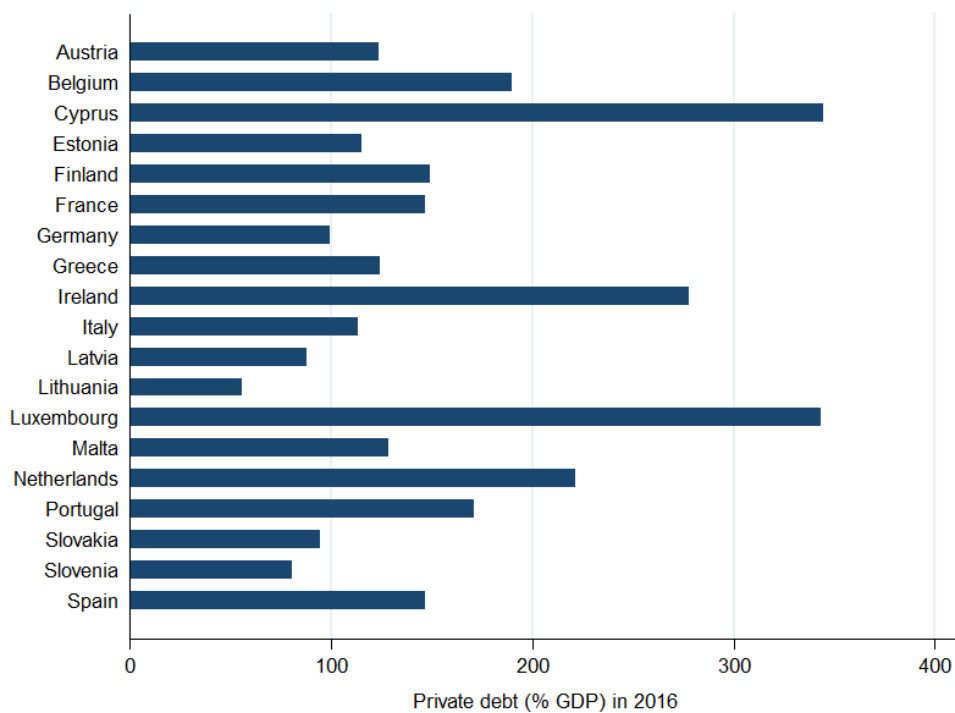


FIGURE 1.3: Private sector debt consolidated as a percent of GDP in 2016 for the EZ countries. Source: Eurostat.

More specifically, a renewed interest has been posed on the debt overhang theory which analyzes the negative effects that an high level of debt produces into the economy. This theory has been introduced for the first time by Myers (1977) in a corporate context. He defined debt overhang as a situation where the high level of debt distorts the possibilities for companies to make optimal future investment decisions. More specifically, a firm is less incentivated to invest because the benefits (i.e. future cash flows) deriving from the additional investment undertaken must be used largely to reimburse the existing debt holders (rather than to pay the shareholders). The larger is the profit that goes to the creditors the lower is the incentive to invest and to suffer the cost of investment for the shareholders. Potential lenders might even decide to not finance the firm because of its high debt. Otherwise, they might ask for an higher interest rate in order to protect themselves. This reduces debtor's gain deriving from the investment undertaken thus creating a disincentive effect in the firm's investments policy and therefore an underinvestment problem¹.

This concept of debt overhang used in the finance literature is similar to the concept used in the macro literature. In this context there are two significant definitions that deserve to be mentioned. In the first one, Krugman (1989a) defines debt overhang as "*the presence of an existing, inherited debt sufficiently large that creditors do not expect with confidence to be fully repaid*". In other words, debt overhang represents a condition in which a country has a stock of debt larger than its capacity to repay it in the future. The second definition is due to IMF (1989) that defines debt overhang as a situation where "*the existence of foreign debt distorts the relevant margins considered for production and investment decisions*" (the so-called debt overhang effect).

In this kind of literature, the debt overhang has been analyzed mainly in the context of sovereign-debt crises. It was indeed due to the debt crises in the 80s and 90s that this theory has been extended in a sovereign context with the aim to explain the effects that the high debt had produced on the level of investment in the "less developed countries" (LDCs)². In those years, the highly indebted countries' low investments level and the low growth rate were often attributed, at least in part, to the high level of foreign debt. Basically, a debt overhang scenario occurs when a debtor country, due to the "debt servicing obligations", can benefit only of a small portion of the profits/resources produced. In such a situation, debt is perceived as a tax on country's resources and it reduces the incentives to invest.

For the same reason, a debt overhang condition might reduce the *fiscal space* of a country, restraining then its fiscal policy choices, or it might discourage any general efforts of the debtor country to improve its economy through the implementation of some necessary *policy reforms*

¹Lamont (1995) focuses on the link between a corporate debt overhang condition and the macro performance of the Sovereign. He finds that the debt overhang effect depends on the economic conditions: if the economy is in boom, debt overhang is not binding because the investment returns are high and vice versa in case of recession or stagnation.

²Several papers have analyzed these effects in that period (Krugman, 1988a; Krugman, 1989a; Borensztein, 1990b; Obstfeld and Rogoff, 1996; Sachs, 1989).

(such as structural reforms) and stabilization interventions³ (Deshpande, 1997; Goretti and Souto, 2013)⁴. The consequence is then a further growth depressing effect with the likely establishment of a negative spiral between debt and growth. These adjustments affect negatively investment since policy changes might result in less fiscal activity (i.e. fiscal space) and exchange-rate devaluations that reduce public investment and make imports of capital more expensive. As explained before, in such a case the benefits would go especially to foreign creditors and not to the debtor country (at least in the short-run). These disincentives in undertaking the necessary reform are of special concern in low-income countries, where an acceleration of structural reforms is instead necessary (Clements et al., 2003).

Debt overhang also depresses investment and growth by increasing *uncertainty* (Liu and Rosemberg, 2013). When public debt becomes large, the uncertainty related to the decisions that the government will take in order to meet its debt servicing obligations, increases too. In particular, the private sector might expect an inflation tax, a currency devaluation and/or an increase in taxes in order to make the government able to service its debt. Therefore, in such a situation, potential private investors might prefer to delay their investment decisions and/or a capital flight might occur in the period.

Considering these negative consequences deriving from an excessive debt accumulation, debt sustainability problems might arise. In such a situation and especially in the European framework, the use of fiscal policy in order to deal with cyclical crises might be undermined. The recent Greek case, with the largest restructuring episode in history, has then re-animated the debate on how to restructure public debt and on its possible consequences. In a debt overhang condition, a wide literature has been developed to prove that it is efficient to reduce the amount of debt that must be paid by a debtor country (Krugman, 1988a; Krugman, 1988b; Krugman, 1989a; Sachs, 1989; Froot, 1989; Aguiar et al., 2009). For this reason, new interest has been posed on these topics (IMF, 2013b; IMF, 2014b; Buchheit et al., 2014) and several proposals for different (or un-conventional) forms of debt restructuring have been discussed in the last years (Krueger, 2002; Gianviti et al., 2010; Paris and Wyplosz, 2014; Economides and Smith, 2011). In this regard, several points of interest deserve to be studied further:

- how to restructure the public debt?
- are the restructuring interventions really effective?
- is there a first best?

The aim of this Chapter is to shed light on these points and to discuss them.

The Chapter proceeds as follows: some general considerations in term of sovereign debt restructuring are discussed in Paragraph 1.2; the phases and the negotiation procedures of the

³These adjustments are usually imposed in the negotiations between creditors and debtor country in exchange for financial support.

⁴Another consequence is that an high level of debt might compromise the ability of the debtor country to borrow long-term and in its own currency: the so-called "original sin" (Hausmann and Panizza, 2003).

restructuring process, the concept of haircut, the most used restructuring strategies, past episodes and some stylized facts are described in Paragraph 1.3; Paragraph 1.4 contains a discussion about the economic consequences of sovereign debt restructuring for both creditor and debtor countries; Paragraph 1.5 describes the Greek debt restructuring of 2012 and some of its economic consequences; Paragraph 1.6 concludes describing the recent developments in the topic and the current debate related to the introduction of a sovereign debt restructuring process in the Eurozone.

1.2 Some Practical Considerations in term of Sovereign Debt Restructuring

Sovereign debt restructuring can be defined as an exchange, implemented through a legal process, between government outstanding debt⁵ and new debt instruments or cash. Since currently there is no an international recognized bankruptcy law for Sovereign, borrowers and creditors have to negotiate in each case of default⁶ and this is the reason why all the restructuring episodes have always been structured as ad-hoc interventions. The different treatment of creditors' claims has been indeed a characteristic of large part of the debt restructurings implemented in the last years (Erce, 2012).

The aim of a restructuring intervention is to put a country's debt back on a sustainable path at the lowest possible cost. This process involves indeed a creditors' upfront loss (i.e. haircut), in term of their claims toward the debtor country, but that should be lower than the costs that they will suffer in case of further deterioration of the debtor's country economic conditions in absence of a restructuring.

An important point that must be discussed is the difference existing between sovereign and corporate debt. In case of corporate default, indeed, there are some legal mechanisms able to protect creditors' interest, by enforcing debt repayment such as a liquidation procedure (with assets' seizure). For a sovereign debtor instead these mechanisms are much more difficult to implement (i.e. there is a weaker contract enforcement available). International loans are in fact not easily enforceable in legal courts. While creditors can sue their private debtor in case of a corporate default (since it is subject to a legal authority) they have just some limited legal actions available if a Sovereign fails a debt repayment. Sovereign's asset in fact cannot be liquidated and a global mechanism able to discipline how creditors can appropriate of a sovereign's asset

⁵Sovereign debt means debt issued or guaranteed by the government.

⁶A default is defined as a missed payment of principal or interests on the due time. Following this missed payment, a 30 days of grace period is usually allowed in order to pay-back the due amount. After that period a default is officially announced. Moreover, a default can be total (when all debt repayment is stopped) or partial (when it is stopped the repayment of just part of debt (Erce, 2012)).

is not available yet⁷. There is indeed the concept of sovereign immunity (also related to its non-commercial assets) that prevents creditors' action in this sense (Strickland, 2014).

Moreover, the probability of default for a Sovereign is not necessarily related to the concept of solvency as it is in the case of corporate debt. The distinction that is indeed usually made in case of sovereign debt is between "willingness to pay" and "ability to pay". The latter is directly related to the solvency/liquidity concept since it depends on the economic conditions of the debtor country (generally measured as the amount of debt versus the strength of the economy, the volatility of the domestic currency etc.); the former instead depends of the relative cost of default compared to that one of keep servicing the debt (Manasse and Roubini, 2009; Obstfeld and Rogoff, 1996). A debtor country might indeed decide to not pay-back its debt even if it has the ability to do that. The decision is related to the opportunity costs in action in this framework. In this regard, the costs deriving from a default⁸ are the only mechanism able to incentivize a country's debt repayment: if a country will face large negative consequences deriving from default then it will pay-back its debt⁹.

The kind of debt involved in a restructuring process can vary with a general distinction that is made between domestic¹⁰ and external debt. The first one refers to the debt issued under domestic law whereas the latter refers to the debt issued under foreign law (usually New York or English law)¹¹. The important difference is that bonds issued under domestic law can be easily changed through a legislative fiat¹² whereas foreign law bonds are more difficult to modify.

The existing literature has been mostly focused on cases of external debt restructuring episodes (see Cruces and Trebesch (2013) for a comprehensive dataset) but there is a new emerging branch of literature focusing of domestic debt restructuring (see Reinhart and Rogoff (2011b), Erce (2012), Erce and Díaz-Cassou (2010), and Mallucci (2015)).

Another layer of differentiation that can be added comes from the fact that some holders are internal (such as domestic households and banks) and others are external (foreigners). This is relevant in order to study the resource transfers between resident and non-resident debt holders and the related international risk sharing implications.

⁷In 2012 for example, waiting for Argentina's debt repayment, NML Capital (an Argentina's private creditor) confiscated the Argentinian ship Libertad with the aim to recover part of the amount due from the country. Some months later however, the ship was released because of the recognition of sovereign immunity (UN International Tribunal for the Law of the Sea).

⁸Several papers study the consequences deriving from a default such as the exclusion from financial markets (Cruces and Trebesch, 2013), the reduced credit to the private sector (Arteta and Hale, 2008), the trade sanctions (Rose, 2005; Martinez and Sandleris, 2011), the reduced FDI flows (Fuentes and Saravia, 2010) etc. For a review see Borensztein and Panizza (2009) and Sandleris (2016).

⁹Countries cannot commit to repay their debt (Eaton and Gersovitz, 1981; Aguiar and Gopinath, 2006; Arellano, 2008; Mendoza and Yue, 2012).

¹⁰See Bua et al. (2014) for a discussion about the benefits of domestic debt.

¹¹Taking into account also the currency of denomination then a further distinction can be considered: domestic debt denominated in foreign or local currency and external debt denominated in foreign or local currency. This distinction is useful when the vulnerability deriving from the currency composition of the debt portfolio is studied.

¹²This is for example what happened in Greece where the government approved the Greek Bondholder Act 4050/12, 23 February 2012 in order to facilitate the restructuring of Greek law bonds (Zettelmeyer et al., 2013; Martinelli, 2016).

In general, the distinctions above described are quite important when the consequences deriving from a restructuring intervention must be taken into account. For example indeed, assuming that domestic debt is held mostly by domestic banks, a restructuring of domestic debt might affect negatively the debtor country's financial sector. This is the reason why, in some cases (such as Belize in 2007, Ecuador in 1998¹³), restructuring interventions have been negotiated just for the external part of a country's debt. However there have been also cases where only domestic debt holders were involved in restructuring episodes (such as Russia in 1998 and Ukraine in 1998¹⁴).

1.3 How does a Sovereign Debt Restructuring work?

A restructuring process is characterized by different phases as represented in Figure 1.4¹⁵

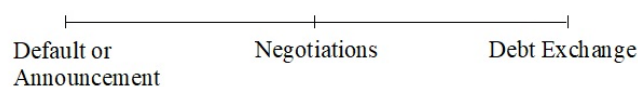


FIGURE 1.4: Timeline for the different phases of a sovereign debt restructuring process

1. Announcement: the process usually starts after a default event (or they can be simultaneous) but there have been also cases of pre-emptive restructuring episodes (i.e. implemented without missed payments) as a way to prevent the default and its consequences (IMF, 2013b). Using a dataset of external debt restructuring episodes between 1978 and 2010, Asonuma and Trebesch (2016) show that 38% of the cases were indeed pre-emptive (i.e. 68 episodes were pre-emptive whereas 111 were post-default). This distinction between pre-emptive and post-default is important because of the different consequences that

¹³See Erce and Díaz-Cassou (2010) for a complete description of the episodes.

¹⁴See Erce and Díaz-Cassou (2010).

¹⁵Actually, there is also a preliminary phase that should be considered: the "pre-restructuring period". This defines the time that goes from the start of the debt problems till the announcement of the restructuring. This period is more than twice as long as the period of negotiation and it is characterized by a double output loss (18% versus 9%) (House et al., 2017).

it produces. As reported by Asonuma and Trebesch (2016) indeed, pre-emptive restructuring episodes produced quicker negotiations (almost 20% quicker) than the post-default cases.

2. Negotiation phase: it is usually a very long process¹⁶ because of the strategic behaviour of the parties involved (see Bi (2008) for some information about the length and the strategic considerations in action). During this phase there is an evaluation of the debtor country's debt and its main characteristics (Lim et al., 2005). The aim is to reach an agreement that can provide a debt relief to the troubled country.

According to the type of creditors, there are different negotiation methods for a Sovereign debt restructuring (Table 1.1).

TABLE 1.1: Sovereign debt restructuring process according to creditors' type

Sovereign debt restructuring process			
Creditor	Commercial Banks	Bilateral	Bondholders
Negotiation's procedure	London Club	Paris Club	Exchange Offers

The *London Club* and the *Paris Club* have been both introduced in order to facilitate a coordinated solution, between creditors, to the payment problems of a debtor country. The two Clubs use similar procedures and have similar characteristics: they have not rules or statutes, their decisions are not legally binding and the participation to their meetings varies case-by-case.

The London Club was established for the first time in 1976 because of Zaire's problems and it is an informal group of private creditors. It is indeed used for restructuring processes with private creditors such as commercial banks. Negotiations are conducted by a representative private creditors committee (i.e. the Bank Advisory Committee¹⁷).

The Paris Club instead was established for the first time in 1956, because of Argentina's problems, and it is an informal forum of creditor countries (i.e. official creditors). It indeed deals with public claims toward a debtor country deriving from bilateral loans¹⁸ (i.e. public debt of the debtor country coming from loans of other governments). It takes case-by-case decisions that require the consensus of all the creditor countries involved. Restructuring interventions are negotiated just with countries that have a current program with IMF¹⁹.

¹⁶Nowadays the process has become quicker and less disputed than it was in the past. According to Tomz and Wright (2013) the average length of default is 9.9 years (7.8 years after 1970) but with a large variability (the standard deviation of this length is 10.5).

¹⁷This committee is made of a limited number of representative banks that negotiate on behalf of all the banks involved.

¹⁸The terms of treatment adopted changed through times: Venice terms were adopted in 1987 (giving longer repayment period), Toronto terms in 1988 (giving a partial cancellation of debt), Houston term in 1990 (extending the eligible countries for the Toronto terms), London terms in 1991 (raising the percentage of debt cancellation), Naples terms in 1994 (raising again the percentage of debt cancellation).

¹⁹See Cheng et al. (2017a) for an analysis of the Paris Club's procedures.

The negotiation with retail bondholders instead is a different case. Creditors coordination is indeed particularly problematic in this case given that bonds are widely dispersed²⁰ in the financial markets and involve several different bondholders. One big problem of a government undergoing a restructuring is indeed to identify all the bondholder and to start consultations with them (or with their representatives).

3. Debt exchange²¹: at the end of the negotiations, a restructuring offer is prepared (it can assume several forms as we will see later in the chapter) and the creditors can choose to accept it or not within a certain period²². In case of a positive conclusion, this is usually considered as the ending date of the restructuring process²³. However, it is necessary to reach a certain minimum participation-threshold (usually between 75% and 85% of outstanding bonds), in terms of accepting creditors, in order to have a successful exchange. This is the reason why many exchange offers have some "carrot" features, such as upfront cash payments or a menu options, able to incentivate the participation.

A particular condition that can arise during this phase is known as the *holdout* problem. In order to reach an agreement between debtor and creditor countries indeed, the consent of the majority of bond-holders is required. However, it might happen that some bondholders do not give their consent for the restructuring, retaining their claims with the aim to receive in the future a larger or the full repayment from the debtor country. This is the so-called *collective action problem*: the best group strategy for creditors is that all of them participate in the restructuring whereas the best individual strategy is to leave everyone else to participate. This can disrupt the restructuring process as happened in the Argentinian case of 2005²⁴. In order to minimize the holdout problem and to facilitate the negotiations²⁵, the Collective Action Clauses (i.e. CACs) have been introduced into bonds' contracts^{26 27}. These clauses allow a super-majority of creditors (usually 66% or 75%) to change the bonds' contractual terms, binding all creditors of a specific bond series. CACs can be used for a single bond or across bond series (i.e. bonds with different terms and conditions) and in this second case, basically, the country treats the bond series

²⁰Around 600.000 retail investors were involved in the restructuring of Argentina in 2005.

²¹Here I am referring to *distressed exchange*: "exchanges at terms less favorable than the original bond or loan terms" (S&P's, 2006). These exchanges are different from the normal liability management operations.

²²In the past episodes, the deadline has been often extended in order to increase the participation rate.

²³As we will see later, there are however cases of prolonged debt distress and serial restructurings.

²⁴In the Argentinian restructuring of 2005, just part of debt-holders participated into the debt swap. Then, in August 2013, the United States' court (with the Griesa's ruling) established that the holdouts in that restructuring episode had to receive the full face value of their original bonds.

²⁵The important role of CACs is to minimize the risk that an holdout minority can block the restructuring.

²⁶CACs are generally included in bonds issued under English law and New York law (since 2003).

²⁷This is the so-called "contractual" approach to sovereign debt restructuring. Conversely, the so-called "statutory approach" is based on the willingness to create an international institution or mechanism able to oversee the sovereign debt restructuring cases (such as the Sovereign Debt Restructuring Mechanism proposed by Krueger (2002)).

as a single group. Their role can be then considered very important during the negotiation phase²⁸.

1.3.1 Haircut

Many formulas are used to compute the amount of creditors' losses (i.e. haircut). The most commonly used approach, introduced by Sturzenegger and Zettelmeyer (2006), Sturzenegger and Zettelmeyer (2008), and Cruces and Trebesch (2013), is based on net present value. More specifically, creditors' losses are generally computed comparing the present value of the new instruments and the present value of the old instruments. Both values should be computed using the same interest rate according to this formula:

$$H_t^i = 1 - \frac{\text{present value of new debt}(r_t^i)}{\text{present value of old debt}(r_t^i)}$$

where H_t^i is the haircut and r_t^i represents the discount factor used to compute the present value of old and new debt instruments²⁹.

This equation allows to measure the loss realized in the exchange by the participating creditors³⁰.

1.3.2 Restructuring Strategies

A sovereign debt restructuring can be implemented in several different forms. The resulting outcome might vary in terms of the distribution of gains and losses among creditors and debtor country (depending on the strategy used) and therefore, each approach should be evaluated case by case. Here I will provide some information about the most used strategies³¹.

- Face value reduction (i.e. nominal haircut).

A face value reduction consists in a write-down of the nominal amount of the outstanding debt. For example, taking \$100 as nominal amount, a 20% face value reduction implies that the new amount of debt to be paid will be just \$80. This is usually considered a proper strategy when debt cannot be considered sustainable with high probability (IMF, 2014b) such as in case of solvency crisis. A debt forgiveness would be indeed useful in such a situation because it might provide the debtor country with the right incentive to

²⁸See Haldane et al. (2005) and Eichengreen and Portes (1995) for a costs and benefits analysis deriving from the introduction of CACs.

²⁹Sturzenegger and Zettelmeyer (2006) suggest to use the secondary market yield deriving from the price of the new debt instrument in the first available trading day after the exchange. The limit of this approach is that this yield is not always available, especially for countries with illiquid bond market. As alternative, Cruces and Trebesch (2013) propose to impute exit yields based on ratings and market data.

³⁰There have been also cases where the net present value (NPV) of debt after the restructuring was larger than before (such as the mega-swap implemented in Argentina in June 2001 that, according to Díaz-Cassou et al. (2008), produced a NPV gain between 2 and 28%).

³¹Here I will discuss these strategies in isolation even if a combination of them is possible and it has been often used in the past episodes.

implement some structural reforms (when the situation is critical), accelerating then its recovery process (Krugman, 1988a; Sachs, 1989). In the theoretical literature, originally, the determination of this face value reduction was modelled in an exogenous way (Marchesi and Thomas, 1999; Froot, 1989; Sachs, 1989) whereas, more recently, some endogenous forms of nominal write-down have been introduced (for example Yue (2010), Prokop (2012), Asonuma (2012) consider a Nash bargaining process).

- Maturity extensions (i.e. rescheduling or net present value haircut).

A maturity extensions can be defined as a lengthening of maturities of the old debt. Since it postpones in the future the repayment schedule, giving then fiscal space to the debtor country, it is usually considered a proper strategy to deal with liquidity crises (IMF, 2014b). This strategy can be implemented also in combination with a reduction of the interest rate. From the literature, some useful insights in term of debt rollover risk when a maturity extension is implemented are given in Fernandez and Martin (2015). Bac (1999) instead considers an extreme lengthening of maturity in the form of grace periods³² deriving as a Nash equilibrium creditors' strategy in a dynamic non cooperative game³³. Its length depends on the planning horizon of the parties (function of policy cycles in the debtor country and of creditors' future repayment expectation), the discount factor and the growth perspective of the debtor country (in case of pessimistic beliefs no grace period would be allowed).

- Additional lending.

This strategy consists in new lending from creditors, provided at an advantageous interest rate (a sort of concessional loan³⁴), in the hope that the debtor country will recover and then it will pay back its debt (Sachs and Cohen, 1982; Krugman, 1988a). Usually, the new money is given conditional to the implementation of some structural reforms (defined during the negotiation process). The rationale of new lending relies on the idea that even if countries are suffering from a debt overhang condition, there is still a possibility for creditors to be fully repaid in case of positive news for the debtor country (such as a positive shock or a positive effect deriving from the structural reforms undertaken)³⁵. Therefore, the existing creditors might be interested in providing new lending in order to avoid the default and to protect the value of their existing claims toward the debtor country (i.e. a *defensive lending* á la Krugman (1989a)³⁶). This new lending might be provided

³²A grace period can be defined as a period where interest payments are suspended.

³³The *ratio* of a grace period is to give to the debtor country the possibility to exploit some investment opportunities, allowing the creditors to maximize then the present value of debt repayments.

³⁴Krugman (1988a).

³⁵In such a case, creditors don't have to write-down their claims unnecessarily (Krugman, 1988a)

³⁶No consensus has been clearly set yet regarding the defensive lending hypothesis. Easterly (2002) find empirical evidence for such an hypothesis whereas Marchesi and Missale (2013) find evidence for defensive *granting* instead of lending. In the highly indebted countries, between 1982 and 2008, grants were indeed provided in order to compensate the reduction of loans and to ease the debt reduction process.

not only by the private creditors but also by the official sector³⁷.

- Debt buyback.

It can be defined as a transaction in the secondary market where outstanding debt instruments are exchanged for cash (often at a discount)³⁸. The buyback could be self financed or financed by an international financial institutions³⁹. In the first case, the resources used for the buyback come from a reduction in debtor's investment, consumption and trade surpluses or from its foreign exchange reserves. Such a debt buyback could then reduce the future debtor country's ability to repay (i.e. *high appropriability*) or not (i.e. *low appropriability*), as explained in Arias and Broner (2013)⁴⁰. In the former case, the debtor will be better-off and the creditors worse-off; in the latter case instead it will be the other way around (it is considered a zero sum game). An alternative might be the use of the new bond issuance's revenues to buyback the old outstanding debt (Arias and Broner, 2013). In such a framework, the new debt must be senior otherwise it would be treated as the old one and its secondary market price would be the same (i.e. a debt reduction would not be possible). The introduction of seniority is crucial in order to obtain a debt reduction since it will reduce the price of the existing debt, providing then debt relief (Manasse, 2011; Schmitt-Grohe et al., 2016)^{41 42}.

- Debt for equity swap.

It is defined as an exchange between debt and local currency funding for an equity investment (i.e. real investment) in the debtor country. This exchange usually involves also some restrictions in order to avoid a quick repatriation of capital in the creditor's countries. This strategy was used by several LDCs⁴³ in the 80s and 90s⁴⁴. For example,

³⁷Official loans usually have a seniority clause.

³⁸In the past experiences, these transactions usually produced a lower reduction in the net asset position than other strategies (implying also an higher cost). See Claessens and Dell'Ariccia (2011) and the case of Bolivia described by Bulow and Rogoff (1988). A large literature (see Manasse (2011)) shows that, when the probability of repayment is reflected correctly by the market prices, these buybacks typically produce a waste of resources. Bulow and Rogoff (1991) show that a country cannot gain repurchasing its debt at market prices because in such an operation, the largest part of benefits deriving from the buyback will go to the creditors. Indeed if creditors believe that the buyback will stimulate growth, then they will demand a higher price. A buyback indeed increases the market value of the remaining debt outstanding and consequently it may worsen the net asset position of the debtor country.

³⁹A debt buyback on the secondary market can be financed also by financial institution's money such as IMF, World Bank etc. Schmitt-Grohe et al. (2016) consider a purchase of debt from a third party, such that the country will be able to repay in full its outstanding debt even in the worst case scenario. Creditors will be then better-off because, if the bad state occurs, they will be compensated from the international institution. In such a framework, the money lent from the third party is then mainly used to increase the creditor's expected payment.

⁴⁰Another interesting contribution is Medeiros et al. (2007).

⁴¹If the price of the old debt is lower, there is the possibility to retire a larger quantity of old debt with the new bonds.

⁴²The debtor country will benefit from this transaction, but existing creditors will be worse-off given that the secondary market price decreases. However, the issuance of new senior debt might still be in the interest of creditors since, once the debt reduction is completed, debtor's economy might improve and the market price of outstanding debt too. See Krugman (1989b) for some examples.

⁴³Countries that have used debt for equity swaps include Argentina, Brazil, Chile, Costa Rica, Ecuador, Jamaica, Mexico, Uruguay, and Venezuela.

⁴⁴Between 1985 and 1996, debt for equity swaps totaled \$38.6 billion (World Bank, 1998).

the Mexican debt for equity swap (in 1985) gave the possibility to exchange loans for Mexican equity in certain investment areas (i.e. motor, tourism, and chemical industries). A similar strategy called *debt for land swap* was adopted by St Kitts and Nevis where lands were offered to creditors in order to pay back the country's debt (IMF, 2013c).

1.3.3 Past Episodes

Before the Financial Crisis of 2007, the interest about debt relief was almost exclusively focused on the initiatives for the highly indebted and poor countries. Public debt overhang episodes however have afflicted both poor and advanced economies since the early 1800s (Reinhart et al., 2012)⁴⁵ and they have been generally interconnected with default cycles (Reinhart and Rogoff, 2009). More specifically, Reinhart and Rogoff (2009) identify five important default cycles: 1) during the Napoleonic War, 2) between the 1820s and the 1840s, when several countries in the world were in default, 3) between the 1870s and the 1890s, 4) from the Great Depression in the 1930s until the 1950s, when again several countries in the world were in default⁴⁶, 5) during the emerging market debt crises in the 1980s and 1990s⁴⁷.

War times have been identified as one of the most important cause of debt accumulation and default (Reinhart and Rogoff, 2011a). There are indeed two debt spikes for the advanced economies corresponding to the two world wars (and another one during the Napoleonic War in the early 1800s). In peace times instead, financial crises have played an important role for the deterioration of public finances (Reinhart and Rogoff, 2011a). More specifically, due to the several rescue operations undertaken by the governments (in particular for banks), the link between financial crises and public debt accumulation has become stronger especially in the recent years⁴⁸. Nowadays, then, the high private debt burden represents an important problem and its potential interaction with public debt should be then taken into account from a policy perspective.

Several sovereign debt restructuring episodes occurred in the past deserve to be mentioned:

1. Post World War I (WWI): two debt relief episodes, related to official debt in Europe, occurred at that time. The first one is the Hoover Moratorium signed in 1931 in order to suspend interest and principal payments on war debts for one year⁴⁹. The second one is the generalized debt default of 1934 followed by a cancellation of war debts⁵⁰. All debtor countries indeed suspended debt payments related to the war debt due to the United States

⁴⁵Defining debt overhang as episodes with public debt-to-GDP larger than 90% for at least 5 years, Reinhart et al. (2012) identify 26 cases between 1800 and 2011 for the advanced countries.

⁴⁶Before the World War I and II many countries stopped their debt repayments toward the enemy country creditors. Also after the two wars, defaults were quite common for the losing countries.

⁴⁷Defaults in this period were concentrated mainly in Latin America.

⁴⁸See Erce (2015) for an explanation of the Sovereign-banks nexus.

⁴⁹However, after the end of the moratorium in 1932, scheduled payments did not resume in a regular way (Reinhart and Trebesch, 2016).

⁵⁰Debt relief in the 30s amounted to around 21% of GDP. See Reinhart and Trebesch (2016) for more information and data about the official debt overhang resulting from WWI.

and the United Kingdom⁵¹ removing this debt from their balance sheets (Reinhart and Trebesch, 2016).

2. Post World War II (WWII): With the London Debt Agreement of 1953, following the end of the WWII, Germany benefited of a significant debt reduction (almost 50%), amounting to 15 billion Deutschmarks, and of a thirty years maturity extension⁵². The German debt was accumulated in part after the WWI, because of the huge reparations imposed to the country, and in part after the WWII due to the reconstruction expenditures. The debt reduction contributed to the post-war growth of the country, creating fiscal space, lowering borrowing costs and normalizing inflation.
3. Brady Plan: Between the late 1970s and the early 1980s, many developing countries started facing debt repayment difficulties (Arslanalp and Henry, 2005). During the first negotiations in the 1970s, creditors adopted a refinancing strategy for the debtors, without discussing a debt restructuring⁵³. The debt crisis started officially in August 1982 after that Mexico announced its impossibility to service its debt⁵⁴. After this announcement, many commercial banks reduced or refused new lending to Latin American countries. By the late 1980s, several developing countries were in default. Although rescheduling agreements were signed with the creditors, they were based just on short-term liquidity relief without involving any reduction in face value (such as the *Baker Plan*⁵⁵ in 1986). The Brady plan⁵⁶, announced in March 1989, represented then a big change since it promised a debt reduction in exchange for the implementation of structural reforms. The Plan was structured with the three following characteristics: 1) bank loans were exchanged into sovereign bond (partly collateralized by US Treasury bonds)⁵⁷; 2) participating creditors were offered a "menu" of options with the possibility to choose between different new instruments^{58 59}; 3) part of the accumulated interest arrears was written off and part was capitalized into new short-term floating rate bonds. The agreements fostered capital

⁵¹Finland was the only country which fully repaid its debt.

⁵²According to the signed agreement, debt repayment was due only in case of Germany running a trade surplus. In addition, this repayment was limited to 3% of export earnings. In such a way, creditors were incentivized to import German goods.

⁵³Creditors adopted this strategy for three reasons: 1) they believed the debtor countries were facing a liquidity crisis; 2) they believed that, with a positive external shock and some internal adjustments, debtors would have been able to repay; 3) by maintaining debt service financed by new lending, banks didn't have to classify the loans as impaired.

⁵⁴Actually, the first Latin American country to default was Costa Rica in 1981.

⁵⁵The Baker Plan produced only a reduction of the interest rates and a lengthening of the maturities up to 30 years.

⁵⁶In total, 17 Brady deals were signed. Most Brady countries were in Latin America. The other six were Bulgaria, Cote d'Ivoire, Jordan, Nigeria, Philippines, Poland and Vietnam.

⁵⁷In such a way, a liquid secondary market for emerging market sovereign bonds was created

⁵⁸The instruments offered were: *discount bonds* with a lower face value or *par bonds* with long maturities and low interest rates but no debt reduction. The alternative was to provide new money to the debtor countries receiving in exchange new instruments with better conditions (i.e. higher coupons or shorter maturities).

⁵⁹With this approach, banks were free to choose among different options and thus it was not imposed the same treatment to all of them.

inflows to the Brady countries, re-opened capital markets, boosted stock markets, growth and investment (Arslanalp and Henry, 2005)⁶⁰.

4. Heavily Indebted Poor Countries (or HIPC) Debt Initiative: Because of the debt crisis that affected the HIPCs between the 80s and 90s, the World Bank and the IMF launched this program in 1996 with the aim to help poor countries struggling with high level of debt. The HIPC initiative was then strengthened in 1999 (increasing the link between debt relief, poverty reduction and social policies) and in 2005 with the introduction of the Multilateral Debt Relief Initiative (i.e. *MDRI* ⁶¹). Currently, the HIPC initiative is based on a two-steps procedure: in the first step (the *decision point*), a country has to meet some criteria in order to be considered eligible for the Initiative⁶² and then to receive a relief for its debt service⁶³ (Ferry et al., 2016); in the second step (the *completion point*), when a country fulfils other requirements⁶⁴, there could be a full debt relief. Through the HIPC Initiative, the majority of debt owed by heavily indebted poor countries has been cancelled. Out of the 39 countries considered eligible for the HIPC Initiative, 36 received full debt relief (for a total of \$99 billion) whereas 3 have not reached yet the decision point (IMF, 2017).
5. Russia: In 1998, Russia shocked the financial markets by defaulting on its debt (\$30.4 billion). This event produced financial contagion for both advanced and emerging market economies. The default was largely unexpected since the country was considered "too big" or "too nuclear" to fail (Díaz-Cassou et al., 2008). After the rejection of the first restructuring proposal in August 1998, an agreement with the creditors was reached in March 1999 (the restructuring was then implemented in August 1999 and February 2000⁶⁵). It combined debt restructuring in the form of principal reduction of around 17% of the total restructured debt (almost 4.1% of GDP) with capital controls (IMF, 2006).
6. Argentina: Starting from 2001, four episodes of debt restructuring afflicted Argentina. The first one is the *Megaswap* implemented in June 2001 (involving \$30 billion). The

⁶⁰Ten years later however, according to Chuan and Sturzenegger (2005), the step-up interest payments of some of the new bonds issued under the Brady Deal affected the debt sustainability of some debtors, reproducing again default risks. Ecuador (in 2000), Uruguay (in 2003), Argentina (in 2005) and Cote d'Ivoire (in 2010) had indeed to restructure their Brady bonds).

⁶¹The MDRI gave the possibility for a 100% relief on eligible debt by the multilateral institutions (IMF, World Bank and African Development Fund).

⁶²Four criteria are required: 1) to be eligible to borrow from the World Bank's International Development Agency and from the IMF's Poverty Reduction and Growth Trust; 2) to have an unsustainable debt that cannot be addressed through traditional relief mechanisms (originally defined as a ratio of external debt in net present value to export larger than 250% and then reduced to 150%); 3) to have a good track record of reforms and policies implemented through an IMF or a World Bank program; 4) to have developed a Poverty Reduction Strategy Paper.

⁶³This was the first time that a relief on multilateral debt was provided (Lisandro and Ross, 2001).

⁶⁴The other requirements are: 1) the country has to prove a good track record related to its performance under the IMF and the World Bank programs; 2) it has to implement key reforms agreed in the first step and the Poverty Reduction Strategy Paper for at least one year.

⁶⁵See Moody's (2016).

peculiarity of this debt exchange is that increased both the debt maturity and the coupon rates, resulting then in a net present value gain between 2% and 28% for creditors (Díaz-Cassou et al., 2008). The second episode is the *Phase 1* implemented in December 2001 that, targeting the domestic residents, was based on a voluntary exchange of bonds for a total amount of \$58.52 billion⁶⁶. Originally, it was planned also a *Phase 2*, involving non-resident creditors, but it was never implemented because of the default of 2001. The third episode is the *Pesification* of February 2002 where any dollar-denominated domestic law instruments were re-denominated in local currency, affecting \$58 billion⁶⁷. The fourth restructuring episode is the *International Global debt exchange* implemented in June 2005, where 152 defaulted securities were exchanged for 11 new financial instruments (involving \$80.08 billion). It involved 56% principal reduction and a net present value reduction of 75% (IMF, 2006).

7. Greece: The restructuring of 2012 represents the largest debt restructuring in the history of sovereign debt (with a debt relief larger than 50% of its 2012 GDP). It will be discussed in more details in Paragraph 1.5.

1.3.4 Stylized Facts

In order to show some stylized facts about sovereign debt restructuring, it is useful to start from the dataset of Cruces and Trebesch (2013) that collects 187 restructuring episodes, involving external debt, for 72 countries between 1978 and 2010 (this dataset is then complemented with Asonuma and Trebesch (2016)). Figure 1.5 shows graphically the large number of restructuring interventions, undertaken between 1978 and 2013, with haircut values that range from negative to high positive territory.

The mean haircut for the whole sample is 37% (Figure 1.6) with a standard deviation of 27%. Separating the analysis in subgroups, however, Cruces and Trebesch (2013) show the presence of some heterogeneity: the haircut is larger for the Highly Indebted and Poor Countries (87%) and it is smaller for restructuring episodes pre-1990⁶⁸.

Figure 1.6 shows the positive correlation between the haircut and the amount of debt involved (in % of the GDP) in the restructuring episode. Historically then, the largest default episodes implied larger haircuts. The picture however is quite different if a distinction between restructuring involving a face value reduction and restructuring based only on maturity extensions is introduced. In case of a simple maturity extension, the average haircut is around 20% and a slightly negative correlation with the amount of debt involved can be observed (Figure 1.7).

⁶⁶See Sturzenegger and Zettelmeyer (2008) and Díaz-Cassou et al. (2008).

⁶⁷See Sturzenegger and Zettelmeyer (2008) and Díaz-Cassou et al. (2008).

⁶⁸ Benjamin and Wright (2009), focusing on the reasons of larger or smaller haircuts, notice that the haircut size depends on the length of the default and on the output decline in year of the default.

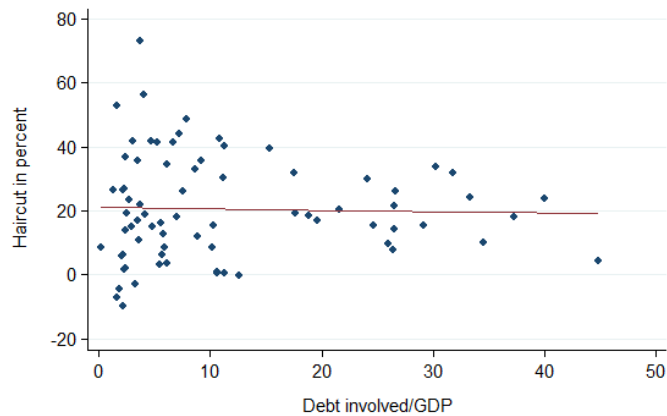


FIGURE 1.7: This figure plots the correlation between haircut in percentage points and the amount of debt involved in the default when there is no a face value reduction. Source: Author's computation based on Cruces and Trebesch (2013) and Asonuma and Trebesch (2016).

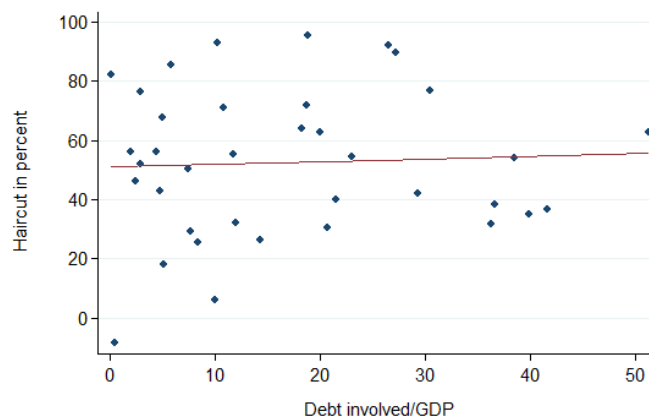


FIGURE 1.8: This figure plots the correlation between haircut in percentage points and the amount of debt involved in the default when there is a face value reduction. Source: Author's computation based on Cruces and Trebesch (2013) and Asonuma and Trebesch (2016).

put an end to their debt problems, requiring often repeated interventions over time (serial restructuring as serial default⁶⁹ (Asonuma, 2012; Asonuma, 2016)). One explanation to this multitude of debt relief episodes over time, for developing countries and emerging markets, might be the slow rate of change in these countries' structural characteristics (Depretis Chauvin and Kraay, 2007). An alternative explanation might be instead related to the preference of debtors for high debt levels because of an high discount rate⁷⁰ (Easterly, 2002). Countries might

⁶⁹Countries that default tend to default more than once (Reinhart and Rogoff, 2004).

⁷⁰An high discount rate might reflect for example a profligate government or a condition of political instability (Easterly, 1999).

indeed borrow anticipating future debt forgiveness and this might lead them, over time, to use new borrowing to replace the old cancelled debt⁷¹. Alternatively, it might be the creditors' strategy to avoid reporting non-performing loans in their balance sheets⁷², to produce a common practice of debt roll-over (Geginat and Kraay, 2012), instead of providing substantial relief, implying then the necessity of several interventions over years.

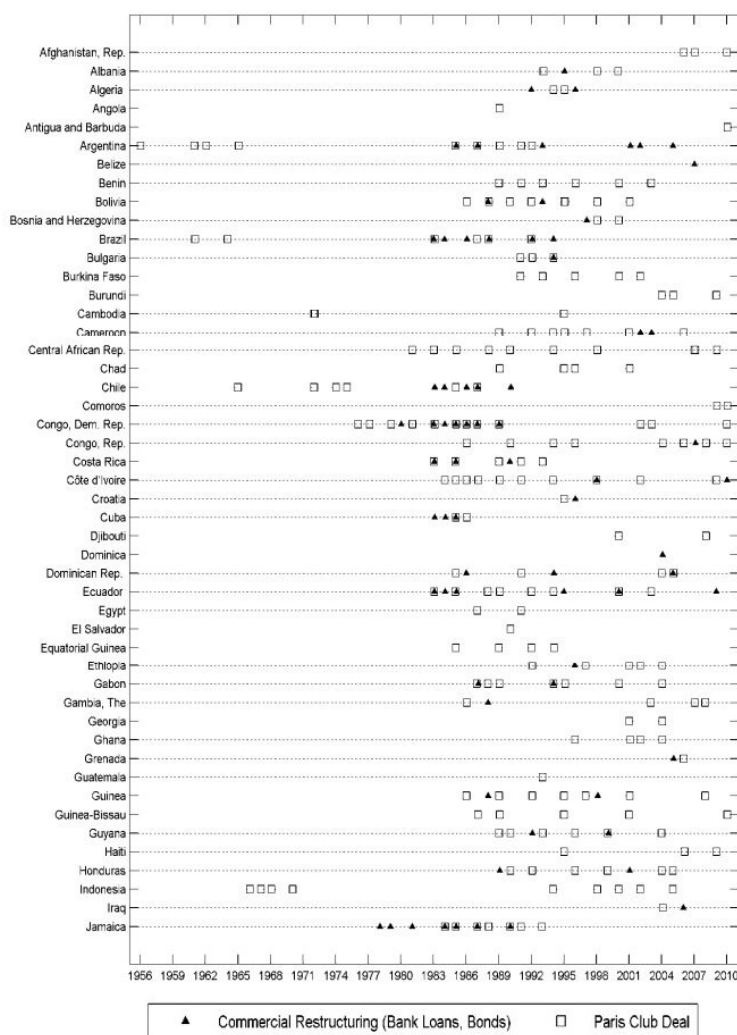


FIGURE 1.9: The triangles represent the restructurings undertaken through the London Club whereas the squares refer to the Paris Club agreement. Source: Das et al. (2012a).

Other layers of heterogeneity can be derived from Das et al. (2012a)'s review. 1) Quite different haircuts were used for the restructuring episodes analysed in the sample with an average higher value for post-default restructuring. 2) Maturity extension was the most used strategy (i.e. 129 episodes) even if the number of restructuring interventions implemented through a face value reduction (i.e. 59) has increased since 1980. 3) The number of debt restructuring

⁷¹Easterly (2002) shows that the debt forgiveness, for 41 heavily indebted poor countries, received from the World Bank between 1989 and 1997 amounted at US\$33 billion whereas the new borrowing in the same period was US\$ 41 billion.

⁷²The recognition of non-performing loans in the balance sheets might indeed be financially costly.

1.4 Economic Consequences of Sovereign Debt Restructuring

An important topic that deserves specific attention is related to the economic relevance of sovereign debt restructuring. Several papers have studied the consequences of sovereign debt restructuring episodes focusing on different aspects. The most important one is whether or not such an intervention is able to solve country's problems and to restore growth. The evidence is quite ambiguous on this point⁷⁵. With a focus on developing countries, Hepp (2005) shows that debt relief interventions had on average no effect in term of growth. The same lack of evidence is found also in Depretis Chauvin and Kraay (2005) studying 62 low-income countries over the period 1989 and 2003⁷⁶. However Hepp (2005), introducing a distinction between Heavily Indebted Poor Countries (HIPC) and non-HIPC, shows that the growth rate of the second group actually benefited of the debt relief. This result shows then that there might be different consequences according to the group of countries analysed and the kind of restructuring implemented. Several papers present evidence for the heterogeneity of the economic impact of debt restructurings and deserve to be mentioned.

Forni et al. (2016), focusing on restructurings with external private creditors implemented between 1970 and 2010⁷⁷, find different consequences in term of growth according to the grouping method used. In general they notice that 3 years after a debt restructuring, countries experience a per capita GDP growth lower (around 5%) than the other countries that didn't restructure their debt in the same period. The results are different if a distinction between agreements that can be considered as "final" (in the sense that let the countries to exit from a default condition) is introduced⁷⁸. They find indeed that, such final interventions are able to produce positive effects for growth even in the year immediately after the restructuring. This is due to the fact that final restructurings produce on average a lower level of debt post intervention whereas non-final restructuring produce the opposite result. Moreover, they find that the lower is the level of debt after the restructuring the better is the growth performance after the restructuring (i.e. the post-restructuring debt level matters) and that the amount of debt relief has a positive and persistent effect on growth when the initial debt level is low (i.e. the size of debt relief matters). In conclusion they claim that a restructuring can allow to exit from a default but, in order to be growth improving, it has to address the debt overhang problem and then it might imply larger haircuts.

Always looking at restructuring episodes with private creditors and at final restructuring, Das

⁷⁵Even if the causality between debt restructuring and growth is still not well defined, it represents an important point to be understood from the policy-makers' perspective. It is indeed crucial to understand whether a debt restructuring can produce a better growth performance or whether it is easier to restructure public debt when growth prospects improve.

⁷⁶This might be because the weakness of the economic institutions and of the infrastructures represent a greater barrier to growth than the debt overhang (Arslanalp and Henry, 2006a).

⁷⁷They focus on 168 restructuring episodes occurring during default.

⁷⁸This is the same approach used in Reinhart and Trebesch (2016).

et al. (2012b)⁷⁹ show that the median real GDP growth is around 4.5%, three years after a final debt restructuring agreement, whereas it is around 1.5% in the three years before. Similarly, Trebesch and Zabel (2016)⁸⁰ find that countries experiencing final debt restructurings have a GDP growth per capita, in the five years following the agreement, on average larger than 10%. Adopting the same horizon of five years and the same definition of final restructuring interventions, also Arslanalp and Henry (2005), show the faster increase in the real GDP per capita, for the countries signing the Brady Deal compared to a control group.

Another kind of heterogeneity is introduced in Asonuma and Trebesch (2016) (as already discussed before). Separating between preemptive and post default restructuring, they find indeed that in case of preemptive restructurings, countries recovers quickly in term of growth. In case of post default restructurings instead, growth stays below the trend at least three years after the default .

Differently from what described above (focus on episodes involving private creditors), Cheng et al. (2017b) study the growth consequences of sovereign debt restructurings by focusing on episodes involving official-sector creditors and using a novel dataset about the Paris Club restructuring agreements between 1956 and 2015 (Cheng et al., 2017a). More specifically, they separate between restructuring episodes with and without face value reduction finding that only in the first case there is a positive growth effect. They find indeed that agreements involving a nominal relief produce a 2% higher real GDP growth in the 2 years following the restructuring intervention. Conversely, agreements with only net present value relief are found to be without growth impact. Using the same distinction between restructuring episodes with and without face value reduction, also Reinhart and Trebesch (2016) and Reinhart and Trebesch (2014) study the link between restructuring interventions and growth⁸¹. Using a difference-in-difference approach, they show that debt restructurings are beneficial in term of growth only when they imply nominal haircuts. Relief intervention in the form of maturity extensions or interest rate reductions produce instead non-significant results. The restructurings involving private creditors' face value reduction translated into a real per capita GDP growth that was 3% higher than a control group of non-crisis emerging countries⁸².

Marchesi and Masi (2017) adopt a different approach, taking into account the distinction between private and official restructuring and comparing the two related growth effect⁸³. They indeed show that private and official restructuring might have different growth effects. More specifically, they show that defaults with private creditors are in general correlated with a

⁷⁹This paper focuses on 44 final restructuring episodes since 1980.

⁸⁰This paper focuses on 30 default episodes with private creditors.

⁸¹They consider the official sovereign debt restructurings of the 1920s and the 1930s and the private ones of the 1980s and the 1990s.

⁸²Cheng et al. (2017b) show also that countries that received nominal debt relief are characterized by less prudent fiscal policy (i.e. larger fiscal deficit) than countries not receiving a nominal relief. A similar result is found also in Easterly (2002) where it is shown how the debt relief to the Highly Indebted Poor Countries often resulted in larger indebtedness.

⁸³They study 73 default episodes in 117 countries for the period 1975-2013.

subsequent larger output growth but, once the severity of the default (i.e. the amount of debt actually restructured) is taken into account, the results are the opposite with a lower growth for up to nine years after the relief. Vice versa, in case of official debt restructuring there is no effect deriving from the simple debt relief but, once the amount restructured is taken into account, a positive effects can be observed up to seven years after⁸⁴. The size of debt restructuring might indeed affect growth in two alternative ways: 1) larger reliefs might have negative consequences producing adverse spillovers and a punishment effect (Cruces and Trebesch, 2013), 2) larger reliefs reduce more the level of debt giving then the possibility to countries to exit from a debt overhang condition (Krugman, 1988a).

Some papers study also the channels through which a debt restructuring intervention can influence output. One is related to trade. Imports might indeed decline after a restructuring intervention in case of a following exchange rate depreciation or because of some difficulties in financing a trade deficit. Rose (2005), focusing on Paris Club negotiations over the period 1948–2007, shows that debt restructurings produced a significant reduction in debtor countries' trade (around 8% for 15 years after). Asonuma et al. (2016) study instead the trade effects when a restructuring is implemented preemptively or post default⁸⁵ as these two kind of restructuring are quite different to each other. More specifically, in case of post default restructuring they observe a larger and more protracted reduction in imports (around 1.7% on average during the first 3 years versus the 0.7% for the preemptive cases⁸⁶) and a larger reduction in exports (1.8% in the contemporaneous year versus no significant drop for the preemptive cases) and real exchange rate. On the other hand, pre-emptive restructurings can be considered as more creditor-friendly and debtor countries might be able to maintain access to external financing. In this regard, Cheng et al. (2017b) find that restructuring involving a non-nominal reduction produce a slightly positive and significant effect in term of trade balance whereas the effect deriving from restructuring with nominal reduction is not significantly different from zero (this result is in line with Rose (2005)).

Another channel is related to investment. Asonuma et al. (2016) and Asonuma et al. (2017) show indeed that the reduction in investment is larger (around 10% lower) and prolonged in case of a post default restructuring (five years after the event it is still below the pre crisis level). Investment instead recovers quickly in case of preemptive interventions. Asonuma et al. (2017), in particular, study the credit-investment channel in order to see wether this channel is different in case of preemptive or post default restructuring. They show the existence of a feedback between GDP and credit that operates through investment. Post default restructurings produce a larger decline in bank credit than the pre emptive interventions, an increase in bank lending rates and make more likely future banking crises. This channel amplifies the decline of GDP

⁸⁴Contrarily to what found in Reinhart and Trebesch (2016), the size of debt relief then matters. Also Trebesch and Zabel (2016) show that it matters in case of preemptive restructuring.

⁸⁵They use data from 177 private external debt restructurings implemented between 1978 and 2007.

⁸⁶The drop for the preemptive cases is just contemporaneous to the restructuring.

and investment⁸⁷. Fuentes and Saravia (2010) focuses instead on FDI flows finding that Paris Club restructurings are associated to reduced flows by around 2% of GDP.

The impact of debt restructurings has been studied also for variables such as market access and borrowing costs. Cruces and Trebesch (2013) show that restructurings with larger haircuts (i.e. higher reductions in the net present value) are followed by higher bond yield spreads and longer periods of capital market exclusion. Dias et al. (2012), taking the median haircut, show that countries with haircuts larger than the median experience an eight years median exclusion from capital markets. The exclusion instead lasts only of three years for countries with smaller haircut. Separating private from official restructurings, Asonuma and Trebesch (2016) show instead that preemptive restructurings in general produce a quicker market re-access than post default cases⁸⁸. Arteta and Hale (2008) find that official debt restructurings are more damaging in term of re-access to capital markets. This result however is quite controversial in the literature. Corsetti et al. (2017b), using an event analysis approach, studies the effects of the official lending's terms (adopted during the Euro area crisis), in sovereign bond markets. More specifically, focusing on changes in maturities and interest rates of the programmes implemented, they find that yields dropped, yield curves flattened and market liquidity improved. Also Ferry et al. (2016) find a positive consequence deriving from the official lending used during the HIPCs initiative. Official lending, indeed, made international financial markets accessible again (it was excluded before) for the countries involved.

1.4.1 An Event Analysis

In this subsection, I use a regression based event analysis (Gourinchas and Obstfeld, 2012; Balteanu and Erce, 2017) in order to show the effect of a sovereign debt restructuring for some of the macro variables above discussed. This kind of analysis is interesting because it allows to study the dynamic of the variables around the year of the debt restructuring intervention, considering both the run-up to the crisis and its aftermath. I consider then the restructuring dates from Cruces and Trebesch (2013) (complemented with Asonuma and Trebesch (2016)) and I focus on the effects for real GDP growth, investment growth rate, export, import and credit to the private sector⁸⁹, considering a time horizon of 9 years: $t \in [-4, 4]$.

The equation to estimate is the following:

$$y_{it} = \alpha_i + \sum_{k=-4}^4 \beta_k D_{i,t+k} + v_{it} + u_t + \epsilon_{it}$$

⁸⁷Asonuma et al. (2017) work also with sub samples of post-default restructurings, separating cases with and without credit crunches.

⁸⁸Preemptive restructurings produce also lower haircut (30% lower).

⁸⁹Data are taken from the World Bank WDI.

y_{it} represents the variable of interest for each country i and year t , β_k^R captures the difference of variable y_{it} from normal times when there are K periods of distance from the event considered, $D_{i,t+k}^R$ represents a dummy variable that is equal to 1 when the country is K periods away from the restructuring year, v_{it} and u_t control for country and time specific effects and ϵ_{it} is the error term.

As we can see from Figure 1.11 to 1.15, the real GDP growth stays below the trend in the years before the restructuring but then it recovers after the relief. The same applies to investment growth even if the recovery starts around 1 year after the restructuring. From a trade perspective, imports continue declining whereas export increases significantly one year before and after the restructuring, likely because of the devaluation of the currency. Credit to the private sector starts declining one year before the restructuring and then it stays below the trend, because of losses suffered by the banks due to the usual large amount of government bonds held by the domestic banking sector.

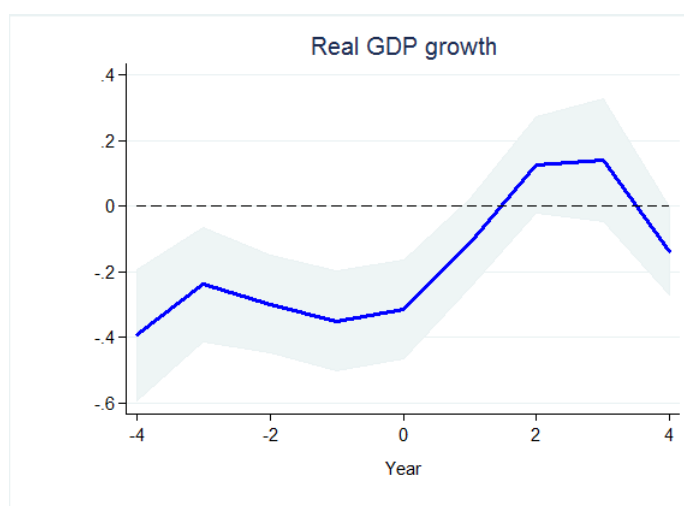


FIGURE 1.11: Author's computation. 0 is the year of the restructuring and -4 represents the fourth year before the restructuring. The grey area represents the 90% confidence bands.

1.4.2 What about the Creditors?

A positive consequence coming from a debt relief is the reduction of the negative effect that the debt overhang problem produces on investment. It should be discussed also whether there exists a space for creditors' potential gains in case of debt relief. It is indeed very likely that they will suffer a net present value loss because of the restructuring of their claims toward the debtor country. However there are also other effects in action that might reduce or compensate their welfare loss.

In this regard, Arslanalp and Henry (2005) give an interesting contribution, from an empirical point of view, analyzing the consequences that the Brady Plan produced for the Least Developed

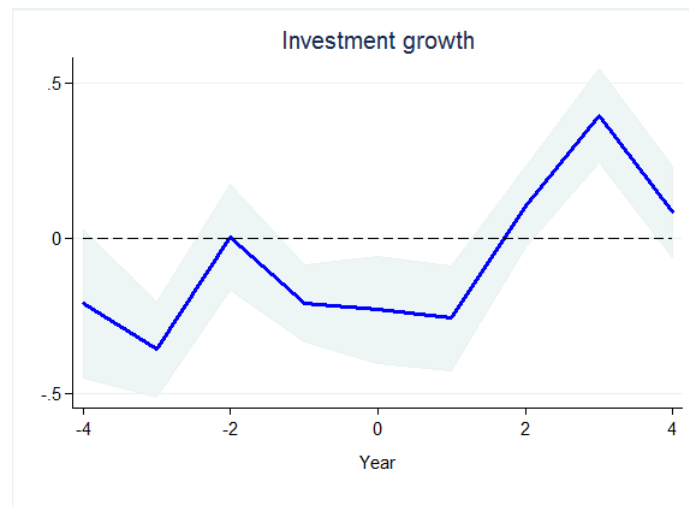


FIGURE 1.12: Author's computation. 0 is the year of the restructuring and -4 represents the fourth year before the restructuring. The grey area represents the 90% confidence bands.

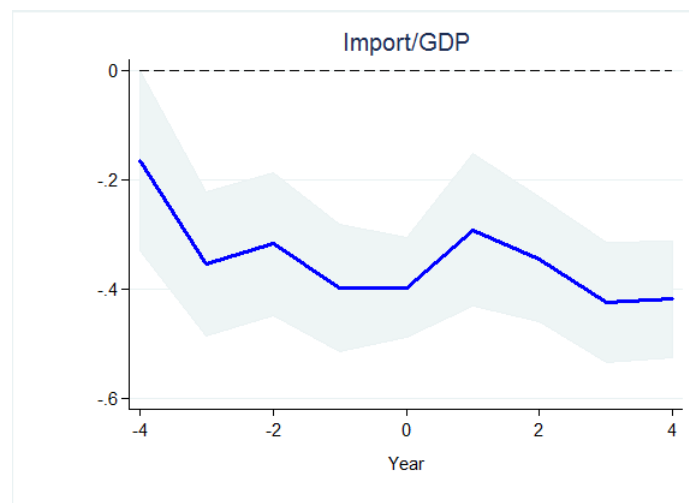


FIGURE 1.13: Author's computation. 0 is the year of the restructuring and -4 represents the fourth year before the restructuring. The grey area represents the 90% confidence bands.

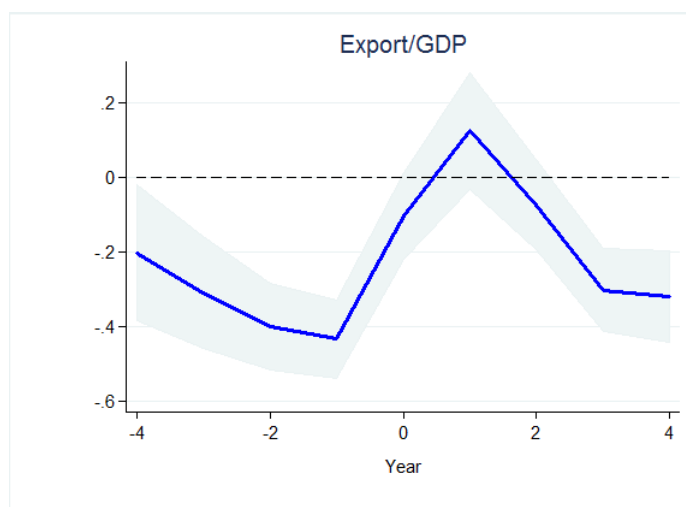


FIGURE 1.14: Author's computation. 0 is the year of the restructuring and -4 represents the fourth year before the restructuring. The grey area represents the 90% confidence bands.

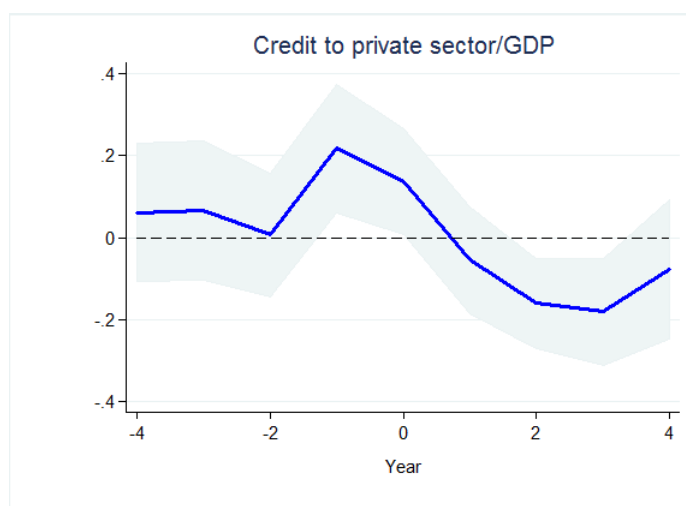


FIGURE 1.15: Author's computation. 0 is the year of the restructuring and -4 represents the fourth year before the restructuring. The grey area represents the 90% confidence bands.

Countries (i.e. LDCs). In particular, the authors compared the two policy-interventions implemented to solve the debt crisis that was affecting these countries in the '80-'90: 1) the Baker Plan and 2) the Brady Plan. The main difference between the two plans was that just the second one provided a face value reduction of debt. According to the authors, this is the reason why only the Brady Plan was able to restore the incentives to invest, producing an inflow of capitals and a consequent increase in LDCs' growth rates⁹⁰.

Moreover, the results deriving from the Brady Plan strengthen the thesis that both creditors and debtor countries can benefit of a debt relief (Sachs, 1989; Krugman, 1988a; Krugman, 1988b; Krugman, 1989b). More specifically, not all the debt relief interventions are really effective in solving a debt overhang condition but there are restructuring processes that can be considered more effective than the others.

The focus of Arslanalp and Henry (2005) is on financial markets effects.

Figure 1.16 shows indeed how the stock-market index appreciated (around 60% after the announcement of the Brady Plan compared to the 4.8% of a control group) in the debtor countries that accepted the deal, maybe reflecting positive expectations about future firms' profits and therefore about larger investment and growth. There was indeed the expectation that the debt relief would have restored the inflow of capitals in those countries (measured by *Net Resource Transfer* i.e. NRT). At the beginning of the crisis $NRT < 0$ whereas after the Brady Plan it turned out to be positive. The debt relief, reducing the marginal tax on future cash flows, gave indeed the possibility to reduce the debt overhang problem, restoring positive values for NRT.

A similar market appreciation was also observed for the stocks' price of the 11 largest US commercial banks with a significant LDC loan exposure: the average increase was about 35% that means a \$13.3 billion increase in shareholder value.

Adding the LDCs' wealth increase to that one of the creditor banks gives a measure of the total net benefit produced by the Brady Plan's: \$55.3 billion.

Understanding the reasons why the Brady plan produced such an increase in the stock market prices, in investment and growth is fundamental in order to identify the conditions that make a restructuring plan efficient.

According to the authors, the Brady plan did work because the debt relief via face value reduction was the right solution for countries (i.e. the LDCs) that were suffering from a debt overhang condition. Therefore, debt relief might be considered an effective solution especially if the debtor country is in a situation of debt overhang. This doesn't mean that this kind of intervention is always beneficial for all countries. For the HIPC's indeed, the debt relief was not an effective strategy (Arslanalp and Henry, 2006b) since their main problem was not related to the debt

⁹⁰According to Forni et al. (2016) and Reinhart and Trebesch (2016), as explained in the previous paragraph, the Brady Plan is considered as a final restructuring episode. Both studies show indeed the positive consequences produced by this agreement.

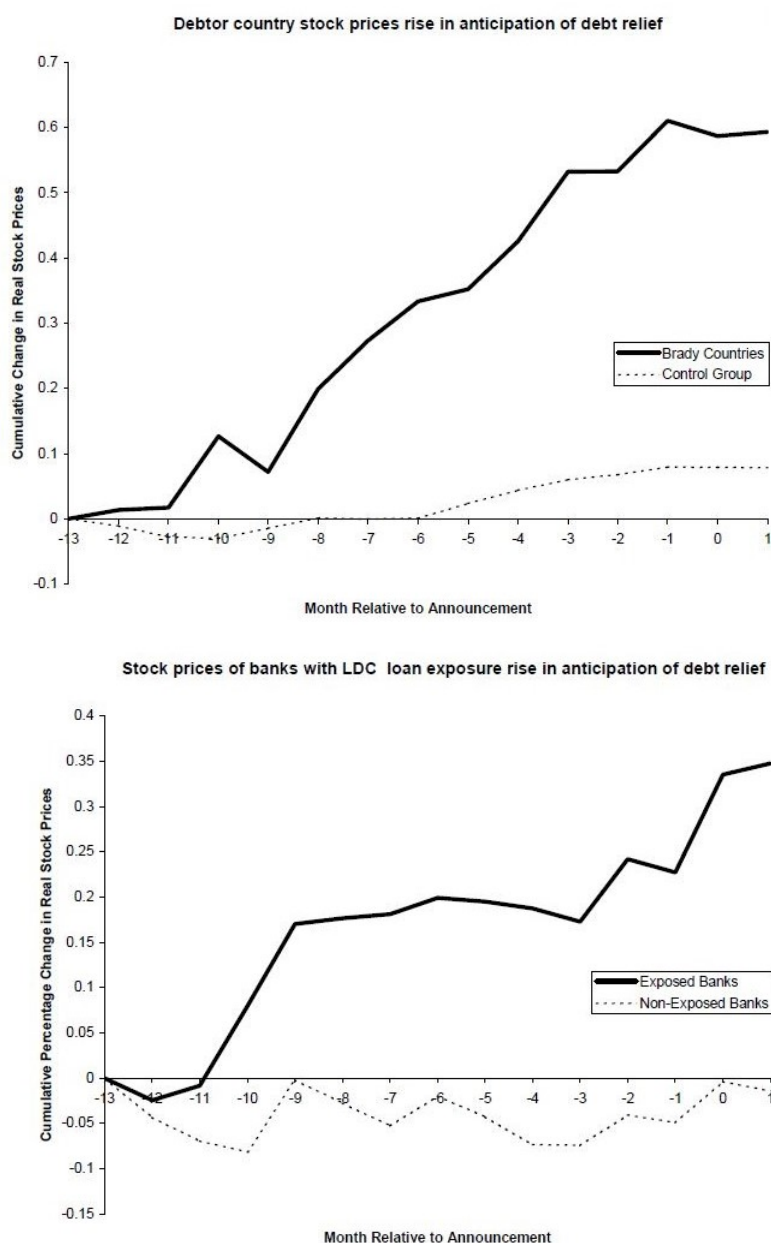


FIGURE 1.16: Debtor and creditors stock prices rise anticipating the debt relief. On the y-axis there is the abnormal percentage change of the stock prices. On the x-axis there are the 13 months before the announcement (-13) where 0 is the announcement month. Source: Arslanalp and Henry (2005).

overhang but to the weakness of institutions and infrastructures⁹¹ (Arslanalp and Henry, 2006a). Ferry (2015) shows indeed the moral hazard behavior adopted by HIPC's governments. They increased their tax effort in order to get the debt relief but then they reduced it right after⁹².

Even Asiedu (2008) claimed the existence of an institution quality threshold that must be reached in order to make debt relief beneficial (otherwise it would be an inefficient intervention).

⁹¹Moreover, these countries, in contrast to the Brady ones, were characterized by the lackness of a proper private sector.

⁹²However, Ferry (2015) shows also that the tax effort after the debt relief remained larger than the level recorded before.

She showed the existence of a link between debt relief and the quality of institutions and she noticed that the HIPCs had a quality of institutions much lower than that one of LDCs. Therefore, in order to make the debt relief interventions effective, some institutional reforms were firstly required for those countries.

Another paper, focusing also on the consequences for creditors, is related to the abandonment of the gold standard. The large debt relief, related to the repudiation of gold-indexation in debt contract, produced benefits for both firms' shareholders and their creditors (Kroszner, 1998)⁹³ revealing then to be welfare improving and growth stimulating.

1.4.3 Debt Laffer Curve

Another argument, that can be used to explain creditors' gain, is the so-called Debt Laffer Curve introduced by Krugman (1988b) and Obstfeld and Rogoff (1996).

It can be formalized as follow:

- the probability of repayment π is related to the level of outstanding debt D : $\pi = \pi(D)$;
- there is a negative relation between the level of debt and the probability of repayment: $\frac{\delta\pi(D)}{\delta D} < 0$.

Figure 1.17 depicts the curve.

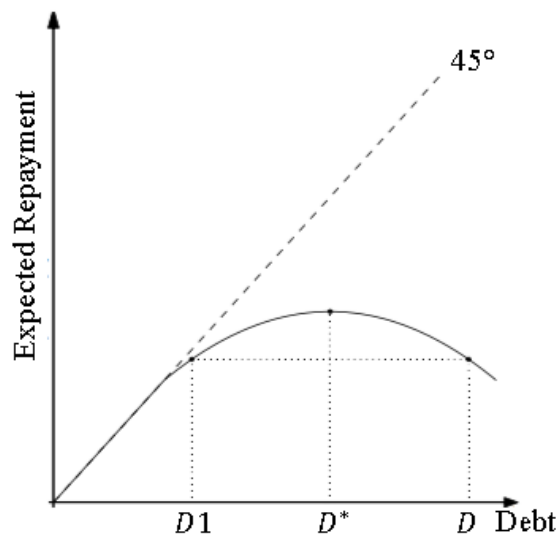


FIGURE 1.17: The Debt Laffer Curve

The horizontal axis represents the face value of debt whereas the vertical one represents the

⁹³Equity prices rose and the prices of corporate bonds too.

⁹⁴Moreover, the countries that left the Gold Standard earlier in the Great Depression (which resulted in inflation and reduced debt burdens for nominal debt contracts) recovered faster than the others (Eichengreen and Temin, 2000).

level of expected repayment. The 45 degree line denotes the situation with a perfect match between the expected repayment and the amount of outstanding debt. In other words, it means that creditors expect to be fully repaid.

This is an inverse U-shaped curve because if debt outstanding rises beyond a certain limit, represented by D^* (the so called peak of the Debt Laffer curve), the creditors do not expect to be fully repaid because of an increase in the probability of default (i.e. the expected payment decreases). This explains the reason of the "slippery side" in the debt Laffer curve and as claimed by Lei et al. (2010), the debt overhang occurs exactly when the slope reverses.

The argument behind the graph is that creditors might decide to partially forgive a certain percentage of the outstanding debt (moving for example from D to D^*) because this would imply an increase in the probability of repayment of the debtor country and thus an increase in the expected repayment (Schmitt-Grohe et al., 2016). Another potential positive consequence is that the market value of the remaining assets in creditors' balance sheets will increase because of the lower default probability. There would be indeed an increase in the secondary market price of debt although in D^* it would be still lower than one⁹⁵.

Therefore, applying a debt relief according to the debt Laffer curve's concept would make possible to have both creditors and debtors better-off. The problem is that it is difficult to apply the concept of the debt Laffer curve in the real world since it is hard to identify on which side of the curve the countries are situated⁹⁶. Moreover, a debt reduction might be difficult to implement because of the free-rider problem (Sachs, 1989) explained in the previous paragraphs⁹⁷. Let's consider for example a case where some creditors decide to accept a debt buyback. The secondary market price of debt will go up since the expected repayment increases after the debt relief. In this way however, also the creditors that did not participate in the transaction can benefit from this operation: they would enjoy the benefits (i.e. increase in debtor expected payment and in the market value of the outstanding debt) without suffering the costs of this intervention. The individual incentive for participating is therefore low.

1.5 The Greek Sovereign Debt Restructuring

The most significant and important episode of sovereign debt restructuring of the last years is the Greek case of 2012. This episode plays an important role in the history of sovereign debt restructuring for two reasons: 1) it represents the largest restructuring ever implemented in term

⁹⁵This price is given by the ratio between the level of expected repayment and the face value of the debt. As the figure shows, it reaches a value of one only for low level of debt when the full repayment is certain (Claessens, 1990).

⁹⁶Claessens (1990) estimated the Debt Laffer curve using cross-sectional data showing that only 5 of the 29 countries analysed were actually on the wrong side of this curve (i.e. the slippery side).

⁹⁷Cline (1995) refers to the free-rider incentive related to banks' lending during the Latin America debt crisis.

of volumes and creditor losses; 2) it is the first major case of sovereign debt restructuring in Europe since the WWII.

The crisis started on the 20th of October 2009 when the new elected government revealed that the public sector deficits had been understated for years. In particular, the 2009 public deficit, previously estimated around 7%, eventually was found to be 15.6% of GDP. These negative news combined with the structural weaknesses of the Greek economy produced as a consequence an immediate deterioration in the market confidence about Greece's real conditions. The country was then downgraded and the spread over the German Bunds surged from 300 to 900 basis points in April 2010. The access to the international capital markets for Greece was then compromised and the country was "forced" to ask for the other European countries' and the IMF's support.

Since the beginning of the crisis in 2009, several bailout interventions have been implemented for Greece. The first one, the "Greek Loan facility" (GLF), was implemented in May 2010 and it consisted in: a three years 80€ billion⁹⁸ rescue package provided by the European Commission and the ECB plus 30€ billion of additional financial resources provided by the IMF. This new money was provided to Greece being conditional to the implementations of some structural reforms. Austerity measures were indeed required in order to put the Greek public finances on the right track. More specifically, creditors required for several adjustments⁹⁹:

- a decrease in fiscal deficit to 3% of GDP until 2014;
- the implementation of economic reforms in order to restore market's competitiveness;
- a 11% of GDP fiscal adjustments in three years divided as follow:
 - an higher fiscal pressure, mainly through a 4% of GDP rise in VAT;
 - a lower public expenditure of 5.2% of GDP¹⁰⁰;
 - structural fiscal reforms for 1.8% of GDP.

Moreover, always in May 2010, the EZ countries agreed on the introduction of a temporary crisis resolution mechanism called *European Financial Stability Facility* (EFSF) with the power to lend up to 440€ billion to countries experiencing debt problems. More specifically, the EFSF had the possibility to issue new bonds in the capital markets in order to raise the funds necessary to ensure lending to the troubled countries¹⁰¹.

Notwithstanding the several fiscal consolidation measures implemented, Greece delayed the introduction of some structural reforms that were considered necessary to restore growth in the

⁹⁸This amount was tn reduced to 77.3€ billion because of the payment difficulties experienced by Portugal, Ireland and Slovakia (European Commission, 2015).

⁹⁹Several concerns were expressed about these points and their effectiveness (Manasse, 2015) but as shown by Ardagna and Caselli (2014), the adjustments required were tough but not unprecedented. Moreover as they claimed "it is difficult (...) to identify possible alternative deals that would have made all interested parties (weakly) better off".

¹⁰⁰Particular focus was posed on the Greece's pension system (Haitas, 2016).

¹⁰¹Few months later, it was decided to replace this temporary mechanism with a permanent one called *European Stability Mechanism* (ESM) that would have been effective starting from 2012

medium-long term. Moreover, the recession was becoming deeper and deeper with the GDP that was expected to decline even further in the following years. The IMF review in 2011¹⁰² was indeed extremely negative on the future of Greek debt sustainability. Therefore, the IMF started asking for a debt restructuring involving some forms of private sector involvement (PSI). This step was unavoidable as the Greek government alone was no more able to manage the adjustments required to reduce debt, without creating political and social side effects. There was however the fear that a debt restructuring would have affected the EU banks exposed to Greece, producing then contagion and spillover effects to the other European countries.

A second financial package was then proposed in July 2011 and it consisted of both official and private sector involvement¹⁰³. On one side, the EU countries and the IMF agreed on lending for €109 billion¹⁰⁴. For the EU's part, according to the agreement, the EFSF would have then provided loans with lower interest rates and a longer maturity (ranging from 15 to 30 years). On the other side, the international and Greek financial institutions agreed on participating in a voluntary debt exchange with the possibility to choose between a 30-years "par bond" without reduction in the face value and an average coupon of 4.5%; a 30-years "discounted bond" with an average coupon of 7.42% but involving a 20% face value reduction; a 15-years "discounted bond" with a 20% face value reduction and 5.9% coupon; or to receive the "par bond" at the time of maturity.

Eventually, because of the worsening conditions of Greece and the difficulties in reaching an agreement between the EU countries and the IMF, the July 2011 proposal was never implemented and a larger PSI became then necessary.

After a new round of negotiations, a second programme involving a larger PSI was then approved in February 2012. For the official sector's contribution, the EZ countries and the IMF agreed on an additional lending of €130 billion for the period 2012-2014 (with the EZ's part provided through the EFSF)¹⁰⁵ whereas for the private sector's contribution a debt exchange was implemented in March 2012. Conversely to the menu option discussed in the July proposal, investors received in this case a take-it-or-leave it offer¹⁰⁶. Private creditors were then forced to accept a lengthening of maturities, a lower interest rate and a face value reduction of debt. Basically, creditors received in exchange for a €1000 old bond, notes (with 1 or 2 years of maturity) issued by the EFSF for 15% of the original debt face value, new government bonds issued under English law (with maturity between 10 and 30 years) for 31.5% of the original debt face value and GDP-linked securities for 31.5% of the original amount (Moody's, 2016)¹⁰⁷.

¹⁰²IMF (2011)

¹⁰³The participation of the private sector was necessary since, at that time, €205.6 billion of the €350 billion outstanding debt were held by private creditors.

¹⁰⁴This amount was basically the remaining part of the original bailout programme since just €65 out of the original 110€ billion had been disbursed till that time

¹⁰⁵European Commission (2015).

¹⁰⁶Another difference with respect to the July proposal is that the offer was targeted to all the amount of privately held debt issued before 2012.

¹⁰⁷Accrued interest were paid with an EFSF zero coupon notes of 6 months.

Once the process was completed, the Greek debt declined by €107 billion with €6.4 billion of holdouts. The Figure 1.18 shows how the Greek payments (coupons and principals) changed because of the debt exchange of March 2012.

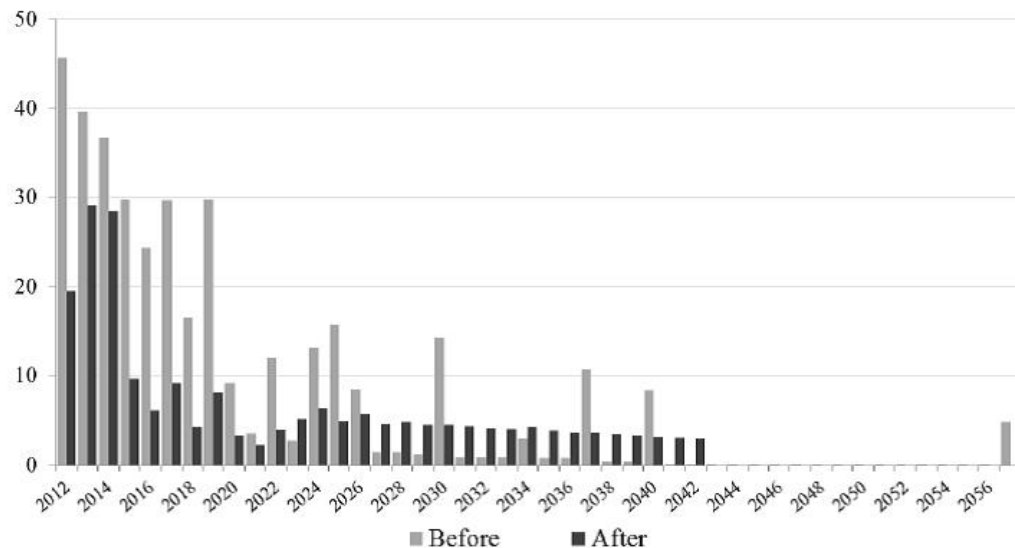


FIGURE 1.18: Coupon and principal repayments at face value in billion of € before and after the restructuring. Source: Zettelmeyer et al. (2013).

Estimates of investors NPV losses, under the PSI, range between 59% and 65% (according to the discount factor used for the computation¹⁰⁸) with holders of short-term debt that suffered more (losses of 75%) than holders of long-term (losses lower than 50%) debt¹⁰⁹.

Some months after the debt exchange, Greece's economic news were again quite negative in term of growth. According to IMF (2013a), "the deepening recession (...) increased the burden of Greece's debt (...) that Greece would get stuck in a weak-confidence, high-debt, low-growth trap". As a consequence, a new agreement was reached in November 2012 based on:

- lengthening loans' maturities (both bilateral and EFSF's loans by 15 years) and lowering interest rates (by 100 basis point i.e. bps) on the Greek Loan Facility;
- deferring interest payments on EFSF loans by 10 years;
- lowering the guarantee fee costs on EFSF loans paid by Greece by 10 bps;
- returning to Greece the revenues realized on Greek's bonds purchased by the ECB in the secondary market under the *Security Market Program*;
- funding from the ESFS in order to buyback the debt issued 9 months before;
- a commitment in further interventions from the Eurogroup;

¹⁰⁸It is indeed difficult to identify the proper exit yield to use in order to compute the present value.

¹⁰⁹Holders of short-term bonds were indeed closer to the repayment date and therefore suffered an higher haircut. The difference in the haircut received was around 30% as estimated by Zettelmeyer et al. (2013).

The debt buyback, in particular, was a quite controversial measure (Zettelmeyer et al., 2013): it used €11.3 billion received from the ESFS, to buy €31.9 billion of outstanding debt. The consequent estimated debt relief was between €12 and €21 billion (Zettelmeyer et al., 2013; Moody's, 2016) notwithstanding the critiques related to the use of a market price for this buyback instead of a negotiated one¹¹⁰.

The last episode of the Greek saga dates back to 2015, when the new elected government (led by SYRIZA) started a new round of negotiation with the creditors in order to unlock the last financial tranche of the programme. Because of the unsatisfactory list of reforms proposed after several rounds, in June 2015, the government broke unilaterally the negotiations and it decided to launch a referendum in order to ask the Greek people's opinion about the last proposal. Notwithstanding the popular rejection of the agreement (with a majority of 61%), the government eventually decided to accept the measures required by the creditors and to sign a Memorandum of Understanding in August 2015¹¹¹¹¹².

The IMF didn't participate because it required two conditions, in order to make the new lending useful to help Greece, that were not accepted by the European Commission: 1) a debt relief and 2) the specification of structural, fiscal and financial reforms. The European Commission indeed considered a debt relief not necessary at that stage since it believed that debt sustainability could have been reached just through the implementation of structural reforms (European Commission, 2015).

The rescue package for Greece was then structured as a €86 billion lending provided from the ESM for the period 2015-2018¹¹³. The plan didn't provide any debt relief but it required in exchange the implementation of some reforms in terms of growth, competitiveness, investment, fiscal sustainability¹¹⁴, financial stability and modernization of the State administration.

To sum up, it is possible to claim that the restructuring had both positive and negative features: on the one side it was successful because the debt exchange was an orderly and fast procedure and it provided a significant amount of relief; on the other side it represented a too little and too late intervention (IMF, 2013b) failing to restore the sustainability of the Greek debt¹¹⁵. Debt forgiveness is a useful strategy to incentivize the debtor country when it is clear that it is no longer able or willing to repay. For this reason a restructuring intervention should be implemented as soon as possible (Manasse, 2012). With respect to the timing of the intervention, it is argued that a lot of time has been wasted between the PSI proposal and its implementation.

¹¹⁰As described by the theory (see Bulow and Rogoff (1988) for a discussion of the benefits deriving from a debt buyback), as soon as the buyback is announced, the secondary market price tends to appreciate making creditors better off.

¹¹¹The MoU can be found here https://ec.europa.eu/info/sites/info/files/01_mou20150811_en1.pdf

¹¹²A bridge loan of €7.16 billion (with a three months maturity) was disbursed in July 2015 in order to give to Greece the possibility to cover its financing needs while waiting for the signature of the agreement with creditors.

¹¹³€13 billion of the first installment were used to pay-back creditors (ECB, IMF, EFSF and national creditors) and €10 billion to recapitalize the Greek banks.

¹¹⁴The public pensions expenditure in 2016 was still around 15% of GDP (almost twice the OECD average).

¹¹⁵Too little was referred to the fact that the debt reduction was partially compensated by the new lending from the official sector (Manasse, 2015).

The same intervention could have been undertaken maybe already at the beginning of 2011 when the Greek programme went off-track.

Other critiques are related to:

- the design of the exchange that left money on the table. This is mostly due to the one size fits all approach used for the offer to creditors, without taking into account the maturity of their bonds. Zettelmeyer et al. (2013) show different feasible alternatives for the exchange (such as imposing a 70% haircut to all creditors) that would have produced larger relief;
- the soft approach adopted toward private sector holdouts (notwithstanding the retroactive CACs imposed on the domestic law bonds) that might create a precedent for future debt restructuring in Europe (Buchheit et al., 2013);
- the decision to not use a negotiated price for the buyback instead of the market price in order to avoid price increase and therefore a reduced relief. A 20% price increase has instead been observed since the announcement of the operation therefore reducing the potential size of the debt relief;
- the negotiation framework used: the key decisions have been taken by the European institutions and not by the IMF. According to Ardagna and Caselli (2014), the policy outcome has been then different, considering that for the IMF could have been easier to find a Pareto-efficient solution.

1.5.1 The Effect of the Haircut

It is interesting to replicate for Greece what Arslanalp and Henry (2006a) did in order to study the consequences that the Brady Plan produced for the LDCs that signed the deal. Their main result was that the announcement of debt relief produced a stock markets appreciation for both creditor¹¹⁶ and debtor countries. Basically, they wanted to capture the stock extra return deriving from the anticipation of the relief decision. To do that, they focused on the 12 months preceding the announcement date of the Brady deal (I will refer to this period as "announcement window") and they computed the returns as first difference of the natural logarithm of the stock index prices. Thus, $t = 0$ is the month where the announcement takes place and $t = -12$ is the twelfth month preceding the announcement. In order to find out the abnormal returns, they computed the difference between the 12 actual returns observed each month before the announcement and the average monthly return for all the sample¹¹⁷. Finally, they computed the cumulative abnormal return as the summation of all the abnormal returns of each month.

Figure 1.16 shows the cumulative abnormal return for the debtor countries. From this Figure can be noticed that debtor countries' stock markets experienced a cumulative abnormal return

¹¹⁶They focus on the stock-prices of the US banks with large exposure toward the debtor countries.

¹¹⁷The average monthly return can be considered as a proxy for the expected monthly return.

of around 60% in the 12 months preceding the announcement of the deal. It means that the stock market increases 60% more in that period, with respect to a preceding one. Other way around, creditors had an increase of 35% deriving from the news related to the introduction of the Brady Plan. In conclusion, they showed that the debt relief announcement had a positive effect on the stock-market for both debtor and creditor countries (i.e. the information about debt relief had a crucial impact in generating the stock increase). The idea was indeed that, with the debt reduction, the capital freed for the LDCs could foster the implementation and the success of some structural reforms.

In order to replicate this exercise, I focus on the Greek sovereign debt restructuring undertaken in March 2012¹¹⁸. Notwithstanding the exposure of European banks toward Greece was reduced after the first bailout of May 2010 (as can be seen from the data reported in BIS Quarterly Reviews), in 2012 Greece still had debt for around €60 billions with the European banking sector (especially German and French banks (BIS, 2012)). Because of the several events that affected Greece in those years¹¹⁹, I will consider just 6 months as "announcement window" in order to capture only the effect of the haircut measure. Therefore, $t = 0$ is March 2012 and $t = -6$ is October 2011. The abnormal return is then computed as difference between the actual returns recorded in these 6 months and the average monthly return computed between September 2009 and March 2012 (31 months before the announcement). I consider ATHEN COMPOSITE Index in order to see the consequences for Greece and FTSE FRANCE BANKS Index and FTSE GERMANY BANKS Index in order to study the effects for the two most important Greece's creditor countries. All data are monthly. Results are presented in Figures 1.19, 1.20, 1.21 and 1.22. According to Figure 1.19, the stock-market of the debtor country increased by 12.4%. The increase was even larger for the creditors. Figure 1.20 and 1.21 indeed show respectively a stock-market appreciation of 34.4% for German banks and of 22.9% for French ones. For these creditors, I compute the abnormal return of the German and the French banking sector as a difference between the returns of the FTSE FRANCE BANKS Index and the FTSE GERMANY BANKS Index, observed in the announcement window, and the monthly average return of the MSCI Europe Banks¹²⁰. In other words, these excess returns of the German and French banks are computed with respect to the EU average.

Figure 1.22 depicts the specific situation for Deutsche Bank (one of the largest bondholder of Greek government debt) that, during the announcement window, benefited of a 41.1% increase in its stock price.

¹¹⁸In Appendix A, Tables 1.1 to 1.7 describe the market appreciations for both creditor and debtor countries for all the EZ countries that benefited of financial support during the recent crisis.

¹¹⁹In 2011 many events might have affected the index-market return: 5/11 EU meeting due to fear of Grexit, 6/11 Greece downgrading to CCC from S&P, 7/11 approval of second bailout, 10/11 approval of new austerity plan.

¹²⁰These abnormal returns are computed considering only the events related to Greece. I am not considering specific events in Germany or France that might have affected the results.

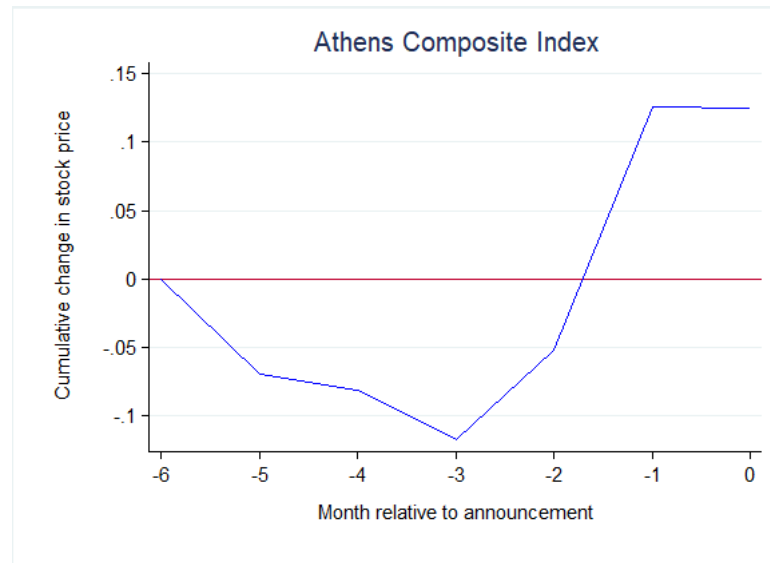


FIGURE 1.19: Debtor stock prices rise anticipating the debt relief. On the y-axis there is the abnormal percentage change of the stock prices. On the x-axis there are the 6 months before the announcement (-6) where 0 is the announcement month. Source: author's computation.

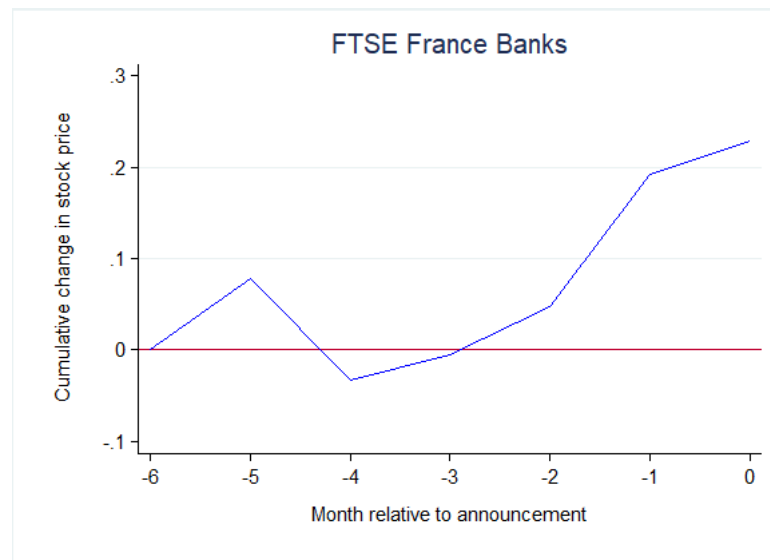


FIGURE 1.20: Creditors stock prices rise anticipating the debt relief. On the y-axis there is the abnormal percentage change of the stock prices. On the x-axis there are the 6 months before the announcement (-6) where 0 is the announcement month. Source: author's computation.

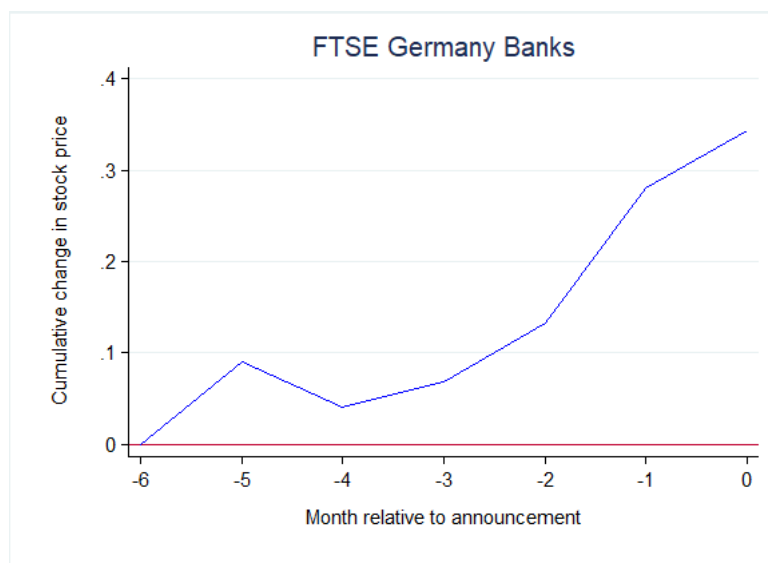


FIGURE 1.21: Creditors stock prices rise anticipating the debt relief. On the y-axis there is the abnormal percentage change of the stock prices. On the x-axis there are the 6 months before the announcement (-6) where 0 is the announcement month. Source: author's computation.

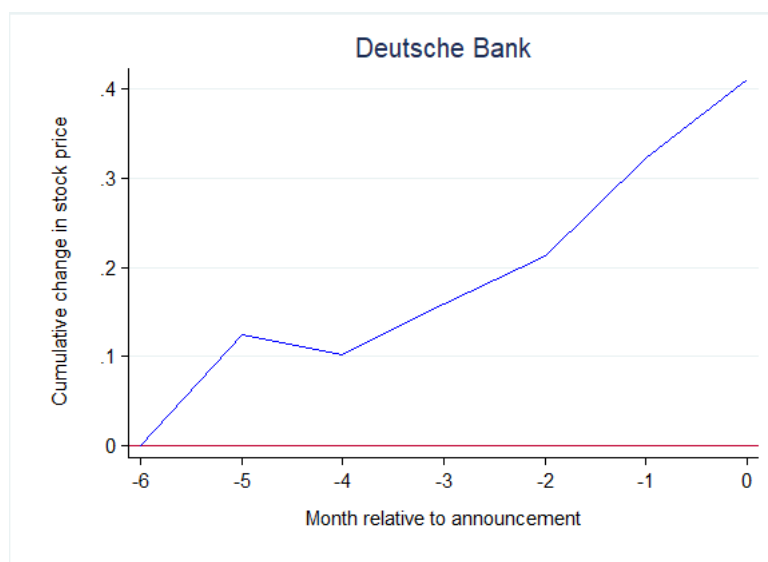


FIGURE 1.22: Creditor stock prices rise anticipating the debt relief. On the y-axis there is the abnormal percentage change of the stock prices. On the x-axis there are the 6 months before the announcement (-6) where 0 is the announcement month. Source: author's computation.

Summarizing, we can claim that in both cases (Brady deal and Greek restructuring) the market appreciation for creditors was due to the fact that, because of the important debt reduction implemented, the probability that the debtor country would have been able to pay-back the remaining part of debt increased. In other words, the debt reduction produced an increase in creditor's expected repayment and therefore in the value of creditor's claims toward the debtor country. According to these market appreciations, it is also possible to claim that at that time the haircut was perceived by both creditor and debtor countries as the right strategy to implement in order to solve the crisis¹²¹.

The Brady countries, thanks to the debt reduction, were able to exit from the crisis. The debt overhang problem was reduced and this produced an increase in domestic investment. This debt reduction was essential to encourage the Brady countries to implement structural reforms that eventually led the country to restore competitiveness and economic growth. Contrarily, the debt restructuring in Greece had some controversial results. The debt reduction did not help the economy to put its debt on a sustainable path and negative real GDP growth rates have been observed for almost all the recent years. This might then represent a case of "too little" and especially "too late" problem (IMF, 2013b).

According to the literature here examined, debt forgiveness should make both creditor and debtor countries better off in case of a debt overhang problem. That was the case for many Brady countries that restored their debt sustainability throughout the implementation of economic reforms encouraged by the debt reduction. The same cannot be concluded for Greece because the debt reduction led to an unexpected outcome with respect to the literature examined in this chapter. As Arslanalp and Henry (2006a) claimed for the HIPC countries then, it could be that the main problem for Greece maybe was not the debt overhang but the weakness of institutions and infrastructures (i.e. structural problems¹²²). Therefore, a strategy based on debt reduction only might be unable to let Greece exit from the crisis.

1.6 Ongoing Debate

The past Sovereign debt restructuring episodes have been characterized by two important weaknesses (IMF, 2013b):

1. the ineffectiveness of contractual market-based approach (notwithstanding the introduction of CACs) in ensuring a large participation of creditors;
2. the "too little - too late" problem, often characterizing the restructuring interventions, making then difficult to put debt back on a sustainable path.

¹²¹Of course this creditors' gain just examined did not represent a "free-lunch" since creditors suffered an important loss deriving from the Brady Plan in the first case and from the 2012 haircut in the second one.

¹²²The slow rate of change in term of structural reforms might be considered the reason of the several supporting policies that have been implemented in the last years.

With respect to the first point, the aim is to reduce creditors' incentive to hold out in a debt restructuring process (as claimed also by the International Capital Market Association (ICMA, 2013)). Minimizing the holdout risk is quite important in order to avoid that some creditors will get a preferential treatment relative to the others participating in the restructuring.

In the last years, there has been a large discussion about potential additional changes for the current market-based approach in order to enhance the current framework. Since the statutory approach has been rejected, the focus has been posed on the contractual side with the introduction of CACs into international bond contracts (recently in Europe the situation has changed with a revival of interest for the statutory approach). The problem with the original CACs' structure was that the individual bond-by-bond approach was not so effective. Each bond issue could be indeed restructured separately with the voting threshold calculated for each of them. In case of a single creditor controlling more than 25% of a specific series, he had indeed the possibility to block the restructuring (at least for that series) hoping to get better conditions.

Recent improvements in the contractual approach have therefore introduced the *aggregate CACs* in order to allow the aggregation, across different series of bonds, of voting bondholders to further reduce the holdout risk and to improve the coordination between different bond series (United Nations, 2017). Since January 2013¹²³, the aggregated CACs (the so-called "Euro-CACs") are the new norm for the Euro area international bonds with a maturity over 1 year. These clauses are based on the introduction of a *two-limb voting procedure* according to which some bond series can be aggregated for voting purposes. Two voting thresholds have to be met: the first one is for the aggregated bonds (2/3 of the total amount involved) and the second one is computed at the individual level (50% of each bond series)¹²⁴. These CACs are stronger than the series-by-series traditional CACs but still the necessity to obtain an approving majority for each series of bonds is not considered sufficient to reduce the hold out risk. Therefore, the ICMA introduced the *single-limb voting procedure*¹²⁵. According to this procedure, the condition that has to be met in order to activate the CACs is that all creditors must to be treated equally: they have to be offered the same instruments or the same menu of options¹²⁶. The voting threshold of 75%, necessary to activate the CACs, is calculated at an aggregate level for all the bond series involved in the restructuring. If the threshold is reached then the changes will be binding for all the note holders otherwise the restructuring will fail (it is an all or nothing approach). As a consequence, it will be much more difficult for a bondholder to acquire a blocking minority and to stop the process. These changes introduced by the ICMA should produce smoother future restructurings by minimizing the possibility and the incentives to hold out. However, it will be necessary some time for these changes to become effective and to be included in the majority of

¹²³It comes from the Deauville agreement of 2010.

¹²⁴See Mrad (2016) for a detailed analysis.

¹²⁵This innovation has been supported also by the IMF (see IMF (2014a)).

¹²⁶However, the uniformity of applicable condition does not guarantee the same economic impact of the restructuring to the different bond series. Actually, it might well be the case that different net present value outcomes will be produced for different series (Stolper and Dougherty, 2017).

EZ bonds (Strickland, 2014; Buchheit et al., 2013).

With respect to the second weakness of the current restructuring framework, it is clear that restructuring interventions have often occurred many years after debt was classified as unsustainable (the "too late" problem)^{127 128}. Additionally, in many cases, the interventions were not able to restore debt sustainability (the "too little" problem¹²⁹) implying then the necessity of subsequent interventions (see Figure 1.9 and 1.10).

The current framework involves therefore costs that might be reduced if a better framework for a timely and orderly sovereign debt restructuring would be developed. In particular the timing is a very important feature that can determine the success or the failure of a restructuring process. Any kind of delays in the intervention indeed reduce the "size of the pie" for both the parties involved then affecting negatively their welfare¹³⁰.

The IMF has already introduced some changes in order to reform its current lending framework and to overcome part of the existing problems. More specifically, the IMF tried to put more focus on pre-default restructurings in designing its sovereign lending policies (United Nations, 2017) and it introduced a new tool in order to assess debt sustainability, taking into account the Gross Financing Needs, a flow variable that captures the vulnerabilities in the debt structure¹³¹. Moreover, the "exceptional access framework" established in 2002 was modified in 2010. Under the original framework, IMF's lending above normal access limits (a cumulative 600% of country's quota) were granted if a country's debt was considered sustainable with high probability. In case of uncertainty regarding the sustainability of debt, instead, exceptional access was granted only after the implementation of an upfront debt restructuring able to restore debt sustainability (IMF, 2014b). Then in 2010, the IMF introduced a *systemic exemption clause* in order to allow lending (without an upfront restructuring) to countries that imply high risk of systemic spillovers and that are not characterized by a high probability of debt sustainability (this exemption was then removed in 2016¹³²).

On top of that, in order to avoid unnecessary restructuring interventions (and their related costs) there has been a discussion about the introduction of a *reprofiling option*. In particular, when debt cannot be considered as sustainable with a high probability, the IMF will require the debtor country to negotiate with its creditors a maturity extension as a precondition for receiving IMF

¹²⁷For St Kitts and Nevis a debt restructuring was implemented in 2012 but debt was classified as unsustainable in 2006, Belize waited for two years (restructuring in 2007) after that debt was defined unsustainable in 2005 etc. See IMF (2013b).

¹²⁸See Borensztein and Panizza (2009) and Levy and Panizza (2011).

¹²⁹IMF (2013b) describes some restructuring cases involving a small intervention that did not restore debt sustainability.

¹³⁰A smaller "size of the pie" might produce as a consequence a lower incentive to negotiate a restructuring for both debtors and creditors (Benjamin and Wright, 2009; Bi, 2008) postponing then even further the resolution intervention.

¹³¹See Gabriele et al. (2017) for an analysis of gross financing needs as a measure of Sovereign's likelihood of distress.

¹³²See IMF (2014b), IMF (2016), and Schadler (2016) for a discussion about the limits and the problems related to the systemic exemption.

lending. In case debt would be determined to be unsustainable, then a full restructuring would have to be undertaken¹³³.

In designing a new operative framework for the ESM in the Euro area and taking advantage of the discussion above described, the German Council of Economic Experts (Andritzky et al., 2016) has proposed a two-stages mechanism for the Eurozone. The peculiar characteristic of the German proposal is that, since usually a liquidity crisis precedes solvency problems, debt rescheduling and debt reduction are considered as two possible sequential operations. More specifically, it is proposed an automatic maturity extension in case of an ESM's assistance is required by a specific country.¹³⁴

Other related proposals to change the current framework in the Euro area come from:

- the Committee on International Economic Policy Reform (Buchheit et al., 2013). According to this proposal, two thresholds should be taken into account: 1) debt between 60% and 90% of GDP and 2) debt above 90% of GDP. In the first case, countries would have the possibility to receive assistance based on conditionality whereas in the second case, the assistance would be granted just following a restructuring intervention;
- the European Economic Advisory Group (Corsetti et al., 2011). This proposal is based on a three stages approach: in the first one ESM financial support is provided for 2 years, in the second one maturing bonds are exchanged for "replacement bonds" involving an haircut and an ESM guarantee and in the third one a total restructuring is provided if default becomes unavoidable;
- Fuest et al. (2014) who propose a restructuring intervention if, after the implementation of an ESM programme (for 3 years), market access is still not considered sufficient.

The number of existing proposals is quite large and the debate on the topic is still open. The introduction of a specific restructuring framework implies in fact an implicit costs benefits analysis that should be taken into account. From one side, there is consensus on the fact that all the potential reforms to the current framework would have to deal with moral hazard problems from debtors' perspective. Countries need to have indeed proper incentives to manage their

¹³³This distinction is important in order to separate liquidity from solvency crisis and in particular to reduce cases of full restructuring interventions in case of liquidity problems.

¹³⁴The automatic maturity extension has been proposed also in other previous studies. Weber et al. (2011) suggested the introduction of trigger clauses in bond contracts in order to produce an automatic maturity extension of 3 years when the country asks for ESM's support (Brooke et al. (2013) propose the same approach in case of IMF's support). Similarly, Heinemann et al. (2016) propose an automatic maturity extension and the stop of coupon payments of the so-called "accountability bonds" (issued in order to fund the structural deficit larger than 0.5% of GDP) if debt-to-GDP ratio is larger than 120%. In case of an ESM's support these bond might even be cancelled. Also Corsetti et al. (2015) proposed a maturity extension intervention if two criteria are met: 1) debt-to-GDP ratio larger than 95% and 2) gross financing requirement larger than 20%. These criteria are close to those ones defined in the most recent proposal by Andritzky et al. (2016): 1) debt between 60 and 90% of GDP and 2) gross financing needs between 15 and 20% of GDP (the benchmark used by the IMF (IMF, 2013b) in the new debt sustainability framework. However, these proposals underestimate the fact that an automatic maturity extension might produce an opposite problem of "too much and too often" restructurings.

debt in a sustainable way. From the other side, the establishment of a credible restructuring framework should be useful in term of crisis prevention and in promoting a proper pricing of risk in sovereign bond markets. Creditors will be provided with the right incentives to assess accurately crisis risks, then disciplining ex ante the debtor countries' fiscal policies. Moreover, the introduction of a restructuring framework would reduce uncertainty and therefore market volatility, anchoring then market expectations.

1.7 Appendix A

I replicate the same exercise, described in Paragraph 1.5.1, for all the EZ countries that benefited of financial support during the crisis. In particular I consider Ireland (11/2010), Portugal (5/2011), Spain (6/2012), Cyprus (3/2013) and the three interventions for Greece (5/2010, 3/2012 and 8/2015). Information about the most important creditor countries are taken from BIS reports.

An important difference, existing between these cases and the Greek restructuring implemented in 3/2012, is that only the last one implied a face value reduction measure.

	Country	$t = -12$	$t = -6$	Period
Debtor	Greece	16.10%	-19.76%	11/2007 - 5/2010
Creditors	Germany	49.37%	16.03%	11/2007 - 5/2010
	France	42.78%	-2.55%	11/2007 - 5/2010

TABLE 1.2: Columns $t = -12$ and $t = -6$ report respectively the abnormal returns computed for the 12 and 6 months before the announcement; the last column reports the period considered for the analysis (taking 5/2010 as announcement date).

	Country	$t = -12$	$t = -6$	Period
Debtor	Greece	-25.84%	12.45%	9/2009 - 3/2012
Creditors	Germany	-24.37%	34.39%	9/2009 - 3/2012
	Deutsche Bank	-12.97%	41.09%	9/2009 - 3/2012
	France	-48.79%	22.86%	9/2009 - 3/2012

TABLE 1.3: Columns $t = -12$ and $t = -6$ represent respectively the abnormal returns computed for the 12 and 6 months before the announcement; the last column reports the period considered for the analysis (taking 3/2012 as announcement date).

	Country	$t = -12$	$t = -6$	Period
Debtor	Greece	-36.44%	-16.86%	2/2013 - 8/2015
Creditors	Germany	9.66%	-0.18%	2/2013 - 8/2015
	France	17.57%	14.47%	2/2013 - 8/2015

TABLE 1.4: Columns $t = -12$ and $t = -6$ report respectively the abnormal returns computed for the 12 and 6 months before the announcement; the last column reports the period considered for the analysis (taking 8/2015 as announcement date).

	Country	$t = -12$	$t = -6$	Period
Debtor	Portugal	6.41%	-3.09%	11/2008 - 5/2011
Creditors	Germany	-4.84%	0.86%	11/2008 - 5/2011
	France	15.22%	3.72%	11/2008 - 5/2011

TABLE 1.5: Columns $t = -12$ and $t = -6$ report respectively the abnormal returns computed for the 12 and 6 months before the announcement; the last column reports the period considered for the analysis (taking 5/2011 as announcement date).

	Country	$t = -12$	$t = -6$	Period
Debtor	Spain	-18.49%	-12.40%	12/2009 - 6/2012
Creditors	Germany	-15.75%	12.95%	12/2009 - 6/2012
	France	-42.56%	6.94%	12/2009 - 6/2012
	UK	19.48%	26.22%	12/2009 - 6/2012

TABLE 1.6: Columns $t = -12$ and $t = -6$ report respectively the abnormal returns computed for the 12 and 6 months before the announcement; the last column reports the period considered for the analysis (taking 6/2012 as announcement date).

	Country	$t = -12$	$t = -6$	Period
Debtor	Ireland	36.99%	2.43%	5/2008 - 11/2010
Creditors	Germany	17.95%	6.53%	5/2008 - 11/2010
	UK	31.34%	17.94%	5/2008 - 11/2010

TABLE 1.7: Columns $t = -12$ and $t = -6$ report respectively the abnormal returns computed for the 12 and 6 months before the announcement; the last column reports the period considered for the analysis (taking 5/2008 as announcement date).

	Country	$t = -12$	$t = -6$	Period
Debtor	Cyprus	-0.93%	41.41%	2/2010 - 3/2013
Creditors	Germany	-7.90%	5.52%	2/2010 - 3/2013

TABLE 1.8: Columns $t = -12$ and $t = -6$ report respectively the abnormal returns computed for the 12 and 6 months before the announcement; the last column reports the period considered for the analysis (taking 3/2013 as announcement date).

Chapter 2

Debt overhang and sovereign debt restructuring: a theoretical model

2.1 Introduction

Sovereign debt restructuring is once again at the center of the academic debate because of the large public debt increase observed in the last years in the Eurozone and, more specifically, because of the recent events occurred in Greece. In particular, the Greek debt crisis of 2009 revealed an inadequate knowledge of the set of instruments that can be used to deal with a debt crisis and their related effectiveness.

Motivated by these recent events, I build in this Chapter a model of sovereign debt restructuring in order to shed lights on this topic and the related drivers. The aim is to represent schematically the functioning of three restructuring processes to gain insights into their differences.

Relatively little is still known about which might be the most effective strategy to deal with a sovereign debt overhang problem. According to the existing literature, several strategies have been analyzed but each one is usually studied in its specific framework without any kind of comparison. Therefore, this paper is a first attempt to analyze separately¹, but in the same framework, the following three different policies in order to compare their consequences in term of investment:

1. Sovereign debt restructuring: face value reduction (i.e. nominal reduction);
2. Sovereign debt restructuring: net present value reduction through lengthening of maturities and/or lower interest rate (i.e. debt rescheduling);
3. Conditional-additional official lending.

In such a way, it would be also possible to underline which are the elements/factors of each strategy that can be considered as drivers of the final result.

¹A mix of these strategies is also feasible and it is commonly used in order to reach a compromise between the parties involved in the renegotiation process.

This chapter then develops a three-periods model with default risk with the aim to analyse the consequences of these three different policies in a debt overhang framework. Then, through the comparison of these consequences, it will be possible to find out the best policy able to restore the incentives to invest in an highly indebted country.

With a large amount of outstanding debt, maintaining unchanged the nominal value of the debtor's obligations can produce negative consequences for both creditor and debtor countries. In such a situation and according to the debt overhang theory, a debt restructuring could be an efficient strategy for both creditors and debtors (Krugman, 1988a; Sachs, 1989; Arslanalp and Henry, 2005): it would avoid a default and it should restore incentives to invest in the debtor country. However, it is difficult to say, between face value reduction and net present value (i.e. NPV) reduction, which might be the most effective way to incentivize investment. Both measures, implying a partial relief, are indeed able to increase the fiscal space in the debtor country, freeing up funds that might be used for other purposes such as investment.

A priori, it would seem reasonable to assume that a face value reduction can produce more effective results as it would deal with debt problems once and for all, solving definitely the problem of uncertainty. As we will see later, however, this result is strictly dependent on the amount of reduction that will be agreed during the renegotiation.

Also an NPV reduction, for example in the form of a lengthening of maturities process, might be useful for a country facing with a debt crisis: it would postpone the debt burden in the future, giving some fiscal spaces to the debtor country². Creditors might then increase the probability to be fully repaid in the future, without engaging in a real debt reduction. However, an extension of maturities might also exacerbate a debt overhang condition by simply postponing the solution of the problem, without eliminating the uncertainty related to the borrower's financial conditions and its repayment capacity (IMF, 2014b).

As shown by the literature, the choice between these two restructuring strategies is usually driven by whether a country is experiencing a solvency or a liquidity crisis. Debt rescheduling is generally used to help solvent but illiquid countries that are temporarily unable to roll over their debt; debt reduction is used instead in case of insolvent countries that are permanently unable to pay back their debt.

A comparison between these two restructuring interventions is interesting for two reasons: 1) they produce different consequences and 2) they are structured in different ways. According to Figure 2.1, it is possible to notice how a debt restructuring involving a nominal reduction produces larger positive consequences, in term of investment growth rates, than a restructuring without nominal reduction. The blue bars represent the average investment growth rate in all the countries that benefited of a nominal reduction whereas the orange ones represent the same

²See the case of Zimbabwe in 2001 and Nigeria in 2004.

variable for the countries that experienced only a NPV reduction³. As it is possible to see from the figure, the average investment growth rate is larger in case of nominal reduction. This is true for the average growth rate of investment in the year of restructuring (T) but also when the years following the restructuring ($T + 1$; $T + 2$; $T + 3$; $T + 4$) are taken into account in the computation of the average.

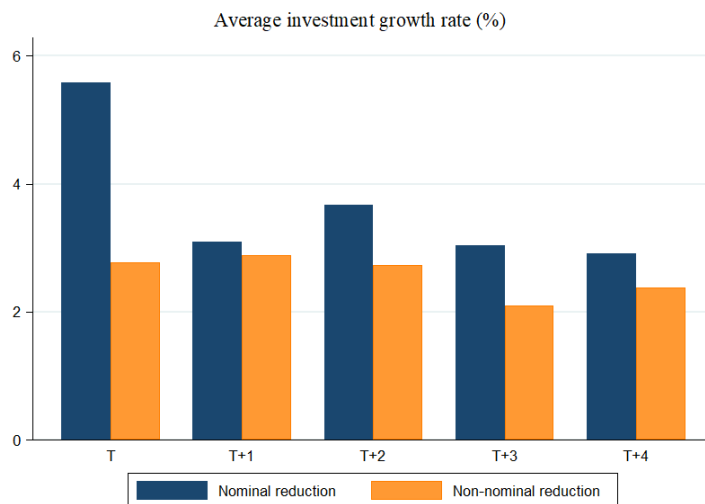


FIGURE 2.1: Average investment growth rate computed in the year of restructuring (T) and up to four years later using World Bank data. Source: author's computation.

The two strategies are also quite different in the way they are structured. As we can see from Table 2.1 indeed, debt restructuring episodes involving a nominal reduction produced a larger average haircut than episodes involving only a maturity extension.

	Average haircut	Std. Dev.	Obs.
Non-Nominal reduction	0.217	0.16	85
Nominal reduction	0.537	0.25	41

TABLE 2.1: Author's computation from Cruces and Trebesch (2013)

The third strategy analysed in this paper is the conditional-additional official lending. The general aim of official lending and conditionality is to restore market access for the debtor country. Official loans have indeed an important catalytic role for private investors' financing⁴ (IMF, 2014b; Mody and Saravia, 2006). The new lending is here assumed to be "conditional" in the sense that it is granted in exchange for the debtor's commitment to undertake some necessary "adjustments policies" (such as structural reforms). These adjustments are based on the idea

³Data for the restructuring dates and nominal versus non-nominal interventions are taken from the dataset of Cruces and Trebesch (2013).

⁴However, the catalytic role is not the only reason that motivates official lending (Tirole, 2015; Corsetti et al., 2017a). The default of a country might indeed produce international spillovers that might make foreign governments willing to intervene.

that a country makes some efforts today in order to increase its GDP and then its probability to be solvent in the future. In other words, these "adjustments" can be considered as a particular kind of investment because, as investment does, they produce costs in the short and benefits in the long-run (Diwan and Rodrik, 1992).

The IMF and the World Bank have developed this approach based on conditionality since the Mexican crisis in 1982. New lending have been in fact provided to countries with debt sustainability problems in exchange for measures aimed to correct their external imbalances such as: currency devaluation, cuts in fiscal deficit (i.e. raises in taxes and cuts in public expenditure), control of the money growth rate, of the credit expansion and of wages. Conditional lending were used in the 80s and 90s, during the Brady Plan, and in Greece during the Sovereign Debt Crisis, provided by the other EU countries and the IMF (since 2010) and by the ESM (in 2015). Actually in Greece, after the provision of additional lending, a debt restructuring intervention became necessary (with a reduction of more than 50% in face value term⁵) in order to recover from a dramatic situation and to calm down the markets. This means that the strategy of providing new lending to the debtor country might work just under some specific conditions. For this reason, these new lending are here modelled with two additional features: 1) they are constrained by a specific credit ceiling in order to limit the amount of resources that creditors are willing to provide and 2) they are able to reduce the probability of default under some specific conditions. An additional lending indeed produce two opposite effects that must be studied: on the one side, it increases the probability of default making the debt level bigger and on the other side, it reduces the probability of default increasing investment.

A comparison between these three strategies, with a focus on their investment consequences, might then be useful in order to see which is the best way to deal with a debt overhang problem. In particular, given the current Greek crisis, such a study might provide some useful information on the underlying drivers of each strategy and on their importance for the final results.

The chapter proceeds as follows: Paragraph 2.2 makes a literature review; Paragraph 2.3 develops the theoretical model characterizing the restructuring via face value reduction, via rescheduling and the conditional-additional official lending strategy; Paragraph 2.4 concludes.

2.2 Related Literature

As discussed extensively in the first Chapter, according to the debt overhang hypothesis, the accumulated debt discourages private sector's investment and government's adjustment efforts because a possible improvement in the debtor country's performances determines mainly an increase in creditors' repayment⁶ (Muller et al., 2015). Several papers showed then how desirable a debt relief was, in the 80s and 90s, for the LDCs. The debate was focused on the

⁵Zettelmeyer et al. (2013).

⁶See Andres et al. (2014) for an analysis of the consequences of labour and product market reforms in a debt overhang scenario.

effects produced by the implemented restructuring programs. In particular, part of the literature showed the beneficial effects that some debt restructuring plans produced in some countries (Arslanalp and Henry, 2005; Forni et al., 2016; Reinhart and Trebesch, 2016; Trebesch and Zabel, 2016)⁷.

Before proceeding with a detailed literature review for each one of the three strategies described, some specific empirical and theoretical works, studying the different consequences and comparing restructuring interventions implemented via nominal or via NPV reduction, deserve to be mentioned.

From an empirical point of view, there are two relevant contributions. The first one is Reinhart and Trebesch (2016) where the authors show how debtor countries' conditions (economic growth or credit ratings) improve significantly just in case of nominal reduction. Different forms of debt relief instead, such as lengthening of maturities, do not generally produce the same results. Cheng et al. (2017b), focusing on restructuring episodes involving the official sector⁸, show similar results to Reinhart and Trebesch (2016). GDP growth is indeed found to be larger in case of restructuring involving nominal reduction whereas no significant effect is observed for cases with only NPV reduction.

From a theoretical point of view, my paper is close to Sandri (2015). Such a paper builds a three-periods model and compare three policy strategies that can be used to solve a systemic sovereign debt crisis: fiscal consolidation, official transfers and private creditors' bail-in (with a particular focus on its potential spillovers). The aim of this paper is to compute the welfare implications deriving from these three strategies, for the agents involved in the crisis (debtor country, creditors and the international community).

Regarding the debt restructuring via nominal reduction, the literature modelled it, initially, considering an exogenous debt reduction (Marchesi and Thomas, 1999; Froot, 1989; Sachs, 1989). Then, thanks to Fernandez and Rosenthal (1990) and Fernandez and Kaaret (1992) the renegotiation process between creditors and debtors countries has been explicitly modelled and introduced in the literature. The bargaining power in these models was mostly attributed to the creditors since it was assumed the debtor's willingness to make some payments in order to mitigate/avoid the costs of the default. Actually, also the debtor country might have a certain amount of bargaining power during the renegotiation. Moreover, there might be creditor's incentives to make some concessions to the debtor country in order to support its recovery.

Bi (2008) and Benjamin and Wright (2009) developed then a different approach in modelling the renegotiation between creditors and debtor country. More specifically, they built a stochastic multi-round bargaining model where they studied the delays (i.e. the inefficiencies) that can arise during a sovereign debt renegotiation process. Bi (2008) assumes that the creditors have

⁷See Arslanalp and Henry (2006b) for a literature review on the debt overhang problem

⁸Cheng et al. (2017b) build a novel dataset on Paris Club restructuring episodes (i.e. 429) occurred between 1956 and 2015.

an option to propose to the debtor country whereas Benjamin and Wright (2009) assume that both creditors and debtor country can alternate in proposing a bargaining outcome (creditors' and debtor country's bargaining power is assumed to fluctuate over time). In particular, they both show that potential delays actually arise during the renegotiation between creditors and debtors countries because they both prefer waiting until the economy recovers in order to divide a larger "cake".

Then, with the aim to study the strategic behaviour between creditors and debtors countries and to assume a more evenly distributed bargaining power, an endogenous debt reduction in the form of a Nash Bargaining has been introduced. A Nash bargaining approach results in a pairwise Pareto-efficient outcome where basically, according to the structure of this process, the creditors have to give some forgiveness whereas the debtor country has to repay part of its debt. In this renegotiation, endogenous debt recovery rates (Yue, 2010; D'Erasmus, 2011; Prokop, 2012; Arellano and Bai, 2014; Asonuma and Trebesch, 2016) or also the rate of return offered on the new debt issued by the debtor country (Asonuma, 2012) are determined.

My paper then complements the literature on Nash bargaining in particular using the endogenous haircut to determine the optimal investment level. In this context, the closest reference to my paper is Prokop (2012) but with respect to this model I find several determinants of the endogenous haircut and I take into account a productivity shock. More specifically I do not consider, as this paper does, an "extreme" debt overhang condition where the debtor country is left without resources (for consumption or investment purposes) after paying back its debt.

To the best of my knowledge, no theoretical model has been built to study the effects, in a debt overhang context, of a debt restructuring via lengthening of maturities (that is how this paper will model an NPV reduction). This might be a good strategy to maximize the discounted value of debt repayment by alleviating partially the debt burden on the debtor country. The logic is that forcing the debtor country to pay in a difficult situation will reduce investment today and therefore its repayment capacity tomorrow. Due to this trade-off, creditors might then opt for a maturity extension. In this regard, the three periods model presented in Fernandez and Martin (2015) offers an interesting framework especially in term of roll-over risk. An "extreme" kind of lengthening of maturities is instead considered in Bac (1999) in the form of grace period. This solution is derived as a Nash equilibrium creditors' strategy in a dynamic non-cooperative game. The structure of the game is such that creditors choose the debt repayment path according to debtor's capital accumulation process and given this path, the debtor country decides then its investment level. The larger is disincentive effect of debt repayments the more effective is then the grace periods.

Finally, regarding the official lending, this paper extends the related literature by explicit modelling the additional lending as a function of the investment undertaken by the debtor country. The conditionality clause, implicit in this kind of contracts, has been considered in some studies as an useful instrument to solve the time-inconsistency problem deriving from a debt

overhang condition (Obstfeld and Rogoff, 1996; Sachs and Cohen, 1982; Krugman, 1988a; Sachs, 1989; Diwan and Rodrik, 1992). This clause represents indeed the only possibility for the debtor country to commit itself to not squander in consumption the additional lending received. In other words, it makes the ex-ante and ex-post debtor adjustment's incentives the same (i.e. before and after the new loan). Agreeing on following an adjustment programme can be considered then as a signal of the debtor country's ability and willingness to use the new money for investment and adjustment purposes (Marchesi and Thomas, 1999)⁹.

There is no consensus in the literature about the impact deriving from the strategy of granting new loans to an highly indebted country (Marchesi and Missale, 2013; Easterly, 2002). From the one side, a "perverse mechanism" is in action: a country might be indeed incentivated to accumulate high "concessional" debt and to consume everything in order to keep benefiting of the financial aid (at a low cost) from international institutions (Easterly, 2002; Koeda, 2006)¹⁰. From the other side instead, the strategy of granting new loans was found to be effective. Several studies have shown indeed that the liquidity constraints of the debtor countries were the main reason of the low investment level (Sachs and Cohen, 1982; Froot, 1989; Borensztein, 1990a). In such a context, an increase in lending might also be implemented in combination with a debt reduction interventions in order to be more effective. More specifically, according to three agents framework elaborated by Diwan and Rodrik (1992)¹¹, debt reduction is considered as the prerequisite in order to make the new lending effective in solving a debt overhang effect. Since new money is usually provided conditional to the implementation of some adjustment policies and since implementing an adjustment programme is costly in the short-run, a debt reduction measure can then be used as an instrument in order to produce some fiscal spaces for the debtor country.

2.2.1 Debt Overhang: an Example

Before starting with the model, a simple example might be useful to clarify the debt overhang concept. Following Sachs (1989), I will consider the adjustment effort as an extra public investment that can contribute to generate future additional government's resources.

Let's assume a country in a debt overhang condition with \$150 million of debt and a capacity to pay equals to just \$100 million. I will assume that the debtor country will try to honor its debt as much as it can, otherwise it will declare a default. Given its debt overhang condition, any

⁹See Marchesi and Thomas (1999) for considerations in term of asymmetry of information between debtor and creditor countries.

¹⁰There is also a *defensive lending* perspective in action, according to which it is in creditors' interest to keep providing money to the debtor in order to ensure the repayment of existing loans (Geginat and Kraay, 2012). The recognition of non-performing loans in creditors' balance sheets would otherwise be costly. The empirical evidence on the defensive lending hypothesis is however quite controversial (Easterly, 2002; Marchesi and Missale, 2013).

¹¹They consider a debtor country that undertake adjustment policies, commercial banks (i.e. the existing creditors) that provide a debt reduction and international financial institutions (IFIs such as the IMF) that provide new lending.

attempt to increase its capacity to pay up to \$150 million would be beneficial only for creditors. Let's assume that the country has a possibility to invest \$10 million today in order to generate more resources and then to increase its capacity to pay to \$120 million in the next period¹². This adjustment effort would be beneficial only for creditors that will increase their expected payoff from \$100 million to \$120 million. It would be instead irrational for the debtor country because it would reduce its consumption by \$10 million today but it will get nothing in the future since all the profits deriving from the investment will go to the creditors. In other words, the country would suffer the cost of investing without enjoying the benefits. Adding debt relief, in such an example, would change the framework. If creditors agree for a debt relief of \$40 million (the amount of debt to be paid will be then \$110) and if the debtor country undertakes the investment, \$120 million will be enough for both debt repayment and debtor's consumption (of \$10 million). In such a case then, it would be possible to observe a debtor country raising its adjustment effort once debt relief is provided.

2.3 The Model

This model builds on the theoretical framework described in Obstfeld and Rogoff (1996) chapter 6, adding then different resolution mechanisms for a debtor country struggling with an high level of debt¹³.

Let's consider a two periods model ($t = 1, 2$) for a debtor country that can be described by the following timeline:



At time $t = 1$ the country has an exogenous endowment Y_1 and an investment opportunity. The country then invests K_2 at $t = 1$ and gets a profit $AF(K_2)$ at time 2 (for simplicity capital is assumed to depreciate at 100 %) with $F''(K_2) < 0$. "A" is the productivity shock and it is represented by a random variable that belongs to $[\underline{A}, \bar{A}]$, with $E(A) = 1$ and density probability function $\pi(A)$.

It is further assumed that the country has inherited debt D (there are no considerations on how debt was accumulated) that expires in $t = 2$ with the interest rate r (set in the past). It means that $AF(K_2)$ will be used in $t = 2$ for both consumption and debt repayment.

¹²I will assume interest rate equals to zero.

¹³In this paper there are no considerations in term of asymmetry of information between creditors and debtor country. Understanding the type of debtor country (good or bad) is however crucial in choosing the right policy against debt overhang. For a discussion on screening devices see Marchesi and Thomas (1999) and Acharya and Diwan (1993).

Let's assume a risk neutral debtor country with the following utility function:

$$U_1 = C_1 + \beta E(C_2) \quad (2.1)$$

Moreover, in line with the canonical endogenous default models (Cohen et al., 2016; Bulow and Rogoff, 1989; Bolton and Jeanne, 2007; Corsetti and Dedola, 2012; Arellano et al., 2013; Adam and Grill, 2017; Fernandez and Martin, 2015), I assume $\eta AF(K_2)$ represents the penalty imposed to the debtor country in case of default. It is modelled in the form of a proportional output reduction¹⁴ intended as a deadweight loss¹⁵ (Adam and Grill, 2017) with $0 < \eta < 1$ that represents the magnitude of the default. The effects of default can be indeed considered different if they affect a small or a large economy. There is also a recent empirical evidence (Trebesch and Zabel, 2016; Cheng et al., 2017b) showing that output losses depend on the severity of default (i.e. they increase the more severe is the default). The idea behind is that the collateral damages (i.e. output reduction) deriving from a default are likely to be larger the larger the losses imposed. It is then necessary to take into account the heterogeneity of debt crises when studying their consequences¹⁶.

At time $t = 1$, consumption is given by $C_1 = Y_1 - K_2$ whereas in $t = 2$ by $C_2 = AF(K_2) - P$. P represents the debtor's payment $P = \min[D(1+r), \eta AF(K_2)]$ which depends on the realizations of A . From this expression it is possible to identify two intervals for the realizations of the variable A :

- if $A < \frac{D(1+r)}{\eta F(K_2)}$ default will be more convenient for the debtor country as the output reduction in case of default is less than the cost of debt repayment;
- if $A > \frac{D(1+r)}{\eta F(K_2)}$ the country repays its debt because it is more convenient than the loss of output that it would suffer in case of default.

To see the effect of a debt restructuring, through face value reduction, in a debt overhang framework, I assume that in case of default in $t = 2$, there is a renegotiation between creditors and debtor in the form of Nash Bargaining. In this renegotiation, that comes without delays, a

¹⁴The assumption of cost of default proportional to output deviates from some of the mainstream frameworks for the analysis of sovereign risk, which see this cost as fixed (Aguar and Amador, 2014). Instead, I decided to follow another influential branch of the literature where the cost is considered as proportional to output (Arellano, 2008; Hatchondo et al., 2016; Aguiar and Gopinath, 2006; Adam and Grill, 2017).

¹⁵In the literature, $\eta AF(K_2)$ can be considered both as a fraction of output of the debtor country that can be expropriated from creditors (i.e. "gunboat technology") or just as an output reduction due to the default. Several papers study the consequent output reduction for a country in default deriving from trade sanctions (Rose, 2005), reduced FDI flows (Fuentes and Saravia, 2010), exclusion from financial markets (Cruces and Trebesch, 2013), reduced credit to the private sector (Arteta and Hale, 2008) etc. These are the so called "issue linkages". For a theoretical and empirical discussion see Borensztein and Panizza (2009) and Sandleris (2016).

¹⁶See Asonuma and Trebesch (2016) and Marchesi and Masi (2017) for different kind of heterogeneities that can be taken into account.

debt reduction is determined in an endogenous way¹⁷.

Let's see in more details how this renegotiation process works.

2.3.1 Restructuring via face value reduction

In the Nash Bargaining there are two different scenarios that must be taken into account:

1. Agreement. The creditors and the debtor country decide the "new" reduced amount of debt that must be paid. Therefore, the creditors receive as payment this new level of debt whereas the debtor gets the difference between the output produced in the second period and what it must repay:

$$U^C = D(1 + r)(1 - h)$$

$$U^D = AF(K_2) - D(1 + r)(1 - h)$$

2. No Agreement. This is the so-called threat point of the bargaining game. I assume that the creditors get 0¹⁸ whereas the debtor country suffers a reduction in its output, because of the default:

$$\bar{U}^C = 0$$

$$\bar{U}^D = (1 - \eta)AF(K_2)$$

where U^C and U^D represent respectively creditors' and debtor's utility functions in case of agreement (\bar{U}^C and \bar{U}^D in case of no agreement).

Thus, it is possible to build the creditors' ($U^C - \bar{U}^C$) and debtor's surplus functions ($U^D - \bar{U}^D$) that represent the utility gains of creditors and debtor country in case of agreement in the Nash Bargaining (assuming $0 < h < 1$). The resulting Nash product Ω must be maximized with respect to h (i.e. the amount of haircut) considering θ as creditors' bargaining power and $(1 - \theta)$ as debtor's bargaining power where θ summarizes the institutional arrangements of sovereign debt restructurings¹⁹. In such a way, it is possible to prove the existence of an optimal value of reduced debt that maximizes the total renegotiation surpluses. Basically, this is a maximization

¹⁷According to the literature, a face value reduction usually produces two opposite effects for the receiving debtor country: 1) a relief effect lowering the debt burden and 2) a negative reputational effect in the international capital markets lowering the ability to attract foreign direct investment (Eaton and Gersovitz, 1981; Cole and Kehoe, 1998; Arellano, 2008; D'Erasmus, 2011; Yue, 2010; Cruces and Trebesch, 2013; Marchesi and Masi, 2017). However, given the very simple structure of my model and the fact that there is no period following the face value reduction, I do not consider explicitly an additional reputational effect.

¹⁸The creditors' zero payoff might seem a strong assumption. However, I decided to follow recent theoretical work in the literature (Arellano and Bai, 2014; D'Erasmus, 2011; Asonuma and Trebesch, 2016) where the same assumption is used. Additionally, I solved the model assuming that creditors receive a proportion q (with $0 < q < h$) from the original debt due. As adding this term does not change the message of the model, I left the model unchanged.

¹⁹The set of the bargaining power is defined as $\Theta \subset (0; 1)$ such that $\theta \in \Theta$ and there is a unique optimum.

problem with the creditors' and debtor's surplus functions taken as participation constraints.

$$\begin{aligned} \max_{K_2} \quad & \Omega \\ \text{s. t.} \quad & U^C - \bar{U}^C \geq 0 \\ & U^D - \bar{U}^D \geq 0 \end{aligned}$$

The result is the following:

$$h = 1 - \theta \eta \frac{AF(K_2)}{D(1+r)} \quad (2.2)$$

Computations are showed in Appendix A and some very preliminary empirical implications of this equation are tested in Appendix D.

The reduced amount of debt that must be paid at the end of the Nash Bargaining process is then:

$$D(1+r)(1-h) = \theta \eta AF(K_2)$$

If the debtor country has all the bargaining power in the renegotiation process, it will extract all the creditors' surplus. Then $\theta = 0$ and the debtor will pay nothing. Vice versa, if the creditors have all the bargaining power then $\theta = 1$ and the debtor will pay a total amount equal to $\eta AF(K_2)$. If the bargaining power instead is distributed between the parties $0 < \theta < 1$, then the debtor pays an amount $0 < D(1+r)(1-h) < \eta AF(K_2)$.

In conclusion, as we can see from equation (2.2), it is possible to claim that:

- an increase in creditors' bargaining power reduces the level of h ;
- a larger output reduction in case of default makes the required level of h lower (it is a sort of disincentive to default);
- a larger D (or a larger interest rate) implies a larger h (otherwise there would be an higher incentive to default for the debtor country).

Using the result of the restructuring process, consumption in the second period can be re-written as:

$$C_2 = \begin{cases} C_2^R = AF(K_2) - D(1+r)(1-h) \\ C_2^N = AF(K_2) - D(1+r) \end{cases}$$

With C_2^R consumption in case of restructuring and C_2^N consumption in case of no default.

Maximizing the (2.1) with respect to K_2 and taking into account the result deriving from the Nash bargaining produces the following optimal investment function:

$$\beta F'(K_2) \left[1 - \theta \eta \int_{\underline{A}}^{\frac{D(1+r)}{\eta F(K_2)}} A \pi(A) dA - \pi \left(\frac{D(1+r)}{\eta F(K_2)} \right) \frac{(D(1+r))^2}{\eta F(K_2)^2} (1 - \theta) \right] = 1 \quad (2.3)$$

Computations are showed in Appendix A1 and from Appendix A2, we can see that the marginal rate of transformation between debt and investment is negative.

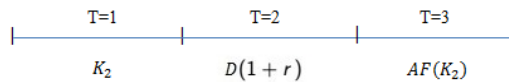
According to equation (2.3) then, the debtor country will invest untill the point where the expected marginal product of investment, net of expected payment in case of default, will be equal to the current consumption cost of investing.

$\theta \eta \int_{\underline{A}}^{\frac{D(1+r)}{\eta F(K_2)}} A \pi(A) dA$ represents how the marginal change in K_2 affects the payment in case of debt restructuring (if there is a change in the amount to be paid) and $\pi \left(\frac{D(1+r)}{\eta F(K_2)} \right) \frac{(D(1+r))^2}{\eta F(K_2)^2} (1 - \theta)$ represents the difference between the repayment change in case of no restructuring and in case of restructuring due to a change in K_2 (that affects the default probability).

Thus, the final result, in terms of incentives to invest, depends on the value of the parameter θ : the lower the value of this parameter, the higher will be the incentives to invest. This is because the smaller the θ , the larger will be the value assumed by h . In other words, the effectiveness of the face value reduction result depends on the creditors' bargaining power.

2.3.2 Restructuring via rescheduling

The second strategy here analysed is related to a restructuring process via lengthening of maturities. In order to model a rescheduling process, I assume there is a delay in the realization of the output coming from the investment undertaken in the previous period. This means that the debtor country has to pay $D(1+r)$ in the second period but, because of the delay, the output deriving from investment will be realized only in the third period. Therefore, the debtor country has to face a debt payment without having the resources to do it. The following timeline describes the current situation:



In this framework, I will consider that the debtor country has the possibility to ask for a payment postponement. The creditors indeed, in order to protect the value of their claims (without cutting their nominal value), might give the opportunity to the debtor country to restructure the debt through a lengthening of maturities. It means to postpone the debt payment from $t = 2$ to $t = 3$ through a debt roll-over. Then, in the third period, since the debtor country gets profits from the investment undertaken and there is the realization of the productivity shock, creditors might be

fully repaid. In such a framework, creditors would be willing to roll-over debt only according to the following credit ceiling condition:

$$D(1+r)(1+r_r) \leq \eta E[A] F(K_2)$$

with r_r that represents the interest rate that will be applied by the creditors in the rescheduling process. According to this condition, the amount of debt that must be paid in the third period, plus the maturing interest rate, must be lower or at maximum equal to the expected cost of default computed according creditors' expectations. In other words, creditors expect the debtor to be able to repay in the third period. In this framework, the credit ceiling is important for two reasons: 1) it is a condition necessary to avoid debt explosion and therefore a default with probability one in the last period; 2) from this condition it is possible to compute the maximum interest rate that can be charged by the creditors r_{max} (i.e. the interest rate that makes this condition binding). Given the riskiness of the debtor country indeed, creditors might be tempted to charge an high interest rate in order to be compensated for the risk of postponing the debt repayment to the next period. Therefore, they might ask for an interest rate as highest as possible : r_{max} (but that would imply for the debtor country to be indifferent between default and debt repayment).

In order to model a maturity extension process including a "relief" component then, it is here assumed a roll-over at an interest rate that does not fully reflect the expected risk of default. The interest rate r_r is determined according to a no-arbitrage condition and therefore it is a function of the risk free interest rate r_F and the probability of default. r_r can be then intended as a sort of "reduced interest rate", lower than then the market one but larger than the risk free rate: $r_r \in (r_F, r_{max})$.

More specifically, then $D(1+r)$ in $t = 2$ is the amount of debt to be rolled over at the rate r_r . Thus, in $t = 3$ the debtor will pay the $\min[D^*, \eta AF(K_2)]$ with $D^* = D(1+r)(1+r_r)$ that represents the total debt that must be repaid. As described before for the case of face value reduction:

- if $A < \frac{D^*}{\eta F(K_2)} = A^*$ default will be more convenient for the debtor country;
- if $A > \frac{D^*}{\eta F(K_2)}$ the country will pay back its debt.

Maximizing the utility function with respect to K_2 , taking the credit ceiling as participation constraint, I get the following optimal investment function:

$$\beta^2 F'(K_2) \left[1 - \eta \int_A^{\frac{D(1+r)(1+r_r)}{\eta F(K_2)}} A \pi(A) dA \right] = 1 \quad (2.4)$$

Computations are showed in Appendix B.

According to this result, we can see the important role of the interest rate charged by creditors

in the investment function of the debtor country: the larger is the interest rate, the lower will be the relief and then the lower will be the incentive to invest.

2.3.3 Conditional-Additional Official Lending

An high debt can adversely affect investment in two ways: through the debt overhang condition above examined and/or through credit rationing. It should be verified then whether the most important reason for the low level of investment is related to the liquidity constraints faced by an highly indebted country or to the debt overhang condition. The credit rationing derives from the presence of high interest rates that an highly indebted country faces into the international financial markets, because of its weak standing. In such a framework then, creditors might not be interested in providing a lengthening of maturity to the debtor country²⁰.

In this section then, it is assumed that the official sector steps in, in order to overcome the standstill. The lending provided by the official sector is used by the debtor country to pay back its debt with private creditors. To put it in different words, it means that private debt is replaced by official debt. This is something quite common during debt crises as it was during the HIPC initiative (Easterly, 2002) or recently for Greece where the money received from the *European Stability Mechanism* (ESM) was used to pay domestic arrears²¹.

Moreover, as described in the introduction, official lending usually comes with conditionality. In order to model this aspect then, I will assume that the total amount of money provided by the official sector will be given by: $D_o + D_1(K_2)$ where D_o is the amount given to repay the private creditors and $D_1(K_2)$ is the additional lending provided, conditional to the amount invested. The investment can be considered here as the adjustment effort undertaken by the debtor country (or as a measure of its fiscal discipline). If the effort undertaken is large, then a larger amount of money will be provided by the official sector. $D_1(K_2)$ can be then represented by a function of the investment undertaken using the following functional form: $D_1(K_2) = \alpha\beta F(K_2)$ with α (defined between 0 and 1) that measures the marginal cost of the additional lending and β is the discount factor²².

Thus, I assume a precommitment to invest for the debtor country (Obstfeld and Rogoff, 1996): firstly the debtor establishes the amount K_2 to invest and secondly the creditors, being able to

²⁰Actually, following a *defensive lending* strategy (Krugman, 1988a), there might another reason why existing creditors might be interested in providing new lending to the debtor country. They might believe indeed that if the new additional lending is used to undertake some productive investment (i.e. a conditional lending) it could reduce the debtor country's probability of default. In such a way, creditors would protect the value of their existing claims toward the debtor country and then it might be interesting from their point of view to compare two strategies: debt reduction vs conditional-additional lending.

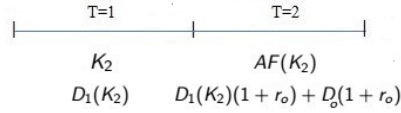
²¹Official creditors have always played an important role in solving sovereign debt crises (IMF, 2013b; Das et al., 2012b).

²²The discount factor here is taken into account in order to consider that the government has a preference toward consumption instead of investment.

observe the value of K_2 , decide the amount of new lending²³.

The new total debt that must be repaid at end of period 2 will be then $D^* = D_1(K_2)(1 + r_o) + D_o(1 + r_o)$ with r_o representing the official interest rate that, in order to simplify, I will consider it equivalent to r_F .

The following timeline describes the current situation:



Following the logic above explained, creditors might be willing to lend more and more with the increase in the amount invested by the debtor country. Actually, as explained also in the previous paragraph, there is a maximum (i.e. a credit ceiling) on the total amount of new loans that the creditors will be willing to grant. Specifically, creditors will provide new loans with the aim to not alter debtor's repayment incentives. This means a situation where the nominal value of debt that must be repaid by the debtor will be equal or lower than the cost of default (calculated according to creditors' expectations). The credit ceiling can be described as follows:

$$D_1(K_2)(1 + r_o) + D_o(1 + r_o) \leq \eta E[A] F(K_2)$$

Existing creditors then will be willing to provide new loans up to the point where the total debt accumulated by the debtor country, will be exactly equal to the expected output reduction that the debtor country would suffer in case of default.

In this framework, maximizing the utility function with respect to K_2 , produces the following optimal investment function:

$$\beta F'(K_2) \left[1 - \eta \int_{\underline{A}}^{A^*} A \pi(A) dA + \alpha \int_{\underline{A}}^{A^*} \pi(A) dA \right] = 1 \quad (2.5)$$

Computations are showed in Appendix C1.

$+\alpha \int_{\underline{A}}^{A^*} \pi(A) dA$ represents the extra benefits deriving from the possibility to get the additional lending of official creditors.

If the change in K_2 (due to the additional lending) makes the probability of default low, then the extra benefit will be larger than the cost of default and investment will be higher. Vice versa if the cost of default has a larger effect, investment will decrease. In other words: if the investment is effective (i.e. it reduces the probability of default) then the conditional official lending strategy will be effective as well.

²³In this paper there are no considerations in term of asymmetry of information between creditors and debtor country.

2.3.4 How does debt restructuring speed up investment?

It is useful now to conduct a comparative statics exercise in order to compare the three strategies described so far and to show how these strategies are able to speed up investment in the debtor country.²⁴ I will assume three periods in all the frameworks analysed in this paper in order to make these strategies comparable and to study which is the best option able to restore the incentives to invest. For this reason I will assume an intermediate period in the face value reduction and conditional-additional official lending cases where there is no action²⁵.

The optimal investment functions will be then:

Face value reduction

$$\beta^2 F'(K_2) \left[1 - \theta \eta \int_{\underline{A}}^{\frac{D(1+r)^2}{\eta F(K_2)}} A \pi(A) dA - \pi \left(\frac{D(1+r)^2}{\eta F(K_2)} \right) \frac{(D(1+r)^2)^2}{\eta F(K_2)^2} (1 - \theta) \right] = 1$$

Rescheduling

$$\beta^2 F'(K_2) \left[1 - \eta \int_{\underline{A}}^{\frac{D(1+r)(1+r_r)}{\eta F(K_2)}} A \pi(A) dA \right] = 1$$

Conditional-additional official lending

$$\beta^2 F'(K_2) \left[1 - \eta \int_{\underline{A}}^{\frac{D_o(1+r_o)^2 + D_1(K_2)(1+r_o)^2}{\eta F(K_2)}} A \pi(A) dA + \alpha \int_{\underline{A}}^{\frac{D_o(1+r_o)^2 + D_1(K_2)(1+r_o)^2}{\eta F(K_2)}} \pi(A) dA \right] = 1$$

Let's proceed now with a pairwise comparison:

1. comparing investment under face value reduction and investment under rescheduling, I can prove the existence of a specific level of $\underline{\theta}$ that makes the two results equivalent. In other words, $\underline{\theta}$ can be considered as a threshold for creditor's bargaining power (see Appendix C3 for the proof):

- if $\theta < \underline{\theta}$ face value reduction is more effective than rescheduling.
- if $\theta > \underline{\theta}$ rescheduling is more effective than face value reduction.

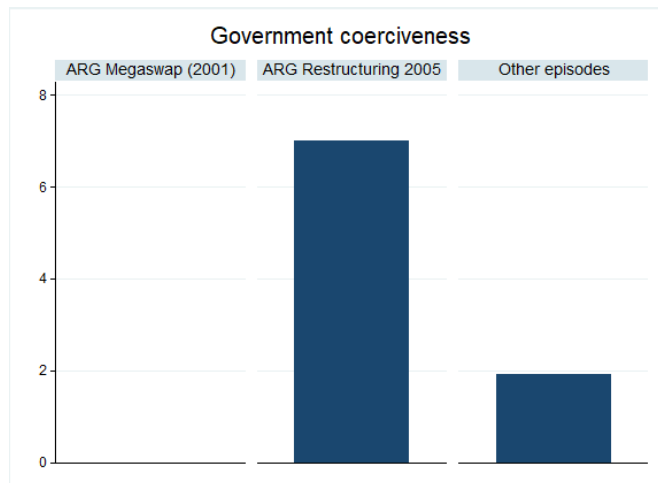
This result is confirmed by the data: the stricter is the government during the negotiation with creditors the more likely is the face value reduction and the higher will be the investment level. In order to give some practical examples, we can consider the coerciveness index developed by Enderlein et al. (2012). This index is built in an additive way where basically each point is given if a particular criterion²⁶ is fulfilled. It ranges between 1 and 10 (maximum coerciveness) according to the number of criteria fulfilled. In such a way

²⁴The comparison in this paragraph is made in term of investment level. No welfare considerations are derived.

²⁵This addition does not change the computation of the investment functions.

²⁶The criteria are divided in *payment behaviour* (any missed payments, unilateral or negotiated payment suspension, full default or partial default and freeze of foreign assets) and *negotiation behaviour* (delays in negotiations produced intentionally by the government, refusal of data disclosure, threat of debt repudiation, explicit declaration of default or moratorium).

we can compare two restructuring episodes of Argentina: the Megaswap of 2001 (first column of Figure 3) and the restructuring of 2005 (second column of Figure 3)²⁷. In the first one, the debtor country did not adopt an harsh approach during the negotiations with creditors and indeed the restructuring consisted in just a debt roll-over for government's obligations. In the second one instead, the government acted in a very strict way and as a consequence it presented to creditors a take-it-or-leave-it offer, involving a large nominal reduction.



Source: Enderlein et al. (2012).

This results, then, leave some space for the rescheduling option. In case the debtor country does not assume a strict behaviour during the negotiations (or it is not able to do it), the resulting face value reduction might be insufficient and then a maturity extension would be preferable.

2. comparing conditional-additional official lending and rescheduling, I can prove there is an equivalence for a given r_o (see Appendix C3). Then, if $r_o = \bar{r}_o$ the probability of default is the same in both cases; if $r_o < \bar{r}_o$ the probability of default is bigger in case of rescheduling; if $r_o > \bar{r}_o$ the probability of default is bigger in case of conditional official lending.

- $r_o = \bar{r}_o$. The probabilities of default are the same and the debt burden deriving from the two strategies as well. Then conditional official lending is the best solution because of the extra kick that it produces for investment.
- $r_o < \bar{r}_o$. The probability of default is bigger in case of rescheduling and as a consequence the debt burden deriving from that strategy is larger. Because of this

²⁷To provide a term of comparison, in the third column it is represented the average coerciveness of the other cases studied in Enderlein et al. (2012).

and because of the extra kick for investment, conditional official lending is again the best solution.

- $r_o > \bar{r}_o$. The probability of default is bigger in case of conditional official lending and then the debt burden deriving from that strategy is larger. If the benefit deriving from the additional investment is larger than the cost in case of default, then the conditional official lending will increase investment more than face value reduction and more than rescheduling. Conversely, if the benefit is not enough to compensate for the cost (i.e. the increase in debt), then the result is uncertain and it might vary according to parameters' calibration.

Creditors' Point of View

Which is the best strategy from creditors' point of view when a risk of default for the debtor country is appearing?

Several factors can influence creditors' preference when they have to choose one strategy between haircut, rescheduling and conditional-additional lending:

- creditors' impatience and their risk aversion;
- default probability: the creditors would prefer the face value reduction if this probability is high (the same for an high level of debt). Otherwise, in case of high probability of default, the debtor would need a huge effort/investment (K_2) to bring this probability back to normal level but it might not have the necessary economic or political strength to do that;
- the timing of intervention: if there is the possibility to intervene when the default probability is still low, it could be useful a rescheduling or an additional lending strategy. On the other hand, if it is too late and the default probability is already high it might be necessary a face value reduction.

2.4 Conclusion

This paper shows the effectiveness of three different strategies that can be used to solve the debt overhang problem and to restore the incentives to invest in a troubled country. The aim is to represent schematically the functioning of three restructuring processes to gain insights into their differences. Two strategies are based on debt relief interventions. The first one is based on a face value reduction (with the amount of debt that is reduced endogenously through a Nash Bargaining process) whereas the second one consists in debt rescheduling. The third strategy analysed is based on conditional-additional official lending. The official sector might indeed step in, providing new lending for the debtor country in exchange for some adjustment measures.

One important result of this work is to show the optimal investment functions for each strategy analysed and the role played by some of their underlying drivers. Then I make some comparisons between these three strategies.

The first result is that a restructuring process via face value reduction can restore the incentives to invest in a stronger way than a restructuring via maturities' extension. This result however depends on the creditors' bargaining power in the renegotiation process with the debtor country (or vice-versa on debtor's bargaining power). More specifically, if creditors' bargaining power is lower than a specific threshold (i.e. creditors are weak or vice-versa the debtor country is strong) then a face value reduction will be better than a lengthening of maturities in terms of restoring incentives to invest. This result matches with the data. Using the coerciveness index developed by Enderlein et al. (2012), it is possible to see that when the government of the debtor country adopted an harsh approach during the negotiations with creditors, they obtained a face value reduction, producing then an higher investment level. This result however does not classify the maturity extension always as a second best option. In case of a weak government of the debtor country, indeed, the resulting face value reduction would be too low and then a rescheduling option might be preferred to the face value reduction.

Then, comparing face value reduction and rescheduling with conditional-additional official lending, this paper shows that if the change in investment (due to the additional lending) makes the probability of default low, conditional-additional official lending will imply higher investment than the other two strategies. The result holds when the benefits deriving from the additional investment undertaken are larger than the increase of debt, produced by the additional lending, and able to more than compensate for it reducing then the probability of default. The other way round, the final result is uncertain and it might vary according to the value of the parameters used in the model. This means that conditional-additional official lending can be an effective strategy only in specific circumstances.

To sum up, this paper builds a ranking for the described strategies. If the extra benefits deriving from additional lending are larger than the related increase in the debt burden, then the conditional-additional official lending strategy is the best intervention in order to restore incentive to invest in a troubled country. Creditors expectations play a key role here when the decision to provide additional lending has to be taken. Moving on with the ranking, if creditors' bargaining power is below the threshold identified in the paper, face value reduction will be the second best solution and rescheduling the last one.

2.5 Appendix A

This Appendix shows how to compute the face value reduction deriving from the Nash Bargaining.

The creditors' ($U^C - \bar{U}^C$) and debtor's surplus functions ($U^D - \bar{U}^D$) represent the utility gains of creditors and debtor country in case of agreement in the Nash Bargaining.

The creditors' surplus deriving from the renegotiation is then:

$$(U^C - \bar{U}^C) = D(1+r)(1-h)$$

whereas debtor's surplus is:

$$(U^D - \bar{U}^D) = AF(K_2) - D(1+r)(1-h) - (1-\eta)AF(K_2)$$

The Nash product is:

$$\Omega = (U^C - \bar{U}^C)^\theta (U^D - \bar{U}^D)^{1-\theta}$$

that must be maximized with respect to h considering θ as creditors' bargaining power and $(1-\theta)$ as debtor's bargaining power. This is then a constrained maximization problem:

$$\begin{aligned} \max \quad & \Omega \\ \text{s. t.} \quad & U^C - \bar{U}^C > 0 \\ & U^D - \bar{U}^D > 0 \end{aligned}$$

The Lagrangian is:

$$\begin{aligned} L = & [D(1+r)(1-h)]^\theta [AF(K_2) - D(1+r)(1-h) - (1-\eta)AF(K_2)]^{1-\theta} + \\ & - \lambda_1(D(1+r)(1-h)) - \lambda_2(-D(1+r)(1-h) + \eta AF(K_2)) \end{aligned}$$

I compute the derivative of the Lagrangian with respect to h and I get:

$$\begin{aligned} \frac{\delta L}{\delta h} = & \theta(-D(1+r))[U^C - \bar{U}^C]^{\theta-1}[U^D - \bar{U}^D]^{1-\theta} + [U^C - \bar{U}^C]^\theta(1-\theta)D(1+r)[U^D - \bar{U}^D]^{-\theta} + \\ & + \lambda_1 D(1+r) - \lambda_2 D(1+r) = 0 \end{aligned}$$

with the two constraints:

$$D(1+r)(1-h) > 0 \quad \wedge \quad \lambda_1(D(1+r)(1-h)) = 0$$

$$D(1+r)(1-h) < \eta AF(K_2) \quad \wedge \quad \lambda_2[(-D(1+r)(1-h) + \eta AF(K_2))] = 0$$

$\lambda_1 > 0$ is not an acceptable solution because it would imply $D(1+r)(1-h) = 0$ and therefore there would not be an incentive to participate for the creditors. $\lambda_2 > 0$ is not an acceptable solution because it would imply $D(1+r)(1-h) = \eta AF(K_2)$ that is a situation in which the debtor would be indifferent between repayment and default. Therefore, the only acceptable solutions are $\lambda_1 = 0$ e $\lambda_2 = 0$.

To simplify, I multiply both sides of the equation for $\left(\frac{U^D - \bar{U}^D}{U^C - \bar{U}^C}\right)^\theta$ and after some computations I get:

$$h = 1 - \theta\eta \frac{AF(K_2)}{D(1+r)}$$

2.6 Appendix A1

This Appendix shows how to get the investment function in case of face value reduction.

Taking into account the result of the Nash Bargaining, the utility function is:

$$U = Y_1 - K_2 + \beta \int_{\underline{A}}^{\frac{D(1+r)}{\eta F(K_2)}} (AF(K_2)(1-\theta\eta)) \pi(A) dA + \beta \int_{\frac{D(1+r)}{\eta F(K_2)}}^{\bar{A}} (AF(K_2) - D(1+r)) \pi(A) dA$$

I derive with respect to K_2 :

$$\begin{aligned} \frac{\delta U}{\delta K_2} = & -1 + \beta[F'(K_2)(1-\theta\eta) \int_{\underline{A}}^{A^*} A\pi(A) dA + F(K_2)(1-\theta\eta) \frac{D(1+r)}{\eta F(K_2)} \pi\left(\frac{D(1+r)}{\eta F(K_2)}\right) \left(-\frac{D(1+r)\eta F'(K_2)}{\eta^2 F(K_2)^2}\right) + \\ & - \pi\left(\frac{D(1+r)}{\eta F(K_2)}\right) \left(-\frac{D(1+r)\eta F'(K_2)}{\eta^2 F(K_2)^2}\right) + F'(K_2) \int_{A^*}^{\bar{A}} A\pi(A) dA + \\ & + F(K_2) \left(-\frac{D(1+r)}{\eta F(K_2)}\right) \pi\left(\frac{D(1+r)}{\eta F(K_2)}\right) \left(-\frac{D(1+r)\eta F'(K_2)}{\eta^2 F(K_2)^2}\right) + \\ & - D(1+r) \left(-\pi\left(\frac{D(1+r)}{\eta F(K_2)}\right)\right) \left(-\frac{D(1+r)\eta F'(K_2)}{\eta^2 F(K_2)^2}\right) = 0 \end{aligned}$$

and after some computations I get:

$$\beta F'(K_2) \left[1 - \theta \eta \int_{\underline{A}}^{A^*} A \pi(A) dA - \pi \left(\frac{D(1+r)}{\eta F(K_2)} \right) \frac{(D(1+r))^2}{\eta F(K_2)^2} (1-\theta) \right] = 1 \quad (2.6)$$

Now I want to compare this result with Obstfeld and Rogoff (1996)'s original result in order to show that the investment function in case of face value reduction implies higher incentives to invest.

$$\left[1 - \theta \eta \int_{\underline{A}}^{A^*} A \pi(A) dA - \pi \left(\frac{D(1+r)}{\eta F(K_2)} \right) \frac{(D(1+r))^2}{\eta F(K_2)^2} (1-\theta) \right] \geq \left[1 - \eta \int_{\underline{A}}^{A^*} A \pi(A) dA \right]$$

The largest one will imply the highest incentive to invest (in the right parenthesis there is the Obstfeld and Rogoff (1996)'s result).

Let's suppose the equivalence:

$$\eta \theta \int_{\underline{A}}^{A^*} A \pi(A) dA + \pi \left(\frac{D(1+r)}{\eta F(K_2)} \right) \frac{(D(1+r))^2}{\eta F(K_2)^2} (1-\theta) = \eta \int_{\underline{A}}^{A^*} A \pi(A) dA$$

This expression means that I am indifferent between the condition with face value reduction and the condition without it: the payment would be the same in both cases.

In order to have the face value reduction beneficial with respect to the "normal" situation, I must impose that:

$$+\eta \theta \int_{\underline{A}}^{A^*} A \pi(A) dA + \pi \left(\frac{D(1+r)}{\eta F(K_2)} \right) \frac{(D(1+r))^2}{\eta F(K_2)^2} (1-\theta) < \eta \int_{\underline{A}}^{A^*} A \pi(A) dA$$

$$\theta \left(\eta \int_{\underline{A}}^{A^*} A \pi(A) dA - \pi \left(\frac{D(1+r)}{\eta F(K_2)} \right) \frac{(D(1+r))^2}{\eta F(K_2)^2} \right) < \left(\eta \int_{\underline{A}}^{A^*} A \pi(A) dA - \pi \left(\frac{D(1+r)}{\eta F(K_2)} \right) \frac{(D(1+r))^2}{\eta F(K_2)^2} \right)$$

$$\text{This is always verified } \forall \theta < 1 \text{ if } \pi \left(\frac{D(1+r)}{\eta F(K_2)} \right) \frac{(D(1+r))^2}{\eta F(K_2)^2} < \eta \int_{\underline{A}}^{A^*} A \pi(A) dA$$

Now I compute the second derivative to prove that equation (2.3) represents a maximum.

$$\begin{aligned} & \beta F''(K_2) - \beta F''(K_2) \theta \eta \int_{\underline{A}}^{\frac{D(1+r)}{\eta F(K_2)}} A \pi(A) dA - F'(K_2) \theta \eta \frac{D(1+r)}{\eta F(K_2)} \pi \left(\frac{D(1+r)}{\eta F(K_2)} \right) \left(-\frac{D(1+r) \eta F'(K_2)}{\eta^2 F(K_2)^2} \right) + \\ & - \beta F''(K_2) \pi \left(\frac{D(1+r)}{\eta F(K_2)} \right) \frac{(D(1+r))^2}{\eta F(K_2)^2} (1-\theta) + \\ & - \beta F'(K_2) (1-\theta) \left[\pi' \left(\frac{D(1+r)}{\eta F(K_2)} \right) \left(-\frac{D(1+r) \eta F'(K_2)}{\eta^2 F(K_2)^2} \right) \frac{(D(1+r))^2}{\eta F(K_2)^2} + \pi \left(\frac{D(1+r)}{\eta F(K_2)} \right) \left(-\frac{2(D(1+r))^2 \eta F'(K_2)}{\eta^2 F(K_2)^4} \right) \right] = 0 \end{aligned}$$

$$\begin{aligned} & \beta F''(K_2) \left[1 - \theta \eta \int_{\underline{A}}^{A^*} A \pi(A) dA - \pi \left(\frac{D(1+r)}{\eta F(K_2)} \right) \frac{(D(1+r))^2}{\eta F(K_2)^2} (1-\theta) \right] + \\ & + \beta F'(K_2) \frac{(D(1+r))^2}{\eta F(K_2)^3} \times \\ & \times \left[\frac{\theta \eta}{\eta} F'(K_2) \pi \left(\frac{D(1+r)}{\eta F(K_2)} \right) + (1-\theta) \pi' \left(\frac{D(1+r)}{\eta F(K_2)} \right) \frac{D(1+r) F'(K_2)}{\eta F(K_2)} + 2(1-\theta) \pi \left(\frac{D(1+r)}{\eta F(K_2)} \right) \right] = 0 \end{aligned}$$

$$\begin{aligned} & \beta F''(K_2) \left[1 - \theta \eta \int_{\underline{A}}^{A^*} A \pi(A) dA - \pi \left(\frac{D(1+r)}{\eta F(K_2)} \right) \frac{(D(1+r))^2}{\eta F(K_2)^2} (1-\theta) \right] + \\ & + \beta F'(K_2) \frac{(D(1+r))^2}{\eta F(K_2)^3} \times \\ & \times \left[\theta F'(K_2) \pi \left(\frac{D(1+r)}{\eta F(K_2)} \right) + (1-\theta) \pi' \left(\frac{D(1+r)}{\eta F(K_2)} \right) \frac{D(1+r) F'(K_2)}{\eta F(K_2)} + 2(1-\theta) \pi \left(\frac{D(1+r)}{\eta F(K_2)} \right) \right] < 0 \end{aligned}$$

This condition needs not hold for all K_2 but it must hold at the optimal investment level. It is negative since: $F''(K_2) < 0$ and $\left[1 - \theta \eta \int_{\underline{A}}^{A^*} A \pi(A) dA - \pi \left(\frac{D(1+r)}{\eta F(K_2)} \right) \frac{(D(1+r))^2}{\eta F(K_2)^2} (1-\theta) \right] > 0$ and also the second term is positive.

2.7 Appendix A2

This Appendix shows how to compute the implicit differentiation of equation (2.3) that gives the marginal rate of transformation between D and K_2 .

Let's consider then (2.3) as F .

$$\begin{aligned} \frac{dK_2}{dD} &= - \frac{\delta F / \delta D}{\delta F / \delta K_2} = \\ &= \frac{- \left[-\theta \eta \frac{D(1+r)}{\eta F(K_2)} \pi \left(\frac{D(1+r)}{\eta F(K_2)} \right) \frac{F'(K_2)}{\eta F(K_2)} - F'(K_2)(1-\theta) \left(\pi' \left(\frac{D(1+r)}{\eta F(K_2)} \right) \frac{1}{\eta F(K_2)} \frac{(D(1+r))^2}{\eta F(K_2)^2} + \pi \left(\frac{D(1+r)}{\eta F(K_2)} \right) \frac{2D(1+r)}{\eta F(K_2)^2} \right) \right]}{U''(K_2)} \\ &= \frac{\left[\frac{\theta D(1+r)}{\eta F(K_2)^2} F'(K_2) \pi \left(\frac{D(1+r)}{\eta F(K_2)} \right) + F'(K_2)(1-\theta) \frac{D(1+r)}{\eta F(K_2)^2} \left(\pi' \left(\frac{D(1+r)}{\eta F(K_2)} \right) \frac{D(1+r)}{\eta F(K_2)} + 2\pi \left(\frac{D(1+r)}{\eta F(K_2)} \right) \right) \right]}{U''(K_2)} \end{aligned}$$

As we can see, the marginal rate of transformation is negative if $U''(K_2) < 0$.

2.8 Appendix B

This appendix shows how to get the investment function in case of maturity extension.

The utility function is:

$$U = Y_1 - K_2 + \beta^2 \left[\int_{\underline{A}}^{A^*} (AF(K_2)(1 - \eta)) \pi(A) dA + \int_{A^*}^{\bar{A}} (AF(K_2) - D^*) \pi(A) dA \right]$$

Since here there is a participation constraint, given by the credit ceiling $D(1 + r)(1 + r_r) \leq \eta E[A] F(K_2)$, we have a constrained maximization problem:

$$\begin{aligned} \max \quad & U \\ \text{s. t.} \quad & D(1 + r)(1 + r_r) \leq \eta E[A] F(K_2) \end{aligned}$$

The Lagrangian will be then:

$$\begin{aligned} L = Y_1 - K_2 + \beta^2 \left[\int_{\underline{A}}^{A^*} (AF(K_2)(1 - \eta)) \pi(A) dA + \int_{A^*}^{\bar{A}} (AF(K_2) - D^*) \pi(A) dA \right] + \\ + \lambda_1 (D(1 + r)(1 + r_r) - \eta E(A)F(K_2)) \end{aligned}$$

Maximizing with respect to K_2 I get:

$$\begin{aligned} \frac{\delta L}{\delta K_2} = -1 + \beta^2 F'(K_2)(1 - \eta) \int_{\underline{A}}^{A^*} A \pi(A) dA + \beta^2 (1 - \eta) F(K_2) \frac{D^*}{\eta F(K_2)} \pi \left(\frac{D^*}{\eta F(K_2)} \right) \left(-\frac{(D^*) \eta F'(K_2)}{\eta^2 F(K_2)^2} \right) + \\ - \pi \left(\frac{D^*}{\eta F(K_2)} \right) \left(-\frac{(D^*) \eta F'(K_2)}{\eta^2 F(K_2)^2} \right) + \beta^2 F'(K_2) \int_{A^*}^{\bar{A}} A \pi(A) dA + \\ + \beta^2 F(K_2) \left(-\frac{D^*}{\eta F(K_2)} \right) \pi \left(\frac{D^*}{\eta F(K_2)} \right) \left(-\frac{D^* \eta F'(K_2)}{\eta^2 F(K_2)^2} \right) + \\ + \beta^2 D^* \pi \left(\frac{D^*}{\eta F(K_2)} \right) \left(-\frac{(D^*) \eta F'(K_2)}{\eta^2 F(K_2)^2} \right) - \lambda_1 (\eta E(A)F'(K_2)) = 0 \end{aligned}$$

with $D^* = D(1 + r)(1 + r_r)$ and the constraint:

$$D(1 + r)(1 + r_r) < \eta E(A)F(K_2) \quad \wedge \quad \lambda_1 (D(1 + r)(1 + r_r) - \eta E(A)F(K_2)) = 0$$

$\lambda_1 > 0$ is not an acceptable solution because it would imply $D(1 + r)(1 + r_r) = \eta E(A)F(K_2)$ and therefore the debtor country will be indifferent between repayment and default.

After simplifying I get:

$$\beta^2 F'(K_2) \left[1 - \eta \int_{\underline{A}}^{\frac{D(1+r)(1+r_r)}{\eta F(K_2)}} A \pi(A) dA \right] = 1$$

2.9 Appendix C1

This Appendix shows how to get the result in the conditional-additional official lending case.

The utility function is:

$$\begin{aligned} U = & Y_1 - K_2 + D_1(K_2) + \beta \int_{\underline{A}}^{\frac{D^*}{\eta F(K_2)}} [AF(K_2)(1 - \eta)] \pi(A) dA + \\ & + \beta \int_{\frac{D^*}{\eta F(K_2)}}^{\bar{A}} [AF(K_2) - (D_1(K_2)(1 + r_o) + D_o(1 + r_o))] \pi(A) dA \end{aligned}$$

Since here there is a participation constraint, given by the credit ceiling $D_1(K_2)(1 + r_o) + D_o(1 + r_o) \leq \eta E[A] F(K_2)$, we have a constrained maximization problem:

$$\begin{aligned} \max \quad & U \\ \text{s. t.} \quad & D_1(K_2)(1 + r_o) + D_o(1 + r_o) \leq \eta E[A] F(K_2) \end{aligned}$$

The Lagrangian will be then:

$$\begin{aligned} L = & Y_1 - K_2 + D_1(K_2) + \beta^2 \left[\int_{\underline{A}}^{A^*} (AF(K_2)(1 - \eta)) \pi(A) dA + \int_{A^*}^{\bar{A}} (AF(K_2) - D^*) \pi(A) dA \right] + \\ & + \lambda_1 (D_1(K_2)(1 + r_o) + D_o(1 + r_o) - \eta E[A] F(K_2)) \end{aligned}$$

$$\begin{aligned} \frac{\delta U}{\delta K_2} = & -1 + \beta \alpha F'(K_2) + \beta(1 - \eta) F'(K_2) \int_{\underline{A}}^{A^*} A \pi(A) dA + \beta(1 - \eta) F'(K_2) \frac{D^*}{\eta F(K_2)} \pi \left(\frac{D^*}{\eta F(K_2)} \right) (\dots) + \\ & + \beta F'(K_2) \int_{A^*}^{\bar{A}} A \pi(A) dA - \beta F'(K_2) \frac{D^*}{\eta F(K_2)} \pi \left(\frac{D^*}{\eta F(K_2)} \right) (\dots) + \\ & - \beta \alpha F'(K_2)(1 + r_o) \int_{A^*}^{\bar{A}} \pi(A) dA + (\beta \alpha(1 + r_o) + \beta D_o(1 + r_o)) \pi \left(\frac{D^*}{\eta F(K_2)} \right) (\dots) + \\ & + \lambda_1(\dots) = 0 \end{aligned}$$

$\lambda_1 > 0$ is not an acceptable solution because it would imply $D_1(K_2)(1 + r_o) + D_o(1 + r_o) =$

$\eta E(A)F(K_2)$ and therefore the debtor country will be indifferent between repayment and default. Rearranging I get:

$$\beta F'(K_2) \left[1 - \eta \int_{\underline{A}}^{A^*} A\pi(A)dA + \alpha \left(1 - \int_{A^*}^{\bar{A}} \pi(A)dA \right) \right] = 1$$

$$\beta F'(K_2) \left[1 - \eta \int_{\underline{A}}^{A^*} A\pi(A)dA + \alpha \int_{\underline{A}}^{A^*} \pi(A)dA \right] = 1$$

2.10 Appendix C3

This Appendix shows the comparison between the three different investment functions.

1. Conditional-additional official lending vs face value reduction:

$$\left[1 - \eta \int_{\underline{A}}^{\frac{D_o(1+r_o)^2 + D_1(K_2)(1+r_o)^2}{\eta F(K_2)}} A\pi(A)dA + \alpha \int_{\underline{A}}^{\frac{D_o(1+r_o)^2 + D_1(K_2)(1+r_o)^2}{\eta F(K_2)}} \pi(A)dA \right] >$$

$$\left[1 - \theta \eta \int_{\underline{A}}^{\frac{D(1+r)^2}{\eta F(K_2)}} A\pi(A)dA - \pi \left(\frac{D(1+r)^2}{\eta F(K_2)} \right) \frac{(D(1+r)^2)^2}{\eta F(K_2)^2} (1 - \theta) \right]$$

Conditional-additional official lending vs rescheduling:

$$\left[1 - \eta \int_{\underline{A}}^{\frac{D_o(1+r_o)^2 + D_1(K_2)(1+r_o)^2}{\eta F(K_2)}} A\pi(A)dA + \alpha \int_{\underline{A}}^{\frac{D_o(1+r_o)^2 + D_1(K_2)(1+r_o)^2}{\eta F(K_2)}} \pi(A)dA \right] >$$

$$\left[1 - \eta \int_{\underline{A}}^{\frac{D(1+r)(1+r_r)}{\eta F(K_2)}} A\pi(A)dA \right]$$

Face value reduction vs rescheduling:

$$\left[1 - \theta \eta \int_{\underline{A}}^{\frac{D(1+r)^2}{\eta F(K_2)}} A\pi(A)dA - \pi \left(\frac{D(1+r)^2}{\eta F(K_2)} \right) \frac{(D(1+r)^2)^2}{\eta F(K_2)^2} (1 - \theta) \right]$$

$$\geq \left[1 - \eta \int_{\underline{A}}^{\frac{D(1+r)(1+r_r)}{\eta F(K_2)}} A\pi(A)dA \right]$$

In the last expression, on the left-hand side of the equation we have the result in case of face value reduction, on the right-hand side that one for rescheduling. The largest one will imply the largest incentive to invest.

We can assume an equivalence for a given $\underline{\theta}$ and after simplifying we get:

$$-\underline{\theta} \int_{\underline{A}}^{A2} A\pi(A)dA - \pi(A2)A2^2(1 - \underline{\theta}) = - \int_{\underline{A}}^{A1} A\pi(A)dA$$

with $A2 = \frac{D(1+r)^2}{\eta F(K_2)}$ and $A1 = \frac{D(1+r)(1+r_r)}{\eta F(K_2)}$ and $A2 > A1$. Rearranging:

$$\underline{\theta} \left[- \int_{\underline{A}}^{A2} A\pi(A)dA + \pi(A2)A2^2 \right] = \left[- \int_{\underline{A}}^{A1} A\pi(A)dA + \pi(A2)A2^2 \right]$$

Since: $\int_{\underline{A}}^{A^*} A\pi(A)dA > \pi(A^*)A^{*2}$ as I proved in Appendix A1, then $\int_{\underline{A}}^{A2} A\pi(A)dA > \pi(A2)A2^2$ and the expressions in the parenthesis are negative (because θ must be a positive value). Moreover, we know that $\int_{\underline{A}}^{A2} A\pi(A)dA > \int_{\underline{A}}^{A1} A\pi(A)dA$.

Thus, if $\theta < \underline{\theta}$:

$$\theta \left[- \int_{\underline{A}}^{A2} A\pi(A)dA + \pi(A2)A2^2 \right] > \left[- \int_{\underline{A}}^{A1} A\pi(A)dA + \pi(A2)A2^2 \right]$$

and face value reduction is better than lengthening of maturities in terms of incentive to invest. The opposite is true for $\theta > \underline{\theta}$.

2.

$$\left[1 - \eta \int_{\underline{A}}^{\frac{D_o(1+r_o)^2 + D_1(K_2)(1+r_o)^2}{\eta F(K_2)}} A\pi(A)dA + \alpha \int_{\underline{A}}^{\frac{D_o(1+r_o)^2 + D_1(K_2)(1+r_o)^2}{\eta F(K_2)}} \pi(A)dA \right] \geq \left[1 - \eta \int_{\underline{A}}^{\frac{D(1+r)(1+r_r)}{\eta F(K_2)}} A\pi(A)dA \right]$$

I compare the default threshold in case of conditional-official lending and rescheduling:

$$\frac{D_o(1+r_o)^2 + D_1(K_2)(1+r_o)^2}{\eta F(K_2)} \geq \frac{D(1+r)(1+r_r)}{\eta F(K_2)}$$

rearranging:

$$D_o(1+r_o)^2 + D_1(K_2)(1+r_o)^2 \geq D(1+r)(1+r_r)$$

I assume there is an equivalence for a given \bar{r}_o .

If $r_o = \bar{r}_o$ then the probability of default is the same in both cases.

If $r_o < \bar{r}_o$ then the probability of default is bigger in case of rescheduling.

If $r_o > \bar{r}_o$ then the probability of default is bigger in case of conditional-additional official lending.

- Let's consider $r_o = \bar{r}_o$.

The probabilities of default are the same and I get:

$$1 + \alpha \int_A \frac{(D_o(1+r_o)+D_1(K_2))(1+r_o)}{\eta^{F(K_2)}} \pi(A)dA > 1$$

that is always verified and thus conditional-additional official lending is the best solution.

- Let's consider $r_o < \bar{r}_o$.

The probability of default is bigger in case of rescheduling and then conditional-additional official lending is again the best solution.

- Let's consider $r_o > \bar{r}_o$.

The probability of default is bigger in case of conditional-additional official lending and then the result might be uncertain as explained in the text.

2.11 Appendix D

In this Appendix, a preliminary empirical evidence for equation (2.2) is provided. Table 2.2 shows respectively the POLS regression of the GDP growth rate (data taken from the World Bank WDI database), in column 2, and of the amount of defaulted debt (data are taken from Cruces and Trebesch (2013)), in column 3, on the amount of nominal reduction provided in the restructuring episode (data taken from Cruces and Trebesch (2013)). In both cases, I control for year dummies and I use robust standard errors. As we can see from the table (and as expected), the larger is the GDP growth the lower is the nominal reduction and the larger is the defaulted debt at $t - 1$ the larger is the nominal reduction.

TABLE 2.2: Nominal reduction determinants

Dep. variable: Nominal reduction	POLS	POLS
$GDPgrowth_t$	-0.28* (0.14)	
$Defaulted\ debt(t-1)$		1.45e-12* (6.56e-13)
$Constant$	0.50** (0.23)	0.29*** (0.00)
Number of observations	35	14
Time fixed effects	Yes	Yes
R^2	0.72	0.84

t statistics in parentheses (* p<0.10, ** p<0.05, *** p<0.01) computed using robust standard errors.

Chapter 3

Determinants of Public Investment in the EU: Is there a Debt Overhang Effect?

3.1 Introduction

The European Union (EU) has experienced a considerable increase in public debt as a result of the Sovereign Debt Crisis. A significant amount of literature has been devoted, especially in the last decade, to studying the impact of this rise in debt on economic growth (Reinhart and Rogoff, 2010; Baum et al., 2013). In general, higher levels of debt can result in lower growth in three ways. Firstly, given the finite pool of financial resources, the more the government taps into the pool of loanable funds, the less capital there is available for private enterprises, which pushes up their borrowing cost, essentially crowding out private investment (Spencer and Yohe, 1970). Secondly, if financial markets start questioning the sustainability of a country, they will demand higher interest rates in order to compensate for the increased default risk. Higher interest rates for the sovereign, in turn, get transmitted to the private sector as government bonds are perceived as the safest investment, in effect acting as a lower bound for interest rates (Das et al., 2010). Finally, Ricardian equivalence suggests that companies and households might anticipate a tax increase when the fiscal sustainability of a country is in doubt, resulting in reduced investment and consumption (Barro, 1996).

In addition, recent research has shown that at least part of the lacklustre recovery after the recent Global Financial Crisis (GFC) can be attributed to the elevated levels of public debt (Reinhart et al., 2012; Chatterjee, 2013). When a country with a high level of sovereign debt faces a crisis, its ability to respond to that crisis, for example by adopting countercyclical fiscal policy, is severely impeded (Jordá et al., 2014).

Little research, however, has been devoted to the causal impact of high debt levels on the flow of public investment. This is rather surprising, as policy makers have clearly recognized the fact that the volume of public investment has declined over the past decade and that considerable

efforts need to be undertaken to bridge this investment gap (Juncker, 2015). Moreover, there is little consensus, both in academic and policy circles, on the factors driving this drop in investment. On the one hand, the decrease in public investment might be primarily caused by the GFC as countries choose the path of least resistance when implementing fiscal austerity, and simply cut public investment rather than reducing public expenditure. On the other hand, the decline might be caused by more secular factors and driven by economic fundamentals: an advanced and aging economy might have less need for investment in public infrastructure.

The literature which does focus on the impact of sovereign debt on investment has mainly been applied to developing countries, and more specifically on highly indebted and poor countries (HIPCs). The Latin-American debt crisis of the 1980s brought about a considerable amount of contributions on the effect of high public debt on investment in less developed countries (LDCs) (Krugman, 1988a; Sachs, 1989).

This paper then, focusing on 26 EU countries over the period 1995-2015, studies whether Europe suffers from a debt overhang. More specifically, we analyze whether the increase in public debt in Europe resulted in a decrease in public investment, offering a richer specification than the existing literature. In addition, we study whether this effect is more pronounced (i) in high debt than in low debt countries, (ii) pre crisis vs post crisis, (iii) in EZ than in non-EZ countries, and (iv) whether there is a threshold effect. Finally, we analyse whether it is only the stock of debt that matters, or also the flow of public debt. To tackle this research question and the accompanying endogeneity concerns, we employ diverse econometrical approaches: we start our analysis with a basic POLS model, next we include FE and finally we regress an IV and a GMM model. We contribute to the existing literature also by incorporating a broader set of explanatory variables to explain public investment. Moreover, we address the issue of reverse causality by using a Generalized Method of Moment model, based on the linear GMM estimator of Arellano and Bond (1991).

The Chapter proceeds as follows: paragraph 2 provides some background on the sovereign debt crisis; paragraph 3 makes a literature review; paragraph 4 describes the empirical analysis and its extensions and we conclude in paragraph 5.

3.2 Background on sovereign debt crisis

Starting from the end of 2009, the European Union has suffered from a sovereign debt crisis. The causes of this crisis are rather varied and extend beyond the scope of this paper (Albanesi et al., 2017; Bayoumi, 2017; Martin and Philippon, 2017). To deal with this crisis, some governments implemented fiscal consolidation policies, raising taxes and lowering spending. However, these mainly had the effect of lowering growth further, especially in the short run, which pushed up debt levels even higher; since 2007, the average public debt-to-GDP level has increased by 66.66% in the European Union and by 70.23% in the Eurozone. However, some

countries experienced an even steeper growth in public debt; in the so-called PIIGS countries (Portugal, Italy, Ireland, Greece and Spain) the debt-to-GDP ratio has increased by 86.52% since 2007.

At the same time public debt levels in Europe surged, public investment plummeted. This decline in public investments is quite puzzling given the highly accommodative monetary policy implemented by the European Central Bank (ECB) over the past years. Public investment, measured by Gross Fixed Capital Formation (GFCF), decreased by 6.32% in the EU since 2007. In the Eurozone, the decrease was more pronounced; public investment, as a percentage of GDP, declined by 11.08% since 2007. The PIIGS suffered an even sharper decline; GFCF-to-GDP decreased by 37.87% since 2007.

Figure 3.1 shows public investment (as a percentage of GDP) declined substantially between 2009 and 2015 for 21 out of 28 European countries.

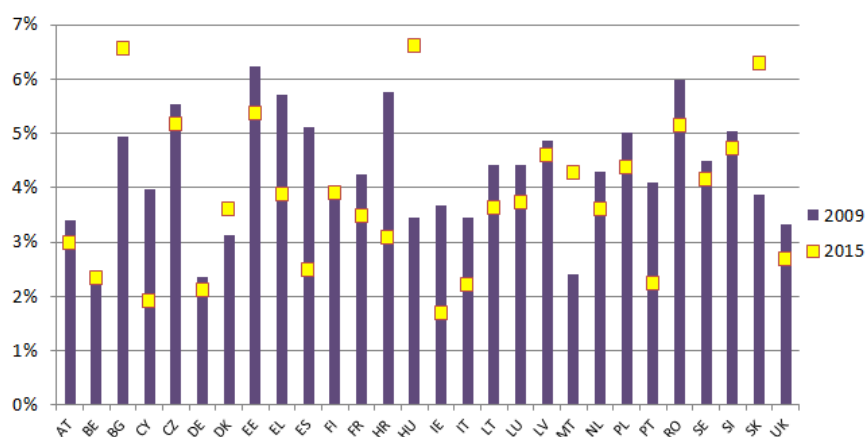


FIGURE 3.1: public investment-to-GDP ratio. Source: Eurostat

It is interesting also to decompose public gross fixed capital formation expenditure by its socio-economic function in order to see how its main components have changed since 2009 (Figure 3.2). Five out of the ten groups used in this classification show a clear decline, while the other five categories remain relatively unaltered. In particular, the current level in health investments is quite low, which is especially worrisome, given that this is found to be a very significant determinant of long-term growth (OECD, 2016b).

There are numerous reasons why a sufficient level of public investment is warranted. Firstly, as mentioned before, public investments can positively impact long-term growth and labour productivity (OECD, 2016b; Abiad et al., 2016; Ganelli and Tervala, 2016). Secondly, public investment in areas such as education can produce significant spillover effects for the private sector, as firms benefit from a highly educated workforce. Thirdly, government investment in

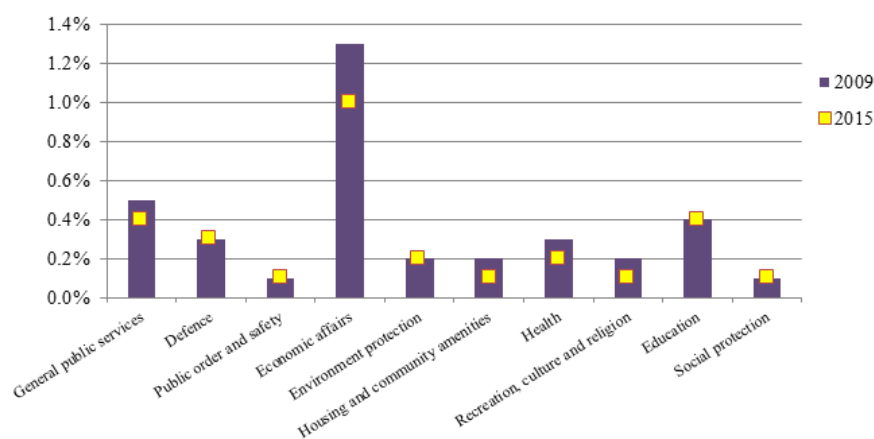


FIGURE 3.2: European Union (EU28) public investment-to-GDP ratio divided by function. Source: Eurostat (COFOG database)

transport, for example, can lead to a crowding in effect of private investment, as companies can more easily get their products to consumers. Fourthly, an adequate level of public investment in defence and security helps in dealing with terrorist threats. Fifthly, investment in basic infrastructure, such as water supply, are preconditions for a normal life. Finally, public investment can also be considered as a potentially useful counter-cyclical fiscal tool, something which is not considered extensively in the literature. Most studies show that public investment is pro-cyclical, mainly due to political motivations (Bove et al., 2017). Political considerations might even result in too large cuts in public investment when consolidation measures need to be introduced during or after an economic downturn, increasing then the degree of pro-cyclicality of this variable. This suggests a certain degree of state-dependency for this variable, which is important to contemplate, especially when hysteresis is a concern (OECD, 2016a; Fatas and Summers, 2018)¹.

The aforementioned benefits of public investment are also reflected in 'Europe 2020' (European Commission, 2010), the 10-year strategy proposed by the European Commission for advancement of the economy of the EU as it promotes "public funding for RD", "efficient investment in education and training systems at all levels" and 'key infrastructure investments in cross-border energy and transport networks, and low-carbon technology'. It also says that "budgetary consolidation programmes should prioritise growth-enhancing items such as education and skills, RD and innovation and investment in networks, e.g. high-speed internet, energy and transport interconnections".

¹In presence of hysteresis, the effect of a public investment stimulus might indeed be stronger (OECD, 2016c).

3.3 Literature Review

This section discusses those papers which are relevant to testing the debt overhang hypothesis in Europe. We selected studies using the search terms 'debt overhang (in Europe)', 'debt and investment', and 'determinants of public investments' in the search engines Web of Science, Google Scholar and EconLit. At first, we selected studies based on title and abstract. In a second phase, we verified the content and excluded studies which focused on private (i.e. corporate) debt.

The debt overhang hypothesis was initially introduced by Myers (1977) when analyzing the determinants of corporate borrowing and more specifically in the context of the impact of having excessive debt on investment decisions at the firm level. Then, due to the Latin-American debt crises of the 1980s, several studies extended the analysis on debt overhang from a corporate context to a country based approach. The aim of these studies was to explain the effect of higher sovereign debt on investment in less developed countries (Krugman, 1988a; Krugman, 1989a; Obstfeld and Rogoff, 1996).

Table 3.1 below shows a brief overview of papers which are relevant to our research. We have focused solely on empirical literature, as this is most relevant to our paper. To the authors' knowledge, this overview is exhaustive. The different papers will be discussed in more detail in the following subsections.

Overview of relevant literature				
Author	Countries	Dependent Variable	Econometric method	Debt variable
Antonakis (2014)	12 EZ countries	GDP growth	2SLS, GMM	Public debt
Balassone et al. (2011)	Italy	Growth	OLS, 2SLS	External debt
Borensztein (1990)	Philippines	Private investment	OLS	Private debt
Clements et al (2003)	55 HIPCs	Growth, public investment	FE, GMM	External debt, external debt service
Checherita and Rother (2012)	12 EZ countries	GDP growth, public investment	FE, 2SLS, GMM	Public debt
Cohen (1993)	81 LDCs	Domestic investment	POLS	Debt service, debt-to-export ratio
Cordella et al. (2010)	79 HIPCs	Real GDP growth	OLS, FE, SGMM	External debt, public debt, debt service, private debt
Deshpande (1997)	13 SICs	Domestic investment	FE, LSDV, OLS	External debt
Eberhardt and Presbitero (2015)	118 DCs, EMs and AEs	GDP	Error correction model	Total debt (external plus domestic)
Heinemann (2006)	16 OECD countries	Public investment	FE, OLS	Public debt
Reinhart et al. (2012)	26 AEs	Growth	Descriptive analysis	Public debt
Reinhart and Trebesch (2015)	12 AEs and 41 EMs	Growth	FE, DID	Public debt, external debt, debt service
Turrini (2004)	14 EU countries	Public investment	FE, IV	Public debt
Valila and Mehrotra (2005)	14 EU countries	Public investment	FE, OLS	Public debt
Vanlaer et al. (2015)	26 DCs	GDP growth	Descriptive analysis	Public debt, private debt, total debt

TABLE 3.1: Note: EZ stands for Eurozone, HIPCs for highly indebted and poor countries, LDCs for least developed countries, SICs for severely indebted countries, AEs for advanced economies and EMs for emerging markets.

3.3.1 Debt overhang, only in developing countries?

The debt overhang hypothesis has been tested mainly for highly indebted and poor countries. In general, two ways to test the debt overhang hypothesis have been used. In the first one, an investment function is estimated, in which a specific term is added to account for debt overhang. In a second one, different econometric techniques are used to study the causal relationship

between high debt and low investment.

A seminal paper in the first category is Borensztein (1990a) in which the topic is studied first from a theoretical point of view, followed by an empirical approach (Borensztein, 1990b). The author estimated a neoclassical investment function, introducing various types of debt (e.g. sovereign debt, private debt, excess debt) as explanatory variables to test the debt overhang hypothesis in the Philippines in the 1980s. He finds that the stock of foreign debt acted as a disincentive to private investment, and especially so after 1982.

One of the most important contributions in the second category is provided by Deshpande (1997). The author uses a panel approach to find a significant negative impact of debt on investment for 13 severally indebted countries (SICs) during 1971-1991. She also introduced a time variable in order to capture the different investment climates over the period studied. She found that the time variable had a positive impact on investment until 1984, after which it largely became negative. In another paper (Deshpande, 1993), the author shifted the focus to several HIPC countries over the period 1970-1990 and again found significant evidence for a negative link between debt and investment.

There are also several contributions to the literature that do not find evidence for the debt overhang hypothesis. Cohen (1991, 1993) finds no evidence of debt overhang for the LDCs in the 1980s. His results suggest that it is not the level of debt, but rather the debt servicing costs which act as a drag on growth: 1% of GDP paid abroad reduces domestic investment by 0.3% of GDP. Hence, according to this paper, high debt cannot be seen as a predictor of low investment. Similarly, Karagol (2005) argues that it is misleading to make generalizations on the relationship between (external) debt and growth as each country has an idiosyncratic combination of social, economic and political elements.

Testing the link between debt and investment is also important from a policy making perspective. Indeed, if a high stock of debt results in decreased investment, debt relief might be an effective way to aid heavily indebted countries. Several papers investigate the empirical validity of the debt overhang hypothesis for HIPC countries. Arslanalp and Henry (2005) and Arslanalp and Henry (2006a) show the effectiveness of debt relief where debt overhang, and not weakness of institutions or poor infrastructure, is the main impediment to growth. Similarly, Cordella et al. (2010) find that the effectiveness of debt relief depends on a country's characteristics, such as the quality of its policies and institutions.

3.3.2 What is the link between debt and growth?

Another strand of literature takes a broader view and looks at the link, not between debt and investment, but between debt and growth (see Panizza and Presbitero (2013) for a review). This is relevant for our research in two ways. Firstly, the literature on the link between debt and

growth helps identifying control variables for our model. Secondly, one channel through which high debt can result in low growth is through reduced public investment, which is exactly the focus of this paper. Some papers identified a non-linear relationship between (external) debt and growth, the so-called Debt Laffer curve (Pattillo et al., 2011; Clements et al., 2003; Reinhart et al., 2012).

Clements et al. (2003), focusing on 55 low income countries (classified as eligible for the IMF's Poverty Reduction and Growth Facility) in 1970-1999, showed that high external debt can negatively affect growth through both a direct and an indirect effect. A direct effect is in place if a certain threshold is reached (50% for the ratio of external debt-to-GDP and 20-25% for the present value of this ratio) after which growth significantly slows down. An indirect effect works through the investment channel; the authors find that a 1% reduction in the external debt service results in a 0.2% increase in investment, which in turn leads to higher growth through an increase of the capital stock and the immediate impact on aggregate demand. Hence, the authors conclude that a debt reduction initiative for HIPCs might be useful as it results in an increase in the growth rate.

Reinhart et al. (2012) studied 26 cases of public debt accumulation in advanced countries since 1800. They find that the relationship between real GDP growth and the public debt-to-GDP ratio is rather weak for sovereign debt below 90% of GDP. For debt levels above 90% however, economic growth reduces by around 1.2%. This 90% threshold for the negative effect of debt over growth is also observed in Checherita-Westphal and Rother (2012). Conversely, Eberhardt and Presbitero (2015) found evidence for the negative relation between debt and growth but not for the presence of a common debt threshold. Their research indicates that the link between total debt (domestic plus external debt) and long-run growth differs significantly across countries. Hence, this suggest there is substantial heterogeneity in the long-run relationship between these two variables. Balassone et al. (2011) also studied the negative link between debt and growth focusing on Italy for the period 1861-2009. They found that external debt had a large negative effect on GDP growth, in particular before WWI. Critics argue that, while there may very well be a negative relationship between public debt and economic growth, the effect might work in the opposite direction: low growth causes the state revenues to fall and public expenditures to rise, thus resulting in a higher level of public debt (Vanlaer et al., 2015).

3.3.3 What determines public investment?

Due to the Sovereign Debt Crisis in Europe, several EU countries, notably Portugal, Italy, Ireland, Greece and Spain are facing debt problems similar to those ones that the HIPCs have faced. In order to test whether high sovereign debt results in low public investment, we must first develop a framework that incorporates the different determinants of public investment in general. Only

a relatively small amount of studies investigate which factors have an impact on the evolution of public investment, especially for AEs. In addition, most studies focus on one country (Aubin et al. (1988) on France, Herenkson (1988) and Kirchgassner and Pommerehne (1988) on Germany and Switzerland, Sorensen (1988) on Norway), with only a limited number of papers looking at a panel of different countries (De Haan et al. (1996) for 22 OECD countries). The explanatory variables that are used in the literature can be categorized into two groups. The first category includes macroeconomic variables, such as the rate of unemployment or the growth rate of real GDP (Turrini, 2004), whereas the second category includes politico-institutional variables, such as the degree of fiscal federalism and the size of the public sector.

The number of papers which specifically examine the determinants of public investment in Europe is even more limited. Valila and Mehrotra (2005), using a panel co-integration model, study the evolution of public investment and public capital stock over the period 1972-2003 for 14 EU countries. They find that public investment has been mainly determined by national income, the fiscal stance and considerations on fiscal sustainability whereas the Maastricht criteria required to join the EMU do not seem to play a significant role.

Going one step further, there are hardly any papers that look at whether public debt has an impact on public investment in Europe. Heinemann (2006) tries to explain the declining level of public investment in 16 OECD countries, most of which are European. The results indicate that increases in public debt since the 1970s severely restricted the ability to finance new investments. Similarly, Bacchiocchi et al. (2011) show how high debt levels result in a decrease in public investments in all OECD countries, without specific differences between EZ/EU countries and non-EZ/EU countries. With a focus on just 12 EZ countries instead, Checherita-Westphal and Rother (2012) claim that public investment is one of the main channels through which debt can negatively affect economic growth.

In summary, the existing literature on debt overhang, suffers from three major limitations. Firstly, most research focuses on developing economies (Borensztein, 1990b; Deshpande, 1993) and those papers which do devote attention to developed economies, only look at a limited number of countries or at least not at the entire European Union (Heinemann, 2006; Checherita-Westphal and Rother, 2012). Secondly, the problem of endogeneity is not always tackled properly (Valila and Mehrotra, 2005); a rudimentary (P)OLS or FE model is not sufficient to capture the potential endogeneity between public investment (i.e. the dependent variable) and several explanatory variables, such as public debt and the government deficit. Thirdly, the literature on the determinants of public investment, especially in advanced economies, is rather limited and generally focuses on just one country Herenkson (1988) and Kirchgassner and Pommerehne (1988). Hence, we add to the existing literature by taking into account a richer set of explanatory variables to determine public investment, focusing on 26 EU countries and address the issue of endogeneity by using a GMM model exploiting the instrumental variable approach based on the linear GMM (Generalized Method of Moments) estimator of Arellano and Bond (1991).

3.4 Analysis

3.4.1 Data description

As discussed above, the central aim of this paper is to test the debt overhang hypothesis in developed countries, rather than developing ones, which most literature focuses on. More specifically we study whether, for 26 EU countries² over the period 1995-2015, higher levels of public debt produces a crowding out effect for public investment. In order to do so, we start from an empirical model containing the determinants of public investment. Hence, in this section, we discuss all the different variables which are included in our model. These variables were identified through the literature review discussed in Section 3.1, 3.2 and 3.3.

Given that our variable of interest is public investment, we focus on general government³ gross fixed capital formation (i.e. GFCF)⁴. More specifically, we consider this variable as a percentage of GDP in order to overcome differences deriving from countries' welfare level.

For what concerns the determinants of public investment, we can categorize our control variables on three groups: 1) variables related to the government's balance sheet; 2) variables explaining the country's relationship with the rest of the world; and 3) variables related to some country's internal characteristics.

In the first group we consider interest rate, debt, and public expenditure. For interest rates, we focus on the long term interest rate⁵ and more specifically the 10-year government bond yield⁶. This variable is included in our model to establish the effect deriving from a long term measure of funding. Indeed, higher borrowing costs put pressure on government's finances as interest expenses increase, in turn potentially affecting the government's decision on how much to spend on public investment (i.e. a country's fiscal space). Then, for debt⁷ we look at the

²Estonia and Ireland are dropped because of data limitations.

³According to Eurostat, the general government sector includes the central government, state governments, local governments, and social security funds.

⁴Data comes from Eurostat, which defines GFCF as resident producers' investments, less disposals, of fixed assets plus the additions to the value of non-produced assets deriving from the productive activity of government producer or institutional units. Fixed assets are considered as the produced assets used continuously in the production processes for more than one year. They do not include inventory investments (that might introduce a large degree of volatility), the ownership of companies, public-private partnerships projects (PPPs) and investment by state-owned enterprise.

⁵Data come from Eurostat.

⁶This is an important rate because it is the basis of the Maastricht criterion for the long term interest rates that must be respected by the EMU candidate countries.

⁷In the empirical literature on debt overhang, External Debt is generally used as the main explanatory variable. This is due to the fact that this hypothesis has mainly been tested for emerging market or less developed countries where basically external debt is the most important debt component. In this paper instead, we focus on a group of advanced countries. Hence, the most important debt component to consider is represented by General Government Consolidated Gross Debt.

general government consolidated gross debt⁸ in percentage of GDP. As explained before, this variable is taken into account since the general hypothesis of this paper is to test whether there is a public debt overhang.

For public expenditure, we focus on the general government total expenditure⁹ expressed as a percentage of GDP.¹⁰ This variable is taken into account in order to see whether the total amount of public expenditure can influence its composition. In particular, when there is a necessity to adjust government expenditure, public investments might be postponed and then reduced. It is indeed 'politically easier' to cut government investments than to reduce other expenditure components, such as the wages of civil servants. Large expenditure now might in fact lead to restrictive future fiscal policies and there is strong evidence (Oxley and Martin, 1991; Roubini and J., 1989; De Haan et al., 1996; Keman, 2010) that during periods of fiscal consolidation capital expenditure is often reduced, sometimes also in a drastic way.

From an international point of view, the exchanges between countries might also play an important role in explaining the flow of public investment. Therefore, in the second group of variables, we consider trade¹¹ taken in percentage of the GDP¹². In particular, we consider the trade-to-GDP ratio as a proxy for the openness of a specific country. The rationale behind this being that countries that are 'more open' are subject to more foreign competition and consequently need larger public investments in order to compete in the international markets (i.e. offering appropriate infrastructures) (Sturm, 2001).

In the third group of variables, we consider private investment, gross national disposable income (GNDI) per capita, production expectations and a proxy for the business cycle. For private investment we consider gross fixed capital formation of the private sector¹³ at current prices in euro and we divide it by the level of GDP¹⁴. This variable is taken into account in order to see if there is a potential displacement effect for public gross fixed capital formation; larger investments from the private sector might produce a crowding-in (i.e. an increase) or crowding-out (i.e. a decrease) effect for public investments. In other words, this allows for testing whether private and public investments are substitutes or complements.

The variable GNDI per capita¹⁵ is taken into account in order to measure the 'maturity' of the economy¹⁶. In a country with low GNDI per capita (such as a less advanced economy), one

⁸It is defined in the Maastricht Treaty as the outstanding consolidated general government gross debt at nominal value at the end of the year. According to ESA2010, it is made up of the following categories of government liabilities: currency and deposits, debt securities and loans.

⁹According to the IMF, it is defined as total expense plus the net acquisition of non-financial assets.

¹⁰Data come from the IMF's WEO database.

¹¹It is defined as the sum between exports and imports of goods and services.

¹²Data come from the IMF.

¹³It includes financial and non-financial corporations, households and non-profit institutions serving households.

¹⁴Both data are taken from AMECO.

¹⁵It is defined as "Gross national income (at market prices) minus current transfers (current taxes on income, wealth etc., social contributions, social benefits and other current transfers) payable to non-resident units, plus current transfers receivable by resident units from the rest of the world".

¹⁶Data come from AMECO.

might expect that the investment needs are larger than those one in a more mature economy. However, a priori it is difficult to establish the causal relation between this variable and public investments since it might also be that a less developed economy has a lower demand for infrastructures from its population and therefore investments will be lower.

Then, we compute the following variable in order to proxy the business cycle (Hallerberg and Strauch, 2002):

$$\Delta \log y_{it} - \Delta \log \bar{y}_{it}$$

where Δ is the first difference operator, y_{it} is the real output and \bar{y}_{it} is the trend output¹⁷. Basically, this measure represents the deviation of the actual from the trend GDP growth rate. This variable might also give some information about the policies implemented by a specific government. For example, in case of adoption of counter-cyclical policies we should observe a negative relation between public investments and this cyclical measure.

In order to deepen the discussion about pro-cyclicality, we also take into account a proxy for future expectations. More specifically, we want to consider whether a positive outlook for the future can influence the investment decisions of the government today. If governments increase their public investment efforts when they have a positive view on the future, this would suggest indeed that public investment decisions are generally pro-cyclical. More specifically, we consider production expectations that are computed by the European Commission as the summation between production and selling price expectations for the 3 months ahead¹⁸. These expectations are evaluated through qualitative surveys and the final values are computed as simple average of the answers to specific questions¹⁹.

3.4.2 Descriptive analysis

The two most important variables that must be considered in order to test the debt overhang hypothesis are: public gross fixed capital formation and general government consolidated gross debt. Table 3.2 in Appendix A contains some descriptive statistics of these variables for each EU country included in our analysis.

At first glance (Figure 3.3) it appears that higher debt levels (scale represented on the right hand axis) are associated with lower public investments (scale on the left hand axis) in the EU.

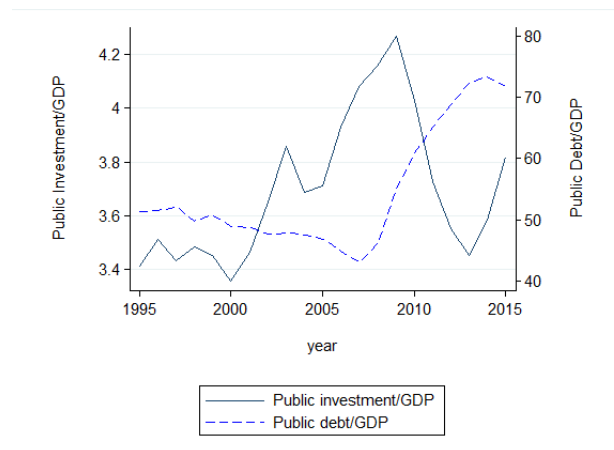
In particular, while the average EU public debt has increased by 66.67% since 2007 and by 30.43% since the Eurozone Sovereign Debt crisis in 2009, the average EU public investment has showed an opposite path. It has indeed decreased by 6.3% since 2007 and by 10.4% since 2009. Another important stylized fact that can be derived from Figure 3.3 and from Figure 3.7 in Appendix C is that the average public investment has been quite volatile especially until 2009.

¹⁷Data come from AMECO and they are computed taking 2010 reference levels.

¹⁸Data are taken from the European Commission.

¹⁹For more information see European Commission (2017).

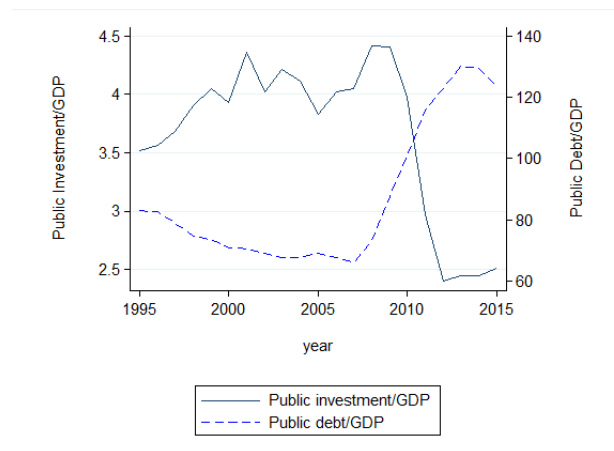
FIGURE 3.3: Average path of public debt-to-GDP ratio and public investment-to-GDP ratio for the EU countries



Source: Eurostat

Figure 3.4 depicts the situation for the highly indebted EU countries, the so called PIIGS: Portugal, Ireland, Italy, Greece and Spain. From this picture, the opposite paths for public debt and public investments are even more evident starting from 2008.

FIGURE 3.4: Average path of public debt-to-GDP ratio and public investment-to-GDP ratio for the PIIGS countries



Source: Eurostat

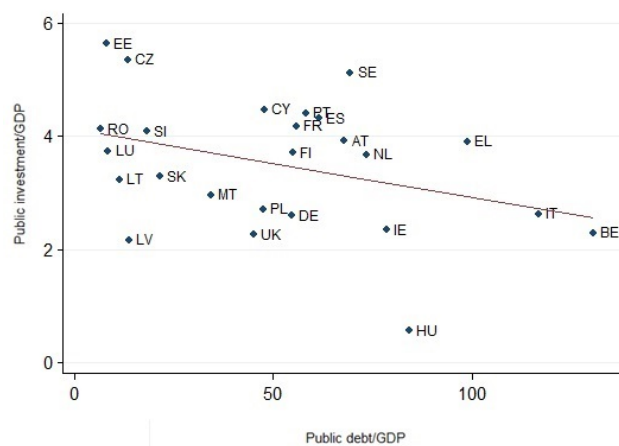
For these countries the increase in the average debt level and the decrease in the average public investment have been quite extraordinary: +86.52% since 2007 and +41.09% since 2009 for public debt and -37.87% since 2007 and -42.97% since 2009 for public investment.

In Appendix B - Table 3.3, we compute the correlation between public debt and public investments. In column 1 we report the unconditional correlation between the two variables for each EU countries for the period 1995-2015. Then, we report in the other columns the same correlation conditional to the debt level being equal or larger than a certain percentile (i.e. 75%, 90% and 95%) in order to see if the correlation becomes stronger with increasing level of debt.

According to the results, we can claim that the simple correlation between public debts and public investments does not provide much explanatory power. The sign is indeed sometimes negative and sometimes positive and therefore it is not possible to identify a clear pattern from the correlations. Therefore, we cannot find support for a potential non-linearity hypothesis in the relation between public investments and public debt as found in other papers for other countries (Clements et al., 2003; Eberhardt and Presbitero, 2015).

The negative link between public debt and public investments can also be demonstrated when plotting the average public debt and the average public investment (i.e. the country average) for each country for the period 1995-2015 (Figure 3.5).

FIGURE 3.5: Relationship between the average debt-to-GDP ratio and the average investment-to-GDP ratios for each EU country (1995-2015)



Authors' computation based on data from Eurostat

3.4.3 Model specification: static model

In order to test the debt overhang hypothesis, we start by using a Pooled Ordinary Least Squares (POLS) estimator²⁰.

The equation that we want to estimate, starting with POLS, builds on Checherita-Westphal and Rother (2012) and can be represented as follows:

$$\begin{aligned}
 \text{public investment}/GDP_{it} = & \alpha + \beta \text{public debt}/GDP_{it-1} + \sum_{c=1}^4 \gamma_c \text{Controls}_{it-1}^c + \\
 & + \sum_{c=1}^2 \gamma_c \text{Controls}_{it}^c + \text{peexpectations}_{it+1} + \epsilon_{it}
 \end{aligned} \tag{3.1}$$

²⁰More specifically, we will use clustered standard errors asymptotically robust to both heteroscedasticity and autocorrelation.

For $i=1, \dots, 26$ EU countries²¹ and $t=1995, \dots, 2015$. $public\ investment/GDP_{it}$ is the public gross fixed capital formation-to-GDP ratio, α is the intercept, $public\ debt/GDP_{it-1}$ is the public debt-to-GDP ratio and $Controls_{it}^c$ is a set of control variables that includes the following variables: $GNDI\ per\ capita_{it}$ is the logarithm of Gross National Disposable Income per capita, $cycle_{it}$ that represents the business cycle measure, $private\ investment_{it-1}$ is private gross fixed capital formation-to-GDP ratio, $public\ expenditure_{it-1}$ is the public expenditure-to-GDP ratio, $gov.\ bond\ yield(10Y)_{it-1}$ is the yield on the 10-year government bond, $trade_{it-1}$ is the amount of trade in percentage of GDP, $expectations_{it+1}$ that represents production expectations and ϵ_{it} represents the observation-specific errors (i.e. the disturbance terms). Then we augment this equation adding a year dummy that controls for year fixed effects and captures factors that varies over time but affects all countries (e.g. the effects of the Global Financial Crisis).

A first important issue that must be acknowledged is the reverse causality that can appear in this equation. Indeed, variables like public debt, private investments and government public expenditure are determined simultaneously with our dependent variable and therefore the causality can work also in the opposite direction. For example, public investment might be a determinant of a larger public debt or of a larger public expenditure and this could bias the coefficients of the regression²². In order to mitigate this reverse causality problem, following Checherita-Westphal and Rother (2012) we take the (1 year) lagged value of all the potentially endogenous variables listed above²³. In this regard, Valila and Mehrotra (2005) explain that the fiscal authority usually decides the amount of public investment according to the information on some variables coming from the previous period. As explained before, there is indeed a lag between the time when investment is decided and when it is actually implemented. For Gross National Disposable Income and the proxy for the business cycle instead we focus on the contemporaneous relation with public investment whereas for production expectations we take the forward value. It is indeed reasonable to assume that the decision to invest might be influenced by expectation about the future.

Results are presented in Table 3.4 column 1 of Appendix C. In the second column instead, we report the results using respectively POLS with year dummies.

Next, we account for the existence of unobserved social and economic characteristics that are specific to each country in the sample but that stay broadly constant over time. In other words, it is possible to assume that each country has its own characteristics and peculiarities that are correlated with the observed independent variables. For this reason then, the pooled OLS regression gives biased estimation and therefore a model that accounts for these 'fixed effects'

²¹Estonia is dropped because of missing data for the 10-year government bond yields (due to a very low government debt there are indeed no long-term governments bonds data available on the financial market for this country,) and Ireland is dropped because of missing data for production expectations.

²²Public investment is usually financed through government debt issuances. Therefore, public investment (which is a flow variable) will not affect directly public debt (which is a stock variable) but rather its change. Hence, there is reverse causality in the sense that public investment is funded through debt issuance and then this translates in a larger stock of debt.

²³Studying the error terms coming out from this regression also shows there is no problem with autocorrelation.

should be preferred:

$$\begin{aligned} public\ investment/GDP_{it} = & \alpha + \beta public\ debt/GDP_{it-1} + \sum_{c=1}^4 \gamma_c Controls_{it-1}^c + \\ & + \sum_{c=1}^2 \gamma_c Controls_{it}^c + \rho expectations_{it+1} + v_i + \epsilon_{it} \end{aligned} \quad (3.2)$$

with v_i that represents the unobserved time invariant country-specific effects. Then, also in this case, we augment this equation considering the year dummies.

Results are presented in Table 3.4 column 3 of Appendix C. The specification with year dummies is presented in column 4. In both cases we can use a FE model taking into account heteroscedasticity. More specifically, we will use clustered standard errors also in this case.

3.4.4 Static model - Estimation Results

According to the results deriving from the regressions explained above (see Table 3.4 of Appendix C), we can claim that there is indeed evidence to support the debt overhang hypothesis in the EU. The coefficient of the debt-to-GDP ratio is in fact always negative and significant across several model specifications. This means that an increase in public debt on average produces a negative effect on public investments. In particular, the coefficient of the debt-to-GDP ratio variable ranges between -0.0129 and -0.0194.

Another interesting result is related to the coefficient of the 10-year government bond yield. Since this variable represents the long term funding cost, it can also be considered as a proxy of a credit rationing effect for a debtor country. The lower is the rating of a specific country (i.e. the higher its riskiness) the higher will be the price that this country needs to pay in the financial markets in order to raise money. Our results indicate that there is suggestive evidence for a credit rationing effect in the EU, in particular when country fixed effects and year dummies are taken into account. Moreover, in this specification, the negative effect that this variable produces on public investment is stronger than the effect deriving from the debt overhang. The coefficient of this variable is, in absolute terms, in fact larger than that one of the public debt variable.

Also the coefficients of the GNDI and public expenditure variables are positive and significant in the model specifications where specific effects for each country are taken out. This might indicate that there is evidence that more 'mature' countries (i.e. with higher GNDI per capita), such as the developed economies, prefer a larger role for the government, which results in a higher level of public investments. Strikingly, the results are exactly the opposite compared to the POLS estimation (variable significant but with a negative sign) suggesting then that the country fixed effects have an important role in this regard and should be taken into account. Regarding public expenditure, according to these results, we do not find evidence that, between 1995 and 2015, more government expenditure implied a reduction in the level of public investment. Hence

in the past, when government expenditure rose, this was not compensated for by lower public investment.

Interestingly, we find also that the business cycle measure is significant with a positive sign in both specifications with year dummies, providing evidence of pro-cyclical policies in term of public investment ²⁴.

3.4.5 GMM and Dynamic Specification

The two estimation processes described above present two important drawbacks that must be underlined and discussed.

The first one is related to the problem of endogeneity in terms of reverse causality. In the previous paragraphs we claimed that in order to mitigate the potential reverse causality of some variables we considered their lagged values. This might be a too simplistic way to deal with endogeneity since the relation between dependent and independent variables potentially goes beyond the first lag. In this regard, we find that the debt coefficient is significant using several lags for the POLS and until the second lag for the FE. These models thus do not provide robust evidence for the debt overhang hypothesis as they do not tackle properly the problem of potential endogeneity in terms of reverse causality.

In order to solve this problem, we then use an instrumental variable approach (GMM/2SLS). A positive feature of this GMM approach is that it allows to deal with the endogeneity problem we mentioned before. A GMM technique is in fact based on a set of orthogonality restrictions (i.e. the moment conditions) and it finds estimates of the parameters in order to come as close as possible to achieve these orthogonality properties. In particular, we will follow Checherita-Westphal and Rother (2012) in order to instrument the lagged value of public debt: we use the average level of debt of the other countries²⁵. Results are presented in Table 3.5.

A second important drawback that has not been addressed yet, is that with the specifications described above, it is not possible to use observable information from investment in the previous period. It might very well be the case that public investment today is in part determined by public investment in the past. Therefore, the potential persistence in the investment series cannot be captured. This is important in our study since it is quite common to assume that the current level of public investment is partly determined by its own past realizations.

In order to address the shortcoming just described, we use in this section a different econometric technique based on a dynamic specification.

The equation that we want to estimate then becomes:

²⁴This evidence for public investment is in line with Guerguil et al. (2017) and Hallerberg and Strauch (2002).

²⁵This can be considered as a good instrument if debt spillovers between EU countries are absent.

$$\begin{aligned}
\text{public investment}/GDP_{it} = & \delta \text{public investment}/GDP_{it-1} + \beta \text{public debt}/GDP_{it-1} + \\
& + \sum_{c=1}^4 \gamma_c \text{Controls}_{it-1}^c + \sum_{c=1}^2 \gamma_c \text{Controls}_{it}^c + \rho \text{expectations}_{it+1} + \\
& + \epsilon_{it}
\end{aligned} \tag{3.3}$$

For $i = 1, \dots, N$ and $t = 2, \dots, T$. Then, we augment this equation adding also the year dummies.

The addition of the lagged dependent variable as a regressor of the current level of public investment is aimed to capture its path dependence. However, this addition produces the so-called "dynamic panel bias" (Nickell, 1981) since the fixed effects contained in the error term are by construction correlated with the lagged dependent variable. It means that the predictive power belonging to country's fixed effects might instead be attributed to the lagged dependent variable. In order to overcome this problem, we will use a difference-GMM approach that first transforms all the regressors taking their first differences²⁶ and then applies a Generalized Method of Moments (Roodman, 2009). More specifically, we will use the Arellano Bond estimator with clustered standard errors.

Moreover, as we did in our initial estimation (i.e. the POLS and the FE model), we take the lags of most regressors.

Since the difference-GMM generates a large number of instruments and this would weaken the power of the endogeneity's test of the instruments, we follow the approach suggested by Roodman (2009) to limit the number of instruments. In particular, we use a collapsed instruments set based on a limited number of lags of the endogenous variables²⁷ According to the difference-in-Sargan test, we can assume that the instruments used in this specification can be considered as exogenous.

Additional confirmation for the validity of the GMM instruments, comes from the serial correlation tests. According to the Arellano-Bond test for autocorrelation and as required by the model, we can reject at a 1% level of significance the null hypothesis of no autocorrelation of order 1 in first differenced-errors and we cannot reject the hypothesis of no autocorrelation of order 2.

3.4.6 GMM and Dynamic models - Estimation Results

The results of the last regressions are presented in Table 3.5 and 3.6 of Appendix D: Table 3.5 shows the results of the GMM/2SLS, whereas Table 3.6 shows the results of the simple dynamic

²⁶All the fixed effects will be then removed since they do not vary over time.

²⁷Conversely, using all the available instruments, their number would increase quickly with the time dimension of the panel. Using just a reduced number of instruments, we can also mitigate the problem related to the fact that too many instruments can create an overfitting for the endogenous variables (Roodman, 2009).

specification.

Most variables appear with the expected sign and are significant in these specifications.

First of all, we find, as expected, that the level of investment in the current year is significantly and positively influenced by the level of the previous year (see Table 3.6). This means that there is a certain degree of persistence in public investments that should be taken into account and therefore that a dynamic model is an appropriate specification for this kind of data²⁸.

According to the regression results, we again find support for the debt overhang hypothesis in the EU countries in both the GMM/2SLS (Table 3.5) and the dynamic specification (Table 3.6). Given the public investment levels prevalent in 2015, a 1% increase in public debt produces a reduction in public investment of around 3.8 billion euro in the dynamic specification with year dummies. Moreover, according to the literature on dynamic models, we can also compute the long-run effect of public debt over investments (the short-run one is represented by coefficient β reported in Table 3.6) applying the following approximation: $\frac{\beta}{1-\delta}$ where $(1 - \delta)$ represents the rate of convergence. The value of interest is -0.03. Basically, this coefficient means that if debt permanently increases by one per cent, investments will be reduced by 0.066 per cent in the long-run, once year dummies are taken into account.

We find results similar to the ones presented in the previous section for GNDI, the business cycle measure, private investment, public expenditure and production expectations (since their coefficients are both positive and significant) and for the 10-year-government bond yields (negative and significant coefficient), which is evidence for the robustness of our initial findings.

Another significant coefficient in this specification is found for trade (negative coefficient), which might be considered as a sign that countries more open to international trade have a lower level of public investments (potentially because they substitute public investment for private investments or FDI).

3.4.7 Robustness Check - Common shock

In this section, we check the robustness of our results to potential bias coming from omitted variables. In particular, we test for the presence of a common shock that could have simultaneously affected both public investment and the regressors described above (i.e. the determinants of public investment), and as a consequence the link between both. Following Erce (2015), we consider the CBOE Volatility Index (VIX)²⁹ as proxy for global shocks. This index is indeed usually considered as a barometer of volatility and uncertainty in the financial markets. As we can see from the results presented in Appendix H, even if a common shock is taken into account, the negative link between public investment and public debt still exists and it is significant.

²⁸We tried also adding a second lag of the dependent variable but the coefficient is negative and not significant.

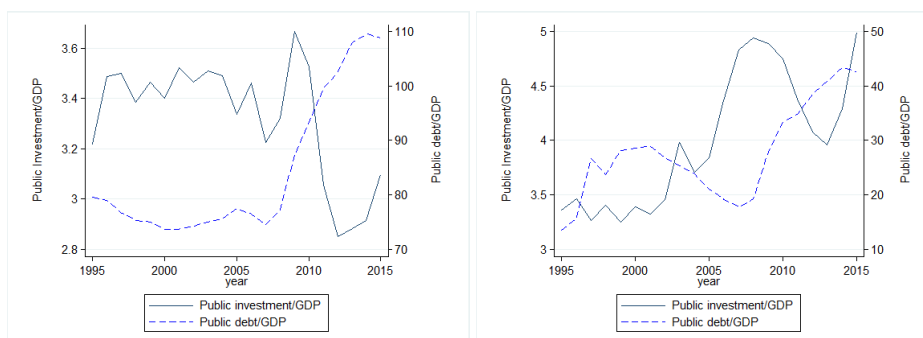
²⁹This index is computed from the SP 500 stock index option prices. Data come from Haver Analytics.

3.4.8 Extension – high vs. low debt countries

As an additional exercise, we divide the sample into three groups, according to their average debt level over the period 1995 and 2015 (high debt, medium debt, low debt), to test whether the debt overhang effect is stronger in the high debt group. As we can see from Figure 3.6 below indeed the patterns are quite different if we focus on countries with large or low levels of debt. The results are presented in Table 3.7 of Appendix E.

The results indicate that the impact of public debt on public investment is indeed stronger for high debt countries than for low debt countries where the coefficient is even positive. In the high debt group the coefficient for public debt is significant at the 0.05 level, whereas it is not significant in the low debt group. This is also visualized in Figure 3.6 below, which shows that the relationship between debt and investment is indeed stronger for high debt countries than for low debt countries. For an average country in the high debt group, the results suggest that a 1% decrease in public debt would increase public investment by €290 million (given the public investment levels prevalent in 2015). This provides some credence to the claim that excessive debt levels should be avoided and, if necessary, need to be addressed by fiscal consolidation measures.

FIGURE 3.6: PPaths of the average public investment and public debt for countries in the top group of high debt (left side) and in the group of low debt (right side)



Authors' computation based on data from Eurostat

Surprisingly and contrarily to what happens in the high debt countries, we do not find evidence of a debt overhang effect but only of credit rationing in the group of countries with medium level of debt, suggesting that for this group of countries, the cost of servicing debt is more important - in determining the level of public investment - than the level of public debt is.

Three other important results require further discussion: 1) public investment is extremely pro-cyclical in the countries with large and medium level of debt (given the large coefficients for the business cycle variable). This is not the case for countries with low levels of debt where production expectations play an important role 2) the maturity of the economy has an important positive role for public investment in countries with medium and low levels of debt 3) trade

openness of countries with high debt results in more public investment whereas the opposite is true for countries with medium levels of debt.

3.4.9 Extension – pre vs. post crisis

In this section, we want to test whether the sovereign debt crisis had a significant impact on public investment. As shown in Section 2, sovereign debt increased markedly in nearly all EU countries over the period 2009-2015. We study whether the debt overhang effect is more pronounced after the crisis of 2007-2009. In order to do that, we add a crisis dummy for the period 2009-2015 and we run again the dynamic regression.

As can be seen from the results in Table 3.8 in the Appendix F, the dummy is not significant. The most likely reason for this is that there is a lot of heterogeneity with regards to the period that the crisis affected a particular country. Some countries (e.g. Ireland) experienced an early crisis whereas other countries were affected by the crisis later. Moreover public investment has been characterized by large volatility in a substantial amount of European countries (see Figure 3.7)³⁰ and this makes difficult to find a specific effect during the years of the crisis over our entire sample.

3.4.10 Extension – Threshold Effect

In this section, we test for the presence of a threshold effect in the relation between public debt and public investment. More specifically, we want to see whether considering debt-to-GDP ratio higher than a specific threshold produces a negative effect over public investment that is even larger. In doing that, we follow the related literature on the topic (described in the first section) that, usually focusing on the relation between debt and growth, shows how debt levels larger than a specific threshold produce negative consequences for the economy. More specifically, we create a dummy variable that assumes value of 1 when debt level is larger than 90% (following Reinhart and Rogoff (2010)) and 0 otherwise. As we can see from the results in Appendix L, the threshold variable is actually negative but not significantly different from zero³¹. Then, there is no evidence related to the fact that governments, when consolidating, tend to cut the expenditure related to public investment and to the maintenance of public infrastructure.

³⁰We tried all the combinations starting in 2007/2008/2009/2010/2011 and ending in 2012/2013/2014/2015 and also for shorter periods 2007/2008/2009 – 2008/2009/2010/2011 but none of them comes out to be significant.

³¹We tried also using 60% as a threshold (following the Maastricht's criteria) but again we do not find any significant result for the threshold. This means that 60% or 90% cannot be considered as useful thresholds for the whole sample.

3.4.11 Extension – Focus on the EZ

In this section, we focus just on the countries which are part of the Eurozone (EZ) in order to see if the adoption of a common currency might have produced results different from what we have found before. In other words, we want to see whether the institutional arrangements of the EZ have had a specific impact on how debt-burdened countries allocate resources to public investment. For example, one of the euro convergence criteria stipulates that the annual government budget deficit must not exceed 3%. If a crisis hits, and government revenues fall and/or its expenditures rise, the government might have no other option than to cut spending on public investment, simply to adhere to the deficit requirement. Moreover, since the adoption of a single common currency implies respecting the Maastricht criteria, this can be considered as a way to group countries that are more similar to each other. Therefore, we focus on the 19 EZ member countries.

According to the regression's results (Table 3.9 of Appendix G) deriving from a dynamic specification, we find once again evidence of the debt overhang hypothesis. Interestingly, we can notice that the negative effect of debt over the incentive to invest is larger³² in the EU as a whole than in the Euro Area which might suggest that the institutional framework of the Eurozone actually does not act as a 'straightjacket' for countries that experience high debt levels. As described before for the EU countries, we can find similar results for GNDI, business cycle, trade and production expectations.

3.4.12 Extension - Stocks vs. flows

In this last section we test another hypothesis: is it only a matter of the stock of outstanding debt negatively impacting investment or whether it is also a matter of the flow of debt, i.e. if rapid debt accumulation leads to lower investment. It is important indeed to study whether a flow-approach can give additional information to that provided by an approach focused on stocks.

In debt sustainability analysis (DSA), the speed at which debt accumulates is an important factor and is generally evaluated in conjunction with the growth rate of a country and its real interest rate (Guzman and Heymann, 2015). Gabriele et al. (2017) show that considering at the same time, in a DSA framework, both stock and flow³³ measures of debt, such as the gross financing needs (GFN), gives a more accurate picture of debt sustainability risks for a specific country.

In order to consider a flow-approach, we add the first difference of the public debt variable in order to see how its change can explain the change in public investment. Since the change in debt cannot be considered as an exogenous variable (because public investment is usually financed

³²The average coefficient is 0.018 for the EZ and 0.03 for the EU.

³³They focus on gross financing needs as flow variable that adds up interest payments, principal repayments, and primary deficit.

through government debt issuances), we use an GMM/2SLS approach where we instrument the change in debt with the GFN-to-GDP ratio^{34 35}. This variable represents the summation of interest expenses, the primary balance and debt maturing in less than one year. The second and third lagged values of this variable can be considered correlated with the change in debt but uncorrelated with the amount of investment today. Hence, it can be considered as a good instrument. Then, we run an instrumental variable approach (GMM/2SLS), as explained in section e using clustered standard errors.

As shown in Table 3.11 in Appendix I, the link between the change in public debt and public investment is negative and significant, as expected. Interestingly, the negative effect is stronger than the effect produced by the debt stock. Thus, this suggest that both the level of public debt as well as its change matter in reducing the public investment with the latter playing a more important role. The results for the other determinants are in line with our initial analysis.

3.5 Conclusion and Policy Implications

Identifying the determinants of public investments in EU countries is a topical subject given the downward trend showed by government investments in the last years. In particular, the current EU framework might represent an obstacle to the recovery of public investments because of the stringent rules established (such as the Stability and Growth Pact and the Fiscal compact) that limit the fiscal manoeuvre of member countries. An attempt to change this framework was made in 2013, when the European Commission introduced the so called ‘Investment clause’ which gives countries the possibility to deviate from the medium-term budgetary objective (MTO) if certain, albeit quite stringent³⁶criteria were met: 1) GDP growth must be negative or GDP must be below its potential; 2) the deviation must not produce a deficit larger than the 3% threshold established in the Stability and Growth Pact; 3) public investments are related to projects co-funded by the EU; and 4) the country has to compensate for this deviation in the subsequent years, ensuring it reaches the MTO in four years.

Recently there has been a debate in the European Parliament on the possibility to exclude public investments, based on EU co-financed programmes, from the calculation of the deficit and debt requirements established in the SGP. This would introduce more flexibility in the EU framework with potential benefits for public investments, especially during times of crisis. However, this kind of rule should be carefully structured since it might produce a moral hazard problem, in normal times, allowing countries to increase their debt levels by labelling unproductive public expenditure as productive public investment.

³⁴GFN data for 26 countries (UK and LU are missing) are downloaded from the ECB.

³⁵More specifically, we use its second and third lagged values as instruments.

³⁶Since many countries have been under the excessive deficit procedure in the last years they have not had the possibility to use this option. In 2014, for example, only Bulgaria, Slovakia and Romania benefited from the investment clause.

Surprisingly, the literature on which variables might have an impact on public investment in Europe is rather limited. Our paper furthers this literature, analysing several potential determinants of public investment and considering nearly the entire European Union. In particular, we focus on the link between public debt and public investment in order to study the debt overhang hypothesis. Because of the recent sovereign debt crisis that affected the whole EU, but especially the southern European countries, this presents an interesting environment to test this hypothesis. In order to perform this exercise, we tackle the potential issue of reverse causality between debt and investment by using a GMM model, exploiting the instrumental variable approach based on the GMM/2SLS and on the linear GMM estimator of Arellano and Bond (1991).

The results of our empirical analysis show a significant negative link in the EU between general government consolidated gross debt and public investments³⁷. Taking the most conservative estimate, in the dynamic GMM specification, our results indicate that a 1% increase in public debt reduces public investment in the European Union by around 3.8 billion euro, or 0.89%, given the level of public investment prevalent in 2015. Thus, we find significant evidence to support the debt overhang hypothesis in Europe, as our results show that high debt can negatively affect public investments. From a policy perspective, fiscal consolidation measures might hence be justified³⁸.

According to part of the related literature (Eberhardt and Presbitero, 2015; Reinhart et al., 2012), focusing on the average relation between debt and growth might be misleading. The impact of an high level of debt on growth in fact might be influenced by country specific characteristics such as past crisis episodes, the institutional framework (Manasse and Roubini, 2009) and debt composition (i.e. short term versus long term debt), domestic versus external debt, the currency denomination, (Dell'Erba and Hausmann, 2013), etc.. Nevertheless, since we focus on countries which are members of the European Union and are hence characterized by a common EU policy - which leaves little room for large differences between countries - we believe that studying the average relation between public investments and public debt is the most appropriate approach.

In summary, this paper offers an interesting contribution to the literature in various ways. We analyse the debt overhang effect for public investment, produced by an increase in public debt, through a broad variety of specifications, offering a richer characterization of this topic than other existing papers. Indeed, we study the link between public debt and public investment using a plethora of econometric models (i.e. (P)OLS, FE, GMM and GMM/2SLS) and comparing high vs low debt countries, pre vs crisis period, EU countries vs EZ countries and stock vs flow measures. More specifically, we find that (i) the crowding out effect is in place only for the high

³⁷This paper shows clear evidence that governments are inclined to reduce public investment when debt and deficits are high. A possible policy instrument to counter this inclination could be to increase EU funds available for investment in times of crises. We do not go into detail on a concrete policy proposal, but refer, inter alia, to the recent literature on the establishment of a European Stabilization Fund (Carnot, 2017).

³⁸This paper does not offer a definitive answer to this discussion as a wide variety of issues needs to be considered, such as the extent to which these measures (i.e. fiscal consolidation) could affect negatively growth in the short-run.

debt countries, (ii) it is not significantly stronger during and after the crisis (2009-2015), (iii) it is slightly stronger inside the entire EU than in the EZ, (iv) there is no threshold effect; and (v) the flow of debt has a stronger negative effect on investment than the stock of debt³⁹.

Two other interesting results can be derived from our analysis. First, it is quite difficult to explain the behaviour of public investment focusing only on macroeconomic variables. The explanatory power of the models used is indeed quite low and this might suggest an important role of politics and the electoral cycle in driving public investment. Second, the credit rationing channel has a significantly larger impact on public investment than debt overhang. To the best of our knowledge, this is the first paper that aims to make this kind of comparison. However, this evidence holds only in some of the specifications used. The consequent policy implication might be that a measure focused on debt reduction would be less effective than an additional lending strategy - for example with a 'concessional' interest rate - in order to restore public investments and then growth. Since the evidence is not robust across all the specifications used, this comparison between crowding out effect and credit rationing warrants further analysis.

³⁹The last point in particular is quite interesting and often understudied in the existing literature. Here, we find evidence that a more rapid debt accumulation can be considered as a drag on public investments, even stronger than the effect produced by a large stock of public debt.

3.6 Appendix A

Country	Public debt/GDP	Public investment/GDP	SD Public debt/GDP	SD Public investment/GDP
Austria	71.78	2.99	8.07	0.38
Belgium	105.83	2.24	11.66	0.15
Bulgaria	137.89	3.79	26.13	1.46
Croatia	55.09	4.99	19.53	1.33
Cyprus	64.18	3.95	18.8	0.94
Czech Republic	27.86	4.64	11.04	0.81
Denmark	41.96	3.08	6.78	0.37
Estonia	6.62	5.27	2.09	0.61
Finland	46.63	3.82	8.45	0.27
France	70.77	3.92	13.51	0.18
Germany	66.31	2.21	8.27	0.18
Greece	122.86	4.57	31.02	1.08
Hungary	67.72	3.80	10.06	1.24
Ireland	60.13	3.016	32.78	0.94
Italy	111.77	2.78	10.50	0.29
Latvia	21.87	3.54	13.90	1.44
Lithuania	24.57	3.57	10.24	1.00
Luxembourg	12.19	4.17	6.45	0.54
Malta	61.48	3.54	10.23	0.73
Netherlands	58.00	3.85	9.16	0.22
Poland	46.09	3.79	5.70	1.06
Portugal	78.05	4.00	29.35	1.08
Romania	22.71	4.12	10.05	1.46
Slovakia	40.34	3.93	9.52	0.91
Slovenia	35.56	4.20	19.94	0.48
Spain	61.5	3.78	19.43	0.82
Sweden	49.55	4.36	11.22	0.28
UK	54.32	2.42	20.57	0.53
EU	54.48	3.70	9.86	0.27

TABLE 3.2: Note: In column 1 and 2 there are the average values of public debt and public investment; in column 3 and 4 there are their standard deviations.

3.7 Appendix B

Country	Correlation D/GDP-Ipub/GDP	75th percent.	90th percent.	95th percent.
Austria	0.26	-0.20	-0.89	1
Belgium	0.31	-0.62	0.52	1
Bulgaria	-0.58	-0.91	-1	-
Croatia	-0.88	-0.3	-1	-
Cyprus	-0.72	-0.97	-0.69	1
Czech Republic	0.005	-0.78	-0.54	-1
Denmark	0.01	-0.34	1	-
Estonia	0.20	0.19	-0.80	-1
Finland	0.66	0.09	-0.80	-1
France	-0.10	-0.81	-0.96	-1
Germany	-0.24	0.04	0.42	1
Greece	-0.70	0.14	0.04	-1
Hungary	-0.20	-0.89	-1	-1
Ireland	-0.77	-0.27	-1	-
Italy	-0.66	-0.97	-1	-1
Latvia	0.58	0.11	-0.73	-1
Lithuania	0.24	-0.86	-0.54	1
Luxembourg	-0.37	-0.77	-0.88	-1
Malta	-0.04	0.17	-0.11	1
Netherlands	-0.51	0.38	0.66	-1
Poland	0.75	0.14	-0.63	-1
Portugal	-0.83	-0.99	-0.95	-1
Romania	0.15	-0.86	-0.63	-1
Slovenia	0.53	0.35	0.76	-1
Slovakia	0.05	0.03	-0.95	-1
Spain	-0.88	-0.95	0.14	-1
Sweden	0.40	0.70	0.86	-1
UK	0.61	-0.91	0.48	-1
EU	-0.15	-0.73	-0.48	1

TABLE 3.3: Note: In column 1 there is the correlation between D/GDP and Ipub/GDP for all the sample period 1995-2015; in column 2, 3 and 4 there are respectively the correlation conditional to D=GDP being greater than the 75th percentile, the 90th percentile and the 95th percentile.

3.8 Appendix C

TABLE 3.4: baseline regression results for the EU countries: pooled OLS and fixed effects

Explanatory variables	Ipub POLS	Ipub POLS	Ipub FE	Ipub FE
<i>public debt</i> _{t-1}	-0.014* (-2.06)	-0.015** (-2.18)	-0.019*** (-3.12)	-0.0129* (-1.98)
<i>GNDI per capita</i> _t	-0.528** (-2.44)	-0.453** (-2.27)	1.050* (1.75)	2.222*** (2.92)
<i>cycle</i> _t	0.180 (0.13)	5.235** (2.12)	1.345 (0.98)	6.045** (2.76)
<i>private investment</i> _{t-1}	0.030 (0.88)	0.028 (0.79)	0.059*** (2.92)	0.030 (1.42)
<i>public expenditure</i> _{t-1}	0.041 (1.66)	0.043 (1.69)	0.070*** (3.44)	0.0660*** (2.82)
<i>gov. bond yield(10Y)</i> _{t-1}	0.016 (0.55)	0.056 (1.57)	-0.020 (-0.60)	-0.066** (-2.39)
<i>trade</i> _{t-1}	0.001 (0.29)	0.0002 (0.12)	-0.006 (-1.22)	-0.008 (-1.64)
<i>expectations</i> _{t+1}	0.003 (0.32)	0.010 (0.65)	0.006* (1.84)	0.013 (1.67)
<i>constant</i>	3.478** (2.59)	2.718 (1.59)	-1.935 (-0.85)	-3.676 (-1.36)
N obs.	404	404	404	404
Country FE	No	No	Yes	Yes
Year FE	No	Yes	No	Yes
<i>R</i> ²	0.259	0.310	0.269	0.379

t statistics in parentheses (*p<0.10, ** p<0.05, *** p<0.01) computed using clustered standard errors. In the POLS, Year FE are significant in 2009 and 2010, in the FE they are significant in 1997, 1999, 2000, from 2002 to 2007 and from 2010 to 2014.

FIGURE 3.7: Paths of public investment-to-GDP ratios for all the EU countries



Authors' computation based on data from Eurostat

3.9 Appendix D

TABLE 3.5: IV-GMM regression results for EU countries

Explanatory variables	Ipub 2SLS
<i>public debt</i> _{t-1}	-0.017*** (-2.84)
<i>GNDI per capita</i> _t	0.957* (1.81)
<i>cycle</i> _t	1.440 (1.06)
<i>private investment</i> _{t-1}	0.066*** (3.63)
<i>public expenditure</i> _{t-1}	0.057*** (2.63)
<i>gov. bond yield(10Y)</i> _{t-1}	-0.040 (-1.42)
<i>trade</i> _{t-1}	-0.006 (-1.23)
<i>expectations</i> _{t+1}	0.007* (1.87)
N. obs	390
Country FE	Yes
Hansen J	0.496

t statistics in parentheses (*p<0.10, ** p<0.05, *** p<0.01) computed using clustered standard errors. In column 1 there are the results deriving from instrumenting the debt variable using its second lag and the average level of debt of the other countries.

TABLE 3.6: IV-GMM regression results for the EU countries

Explanatory variables	Ipub GMM
<i>public investment</i> _{t-1}	0.544*** (4.84)
<i>public debt</i> _{t-1}	-0.030*** (-3.26)
<i>cycle</i> _t	7.223*** (2.86)
<i>GNDI per capita</i> _t	0.693 (1.40)
<i>private investment</i> _{t-1}	0.012 (0.47)
<i>public expenditure</i> _{t-1}	0.019 (0.43)
<i>gov. bond yield(10Y)</i> _{t-1}	-0.0329 (-0.68)
<i>trade</i> _{t-1}	-0.015*** (-2.62)
<i>expectations</i> _{t+1}	0.011* (1.65)
N. obs	378
Year FE	Yes
Difference in Sargan	0.362

t statistics in parentheses (*p<0.10, ** p<0.05, *** p<0.01) computed using clustered standard errors. Year FE are significant in 2000 and from 2004 to 2007.

3.10 Appendix E

TABLE 3.7: Grouping countries according to debt levels – IV-GMM regression results

Explanatory variables	Ipub	Ipub	Ipub
	High debt	Med. debt	Low debt
	GMM	GMM	GMM
<i>public investment</i> _{t-1}	0.214* (1.93)	0.678*** (7.54)	0.371** (2.10)
<i>public debt</i> _{t-1}	-0.012** (-2.09)	-0.0005 (-0.06)	0.018 (1.15)
<i>cycle</i> _t	14.87*** (5.13)	8.547** (2.48)	5.026 (1.32)
<i>GNDI per capita</i> _t	-0.514 (-0.59)	2.088*** (3.07)	2.509** (1.96)
<i>private investment</i> _{t-1}	0.052* (1.86)	-0.007 (-0.14)	0.056 (1.19)
<i>public expenditure</i> _{t-1}	-0.043 (-1.18)	-0.011 (-0.27)	-0.056 (-0.87)
<i>gov. bond yield(10Y)</i> _{t-1}	-0.057* (-1.73)	-0.163** (-2.13)	0.165 (1.61)
<i>trade</i> _{t-1}	0.017*** (2.60)	-0.009* (-1.89)	-0.005 (-0.36)
<i>expectations</i> _{t+1}	-0.005 (-0.62)	-0.008 (-1.13)	0.022* (1.86)
N. obs	150	133	95
Year FE	Yes	Yes	Yes
Difference in Sargan	0.685	0.096	0.408

t statistics in parentheses (* p<0.10, ** p<0.05, *** p<0.01) computed using clustered standard errors. The thresholds for the debt averages (expressed as percentage of GDP), used to identify the three groups are: 40.3381 and 61.47619. The group of high debt countries includes: AT, BE, CY, DE, EL, FR, HU, IT, PT; the group of medium debt countries includes: , DK, FI, ES, HR, MT, NL, PL, SE, UK; the group of low debt countries includes: BG, CZ, , LT, LU, LV, RO, SI, SK. Year FE are negative and significant in the high debt from 1997 to 2008, in 2011 and 2014; in medium debt group they are positive and significant in from 1996 to 1999, from 2001 to 2003, in 2005 and 2009; in the low debt group they are never significant.

3.11 Appendix F

TABLE 3.8: Focus on the crisis for the EU countries – IV-GMM results

Explanatory variables	Ipub GMM
<i>public investment</i> _{t-1}	0.545*** (4.30)
<i>public debt</i> _{t-1}	-0.014* (-1.73)
<i>cycle</i> _t	0.945 (0.41)
<i>GNDI per capita</i> _t	0.178 (0.42)
<i>private investment</i> _{t-1}	0.033 (1.19)
<i>public expenditure</i> _{t-1}	0.003 (0.07)
<i>gov. bond yield(10Y)</i> _{t-1}	-0.049 (-1.24)
<i>trade</i> _{t-1}	-0.002 (-0.37)
<i>expectations</i> _{t+1}	0.008* (1.92)
<i>crisis</i>	-0.022 (0.156)
N. obs	378
Difference in Sargan	0.516

t statistics in parentheses (* p<0.10, ** p<0.05, *** p<0.01) computed using clustered standard errors.

3.12 Appendix G

TABLE 3.9: Focus on the EZ countries – IV-GMM results

Explanatory variables	Ipub GMM
<i>public investment</i> _{t-1}	0.543*** (4.86)
<i>public debt</i> _{t-1}	-0.018** (-2.46)
<i>cycle</i> _t	3.830*** (2.03)
<i>GNDI per capita</i> _t	1.543** (2.97)
<i>private investment</i> _{t-1}	0.001 (0.05)
<i>public expenditure</i> _{t-1}	-0.038 (-0.93)
<i>gov. bond yield(10Y)</i> _{t-1}	0.005 (0.14)
<i>trade</i> _{t-1}	-0.008** (-2.01)
<i>expectations</i> _{t+1}	0.012** (2.05)
N. obs	269
Year FE	Yes
Difference in Sargan	0.101

t statistics in parentheses (* p<0.10, ** p<0.05, *** p<0.01) computed using clustered standard errors. Year FE are significant and negative starting from 1999 to 2008 and from 2010 to 2012.

3.13 Appendix H

TABLE 3.10: Focus on a common shock for the EU countries – IV-GMM results

Explanatory variables	Ipub GMM
<i>public investment</i> _{t-1}	0.544*** (4.84)
<i>public debt</i> _{t-1}	-0.030*** (-3.26)
<i>cycle</i> _t	7.223*** (2.86)
<i>GNDI per capita</i> _t	0.693 (1.40)
<i>private investment</i> _{t-1}	0.012 (0.47)
<i>public expenditure</i> _{t-1}	0.019 (0.43)
<i>gov. bond yield(10Y)</i> _{t-1}	-0.033 (-0.68)
<i>trade</i> _{t-1}	-0.015*** (-2.62)
<i>expectations</i> _{t+1}	0.011* (1.65)
<i>via</i> _t	-0.030* (-1.74)
N. obs	378
Year FE	Yes
Difference in Sargan	0.362

t statistics in parentheses (* p<0.10, ** p<0.05, *** p<0.01) computed using clustered standard errors. Year FE are significant and negative in 2000 and from 2004 to 2011.

3.14 Appendix I

TABLE 3.11: Focus on flows for the EU countries – IV-GMM results

	Ipub
Explanatory variables	2SLS
$\Delta public\ debt_{t-1}$	-0.029* (-1.66)
$public\ debt_{t-1}$	-0.018** (-2.41)
$GNDI\ per\ capita_t$	1.896*** (3.01)
$cycle_t$	0.915 (0.69)
$private\ investment_{t-1}$	0.050* (1.89)
$public\ expenditure_{t-1}$	0.077*** (3.21)
$gov.\ bond\ yield(10Y)_{t-1}$	0.002 (0.07)
$trade_{t-1}$	-0.011* (-1.69)
$expectations_{t+1}$	0.009** (2.51)
N. obs	314
Country FE	Yes
Hansen J	0.97

t statistics in parentheses (* p<0.10, ** p<0.05, *** p<0.01) computed using clustered standard errors.

3.15 Appendix L

TABLE 3.12: Focus on debt threshold for the EU countries – IV-GMM results

Explanatory variables	Ipub GMM
<i>public investment</i> _{t-1}	0.550*** (4.84)
<i>public debt</i> _{t-1}	-0.0278*** (-2.79)
<i>public debt threshold</i> _{t-1}	-0.311 (-1.07)
<i>GNDI per capita</i> _t	0.712 (1.45)
<i>cycle</i> _t	7.318*** (2.90)
<i>private investment</i> _{t-1}	0.0140 (0.54)
<i>public expenditure</i> _{t-1}	0.0171 (0.38)
<i>gov. bond yield(10Y)</i> _{t-1}	-0.0298 (-0.61)
<i>trade</i> _{t-1}	-0.0153*** (-2.76)
<i>expectations</i> _{t+1}	0.0105* (1.65)
N. obs	378
Country FE	Yes
Difference in Sargan	0.311

t statistics in parentheses (* p<0.10, ** p<0.05, *** p<0.01) computed using clustered standard errors. Year FE are significant and negative in 1999, 2000, from 2003 to 2008 and from 2010 to 2012.

Bibliography

- Abiad, A., D. Furceri, and P. Topalova (2016). “The Macroeconomic Effects of Public Investment: Evidence from Advanced Economies”. In: *Journal of Macroeconomics* 50, pp. 224–240.
- Acharya, S. and I. Diwan (1993). “Debt Buybacks Signal Sovereign Countries’ Creditworthiness: Theory and Tests”. In: *International Economic Review* 30(4), pp. 795–817.
- Adam, K. and M. Grill (2017). “Optimal Sovereign Default”. In: *American Economic Journal: Macroeconomics* 9(1), pp. 128–64.
- Aguiar, M. and M. Amador (2014). *Sovereign Debt, Handbook of International Economics*. North-Holland vol(4).
- Aguiar, M. and G. Gopinath (2006). “Defaultable Debt, Interest Rates and the Current Account”. In: *Journal of International Economics* 69(1), pp. 64–83.
- Aguiar, M., M. Amador, and G. Gopinath (2009). “Investment Cycles and Sovereign Debt Overhang”. In: *Review of Economic Studies* 76(1), pp. 1–31.
- Albanesi, S., G. De Giorgi, and J. Nosal (2017). “Credit growth and the financial crisis: A new narrative”. In: *NBER Working paper No. w23740*.
- Andres, J., O. Arce, and C. Thomas (2014). “Structural Reforms in a Debt Overhang”. In: *Journal of Monetary Economics* 88, pp. 15–34.
- Andritzky, J., D.I. Christofzik, L.P. Feld, and U. Scheuering (2016). “A Mechanism to Regulate Sovereign Debt Restructuring in the Euro Area”. In: *CESifo Working Paper 6038*.
- Ardagna, S. and F. Caselli (2014). “The Political Economy of the Greek Debt Crisis: A Tale of Two Bailouts”. In: *American Economic Journal: Macroeconomics* 6(4), pp. 291–323.
- Arellano, C. (2008). “Default Risk and Income Fluctuations in Emerging Economies”. In: *American Economic Review* 98(3), pp. 690–712.
- Arellano, C. and Y. Bai (2014). “Linkages Across Sovereign Debt Markets”. In: *Research Department Staff Report 491, Federal Reserve Bank of Minneapolis*.
- Arellano, C., X. Mateos-Planas, and J.V. R’ios-Rull (2013). “Partial Default”. In: *Mimeo, NBER*.
- Arellano, M. and S. Bond (1991). “Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations”. In: *Review of Economic Studies* 58, 277–97.
- Arias, E. F. and F. Broner (2013). “The Economics of Sovereign Debt Restructuring: Swaps and Buybacks”. In: *Inter-American Development Bank Publications*.

- Arslanalp, S. and P. B. Henry (2005). "Is Debt Relief Efficient?" In: *Journal of Finance* 60(2), pp. 1017–1051.
- (2006a). *Helping the Poor to Help Themselves: Debt Relief or Aid*. in Sovereign Debt at the Crossroads: Challenges, Proposals for Resolving the Third World Debt Crisis, (edited by Chris Jochnick, and Fraser Preston), Oxford University Press.
- (2006b). "Policy Watch: Debt Relief". In: *Journal of Economic Perspectives* 20 (1).
- Arteta, C. and G. Hale (2008). "Sovereign Debt Crises and Credit to the Private Sector". In: *Journal of International Economics* 74(1), pp. 53–69.
- Asiedu, E. (2008). "Debt relief and institutional reform: a focus on Heavily Indebted Poor Countries". In: *The Quarterly Review of Economics and Finance* 43, pp. 614–626.
- Asonuma, T. (2012). "Serial Default and Debt Renegotiation". In: *MPRA Paper No. 55139*,
- (2016). "Serial Sovereign Defaults and Debt Restructurings". In: *IMF Working Papers 16/66*.
- Asonuma, T. and C. Trebesch (2016). "Sovereign Debt Restructurings: Preemptive Or Post-Default". In: *Journal of the European Economic Association* 14(1), pp. 175–214.
- Asonuma, T., M. Chamon, and A. Sasahara (2016). "Trade Costs of Sovereign Debt Restructurings: Does a Market-Friendly Approach Improve the Outcome?" In: *IMF Working Paper 16/222*.
- Asonuma, T., M. Chamon, A. Erce, and A. Sasahara (2017). "Costs of Sovereign Defaults: Restructuring Strategies, Bank Distress and the Credit-Investment Channel". In: *IMF Working Paper Series*.
- Aubin, C., J.P. Berdot, D. Goyeau, and J.D. Lafay (1988). *The Growth of Public Expenditure in France*. J.A. Lybeck and M. Henrekson (eds.), Explaining the Growth of Government, Amsterdam: North-Holland.
- Bac, M. (1999). "Grace Periods in Sovereign Debt". In: *Review of International Economics* 7(2), pp. 322–327.
- Bacchiocchi, E., E. Borghi, and A. Missale (2011). "Public Investment under Fiscal Constraints". In: *Fiscal Studies* 32, pp. 11–42.
- Balassone, F., M. Francese, and A. Pace (2011). "Public Debt and Economic Growth in Italy". In: *Bank of Italy - Economic History Working Papers No. 11*.
- Balteanu, I and A. Erce (2017). "Linking Bank Crises and Sovereign Defaults: Evidence from Emerging Markets". In: *European Stability Mechanism Working Paper No. 22*.
- Barro, R. J. (1996). *Reflections on Ricardian Equivalence*. National bureau of economic research.
- Baum, A., C. Checherita-Westphal, and P. Rother (2013). "Debt and growth: New evidence for the euro area". In: *Journal of International Money and Finance* 32, pp. 809–821.
- Bayoumi, T. (2017). *Unfinished Business: The Unexplored Causes of the Financial Crisis and the Lessons Yet to Be Learned*. Yale University Press.
- Benjamin, D. and M. L. Wright (2009). "Recovery Before Redemption: A Theory of Delays in Sovereign Debt Renegotiations". In: *Manuscript, UCLA*.

- Bi, R. (2008). “‘Beneficial’ Delays in Debt Restructuring Negotiations”. In: *IMF Working Paper*.
- BIS (2012). “The international Banking Market”. In: *Quarterly Review - Statistical Annex*.
- Bolton, P. and O Jeanne (2007). “Structuring and Restructuring Sovereign Debt: The Role of a Bankruptcy Regime”. In: *Journal of Political Economy* 115, 901–924.
- Borensztein, E. (1990a). “Debt Overhang, Credit Rationing and Investment”. In: *Journal of Development Economics* 32, pp. 315–335.
- (1990b). “Debt Overhang, Debt reduction and Investments: The case of Philippine”. In: *IMF WP/90/77*.
- Borensztein, E. and U. Panizza (2009). “The Costs of Sovereign Default”. In: *IMF Staff Papers* 56(4), pp. 683–741.
- Bove, V., G. Efthyvoulou, and A. Navas (2017). “Political cycles in public expenditure: butter vs guns”. In: *Journal of Comparative Economics* 45, pp. 582–604.
- Brooke, M., R. Mendes, A. Pienkowski, and E. Santor (2013). “Sovereign default and state-contingent debt”. In: *Bank of Canada Discussion Paper, No. 3*.
- Bua, G., J. Pradelli, and A. F. Presbitero (2014). “Domestic public debt in Low-Income Countries: Trends and structure”. In: *Review of Development Finance* 4, pp. 1–19.
- Buchheit, L., M. Gulati, and I. Tirado (2013). “The problem of holdout creditors in Eurozone sovereign debt restructurings”. In: <https://ssrn.com/abstract=2205704>.
- (2014). “Guest post: The case for sovereign reprofiling the IMF way, part one”. In: *Financial Times* 11/7/2014.
- Bulow, J. and K. Rogoff (1988). “The Buyback Boondoggle”. In: *Brookings Papers on Economic Activity* 2, pp. 675–699.
- (1989). “Sovereign Debt: Is to Forgive to Forget?” In: *American Economic Review* 79, pp. 43–50.
- (1991). “Sovereign Debt Repurchases: No Cure for Overhang”. In: *The Quarterly Journal of Economics* 106(4), pp. 1219–1235.
- Carnot, N. (2017). “European Fiscal Governance and Cyclical Stabilisation: Searching for a Lasting Arrangement”. In: *Intereconomics* 3, pp. 148–154.
- Chatterjee, S. (2013). “Debt overhang: why recovery from a financial crisis can be slow”. In: *Business Review* Q2, 1-9.
- Checherita-Westphal, C. and P. Rother (2012). “The impact of high and growing government debt on economic growth. An empirical investigation for the euro area”. In: *European Economic Review* 56(7), pp. 1392–1405.
- Cheng, G., J. Díaz Cassou, and A. Erce (2017a). “From Debt Collection to Relief Provision: 60 Years of Official Debt Restructurings through the Paris Club”. In: *Inter-American Development Bank Working Paper*.
- (2017b). “The Macroeconomic Effects of Official Debt Restructuring: Evidence from the Paris Club”. In: *ESM Working Paper* 21.

- Chuan, P. and F. Sturzenegger (2005). *Default Episodes in the 1980s and 1990s: What Have We Learned*. Aizenman, J., Pinto, B. (Eds.), *Managing Economic Volatility, and Crises: A Practitioner's Guide*. Cambridge University Press, Cambridge, M.A.
- Claessens, S. (1990). "The Debt Laffer Curve: Some Estimates". In: *World Development* 18(12), pp. 1671–1677.
- Claessens, S. and G. Dell'Ariccia (2011). "Are buybacks an efficient way to reduce sovereign debt?" In: *VoxEu* 5 March.
- Clements, B., R. Bhattacharya, and T. Q. Nguyen (2003). "External Debt, Public Investment, and Growth in Low-Income Countries". In: *IMF WP/03/249*.
- Cline, W. (1995). *International Debt Reexamined*. Institute for International Economics. Washington, DC.
- Cohen, D., M. Viennot, and S. Villemot (2016). *The Eurozone Debt Crisis: A New-Keynesian DSGE model with default risk*.
- Cole, H. and P. Kehoe (1998). "Models of Sovereign Debt: Practical vs. General Reputations". In: *International Economic Review* 39(1), pp. 55–70.
- Cordella, T., L. A. Ricci, and M. Ruiz-Arranz (2010). "Debt Overhang or Debt Irrelevance?" In: *IMF Staff Papers* 57, pp. 1–24.
- Corsetti, G. and L. Dedola (2012). "The Mystery of the Printing Press: Selffulfilling Debt Crises and Monetary Sovereignty". In: *CEPR Discussion Paper No. 9358*.
- Corsetti, G., M. Devereux, J. Hassler, G. Saint-Paul, H.W. Sinn, J. E. Sturm, and X. Vives (2011). "EEAG Report on the European Economy-A new crisis mechanism for the Euro area". In: *CESifo*.
- Corsetti, G., L.P. Feld, P.R. Lane, L. Reichlin, H. Rey, D. Vayanos, and B. Weder die Mauro (2015). *A new start for the Eurozone: Dealing with debt*. CEPR Press.
- Corsetti, G., A. Erce, and T. Uy (2017a). "Debt Sustainability and the Terms of Official Support". In: *mimeo*.
- (2017b). "Official Sector Lending Strategies during the Euro Area Crisis". In: *Centre for Economic Policy Research*.
- Cruces, J. and C. Trebesch (2013). "Sovereign Defaults: The Price of Haircuts". In: *American Economic Journal: Macroeconomics, American Economic Association* 5(3), pp. 85–117.
- Das, U., M. Papaioannou, and C. Trebesch (2010). "Sovereign Default Risk and Private Sector Access to Capital in Emerging Markets". In: *Journal Issue* 10.
- Das, U. S., M. G. Papaioannou, and C. Trebesch (2012a). "Restructuring Sovereign Debt: Lessons from Recent History". In: *IMF Working Paper*.
- (2012b). "Sovereign Debt Restructurings 1950-2010; Literature Survey, Data, and Stylized Facts". In: *IMF Working Papers* 12/203.
- Díaz-Cassou, J., A. Erce, and J. Vázquez-Zamora (2008). "Recent Episodes of Sovereign Debt Restructurings: A Case-Study Approach". In: *Banco de Espana Occasional Paper No. 0804*.

- De Haan, J., J. E. Sturm, and B. J. Sikken (1996). "Government Capital Formation: Explaining the Decline". In: *Weltwirtschaftliches Archiv* 132(1), pp. 55–74.
- Dell'Erba, S. and U. Hausmann R. Panizza (2013). "Debt levels, debt composition, and sovereign spreads in emerging and advanced economies". In: *Oxford Review of Economic Policy* 29(3), 518–547.
- Depretis Chauvin, N. and A. Kraay (2005). "What Has 100 Billion Dollars Worth of Debt Relief Done for Low-Income Countries?" In: *World Bank, mimeo*.
- (2007). "Who Gets Debt Relief?" In: *Journal of the European Economic Association* 5(2/3), pp. 333–342.
- D'Erasmus, P. (2011). "Government Reputation and Debt Repayment". In: *Manuscript, University of Maryland*.
- Deshpande, A. (1993). *Some aspects of international debt of developing countries*. unpublished PhD thesis.
- (1997). "The debt overhang and the disincentive to invest". In: *Journal of Development Economics* 52, pp. 169–187.
- Dias, D. A., C. Richmond, and T. Wang (2012). "Duration of Capital Market Exclusion: An Empirical Investigation". In: *UIUC Economics, mimeo*.
- Diwan, I. and D. Rodrik (1992). *External Debt, Adjustment, and Burden Sharing: A Unified Framework*. Princeton Studies in International Finance 73. Princeton: Princeton University.
- Easterly, W. (1999). "Life during growth". In: *Journal of Economic Growth* 4(3), pp. 239–275.
- (2002). "How Did Heavily Indebted Poor Countries Become Heavily Indebted? Reviewing Two Decades of Debt Relief". In: *World Development* 30(10), 1677–1696.
- Eaton, J. and M. Gersovitz (1981). "Debt with Potential Repudiation: Theoretical and Empirical Analysis". In: *The Review of Economic Studies* 48(2), pp. 289–309.
- Eberhardt, M. and A. F. Presbitero (2015). "Public debt and growth: Heterogeneity and non-linearity". In: *Journal of International Economics* 97(1), pp. 45–58.
- Economides, N. and R. C. Smith (2011). "Trichet Bonds To Resolve the European Sovereign Debt Problem". In: *NET Institute working paper*.
- Eichengreen, B. and R. Portes (1995). "Crisis? What crisis? Orderly workouts for sovereign debtors". In: *Centre for Economic Policy Research Working Paper*.
- Eichengreen, B. and P. Temin (2000). "The Gold Standard and the Great Depression". In: *Contemporary European History* 9, pp. 183–207.
- Enderlein, H., C. Trebesch, and L. von Daniels (2012). "Sovereign debt disputes: A database on government coerciveness during debt crises". In: *Journal of International Money and Finance* 31.
- Erce, A. (2012). "Selective Sovereign Defaults". In: *Globalization and Monetary Policy Institute Working Paper 127, Federal Reserve Bank of Dallas*.
- (2015). "Bank and sovereign risk feedback loops". In: *ESM Working Paper Series* 1.

- Erce, A. and J. Díaz-Cassou (2010). “Creditor Discrimination during Sovereign Debt Restructurings”. In: *Banco de España, Banco de España Working Papers*.
- European Commission (2010). *Europe 2020: A Strategy for smart, sustainable and inclusive growth*.
- (2015). *Financial Assistance to Greece*. European Commission, available at: <http://ec.europa.eu/economy-finance/assistance-eu-ms/greek-loan-facility/index-en.htm>.
- (2017). *The Joint Harmonised EU Programme of Business and Consumer Surveys. User Guide*. European Commission.
- Fatas, A. and L. Summers (2018). “The permanent effects of fiscal consolidations”. In: *Journal of International Economics* 112, pp. 238–250.
- Fernandez, R. and D. Kaaret (1992). “Bank Heterogeneity, Reputation, and Debt Renegotiation”. In: *International Economic Review* 33(1), pp. 61–78.
- Fernandez, R. and A. Martin (2015). “The Long and the Short of It: Sovereign Debt Crises and Debt Maturity”. In: *NBER Working Paper No. 20786*.
- Fernandez, R. and R. W. Rosenthal (1990). “Strategic Models of Sovereign-Debt Renegotiations”. In: *Review of Economic Studies* 57(3), pp. 331–349.
- Ferry, M. (2015). “The Carrot and Stick Approach to Debt Relief: Overcoming Moral Hazard”. In: *DIAL Working Paper*.
- Ferry, M., M. Raffinot, and B. Venet (2016). “Low Income countries and External Public Financing: Does debt relief Change Anything?” In: *DIAL Working Paper*.
- Forni, L, G. Palomba, J. Pereira, and C. Richmond (2016). “Sovereign Debt Restructuring and Growth”. In: *IMF Working Paper 16/147*.
- Froot, K.A. (1989). “Buybacks, Exit Bonds, and the Optimality of Debt and Liquidity Relief”. In: *International Economic Review* 30, pp. 49–70.
- Fuentes, M. and D. Saravia (2010). “Sovereign defaulters: Do international capital markets punish them?” In: *Journal of Development Economics* 91(2), pp. 336–347.
- Fuest, C., F. Heinemann, and C. Schroeder (2014). “A viable insolvency procedure for sovereigns (VIPS) in the euro area”. In: *ZEW Discussion Paper No. 14-053*.
- Gabriele, C., A. Erce, M. Athanasopoulou, and J. Rojas (2017). “Debt Stocks Meet Gross Financing Needs: A Flow Perspective into Sustainability”. In: *ESM Working Paper Series* 24.
- Ganelli, G. and J. Tervala (2016). “The Welfare Multiplier of Public Infrastructure Investment”. In: *IMF Working Paper, No. 16/40*.
- Geginat, C. and A. Kraay (2012). “Does IDA Engage in Defensive Lending?” In: *Review of Economics and Institutions*.
- Gianviti, F., A. O. Krueger, J. Pisani-Ferry, A. Sapir, and J. Von Hagen (2010). “A European mechanism for sovereign debt crisis resolution: a proposal”. In: *Bruegel Blueprint Series* 10.

- Goretti, M. and M. Souto (2013). “Macro-Financial Implications of Corporate (De)Leveraging in the Euro Area Periphery”. In: *IMF WP/13/154*.
- Gourinchas, P. O. and M. Obstfeld (2012). “Stories of the Twentieth Century for the Twenty-First”. In: *American Economic Journal: Macroeconomics*.
- Guerguil, M., P. Mandon, and R. Tapsoba (2017). “Flexible fiscal rules and countercyclical fiscal policy”. In: *Journal of Macroeconomics* 52, pp. 189–220.
- Guzman, M. and D. Heymann (2015). “The IMF Debt Sustainability Analysis: Issues and Problems”. In: *Journal of Globalization and Development* 6(2), pp. 387–404.
- Haitas, D. (2016). “The Greek pension system: difficult road to reform”. In: *Public Goods and Governance* 1(2).
- Haldane, A. G., A. Penalver, V. Saporta, and H. Song-Shin (2005). “Analytics of sovereign debt restructuring”. In: *Journal of International Economics* 65(2), pp. 315–333.
- Hallerberg, M. and R. Strauch (2002). “On the Cyclicity of Public Finances in Europe”. In: *Empirica* 29, pp. 183–207.
- Hatchondo, J. C., L. Martinez, and C.S. Padilla (2016). “Debt Dilution and Sovereign Default Risk”. In: *Journal of Political Economy* 124(5).
- Hausmann, R. and U. Panizza (2003). “On the determinants of the Original Sin: an empirical investigation”. In: *Journal of International Money and Finance* 22, pp. 957–990.
- Heinemann, F. (2006). “Factor mobility, government debt and the decline in public investment”. In: *International Economics and Economic Policy* 3, 11–26.
- Heinemann, F., C. Fuest, and C. Schroeder (2016). “Reformen für mehr fiskalische Eigenverantwortung der Euro-Staaten-Das Potenzial von Accountability Bonds”. In: *ZEW*.
- Hepp, R. (2005). “Can Debt Relief Buy Growth?” In: Available at SSRN: <https://ssrn.com/abstract=819644>.
- Herenkson, M. (1988). *Swedish government growth: A disequilibrium analysis*. J. A. Lybeck and M. Herenkson (eds.), Explaining the growth of government, Amsterdam: North Holland.
- House, B., M. Joy, and N. Sobrinho (2017). “Sovereign Debt Restructurings: The Costs of Delay”. In: *Bank of England Working Paper*.
- ICMA (2013). “ICMA Sovereign Bond Consultation Paper”. In: Available at <http://www.icmagroup.org/assets/documents/Market-Practice/Regulatory-Policy/Sovereign-Debt-Information/ICMA-Sovereign-Bond-Consultation-Paper-79801-5-863-v1-8-161213.pdf>.
- IMF (1989). *World Economic Outlook (1)*. IMF.
- (2006). *Cross-Country Experience with Restructuring of Sovereign Debt and Restoring Debt Sustainability*. IMF.
- (2011). “Greece: Fourth Review Under the Stand-By Arrangement and Request for Modification and Waiver of Applicability of Performance Criteria.” In: *IMF Country Report No. 11/175, July*.
- (2013a). “Greece: First and Second reviews under the extended arrangement under the extended fund facility”. In: *IMF country report No. 13/20, January 2013*.

- IMF (2013b). “Sovereign debt restructuring - recent developments and implications for the fund’s legal and institutional framework”. In: *Technical report, The International Monetary Fund*.
- (2013c). “St. Kitts and Nevis—Fourth Review Under the Stand-By Arrangement, Financing Assurances Review and Request for Waivers of Applicability—Staff Report and Press Release”. In: *IMF Country Report No. 13/42, February 2013*.
- (2014a). *Strengthening the contractual framework to address collective action problems in Sovereign debt restructuring*. IMF.
- (2014b). *The Fund’s Lending Framework and Sovereign Debt - Preliminary Considerations*. IMF.
- (2016). *The Fund’s Lending Framework and Sovereign Debt -Further Considerations- Supplementary Information and Proposed Decision*. IMF.
- (2017). *Debt Relief Under the Heavily Indebted Poor Countries (HIPC) Initiative*. IMF, 3 November.
- Jordá, Ò., M. Schularick, and A. M. Taylor (2014). “Private credit and public debt in financial crises”. In: *FRBSF Economic Letter 7*.
- Juncker, J. C. (2015). *Investment Plan*. Speech at the EIB Conference Investment Plan for Europe.
- Karagol, E. (2005). “A Critical Review of External Debt and Economic Growth Relationship: A Lesson for Indebtedness of Countries”. In: *Ege Akademik Bakis 4*, No. 1-2, pp. 69–78.
- Keman, H. (2010). “Cutting Back Public Investment after 1980: Collateral Damage, Policy Legacies and Political Adjustment”. In: *Journal of Public Policy 30*, 163–182.
- Kirchgassner, G. and W. Pommerehne (1988). *Government spending in federal systems: A comparison between Switzerland and Germany*. in J. A. Lybeck and M. Herenkson (eds.), *Explaining the growth of government*, Amsterdam: North Holland.
- Koeda, J. (2006). “A Debt Overhang Model for Low-Income Countries: Implications for Debt Relief”. In: *IMF WP/06/224*.
- Kroszner, R. S. (1998). “Is it Better to Forgive than to Receive? Repudiation of the Gold Indexation Clause in Long-Term Debt During the Great Depression”. In: *CRSP working papers*.
- Krueger, A. (2002). “A New Approach to Sovereign Debt Restructuring”. In: Speech delivered to the Indian Council for Research on International Economic Relations in Delhi, India December 20, 2001. International Monetary Fund.
<http://www.imf.org/external/np/speeches/2001/122001.htm>.
- Krugman, P. (1988a). “Financing vs Forgiving a Debt Overhang”. In: *Journal of Development Economics 29*(3), pp. 253–268.
- (1988b). “Market-Based Debt Reduction Schemes”. In: *NBER Working Paper 2587*.

- (1989a). “Private Capital Flows to Problem Debtors”. In: *NBER Chapters in: Developing Country Debt and Economic Performance, The International Financial System* 1, pp. 299–330.
- (1989b). “Reducing Developing Countries Debt”. In: *revista de Análisis Económico* 4, pp. 3–18.
- Lamont, O. (1995). “Corporate-Debt Overhang and Macroeconomic Expectations”. In: *The American Economic Review* 85(5), pp. 1106–1117.
- Lei, V., S. Tucker, and F. Vesely (2010). “Forgive or buy back: an experimental study of debt relief”. In: *Review of Economic Design* 14(3), pp. 291–309.
- Levy, Y. E. and U. Panizza (2011). “The Elusive Costs of Sovereign Defaults”. In: *Journal of Development Economics* 94(1), pp. 95–105.
- Lim, R. H., C. Medeiros, and X. Yingbin (2005). “Quantitative Assessments of Sovereign Bond Restructurings”. In: *Unpublished Paper, International Capital Markets Department, International Monetary Fund*.
- Lisandro, A. and D. Ross (2001). “Debt Relief Under the HIPC Initiative: Context and Outlook for Debt Sustainability and Resource Flow”. In: *IMF Working Paper 01/144*.
- Liu, Y. and C. Rosemberg (2013). “Dealing with Private Debt Distress in the Wake of the European Financial Crisis”. In: *IMF WP/13/44*.
- Mallucci, E. (2015). “Domestic Debt and Sovereign Defaults”. In: *Board of Governors of the Federal Reserve System International Finance Discussion Paper 1153*.
- Manasse, P. (2011). “Unilateral restructuring, buybacks, and euro swaps: An example”. In: *VoxEu* 5 February.
- (2012). “Two lessons from the Greek crisis”. In: *VoxEu* 10 March.
- (2015). “Writing Off, Restructuring or Refinancing the Debt? The IMF’s Role in the Greek Debt Crisis”. In: *Quaderni - Working Paper DSE N° 1042*.
- Manasse, P. and N. Roubini (2009). “‘Rules of thumb’ for sovereign debt crises”. In: *Journal of International Economics* 78(2), pp. 192–205.
- Marchesi, S. and T. Masi (2017). “Life after default: Private vs. official sovereign debt restructurings”. In: *DEMS Working Paper Series* 370.
- Marchesi, S. and A. Missale (2013). “Did High Debts Distort Loan and Grant Allocation to IDA Countries?” In: *World Development* 2894.
- Marchesi, S. and J. Thomas (1999). “IMF Conditionality as a Screening Device”. In: *Economic Journal, Royal Economic Society* 109(454), pp. C111–25.
- Martin, P. and T. Philippon (2017). “Inspecting the mechanism: leverage and the Great Recession in the Eurozone”. In: *American Economic Review* 107(7), pp. 1904–37.
- Martinelli, T. (2016). “Euro CAC and the existing rules on sovereign debt restructuring in the Euro area : an appraisal four years after the Greek debt swap”. In: *ADEMU Working Paper 2016/043*.

- Martinez, J. V. and G. Sandleris (2011). "Is It Punishment? Sovereign Defaults and the Decline in Trade". In: *Journal of International Money and Finance* 30(6), 909–930.
- Medeiros, C., M. Polan, and P. Ramlogan (2007). "A Primer on Sovereign Debt Buybacks and Swaps". In: *IMF WP/07/58*.
- Mendoza, E. G. and V. Z. Yue (2012). "A General Equilibrium Model of Sovereign Default and Business Cycles". In: *Quarterly Journal of Economics* 127(2), pp. 889–946.
- Mody, A. and D. Saravia (2006). "Catalysing Private Capital Flows: Do IMF-Supported programs Work as Commitment Devices?" In: *The Economic Journal* 116, pp. 843–867.
- Moody's (2016). "Sovereign Default and Recovery Rates, 1983-2016". In: *Moody's investors service*.
- Mrad, A. (2016). *From the lost to the second generation collective action clauses: is the inclusion of no-action clause the next step forward?* Available at:
<http://www.eptalex.com/wp-content/uploads/2016/12/CACs-Anthony-Mrad.pdf>.
- Muller, A., K. Storesletten, and F. Zilibotti (2015). "Sovereign Debt and Structural Reforms". In: *CEPR Discussion Papers 10588*.
- Myers, S. C. (1977). "Determinants of Corporate Borrowing". In: *Journal of Financial Economics* 5, pp. 147–175.
- Nickell, S. J. (1981). "Biases in dynamic models with fixed effects". In: *Econometrica* 49(6), pp. 1417–1426.
- Obstfeld, M. and K. Rogoff (1996). *Foundations of International Macroeconomics*. Cambridge, MA: MIT Press.
- OECD (2016a). "Can an increase in public investment sustainably lift economic growth?" In: *OECD Economics Department Working Paper No. 1351*.
- (2016b). "The positive effect of public investment on potential growth". In: *OECD Economics Department Working Paper*.
- (2016c). "What is the scope for public investment to lift long-term growth?" In: *OECD blog*.
- Oxley, H. and J.P. Martin (1991). "Controlling Government Spending and Deficits: Trends in the 1980s and Prospects for the 1990s". In: *OECD Economic Studies* 17, pp. 145–189.
- Panizza, U. and A. F. Presbitero (2013). "Public debt and economic growth in advanced economies: a survey". In: *Swiss Journal of Economics and Statistics* 149(2), 175–204.
- Paris, P. and C. Wyplosz (2014). "PADRE-Politically Acceptable Debt Restructuring in the Eurozone". In: *Geneva Reports on the World Economy Special Report 3, International Center for Monteray and Banking Studies*.
- Pattillo, C., H. Poirson, and L. Ricci (2011). "External Debt and Growth". In: *Review of Economics and Institutions* 2(3).
- Prokop, J. (2012). "Bargaining over debt rescheduling". In: *MPRA Paper No. 44315*.
- Reinhart, C. and K. S. Rogoff (2011a). "A Decade of Debt". In: *NBER Working Papers*.

- (2011b). “The Forgotten History of Domestic Debt”. In: *Economic Journal* 121(552), pp. 319–350.
- Reinhart, C. M. and K. S. Rogoff (2004). “Serial Default and the ‘Paradox’ of Rich-to-Poor Capital Flows”. In: *American Economic Review* 94(2), pp. 53–58.
- (2009). *This Time is Different: Eight Centuries of Financial Folly*. Princeton, New Jersey: Princeton University Press.
- (2010). “Growth in a Time of Debt”. In: *American Economic Review* 100(2), pp. 573–578.
- Reinhart, C. M and C. Trebesch (2014). “A Distant Mirror of Debt, Default, and Relief”. In: *NBER Working Paper No. 20577*.
- (2016). “Sovereign Debt Relief and its Aftermath”. In: *Journal of European Economic Association* 14(1), pp. 175–214.
- Reinhart, C. M., V. R. Reinhart, and K. S. Rogoff (2012). “Public Debt Overhangs: Advanced Economies Episodes since 1800”. In: *Journal of Economic Perspectives* 26(3), pp. 69–86.
- Roodman, D. (2009). “How to Do xtabond2: An Introduction to Difference and System GMM in Stata”. In: *Stata Journal* 9(1), pp. 86–136.
- Rose, A. K. (2005). “One Reason Countries Pay their Debts: Renegotiation and International Trade”. In: *Journal of Development Economics* 77(1), pp. 189–206.
- Roubini, N. and Sachs J. (1989). “Government Spending and Budget Deficits in the Industrial Countries”. In: *Economic Policy* 8, pp. 99–132.
- Sachs, J. (1989). “Conditionality, Debt Relief, and the Developing Country Debt Crisis”. In: *Developing Country Debt and Economic Performance* 1, pp. 255–296.
- Sachs, J and D. Cohen (1982). “LDC borrowing with default risk”. In: *NBER Working Paper No. 925*.
- Sandleris, G. (2016). “The Costs of Sovereign Defaults: Theory and Empirical Evidence”. In: *Economia* 16(2), pp. 1–27.
- Sandri, D. (2015). “Dealing with Systemic Sovereign Debt Crises: Fiscal Consolidation, Bail-ins or Official Transfer?” In: *IMF WP/15/223*.
- Schadler, S. (2016). “Living with Rules: The IMF’s Exceptional Access Framework and the 2010 Stand-By Arrangement with Greece”. In: *IEO Background Paper -Independent Evaluation Office of the International Monetary Fund*.
- Schmitt-Grohe, S., M. Uribe, and M. Woodford (2016). *International Macroeconomics*. Columbia University.
- Sorensen, R. J. (1988). *The growth of public spending in Norway 1865-1985*. in J. A. Lybeck and M. Herenkson (eds.), *Explaining the growth of government*, Amsterdam: North Holland.
- Spencer, R. W. and W. P. Yohe (1970). “The ‘crowding out’ of private expenditures by fiscal policy actions”. In: *Federal Reserve Bank of St. Louis Review*.
- S&P’s (2006). *Sovereign Defaults and Rating Transition Data: 2006 Update*. Available at <http://www2.standardandpoors.com>.

- Stolper, A.E. and S. Dougherty (2017). “Collective action clauses: how the Argentina litigation changed the sovereign debt markets”. In: *Capital Markets Law Journal* 12(2), pp. 239–252.
- Strickland, T. (2014). “Sovereign debt restructuring: recent issues and reforms”. In: *Reserve bank of Australia, December Quarter 2014 Bulletin*.
- Sturm, J.E. (2001). “Determinants of public capital spending in less-developed countries”. In: *Groningen: CCSO Working Paper 2001/7*.
- Sturzenegger, F. and J. Zettelmeyer (2006). *Debt Defaults and Lessons from a Decade of Crises*. The MIT Press, Cambridge.
- (2008). “Haircuts: Estimating Investor Losses in Sovereign Debt Restructurings, 1998–2005”. In: *Journal of International Money and Finance* 27(5), pp. 780–805.
- Tirole, J. (2015). “Country Solidarity in Sovereign Crises”. In: *American Economic Review* 105(8), pp. 2333–2363.
- Tomz, M. and M.L.J. Wright (2013). “Empirical Research on Sovereign Debt and Default”. In: *Annual Review of Economics* 5, pp. 247–272.
- Trebesch, C. and M. Zabel (2016). “The Output Costs of Hard and Soft Sovereign Default”. In: *European Economic Review* 92, pp. 416–432.
- Turrini, A. (2004). *Public investment and the EU fiscal framework*. (European Economy - Economic Paper No. 202). Directorate General Economic and Monetary Affairs (DG ECFIN), European Commission.
- United Nations (2017). “Sovereign Debt Restructuring: Further Improvements in the market-based approach”. In: *United Nations, Technical Study Group Report*.
- Valila, T. and A. Mehrotra (2005). *Evolution and Determinants of Public Investment in Europe*. European, Investment Bank - Economic, and Financial Report 2005/01.
- Vanlaer, W., W. Marneffe, L. Vereeck, and J. Vanoverveldt (2015). “Does debt predict growth? An empirical analysis of the relationship between total debt and economic output”. In: *European Journal of Government and Economics* 4(2), pp. 79–103.
- Weber, A., J. Ulbrich, and K. Wendorff (2011). “Safeguarding financial market stability, strengthening investor responsibility, protecting taxpayers: a proposal to reinforce the European Stability Mechanism through supplementary bond issuance terms”. In: *Deutsche Bundesbank*.
- World Bank (1998). *Global Development Finance 1998, Analysis and Summary Tables*. Columbia University.
- Yue, V. Z. (2010). “Sovereign Default and Debt Renegotiation”. In: *Journal of International Economics* 80(2), pp. 176–187.
- Zettelmeyer, J., C. Trebesch, and M. Gulati (2013). “The Greek debt restructuring: an autopsy”. In: *Economic Policy CEPR* 28(75), pp. 513–563.