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Restructuring Sovereign Debt Through Buybacks: Official Intervention and Debt Price Effects

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Alla mia famiglia

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RESTRUCTURING SOVEREIGN DEBT THROUGH BUYBACKS: OFFICIAL INTERVENTION AND DEBT PRICE EFFECTS

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Abstract

The paper analyzes the effects on debt price of sovereign buybacks. Different ways of financing these restructuring operations are taken into account in a theoretical model, including official intervention through concessional or nonconcessional loans. Price effects are then tested empirically in real cases and with an econometric model. Finally, the discussion includes a discussion about an hypothetical case of debt buyback by the Italian government in order to make its debt burden more sustainable and to restore credibility on financial markets.

SOVEREIGN DEBT; DEBT OVERHANG; DEBT PRICE; OFFICIAL INTERVENTION;

Contents

1 Introduction

The 3rd December 2012 Greek government announced the buyback operation using a 30 year loan by EFSF. It has been the first remarkable debt buyback episode for a developed country included in the monetary union. The prevention of a euro breakup was conditional on the success of the operation which leads to lower country risk by partially restoring creditworthiness. However, a debtor country faces incentive problems when it repurchases its own debt. Thus, an official intervention is boosted by creditors damaged by "debt overhang".

Looking specifically at the operation process, bondholders want to be remunerated in order to sell their bonds and usually ask for an higher price. The upward trend of the secondary market price of debt forces the country to spend more resources in order to restore its ability to repay obligations. Nevertheless, positive price variation does not always happen. Once announced the operation, there are issues related to the way of financing and the size which affect sovereign debtors.

The paper aims at investigating the price effect implied by buybacks, taking into account the different ways they could take place and focusing on the consequences of an official intervention. The next chapter is an historical analysis of country risk, recalling debt crises of South American countries in 1980s and the present European sovereign crisis affecting PIGS. The literature review explains the incentive problems related to sovereign debt and the approach of official institutions. The fourth chapter deals with buyback models from Krugman (1988) to Baglioni (2013), showing their main findings. Starting from Baglioni (2013), the fifth chapter explains the price effect of buybacks in a two period model with a certain probability of partial repayments and differentiate results depending on how operations are financed and on the seniority structure of official loans. A quantitative reason for an official intervention is also analytically explained through the model constructed by Bulow and Rogoff (1991). Then, the empirical evidence from real past cases (Bolivia and Mexico) to more recent ones (Greece) is discussed together with econometric regressions testing price variations by controlling for macroeconomic fundamentals and multilateral loans. Before concluding, I offer possible perspectives for Italy, questioning whether a debt repurchase could be more likely to happen in the future, the optimal time, size and the way of financing. Since Italy has to comply with European Union constraints, the framework is completely different with respect to other parts of the world where debt crises can be solved through money printing in order to repurchase debt, as it happened recently in Japan.

2 Country risk: from South America to Europe

Sovereign debt is part of the overall evaluation of country risk. The riskiness of a country is clearly assumed to be a key factor in asset management decisions since even retail investors and not only financial intermediaries started to put money in sovereign bonds with maturity of 5,10, 30 years. It is nowadays a crucial regressor for the computation of the asset's expected rate of return in multifactor models together with liquidity risk, business risk, financial risk and exchange rate risk. Business risk is characterized by uncertainty of income flows caused by the nature of a business, operating leverage and sales volatility. Financial risk embodies usage of debt financing, interest payments on debt, risk premia. Liquidity risk concerns the secondary market for an investment and exchange rate risk deals with returns' uncertainty introduced by acquisition of securities in a currency different from the one of the investor. For example, a retail European investor putting money in Euro area sovereign debt instruments is not hedged against this risk. Finally, country risk embodies both political and economic factors. Political risk deals with expropriation and nationalization, taxes and regulation, exchange rate controls, corruption indexes and legal inefficiencies, ethnic violence, political unrest, terrorism, home country restrictions, reputation of contracts. Economic risk is instead focused on the central idea of this work, sovereign debt and its level, the need for restructuring it as solution to a debt crisis and the risk premium attached to the country (the magic word "spread" which is nothing else than the difference between government bonds' yield to maturity of one country with respect to the ones of a country chosen as a benchmark and with almost no risk attached).

Sovereign debt is different from corporate debt. This feature is due to commitment problems: a company not satisfying obligations could be forced to pay back its debts by courts. As far as sovereign debt is concerned, countries have been protected by sovereign immunity which subordinates any legal action in front of courts on the approval of the debtor country. Since 1920s, legal protections have been constantly reduced due to moral hazard problems of countries, more willing to declare default without facing any legal consequences and enforcement (Panizza et al., 2009). The default incentive increased over time together with the percentage of debt held by foreign investors. Diamond (1965) introduced government debt applied to OLG model with production, differentiating between internal and external debt and underlining the disutility from having debt held by foreigners due to repayments flowing away from country's borders. In order to repay debtholders abroad, countries tax citizens and other domestic actors to obtain resources for making repayment effective, allowing benefits to leave the country and to increase welfare of investors abroad. Thus, "debt overhang" means that a debtor country facing a solvency problem has no incentive to undertake structural

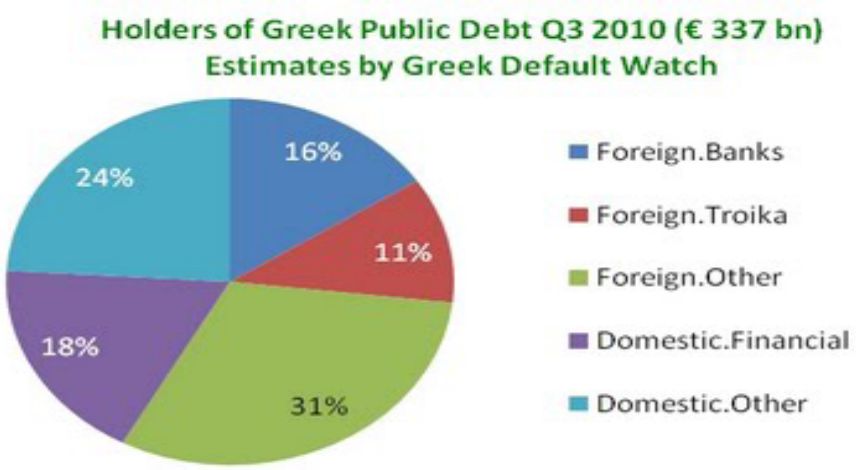
reforms or to increase fiscal burden on its own citizens because benefits fly away to foreign creditors' advantage; it seems more convenient to default on all or part of the outstanding debt. Researchers identify even a debt Laffer curve similar to the normal Laffer curve concerning taxes. As Laffer curve explains the relationship between tax rate and government revenues, upward sloping in the first part, downward sloping once overcome a fixed tax rate, the debt Laffer curve represents the correlation between debt stocks and expected repayments. For low levels of debt stock, the correlation is increasing with a decreasing trend while for higher stocks, expected payments decrease. The "debt overhang" problem becomes clear in the downward sloping part of the relation. Sovereign debt crisis arose during the 1980s in developing countries. Following the boom in oil prices, OPEC (association of countries exporting oil) members accumulated resources and invested them by making loans to International banks in form of US dollar deposits in order to be fully hedged against exchange risk. Banks then lent petrodollars to developing countries which became soon unable to pay back their obligations due to real rate of inflation, recession of the global economy, strength of US dollar and relative low price of commodities. Finally, the low demand for exports made them unable to repay their borrowings; in fact, through production levels, developing countries wanted to offset the US dollar purchasing power which made loans more expensive. Thus, liability went up and exports collapsed, thereby leading the market to attach default risk to sovereign debt of these countries. In 1982, Mexico announced the request for restructuring its debt and the first attempt made to solve the crisis was the concerted lending. Through this method, adopted even by Brazil government in 1983, debtor countries were willing to reschedule principal repayments. Creditors provided new loans to the debtor considered illiquid (not insolvent), thereby obtaining the repayments of interests on existing debt through revenues guaranteed by the new loans. Banks did not trust the method giving room to official institution loans. Troubles were solved by the Baker plan. The plan dealt with 15 principal middle-income debtor countries and was focused on the financing support from the World Bank and continuous lending from commercial banks before the Glass Steagal Act abolishment which made a distinction between commercial and investment credit institutions. Mexico started a huge devaluation of its currency in order to restore competitiveness, reduced government deficits and made use of Brady bonds from 1990. These financial instruments were more marketable and liquid with particular collateral characteristics. They were issued by debtor countries in exchange for commercial bank loans. Creditors (banks) could choose either to exit from the deal, decreasing their exposure and suffering losses given by a discount factor or to stay in the transaction, thereby achieving a capital gain in the future. From that moment, Mexico had an higher probability to pay back debt and less probability to default. Once creditors chose to inject new money to debtor

countries, they could either buy "par bonds" issued to the same value as the original loans but with a lower interest rate or "discount bonds" issued at discount with respect to the original loan with interest rate equal to the market interest rate. The innovative aspect of the agreement between creditors (banks) and debtors (countries) was also focused on collateral (usually the first coupon and the principal). Bulow and Rogoff (1989) together with Sachs (1988) reported even the Bolivian buyback with its effect on market value and outstanding debt's face value. Through the repurchase of its own bonds, Bolivia reduced the face value of its liabilities while the market value improved, thus benefiting creditors who were paid more than expected. Different buyback possibilities could lead to different results explained in next chapters, making use of models assuming repurchases based on debtor country's reserves or on agreements with official institutions (International Monetary Fund). The outcomes could be either a zero-sum game with someone losing and some others winning or a game where efficiency gains lies on both sides. Other remedies are debt-equity swaps. In this case a debtor country converts one kind of obligation (debt) into equity. So the swap is a restructuring deal where the equity investment will generate delayed cash flows available for creditors, usually foreign ones. On the other hand, redeeming external debt for local currency invested in domestic assets by issuing new currency will generate inflation; thus, a country has an incentive to issue domestic government debt, though negative aspects related to local interest rates (Krugman, 1988). The market trust is a fundamental issue in restructuring deals, as it was clear from the Mexican experience in February 1988. Mexico tried to reduce its debt for a substantial amount but the deal was signed by few investors for a smaller amount, thereby lowering the secondary market price of debt.

Until the 2008 financial crisis, sovereign risk has been considered an exclusive issue concerning developing and poor income countries. Nevertheless, from that moment on, Europe was identified as one further breeding-ground. Banks started to issue bonds denominated in euro attaching almost no default risk to all these financial instruments from Greek to German ones. Then, the market perceived it was not possible anymore because some countries embodied higher risk dependent on sovereign itself and efficacy of its own policies (Draghi, lectio magistralis, 6th May 2013). These countries registered high levels of government debt and low GDP growth: they have been called PIGS (Portugal, Italy, Greece and Spain). In this context, Greece seemed to be the most difficult case to be solved in order to avoid a euro breakup. Restructuring sovereign debt was one of the possible solutions in order to prevent a default. In 2012, the Greek government announced the buyback operation, boosted by the European Financial Stability Facility with a 30 year loan. Greek government has repurchased outstanding government bonds and has reduced the face value of its debt at convenient rates. In fact,

the amount needed to buy back outstanding bonds has been guaranteed by an official institution providing favorable interest rates with respect to country risk observed on the secondary market.

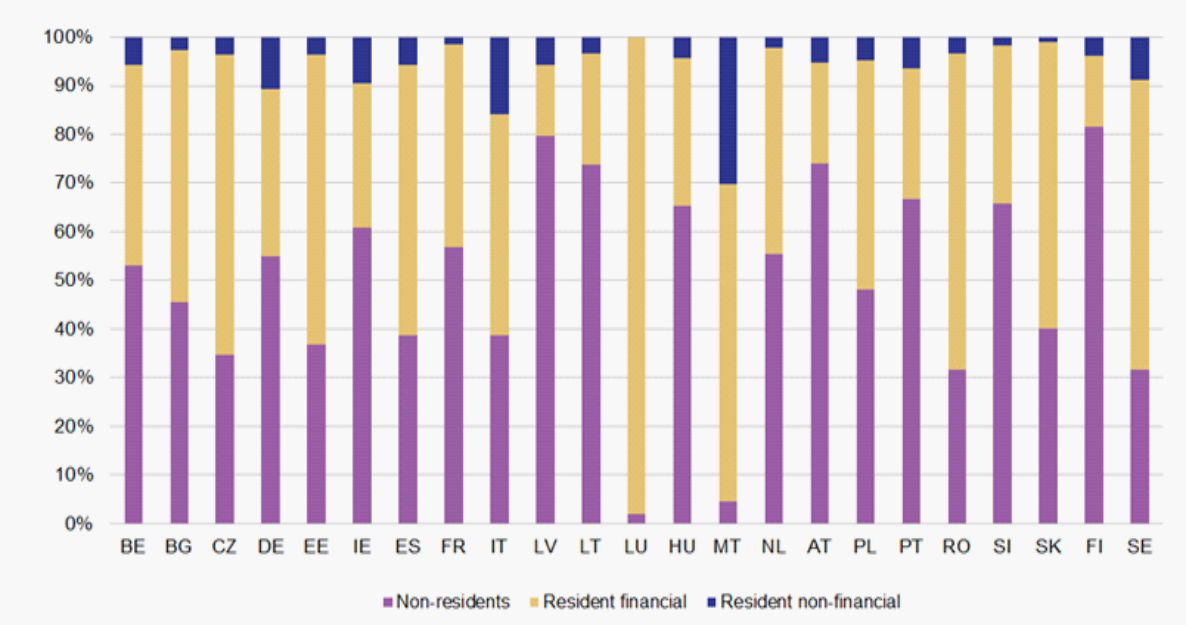
Figure 1. Greek debt by debtholders in the last four months of year 2010.



From: www.greekdefaultwatch.com

In two graphs I resume the situation of public debt by holders in Greece (figure 1) and other 23 European countries (figure 2 from Eurostat). Figure 1 illustrates the five component of Greek debt. It can be inferred that foreigners held more than 50% of public debt in 2010. Thus, the "debt overhang" is strong because, in order to repay debtholders, Greek government may increase the fiscal burden on domestic people who hold only a quarter of the cake (excluding domestic financial institutions), thereby leading benefits to flow away from the country. In a context of unique currency, this negative incentive could provoke negative spillovers but it is prevented by an 11% held by *troika*, triumvirate including European Union Commission, European Central Bank and International Monetary Fund. These official institutions guarantee other creditors by giving financial support to debtor country conditional on the application of reforms centered on austere principles. Exploiting figure 2, future scenarios for other PIGS countries could be analyzed. For what concerns debtholders, Portuguese situation (PT) is very similar to the Greek. As reported by Eurostat, in 2011 foreign holders registered a percentage of public debt close to 70%, thus implying a difficult process of debt restructuring due to foreign creditors' bargaining power and high incentives to default. On the other hand, Italy (IT) and Spain (ES) could be more aligned with EU parameters and requirements given the relatively low percentage of foreign debtholders (close to 40%).

Figure 2. Eurostat(2012).
Government debt in 23 EU countries by debtholders, year 2011.



In order to complete the brief overview of the European sovereign debt problem, I report two graphs regarding marketable government debt amount and debt over GDP ratios.

Figure 3. Marketable public debt; outstanding stocks in USD (2010).

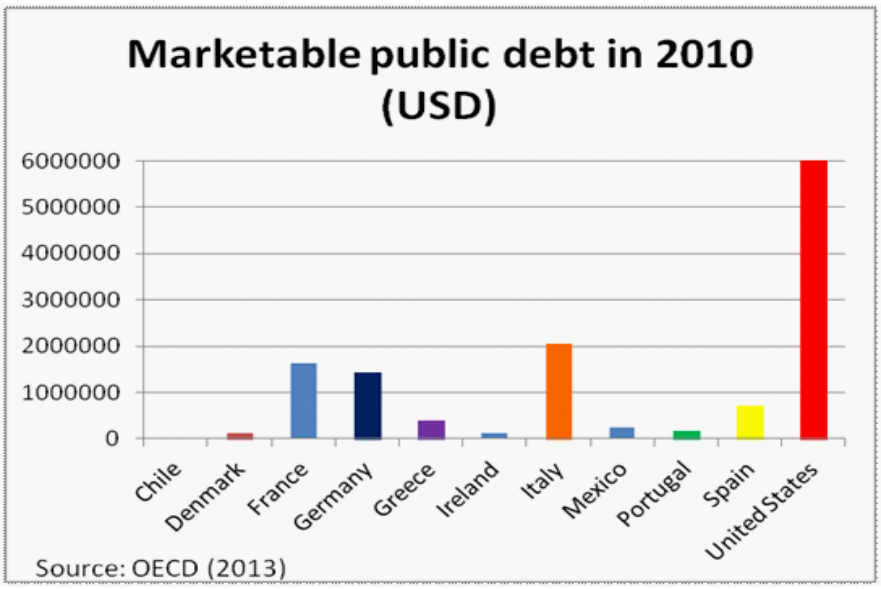


Figure 4. Debt over GDP ratio (government debt % of GDP, 2010).

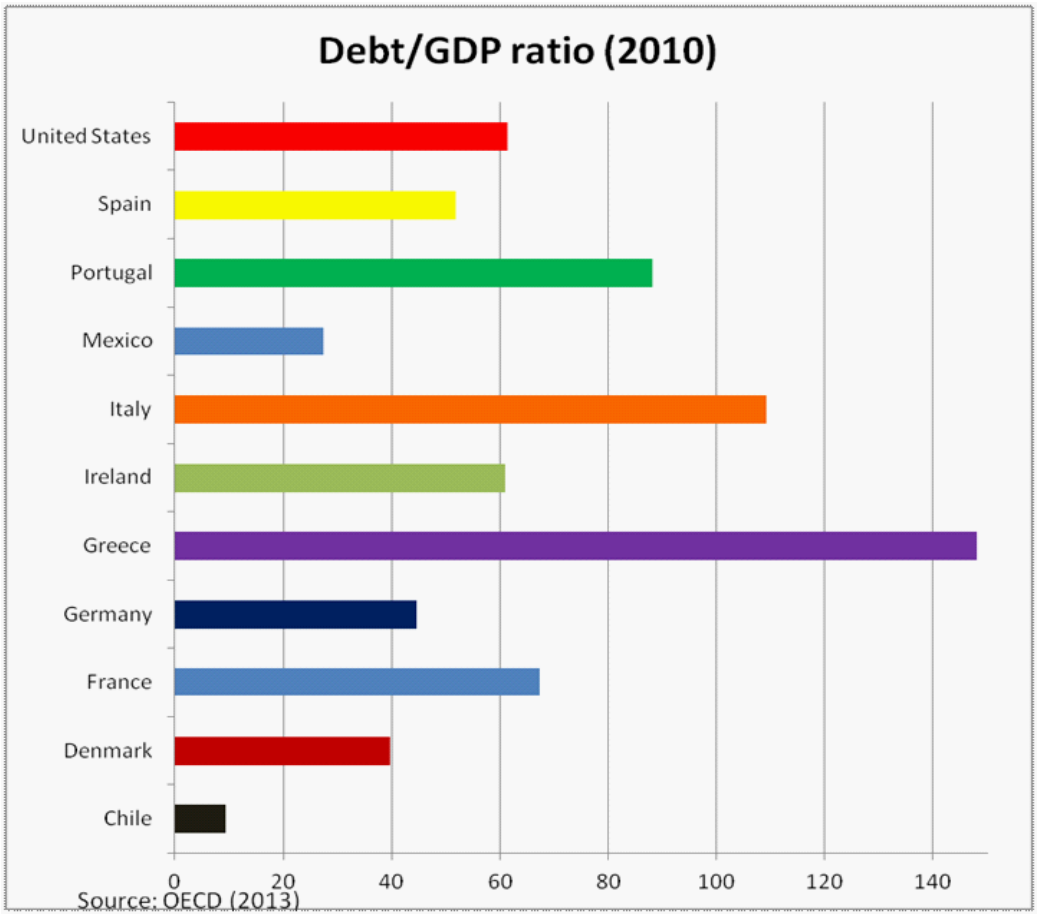


Figure 3 represents the amount of marketable debt. Within the sample, Italy has the second highest amount of marketable public debt and the first at EU level. However, the statistic is in absolute levels and makes comparisons difficult. Figure 4 could better explain the problem of debt and its sustainability because it considers debt compared to country's growth in national wealth. Here it is evident that US have a level of debt compared to GDP more sustainable than Greece, for example. Except for Spain, the highest level of public debt with respect to GDP are registered for Italy and Portugal, thus leading to worrying conclusions. As many analysts, politicians and economists have underlined since ten years, Italy is affected at the same time by low growth and high public debt. Greece has not an high debt in absolute level but its slow growth makes it unsustainable. The same chain of reasoning could be applied to Portugal.
This chapter has been a sort of brief review of basic concepts which will be recalled in this work. It was centered even on a historical review of the sovereign risk and debt

crises which shifted from Latin America to Europe in less than 30 years. Literature on European debt crises is going to develop quickly; Greece has been already considered as a case study in order to analytically construct efficient models for restructuring debt operations (Baglioni, 2013). The paper will be based even on this recent work and will extend the model, concluding buyback price effects are not always univocal. Even empirical evidence will be furnished through descriptive and econometric analysis.

3 Sovereign debt in the literature

It is possible now to briefly review the existing literature on sovereign debt restructuring, deepening into commitment, reasons for a sovereign debt market to exist and incentive problems related to repayment adding also findings on politics of default. Debt overhang and debt Laffer curve are treated while at the end the operations available to reduce debt burden are analyzed, opening the way to the third chapter based on buyback operations, one of the different possibilities to repay creditors of countries in trouble.

Panizza et al. (2009) introduced their treaty on the law and economics of sovereign debt defaults underlining quite big differences with corporate debt. First of all, a country can decide to not repay its debt, opposite to companies and firms that could be brought in front of courts and could be forced to pay back through liquidation procedure or by selling their assets. Actually, countries are more protected than firms by laws and practical reasons. The latter is related to the delivery of assets to internal creditors; in fact, it is not credible that in default state, the country hands over assets to internal creditors before paying the external ones. Sovereign debtors have been protected by sovereign immunity, so that they could not be brought in front of courts without their acceptance. This principle decreased over time because a market for sovereign debt developed and opened to retail investors. The lack of collateral to guarantee the value of the loan is the last but not least motive (Eaton & Fernandez, 1995). Given the problems above, it is hard to explain why a market for countries' debt has developed in a context where the debtor side wants to avoid sanctions and obtain reward if it repays. Since creditors have a reduced bargaining power with respect to the debtor, it seems not convenient for an investor to put money into something that will not be remunerated when a period of recession arises. Nevertheless, creditors must pose a credible threat based on the exclusion from future access to credit market. The result is that a sovereign debt market exists until the lost access to capital markets in case of default is huge. There are other reasons why a debtor country has an incentive to repay its debt. First of all, direct punishment on trade; then, the lost opportunity to invest abroad for a country that previously declared a default. Even financial institutions have an incentive to not pay countries due to their previous default. This leads to a two side commitment problem, a sort of vicious circle based on the condition that whether a country is insolvent, country's debtors will be also insolvent with respect to their obligations with it. The last incentive for a debtor country to repay its obligations concerns the "collateral damages" on its economy. This theory is centered on the higher and bad reputation effects on the borrower. Other agents beyond creditors could change their opinions about the country, leading to wide mistrust reflected upon

risk premia in the long run. Recent models explain also the domestic effects of default decisions, underlining either impossibility or reduced possibility for domestic private agents to buy raw materials because of some conditions imposed by debtor country. This inefficiencies lead to higher costs of default for the private sector and explain partially why sovereign spreads increase when GDP growth is low or even negative.
In general, a country defaults when strict international finance conditions apply due to borrowing's expensiveness which makes the utility from borrowing less than the utility from defaulting. Negative output shocks are another reason for a default to happen because countries typically borrow in bad state of the world; repeated bad states lead the country in the long run to declare default. Nevertheless, a procyclical approach is suggested by the literature, accumulating resources during good times and using them during recessions (Gavin & Perotti, 1997). The explained "overborrowing" increases moral hazard and the possibility either to declare default, above all when the percentage of debt held by foreign creditors increases, or to be bailed out by official institutions (IMF and World Bank). Cline (1984) and McFadden et al. (1985) showed the probability of default is positively correlated with the amount of short-term debt, more fluctuations in output, unstable institutions and negatively with GDP growth. It is interesting to underline even the positive correlation with previous defaults because there are in some sense economies of scale that markets are able to discount; *default-friendly* countries know how they can manage a default, a sort of *know-how* in defaulting. Thus, default could lead the country to be excluded from capital markets, could increase borrowing costs even for private sector and could lead to sanctions and bad consequences on the domestic economy. Empirical evidence resumed by Panizza et al. (2009) shows evidence solely for what concerns the domestic effects related to output losses and costs to political leadership; in fact, governments- announcing a default will unlikely be re-elected in the following political elections.
The last finding of Panizza et al. (2009) enlarges the debate to politics related to defaulting countries (Hatchondo & Martinez, 2010). A default is declared when debtholders have not sufficient political power anymore: countries are less likely to raise taxes in order to repay claims. The reason is explained by Tabellini (1991) showing that if wealthier and older citizens had more power, it would be possible to prevent a default because rich citizens typically are bondholders while young people are centered on their own income stream and are worried about taxation. In an imperfect information context, foreign lenders are more likely to buy bonds because in lending booms they are attracted by higher bond prices, not knowing the electoral competition inside the country between repaying or not repaying debt. Drazen (1998) finally explains that the issuing of debt is more likely to happen when bargaining power of debtholders is higher; for example they can persuade the country to issue new debt to pay previous expenses.

As far as political turnover is concerned, political stability gives less room for default; in fact, the need for transfer resources to the present is not evident, countries usually borrows less leading to less probability of default. The correlation between political turnover and default risk is achieved when two parties with two different approaches to debt repayment are fighting in the electoral competition, one *creditor-friendly* and one *debtor-friendly*. Crucial and intuitive findings are the following; first, governments want to accumulate debt to affect political elections; secondly, default risk decreases when there is more political stability due to the reduced need for transferring resources to the present thereby increasing debt. A counterintuitive result in Hatchondo et al. (2009) is that default is more likely with political stability. The explanation relies on an opposite reasoning. If a turnover is likely to happen, the government could choose an higher level of required loans closer to default levels; thus creditors want to be remunerated and ask for higher interests. Once the probability of turnover is almost certain, incoming governments do not want to borrow anymore, having a more austere behavior because creditors' requests become very expensive. This paternalistic approach has been in some sense less realistic for example in Italy where public debt increased a lot during the last 50 years with two main political periods: stability until 1993 and more political turnovers since 1994. Tomz and Wright (2007) empirically provide for less correlation between debt crises and low output because defaults happen even when production levels are higher than index levels. Finally, in a context of political turnover, Hatchondo et al. (2009) emphasize that *creditor-friendly* governments pay higher spreads than debtor friendly. Spreads make a difference when there are intermediate debt levels because *creditor-friendly* governments are able to face these amount due to their favorable approach to repayment while *debtor-friendly* at intermediate and high level will surely default. So, when a default does not occur, the creditor friendly government pays more in terms of risk premium.

As far as sovereign risk channel is concerned, Corsetti et al (2012) underline an increase in funding costs of the private sector. This line of research calls for an intervention of the monetary policy in a counterintuitive way; when sovereign risk is higher, a constrained monetary policy and fiscal retrenchment could improve future conditions of the economy in the debtor country. This approach aiming at austerity policies is driven nowadays by European Union, more willing to improve credibility of countries with high public debt. Thus, sovereign risk channel could be solved not only by looser monetary policy but also by a constrained one. Finally, Rijckerghem and Weder (2009) historically analyzed default episodes showing an incentive to not repay debts when they are held by external creditors. This is the incentive problem of debt overhang explained in the previous chapter and it was the main object of attention of many researchers.

Sachs (1988) and Krugman (1988) explains that debt burden is a tax on national wealth because either a country is forced to reduce investments or left with less probability for policy reforms because it finds more convenient to not repay obligations at all; otherwise it has to increase fiscal burden on domestic current generations. Reducing debt is Pareto improvement procedure but incentive problems often overcome efficiency gains (Sachs, 1990). Thus, debt affects investments because more debt in period 1 means that future output is expected to pay back previous claims. So, debt overhang exerts its effect when the utility from repaying the debt together with the costs of acting and applying costly reforms for domestic taxpayers is lower than the utility of not repaying debt and facing sanctions. This incentive could be either avoided or mitigated by defaults' indirect costs: deadweight losses (Eichengreen, 2003). They are not only distortions of government policies provoked by debt obligations but also capital outflows following a default decision.

The study of Cordella et al.(2005) reaffirm that a substantial debt burden is a sort of taxation on country's available resources, thus leading to a reduction on the amount of investment. The main finding of this paper is the counterintuitive, but not unrealistic, differences between poor countries with less incentive to enact policy reforms and countries facing better conditions. Obviously the former borrow less than the latter. When indebtedness becomes a concern for richer countries, they face a so called marginal debt overhang while poor countries will have only an average effect. This means that for rich countries one unit more of debt could lead to a very high disutility while low income countries are less worried about a simple unit more of indebtedness because the negative effects will be exerted on aggregate. Thus, poor countries can face two different equilibria: either choose to not increase debt at all in order to avoid the first marginal effect or, once overcome marginal consequences, issue new debt thereby entering in the irrelevance region where only average effect applies. Countries in good conditions present a large interval of marginal debt overhang and they enter in the irrelevance region at 70-80% of debt over GDP ratio while poor countries enter in this region at 50% of debt over GDP ratio with a smaller interval of marginal debt overhang.

The incentive problems and profitable deviations from optimal behavior faced by the debtor side can be recalled even for creditors. Sachs (1990) points out the free rider problem in concerted procedures of debt reduction. In presence of a huge number of creditors complying with debt reduction scheme providing for partial repayment of all liabilities by the debtor, one or more creditors could find convenient to not adhere to this procedure, looking for full repayment. Instead of collective gains, non-aligned creditors look for personal utilities. Panizza et al. (2009) provide for a solution of the coordination failure negatively affecting both the debtor country with longer renegotiations and the creditor side with a possible loss of bargaining power due to

fragmentation. The remedy is based on issuing new bonds together with collective clauses in order to prevent free-riding.

Fernandez and Ozler (1991) studied a model with two creditors' types: small or large banks. The empirical results demonstrate that large banks have a credible threat with respect to the debtor country and opposed to small financial institutions. So, the price of debt on the secondary market seems to be higher the more is the percentage of debt held by big banks. On the other hand, since big banks have more bargaining power, a risk lover big financial institution acts as a free rider because it can threaten the country boosting full repayment. Thus, the more debt is into the hands of risk lover large banks, the longer and more difficult the renegotiation is. In some sense, this conclusion is realistic considering the European debt crisis enhanced by risk lover behavior of banks following deregulation due to the Glass Steagal Act's abolishment. A lack of correct supervision by national authorities led the EU institutions to implement the banking union in order to shift prudential supervision of banks into the hands of the ECB, thus breaking the link between sovereign risk and the banking system.

The role of official institutions was strengthened with the creation of the European Stability Mechanism substituting the EFSF in order to give financial assistance to EU countries with high risk premia. It will have a huge endowment, will give loans and will purchase government bonds upon request on the primary market conditional on the austere behavior of countries in trouble while the ECB will play an active role with unlimited purchases conditional on actions of debtor countries. This recent reforms of official institutions powers could lead to a critical review of actions undertaken even by International Monetary Fund during previous debt crises. As explained in the previous chapter, part of the debt of Greece is held by official institutions (*troika*) because they act as a sort of safety net. They can enter directly in debt restructuring processes as it happened for buyback operations and can protect creditors from possible incentives to not repay debt by sovereign debtor. In 1980s, the role of official institutions was to provide loans to debtor countries in trouble, allowing also a certain percentage of debt forgiveness, conditional on austere policies enacted by debtors. Thus, the IMF was perceived as a debtor friendly institutions by creditors and from that moment it aimed to be indifferent, acting in the negotiations as a simple creditor of countries (Panizza et al., 2009). Nevertheless, this approach is still far from being reached. The intervention of IMF could often lead to different consequences. First of all, moral hazard by the country; putting things simpler, debtors in trouble know they will be bailed out by IMF. Secondly, expecting a future loan by IMF, even new investors are more willing to lend pretending full repayment. This new loans by the investors provoke a flow of resources to private lenders from citizens who finance repayments through taxation. Eichengreen (2003) proposes tight limits on IMF ability to lend in order to prevent

moral hazard. The uncertainty of a bailout by IMF could fear new potential lenders, stopping the vicious circle and preventing opportunistic behaviors by the country itself. Tight limits were not being enforced effectively; in fact, the commitment to lending limits problem arose. It is never credible that an official institution will stop its loans until other successful remedies are effectively discovered.

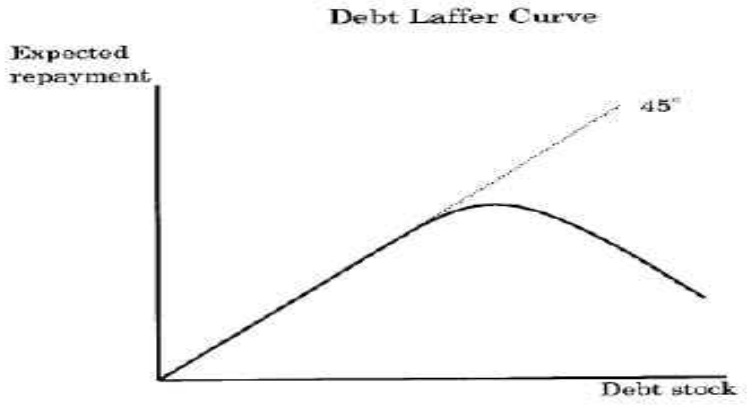
The case study of Greece opened the discussion on whether an official institution's loan could be senior or junior (Baglioni, 2013). Arias and Broner (2001) point out official loans as a good option in a context of debt repurchase . They find convenient for a debtor country to borrow from official institutions with a seniority clause, so that these institutions must be paid back first. Even the bond price will decrease, thus benefiting the debtor in the short run because it pays less. On the other hand, Baglioni (2013) explained the successful buyback of Greece through the junior clause in the loan made by EFSF. Nevertheless, some months after, on the IMF perspective it has been not considered as an optimal clause (confidential document IMF, 6th May 2013). Official institutions can also protect creditors by giving them a stream of payments in the defaulting state.

Rotemberg (1991) critics is based instead on IMF requirements for countries facing a debt crisis. These requests are centered on austerity measures which decrease investments and also the future growth of the country. Instead, Krugman (1988) demonstrated that countries adopting restructuring policies can positively affect investments, thereby making creditors and debtors winners, in opposition to theories based on the assumption that restructuring is a zero-sum game. For this reason, during debt crisis, an official intervention must be taken into account for the stability of the international financial system in order to protect retail and professional investors (banks), for the prevention of free riding by individual creditors deviating from any concerted agreement, for trade interests, contagion fears and effects on the debtor country's politics.

Before dealing with remedies and solutions to prevent the incentive to default, since the 1980s the literature has identified the relation between face value of debt and expected payments, the debt Laffer curve. It is the version of Laffer curve applied to debt repayments. The face value of debt relies on the horizontal axis while on the vertical one there are values for expected repayments. Until a certain debt threshold expressed commonly by D*, creditors will expect full repayments and country will keep its promises by using their available resources. The relation is thus upward sloping while after D* it starts to become a negative relationship. So, a country facing a debt crisis is clearly in the downward sloping side of the curve; this means creditors must allow for some debt forgiveness in order to restore competitiveness of the country and its solvency. For sure, the debt overhang starts when the relation becomes downward sloping and does not follow anymore the 45°line. Claessens (1990) explained the

downward relation applied only for some countries, typically poor income countries of Central and South America (Mexico, Bolivia, Argentina). Fifteen years after, Cordella et al. (2005) showed a completely different situation with many other countries needing debt forgiveness in order to repay creditors. Nowadays, the situation is critical even for Southern European countries. Even US in 2012 started an heated discussion about the simultaneous reduction of public expenditure and increase in taxation in order to avoid the *fiscal cliff* and to restore a sustainable level of public debt.

Figure 5. The debt Laffer curve.



Source: Krugman (1988)

In situation of trouble for the debtor, it is better to forgive part of the debt instead of leading the country to default. Obviously, the single creditor face an incentive problem because he could find profitable to deviate by reasoning in this way: all creditors forgive debt, for me there is a clearer opportunity of being fully repaid. Thus, credit rationing could be an efficient ex ante solution in order to avoid reaching the downward sloping relation (Eaton and Fernandez, 1995). *Ex post* a country could only ask for an agreement with creditors because a default could be discounted by the market which does not trust the country anymore (Ozler, 1993). Thus, it is a matter of forgiving when debtor faces a solvency problem and of postponing when a liquidity problem arises (Krugman, 1990).

The way a country could restructure sovereign debt is the last step of the chapter. According to Eaton and Fernandez (1995), remedies can be differentiated in three cathegories: creditor, debtor and public solutions. First of all, a creditor could enact legal actions in order to force debtor to be declared in default. In this way, creditors try to obtain assets and money as repayment of the obligations. Then, even deadweight

losses concerning future transactions should be taken into account. Expecting an improvement of debtor ability to repay obligations, a creditor could lend new money in order to postpone repayments in the future or, in case of bad news about this ability, he could forgive part of the credits. The last possibility is to boost official institutions to lend additionally to debtor countries, thus avoiding negative spillovers and default costs, both direct and indirect. Linking the creditor initiatives to the debt Laffer curve, the creditor could conveniently refinance debtor with higher repayment rates only when the country is situated in the upward sloping part: the higher the debt, the higher the risk premium attached to it. Forgiveness is instead recommended on the downward sloping side, as explained. Coordination problem and free riding incentives in a multiple creditors context are overcome by participation clauses.

The second classification of restructuring debt remedies is concentrated on voluntary initiatives by debtor countries. Obviously in these class buybacks and debt-equity swaps are included. In a buyback operation it is not granted who is going to gain. As I will explain in the next chapter, in order to compute gains and losses, it is convenient to use a simple model. Given a certain amount of debt outstanding and a certain probability of repaying it (the complement to one of the probability to default), the market value of debt is computed together with the ex ante price of the debt. Then, a certain amount of resources is recalled in order to do the financial operation. The ex post results lead to the conclusion that the ex post price of debt increases due to the expectations of the market who already has discounted the possibility of buyback. Thus, the conclusion is a zero-sum game where debtor countries lose while creditors get money. Nevertheless, researchers have not a unique approach and they also account for other variables such as whether the buyback is leveraged or not (Baglioni, 2013) or whether the operation will affect country's future available resources (Arias & Broner, 2001). Sachs (1988) is instead focused on the economies of scale that these financial operations have; in fact, repurchasing more debt could have more convenience than a small buyback because of some fixed costs that do not depend on the amount rescheduled. On the other hand, some economists affirm the goodness of small buybacks (Rotemberg, 1991). The empirical analysis of Sachs (1988) is centered on classical models that demonstrate the increase in market price of debt following the repurchase. The innovative aspect of his research is based on the fact that buyback operations are not necessarily a game where one party loses and one party gains. Both parties can achieve efficiency gains, reduce bad incentives and participate to the successful outcome. Bulow and Rogoff (1989) critique of Sachs work was based on the lack of consideration of ways in which these operations happen, either through the use of own reserves or through third party financing.

Another debtor side solution is a debt over equity swap where the country simply

exchanges debt for equity in order to postpone some debt repayments, expecting periods of economic growth in the medium-long run when liquidity problems could be solved more easily. These deals are not considered optimal by Krugman (1988) due to some fiscal aspects; the country is in fact offering assets to investors for debt and it must use local currency in order to buy these assets that are in the property of private domestic sector. By coining currency, country must use domestic borrowing in order to avoid inflation. Nevertheless, in a place where sovereign domestic debt is a huge problem, it means high interest rates, thus worsening the situation. Considering the last point, it will not be possible nowadays for a country in the Euro area to issue local currency since the centralization of the monetary policy. An efficient solution could exploit a swap of long term bonds with short term ones, acting as a debt over equity swap but preventing fiscal problems, above all in a context of seniority clauses in favor of new bonds (Arias & Broner, 2001).

The last classification clarified by Eaton and Fernandez (1995) concerns the solutions involving official institutions. They can enter in the negotiations between creditors and sovereign debtor, as it was the case of debt crisis in Mexico with the Brady bonds. Nevertheless, this initiative has some drawbacks dealing with the incentive problems. It is a matter of expectations; creditors expecting an involvement can anticipate this intervention by overlending to the sovereign debtor and being guaranteed by the official institutions. This leads to an inefficient outcome.

Finally, there exists even the possibility for concerted lending solutions exploited at the beginning of the 1980s before Baker and Brady plans. They follow the same rationale of debt swaps: postponing repayments expecting future growth. Liquidity problems are solved by additionally lending to the debtor country with guarantees by official institutions.

Concluding this chapter, the restructuring debt issue is a complex topic involving market failures due to incentive problems likely to happen and that must be solved. If these problems were reduced, it would be possible to restore the creditworthiness of a country, boosting both its domestic and foreign investment levels and its ability to repay its own obligations. Given the updated events in debt crisis literature, this work will now be focused on one of the remedies: buyback operations. In the next chapter models will be resumed in order to pave the way for the construction of a new framework useful for countries dangerously dealing with an high percentage of debt over GDP ratio.

4 Buyback: a way to restructure debt

4.1 The general framework

Now the discussion deals specifically with buybacks. Before building an efficient model, it is better to recall the definition. The buyback is the repurchase of debt issued in the past by the issuer itself. In this case obviously the issuer is the debtor country willing to reduce the face value of its claims. Given the recent events concerning Greece, updated international finance professors demonstrate the effects of buyback on both parties involved, debtors and creditors. An example is meaningful.

Example 1 *A country has outstanding debt of 500 billion € and the probability of full repayment is equal to 50%. In case of default the country will recover only 100 billion. The interest rate is set to 0 for simplicity. The maturity of the debt is 1 year. First of all, the market value of debt can be simply computed: Market value* $= 500 * 0.5 + 100 * 0.5 = 250 + 50 = 300$. *This means that the effective value of the debt in the secondary market is less than the face value reported in the debtor country balance sheets by an amount of 200 billion. The price of a single unit of debt is clearly: Market value / Face value* $= \frac{300}{500}$ *billion € = 0.6. Now it is supposed the country has 200 billion to acquire debt and, given a price of 0.6, the country will acquire 333.33 billion in face value of its previous stock of debt. In this way the new market value of the debt is: New market value* $= (500 - 333.33) * 0.5 + 100 * 0.5 = 133.34$ *billion €. Thus, the new price of the debt is: New market value / new amount of outstanding debt in face value* $= 133.34/(500 - 333.33) = 0.8$. *So the market already discounts the buyback after its announcement. In this way creditors are getting money and debtor country seems to be worse off with respect to the situation before the buyback.*

Simply looking at the example, it seems that this kind of financial transaction between bondholders and debtor country is only a pleasure done to creditors, without any benefit coming to sovereign debtors. Nevertheless, through a deeper analysis of the literature, conclusions are not necessarily unequivocal. The reasons why a country chooses this solution are multiple (Medeiros et al., 2007):

- Reduce service payments on the debt
- Minimize sovereign risk
- Boost domestic capital market
- Strengthen more credible fiscal and monetary policies

- Reduce debt overhang
- Reduce country weaknesses in facing international capital markets
- Reduce risk premia
- Improve rating

As far as sovereign risk is concerned, there are different risks that a buyback could minimize and that deals with portfolio risk of a country (IMF & World Bank, 2003):

- Market risk due to movements in the market prices and exchange rates, the riskiness of short-term obligations with respect to the long term ones.
- Rollover risk when debt is rolled over or could not be reinvested.
- Liquidity risk dealing with the inability to repay debt in a certain period of time

For sure, the country faces a trade-off, considering the standard model in example 1: reduce debt service or reduce sovereign risk. On the other hand, the consequences of a buyback operation depend also on the characteristics of the operation, above all on the way of financing it.
The first experience with these operations have been done with Bolivian case. The Bolivian government repurchased one half of its outstanding debt in 1988. In order for the buyback to successfully meet debtor country's needs, it was financed by a set of countries as "donors" through a transfer equal to the 5% of the gross national product. The outcome was an increase in the market price of debt, a large participation of creditors and efficiency gains for the debtor country which reduced debt overhang, although it faced direct costs due to a more marketable debt.

4.2 Buyback models

Krugman (1988) model is close to example 1's findings. The concept of secondary market price is equal to the ratio between expected payment and debt where the former is approximately equal to the market value of debt while the latter corresponds to the face value of debt. The reduction in the face value overcome the amount available to repurchase debt being debt price between 0 and 1. Since debt reduction is more than money spent, in periods following the buyback operation the country is better off because it will have more resources net of repayments addressed to creditors, obviously in case of good state of the world. Given the assumption of probability of good state of the world increasing with the effort by debtor country,this good state will be more likely to happen because the country has an incentive to put effort and adjust its debt.

Bulow and Rogoff (1988) first of all underline one difference between a corporation and a country reacquiring debts. A corporation uses resources going to creditors in case of default state while a country subtracts resources from investment and consumption. The country maximizes its level of consumption while the market value of debt is the minimum between face value and a percentage of investment levels exploited to repay debt, the minimum between the quantity available respectively in good or bad state of the world.

$$\begin{aligned} v(D) &= \min[D, qI] \\ \text{where } 0 &< q < 1 \end{aligned} \tag{1}$$

Using a certain amount of resources C to repurchase debt, the result is the same of example 1 because those who want to sell must be in the same conditions as those not selling their bonds.

$$\frac{C}{X} = \frac{v(D-X)}{D-X} = P_1 > \frac{v(D)}{D} = P_0 \tag{2}$$

On the other hand, assuming that the other way with respect to investment is holding reserves, the market value of debt takes into account the amount of reserves, being now the minimum between the face value of debt and the sum of investment and reserves multiplied by the fraction of them involved in repaying creditors. In this second case, as these fraction (q) approaches 1, it is better for the debtor country. In fact the debtor find more convenient to use reserves to repay creditors, not having other possibilities than keeping them as reserves. Obviously this second solution seems unrealistic.
The second Bulow and Rogoff (1991) model is based on timing (5 stage), on production technologies and market price of debt together with investor expectations on consumption and investments. The five steps starts with an initial level of debt D_0, an amount X needed to repurchase debt, the buyback operation leaving some resources divided into consumption and investments, an income shock and final resources available after repaying all creditors. In this model the country wants to maximize the resources available in step 5 after repaying creditors given the allocation of resources made in step 3 between investment and consumption. In this way, it is possible to find the optimal level of debt, consumption and investment after the buyback. More clearly:

$$\max_{C,I;X} \left\{ \begin{array}{c} (Y-R) \\ s.t \\ C+I = W' \\ W' = W - X \\ D' = D * (\frac{R'}{X+R'}) \end{array} \right\} \tag{3}$$

where $R\prime$ is equal to expected future repayments, D' represents the debt level after the buyback and W' the *ex post* country wealth.
On the one hand, buyback is a suboptimal solution because it subtract resources that could be available for C and I while on the other hand it can solve debt overhang and incentive problems. Given the assumption of debt being an implicit tax on investments, buyback has a positive effect on them directly proportional to the size of the transaction until consumption is completely crowded out, although the most of gains go to creditors. Finally, referring to Mexican buyback, there is a relation between the probability of repayment (m), the market price of debt (P) and the average implicit tax rate on investment with a default state (q). The condition for buyback profitability of the debtor country:

$$m > \frac{(1-q)}{\frac{1}{(P-q)}} \tag{4}$$

means that since there are three parameters not depending on the change of investments due to debt reduction, one unit more of investments affect only creditors.
With a different approach, Rotemberg (1991) tries to demonstrate that an increase in sovereign debt leads to higher bargaining costs due to the fact that creditors have an incentive to declare more bargaining power by demonstrating their toughness in their willingness to be repaid when debt increases. First of all, it points out a three stage model. In the first period the country faces the decision whether engaging or not in the buyback, the second period involves signaling incentives and in the last period borrower decides to repay or not the creditors by accepting their requests. There are two different types of lenders: soft and tough. The borrower's disutility is given by a function depending on the sum of the amount of resources needed for the buyback (B) the amount of payments made in period 3 (P, in present value), pain suffered by the action of lenders (N) and finally the punishment losses if debtor does not agree with repayments (L).

$$-U = E[B + P + N + L] \tag{5}$$

Obviously pain is a function of efforts posed by the two types of lenders; intuitively, tough lenders (t) can cause more pain to the debtor country. Sovereign debtor must attach beliefs when facing creditors: the probability of a lender being soft (s) is called σ. Thus, the expected loss for the borrower when accepting the lenders' offer is (period 3):

$$\sigma L_s + (1-\sigma)L_t > P \tag{6}$$

holding with equality for the lenders' side.
In period 2, it is a sort of signaling game; when the post buyback debt is less than

the amount of expected payments, no punishment can be enforced by lenders because both soft and tough will receive an amount suboptimal for their expectations. On the other hand, when post buyback debt is more, the country is expected to repay more than expected payments, tough lenders have an incentive to deviate and ask more, thereby obtaining what they ask because recognized as tough. Soft lenders do not find convenient to pretend to be tough in this case because they must implement more efforts. Moreover, even and more importantly in a context of debt repurchase, soft lenders do not want to pretend to be tough because it is less attractive: in fact the face value of debt is reduced and tough lenders diminish their bargaining power in the negotiations by collecting less when the country will repay its claims. The model tries to explain that through a reduction in the face value of debt, it is possible for the country to align the two types of lenders up to a point near to no punishment, thereby lowering bargaining costs. In some sense, the country can benefit from the buyback indirectly through lower bargaining costs, still suffering from an increase in the market price of debt following the transaction, although a price increase is a disutility in real cases only in the short run.

Eaton and Fernandez (1995) set up a model starting from the value that debt has for both creditors and debtors, assuming π as the probability of not default, $1-\pi$ as the probability of default state, and a certain probability of full or partial repayment. Assuming that the buyback is financed by own resources of the debtor, there will be a reduction in future resources. The value of debt for the creditor side is given by the following expression:

$$\pi \int_0^D H dF(H) + [(1 - F(D)] D \tag{7}$$

where $HdF(H)$ indicates what is going to be recovered by creditors in the non default state as partial repayment plus the gain from full repayment (D) when it happens. The value for debtors is instead:

$$\int_0^D H dF(H) + [1 - F(D)] D \tag{8}$$

Given repayments happening, it is the sum of repayments plus the gain from not defaulting and paying all. The price of debt is the expression (7) divided by the face value of debt. Making the derivative of (8) with respect to D, $1 - F(D)$ represents the marginal cost of debt for the debtors equal to the probability of full repayment. Repurchasing debt, as assumed before, could affect future resources, so it is assumed a certain percentage on the price q, called λ, to reduce these future resources. As λ approaches to 1, the country progressively diminishes its expected future payments and this represents a benefit for the country itself and a loss for creditors. As models

analyzed before, this one lacks in considering official loans and allows even for both parties to gain by avoiding default costs (borrower) and by the increase in secondary market price (bondholders).
Prokop and Wang (1997) drew up a model in $N+1$ periods where the initial stock of debt is D_0 and repayment happens in period N. The initial endowment available for repurchase debt is M_0. The borrower maximizes an additional function constituted by production income (Y), endowment (M) in period N, repayments (R) and punishment losses (S) depending on remaining debt similar to the variable L in Rotemberg (1991) model analyzed before:

$$Y + M_N - R - S(D_N - R) \tag{9}$$

The authors differentiate between secret and public buybacks. In the case of secret buyback, the price of debt does not change since investors do not know who is going to do the operation. They demonstrate also that price of debt could increase over time due to a decreasing probability for a lender to sell debt before being repaid. Thus, it is better for the country to buy back debt at the beginning, precisely at time 0. Assuming on the other hand that buyback is public, the investors discount this fact and debt price increases; creditors believes the country in the future will have less debt, thereby spending less resources to repay it and given a certain level of debt reduction[1]. The results in the two cases of secret and public buyback do not change at all: it is always better in a multiperiod model to repurchase in the first period in order to face less costs and having better payback possibilities in the future since delaying buyback implies less reduction in debt which increases from D_0 to $D_0(1+i)$. The model could be slightly changed by assuming endowment M to be stochastic (private information of government): it is 0 with probability q and M^* with probability $1-q$. In the secret case:
$M = 0$ means no buyback at all and debt will be repaid at the end with growing interests and consequently higher payback ratio.
$M = M^*$ with two possible payback ratio when initial endowment overcome a certain amount of debt.
Instead, an interesting solution in public buyback case is that price decreases when the probability of having $M = M^*$. The country spend less for the operation and will repay less in the future not only because of high appropriability but also for the implied reduction in debt burden. In this case it is better to publicly announce the buyback.
Thomas (2000) starts from Bulow and Rogoff model (1989) with repayments as the minimum between the amount of debt and a portion q of the investment levels ("output

[1] In the paper a future debt price increase is assumed.

tax"). Here q is not involved but the portion of repayments depends exclusively on an endogenous decision of the debtor country (willingness to pay model). The author starts from the more irrealistic case concerning the decision either to totally default on existing debt or not defaulting at all. In the first case, given income as a random variable with a certain density function, there are fixed costs of default and only one period. The level of income y^* for which the country is indifferent between defaulting or not applies:

$$u(y^*) - S = u(y^* - D) \tag{10}$$

The debtor decides to employ a certain amount of own resources into a buyback (x), leaving the difference between income and buyback resources to be consumed or to be employed in repaying creditors. The expected utility function of the borrower after the buyback is given by:

$$\int_{\underline{y}}^{y^*} [u(y-x) - S]\, f(y)dy + \int_{y^*}^{\overline{y}} u(y - x - D - \frac{x}{p(x)}) f(y)dy \tag{11}$$

It represents the probability of default times the utility in the defaulting state plus the probability of not defaulting and its related utility. Then, the derivative with respect to x explains the effect of the buyback on the utility of the borrower. The effect on welfare of government is not clear given the particular form of the marginal utility declining before y^* and then increasing.

$$\frac{dE[u]}{dx}|x = 0| = -E[u'] + \frac{1}{p(0)} \int_{y^*}^{\overline{y}} u'(y - D)d(y)dy = -E[u'] + E[u'|nodefault] \tag{12}$$

We can assume marginal utility of consumption to increase when no default happens because of the reduction of debt following a buyback and more resources available. So, it is better to shift repayments when effect of one unit more of consumption is reduced and to have not repayments in states when one unit of consumption has more value. As far as large buybacks are concerned, welfare is lower because the increasing price more than offset expected benefits. In the second model (willingness to pay) partial default and a repayment function depending on income and the amount of resources for buyback are introduced: the effect of a buyback on debtor's utility is positive. Repayment function is obtained by the following maximization:

$$\max_R u(y - x - R) - S(D - \frac{x}{p(x)} - R) \tag{13}$$

with the post buyback price:

$$p(x) = \frac{1}{D(x)} \int_{\underline{y}}^{y^*} R(y,x) f(y) dy + \int_{y^*}^{\overline{y}} (D - \frac{x}{p(x)}) f(y) dy \tag{14}$$

With respect to (11), the utility includes in the probability of default also the repayment function as a negative component. Applying the same process as before, the effect of buyback on the utility:

$$\begin{aligned} \frac{dE[u]}{dx}|x &= 0| = (\frac{1}{p(0)} - 1) E[u'] \\ \text{where } \frac{1}{p(0)} &> 1 \text{ and } u' > 0 \end{aligned} \tag{15}$$

The reason lies on the fact that there is always some default and, keeping the assumption constant, repurchasing debt mean lower repayments to be done in the future and more consumption. Even here, a complete buyback is not optimal: the incentive to deviate is strong. The more realistic assumption relies on the third model comprehending investment. The two period model aims at confuting Bulow and Rogoff (1991) who affirm that creditors appropriate all the gains given an higher levels of investment. It is assumed a country's wealth W divided into x, risky investment (I) and reserves (H). The country starts with a debt level D repaid in period 2, riskless technology replaced by consumption in period 1 and an utility function given by:

$$u(c_1) + \partial u(c_2) - S \tag{16}$$

The results explain that in order for a buyback to be efficient, the reduction in face value of debt must overcome the effect of investment levels on the production income (supposed at efficient level, $1 + r$). Thus, the price of debt must be less than one dollar discounted at the interest rate prevailing. In real terms, a country with a large percentage of debt over GDP is less than efficient on the investment side: it is better for him to borrow senior obligations and repurchasing junior ones in order for the operation to be satisfactory. All models analyzed above have been centered on available resources, now the last two models considered will differentiate between effects of a buyback financed with own debtor resources or through a third party donation.

Arias and Broner (2001) elaborate simple models in order to give different solutions from example 1, where the secondary market price of debt always increased. They differentiate between the way of financing the buyback, between the existence or not of some costs of default and between the effects on the available resources; in fact, a

restructuring of sovereign debt could affect the ability to repay in the future by either diminishing it (high appropriability) or not (low appropriability).
Starting from the assumption that the country will pay debts until resources are available, they explain a 2-period model with initial debt D in period 1 that needs to be repaid in period 2. Uncertainty about income means that in period 2 the country will have:

- Y_0 with probability 0.5 (low income)
- Y_1 with probability 0.5 (high income)
- $Y_0 < Y_1$ and $Y_0 < D < Y_1$.

Assuming no restructuring and no financial operations at all, country pays Y_0 in the state of low output and d in state of high income. Every creditor in this way gets $\frac{Y_0}{D}$in the first state and 1 in high income state, thus making the price of debt equal to $\frac{(Y_0+D)}{2D}$.
In presence of a buyback financed by own resources, the authors differentiate between low and high appropriability. In the first case, the country pays Y_0as before in low income case and $d - (\frac{x}{P_1})$because country repays in period 2 the difference between initial debt and what it bought back. Creditors per bond gets $\frac{Y_0}{(d-\frac{x}{P_1})}$in low income state and 1 in high income state (full repayment). The price is given by what creditors get in every state times the probability of every state and this post buyback price is more than ex ante price. In this way, as in example 1, creditors gain and country loses.
On the other hand, in high appropriability case, the amount needed for the repurchase of debt affects what the country pays even in the state of low income because the assumption is that the country will diminish its ability to pay in the future (period 2). Thus, the result is different and post buyback price is less than pre buyback price of debt, leading country to gain and debtholders to lose ($P_1 < P_0$). The buyback could be even financed by official loans with the same results as the high appropriability case; in fact, official loans usually have a seniority clause meaning that they must be repaid first and so it is equal to diminish future available resources.
In the second class of models assuming default costs, in period 2 the country will repay its obligations only when the debt is less than these costs. Now there are two states of the world depending on default costs being either low (0.5 probability, c_0) or high (0.5 probability, c_1). The debt level lies between the two costs ($c_0 < D < c_1$). Given these assumptions, without any implementation of restructuring operations, creditors get either 0 in default case or 1 in the high default costs case. They are either not repaid at all or repaid fully. With official loans, a large buyback is assumed with resources exceeding the difference between initial debt and low costs of default ($x > d - c_0$). Since

in this way the costs of default will be more than the amount of debt remaining after the buyback, country will always repay and no default happens, thus leading creditors to be fully repaid in period 2.
Finally, a recent model applied to recent case studies is the one from Baglioni (2013). It distinguishes between a buyback financed with a loan (leveraged) or with own resources (unleveraged): Within the leverage case, there is the possibility for a loan to be fairly priced or underpriced. Starting with a leverage buyback with fairly priced loan, there are two alternative states of low or high wealth. Low wealth is expressed by W_L (probability $1-\pi$) , high wealth by W_H (probability π). The percentage of partial debt repayment is q similar to the Bulow Rogoff (1989) model. The market value of debt can be easily calculated by computing the weighted average of two levels of wealth and the price of debt is given as usual by market value over the face value of debt. The value of the loan is C while the amount that can be effectively repurchased is X. The value of the loan (C) must be equal to what the lender can obtain in every state of the world:

$$\pi F + (1-\pi) * kF = C \tag{17}$$

$$\text{country gain} = \pi(X - F) \tag{18}$$

because country benefits only in the non default case and if the amount of debt repurchased is more than the obligations given by the loan.
There are three cases: the Fund repayments has the priority over all obligations in default state ($k = 1$); the Fund is subordinated with respect to other creditors ($k = 0$); Fund and creditors have the same degree of protection in the default state. It is known how to calculate the ex ante and ex post buyback prices, respectively $P_0$and P_1:

$$P_0 = \frac{\pi D}{D} + \frac{(1-\pi)qW_L}{D} \tag{19}$$

(in no default country must repay all the debt D while in the default state for every bond creditors can only recover low wealth divided by the face value of debt).

$$P_1 = \frac{\pi(D-X)}{D-X} + \frac{(1-\pi)(qW_L - kF)}{D-X} \tag{20}$$

(after the buyback the country has debt left equal to $D - X$ that must be repaid at maturity while in the default state what is left to creditors is the difference between the low wealth of the country and the percentage of the repayment due to the Fund).
Given the three cases before:
$\mathbf{k = 1}$ means that according to (17) $F = C$, $B > 0$, $P_1 < P_0$ because $\frac{(qW_L - kF)}{D-X} < \frac{qW_L}{D}$

where $k = 1$ and $F = C$. During default state, the country is subtracting resources for creditors in order to repay the Fund.

$\mathbf{k = 0}$. From (17) $F = \frac{C}{\pi}$ and from (18) the gain for the country is negative. Country loses and gives all benefits to creditors because $P_1 > P_0$. Here instead a constant amount of resources is addressed to repay lower debt and in default creditors can extract more.

Same level of protection. In this case, the country neither gain or lose.

Within leverage buybacks, The case of a concessional loan demonstrates clearly that buyback could lead to gains for both creditors and the debtor country, obtained at the expense of the Fund. The Fund in fact lends money to the country in order to repurchase debt while interest payments on the loan are fixed at an interest rate below market beliefs, for example at a risk-free rate.

$\mathbf{k = 1}$. The same results as for the case of a fairly priced loan apply.

$\mathbf{k = 0}$ and **same level of protection**. In both cases we have high recovery rate in the default state that can be destinated to creditors. On the other hand country will face costs given by an higher post buyback price of debt, but these losses are completely outweighed by gains given by the unchanged resources to repay lenders and the lower face value of debt.

As far as unlevered buybacks are concerned, the amount of country's resources available for the operation is called C needed to buy X amount of debt in face value. The country benefits from the buyback when:

$$\pi X + (1 - \pi)qC - C > 0 \tag{21}$$

where q is the amount subtracted in the default state to lenders. The first part represents the gain of the country, constituted by the sum of reduction in face value of debt in non default state of the world and the reduction of resources available to lenders in default state. The last part (C) represents the cost of the operation, that is the utilization of available resources. Intuitively, the more q is high, the higher the benefit for the country at the expense of lenders, leading to a reduction in ex post buyback price of debt because resources in the default state of the world are reduced: $(1-\pi)qC$ increases.

5 The need for official intervention

In this chapter I am going to analyze two models for a country facing a debt crisis. First, I investigate why official intervention is often enhanced; a country acting alone does not find convenient to repurchase debt ("debt overhang"). For this explanation, I recall Bulow and Rogoff (1991). Secondly, since it is more difficult for countries to act alone with respect to the 1980s because of more globalized financial markets and since debt crisis has affected also developed countries as part of a monetary union, I use the most recent model by Baglioni (2013) where the debtor aims at restoring credibility. I look at the different results when the operation is financed by the debtor itself through the utilization of own resources or when it is implemented through either a fairly priced loan or a subsidized one by official institutions. The aim is to demonstrate that conclusions are not always univocal.

5.1 A quantitative reason.

Through an indirect explanation, it is possible to demonstrate why an official intervention is suggested in restructuring debt operations, in particular in buyback ones. Without any official intervention, in fact, the "debt overhang" problem could be significant and could allow a country to not spend resources to repurchase its own debt. I recall what Bulow and Rogoff (1991) analytically expressed as relevant problem for self financed buybacks. Here I introduce some endogenous elements and no uncertainty.

- In **period 0** the level of buyback resources Z is decided given a country wealth: $Y_0 = C + I + Z$. The stock of debt is D_0.
- In **period 1** the repayment happens but there is uncertainty about income characterized by a productive shock θ for simplicity equal to 1.

$$Y(1) = C_1 + \theta g(I_1) \tag{22}$$

There are no interest on debt and no issuance of new debt but the production income depends on the shock and on a function g of the investments where:

$$g(.)' > 0 \tag{23}$$

Repayments are represented by

$$R = Min\left[(D_0 - X), Y(1)\right] \tag{24}$$

When $g(I_1)$, θ or C increase, it is verified a simultaneous increase in repayments.

$$\frac{dY}{dg} \geq 0, \frac{dY}{d\theta} \geq 0, \frac{dY}{dC} \geq 0 \tag{25}$$

Another key assumption are the decreasing returns to scale: when the country doubles its components of output in period 1, the total output at most is doubled.

$$R\left[2C, 2g(I), 2D\right] \leq 2R\left[C, g(I), D\right] \tag{26}$$

Since the buyback is on the face value of debt, the *ex post* buyback price is

$$P_1 = \frac{V(D_0 - X)}{D_0 - X} \tag{27}$$

and the amount of resources Z needed to buy back debt divided by the price gives the amount of reduction in face value of debt, X

$$\frac{Z}{P_1} = X = \frac{Z}{\frac{V(D_0 - X)}{D_0 - X}} = D_0 - (D_0 - X) \tag{28}$$

After some computations,

$$\frac{Z(D_0 - X)}{V(D_0 - X)} + (D_0 - X) = D_0 \tag{29}$$

$$(D_0 - X)\left[\frac{Z}{V(D_0 - X)} + 1\right] = D_0 \tag{30}$$

$$(D_0 - X) = D_0\left[\frac{V(D_0 - X)}{Z + V(D_0 - X)}\right] \tag{31}$$

The debtor country maximizes available resources given by the difference between output and expected final repayments as its objective function. Final repayments are the level of resources to be repaid to bondholders (those not selling their bonds in the buyback operation) at maturity.

$$\max_{C,I,Z} \left\{ \begin{array}{c} Y(1) - R \\ s.t. \\ C + I + Z = Y_0 \\ C, I, , Z \geq 0 \\ (D_0 - X) = D_0\left[\frac{V(D_0 - X)}{Z + V(D_0 - X)}\right] \\ R = V(D_0 - X) \end{array} \right\} \tag{32}$$

It can be demonstrated that the optimal X equals 0. The country is unwilling to subtract resources from investment and consumption by allocating them to the financial transaction. I consider two different choices. The first choice is: $\left[C^{X>0}, (I^{X>0}), X > 0\right]$. The second choice is :$\left[C^{X=0}, (I^{X=0}), X = 0\right]$. I compute an amount λ given by.

$$\frac{C^{X=0}}{C^{X>0}} = \frac{g^{X=0}(I)}{g^{X>0}(I)} = \lambda > 1 \tag{33}$$

so that consumption and investments are obviously more in case X equals 0.

Proposition 1 *In period 0 debtor country finds the optimal allocation when X equals 0.*

Proof. Suppose $D_0 \leq \lambda(D_0 - X)$. Since repayments are characterized by decreasing return to scale and $Y(1)^{X=0} = \lambda Y(1)^{X>0}$ from the maximization problem

$$Y(1)^{X=0} - R^{X=0} \geq \lambda \left[Y(1)^{X>0} - R^{X>0}\right] \tag{34}$$

Suppose $D_0 > \lambda(D_0 - X)$. Stressing the relation between $P_1$and P_0

$$\frac{V(D_0 - X)}{D_0 - X} \underset{<}{\geqq} \frac{V(D_0 - X)^{X=0}}{D_0} \tag{35}$$

Recalling the third and fourth constraint in (32),

$$\frac{V(D_0 - X)}{D_0(\frac{V(D_0-X)}{Z+V(D_0-X)})} \underset{<}{\geqq} \frac{V(D_0 - X)^{X=0}}{D_0} \tag{36}$$

Thus,

$$\frac{Z + V(D_0 - X)}{D_0} > \frac{V(D_0 - X)^{X=0}}{D_0} \tag{37}$$

This result implies that there are more expected repayments when the country reacquires its debt. In fact, creditors discount the fact that they must sell bonds by asking an higher price which means more expected repayments.

$$\begin{aligned} X + R^{X>0} &> R^{X=0} \\ \text{From (23) } g'(I) &> 1 \end{aligned} \tag{38}$$

I can conclude that more repayments are possible when $X > 0$. So from maximization problem,

$$Y^{X=0} - R^{X=0} > Y^{X>0} - R^{X>0} \tag{39}$$

■

From the maximization problem analyzed, if countries were free to act alone, they would find convenient to not repurchase debt because they will have less resources for their own. Thus, official institutions could break this incentive and could restore creditworthiness of the country by sustaining it through concessional or nonconcessional loans. Their intervention is even crucial to prevent spillover effects and contagion fears in an integrated context with respect to twenty years ago.

5.2 Buyback model with uncertainty

I change the context and I consider a debtor country willing to restore its secondary market price of debt at an adequate level, close to the face value of debt stocks. There are two periods for the economy, *ex ante* and *ex post* the operation (I call these periods 0 and 1). The objective is to restore credibility on financial markets ($P_1 > P_0$) because in case of partial repayments, debtor could face negative spillovers. The chain of the events looks as follows:

- **Period 0**: the situation is characterized by a debt crisis witnessed by market value of debt less than the face value. Price is $P_0 = \gamma = \frac{V(D_0)}{D_0} < 1$, $0 < \gamma < 1$. The economy has an outstanding debt equal to D_0.

- **Period 1**: given the debt crisis, the country decides to buyback an amount X of its debt with resources equal to Z. There is uncertainty about the production income ($Y(1)$). Income is uncertain but it is assumed that Z affects both state of the world (40, high appropriability). In the meantime D_0 has not developed interests between period 0 and period 1.

$$Y(1) = \left\{ \begin{array}{c} Y_1^{low} - Z \text{ with probability } (1-\pi) \\ Y_1^{high} - Z \text{ with probability } \pi \end{array} \right\} \tag{40}$$

  with $Y_1^{low} < D_0 < Y_1^{high}$. Repayments in bad state of the world are made exploiting part τ of Y_1^{low}, assuming $0 < \tau \leq 1$. Resources needed for the operation satisfy the following constraint:

$$Z = P_1 X \tag{41}$$

Let's now differentiate between cases, reminding that $0 < P_{0,}P_1 < 1$ and assuming $\gamma > \pi$[2].

[2]Very strong assumption but I imagine an high discount in debt price ($1-\gamma$ high) is linked to a low probability of full repayments π in period 1.

Without any buyback

$$P_0 = \frac{V(D_0)}{D_0} = \gamma \tag{42a}$$

$$P_1 = \frac{V(D_1)}{(D_1)} = \frac{\pi(D_0) + (1-\pi)(\tau Y_1^{low})}{D_0} \tag{42b}$$

A price increase is verified when

$$\tau Y_1^{low} > \frac{(\gamma - \pi)}{(1-\pi)} D_0 \tag{43}$$

Thus, the perception of improved partial repayments depends on the stock of outstanding debt together with the level of difference between P_0 and the probability of not default divided by the default probability. In order to make comparisons and since probabilities are known together with price in period 0, I suppose $\frac{(\gamma-\pi)}{(1-\pi)} = \delta$ where δ is a constant less than 1.

5.2.1 Buyback with own resources

Debt price in 0 has been computed before in formula (42a). Now the price of debt in period 1 represents the post buyback price because it embodies the effect of the buyback transaction, the repurchase of an amount X of debt face value D_0. The high appropriability assumption means that the amount Z affects both states of the world, showing a decreased ability to repay obligations due to resources allotted to debt repurchase. Thus, I go back to (40) and I can compute the new requirement in order to have a price increase:

$$\tau Y_1^{low} > Z + \frac{(\gamma - \pi)}{(1-\pi)}(D_0 - X) \tag{44}$$

With a self-financed buyback a restored debt price in period 1 is verified for higher levels of τY_1^{low} when $Z > X\delta$ with respect to a situation without any operation. By constraint (41) $\delta < P_1$. In order to have a price increase for a lower level of τY_1^{low}, $Z < X\delta$ and $P_1 < \delta < 1$.

5.2.2 Buyback recurring to official intervention

Leaving things in period 0 unchanged, the debtor country asks for a loan from an international organization (International Monetary Fund, European Stability Mechanism,

World Bank) instead of using own resources. A fairly priced loan means that

$$Z = P_1 X = \pi F + (1 - \pi) kF \tag{45}$$

where F is the value of the loan and k is the seniority structure of the loan (the repayment of the official loan is either privileged over other claims or subordinated). Income $Y(1)$ is obtained now by simply substituting (45) into (40):

$$Y(1) = \left\{ \begin{array}{c} Y_1^{low} - [\pi F + (1 - \pi) kF] \text{ probability } (1 - \pi) \\ Y_1^{high} - [\pi F + (1 - \pi) kF] \text{ probability } \pi \end{array} \right\} \tag{46}$$

$\boldsymbol{k = 1}$. In this case

$$Z = F \tag{47}$$

Nevertheless, the price effect is not the same of expression (44) because also new claims due to the loan must be taken into account.

$$\begin{array}{rcl} P_1 & \geq & P_0 \text{ if} \\ \tau Y_1^{low} & \geq & F + \dfrac{(\gamma - \pi)}{(1 - \pi)} (D_0 - X + F) \end{array} \tag{48}$$

A fair loan is not convenient with respect to a buyback financed with own resources since the new high priority liabilities with the Fund leaves the same resources available in bad state of the world ($\tau Y_1^{low} - Z$) but increases the obligations in the good one ($D_0 - X + F$). At the end, a price increase is verified only for higher levels of τY_1^{low} which has to be more than the expression on the right hand side of (44) plus and additional amount δF.

$\boldsymbol{k = 0}$. In this case the price effect changes because

$$Z = \pi F \tag{49}$$

implying that

$$\begin{array}{rcl} P_1 & \geq & P_0 \text{ if} \\ \tau Y_1^{low} & \geq & \pi F + \dfrac{(\gamma - \pi)}{(1 - \pi)} (D_0 - X + F) \end{array} \tag{50}$$

where obviously given $0 < \pi < 1$, leaving other variables unchanged, a price increase under $k = 0$ is verified for lower levels of partial repayments with respect to a seniority position because $\pi F < F$. In the seniority clause case, creditors discount the fact that debtor country *ex post* has less resources for partial repayments with respect to

a junior position. Nevertheless, with respect to expression (44) a country is able to restore creditworthiness for lower levels of repayments when

$$\frac{Z}{F} > (\pi + \delta) \tag{51}$$

Since π satisfies constraint (49) and $\delta > 0$ even a juniority clause is not preferred to a buyback with own resources.
$\boldsymbol{k = \frac{\tau Y_1^{low}}{D_0 - X + F}}$ (pari passu assumption where k is given by the amount of wealth available for partial repayments divided by outstanding obligations for the debtor country). If $F < X$, the results is:

$$\tau Y_1^{low} \geq [\pi F + \frac{(q-\pi)}{(1-\pi)}(D_0 - X + F)][\frac{(D_0 - X + F)}{(D_0 - X + \pi F)}] \tag{52}$$

With respect to $k = 0$ a positive variation is verified for higher levels of partial repayments; in fact, $\frac{(D_0 - X + F)}{(D_0 - X + \pi F)} > 1$.
In case of fair loan, it is evident the amount of new obligations to be satisfied. Thus, there is no possibility to prefer a fair loan to a buyback financed with own resources since the new liabilities to be satisfied overcome the claims on the right hand side of formula (44), for the same level of τY_1^{low}. Recalling Bulow and Rogoff (1991) a nonconcessional loan cannot be the right approach of official institutions since in the previous section I explained that the optimal behavior of countries acting alone is to not buyback at all. Complying with these predictions, the 1988 Mexican buyback was financed with nonconcessional loans with negative results.

5.2.3 Subsidized loan: different results arise

The utilization of a loan at an high discount rate with respect to the current risk premium of a debtor country gives different results; in fact, only in this case it is not anymore a matter of a zero sum game between creditors and debtor country where one party loses and one gains. The loan adds value for both the actors involved and what creditors and debtor gains is at the expenses of the official credit institution. For a simple analysis, I assume interest rate on the loan set to 0. Thus, the initial condition is:

$$F = Z \tag{53}$$

$\boldsymbol{k = 1}$. Posing this condition implies that it is the same to go back to a fairly priced loan. Going back to inequality (48), senior debt under a subsidized loan leads to the same conclusions of the case under fair price.
$\boldsymbol{k = 0}$. Here conclusions change. I compute payoffs for the official credit institution,

debtor country and general creditors. Assuming official claims junior with respect to other creditors, the IMF, for example, is repaid fully only in the non default state and gives to the country an amount equal to Z. The country repays the institution in the non default state of the world and in the same state obtains a reduction in the face value of debt X. Finally, creditors lose an amount equal to the reduction in the face value of debt in the non default state while they are better by the amount Z: it represents a gain because it corresponds to the loss for the official creditor repaid after them. Summarizing:

$$\text{institutional payoff:} \quad \pi Z - Z < 0 \tag{54a}$$

$$\text{country payoff} \quad : \quad \pi(X - Z) > 0 \tag{54b}$$

$$\text{creditors payoff:} \quad Z - \pi X > 0 \tag{54c}$$

Now it is clear that the sum of country and creditors payoff equals the institutional payoff. Applying the usual procedure, the price effect is:

$$\begin{aligned} P_1 &\geq P_0 \\ \tau Y_1^{low} &\geq \frac{(\gamma - \pi)}{(1 - \pi)}(D_0 - X + F) \end{aligned} \tag{55}$$

Leaving variables unchanged, under a subsidized loan there are less claims to be satisfied in order to have a price increase within buybacks financed with official loans. For this reason it is the way exploited during bailouts of countries facing a debt crisis but is not the best choice for a Fund. Moral hazard problems arise. It is the best solution even against a buyback financed with own resources. In fact, the condition for having a price increase for lower levels of τY_1^{low} with respect to (44) is:

$$\delta < \frac{Z}{F} = 1 \tag{56}$$

It is verified from condition (53) and the initial assumption on δ.
$\boldsymbol{k = \frac{\tau Y_1^{low}}{D_0 - X + F}}$. Here there is a small change in fund and creditors payoffs due to the increase in repayment of the fund with respect to the previous seniority structure. The country payoff does not change.

$$\text{Fund} \quad : \quad \pi Z - Z + (1 - \pi)\frac{(\tau Y_1^{low})}{D_0 - X + F} Z < 0 \tag{57a}$$

$$\text{country} \quad : \quad \pi(X - Z) > 0 \tag{57b}$$

$$\text{creditors} \quad : \quad Z - \pi X - (1 - \pi)\frac{\tau Y_1^{low}}{D_0 - X + F} Z > 0 \tag{57c}$$

The ex post buyback price $P_1$is:

$$\frac{\pi\left[D_0 - X + F\right] + (1-\pi)\left[\tau Y_1^{low} - kF\right]}{D_0 - X + F} \tag{58}$$

because the loan is underpriced but a certain percentage k on the loan value F is devoted to the official institution in the partial repayment state of the world. Applying changes and expression (58), the new condition for *ex post* price to exceed the *ex ante* one is:

$$P_1 \geq P_0 \text{ when } \tau Y_1^{low} \geq [\frac{(\gamma-\pi)}{(1-\pi)}(D_0 - X + F)][\frac{(D_0 - X + F)}{(D_0 - X)}] \tag{59}$$

Thus, it is possible to conclude that a positive variation in the *ex post* price in the *pari passu* assumption case will be verified for higher values than assuming a juniority clause of the loan because $\frac{(D_0-X+F)}{(D_0-X)} > 1$ given $\pi < 1$.

A conclusion could be inferred by cases analyzed before. The possibility to have a price increase with official loans is higher when loans are concessional (below market risk premia) because they leave more resources in both state of the world with respect to a fair loan. Nevertheless, the approach implies a constant junior position of the Fund. This fact must be mitigated in order to prevent moral hazard issues and could partially be solved with subsidized loans with the Fund acting as a simple creditor. Comparing (59) with (44), an *ex post* price increase for lower levels of partial repayments with respect to a self financed buyback is verified when (condition 53 applies):

$$Z > (\frac{\delta(D_0 - X + Z)^2 - \delta(D_0 - X)^2}{(D_0 - X)}) \tag{60a}$$

$$Z < \frac{1-2\delta}{\delta}(D_0 - X) \tag{60b}$$

This suggested approach could be preferred only when this condition is satisfied.

Concluding the discussion, a price increase happens when the debtor has less obligations to be satisfied in case of partial repayments. Thus, creditors are happy even if probabilities of partial repayments are present because bondholders will be paid in an adequate way. The Fund could act as a simple creditor under certain conditions; otherwise, if the objective is to restore debt price of countries at an adequate level, it is better to lend money at favorable interest rates. I will investigate in the next section real cases in order to see whether the results are in line with this theory.

5.3 Strong assumptions

The model could be changed by assuming γ embodies some probability of partial repayments exploiting part q of deterministic income Y_0. I can rewrite $\gamma = \frac{\pi D_0 + (1-\pi)(qY_0)}{D_0} =$

P_0 and I suppose debt in period 1

$$\begin{aligned} D_1 &= D_0(1+i) \\ Y_1^{low} &< D_0(1+i) < Y_1^{high} \end{aligned}$$

Keeping these assumptions in mind the results are almost the same but expressed without any influence of probabilities on the price variation.
In a normal situation without any buyback, I compute P_0 and P_1.

$$P_0 = \frac{V(D_0)}{D_0} = \frac{\pi D_0 + (1-\pi)(qY_0)}{D_0} \tag{61a}$$

$$P_1 = \frac{V(D_1)}{(D_1)} = \frac{\pi\left[D_0(1+i)\right] + (1-\pi)(\tau Y_1^{low})}{\left[D_0(1+i)\right]} \tag{61b}$$

and ex post price is more than the ex ante one when

$$\frac{\tau Y_1^{low}}{qY_0} > (1+i) \tag{62}$$

The ratio between partial repayments in the two periods must overcome the rate of growth of debt.

Buyback with own resources

$$\begin{aligned} P_1 &\geq P_0 \text{ if} \\ \frac{(\tau Y_1^{low} - Z)}{qY_0} &\geq (1+i) - \frac{(X)}{D_0} \end{aligned} \tag{63}$$

Buyback recurring to official intervention

$\boldsymbol{k = 1}$.

$$\begin{aligned} P_1 &\geq P_0 \text{ if} \\ \frac{(\tau Y_1^{low} - F)}{qY_0} &\geq 1 + i - \frac{(X-F)}{D_0} \end{aligned} \tag{64}$$

$\boldsymbol{k = 0}$.

$$\begin{aligned} P_1 &\geq P_0 \text{ if} \\ \frac{(\tau Y_1^{low} - \pi F)}{qY_0} &\geq 1 + i - \frac{(X-F)}{D_0} \end{aligned} \tag{65}$$

$\boldsymbol{k = \frac{\tau Y_1^{low}}{D_0(1+i)-X+F}}$.

$$\begin{aligned} P_1 &\geq P_0 \text{ if} \\ \frac{\tau Y_1^{low} \frac{[D_0(1+i)-X+\pi F]}{[D_0(1+i)-X+F]} - \pi F}{qY_0} &\geq (1+i) - \frac{(X-F)}{D_0} \end{aligned} \tag{66}$$

Subsidized loan: different results arise

$\boldsymbol{k = 1}$. The same of fair loan case with $k = 1$.
$\boldsymbol{k = 0}$.

$$\begin{aligned} P_1 &\geq P_0 \\ \text{when } \frac{\tau Y_1^{low}}{qY_0} &\geq (1 + i - \frac{(X-F)}{D_0}) \end{aligned} \tag{67}$$

$\boldsymbol{k = \frac{\tau Y_1^{low}}{D_0(1+i)-X+F}}$. The *ex post* buyback price $P_1$is:

$$\frac{\pi \left[D_0(1+i) - X\right] + (1-\pi)\left[\tau Y_1^{low} - kF\right]}{D_0 - X + F} \tag{68}$$

$$P_1 \geq P_0 \text{ when } \frac{\tau Y_1^{low} \frac{[D_0(1+i)-X+\pi F]}{[D_0(1+i)-X+F]}}{qY_0} \geq (1 + i - \frac{(X-F)}{D_0}) \tag{69}$$

In the *pari passu* assumption case there is less room for *ex post* price to increase with respect to the previous clause because $\frac{[D_0(1+i)-X+\pi F]}{[D_0(1+i)-X+F]} < 1$ given $\pi < 1$. These assumptions are crucial for the empirical evidence of the next chapter.

6 Empirical evidence

Before going further to test the price effects of buyback, I try a more descriptive approach in order to emphasize what reality and literature offered on the issue. First, I analyze how Mexico and Bolivia came out from their sovereign debt crisis.

6.1 The past: Bolivian and Mexican buybacks

In March 1988 Bolivia announced the repurchase of one half of its outstanding debt with foreign commercial banks. At that time, the secondary market price of Bolivian debt was 6 cents per dollar (94% discount). The huge discount was due to the high amount of outstanding debt with respect to GDP and GNP. In 1987

$$\frac{debt}{GDP} = \frac{5836}{4323.62} million\ \$ = 135\%$$

$$\frac{debt}{GNP} = 144.1\%$$

The commercial operation was financed by a group of European and American countries and the overall amount spent for the buyback was 34 million \$[3]. Given a reduction in face value of debt of 305 million \$, it is possible to easily derive the *ex post* buyback value of debt. Recalling constraint (41)

$$P_1 = \frac{Z}{X} = \frac{34}{305} = 0.11$$

The market value of debt improved by 0.05 cents per dollar. Foreign liabilities were reduced and the debt over GNP ratio was reduced and was recorded at the end of 1988 at 117%. , I collected some data[4].

macroeconomics fundamentals	1986	1987	1988
$1+i$	1.16	1.046	0.84
I	554.1	605.3	643.7
Y	3954.8	4323.6	4597.6
$C_1 = \tau Y_1^{low}$	3218.5	3467.5	3631.6

$1+i$ represents the ratio between debt levels between period 0 and period 1, Y the income, I the amount of total investments and C the consumption equal for assumption

[3]data on GDP current US \$ are extracted from the World Bank database while the debt/GNP ratio and the amount of oustanding debt is extracted from World Debt Tables (1996). Debt refers to external debt stocks and will be considered this indicator even for Mexican restructuring agreement.

[4]some clarifications are needed. I assume consumption level equal to partial repayments in bad state of the world: country is in bad state when $I = 0$. Data on debt, consumption and investments are from WEO (2012) and World Bank (2013).

to the income in low state of the world since I assume $I = 0$ as in Bulow and Rogoff (1991) with $\theta^L = 0$.
Going back to (67):

$$\begin{aligned} P_1 &> P_0 \text{ if} \\ \frac{3631.6}{q(4323.6)} &> 0.84 - \frac{(305-34)}{5836} \end{aligned}$$

The transaction was financed with concessional credit by donors, so I suppose $k = 0$. The improvement in market price was :

$$\begin{aligned} 0.84 - 0.794 &\cong 0.05 \\ P_1 &> P_0 \ \forall q \in (0,1] \end{aligned}$$

Given macroeconomic fundamentals of Bolivia together with our strong assumptions, the secondary market price of debt was very likely to increase even in an own financed buyback or through fair official loans, even though the price improvement could be less significant with respect to an operation financed by "donors"[5], contrasting with outcomes of Baglioni (2013) model explaining that under a fair and subsidized loan with seniority clause debt price decreases with respect to its ex ante level. The outcome of the transaction in the medium-long term has been a significant reduction of outstanding external debt of the country. In order to understand the impact on the overall economy, graphs could help. From Figure 6, it is clear that a more sustainable level of debt has been reached after the buyback. Bolivia is classified as a poor country according to Cordella et al. (2005). So, it could face only an average effect of the increase in debt, being closer to the debt irrelevance region. Given the high ratio, Bolivia could easily issue new debt with less costs and the incentive could be high. Nevertheless, the donors action was the key in order to restore creditworthiness; through a sustainable debt level, the country rejects an increase of debt by one unit because it will cost more (marginal effect). The restored creditworthiness is reflected in the FDI net inflows which from 1990 (the time when operation ended up) face an inverse relation with debt/GDP ratio. As explained by Figure 7, the overall economy recovered. Nevertheless, another important negative shock in 1992 led to a second buyback transaction, stabilizing its external outstanding debt stocks. The third graph instead demonstrates the theory explained in the literature review chapter. Bolivia registered either a decline in the investments or a reduced growth rate during buyback transaction periods (1988-89 and 1993-94) in line with authors defining debt as

[5]The operation was announced in March 1988. External debt outstanding (D_0) refers to 1987 and consequently debt growth to 1988, Y_0 with 0 = 1987

an implicit tax on investments (Sachs,1988 & Krugman,1988). When debt is repaid (even partially), country resources are destinated to the transaction and subtracted from investments. Nevertheless, buybacks are not always happy ending stories with a restored secondary market price of debt, satisfaction for creditors that are paid more than expected and losses only for the Fund making loans.

Figure 6. Bolivian FDI net inflows and debt over GDP ratio (1985-1994).

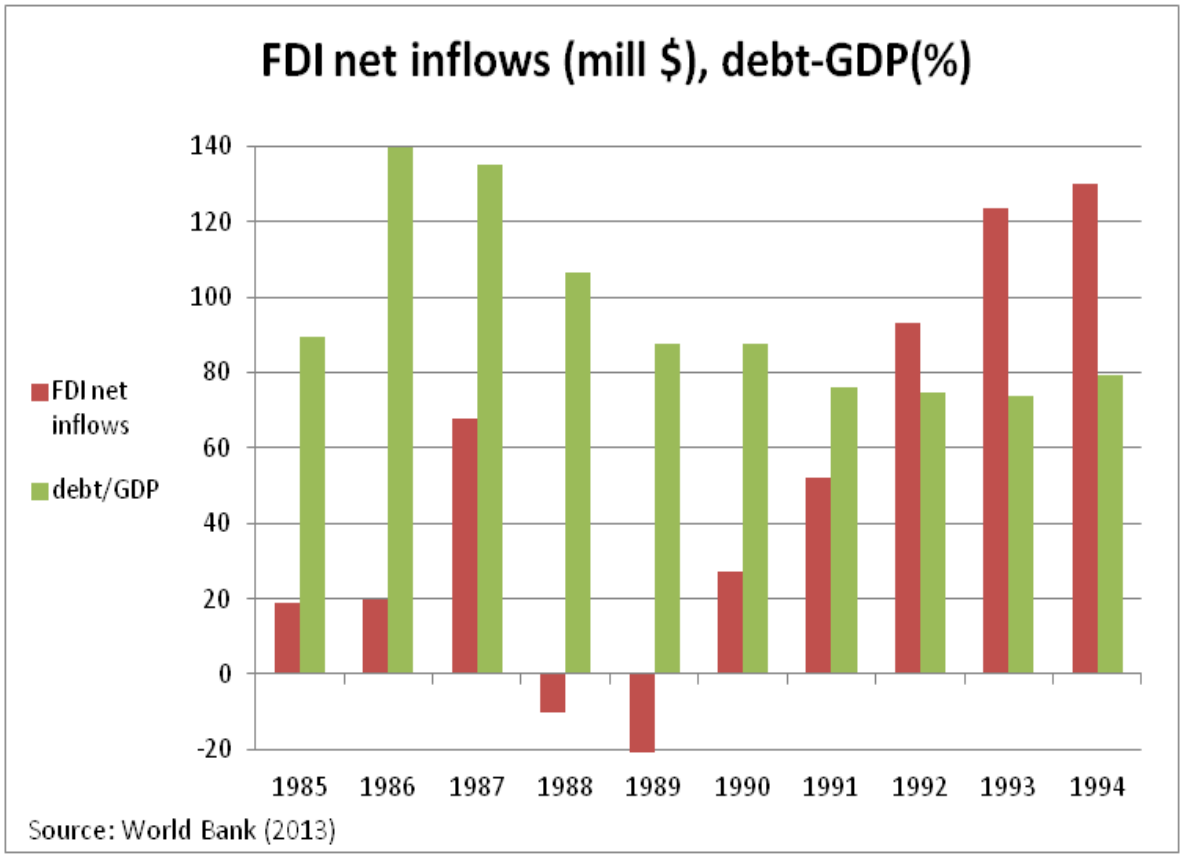


Figure 7. Bolivian annual GDP growth (1985-1994).

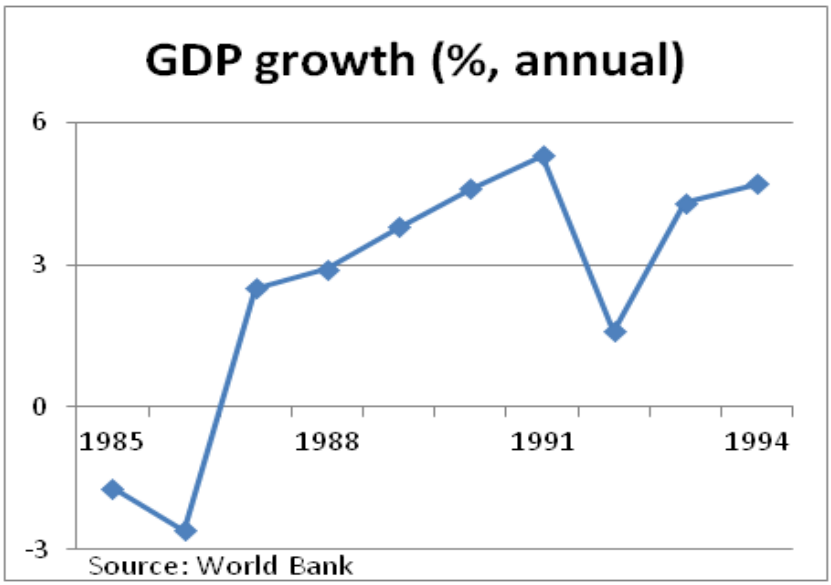


Figure 8. Bolivian total investments growth (1986-1994).

Mexico in the same year announced a rescheduling of its debt. Originally, the debtor country wanted to reduce 10 billion $ debt spending 1.8 billion $. Investors did not evaluate the operation as a good one maybe for the high level of reduction in face value of debt and in 1989 the reduction in face value of debt was only of 1.38 billion

$ using non concessional credit by International Monetary Fund of 481 $[6]. I connect this loan to the case of a fairly priced loan thus I can assume either high priority of it or the same level of protection of the IMF with respect to other creditors, so $k = 1$ or $k = \frac{\tau Y_1^{low}}{\boldsymbol{D_0(1+i)-X+F}}$.

Recalling Bulow and Rogoff (1988), I go deeply into the technicality of the deal, implying the issuing of senior bonds with respect to the old and now junior ones. The variable X indicates as usual the face value of debt reduced, exchanged for new bonds having value $v(N)$ and cash C. The indifference point for bondholders is clearly:

$$\frac{[C + v(N)]}{X} = P_0 = \frac{v(D)}{D} \tag{70}$$

with $C + v(N)$ indicating what bondholders selling old debt are going to receive for a face value of their credit X. Creditors not selling their credit at the break even point instead:

$$\frac{[v(D + N - X) - v(N)]}{D - X} = P_0 = \frac{v(D)}{D} \tag{71}$$

with $[v(D + N - X) - v(N)]$ indicating the value of unsold bonds after the operation divided by the value of old bonds remained. Applying the derivative in the above equations with respect to X, I obtain

$$D > \frac{v(D)}{v'(D + N - X)} \tag{72}$$

$$\text{when } D = X \text{ this implies}$$

$$v'(N) = \frac{v(D)}{D} \tag{73}$$

The largest amount rescheduled could reduce at most the face value of debt so that the *ex post* marginal debt value equals the *ex ante* average value of debt. Higher amount of debt could be rescheduled only if the country is expected to pay more than the reduction in secondary market price of its debt. In this case, credibility matters. The new senior bonds issued were not perceived as safer because of the historical commitment problem of government debt so that senior bondholders could not have an higher bargaining power with respect to the historical junior ones because of the bad creditworthiness of the debtor country. Thus, the deal flopped and a small part of its debt was effectively reduced: only the Brady plan in 1990 rescued Mexico from default, involving a huge participation of creditors due to different options available to them. Applying now

[6] this amount corresponds to the variation in non concessional net financial flows from the IMF. Bulow and Rogoff (1989) referred to own reserves.

inequality (64) which seems to fit well to Mexican repurchase:

$$\begin{aligned} \frac{123805.5 - 481}{q(183144.3)} &< 0.95 - \frac{(1380 - 481)}{100781} \\ P_1 &< P_0 \text{ if } 0.72 < q < 1 \end{aligned}$$

With the same assumptions on θ as in Bulow and Rogoff (1991)[7], the *ex post* price is less than *ex ante* price given the results on q, the fraction of income destinated to repayments in case of default. Moreover, with *pari passu* assumption of the loan, the results are almost the same ($k = \frac{\tau Y_1^{low}}{D_0(1+i)-X+F}$).

I conclude that, given my assumption on θ, the model is reflected in real cases. The reasons could be found in some ideas. First, the reduction of the huge plan for debt restructuring could be the reason for price collapse between 1987 and 1988. Secondly, together with the interpretation of Arias and Broner (2001), I suppose a more than expected lack of ability to repay debts in the future maybe linked to a larger mistrust by financial markets and foreign countries investing in Mexico. Mexican government, in fact, is simply having new senior obligations and maybe the still high outstanding debt is a crucial parameter in order to evaluate its creditworthiness. I recall the discussion on the model with fair loan in the previous chapter: it is more difficult to have a price increase with a fair loan with respect to a buyback financed with own resources. The Brady deal will solve the problem by allowing different options, either new financing with future repayments or exiting at a discount.

The two cases of Bolivia and Mexico underlines that every government could gain by restoring creditworthiness expressed by an higher secondary market price of debt implying FDI net inflows growth, positive GDP growth, huge debt reduction. Nevertheless, a concessional loan is a crucial parameter in order to allow both parties to gain. In this context, the Fund seems to lose but the better position of the borrower in the market means higher likelihood of long-term repayments due to an improved ability to invest and to attract capital flows.

6.2 Greece: a successful case.

The first big transaction operation dealing with European sovereign debt crisis has been made in Greece in December 2012. In order to reduce debt burden and to restore creditworthiness, Greek government repurchased on the market its bonds previously issued with a maturity from 10 to 30 years. As I explained in the previous section, the buyback did not exploit own resources of the country. It was financed by the EFSF with a 30 year loan to Greece. Thus, the operation involved an official institution. The

[7] $\theta^L = 0$ and $\theta^H = 1$ such that $Y_1^{low} = C_1$ and $Y_1^{high} = C_1 + \theta I_1$.

loan granted by EFSF has been made at favorable conditions for the Greek government because the interest rate was quite low with respect to the current yield on 10 year government bonds reflecting country risk premium. In order to prevent a euro breakup in case of failure of the transaction, the EFSF and European Union Member States bear the burden. I can recall formulas (67). The operation creates value for both creditors and debtor country that is the reason why Greek buyback has been considered a success. The price effect on Greek debt has been positive because creditors were offered a very overvalued price in order to sell, perceiving Greek government able to face future obligations. Some data could help to understand the bailout operation

$$\begin{aligned} Z &= F = 11.29 \text{ billion } € \\ X &= 31.9 \text{ billion } € \\ P_1 &= \frac{11.29}{31.9} = 0.35 \approxeq 0.338 \text{ (real weighted average price)} \end{aligned}$$

In order to highlight the success of the transaction made by Greek government, I found some data from Bank of Greece database concerning the bond price and yield of 10 year government bonds with 100 € nominal value from 2008 to April 2013.

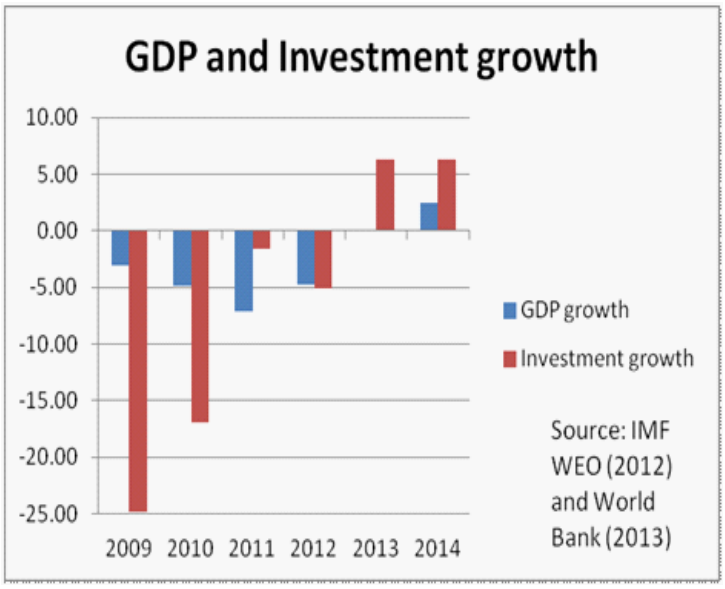
Figure 9. Greek government benchmark bonds, price and yield (2008-2013).

month-year	Price	Yield
April-08	98.18	4.54%
August-08	97.84	4.87%
December-08	96.43	5.07%
April-09	103.74	5.5%
August-09	111.55	4.52%
December-09	103.65	5.49%
April-10	89.39	7.83%
August-10	73.56	10.7%
December-10	68.18	12.01%
April-11	61.87	13.86%
August-11	55.84	15.9%
December-11	43.94	21.14%
April-12	22.85	21.48%
August-12	19.82	24.34%
December-12	43.62	13.33%
Aprile-13	50.69	11.58%
Source: Bank of Greece (2013)		

The yield indicating the economic risk of the country has dropped but it is still high. The overall economy of Greece is predicted to grow in the future with positive annual

GDP growth since 2013. Even debt/GDP ratio has been substantially reduced with the repurchase transaction and will reach the 136% in 2017 according to the WEO forecasts of 2012 (before buyback it was 162%).

Figure 10. Greek GDP and total investments growth (2009-2014)



In this case the announcement of the transaction has collected the participation of many external creditors, reducing the perspective of a Greek default given the EFSF subsidy and the juniority clause of the loan. The buyback has been part of an official bailout in order to avoid contagion effects and the likelihood of a euro breakup. From the Greek debt cake in the first chapter, it was clear a certain percentage of debt held by troika (IMF, EFSF now ESM) in order to supervise austere behavior by debtor country and in order to avoid incentive problems such as "debt overhang" since Greece is a member of a monetary union. In exchange for austere economic policies, ECB has been more willing to help countries with an higher risk on the financial markets. From the 6th September 2012 ECB can directly purchase government bonds with a maturity from one to three years in order to prevent troubles in the interest rates for governments, companies and banks. These Outright Monetary Transactions aim at lowering borrowing costs for the debtor country.

Actually, Greece experience is treated as an innovative case study. Baglioni (2013) links its model of leveraged and unleveraged buyback to Greece and tests the price effects of the transaction on bonds with different maturities by using first difference estimation. He considers every bond as a separated time series and he finds positive effects of the leveraged buyback on the bond price with a positive variation of the daily

changes. Even OMT have had a clear positive impact. Thus, the subsidized loan by EFSF and its juniority clause was perceived by investors as a good solution in order to restore reliability of Greece and of the overall Euro area instead of simple financial aid without any action undertaken by the government of the debtor country, as it is clear from the decreasing trend of bond prices in 2011 and 2012. The perception of a non repayable loan without any restructuring operation prevailed over financial markets. Some mistakes in the procedure were committed, such as underestimating the recessive effects of austere policies, conditions for Greece to have money from the EFSF (confidential document from IMF, June 2013). I resume some of them. First of all, the delay in the implementation of the buyback, two years after the first financial aid. Secondly, the underestimation of debt over GDP ratio in the next years that will reach 160% in 2016. Finally, the underestimation of negative data for unemployment in the country as effects of new policies of debt contraction.

6.3 Econometric approach to price effects

In this section I test the theoretical model based on the price effect of the buyback. I collected data from 17 countries which faced debt restructuring deals in different periods of time, from 1987 to 2013. Countries and years considered are[8]:

- Chile from 1985 to 1992, announcement of buyback in 1988
- Mexico from 1985 to 1992, announcement in 1988 and 1990
- Bolivia from 1985 to 1994, announcement in 1987 and 1993
- Uruguay from 1986 to 1992, announcement 1988 and 1990
- Costa Rica from 1988 to 1992, announcement in 1989
- Philippines from 1986 to 1992, announcement in 1990 and 1991
- Venezuela from 1988 to 1992, announcement in 1990
- Argentina from 1988 to 1993, announcement in 1989 and 1992
- Nigeria from 1990 to 1992, announcement in 1991
- Former Yugoslavia from 1986 to 1991, announcement in 1987,1988,1989,1990

[8] Some assumptions are needed. I collected all operations implying a reduction in face value of debt and some Paris Club debt relief (not commercial operations) from World Debt Tables of IMF and Trebesch et al.(2012) except for Uruguay (1988) and Senegal where no reduction in debt is reported. Fnally, I assume operations announced until March of one year to be announced in the year before in order to see the effects.

- Brazil from 1986 to 1994, announcement in 1988,1989, 1993
- Nicaragua from 1988 to 1992, announcement in 1991
- Senegal from 1987 to 1992, announcement in 1989 and 1990
- Honduras from 1986 to 1992, announcement in 1989
- Poland from 1993 to 1995, announcement in 1994
- Greece from 2008 to 2013, announcement ion 2010, 2011, 2012
- Cyprus from 2011 to 2013, announcement in 2012

I collected data on debt price (dollar on a equal amount of 100$) from Bulow and Rogoff (1988), Bowe and Dean (1997), Palac-McMiken (1995), Bank of Greece website (2013), Global Financial Data (2013). Then I have collected data on debt repurchased, outstanding external debt, GDP amount and investment amount. In order to catch the price effect of official loans, I have taken into account multilateral net financial flows. Then I have differentiated between concessional and nonconcessional credit from the IMF. The sum of observations equals 104. Finally I have run regressions based on price as dependent variable and macrofundamentals, loans and announcements as regressors together with some interactions. Basically there are three regressions: the first is the more general one using multilateral net financial flows ($loan = multi$), the second substitutes general flows with nonconcessional credit ($loan = noconc$) and the last controls for concessional credit by IMF ($loan = conc$):

$$\begin{aligned} price_t &= \beta_0 + \beta_1 \ln(I_t) + \beta_2 DEBTGDP_t + \beta_3 X_t + \beta_4 loan_t * Dloan_t \\ &+\beta_5 announcement_t + \beta_6 (loan_t) * (announcement_{t-1}) \\ &+\beta_7 (loan_t) * (X_t) + \beta_8 (loan_t) * (DEBTGDP_t) \\ &+\beta_9 Dloan_t + u_t \end{aligned} \tag{74}$$

where the first three regressors represents macroeconomic fundamentals[9]:

- $\ln(I)$ is the logarithm of the investment amount.
- $DEBTGDP$ is the debt over GDP ratio.
- X is the amount of debt repurchased.

[9]I apply the sort by country and year in order to verify the effect on price of variables as announcement in $t-1$.

- *loan* are multilateral net flows (1), nonconcessional loans from IMF (2) or concessional ones (3).
- *announcement* is the announcement of the transaction in period t (dummy).
- *Dloan* embodies the presence of positive net flow on multilateral debt (dummy, proxy for presence of a loan).
- $loan * announcement_{n-1}$ represents the interaction between a loan received and an announcement of restructuring in previous period $t-1$.
- $loan * X$ is the interaction between loan and debt repurchased.
- $loanDEBTGDP$ is the interaction between loan and debt over GDP ratio.

In regression 1, the goodness of fit is sufficient and equals 30%, with a number of observations slightly reduced (83 since I interact variables in t with variables in $t-1$). Within macroeconomic fundamentals, the natural logarithm of investment amount has a positive and significant effect. Given the logarithmic function, $\beta_1$means that a 1% more in the investments can lead to a price increase of $0.01 * \beta_1(0.04206\$)$. Leaving other variables unchanged, investments seem to perfectly substitute a buyback transaction when testing the price effects. Thus, a country could restore creditworthiness by investing more. Nevertheless, countries facing a debt crisis do not usually have resources to invest and either ask for external aid or declare default. On the other hand, the amount of debt repurchased has a negative effect (5% significant) partly compensated by a positive one. One additional million of debt repurchased (X_t) affects price of a quantity equal to $\beta_3 + \beta_8 loan_t$ $(-0.004 + 0.000022 multi_t)$. The marginal effect could change its sign if and only if the size of the loan is more than 182 *million* \$. This finding could prevent from small buybacks. I can think about a simple repurchase without any positive multilateral financial flow as a sort of operation financed with own resources. The market could imagine that in the future there will be less resources available for repayment of creditors. Thus, the effect of the buyback size alone is negative given the future reduced ability to repay obligations, as the high appropriability case in Arias and Broner (2001).

The regression explains even the general effect of a multilateral transfer. At 5% significance level, an additional *million* \$ of financial aid could improve the debt price of the debtor country by $0.015\$loan$. I could say that the presence of a loan has a positive effect.

$$\frac{d(price_t)}{d(Dloan_t)} = +0.015 loan_t$$

Nevertheless, the overall size effect of the loan is $\beta_4 + \beta_7 X_t + \beta_8 DEBTGDP_t$ with $\beta_7 > 0$, $\beta_8 < 0$. Thus, increasing the debt repurchased could improve the positive effect of the loan but a huge current debt over GDP ratio might mitigate it. Resuming the overall effect:

$$\frac{d(price_t)}{d(loan_t)} = +0.015 + 0.000022X_t - 0.0000441DEBTGDP_t$$

In regression 2 I have substituted multilateral net flows with the amount of nonconcessional multilateral flows given to debtor countries, a proxy for a fairly priced loan ($nonconc_t$). Here some variables become non significant with respect to the outcome of regression 1. The function of total investments has always the same positive effect on price while the other relevant effects are related to debt over GDP ratio, the size of the non concessional loan with significant effects of the interaction with debt repurchased. For sure, a 1% in debt over GDP reduction could lead to a price improvement, as it is clear from real cases and theory. The innovative element of the regression is the higher positive variation in price that a fairly priced loan leads ($+0.035\$ > +0.015\$$). But here the positive effect of non concessional loan could change sign; in fact the overall effect is:

$$\frac{d(price)}{d(noconc)} = +0.035 - 0.0004451DEBTGDP$$

So that:

$$\frac{d(price)}{d(noconc)} > 0 \text{ if } DEBTGDP < 78.6\%$$

This result tells us that a fair loan could have a significant effect maybe when the debt rescheduling is done for countries having a sustainable level of indebtedness. In fact, Greece did not receive a fair loan, for example, because the government debt was the 156% of GDP in 2012. Recalling Cordella et al. (2005), countries in good conditions presenting a large interval of marginal debt overhang enter in the irrelevance region at 70-80% of debt over GDP ratio while poor countries enter in this region at 50% of debt over GDP ratio with a smaller interval of marginal "debt overhang". Thus, a fair loan could have a positive effect for poor countries and not for developed ones. Thus, from 50% to 79% the financial aid could be helpful in restoring trust of financial markets in poor countries and mitigating incentives to deviate while developed countries facing a debt crisis needs an additional help through favorable interest rates. Nevertheless, moral hazard problem remains and could only partially be solved by conditioning loans to austerity measures to be undertaken in the debtor country.

Leaving other variables unchanged I can investigate the effect of the repurchase on price. It is a negative effect, increasing with the size of the fair loan since there are more claims to be satisfied with no concessions by the Fund making the loan. The

effect is (5%)

$$\frac{d(price)}{d(X)} = -0.000202 noconc$$

Buyback exploiting a fair loan is a condition too heavy for a country facing a debt crisis since the perception of other claims to be satisfied fear creditors who expect less repayments in the future.

Regression 3 relies on concessional loans (*conc*), explaining that they have not any effect on price alone but they have an overall positive effect interacted with the size of debt face value repurchased.

$$\begin{aligned} \frac{d(price)}{d(X)} &= 0.00017 conc - 0.002 \\ \frac{d(price)}{d(X)} &> 0 \text{ if } loan_t > 11.76 \; million \; \$ \end{aligned}$$

Here I notice a positive effect of the presence of the loan on price, maybe catching the perception of a subsidy which helps to sustain obligations with creditors other than Fund in the long run.

Concluding the discussion on the empirical evidence of price consequences, through three simple regressions it has been tested that the implications of a multilateral positive flow on price are positive only when a certain amount of financial aid is required for a substantial operation. The results change when I take into account only nonconcessional transfers which require a country able to sustain additional liabilities with respect to the Fund with no concession available and when I control for concessional loans which have positive effects (negative only for small amounts), complying with findings about Greece. The interaction of the size with the amount of debt repurchased has a positive effect than a buyback financed with own resources for multilateral flows and concessional loans. Even the amount of total investment has a positive correlation with price, thus opening the field of perfect substitutability between investments and resources addressed to restructuring deals. Unfortunately given the low availability of data, I have not tested for the seniority structure of loans.

It is evident from empirical analysis that a price reduction could happen in case of debt restructuring, contrasting with example 1. A price increase could be related to certain variables, such as the size of the loan and the concessionality with their interactions with X. Although in the short-term it could be preferred by debtor countries to pay less for restructuring agreements, they have to take into account that a price decrease means a default very likely some years after, with all the consequences that it brings (Panizza et al.,2009). From these regressions it can be inferred that the concessionality of a loan is the best way to improve the credibility of a country on financial markets.

A fair loan has an important negative effect and a multilateral transfer in general has a positive effect only from a certain level of the operation.

Regression 1-3. Dependent variable: $price_t$.

Variables	(1)		(2)		(3)
Y=price (t)					
ln(I)	4.206***		5.006***		2.672*
	(2.64)		(3.57)		(1.75)
DEBTGDP	-0.027*		-0.027**		-0.036***
	(1.92)		(2.04)		(2.65)
X	-0.004**		-0.0004		-0.002*
	(2.5)		(1)		(1.87)
multi	0.015**	noconc	0.035**	conc	-0.172
	(2.1)		(2.62)		(0.73)
multi*DEBTGDP	-0.0000441*	noconc*DEBTGDP	-0.0004451***	conc*DEBTGDP	-0.0000358
	(1.9)		(2.86)		(1.44)
multi(t)*announc(t-1)	-0.008	noconc*announc	0.003	conc*announc	0.178
	(1.13)		(0.27)		(0.75)
multi*X	0.000022**	noconc*X	-0.000202**	conc*X	0.00017*
	(2.24)		(1.98)		(1.93)
Dmulti	-8.102	Dnoconc	-6.256	Dconc	-21.175
	(1.14)		(1.04)		(1.61)
announcement	-8.243		-6.752		-7.868*
	(1.65)		(1.45)		(1.75)
Obs	83		83		83
*10%; ** 5%; ***1%					
Absolute value of t statistics in parentheses					
R^2	30%		31%		36%
adj R^2	22%		22%		28%

Figure 11. Effects of debt repurchased on price (regression 1).

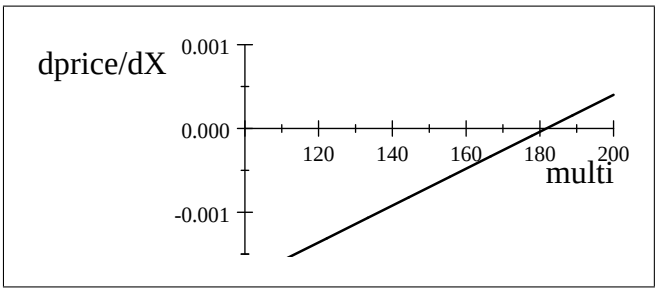


Figure 12. Effects of debt repurchased on price (regression 2).

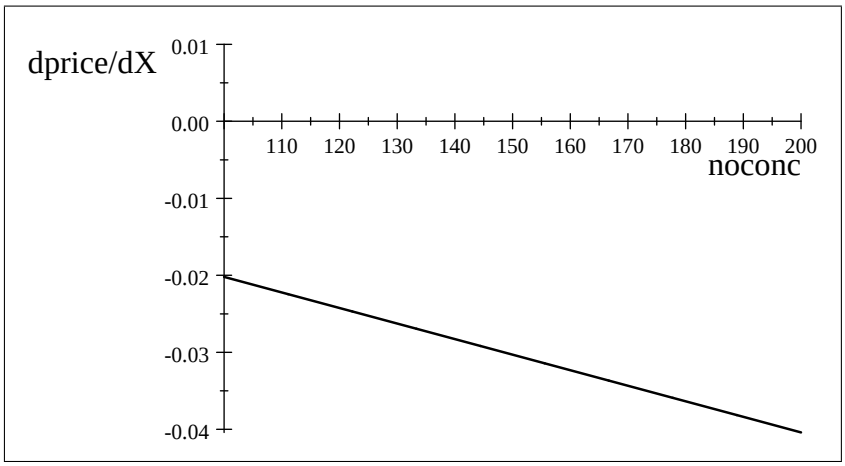
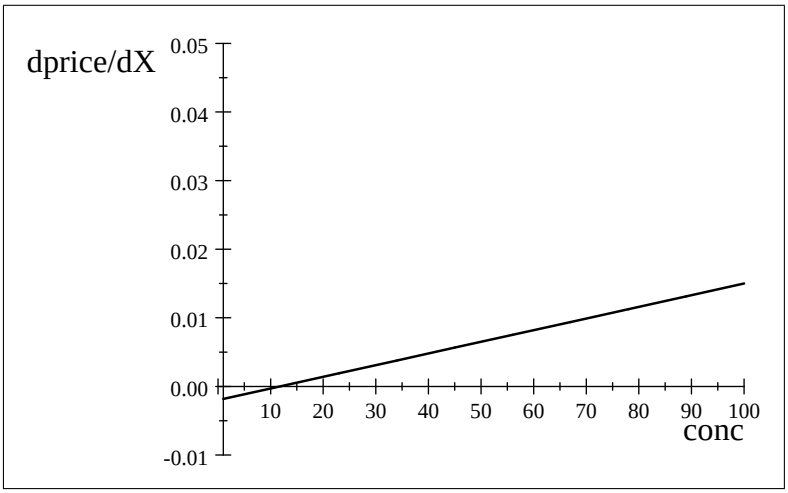


Figure 13. Effects of debt repurchased on price (regression 3).



Elaborations on Scientific Workplace 5.5.

7 Italy as future buyback case?

The last chapter aims at analyzing a theoretical case of Italian government buyback. Actually, Italy is part of Euro area debt crisis countries with a level of public debt over GDP recorded by Eurostat in 2012 equal to 127%, with an amount of outstanding public debt of 2454316 million $ in 2013 and that will slightly diminish in 2014 (-2%) according to The Economist forecasts. Since the denominator of the ratio is slow to recover because estimates of IMF World Economic Outlook register a -0.28% in 2013 and a $+1.2\%$ in 2017, the European constraints will be difficult to sustain. I would like to discover whether Italy could implement the same operation made by the Greek government. First of all, I explain the possible time for buyback to happen and then an empirical study taking into account the EU context.

7.1 Optimal time for a successful repurchase

For sure, Italy sometimes repurchases debt. The last news of a buyback on government bonds was reported on newspapers on the 15th March 2013. The operation was a small one since the amount repurchased was equal to 3705 million \$, so a 0.15% of the outstanding amount of public debt[10]. As I explained briefly in the third chapter, Prokop and Wang (1997) drew up a model with $N+1$ periods. There is an initial stock of debt equal to D_0 with maturity in N and interest rate equal to r in every period. They consider a deterministic endowment Z of debtor own resources. X represents the amount of debt repurchased. Through straightforward reasoning, they find the optimal time for a buyback to happen. P_i represents the cost of buying back debt in period i. Postponing the repurchase to period $i+1$ the debt reduction will be less. In fact, the amount of debt could increase by $1+r$ in the following period and by assumption of their model, $P_{1+i} > P_i$. Thus, the amount of debt repurchased X must be acquired in one period. Proving it by contradiction, suppose that government spends an amount $Z\prime < Z^*$ in period i. The amount of debt repurchased is

$$X_i = \frac{Z'}{P_i} \tag{75}$$

and in the following period $i+1$ the country will spend the remaining $Z^* - Z'$ money increased by $1+r$. Thus:

$$X_{i+1} = \frac{(Z^* - Z')(1+r)}{P_{i+1}} \tag{76}$$

At maturity (period N), debt level will be

$$\left[D_i - \frac{Z'}{P_i} - \frac{(Z^* - Z')}{P_{i+1}}\right](1+r)^{N-i} > \left[D_i - \frac{Z^*}{P_i}\right](1+r)^{N-i} \tag{77}$$

In order to have lower final debt, it is better to buyback earlier, given a debt price increase in every period. Discovered $t^* = 0$, in order to choose the level of buyback debtor country maximizes the following expression:

$$\max_{X_0,R} \left\{ \begin{array}{c} Y + [Z_0 - P_0X_0](1+r)^N - R - S\left[(D_0 - X_0)(1+r)^N - R\right] \\ s.t. \\ X_0 \leq D_0 \\ P_0X_0 \leq Z_0 \\ R \leq (D_0 - X_0)(1+r)^N \\ R \leq Y + [Z_0 - P_0X_0](1+r)^N \end{array} \right\} \tag{78}$$

[10] in the next subsection I will discover the effect of the operation on the price of bonds.

Applying the derivative with respect to R , FOC is:

$$-1 + S'\left[(D_0 - X_0)(1+r)^N - R\right] = 0 \tag{79}$$

FOC with respect to X_0 is:

$$-P_0(1+r)^N + S'\left[(D_0 - X_0)(1+r)^N - R\right](1+r)^N > 0 \tag{80}$$

given $P_0 < 1$ and $S'(D^*) = S'\left[(D_0 - X_0)(1+r)^N - R\right] = 1$. D^* represents the optimal debt in the final period given assumption on function $S(.)$:one unit more of indebtedness increases sanctions by one unit. The price effect is also an interesting topic. In fact it is the ratio between expected repayments and the amount of debt. In this case, I consider the price in the last period, $P_N = \frac{R}{D_N} = \frac{(D_0 - X_0)(1+r)^N - D^*}{(D_0 - X_0)(1+r)^N}$. It can be demonstrated that an higher price is given by an higher amount of debt remaining with respect to optimal level ($D_0 - X_0 > D^*$). An improvement in market price of debt could be reached by repurchasing:

$$X_0 < D_0 - D^* \tag{81}$$

A huge repurchase could lead to a collapse in the price of debt in the long run because remaining creditors perceived less repayments for them in the future. Thus, neither a huge nor small buybacks are beneficial in $t^* = 0$. The former could be unsustainable in the long term due to less ability to repay in the future leading to a price collapse. On the other hand, small operations in every period could not substantially lower debt as I explained in formula (77).

In order to be hedged against a price increase or a price collapse, an official loan is usually given to debtor countries. They can conduct huge debt rescheduling with creditors being trusted by financial markets. They do not exploit their resources which could diminish future repayments in the future and they are protected against costs given by selling bondholders who ask higher prices. As I explained in the first part, the only remedy is to have a concessional loan with less obligations with the Fund: this does not necessarily mean $k = 0$ but also a *pari passu* assumption under certain conditions.

Italy as Member of the European Union in the last two years faced some changes in its debt price, due to announces and internal facts. In the next section I would like to analyze the effects of these facts on the Italian government bond price, suggesting at the end a debt buyback amount and the possible period for the operation. Obviously a buyback following the Japanese one is impossible given the monetary union and the dependence of Italian monetary policy on ECB.

7.2 Credibility matters

Recalling what Prokop and Wang (1997) discovered in their model, that is buyback is much more convenient at time t_0, I could say that being in a monetary union could simplify things because subsidized loans are now easier with the new European Stability Mechanism together with a more favorable approach by the ECB, although conditional to some requirements and future economic policy actions.
Since European perspective are not clear for the future and solutions to be crisis have been already announced but encounter a difficult implementation, I have collected daily data of price of Italian government bonds with different maturities from August 2011 to May 2013 using Datastream database following the approach of Baglioni (2013). I consider daily data of every bond as a separated time series and as dependent variable I put the first differenced price of bonds in order to catch the trend. As regressors, I have chosen dummies representing political and economic factors in the last two years.

- OMT has value 1 since 26 July 2012, the Draghi announcement of this new instrument into the hands of European Central Bank and 0 before.
- *greece* has value 1 from the 3rd December 2012, the buyback announcement, and 0 before.
- FC has value 1 from the 5th March 2012 when the fiscal compact was announced and 0 before. Fiscal compact deals with a package of measures for EU countries aiming, for example, at the introduction of balancing of accounts principle even in the constitutional law of Member States.
- BU has value 1 from the 12 December 2013, when the Banking Union was approved by ECOFIN.
- ESM has value 1 from the 8th October 2012, first day of the new institution European Stability Mechanism.
- *greeceok* has value 1 from the closing of the buyback transaction on the 12th December 2012.
- $CIPRO$: value 1 from the day of financial aid transfers to Cyprus (13 May 2013).
- *operation*: value 1 from the 15 March, day of a small buyback made by Italian government on its government bonds.
- *credgov*: value 1 when Italian stable government is in charge and 0 when period of unstable parliamentary majority.

Regressors are only dummy variables and in order to estimate their effect I run a simple regression on Stata. Then, in order to adjust for possible heteroskedasticity and autocorrelation, I run all variables on command *newey* which automatically adjust regressors with autocorrelation and heteroskedasticity consistent standard errors specifying the longest lag at which autocovariances must be computed. Up to the arbitrary lag, HAC standard errors are robust to autocorrelation and heteroskedasticity. For this regression based on daily data, I have chosen lag order equal to 7. Regression 4 looks as follows for every bond considered:

$$\begin{aligned} dP_t &= \beta_0 + \beta_1 OMT_t + \beta_2 greece_t + \beta_3 FC_t + \beta_4 BU_t + \beta_5 CIPRO_t + \beta_6 ESM_t \\ &\quad + \beta_7 credgov_t + \beta_8 greeceok_t + \beta_9 operation_t + \varepsilon_t \end{aligned} \tag{82}$$

Since the European Council approving the Banking Union and the closing of Greek buyback happened almost in the same day, I drop variable BU_t from the regression. Here the interpretation of the results differ from the previous empirical analysis; in fact, in regressions 1-3 β represents the effect of one variable on the price, the amount of variation in price with a marginal change in the regressor. Here, the coefficients represents in some sense the variation of the variation in price: a daily price change. Thus, a sort of second order variation.

First, only the variable related to the birth of the ESM seems to not affect bond price variation. On the other hand, a positive effect is exerted by the Outright Monetary Transaction, the new instrument in order to mitigate risk premia and restore confidence of investors in debt crises countries. The effect on the variation is between 0.3 and 0.4 with a slightly larger effect for bonds with longer maturity (2023 and 2039). Dummy $greece_t$ negatively affects the first differenced price of bonds. The announcement of buyback for Greece was accompanied by fears of contagion effects and of a consequent euro breakup. This coefficient is mitigated by a positive effect of the closing of the operation so that the real effect of the transaction on every variation in price of bonds is:

	2018	2019	2022	2023	2039
$\beta_2 + \beta_8$	0.027	0.013	-0.012	-0.004	-0.452[11]

For bonds with longer maturity the negative effect of the announcement and fears of a restructuring operation for Italy prevail. The successful operation has been seen positively by Italy, another country facing a similar debt crisis, so maybe a similar operation could have a positive effect for debt price of Italy, being accepted by creditors and so trusted by markets. Nevertheless, in the long run, it could not solve all problems.

[11] β_8 not statistically significant when maturity in 2039

It might be accompanied by other economic indicators, such as growth of the economy or less outstanding public debt growth. Otherwise, it is meaningless and does not solve the sustainability of public debt. Thus, it is less relevant the way buyback happens: it is important the sustainability of the operation and its interaction with other policies, contrasting with the idea of Baglioni (2013) which attributes the price effect for Greek debt only to the subsidized loan, analyzing only bonds with reduced maturity: even there the positive effect was mitigated in the long run. The financial aid given to Cyprus in order to solve its debt crisis negatively affects the variation in debt price of Italy. It is due to the fact that no restructuring has been clearly specified. Even Greek debt, as it can be seen in Figure 9, has not improved during 2010 and 2011 when two packages of financial aid were issued by the European Union institutions. The positive effect has been verified only when some conditions are met.

Shifting the attention on internal controls, a large positive effect on price variation is implied by the small operation of buyback the Italian government conducted in March. I infer that many small operations could help a price improvement in the long run, with two contrasting effects. The former is related to a restored creditworthiness, the latter is that for the same reduction in public debt, the Italian government needs more money in the following periods (Prokop and Wang, 1997). The small buyback was financed by own resources and this was not a huge problem. Recalling Bulow and Rogoff (1988), it was not a boondoggle. There are gains from having more investments in the future given the lower debt burden and even the debt is more marketable. Looking only at price it hurts the debtor since

$$1 - q[1 - \pi] > \frac{Dv'(D)}{v(D)} \tag{83}$$

where q is the fraction of repayments rising with an increase in GDP, $v\prime(D)$ is the effect of one unit of debt repurchase on the market value of debt (the derivative with respect to D of the market value of debt). Since this inequality seems to hold, the price increase is not only a problem. It implies, as clarified from graphs of Bolivia, a recovering economy, more resources for investments in the future and competitiveness for the country.

The other crucial internal factor is the credibility of the government. It improves variation in price between 0.3 and 0.4. Thus, credibility matters for a debtor country in order to restore its creditworthiness. The longer the maturity, the more crucial a credible government is, given other dummies unchanged. With a restored political stability after two months of uncertainty, the default risk is decreased so it could be better to implement restructuring operation before negative shocks and a new phase of political instability could affect the country, since the government is led by two

parties with completely different approach to the EU context and to the economy. Italy is in a phase of a *creditor friendly government* and this period could be crucial in implementing financial operations for debt reduction.
The last regressor deals with the golden rules for budget balancing, the Fiscal Compact. This plan press for the introduction of constitutional laws expressing the principle of budget balancing and it wants countries to reduce their public debt at a rate of $\frac{1}{20}$ every year, reaching in 20 years the threshold of the 60% of debt over GDP. Moreover, countries with more than 60% for this ratio cannot overcome the 0.5% of structural deficit. This new Treaty is proved to have a negative effect on the price variation for Italian government bonds. It is an index of austere policies that could be unsustainable for a country with high debt and low growth.
In this chapter I have gone ahead talking about an abstract and maybe future case study about Italy, analyzing the European context. Recalling Prokop and Wang (1997) but also the theoretical model in chapter 4, I suggest Italian government to repurchase debt soon because uncertainty will make variables random in the future. Growth is still far from being acceptable, European parameters become stricter and ECB has started a new expansionary approach conditional on Member States economic policies. In order to implement a successful debt restructuring:

- *time*: it must be implemented earlier to avoid larger payments either in a price positive shocks (direct effects) or in a price collapse (deadweight losses, the price of restoring creditworthiness). In a strictly confidential document of the beginning of June 2013, International Monetary Fund admits mistakes in bailout of Greece. One of the critics relies on the delay of debt restructuring, two years after the first financial aid of 110 billion €.

- *size*: many small sized buybacks and large ones could be replaced by a one shot medium sized repurchase as it happened for Greece. In this case risk premia are lower.

- *way of financing*: taking into account all regressions made, a loan by EU institutions is preferred for a large buyback in order to be perceived as credible. Moreover, given a decreased tension on the markets for Italian debt, it could be financed by a subsidized one with no difference between clauses; a fair loan cannot be exploited because as in regression 2 of the previous chapter, Italy has more than 80% debt over GDP ratio and the negative consequences of new obligations to be satisfied could worsen the situation. The important thing for the financing institution is to not embody a junior clause to not increase moral hazard. A buyback with own resources of a huge entity could be unsuccessful because it

means lower repayments for creditors when their bonds will reach maturities. A fundamental condition is also the rate of growth of debt which must be mitigated $(1+i)$.

Regression 4. Dependent variable $dP_t = price_t - price_{t-1}$.

Variables	2018	2019	2022	2023	2039
P(t)-P(t-1)					
OMT	0.297**	0.318***	0.291**	0.400***	0.374***
greece	-0.233*	-0.258*	-0.393**	-0.516**	-0.452**
FC	-0.247**	-0.255**	-0.250**	-0.354**	-0.342***
CIPRO	-0.325***	-0.339***	-0.461***	-0.668***	-0.688***
ESM	-0.146	-0.147	-0.097	-0.141	-0.053
credgov	0.290***	0.293***	0.332***	0.486***	0.400***
greeceok	0.260*	0.271*	0.381*	0.512**	0.361
operation	0.199*	0.215*	0.272**	0.401**	0.412***
Constant	-0.143*	-0.146*	-0.178*	-0.265**	-0.195*
Obs	457	457	457	457	457
R^2	2%	2%	4%	5%	5%
adj R^2	0.20%	0.22%	2%	3%	3%
* significant at 10%; ** significant at 5%; *** significant at 1%					

8 Conclusion

In the paper I have underlined that price effects are not always univocal. Positive or negative variations are not influenced solely by the fact that creditors want higher prices in order to be remunerated when selling their bonds but also by the way of financing the operation. Throughout the paper, I have had a slightly different approach with respect to other theoretical models analyzed; in fact, price increase on the one hand affects negatively a buyback for its direct costs but on the other hand it means a restored creditworthiness. At the same time, price decrease could be beneficial for the country only in a direct way, but could affect debtors through deadweight losses, such as international trade troubles and less marketable government debt with implied solvency problems.

In the theoretical model, I explained debt crises in 1980s: countries found convenient to not repurchase debt at all. The need for official loans was clear; otherwise, countries acting alone had no incentive to undertake restructuring operations ("debt overhang"). Since more integration arose, a debt crisis in one country could now provoke negative spillovers in many others. For this reason, I have studied price effects of buybacks analyzing the way of financing them (own resources, utilization of official fair loan or subsidized ones). In every case price effects could be positive under certain conditions. Assuming in the period *ex ante* the operation that market value of debt is less than face value and assuming uncertainty in the *ex post* period about income, price increase when resources available for partial repayments in the second period overcome the overall liabilities. The price variation depends on the way of financing but also on seniority clause. Considering for example a fair loan, a positive price variation with respect to a buyback financed with own resources is difficult whatever clause is applied. It is required an higher level of partial repayments. Nevertheless, concessional loans seem to be the best choice when the Fund is junior or acts as a simple creditor, although in this case under certain conditions.

In the descriptive part I compared models with real experience of Bolivia and Mexico at the end of 1980s and recent Greece successful operation. Together with the different ways of financing, the effects on price depend also on credibility; a substantial Mexican restructuring deal in 1988 was not believed by creditors while Greece seven months ago faced an improvement of its benchmark bonds price and decreasing risk premia.

In order to give robustness to the model, I collected data for debt buybacks in different countries and years and I regressed the price at time t controlling for macroeconomic variables, loan, amount repurchased and their interactions. An own financed repurchase without any loan has a negative effect on debt price but it leads to a positive variation for higher amounts of financial aid. Another important result is the negative

significance of fair loans since they are perceived as an additional claim to be satisfied (Figure 12), in line with predictions of the model. The best financial aid could be a concessional loan, given its overall positive effect (Figure 13).
Finally, an eventual future restructuring has been supposed for Italy, given its huge debt over GDP ratio and the slow growth of its economy. I discussed about the time, the size and the way of financing it. Recalling Prokop and Wang (1997) it could be strategic to implement it soon. Then, assuming a price increase in the future, it should be a one shot operation of medium size in order to avoid lower payments for creditors at maturity. Exploiting a simple regression and taking into account daily price changes of bonds with different maturities (every bond considered as a time series), I proved that a favorable European Union environment could help and requires less resources, given the new policy of European Central Bank through the Outright Monetary Transactions. Nevertheless, credibility matters and a stable government is crucial for buybacks to happen in order to avoid consequences of an unsuccessful experience.

A Auction rules

In order to complete the essay on buyback models, it is also interesting to add something on the method debtor countries use when repurchasing bonds. A *summa* of these operations is given by Blommestein et al.(2012), overviewing a large range of OECD countries. They discover the reasons why countries do buybacks, their aims, and the methods used by public debt managers. The two methods exploited are reverse auctions and secondary market purchases in general. We know that in general a standard auction implies buyers submitting bids and the item that is going to be sold goes to the bidder with the highest bid at a price dependent on the auction format (first price auction or second price auction, for example). In a reverse auction the buyer requests a good without making any bid while sellers submit their requests. Thus, the buyer will choose the seller submitting the lowest value. That is the reason why these auction are called reverse: they have the opposite procedure from the standard. So, in this case, the buyer is the country while the sellers are the bondholders submitting their prices: the lowest bid will be accepted by the country, thus repurchasing part of its debt. Otherwise, the secondary market purchases are the methods assumed in the previous macroeconomic and financial discussion: the transactions happen on the secondary market with securities already issued and the consequence could be an increase of debt price because creditors are willing to find an incentive to sell their bonds. As examples, Italy uses to repurchase debts through a multi price auction or a Treasury mandate. The former implies that bids above a fixed price called cutoff price are allocated at the bid value. This is an ideal situation when there is a large amount to be repurchased at a fixed time and a it is a sort of one shot transaction. On the other hand, Treasury mandate exploited the role of banks as intermediaries and this method implies a transaction involving a small amount of bonds to be repurchased. Finally, the most recent case of large buyback (small buybacks could happen even periodically) was the one of Greece at the end of 2012. The method exploited has been a modified Dutch auction. Generally speaking, a Dutch auction consists of an auctioneer setting an upper bound of the price and progressively decreasing it until someone of the bidder accepts. Thus, in a modified Dutch auction, the investors declare the value of their bond to be sold and then the Greek government sets the price. This kind of auction implies an aggressive behavior by sellers, competing at lower prices near to their reservation price. The method could have been even one of the reason for the success of the buyback: a seller could lower its claims instead of being out from the auction through an higher evaluation of his item and the buyer (debtor country) could save money.

B List dataset variables

Regression 1-3. Variables list

variables	mean	deviation	min	max	description
multi[12]	2992.88	19007.99	−740	144000	multilateral transfers (mill$)
nonconc	−13.5	367.76	−1148.7	1843	nonconc IMF transfer (mill$)
conc	2811.831	19030.01	−38.4	144000	conc IMF transfer (mill$)
DEBTGDP	110.7	164.44	24.6	1059.14	debt over GDP ratio(%)
I	18378.2	26787.01	191.8	135181.8	investment amount (mill$)
gI	10.06	28.47	−66.5	109	investment growth (%)
Debt	56941.7	95824.59	2973	449367	external/public debt (mill$)
GDP	96830.3	137229.6	1009.5	614462.7	GDP (current mill$)
X	1011.9	4329.34	0	41470	debt repurchased (mill$)
price	43.236	22.7	1	104	debt price (on 100)

Source: Bulow and Rogoff (1988), World Debt Tables (1996), World Bank (2013), Palac-McMiken (1995), The Economist (2013).

Regression 5. Variables list.

variables	mean	deviation	min	max	description
$dP_t(2018)$	0.017	0.955	−10.11	10.19	1st differenced bond price mat.2018
dP_t (2019)	0.018	0.991	−10.87	10.81	1st differenced bond price mat.2019
dP_t (2022)	0.0216	0.791	−3.36	4.35	1st differenced bond price mat.2022
dP_t (2023)	0.028	1.001	−4.73	3.54	1st differenced bond price mat.2023
dP_t (2039)	0.037	0.917	−2.65	4.19	1st differenced bond price mat.2039

Datastream (2013).

[12]The negative quantity points out that outflows overcome inflows, positive quantity the opposite. The same reasoning applies for concessional and nonconcessional transfers.

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