

**Department:** *Economia e Finanza – Financial Economics*

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

**SUMMARY**

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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, assuming official intervention through either concessional or nonconcessional loans. Price effects are then tested empirically in real cases and with an econometric model. Finally, the discussion is focused on suggestions about an hypothetical 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

<b>Contents</b>	<b>1</b>
<b>1 Introduction</b>	<b>2</b>
<b>2 Country risk: from South America to Europe</b>	<b>3</b>
<b>3 Sovereign debt in the literature</b>	<b>3</b>
<b>4 Buyback: a way to restructure debt</b>	<b>4</b>
4.1 The general framework . . . . .	4
<b>5 The need for official intervention</b>	<b>5</b>
5.1 A quantitative reason. . . . .	5
5.2 Buyback model with uncertainty . . . . .	6
5.2.1 Buyback with own resources . . . . .	7
5.2.2 Buyback recurring to official intervention . . . . .	7
5.2.3 Subsidized loan: different results arise . . . . .	8
<b>6 Empirical evidence</b>	<b>9</b>
6.1 Econometric approach to price effects . . . . .	9
<b>7 Italy as future buyback case?</b>	<b>11</b>
7.1 Optimal time for a successful repurchase . . . . .	11
7.2 Credibility matters . . . . .	11
<b>8 Conclusion</b>	<b>12</b>
<b>References</b>	<b>13</b>

# 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

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. Given the positive effects of the introduction of the unique currency, 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. In this context, Greece seemed to be the most difficult case to be solved in order to avoid a euro breakup. Repurchasing 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. The government has repurchased bonds with maturities from ten to thirty years and has reduced the face value of its debt. The amount needed to buy back outstanding bonds has been guaranteed by EFSF providing favorable interest rates with respect to risk premia observed on the secondary market.

## 3 Sovereign debt in the literature

The literature on sovereign debt crises has been focused on the demonstration that countries acting alone find more convenient to not repurchase debt at all. They prefer to increase investments and consumption rather than tax citizens in order to repay their debt. Hence, an official intervention is important in order to break this incentive. The role of official institutions has been strengthened with the creation of the European Stability Mechanism 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. The ECB will play an active role with unlimited purchases conditional on actions of debtor countries. Part of Greek debt 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 operation and can protect creditors from possible incentives to not repay debt.

The recent reforms of official institutions powers lead to a critical review of actions undertaken even by International Monetary Fund during previous debt crises. 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* institution by creditors and from that moment it aimed at being 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; debtors in trouble know they will be bailed out by IMF. Secondly, expecting a future loan by the Fund, even new investors are more willing to lend pretending full repayment. 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 behavior by the country itself. Tight limits are not enforced effectively; in fact, the commitment to lending limits is another incentive problem. It is never credible that an official institution will stop its loans until other successful remedies are effectively discovered.

The case study of Greece opens 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 decreases, thus benefiting the debtor in the short run because it pays less. On the other hand, Baglioni (2013) explains the successful buyback of Greece through the junior clause in the loan made by EFSF. Nevertheless, some months after, it has been not considered as an optimal clause in the IMF perspective (confidential document IMF, 6th June 2013).

## 4 Buyback: a way to restructure debt

### 4.1 The general framework

**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.*

Considering the standard model in example 1, the country faces a trade-off: 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.

## 5 The need for official intervention

### 5.1 A quantitative reason.

I recall what Bulow and Rogoff (1991) analytically expressed as relevant problem for self financed buybacks. Here I introduce some endogenous elements.

- 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  $\theta$  for simplicity equal to 1.  $Y(1) = C_1 + \theta g(I_1)$ .  $g'(\cdot) > 0$ .

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.

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

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.

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

## 5.2 Buyback model with uncertainty

I consider a debtor country willing to restore its secondary market price of debt at an adequate level, close to 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 ( $P_1 > P_0$ ).

- **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 ( $Y(1)$ ). It is assumed that  $Z$  affects both state of the world (2, high appropriability). In the meantime  $D_0$  has not developed interests between period 0 and period 1.

$$Y(1) = \left\{ \begin{array}{l} Y_1^{low} - Z \text{ with probability } (1 - \pi) \\ Y_1^{high} - Z \text{ with probability } \pi \end{array} \right\} \quad (2)$$

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

satisfy the following constraint  $Z = P_1 X$ . I remind that  $0 < P_0, P_1 < 1$  and assume  $\gamma > \pi^1$ .

Without any buyback

$$P_0 = \frac{V(D_0)}{D_0} = \gamma \quad (3a)$$

$$P_1 = \frac{V(D_1)}{(D_1)} = \frac{\pi(D_0) + (1 - \pi)(\tau Y_1^{low})}{D_0} \quad (3b)$$

A price increase is verified when

$$\tau Y_1^{low} > \frac{(\gamma - \pi)}{(1 - \pi)} D_0 \quad (4)$$

I suppose  $\frac{(\gamma - \pi)}{(1 - \pi)} = \delta$  where  $0 < \delta < 1$ .

### 5.2.1 Buyback with own resources

Debt price in 0 has been computed before in formula (3a). The price 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  $D_0$ . With respect to a situation without any operation, in a self-financed buyback a positive variation in price is verified only for higher levels of  $\tau Y_1^{low}$  if  $Z > X\delta$ . Following the resource constraint,  $\delta < P_1$ . In order to have a price increase for lower values of  $\tau Y_1^{low}$ ,  $Z < X\delta$  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  $Z = P_1 X = \pi F + (1 - \pi)kF$ .

With  $k = 1$  a fair loan is not convenient with respect to a buyback financed with own resources since the new high priority claim 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 ( $D_0 - X + F$ ).

In case  $k = 0$  the price effect changes because  $Z = \pi F$  implying  $P_1 \geq P_0$  if  $\tau Y_1^{low} \geq \pi F + \frac{(\gamma - \pi)}{(1 - \pi)}(D_0 - X + F)$  where  $0 < \pi < 1$ . A price increase could be verified for lower levels of  $\tau Y_1^{low}$  under  $k = 0$  with respect to  $k = 1$  because  $\pi F < F$ . In the seniority clause case, creditors discount the fact that debtor country *ex post* has less resources

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<sup>1</sup>Very strong assumption but I imagine an high discount in debt price ( $1 - \gamma$  high) is linked to a low probability of full repayments  $\pi$  in period 1.



for partial repayments with respect to a junior position. Nevertheless, with respect to a self-financed operation a country is able to restore creditworthiness for lower levels of  $\tau Y_1^{low}$  when  $\frac{Z}{F} > (\pi + \delta)$  and since  $\pi = \frac{Z}{F}$  and  $\delta > 0$  even a juniority clause is not preferred to a buyback with own resources.

Finally,  $k = \frac{\tau Y_1^{low}}{D_0 - X + F}$  (*pari passu* assumption). If  $F < X$ , with respect to  $k = 0$  a price increase is verified only for higher levels of fraction of income in period 1 available for partial repayment.

In case of fair loan, it is evident the amount of new claims to be satisfied whatever clause is applied. Thus, there is no possibility to prefer a fair loan to a buyback financed with own resources since the new claims to be satisfied overcome claims under a self-financed buyback ( $Z + \delta(D_0 - X)$ ). Only higher levels of  $\tau Y_1^{low}$  could provoke a positive price variation. Recalling Bulow and Rogoff (1991), a nonconcessional loan cannot be the right official institutions' approach since in the previous section I explained that the optimal behavior of countries acting alone is to not buyback at all.

### 5.2.3 Subsidized loan: different results arise

I assume interest rate on the loan set to 0. Thus, the initial condition is  $F = Z$ . With  $k = 1$  it is the same to go back to a fairly priced loan. With  $k = 0$  a price increase is verified when  $\tau Y_1^{low} \geq \frac{(\gamma - \pi)}{(1 - \pi)}(D_0 - X + F)$ . The outcome in case of subsidized loan implies a positive price variation even for lower levels of partial repayments 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 optimal solution for the Fund because moral hazard arises. It is the best solution for the objective of the country even against a buyback financed with own resources. In fact, the condition for having a price increase with respect to a self-financed operation is  $\delta < \frac{Z}{F} = 1$ . Thus, from the assumption of subsidized loan and the initial assumption on  $\delta$ , even for lower levels of partial repayments with respect to a self financed buyback it is verified a positive price variation. Finally, even with  $k = \frac{\tau Y_1^{low}}{D_0 - X + F}$ , it is possible to demonstrate a positive price variation could happen for lower levels of partial repayments with respect to a self financed buyback only when  $Z < \frac{(1 - 2\delta)}{\delta}(D_0 - X)$ .

A conclusion could be inferred by cases analyzed before. The best solution for a debtor country is when loans are concessional (below market risk premia) with respect to all the other options analyzed. The constant junior position of the Fund could be mitigated in order to prevent moral hazard issues and could partially be solved through subsidized loans where the Fund acts as a simple creditor under certain conditions about the amount of resources.

A price increase is verified when the debtor has less obligations to be satisfied com-

pared to partial repayments. Thus, creditors are happy even if probabilities of partial repayments are more likely to happen because bondholders will be paid in an adequate way.

## 6 Empirical evidence

### 6.1 Econometric approach to price effects

Using the econometric model in (5) and through related graphs I explain the effect on debt price of the amount repurchased  $X$  interacted with variable  $loan$ : multilateral net flows ( $multi = loan$ ) fair loans ( $noconc = loan$ ) and concessional loans ( $conc = loan$ ). This effect is the most important in order to understand whether some ways of financing are effectively preferred to others. Unfortunately, it is not possible to test for the seniority structure of the loan.

$$\begin{aligned}
 price_t = & \beta_0 + \beta_1 \ln(I_t) + \beta_2 DEBTGDP_t + \beta_3 X_t + \beta_4 loan_t * Dloan_t \quad (5) \\
 & + \beta_5 announcement_t + \beta_6 (loan_t) * (announcement_{t-1}) \\
 & + \beta_7 (loan_t) * (X_t) + \beta_8 (loan_t) * (DEBTGDP_t) \\
 & + \beta_9 Dloan_t + u_t
 \end{aligned}$$

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

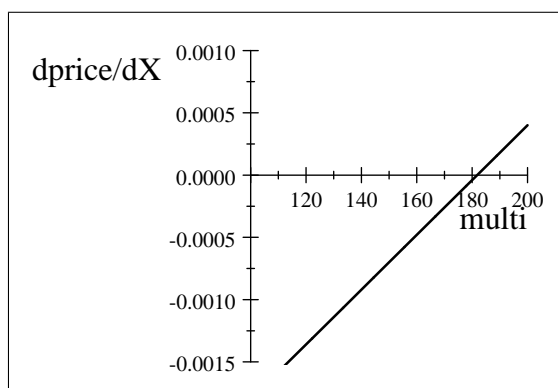


Figure 2. Effects of debt repurchased on price (regression 2).

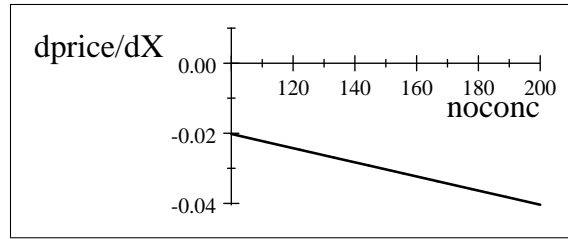
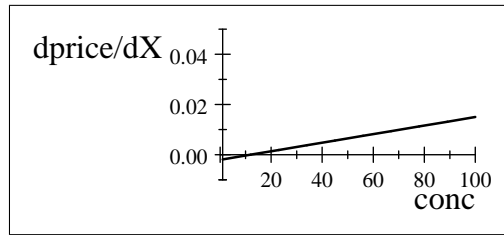


Figure 3. Effects of debt repurchased on price (regression 3).



(Elaborations using Scientific Workplace 5.5)

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

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

## 7 Italy as future buyback case?

### 7.1 Optimal time for a successful repurchase

A series of small buybacks could be not beneficial for the country because assuming price increase over time, the same amount  $Z$  could acquire less portion of debt in the following periods. At the same time, an high repurchase could lead to a collapse in debt price in the long run because remaining bondholders perceive less repayments for them at maturity. Thus, neither a huge nor small buybacks are beneficial, but the optimal time for a medium sized operation is  $t^* = 0$ .

### 7.2 Credibility matters

$$dP_t = \beta_0 + \beta_1 OMT_t + \beta_2 greece_t + \beta_3 FC_t + \beta_4 BU_t + \beta_5 CIPRO_t + \beta_6 ESM_t + \beta_7 credgov_t + \beta_8 greeceok_t + \beta_9 operation_t + \varepsilon_t \quad (6)$$

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 <sup>2</sup>	2%	2%	4%	5%	5%
adj R <sup>2</sup>	0.20%	0.22%	2%	3%	3%

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

- *time*: it must be implemented earlier to avoid larger payments either in a positive price shock (direct effects) or in a price collapse (deadweight losses). In a strictly confidential document 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 medium sized repurchase as it happened for Greece. In this case risk premia are also

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. A fair loan cannot be exploited because as in regression 2 of the previous chapter, Italy has 121% of debt over GDP ratio and the negative consequences of new obligations to be satisfied could worsen the situation, above all in a context of slow economic growth. 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. Thus, a subsidized loan with a juniority clause could be the optimal choice, since *pari passu* assumption is convenient for very high levels of discount, more likely for Greece rather than for Italy. Nevertheless, official institutions, in particular IMF, would like to change their mind in order to participate in the negotiations as simple creditors.

## 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, allowing both creditors and countries to gain except when the Fund is in a seniority position and when the amount of resources needed overcome a certain threshold under the *pari passu* assumption.

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.

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<sup>2</sup>References refer here only to citations in the summary. All references are in the original paper.