Welfare Costs of Sovereign Debt Crisis: the Role of Bailouts*

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Abstract

This paper examines the welfare effects of bailouts, policies that combine third-party subsidized loans with limits on sovereign borrowing, in economies exposed to sovereign debt risk and to financial stress. Our quantitative exercise focused on the Eurozone debt crisis shows that, *ex-ante* (i.e. before observing the exogenous path of the economy), bailouts are welfare improving and amount to 0.37 percent in consumption equivalent terms. However, *ex-post* (i.e. after observing the exogenous path of the economy), their desirability is much less certain. If the crisis is short-lasting, bailouts have an overall positive effect. In this case the loan is repaid and the bailout acts as an additional consumption-smoothing asset that makes the economy better off. Crucially, however, we show that if the crisis is long-lasting and severe, economic bailouts can be undesirable. In this case the imposed borrowing limit may push the country into default, thereby increasing sovereign spreads and making the economy worse off than an economy without a bailout option.

Keywords: Default, Sovereign Spread, Private Credit Spread, Bailouts.

JEL Classification: E44, F32, F34.

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1 Introduction

This paper studies the role of bailouts, policies that combine third-party subsidized loans with limits on borrowing, in economies subject to sovereign debt risk and financial stress. The main questions we address are whether, and by how much, these bailouts are likely to be beneficial from the perspective of the receiving economy. Using a calibrated general equilibrium model, we find that even though bailouts are *ex-ante* (i.e. before observing the exogenous path of the economy) welfare improving, when the troubled economy experiences a long-lasting recession they may in fact increase default risk and have a negative impact on financial markets. In this case bailouts can, *ex-post* (i.e. after observing the exogenous path of the economy), have detrimental effects on the receiving economy.

To study these questions, we develop a quantitative small-open economy model with endogenous default, financial frictions, and a non-trivial bailout choice. We first augment the standard endogenous default decision as in Arellano (2008) with an endogenous bailout decision. Specifically, the government decides to enter the bailout program by asking for a non-defaultable loan from a third party, for instance a monetary authority or an international organization, and decides to exit the program by repaying the loan. The bailout, at the same time, imposes a borrowing constraint on the government, reflecting a fiscal conditionality clause. We then augment the model with a financial intermediation channel in order to take into account the effects that policies aimed at stabilizing sovereign spreads have on domestic private credit.[1] In particular, we assume that firms face a working capital constraint on their wage bill as in Mendoza and Yue (2012). To meet the constraint firms must borrow funds from international financial intermediaries (banks) that buy government bonds on the secondary market. These sovereign bond holdings on the banks' balance sheet generate an endogenous relationship between the price of government debt and the interest rate that banks charge to firms, as pointed out by Gennaioli et al. (2014a), at the same time replicating the observed relationship between sovereign spreads and private lending spreads in Europe.

In our framework the presence of the bailout option affects welfare through three distinct channels. First, bailout represents an additional option that augments the government's decision set and that is, therefore, ex-ante welfare improving. Second, when the country is in a bailout program, the

[1] The relationship between sovereign spreads and private credit markets is widely recognized in the policy circles. For instance, Mario Draghi, president of the ECB, addressed this issue (Wall Street Journal, 22 February 2012) by highlighting that "Backtracking on fiscal targets would elicit an immediate reaction by the market. Sovereign spreads and the cost of credit would go up". This fact serves as one of the underlying motives for the ECB's 2012 introduction of Outright Monetary Transactions. In addition, Emma Marcegaglia, former president of the General Confederation of Italian Industry, stated that "the spread should decline, otherwise there is a risk of credit freeze to households and businesses" (LaPresse, 11 Nov. 2011).

fiscal conditionality constrains government's options. We show that in this case the welfare effects of bailouts depend on the recovery path of the economy. Specifically, if the economy is on a quick recovery path, the country endogenously decides to repay the loan ending the bailout regime with restrictive borrowing limits. In this case, a bailout provides the government with an instrument to smooth consumption by transferring income from a good state to a bad state, since, effectively, the country receives a loan during a recession and decides to exit the bailout during the expansion. If, however, poor economic performance is long-lasting, the inability to borrow due to the conditionality clause pushes the country into default. This scenario leads to high spreads because investors recognize that the combination of the limited borrowing capacity and poor economic performance puts a strain on the government. Third, given that bailouts affect sovereign spreads, they also affect private credit through the financial intermediation channel.

Our setup directly resembles the bailout programs created during the recent Eurozone crisis, such as the European Financial Stabilization Mechanism, the European Financial Stability Facility, and the European Stability Mechanism, which provided financial assistance to the Eurozone states in difficulty and aimed at preserving financial stability of the overall union. We calibrate the model to match financial variables (sovereign spreads and private interest rates), output dynamics, and default statistics of Greece, Ireland, Italy, Portugal, and Spain (henceforth, GIIPS). We focus on these countries because arguably they have been affected the most by the recent European sovereign debt crisis. The model is able to replicate the data in several dimensions, namely default frequency, average sovereign spreads, average private credit rates, etc. As such, the model is suitable for evaluating the effects of bailout interventions.

We find that the presence of a bailout option reduces both sovereign and private credit spreads. We also compute the level of welfare in terms of consumption equivalent associated with having the additional option of asking for a bailout. This calculation sheds light on whether the benefits of having an extra instrument for insurance exceed the costs of losing access to debt when in the bailout program. We find that, ex-ante, the welfare gain is about 0.37 percent in consumption equivalent terms. Our sensitivity analysis shows that a small portion of this welfare gain is due to the existence of credit friction, and a large portion is due to the agents' insurance motive. Overall, we conclude that the bailouts are ex-ante moderately welfare improving.

Related Literature Our paper relates to the growing literature on debt crisis and policy interventions as in Boz (2011), Fink and Scholl (2016) and Mengus (2014). Boz (2011) investigates how the presence of the loans from the international financial institutions affects the decisions of the sovereign, in a framework where the government can repeatedly borrow from these institutions even when it does not honor its debt to private international creditors. In her framework, fiscal conditionality is accounted for by a higher discount factor in periods when the sovereign is indebted to the international institutions. Fink and Scholl (2016) complement our model by using a model with distortionary taxation where conditionality enters as a constraint on fiscal policy. However, their analysis abstracts from the financial intermediation channel and is implemented using Argentinian data. Mengus (2014) studies bailout from a perspective of a two-country model investigating the incentives that lead one country to pay off another country's debt. However, our setup, similarly to the first two papers, abstracts from the decision-making process of the creditor. This is also similar to Aguiar and Gopinath (2006) who model bailout originating from an unmodeled third party. In their setup, however, the bailout comes in the form of an unconditional transfer, while in our setup bailout comes in the form of a non-defaultable loan and with imposed borrowing regulations, leading to more relevant trade offs. Moreover, a novel finding of our paper relates to the ex-post consequences of a bailout program conditional on the economic performance upon its implementation.

This paper is also related to the work of Guler et al. (2014) and Hatchondo et al. (2017). While the first paper studies bailouts in a two country version of the Eaton and Gersovitz (1981) model, the second paper considers the impact of introducing non-defaultable debt in a standard open economy endogenous default model . While in our setup the bailout has also the form of non-defaultable debt, our paper focuses on the welfare effects of bailouts to the debtor in an environment sovereign default and private domestic lending.

Our work also relates to the work of Corsetti et al. (2006), Roch and Uhlig (2012) and Kirsch and Rühmkorf (2015) who study the role of official lending; however, in contrast to our approach, these authors consider the role of official lending in sunspot models with multiple equilibria. On the other hand, a large literature studies how macroprudential policies can be used to avoid overborrowing and debt crises, such as Bianchi and Mendoza (2011). We also relate to Jeanne and Zettelmeyer (2001) who, in a policy oriented paper, discuss the implications of international bailouts and conditionality in relation to moral hazard. More generally, this paper relates also to the literature on strategic default such as Eaton and Gersovitz (1981), Arellano (2008), Aguiar and Gopinath (2006) and Mendoza and Yue (2012), and to papers that study the impact of different types of debt on the dynamics of sovereign spreads such as Hatchondo et al. (2014). To the best of our knowledge, our paper complements existing literature by analyzing welfare implications of bailouts in economies subject to financial constraints considering realistic trade-offs arising from fiscal conditionality.

We relate to the literature that studies the interaction between financial intermediaries and sovereign risk, such as Bianchi (2012) and Acharya et al. (2014). Also, sovereign default and banking crisis have raised the attention of many recent papers in the international macroeconomics literature. For instance, Reinhart and Rogoff (2011) and Gennaioli et al. (2014a) conduct empirical studies to uncover the relationship between sovereign debt and banking crisis, using aggregate and cross-country panel data on banks, respectively. In addition, Padilla (2013) develops a model where banks are exposed to the risk of sovereign default as they lend both to the government and to the corporate sector. Mallucci (2013) uses a similar model with wholesale funding to study the implications of a relaxation of collateral eligibility requirements by a central bank.

The remainder of the paper is as follows. Section 2 describes the model. Section 3 discusses the calibration and performance of the model. Section 4 introduces bailout programs and describes their implications on sovereign risk, private credit, output losses, and welfare. Section 5 concludes.

2 The Model

This section describes the full endogenous sovereign default model that we later use for welfare evaluation. Our framework consists of a small open economy populated by households, firms, and a government. In addition, there are international lenders and financial intermediaries (banks) that are international entities.

2.1 Households

Households are identical, risk averse, and choose consumption and hours to maximize the present value of their expected utility given by

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t u\left(c_t, h_t\right).$$

Here c_t represents households' consumption in period t, h_t represents labor supply, $\beta \in (0,1)$ is the discount factor, and $u(\cdot)$ represents a utility function, which is strictly concave, strictly increasing, and satisfies the Inada conditions. Households decide how much to consume and how much labor to supply for an hourly wage of w_t. They own and rent a constant amount of capital k at the rate u_t.[2] Additionally, we assume that households receive government transfers, τ_t, and also own firms, which distribute profits, π_t. Given these assumptions, the budget constraint of the households at any period t is the following:

$$c_t = h_t w_t + k u_t + \tau_t + \pi_t.$$

[2]We follow Meza and Quintin (2005) and Mendoza (2010), who find that changes in the capital stock play a small role in output dynamics around financial crises. Additionally, as emphasized by Mendoza and Yue (2012), endogenizing capital makes the recursive contract with default much harder to solve as an additional endogenous variable is introduced. For these two reasons we fix the amount of capital in the economy.

2.2 Firms

Firms produce a single good and rent capital and labor services taking all prices as given. They are subject to financial frictions in the form of a working capital constraint; firms have to advance a share of the wage bill before production takes place, as in Neumeyer and Perri (2005) and Mendoza and Yue (2012). Their production function is given by

$$y_t = \varepsilon_t F\left(k, h_t\right),$$

where ε_t represents an exogenous productivity process, y_t denotes output and $F(\cdot)$ satisfies the assumptions of the neoclassical production function.

Formally, the working capital constraint is given by

$$L_t^d \geq \eta w_t h_t,$$

where $\eta \geq 0$ is the share of wage bill that needs to be paid in advance and L_t^d denotes the demand for loans by a representative firm in period t. Borrowing above this amount would be suboptimal, because firms need loans only to finance the working capital constraint. This equation, therefore, will always hold with equality. Accounting for this fact, the firm's profits are

$$\pi_t = y_t - w_t h_t - u_t k - r_t^d \eta w_t h_t,$$

where r_t^d denotes the net interest rate that firms face when financing the working capital constraint.

Firms choose labor according to the first order condition

$$\varepsilon_t F_h(k, h_t) = w_t \left[1 + \eta r_t^d\right].$$

This condition equates the marginal product of labor with the marginal cost of hiring an additional unit of labor, which is affected by the degree of financial friction in the private sector, η, and by the private lending rate, r_t^d, that will be determined on the credit market. The equilibrium level of employment, therefore, will be affected by the conditions on the private credit market.

2.3 International Lenders

Following Yue (2010) and Arellano (2008), we assume that risk-neutral international investors trade one-period government bonds and have access to a risk-free asset with net return $r > 0$. When pricing sovereign bonds, they take into account that the government can default on its debt with probability δ_t. Given the risk-neutrality assumption, they price sovereign bonds such that they break even in expected terms. Investors demand small open economy bonds b_{t+1} in order to maximize profits, ϕ, given by

$$\phi = q_t b_{t+1} - \frac{1-\delta_t}{1+r} b_{t+1}.$$

Hence, equilibrium bond price will be:

$$q_t = \frac{1-\delta_t}{1+r}.$$

The default probability is endogenous and depends on the government's incentives to repay its debt obligation.

2.4 Financial Intermediaries

Firms finance the working capital constraint by raising funds from financial intermediaries (banks) who produce within-period loans. In the spirit of Padilla (2013) and D'Erasmo et al. (2014), banks hold sovereign debt to fund loans to firms. This setup intends to capture, admittedly in a stylized form, the relationship between banks' holdings of sovereign debt and loans during crisis, as documented by Gennaioli et al. (2014a). Specifically, banks are competitive, international, and face an intratemporal profits maximization problem.[3] Since this problem is intratemporal, we omit the time-t subscript in its exposition. In order to keep the financial intermediary environment as stylized as possible we will focus on the production of loans to domestic firms, and consequently we focus on the banks asset position of their balance sheets, rather than on the banks liabilities.[4] We assume that the production function of loans, L^s, is linear and is given by:

$$L^s = \phi \left(A + q\Delta \right),$$

where A denotes an endowment portfolio of risky assets and Δ are the banks' holdings of sovereign bonds valued at price q. Hence, one should interpret the two assets as inputs in the production of loans for banks. The parameter ϕ is a technology parameter for the production of loans. Banks purchase sovereign bonds in the secondary debt market at the beginning of the period (after the government decides to default or not) and sell those bonds at the end of the period in the same market before the government takes the new default/repayment decision. The acquisition of bonds is subject to portfolio adjustment costs. These bonds, however, are part of banks' capital that is used to finance loans.[5] The bank's problem is given by

$$\max \Pi_b = A + r^d L^s - \Psi \left(\Delta - \bar{\Delta} \right)$$
$$\text{s.t. } L^s = \phi \left(A + q\Delta \right),$$

[3]The assumption that banks are international implies that their profits are not distributed to the domestic households. Moreover, this assumption is convenient because in this case the planner does not consider the utility of bankers when taking decisions.

[4]Our setup is consistent with one in which the bank holds liabilities, which can be for example deposits from unmodelled agents in the rest of the world, and each period distributes positive or negative profits to their shareholders.

[5]Popov and van Horen (2013) point out that the large holdings of government debt securities on the balance sheets of European banks represent a possible source of the link between private credit spreads and sovereign spreads. Additionally, Gennaioli et al. (2014b) show that private credit declines because banks' balance sheets are weakened during the crisis due to large holdings of sovereign bonds.

where $\Psi\left(\Delta-\bar{\Delta}\right)$ denotes portfolio adjustment costs, and r^d is the rate charged on the loans extended to firms. The optimality condition for this problem is:

$$\phi r^d q - \Psi'\left(\Delta-\bar{\Delta}\right) = 0.$$

Assuming a quadratic adjustment cost function, $\Psi\left(\Delta-\bar{\Delta}\right) = \frac{\psi}{2}(\Delta-\bar{\Delta})^2$, we have:

$$r^d = \psi\frac{L^s-\phi A}{(\phi q)^2} - \psi\frac{\bar{\Delta}}{\phi q}.$$

Notice that the supply of loans depends positively on the price of sovereign bonds, q; with favorable conditions on the sovereign credit market (high q), the supply of loans is high, and, as a consequence, the interest rate charged to the firms is low.

In equilibrium, banks' loan supply, L^s, equals firms' demand for loans, L^d. Therefore, the equilibrium level of the private loan interest rate when the country is not in default solves the following non-linear equation:

$$r^d = \psi\frac{\eta\left(\frac{\varepsilon(1-\alpha)k^\alpha}{1+\eta r^d}\right)^{\frac{1+\zeta}{\zeta+\alpha}} - \phi A}{(\phi q)^2} - \psi\frac{\bar{\Delta}}{\phi q},$$

where here with a slight abuse of notation we have assumed a utility function proposed by Greenwood et al. (1988) as in equation (1) and a Cobb-Douglas production function as in equation (2), with ζ representing the inverse of the Frisch labor supply elasticity and α representing income share of capital.

We assume that during default the government still allows the bank to keep sovereign bonds on their balance sheet, but they are valued at a regulated price. This has been shown as an extended practice, to cope with the deterioration of banks' balance sheets, as shown in Gelpern (2004). In practice this is done in several ways; for instance, in the case of Argentina the government issued new (non-defaultable) debt to financial institutions and allowed banks to book government debt at face value. Although we do not model explicitly how the regulated price is set, this assumption captures the fact that, if a sovereign defaults, banks that hold sovereign bonds on their balance sheet experience a deterioration of their capital, and, therefore, their ability to finance firms becomes more limited. Consequently, given this setting, during default the banks solve a similar problem as in normal times, but the value of government bonds is the regulated price, $\tilde{q}$. Hence, in time of default the private loan interest rate becomes:

$$r^d = \psi\frac{\eta\left(\frac{\varepsilon(1-\alpha)k^\alpha}{1+\eta r^d}\right)^{\frac{1+\zeta}{\zeta+\alpha}} - \phi A}{(\phi \tilde{q})^2} - \psi\frac{\bar{\Delta}}{\phi \tilde{q}}.$$

As emphasized earlier, the banking sector is given in a stylized form. Our setup is consistent with the one in which the bank keeps its net worth constant distributing its profits, whether positive or negative, to international shareholders. The focus of this paper is to understand the effects of bailout policies, but we introduce banking sector to illustrate an additional channel through which default costs could be amplified; default reduces the amount of loans that banks can provide, which results in a higher private credit interest rate.

2.5 Government

The government is benevolent and issues bonds to maximize households utility under no-commitment. In each period the government chooses the level of one-period asset holdings, b' and has three options: *(i)* default on its debt obligations; *(ii)* repay the debt and issue new debt in international markets; *(iii)* repay its debt obligation while entering/exiting the bailout program. We denote the participation in the bailout program with the state variable $s = \{0, 1\}$, where $s = 0$ denotes that the domestic economy is not in the bailout program and $s = 1$ denotes otherwise. The endogenous decision of entry and exit from the program determines the evolution of the state variable s.

The consequences of the default decision are as conventionally assumed in the literature. If the government defaults, the country is excluded from financial markets for a random number of periods. At the same time, the country experiences a productivity loss, which captures the disrupting effects of default in the domestic economy. Hence, consumption in default equals

$$c = \tilde{y} - r^d \eta w h,$$

where $\tilde{y} = \varepsilon^{def} F(k, h)$ and $\varepsilon^{def} = \Gamma(\varepsilon)$. We assume that $\Gamma(\cdot)$ is a penalty function as in Arellano (2008).[6] With an exogenous probability θ, government reenters the international credit markets where all past debt is forgiven.

If the government chooses to repay its debt, it remains in the contract and chooses the new level of assets, b'. Because the government is benevolent, its objective is to maximize households' lifetime utility subject to the following resource constraint of the economy:

$$c = y - r^d \eta w h + b - q(b', \varepsilon, s) b',$$

where the second term on the right hand side represents a resource cost to the economy resulting from the working capital constraint that firms face.

We introduce an endogenous decision of the government to enter and exit a bailout program. When the government asks for a bailout, the domestic economy receives a loan of size G from a third party, which, at the same time, imposes a borrowing constraint on the government such that $b' \geq b$. This constraint is in effect until the government fully repays the loan, depicting the fiscal conditionality clause of bailouts. Furthermore, once in the program, the domestic economy cannot

[6] In particular, $\Gamma(\varepsilon) = \begin{cases} \hat{\varepsilon}, & \text{if } \varepsilon > \hat{\varepsilon} \\ \varepsilon, & \text{if } \varepsilon \leq \hat{\varepsilon} \end{cases}$, where $\hat{\varepsilon} = \gamma E(\varepsilon)$.

request additional interventions and in each period it has to pay interest on the loan at a given rate r^b. The country can decide to exit the program in order to end the restrictive borrowing regime. To do so, the country needs to repay the principle G. Therefore, the bailout program assumes the form of a non-defaultable loan issued by the third party to the domestic economy that can be repaid at an interest different (lower) than the one charged in the international market.

Formally, the optimal value of the government that is not in a bailout program, $(s = 0)$, is given by

$$v^o(b, \varepsilon, 0) = \max \left\{ v^c(b, \varepsilon, 0), v^p(b, \varepsilon, 0), v^d(\varepsilon, 0) \right\},$$

where $v^c(b, \varepsilon, 0)$ is the value of repaying the debt without asking for a bailout, $v^p(b, \varepsilon, 0)$ is the value of repaying by entering the bailout program, and $v^d(\varepsilon, 0)$ is the value of defaulting. Instead, the optimal value of the government that is already in a bailout program, $(s = 1)$, is given by

$$v^o(b, \varepsilon, 1) = \max \left\{ v^c(b, \varepsilon, 1), v^e(b, \varepsilon, 1), v^d(\varepsilon, 1) \right\},$$

where $v^e(b, \varepsilon, 1)$ is the value of repaying the international debt and at the same time repaying the loan, and thus immediately exiting the bailout program, and $v^d(\varepsilon, 1)$ is the value of defaulting when being in the program. In particular, when by some exogenous probability the country exits the autarky, it cannot borrow at all until the third-party loan is repaid.

The value function of repaying the debt while not asking for a bailout is

$$\begin{aligned} v^c(b, \varepsilon, 0) = \max_{b'} u\left(c(b, \varepsilon, q, 0), h\right) + \beta \mathbb{E}\left[v^o(b', \varepsilon', 0)\right], \\ \text{s.t. } c(b, \varepsilon, q, 0) = y - r^d \eta w h + b - q\left(b', \varepsilon, 0\right) b', \\ s' = 0. \end{aligned}$$

With this notation, we emphasize that the amount of consumption in the economy is a function of the state variables b, ε, and s.[7] The value function of repaying the debt while asking for a bailout is

$$\begin{aligned} v^p(b, \varepsilon, 0) = \max_{b' \geq b} u\left(c^p(b, \varepsilon, q, 0), h\right) + \beta \mathbb{E}\left[v^o(b', \varepsilon', 1)\right], \\ \text{s.t. } c^p(b, \varepsilon, q, 0) = y - r^d \eta w h + b - q\left(b', \varepsilon, 0\right) b' + G, \\ s' = 1. \end{aligned}$$

The value of repaying the debt while staying in a bailout program is as follows

$$\begin{aligned} v^c(b, \varepsilon, 1) = \max_{b' \geq b} u\left(c(b, \varepsilon, q, 1), h\right) + \beta \mathbb{E}\left[v^o(b', \varepsilon', 1)\right], \\ \text{s.t. } c(b, \varepsilon, q, 1) = y - r^d \eta w h + b - q\left(b', \varepsilon, 1\right) b' - r^b G, \\ s' = 1. \end{aligned}$$

Notice that no new transfers of resources occur, but for the entire duration of the bailout the

[7] Obviously, also the other endogenous variables, such as hours worked, h, wages, w, private credit rate, r^d, and savings, b', are all functions of the three state variables. We omit this link in the notation for simplicity.

economy must reduce its stock of debt, since the optimal asset level b' must satisfy $b' \geq b$, and it must repay the interest rate r^b on the loan received. The value of exiting the program is

$$v^e(b,\varepsilon,1) = \max_{b'} u\left(c^e(b,\varepsilon,q,1),h\right) + \beta\mathbb{E}\left[v^o(b',\varepsilon',0)\right],$$
$$\text{s.t. } c^e(b,\varepsilon,q,1) = y - r^d\eta wh + b - q\left(b',\varepsilon,1\right)b' - (1+r^b)G,$$
$$s' = 0.$$

Notice that when exiting the program, the country needs to repay the principle G, in addition to the interest.

Finally, the default values are given by

$$v^d(\varepsilon,0) = u(c^{def},h) + \beta\mathbb{E}\left[\theta v^o(0,\varepsilon',0) + (1-\theta)v^d(\varepsilon',0)\right], \text{with } s' = 0,$$
$$v^d(\varepsilon,1) = u(c^{def},h) + \beta\mathbb{E}\left[\theta v^o(0,\varepsilon',1) + (1-\theta)v^d(\varepsilon',1)\right], \text{with } s' = 1,$$

where θ is the exogenous probability of leaving financial autarky. The two default value functions differ because the government that defaults on its international debt while in the bailout program ($s = 1$) will still be borrowing constrained when it exogenously reenters the financial markets until it pays the third-party loan. This is because the government can default on its international debt but not on its third-party bailout loan.

3 Empirical Strategy

This section presents the calibration and assesses the ability of the model presented in Section 2 to match various aspects of the data. Our strategy is to initially calibrate the model without the bailout option by imposing $G = 0$, and, then, to introduce separately-calibrated bailout parameters in order to evaluate bailout effects. This approach is motivated by the fact that we base our calibration on historical data that correspond to periods in which the bailout option was arguably unexpected. We now describe the calibration of the full model without the bailout option and document that our model can successfully replicate the data.

3.1 Calibration

We assume a utility function as proposed in Greenwood et al. (1988)[8]

$$u(c,l) = \frac{1}{1-\sigma}\left(c - \frac{l^{1+\zeta}}{1+\zeta}\right)^{1-\sigma}. \quad (1)$$

The production function is Cobb-Douglas

$$Y_t = \varepsilon_t k^\alpha h_t^{1-\alpha}, \quad (2)$$

[8]The use of this functional form of the utility function is quite standard in the international real business cycle literature, because the absence of the wealth effect on labor supply prevents models of having counterfactual predictions whereby output increases in default periods. See, for example, Mendoza (1991) and Mendoza and Yue (2012).

where α denotes income share of capital. Both choices are in line with the previous literature. Technology ε_t is assumed to follow a mean zero log-normal $AR(1)$ process. The persistence parameter, ρ_ε, and the standard deviation of its innovations, σ_ε, are calibrated to match the GIIPS quarterly real output per capita over the 1960-2008 period. Following Garcia-Cicco et al. (2010), we remove a cubic trend from output and compute the first order autocorrelations and standard deviations.[9] As displayed in Table 1, in all five economies output is highly persistent with similar levels of volatility.

Table 1 – Output moments

	Greece	Ireland	Italy	Portugal	Spain	Average
$\rho(y)$	0.85	0.97	0.93	0.98	0.97	**0.94**
$\sigma(y)$	0.05	0.06	0.02	0.06	0.04	**0.05**

Note: $\rho(y)$ denotes the first order autocorrelation and $\sigma(y)$ denotes the standard deviation of log cubic detrended output. We use quarterly real output per capita for the period 1960-2008.

Let us now describe some key features of default episodes in Europe during the last 200 years that we will use to calibrate some parameters of the model.[10] Table 2 displays the number of default episodes, the quarterly probability of a default episode, the share of periods that the economy spent in default relative to the total quarters in our sample, and the average length of a default episode. Based on this data we calculate the average probability of default per quarter to be 0.64 percent, and the average length of default to be 30 quarters.

Table 2 – Default statistics

	Greece	Ireland	Italy	Portugal	Spain	Average
Default episodes	5	0	1	6	13	
Frequency default per quarter (%)	0.70	0	0.17	0.71	1.64	**0.64**
Average length of default	72	N.A.	20	14	14.36	**30**

Note: Greece (1832-2009), Ireland (1919-2009), Italy (1861-2009), Portugal (1800-2009) and Spain (1812-2009). Statistics are in quarters. Default statistics are taken from Reinhart and Rogoff (2009).

The discount factor β is calibrated to match the observed default frequency of 0.64 percent across the GIIPS countries, as reported in Table 2. The probability of re-entering the asset market, θ, is calibrated to match the average length of default in the GIIPS countries (30 quarters).

A subset of parameters is calibrated by following the existing literature. Specifically, the relative risk aversion parameter σ is set to 2, the utility parameter associated with labor supply, ζ, is set

[9] Moments are similar for linear and quadratic detrending. Moreover, moments are also similar if we extend the sample until 2014.

[10] We use the evidence provided in Reinhart and Rogoff (2009). Here, a default episode is defined as follows: "A sovereign default is defined as the failure of a government to meet a principal or interest payment on the due date (or within the specified grace period). These episodes include instances in which rescheduled debt is ultimately extinguished in terms less favorable than the original obligation."

to 2.66, which implies a value of Frisch labor supply elasticity in line with the micro evidence documented by many authors (see, for example, Altonji (1986), Chetty et al. (2011) and Peterman (2016)), and also consistent with macro models as in Martinez-Garcia et al. (2012) and Rotemberg and Woodford (1999). The capital share in the Cobb-Douglas production function is set to 0.32. The risk-free interest rate r is set to match the real interest rate on 10-year German bonds over the sample period. Since the endogenous labor supply implies some endogenous default cost, we assume a slack default penalty, captured by the parameter γ set to 1. The parameter η that determines the size of firm loans is set to 0.3, which ensures that the model generates an average debt service burden as a percentage of the surplus equal to 60 percent, which is in line with its data counterpart (debt service burden of non-financial corporations as a percentage of the surplus) for EU countries in our sample period.[11] This estimate is on the lower side of the values assumed in the existing literature and therefore this assures that our welfare analysis of bailouts is not biased by assuming too strong financial frictions.[12]

The financial sector parameters, namely ψ, A, ϕ, and $\bar{\Delta}$, are calibrated to obtain reasonable ranges for: *(i)* implied average private credit spreads when sovereign spreads are high; *(ii)* implied average private credit spreads when sovereign spreads are particularly low; *(iii)* implied standard deviation of private credit spreads when sovereign spreads are particularly low; *(iv)* implied positive correlation between private credit and sovereign spreads. Figure 1 shows the observed relation between sovereign spreads (top panel) and private credit rates (bottom panel) in the GIIPS countries that our model attempts to capture. Finally, the regulated bond price in time of default, $\tilde{q}$, is set to 0.78. This value guarantees that the private credit rate in times of default is not extremely large, around 9 percent annualized. This seems a reasonable bound since the private credit rate was around 7.5 percent in Greece when, despite very high sovereign spread (35 percent), it was not in default. Table 3 summarizes the resulting baseline calibration.

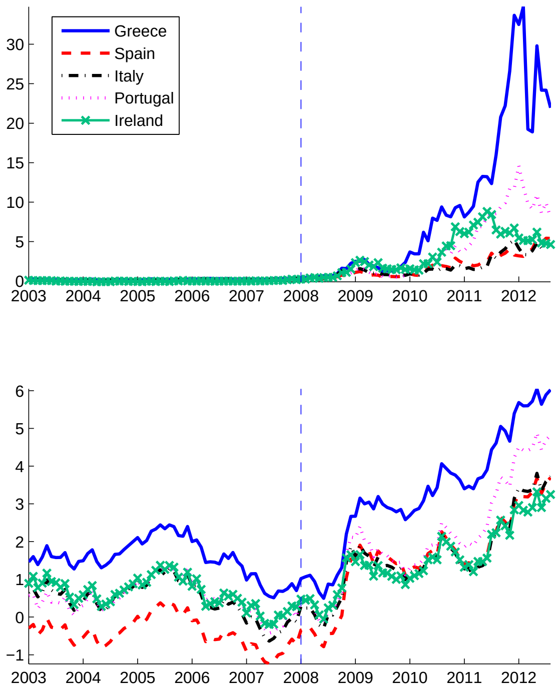
Table 4 reports empirical and theoretical moments.[13] Our model-generated default episodes on average match well the ones observed in GIIPS countries. The model also successfully replicates the relevant asset prices in the model. Although the pre-crisis average private credit spread is larger than in the data, it is important that the model can capture the increase in that spread during the

[11]Data Source: ECB, and *ECB Monthly Bulletin, February 2012.*

[12]For instance, the benchmark specification of Neumeyer and Perri (2005) requires that the entire wage bill must be paid before final output is available, implying $\eta = 1$, while Mendoza and Yue (2012) set their share of import goods that has to be paid using working capital to 0.7.

[13]We discretize the exogenous process for total factor productivity using 41 nodes, following the procedure proposed by Tauchen (1986). In the same spirit as Arellano (2008), we discretize the asset space using 300 nodes and, to compute the model moments, we simulate the economy over one million periods. Given the simulated data, we identify the default episodes and compute the average duration of default, the default frequency, and the share of quarters in default. Finally, we use all the subsamples of at least 275 quarters that do not contain default episodes to compute all the relevant moments.

Figure 1 – Sovereign Spreads and Private Lending Rates



Note: The top panel displays monthly annualized spreads for Greece, Ireland, Italy, Portugal, and Spain. The bottom panel displays private lending rates for the same economies. The vertical line depicts the first month of 2008. The construction of sovereign and private credit spreads is explained in the main text.

Table 3 – Baseline calibration

Parameter	Description	Values
ρ_ε	TFP persistence	0.95
σ_ε	Std. deviation of the TFP shock	0.045
α	Capital share	0.32
β	Intertemporal discount factor	0.887
σ	Relative risk aversion coefficient	2
ζ	Utility parameter with labor supply	2.66
r	Risk-free interest rate	1.0069
γ	Default penalty	1
θ	Prob. of re-entering asset markets	0.033
η	Working capital constraint coef.	0.3
ψ	Adjustment cost parameter, slope	40.08
$\bar{\Delta}$	Adjustment cost parameter	0.0025
A	Bank endowment	0.0012
ϕ	Loan Production Technology	20
$\tilde{q}$	Regulated price in default	0.78

crisis period, reflecting the tightening conditions on the domestic lending markets. At the same time, the model can replicate quite well the correlation between the sovereign and private credit spreads. Finally, the last row of the table reports the impact of financial frictions in the economy, by computing the amount of resources that are lost, in percent of output, due to the working capital constraint. [14]

Table 4 – Data and Model Moments

Moments	Data	Model
Output moments		
$\rho(y)$	0.94	0.95
$\sigma(y)$	0.05	0.05
Default		
Average duration of default	30	30
Default frequency (%)	0.64	0.67
Asset Prices		
Pre-crisis average sovereign spread (%)	0.12	0.07
Crisis average sovereign spread (%)	4.11	3.12
Pre-crisis average private credit spread (%)	0.55	1.65
Pre-crisis standard deviation private credit spread (%)	0.40	0.30
Crisis average private credit spread (%)	2.05	2.03
Private-credit and sovereign spread correlation	0.7	0.5
Loans and Output Loss		
Debt service burden as percent of surplus	0.60	0.64
Average output loss from financial friction(% of output)	-	0.27

4 The Effects of the Bailout Program

Having a model that is able to capture the empirical evidence regarding default, sovereign and private interest rates reasonably well, we now introduce the additional option of asking for a bailout. Two parameters characterize the bailout policy intervention: the size of the loan, G, and the interest rate on this loan, r^b. In our benchmark setting we assume a bailout size $G = 0.05$, which implies a loan equal to 5 percent of GDP. This number is the median bailout size that the European Financial Stability Facility (EFSF) issued to Greece, Ireland, and Portugal in the period 2010-2015, in relation to the size of their economies.[15] We assume that the interest rate on the loan is equal to the risk-free rate. In the next sectfgion we analyze the robustness of our results to different bailout sizes and to different repayment interest rates.

[14] A known quantitative issue with similar stylized strategic default models is that they generate low debt-to-output levels; this is the case also for our model (the average debt/output ratio in our benchmark model is close to 7 percent, but in time of crisis reaches values around 40 percent). In the recent literature it has been shown that long term bonds, as in Sanchez et al. (2014), stochastic volatility, as in Seoane (2016), and renegotiation, as in Yue (2010) bring the model-implied debt levels somewhat closer to the levels observed in the data. However, because these additional features would obscure the channels operating in our model, we believe that it is better to conduct our analysis using a parsimonious model even at this quantitative cost.

[15] Specifically, Greece received a per-year bailout equal to 14.5 percent of its GDP, Portugal equal to 4.9 percent, and Ireland equal to 3.3 percent. See *FAQ about European Financial Stability Facility (EFSF) and the new ESM*: http://www.efsf.europa.eu/attachments/faq_en.pdf

4.1 Regions

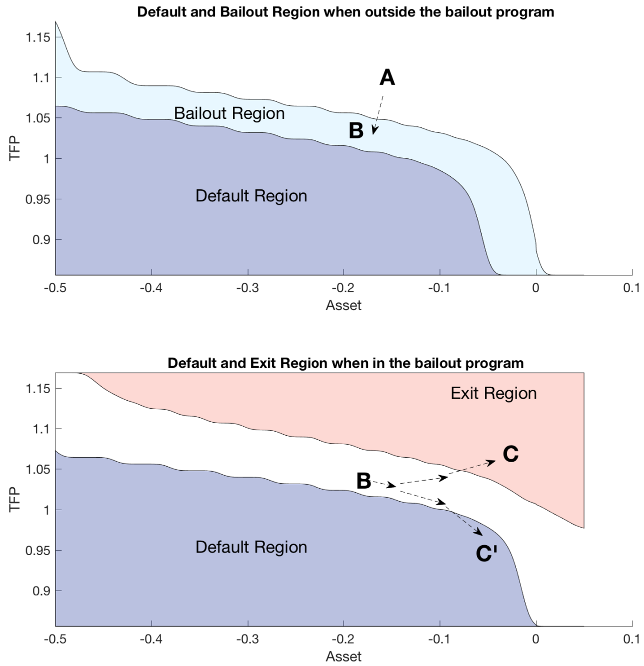
Figure 2 illustrates the optimal choices when the bailout option is introduced in the model. The top panel shows, in the state space (b, ε), the default (dark blue) and bailout (light blue) regions conditional on not being in the bailout program ($s = 0$). As the figure suggests, the economy honors its debt without asking for a bailout during good times, characterized by low debt and relatively high TFP levels. The economy asks for a bailout when debt level is relatively higher or when TFP level is relatively lower. Finally, the economy defaults when the economy performs badly along both dimensions, that is when both debt level is relatively higher and TFP level is relatively lower.

The bottom panel of Figure 2 shows the same sets conditional on already being in the bailout program ($s = 1$). Since additional bailouts are not feasible when a country is already in the bailout program, the bailout set is empty by construction. Nevertheless, in addition to choosing to remain in the bailout program (white region), the government can still choose to default (dark blue region) or to exit from the bailout program (red region). When already in the program, the country is forced to deleverage and whether it exits the program or not depends on the realization of TFP - it exits the program only when economic conditions improve. Because the economy cannot request additional bailouts once it enters a bailout program, the deleveraging force puts even more strain on the economy if the TFP conditions do not improve. This is reflected in the default region when country enters the bailout program (bottom panel) being larger than the default region when it is outside the bailout program (top panel).

Understanding the dynamics behind these regions helps with understanding how costs and benefits of having a bailout option depend on the realizations of the exogenous process. To illustrate this point, let us use a simple example displayed in Figure 2. Suppose that the economy starts at point A, where it services its debt regularly and is not in the bailout program. Now assume that TFP starts declining and that the economy slips into a recession, moving to point B. For this economy it will initially be optimal to ask for a bailout, whereby the country obtains a third-party loan and becomes borrowing constrained as it cannot increase its level of debt. Whether the economy will end up in the exit region (point C) or in the default region (point C') depends on the path of the exogenous forces that drive the economy. Specifically, if TFP prospects improve, the country will endogenously choose to repay the loan and exit the bailout program. In that case, the bailout acts as a consumption smoothing instrument since it transfers income from a good state to a bad state; in fact, the country receives a loan during a recession and repays it during the boom. If, however, poor economic performance continues, the inability to increase debt levels due to conditionality clause pushes country into default.

To further investigate the implications of different paths of exogenous processes, in Figure 3

Figure 2 – Repayment, default and intervention sets



Note: The top panel represents the combinations of assets and TFP that determine the optimal default and intervention sets in an economy that is not in the bailout program, but has an option of asking for it. The dark blue area represents the default region, the light blue area represents the bailout region, and the white area represents the continuation region in which the economy decides to repay its debt. The bottom panel represents the optimal regions when the economy is already in the bailout program. The dark blue area represents the default region, the white area represents the continuation region in which the economy remains in the program, and the red area represents the region in which the economy chooses to exit the bailout program. The arrows connecting A, B, C and C', illustrate possible directions in which the economy moves.

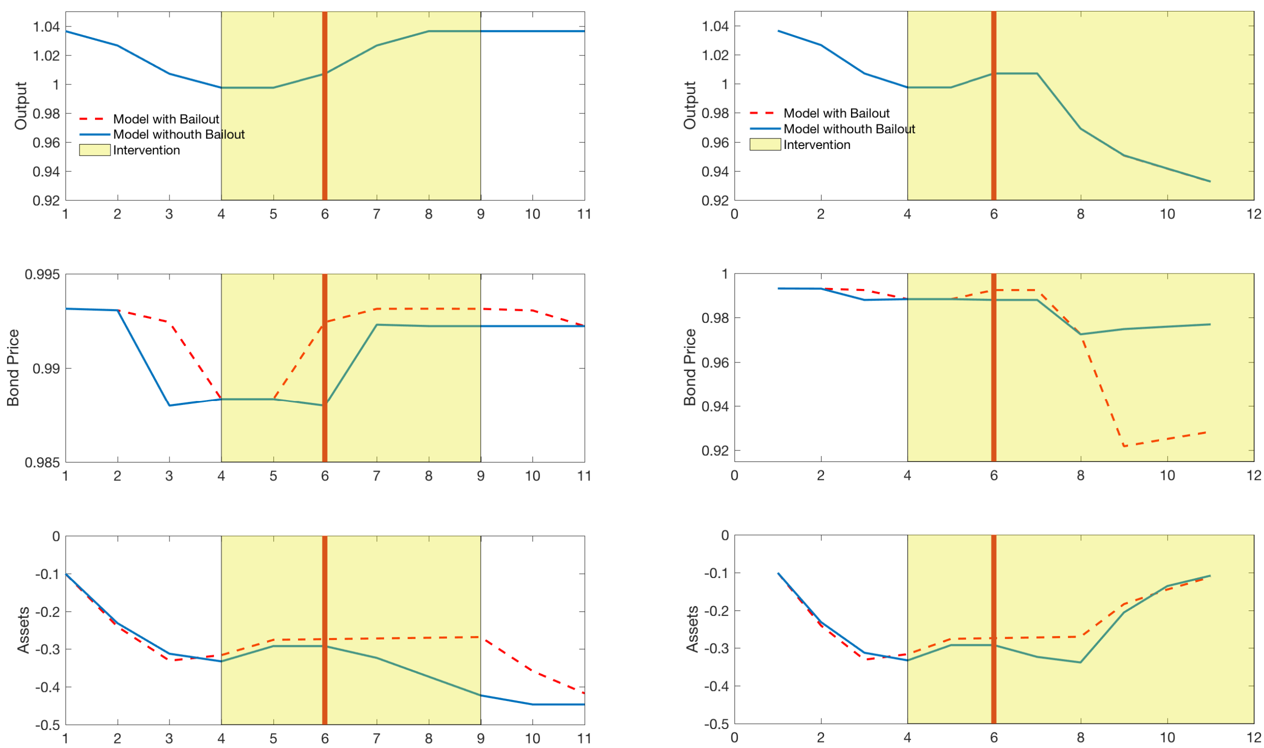
we illustrate the evolution of bond prices and asset levels in two models - a model with a bailout option (dashed red line) and a model without a bailout option (solid blue line) - under two different output paths. The two output paths start diverging only after six quarters (red vertical line), when one economy starts to recover (V-shaped recession scenario, left panel) and the other economy slips into yet another recession (double V-shaped recession scenario, right panel). The shaded yellow area represents the intervention area in the model with a bailout option. The bond price and asset levels across the two scenarios are identical until the output processes start to diverge in period t=6.

Let us first examine the first six periods in which the output processes are identical across the two scenarios. In both scenarios, the bond price is higher in a model with a bailout option. The intuition behind this result is simple: international investors are aware that asking for a bailout is now an additional option for the government to avoid default and, because the default risk is reduced, the investors ask for a smaller premium. After the economy enters a bailout program and starts to recover slowly, international investors still assign lower probability of default to this economy. This is because the economy obtained additional resources and, given good output prospects, conditionality clause does not pose a strain.

When the two output processes start to diverge, however, the differences between the two scenarios become stark. In the scenario with a V-shaped recession (left panel), the economy recovers and the bond prices remain higher in the economy with a bailout option for the same reasons as before. In the scenario with a double V-shaped (right panel) recession, as the economy slips into another recession, the international investors recognize that the constrained economy becomes riskier than the unconstrained one, charging a much higher premium. This is because they recognize that the conditionality clause severely limits the government's ability to smooth consumption and that, therefore, it is more likely to default on its debt.

Figure 3 – Bond Price and Asset Evolution Under Two Alternative Recession Specifications

(a) V Recession (b) Double V Recession



Note: The figure shows the evolution of bond prices and asset levels in two economies - an economy with a bailout option (red dashed line) and an economy without a bailout option (blue solid line). The left panel represents a scenario with a V-shaped recession, while the right panel represents a scenario with a double V-shaped recession. The shaded yellow areas represent periods when the economy with a bailout option is in the bailout program.

These two examples illustrate how two different exogenous paths can lead to different implications of the bailout program. Ex ante, having an additional instrument through which consumption can be smoothed is certainly desirable. Ex post, however, if the economy does not recover, borrowing constraint becomes crucial making borrowing conditions in a constrained economy less favorable than in an unconstrained economy. In the next section, we quantify the importance of these two channels.

4.2 Quantitative Implications

Table 5 compares various aspects between the economy without a bailout option (column 1) and the benchmark economy with a bailout option (column 2). First notice that the default frequency in the benchmark economy with a bailout option is smaller than in the economy without this option; this gets translated into lower sovereign spreads in the benchmark economy, because international investors perceive that bailouts increase the repayment set. At the same time, the average private credit spread is reduced slightly, but enough to reduce the average output loss, measured as a percentage of GDP, from 0.27 to 0.26. In this dimension, the bailout model has also an unambiguously beneficial effect with respect to the model without bailout through the reduction of the output losses generated by the financial friction. Although small, this effect explains a slightly positive effect of the bailout on average consumption.

In our benchmark economy, the government asks for a bailout relatively frequently (frequency of 32 percent) and it endogenously remains in the bailout program for about 3.5 years.[16] The bailout generates interesting consumption variance dynamics, which in turn affects the welfare evaluations of bailouts, as we will discuss more thoroughly in the next section. It is important to understand whether the existence of the bailout leads to smaller or larger consumption variation with respect to an economy without a bailout option.

There are two opposite forces in play, which relate to the different paths that the economy can follow while in the bailout program, as discussed in the previous section. Recall that once the government asks for a bailout, eventually it either exits without defaulting (as displayed by the path from B to C in Figure 2) or it first defaults (path from B to C'). Specifically, when the economy enters the bailout program and after good TFP realizations decides to exit, consumption smoothing is stronger; this is because the bailout provides in bad times resources that are repaid in good times. This effect is easily observed in the reduction of the standard deviation of consumption, conditional on the government being active in the international financial markets (from 5.80 percent in the non-bailout economy to 5.55 in the bailout economy). If, however, the economy enters the bailout

[16]This duration mimics the duration of recent bailout programs for European economies: Ireland was using bailout funds from November 2010 to December 2013, Portugal from May 2011 to June 2014, Spain from July 2012 to December 2013, and Greece from May 2010 to June 2015, with a new bailout program to be used from August 2015 to August 2018.

program and after bad TFP realizations decides to default, the country will need to repay the loan when in autarky. This typically happens when the recession is severe and long. In this case, the bailout will cause a larger consumption volatility, as the consumption volatility in autarky shows.[17] Overall, however, the first scenario is more likely than the second one because, in the benchmark model, the government repays the loan without defaulting 87 percent of the time.

We also compute how the bailout loan G, on average, is allocated between current consumption increase and debt reduction. In particular, we calculate the change in contemporaneous consumption induced by the access to the bailout funds, controlling for the other determinants of contemporaneous consumption, TFP level ε and the level of asset holdings b. We find that 55 percent of the loan is used for current consumption and the remaining 45 percent is used for deleveraging. This finding confirms that the received bailout funds strongly affect the intertemporal allocation of resources.

To evaluate jointly the strengths of the two different channels described above, we compute the overall welfare gain/loss generated by the existence of the bailout. As common in the literature, to measure welfare we compute the percentage of consumption (in any date and state) that an agent in the model without a bailout option is willing to give up to move to an economy with a bailout option.[18] Overall, the existence of the bailout is welfare improving as it leads to a 0.376 percent improvement in terms of consumption equivalent. This result states that the bailout benefits generated by the reduction of sovereign spreads, default frequency, private credit spreads, output losses, and consumption volatility, outweigh the bailout costs generated by imposed borrowing restrictions and by the risk of higher consumption variance that would occur if country defaulted before repaying the bailout loan.

We investigate the sensitivity of these results to changes in the conditions of the bailout program (columns 3 and 4): by varying slightly the size of the bailout G and the policy repayment rate r^b, we investigate how these two parameters affect the outcome of the model. Column 3 represents the scenario in which the country repays only the principal when it decides to exit the bailout program. Unambiguously, a lower interest rate is beneficial, since the amount of resources received is not affected, but the repayment cost is reduced. Therefore, the intervention frequency is slightly higher (34 percent) and the average length of a bailout is smaller, since it is easier to exit from the program. Column 4 represents the scenario in which we decrease the size of the bailout, and assume $G = 0.045$; in this scenario the bailout effect might be ambiguous because, on one hand, the country receives a smaller loan when asking for a bailout but, on the other hand, it repays a

[17]Notice that in these models the exogenous asymmetric cost of default (outlined in footnote 6) limits TFP volatility and, therefore, the economy is less volatile in default periods.

[18]We compute the consumption equivalent by performing 1000 Montecarlo simulations of the two economies.

lower amount when it exits the program.[19] Our calculations show that these two effects jointly reduce consumption volatility both when in autarky and not, which is welfare improving.

Table 5 – Quantitative implications of Bailouts

	No Bailout	Bailout		
		Benchmark	Interest(-)	Policy (-)
	(1)	(2)	(3)	(4)
		Bailout Parameters		
Bailout size, G		0.05	0.05	0.045
Repayment Rate, $1 + r^b$		Riskfree	1	Riskfree
		Regions		
Unconditional Default frequency (%)	0.64	0.60	0.58	0.58
Conditional on $s = 0$, No Bailout				
Default Frequency (%)		0.08	0.04	0.07
Intervention Frequency (%)		32.4	34.0	33.3
Conditional on $s = 1$, Bailout (%)				
Length Bailout Program (quarters)		18.7	17.8	16.2
Transition into Default (%)		13	12	11
Transition into Exit Program (%)		87	88	89
		Returns		
Mean sovereign rate (%)	2.78	2.57	2.58	2.55
Mean private rate (%)	2.56	2.50	2.51	2.50
		Macroeconomic Variables		
Mean Consumption (int-market)	0.910	0.911	0.911	0.911
Std.Dev. Consumption (int-market) (%)	5.80	5.55	5.53	5.52
Std.Dev. Consumption (autarky) (%)	3.35	3.78	3.78	3.75
OutputLoss from Financial Frictions (%)	0.27	0.26	0.26	0.26
		Welfare		
Welfare (%)	-	0.376	0.389	0.434

4.3 Welfare Sensitivity

In this section, we investigate the sensitivity of our welfare calculations to different specifications of the model. Table 6 displays the welfare elasticities to bailouts, when perturbing several channels: the repayment interest rate, r^b, the size of the loan, G, the strength of the financial friction, η, and the agent's risk aversion, σ. Notice that these elasticities must be interpreted as a local result. In fact, since some of the model moments are sensitive to large changes of the parameters, for each column of the table, we perturb the corresponding parameter by a small amount in order to keep the model predictions to be similar to their data counterpart. Hence, we alter each of the above parameters by a small amount, solve the model with and without a bailout option under that particular parameterization, compute the welfare gain of the bailout, and finally compute the

[19] We also compute the optimal bailout size G from the perspective of the domestic economy and find that it is rather small $G = 0.006$. The intuition is simple: when the loan is smaller, it is much easier to repay and therefore, the country can use this option in much more favourable way. Notice that this calculation takes into account only the welfare of the domestic economy and ignores the costs of issuing loans from the point of view of the third party. Therefore, we prefer not to emphasize excessively this notion of optimal bailout.

elasticity with respect to the benchmark.

Table 6 – Welfare Elasticities

	Benchmark	Interest Rate (-) r^b	Policy (-) G	Fin. Friction (+) η	Risk Aversion (+) σ
Δ wrt benchmark		0.0069	0.005	0.05	0.01
Welfare (%)	**0. 3765**	0.3896	0.4340	0.3905	0.3795
Elasticity		5.07	1.52	0.22	1.59

Overall, the welfare gain of the bailout implied by our benchmark model, equal to 0.376 percent, is robust to perturbing the parameters of the model. Interestingly, this exercise also sheds some light on the strengths of the possible welfare channels. Regarding bailout policy parameters, the bailout welfare gain is more sensitive to changes in the repayment interest rate (elasticity of 5.07) than to a reduction in the loan size (elasticity equal to 1.52). This is not surprising since, as discussed in the previous section, a lower repayment interest rate is unambiguously better for the domestic government, while a reduction of the size of the loan means both lower repayment to and lower transfer from the third party. An increase in the financial friction parameter of the economy, η, slightly increases (elasticity of 0.22) the beneficial effects of the existence of bailout. This results is intuitive since, according to the modeling of our banking sector, higher degree of financial friction implies a stronger link between sovereign spread and private credit. Since bailout puts downward pressure on sovereign spreads, it also lowers private credit rates and, as a consequence, financial frictions. However, this channel is rather small in our calibration. We perturb the curvature of the utility function next. An increase in the coefficient of risk aversion σ increases the welfare benefit of bailouts (elasticity of 1.59). Intuitively, as discussed, the bailout enables better consumption smoothing, which is more valued by the risk averse agents.

In summary, our results show that the welfare gain of bailout from the perspective of the receiving economy is rather sizeable (0.37 percent in terms of consumption equivalence), robust, and mainly driven by the better insurance the bailout provides and by the effects it has on reducing default probabilities.

5 Conclusion and Discussion

In this paper we investigate the welfare effects of bailout policies in economies exposed to sovereign debt risk and to financial stress. The bailout represents a non-defaultable subsidized loan that comes with an imposed borrowing constraint on the government, reflecting a conditionality clause in line with the recently-proposed bailout programs for troubled European economies, namely

GIIPS.

Using an endogenous default general equilibrium model augmented with an endogenous bailout decision and financial frictions, and calibrated to GIIPS economies, we find that bailouts are ex-ante welfare improving, increasing welfare by 0.37 percent measured in consumption equivalent terms. However, if the troubled economy experiences a long-lasting recession, bailouts may increase default risk and have a negative impact on financial markets. In this case, bailouts can have detrimental ex-post effects. Intuitively, ex ante, having an additional instrument through which consumption can be smoothed is certainly desirable. The presence of this instrument translates into lower default incentives, reducing interest rates on sovereign bonds. In addition, because of the generated link between private credit markets and sovereign credit markets, when sovereign interest rates decline, private interest rates decline as well. Importantly, these effects are present even when government does not choose a bailout option; the mere presence of a bailout option has a positive beneficial effect on sovereign spreads, as investors assign lower probability to the default scenario. Ex post, however, if the economy does not recover, borrowing constraint becomes crucial, making borrowing conditions in a constrained economy less favorable than in the unconstrained economy. International investors, therefore, assign higher probability of defaulting to the constrained economy and ask for a larger premium.

Our findings open three main avenues for future research. First, we focus on the impact of bailouts solely from the perspective of the receiving economy; an important complementing question would explore costs and benefits of bailouts when the incentives of a supranational authority together with potential contagion effects to other fragile economies are taken into account. Second, in our framework bailouts affect output through their impact on bond prices, private credit rates, and, as a consequence, wages and labor leisure choice. A logical follow-up question would be to study whether bailout programs stimulate growth through fiscal and political reforms or whether they limit future economic prospects through imposed austerity measures. Third, moral-hazard problems faced by the government that strategically restructures its debt after obtaining a bailout loan are certainly worth investigating. As highlighted by Reinhart and Rogoff (2009), this could be one of the reasons behind the sharp increase in the number of sovereign default episodes observed following the establishment of international financial institutions, and can represent a promising avenue for future work.

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