

# **The Political Economy of Corporate Bailout Design**

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## **Abstract**

The aftermath of the recent economic crisis saw the largest U.S. government bailout of corporate entities ever. While the bailout was carried out with the explicit goal of restoring stability, it aroused much controversy and public criticism based on moral hazard concerns and the exorbitant cost to the taxpayer. This paper purports to make a contribution by exploring bailout decision making mechanisms in the face of multiple firms' failures under incomplete contracting. It explores, in particular, the design of such mechanisms on behalf of an imperfectly informed legislature aimed at shaping the incentives of a policymaker to whom bailout decisions are delegated and who is potentially biased toward corporate interests. A ceiling on the bailout magnitude, which can only be exceeded through the legislature's consent, and appointment of a policymaker with a low vulnerability to shocks are shown to be important elements of the design.

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## 1. Introduction

The financial crisis that erupted in 2007-8 triggered concerns for economic stability, in the US and around the world. In the aftermath of the crisis, the US government promoted the Emergency Economic Stabilization Act, which authorized the US Treasury to spend \$700 billion on the purchase of distressed assets.<sup>1</sup> This, as well as the subsequent loan assistance to automakers and other corporate entities, represents the largest government bailout in history. The bailout was conducted in response to a situation where, in rapid sequence, financial institutions and then additional corporate entities dependent on them showed signs of extreme distress. Consequently, a large number of such distressed firms were bailed out: the site <https://projects.propublica.org/bailout/list> lists many hundreds of businesses that received federal assistance in the course of the crisis. Most of the entities on the list are banks, but it also includes other financial institutions (such as mortgage servicers), insurance companies, and car makers.

The massive response to the crisis, much of it at taxpayers' expense, stirred up heated controversy. Both economists and the public at large had serious reservations about the adequacy of such a policy response, and calls mounted to create a more structured and less *ad hoc* mechanism to deal with potential future crises. Because the massive corporate bailouts inevitable entailed substantial redistribution, tensions between the general public, the corporate world, and the government were elevated. The Dodd–Frank Act of 2010 is an attempt to boost up the regulatory framework in order to prevent and better handle future potential crises. The Act is explicit about its goals of promoting the public interest and shows awareness of a potential conflict between this

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<sup>1</sup> Similar policies were pursued elsewhere, such as in the UK, Sweden, Iceland, etc.

objective and the possibility of policymakers' bias in favor of corporate interests. While major parts of the Act are explicitly designed to prevent crises, some address the need to manage post-crisis situations. For example, its Title II deals with liquidation of financial institutions, stipulating limits of taxpayers' money that can be committed in such cases toward individual businesses. Title XIII deals with the management of potentially non-distributed funds through the Emergency Economic Stabilization Act, in particular, by limiting their fungibility.

This brings forth the question, still little addressed in academic literature, about the government's design of a bailout management system in the event of a major crisis, or an economy-wide shock, with potential multiple firms' failures and distress.<sup>2</sup> The bailout incentive the government faces then stems from the potential for the deepening of the crisis and its economy-wide implications, should the firms be allowed to fail. The link between the number of failed firms and the likelihood of the crisis implies that the magnitude of the bailout should be related to the magnitude of firm failures. One issue here is that this likelihood may not be known, definitely not to the general public. Therefore, conditioning bailout policy on the realized crisis probability is unlikely to be feasible, which by necessity implies an incomplete contracting approach to the policy design. The crisis probability, however, may be (better) known to the policymaker, with expertise and logistical and analytical capabilities to acquire the needed information. In general, however, policymakers' objectives may or may not coincide with those of the general public. In

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<sup>2</sup> The lack of intellectual guidance is reflected in the following quote from the then Secretary of the Treasury: "There is no playbook for responding to turmoil we have never faced." Secretary Henry Paulson's testimony before the United States House Committee on Financial Services, November 18, 2008.

particular, it is conceivable that the policymaker takes into consideration corporate interests beside broad public interest. This, in fact, was a major concern during the recent US bailout that stirred public protests.<sup>3</sup>

Under these circumstances, the individuals (and their representatives in the legislature) face a tradeoff between making a direct bailout decision under incomplete information versus delegating it to a better informed, but also possibly biased policymaker. This tradeoff is our point of departure in this paper, which more generally explores mechanisms shaping bailout policies under incomplete contracting. In particular, one focus of the paper is a hybrid mechanism between the above two, referred to as bailout restraints. Under this mechanism, the individuals set a ceiling on the magnitude of the bailout. If the policymaker is interested to bail out a smaller fraction of the failed firms than stipulated by the ceiling, she can freely implement that. But a bailout proposal exceeding the ceiling has to be approved by the legislature (the ceiling constituting, therefore, the default option). This more flexible mechanism is shown to be superior to direct decision making by the individuals, and may also be superior to a full delegation of the bailout determination to the policymaker, when the crisis likelihood is large.

We then extend the basic framework to study the situation where the individuals differ with respect to their vulnerability to the economy-wide shock. In this case, we construct another effective decision making mechanism: appointment of a “bailout czar” – endogenous election of a

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<sup>3</sup> In particular, Secretary Henry Paulson’s career as a business executive aroused suspicions of a potential conflict of interests; Johnson and Kwak, 2010, document, in particular, the revolving door between the Wall Street and the government that, in the authors’ view, interferes with policy making.

policymaker. Such mechanism is shown to devise a commitment to refrain from too generous bailout packages.

Taken together, our results indicate a potentially important role regulatory framework can play even in the aftermath of the eruption of a crisis. They indicate several principles, which should guide this framework in the context of bailout policies. In particular, specifically structured rules of bailout process designed to address the possible failure of multiple corporate entities may enhance welfare relative to alternatives. Parts of the Dodd-Frank Act can be interpreted as introducing such structural elements of bailout management.

This paper is related to emerging work on the economics of corporate bailouts, see Keister, 2016, Nosal and Ordonez, 2016, and references therein. Much of this work deals with the specifics of financial markets in the context of liquidity provision, which is not an emphasis here. Instead, ours is a public economics cum political economy perspective, which explores rules for public decision making in the context of corporate bailouts. While liquidity concerns represent important motivation for bailouts, additional potential concerns include mass unemployment or major infrastructure breakdowns resulting from firm failures, implying that the issue is quite broad. Recent work (Farhi and Tirole, 2012, Jeanne and Korinek, 2016) tends to focus on *ex ante* or macroprudential regulation. This paper complements this work by focusing on *ex post* bailout procedures based on the argument that they too may be essential in shaping corporate incentives. This paper is also related to the literature on incomplete contracting (see, e.g., Aghion and Bolton, 2003), which is an essential premise of our analysis. The assumed incongruence in preferences between the individuals and the policymaker and the related delegation issues have been addressed in other contexts in, for example, by Harstad, 2012; additional papers that explore delegation in

the context of specific voting rules include Bai and Lagunoff, 2011, and Messner and Polborn, 2004. The relevant literature on fiscal limits deals more generally with the construct of a fiscal constitution that restrains policymakers' tax powers; see Coate, 2015, for an important recent contribution that also contains a comprehensive review of existing research on the matter. Finally, voluminous work on dynamic inconsistency in the context of monetary policy and various mechanisms to alleviate it, e.g., Dal Bo, 2006, Lohmann, 1992, Rogoff, 1985, is relevant to our analysis of the value in appointing a less vulnerable policymaker as a commitment vehicle to refrain from excessive bailouts.

The rest of the paper proceeds as follows. The next section describes the basic model, with uncertainty about the likelihood of an economy-wide shock. Two benchmark bailout mechanisms, direct and delegated decision making, are then introduced and analyzed in Section 3. Section 4 explores their hybrid, with bailout restraints. Section 5 considers the case of differential vulnerability to the economy-wide shock and studies endogenous election of a policymaker. Section 6 concludes with brief remarks.

## **2. Basic model**

Consider an economy populated by a measure 1 of identical individuals, represented in the legislature, indexed  $i$ ; a measure 2 of identical firms, indexed  $j$ ; and a policymaker. We now describe each of these sets of actors in more detail.

Each firm is faced with a choice of a project. The project can be either safe, in which case its net return is certain and normalized 0; or risky, in which case the return on firm  $i$ 's project can

be either  $a_i$ , or  $-1$  with equal probabilities, where  $a_i$  is distributed in the population of firms according to the uniform distribution in a closed interval, say,  $[0,2]$ . By the law of large numbers exactly one half of the firms with this distribution of risky returns will fail with the net loss of  $-1$  while the other half will earn the expected net return of  $1$ . We refer to firms with a higher  $a_i$  as being more productive and assume that this is private information.

Thus, different firms face different risky project opportunities. Firms' choices of projects and their outcomes may have economy-wide implications, on whose scenarios we will elaborate more in detail in a moment. In the case of a project failure, the policymaker may, under some scenarios, bail the firm out at the cost of  $t$ , paid by taxpayers. We assume that  $t > 1$ , so that the bailout is associated with a deadweight loss. For example, if the fraction  $b$  of the firms get a bailout, the total cost is  $tb$ .

We posit that the probability of the economy-wide shock is generated by two sets of factors which, while in principle could be correlated, are assumed, for simplicity, to be independent. One factor, which we consider to be exogenous, and treated as such by all actors in our model, is a general economic downturn which may be caused, for instance, by an international financial crisis. We assume that such event occurs with a given probability  $\gamma$ ,  $0 < \gamma < 1$ , which is known to the legislature. The second, endogenous, factor which can exacerbate the economy-wide cost of the downturn is the failure of numerous firms. To clarify, when the first factor, the exogenous shock, is absent, firm failure poses no danger *per se*. It only does so when the two factors are combined. We posit that the likelihood of economy-wide consequences of firm failure is related to the number of failed firms, which have not been bailed out,  $f-b$ ; we denote this probability  $P(f-b)$ . To obtain closed form solutions, we will further parametrize this probability as  $P(f-b) = (f-b)^2/2$ . Thus,

combined with the likelihood  $\gamma$  of an economy-wide shock, significant systemic costs to the society emerge with probability  $\gamma(f-b)^2/2$ . It also follows that with probability  $1-\gamma$  the economy is fully immune to the shock regardless of the number of failed firms  $f$ .

The assumed convexity of the probability  $P$  implies that bailouts make firms' risky project decisions strategic complements, as is detailed in Farhi and Tirole, 2012; see also Cooper and John, 1988, for a general macroeconomic analysis that entails strategic complementarities in agents' actions. We assume that the firms value the expected return on their project,  $\mu_j$ .<sup>4</sup>

Letting  $\lambda > 0$  denote each individual's loss in the case of an adverse shock, the individuals' expected loss with  $f$  failed firms and  $b$  bailed out ones then is  $\lambda\gamma (f-b)^2 /2$ . We assume risk neutrality and thereby can write each individual's expected utility as follows:

$$EU_i = -tb - \lambda\gamma (f-b)^2 /2 \tag{1}$$

We now introduce the structure of governance into the model, dealing with the decisions about bailouts and their implementation. Legislature is assumed to be a representative body of the government, faithfully reflecting the interests of the population, which is in charge of budgets necessary for bailouts and thus controls their magnitude. The legislature, however, lacks some of the required expertise, such as the ability to determine that a systemic crisis is imminent (only the probability  $\gamma$  of it occurring is known) and may therefore delegate some authority to an executive agent, who we call *policymaker*, and who does possess the requisite expertise but may have

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<sup>4</sup> Obviously, the assumption of homogeneous firms – and, specifically, in regard to their economy wide impact – is a significant simplification of real life, but is useful as a first approximation.



autonomous objectives which may diverge from those of the legislature. We assume, for simplicity, that there are two types of potential policymakers: those whose interests are aligned with those of legislature, i.e., aimed at maximizing the individuals' expected utility, and those captive to corporate interests seeking to maximize the aggregate of firms' expected payoffs,

$\int_0^2 \mu_j dj$ .<sup>5</sup> The probability an appointed policymaker is of the former type is  $q$ , and the probability

she is of the latter type is  $1-q$ . Whereas the individual citizens are *ex ante* ignorant about the likelihood of the external systemic shock, by the time the firms have undertaken their projects and their outcomes have been realized, the policymaker (but not the legislature) will possess expert knowledge of the shock's imminent occurrence.<sup>6</sup> Another informational assumption we maintain is that the legislature as well as the policymaker only know the distribution of firm productivities, but not the specific productivity levels of individual firms.

Note that from the individuals' perspective, legislature's and/or policymaker's commitment to refrain from a bailout would make the risky project disadvantageous for all firms with  $a_i < 1$ .<sup>7</sup> We, however, assume that such a commitment is impossible to ensure, implying that the ultimate bailout decision is made after the firms choose projects. Such policy is shaped by the interaction between the individual citizens, as represented in the legislature, and the policymaking

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<sup>5</sup> We could alternatively define the former type as caring for a weighted average of individual utilities and firms' profits without altering qualitative results.

<sup>6</sup> This is a simplification, which reflects the fact that the policymakers have at their disposal superior expertise and resources to assess the likelihood of an economy-wide shock when crises erupt.

<sup>7</sup> Recall that, in case of indifference, the firms favor the safe project.

agent, and we consider several possibilities in this regard.

One baseline *scenario A* we consider is where the legislature, faithfully representing the individuals, makes its bailout policy decision directly on its own, being faced with the lack of information about the likelihood of the systemic shock. The second institutional *scenario B* is that of full delegation of this decision to policymaker whose agenda is either aligned with that of the populace or is biased in favor of corporate interests. We then consider the possibility whereby the citizens, through the legislature, set the limit on the magnitude of the bailout, which is then implemented by the policymaker, whereas an override of the limit requires then the legislature's approval. We assume that the identity of the policymaker is realized *ex post*, after these constitutional choices have been made.<sup>8</sup> Thus, the formulation of the bailout procedure can be viewed as an incomplete contract between the individuals and the policymaker. The nature of this contract, in turn, affects firms' decisions, hence it shapes their incentives to undertake – or not – risky projects. Finally, we consider the endogenous determination of the policymaker's identity, through a vote in the legislature.

### *Discussion*

We now briefly discuss some of the key assumptions of the model. One important simplifying assumption is that the individuals do not have ownership over the firms, presumably because of incomplete equity markets. Allowing firm ownership by individuals would enrich the model at the cost of added complexity. The social cost of the crisis in the model can be interpreted as the

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<sup>8</sup> The rationale is that at the constitutional stage, the policymaker's identity is still unknown but is revealed thereafter.

societal hardship of unemployment resulting from it, i.e., the cost to the economy that goes beyond firm losses. Another key assumption in the basic framework is that a commitment to refrain from bailout is impossible; it is somewhat relaxed subsequently by introducing a supermajority procedure, which in itself does constitute a commitment.<sup>9</sup> While in the baseline model only extensive margin in firm decision making is considered, we show subsequently how the analysis can be extended to intensive margin. Finally, there is the assumption of a fraction of policymakers being captives to corporate interests. In support of this view, Johnson and Kwak, 2010, document the existence of a revolving door in their description of the interaction between the financial industry and the government in the US, resulting in regulatory capture. More specifically, Acemoglu et al. (2016) show that returns of firms connected to Timothy Geithner, who was appointed as a Treasury Secretary at the height of the crisis, were abnormally high in its aftermath.

### **3. Direct and delegated bailout procedures**

#### **3.1. Scenario A: Direct bailout decision making**

We now consider the following chain of events. First, the firms decide on projects to undertake. Those choosing the risky project face the probability 0.5 of a failure. Upon its realization – and under the veil of ignorance about the realization of the external shock - the individuals determine the magnitude of the bailout. We are interested in characterizing the resulting subgame perfect equilibrium.

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<sup>9</sup> Note, however, that this is a commitment to a decision-making *procedure*, not a decision itself, direct commitment to which is ruled out.

With the uncertainty about the external shock in place, with  $f$  failed firms, the internal equilibrium, from the legislature's (people's) perspective, obtains from maximizing the objective (1), so that the magnitude of bailout is given by the following first order condition:

$$-t + \lambda\gamma(f-b) = 0 \quad (2)$$

We assume that  $t < \lambda\gamma$ , so that  $f-b = t/\lambda\gamma$ , and  $b = f - t/\lambda\gamma$  (and  $b=0$  if  $f - t/\lambda\gamma < 0$ ). The obtained value of  $b$ , in turn, determines each firm's probability to get a bailout, that is  $P(\text{bailout}) = b/f = 1 - t/f\lambda\gamma$  and, accordingly, the probability  $1-b/f = t/f\lambda\gamma$  to carry the full loss of failure.

This then enables us to calculate each firm's expected utility when undertaking the risky project as

$$\mu_i = a_i(1/2) + (-1) [1-P(\text{bailout})] (1/2) = a_i(1/2) + (-1) t/f\lambda\gamma (1/2) = (a_i - t/f\lambda\gamma)/2 \quad (3)$$

This implies that a risky project will be undertaken iff  $a_i > t/f\lambda\gamma$ . Therefore, the equilibrium is characterized by the threshold for upside risk  $a^* = t/f\lambda\gamma$ . In other words, only the firms with upside returns above this threshold will undertake risky projects, so the number  $f$  of failed firms is given by  $[1-a^*/2]$ , (i.e., half of the total number of firms undertaking risk  $2 - a^*$ ), recalling that all firms form the mass of 2. Combined with the above, this yields

$$a^* = t/([1-a^*/2]\lambda\gamma) \quad (4)$$

Whereas in principle this equation yields two equilibria, only the smaller of them is relevant in the sense of constituting a productivity threshold such that when crossed ensures expected profitability of the risky project for a firm. This equation will have solutions iff the following condition is satisfied:

$$x = 2t / \lambda\gamma < 1 \tag{5}$$

which is equivalent to the requirement that  $f-b = t/\lambda\gamma < 1/2$ , which can be compared against the fact that  $f = [1-a^*/2] > 1/2$  (because  $a^* < 1$ ) to produce numerical localizations for the equilibrium values for  $f$  and  $b$ . This demonstrates, that meaningful equilibria exist only if the value of the expected “pain” as a result of a crisis  $\lambda\gamma$  is large.

Thus, the equilibrium is given by the smaller root of the equation (4) (it exists when  $\lambda$  is large enough) which increases in  $t/\lambda\gamma$ . Note that, this equilibrium value  $a^* < 1$ . This means that the risk-taking threshold for firms induced by the bailout policy under consideration is lowered relative to the laissez faire benchmark of no government bailouts ( $b=0$ ). In other words, some of the firms whose risk-taking is individually irrational and socially inefficient in the absence of government subsidy, are now encouraged to take on such risk. This happens due to informational asymmetry, given that government is unable to distinguish *ex ante* return distributions of the firms who have failed *ex post*. This moral hazard feature entailed in the bailout policy is an essential element of our analysis.

According to (3), in equilibrium, the resulting expected returns of risk taking firms are:

$$\mu_i^{\text{direct}}(\text{risky}) = [a_i - t/f\lambda\gamma]/2, \tag{6}$$

where  $f = [1-a^*/2]$  and  $a^*$  is the smaller root of (4), i.e.,

$$a^* = 1 - \text{sqrt}[1-2t/\lambda\gamma] \tag{7}$$

and thereby, the corresponding number of failed firms

$$f^* = 0.5(1 + \sqrt{1-2t/\lambda\gamma}) \quad (8)$$

so that according to (2) the number of bailed out firms

$$b^* = f^* - t/\lambda\gamma = 0.5(1+\sqrt{1-2t/\lambda\gamma}) - t/\lambda\gamma \quad (9)$$

Clearly, from the individuals' perspective this outcome is welfare inferior to the situation where all firms whose  $a_i < 1$  choose the safe project.

### 3.2. Scenario B: Delegated bailout choice

In this sub-section, we consider the case where the bailout decision is made by a policymaker. When the policymaker represents the firms' interests, which occurs with probability  $1-q$ , she will choose to bail out as many firms as possible,  $b=f$ .

In contrast, a policymaker representing the individuals will bail out no firm if she concludes that no crises will take place which will be the case with *ex ante* probability  $1-\gamma$ ; or, else, with probability  $\gamma$  her *ex post* bailout provision will maximize individuals' utility

$$-tb - \lambda(f-b)^2 / 2$$

The first order condition is

$$-t + \lambda(f-b) = 0, \text{ so that } b = f - t/\lambda \quad (10)$$

This means, that conditional on the above provisions, the probability of a failing firm to be bailed out, when an unbiased policymaker is in charge, is given by  $1 - t/f\lambda$ .

Then, given that the probability that a firm undertaking the risky project will succeed is  $\frac{1}{2}$  and the probability that a failing firm gets bailed out is  $b/f$ , a firm's *ex ante* probability of failing and being bailed out is given by  $[(1-q) + q\gamma(1-t/f\lambda)]/2$ , and thereby the probability of failing and not getting bailed out is  $\frac{1}{2} - [(1-q) + q\gamma(1-t/f\lambda)]/2 = [q(1-\gamma) + q\gamma t/f\lambda]/2$ .

We can then calculate firm  $i$ 's expected return if it undertakes the risky project:

$$\mu_i^{\text{delegation}}(\text{risky}) = [a_i - q(1-\gamma) - q\gamma t/f\lambda]/2 \quad (11)$$

It then follows that there is a threshold level of return  $a^{**}$  such that only the firms with  $a_i > a^{**}$  undertake risky projects, where  $a^{**} = q(1-\gamma) + q\gamma t/f\lambda$  while  $f = [1 - a^{**}/2]$ , such that  $a^{**}$  is the smaller root of the equation

$$(a^{**})^2 - (2+q(1-\gamma))a^{**} + 2q(1-\gamma) + 2q\gamma t/\lambda = 0$$

so that

$$a^{**} = 1 + q(1-\gamma)/2 - \text{sqrt}[(1-q(1-\gamma)/2)^2 - 2q\gamma t/\lambda] \quad (12)$$

We shall now show that parametric restriction (5) stated above ensures that equation (12) has solutions.

Proof. We need to show that restriction (5) ensures that inequality

$$(1-q(1-\gamma)/2)^2 > 2q\gamma t/\lambda \quad (13)$$

also holds, in other words,  $1 - q(1-\gamma) + (q(1-\gamma)/2)^2 > 2q\gamma t/\lambda$  is true. The latter will certainly be ensured if  $1 - q(1-\gamma) > q\gamma t/\lambda$ , is true. Since  $q \leq 1$ , the latter is in turn ensured if  $\gamma > q\gamma t/\lambda$ , or equivalently,  $1 > qt/\lambda$  holds, for which (3\*) is indeed sufficient since  $q \leq 1$  and  $\gamma < 1$ .  $\square$

**Proposition 1.** Assume that the inequality condition in (5) holds. Then the following facts are true.

- (i) Let  $q=0$ , i.e., the policymaker is with full certainty biased in favor of the firms' objective to maximize the magnitude of bailout. Then  $a^{**} < a^*$ . This implies that the delegated bailout determination procedure is more encouraging of excessive risk-taking by less productive firms.
- (ii) Let  $q=1$ , i.e., the policymaker is with full certainty aligned with the legislature's (people's) objectives. Then  $a^{**} > a^*$ . This implies that the delegated bailout determination procedure is superior to the direct one in that it is less encouraging of excessive risk-taking by less productive firms. [This wording can be probably improved but it conveys the meaning.]
- (iii) Let  $0 < q < 1$ . Then, depending on parameter values,  $a^*$  may or may not exceed  $a^{**}$ .

**Proof.** According to (4) and (12), respectively, we have

$$a^* = 1 - \sqrt{1-2t/\lambda\gamma}$$

$$a^{**} = 1 + q(1-\gamma)/2 - \sqrt{[(1-q(1-\gamma)/2)^2 - 2q\gamma t/\lambda]}$$

(i) Let  $q=0$ . Then  $a^{**}=0$ , i.e., all the firms will take on the risky project, so the asserted result is obvious according to the above expressions.

(ii) Let now  $q=1$ ; it is straightforward to show that  $\text{sign}(a^{**} - a^*)$  is the same as the value  $\text{sign}\{q(1-\gamma)/2 + \sqrt{1-2t/\lambda\gamma} - \sqrt{[(1-q(1-\gamma)/2)^2 - 2q\gamma t/\lambda]}\}$ , which in turn equals

$$S = \text{sign}\{q(1-\gamma) + 2q\gamma t/\lambda + q(1-\gamma)\sqrt{1-2t/\lambda\gamma} - 2t/\lambda\gamma\} \quad (14)$$

so the above becomes

$$S = \text{sign}\{(1-\gamma) + 2\gamma t/\lambda + (1-\gamma)\sqrt{1-2t/\lambda\gamma} - 2t/\lambda\gamma\} =$$

$$\text{sign}\{(1-\gamma)\sqrt{1-2t/\lambda\gamma} - [(1-\gamma^2)2t/\lambda\gamma - (1-\gamma)]\} = \text{sign}\{\sqrt{1-2t/\lambda\gamma} - [(1+\gamma)2t/\lambda\gamma - 1]\}$$



Observe now that if  $(1+\gamma)2t/\lambda\gamma - 1 \leq 0$ , then automatically the above is positive:  $S = +1$ , so  $a^{**} > a^*$ . Let now  $(1+\gamma)2t/\lambda\gamma - 1 > 0$  be true (which is, of course, consistent with (5)). Then

$$\begin{aligned} S &= \text{sign}\{[1-2t/\lambda\gamma] - [(1+\gamma)^2(2t/\lambda\gamma)^2 - (1+\gamma)(4t/\lambda\gamma) + 1]\} = \\ &= \text{sign}\{(1+\gamma)(4t/\lambda\gamma) - 2t/\lambda\gamma - (1+\gamma)^2(2t/\lambda\gamma)^2\} = \text{sign}\{(1+\gamma)(4t/\lambda\gamma) - 2t/\lambda\gamma - (1+\gamma)^2(2t/\lambda\gamma)^2\} = \\ &= \text{sign}\{(1+\gamma)(4t/\lambda\gamma) - 2\gamma t/\lambda\gamma - (1+\gamma)^2(2t/\lambda\gamma)^2\} = [\text{factoring out } 2t/\lambda\gamma] = \text{sign}\{2+\gamma - (1+\gamma)^2(2t/\lambda\gamma)\} \end{aligned}$$

which is indeed positive according to (5).

(iii) Note that  $da^{**}/dq > 0$ . The claim then follows from the continuity of the argument of the sign function in (5\*) with respect to  $q$ . (It is easy to see, for example, that the sign is positive under  $q=0.5$  if  $\gamma < 0.6$ ).  $\square$

Note that (12) helps determine the corresponding number of failed firms (as a function of the probability  $q$  associated with the policymaker's type):

$$f^{**}(q) = 0.5 - q(1-\gamma)/4 + 0.5\sqrt{[(1-q(1-\gamma)/2)^2 - 2q\gamma t/\lambda]} \quad (15)$$

and thereby, according to (7), the number of bailed out firms  $b^{**}(q) = f^{**}(q) - t/\lambda$ . In particular, in the case  $q=1$  where the policymaker is aligned with the legislature with certainty, we have

$$\begin{aligned} f^{**}(1) &= 0.5 - (1-\gamma)/4 + 0.5\sqrt{[(1+\gamma)/2]^2 - 2q\gamma t/\lambda} \\ b^{**}(1) &= 0.5 - (1-\gamma)/4 + 0.5\sqrt{[(1+\gamma)/2]^2 - 2q\gamma t/\lambda} - t/\lambda \end{aligned} \quad (16)$$

Note that in both situations examined above, the underlying assumption is that bailout commitment is impossible to make. This in itself leads to an inferior outcome relative to the alternative of

commitment. To illustrate this point, we compare in the Appendix social welfare with and without bailout commitment to show that the former dominates the latter.

#### 4. Bailout restraints

We now consider the following mode of interaction between the individuals and the policymaker. Upon getting informed about the number of failed firms, the individuals, through the legislature, and acting under uncertainty about the likelihood of the crisis, set a limit on the magnitude of the bailout, i.e., the maximal number of firms to be bailed out,  $B$ ,  $0 \leq B \leq f$ . Then, the policymaker, whose identity is determined by the nature's draw – possessing the expert knowledge of whether the crisis is imminent – can freely implement any bailout below  $B$ ; in contrast, any bailout above the limit  $B$  requires the legislature's approval. Unless it is granted, the bailout is implemented within the limit  $B$ . We assume that, whereas the policymaker's identity is not known at the constitutional stage of formulating the bailout limit, it becomes known at the bargaining stage *ex post*.<sup>10</sup>

We will analyze the equilibrium of this decision making sequence backwards. Anticipating that the individuals (the legislature) would veto any bailout proposal exceeding  $B$ , the policymaker of the type biased toward the firms will propose implementing bailout to the maximum permissible extent  $B$ , for any realization of the crisis shock, as this is the best she can do under any circumstances. Consider now the benevolent (pro-public) policymaker's proposals. If she observes that there is no shock (the state whose *ex ante* probability is  $1-\gamma$ ), she will implement no

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<sup>10</sup> This assumption facilitates the analysis; but the important one is that the policymaker's identity is not known at the constitutional stage.

bailout,  $b=0$ . In contrast, in the case she determines that the crisis is imminent, her bailout proposal will be  $b(f) = f - t/\lambda$ , i.e., as that determined by expression (7) corresponding to the case of delegated bailout where the policymaker is aligned with the legislature. The legislature will clearly implement a proposal of the benevolent policymaker, whether  $b(f)$  falls below  $B$ , or not.

We now turn to the choice of the bailout limit  $B$  by the legislature. For a given number of failed firms, individuals' expected utility can be written as follows:

$$(1-q)[-tB - \lambda\gamma (f-B)^2 /2] + q\gamma [-tb(f) - \lambda(f-b(f))^2 /2] \quad (17)$$

and its maximization yields  $B(f) = f - t/\lambda\gamma$  - the same formula as that given by (2) which arises under direct bailout decision process. A failing firm's probability of getting a bailout is then

$$P(\text{bailout}) = [(1-q)B(f) + q\gamma b(f)]/f = (1-q+q\gamma) - (1-q+q\gamma^2)t/f\lambda\gamma \quad (18)$$

Direct comparison reveals that, for a given  $f$ , this is smaller than the probability of a bailout for a failed firm under delegation,  $[(1-q) + q\gamma(1-t/f\lambda)]$ . Since firms' payoff is  $\mu_i = a_i(1/2) + (-1) [1 - P(\text{bailout})] (1/2)$ , they will undertake risky project insofar as  $a_i > a^{***} = 1 - P(\text{bailout})$ , implying, similarly to the derivation of equation (4), that in equilibrium

$$f = [2 - (1 - P(\text{bailout}))]/2 \quad (19)$$

and equations (18) and (19) jointly determine the probability of a bailout and the number of failed firms at equilibrium. Clearly, the larger is, for a given  $f$ ,  $P(\text{bailout})$ , the larger are the equilibrium values  $f$  and  $P(\text{bailout})$ .

To compare this probability to the one under direct bailout,  $B/f = 1 - t/f\lambda\gamma$ , consider the following

**Lemma 1.** There exists  $x^*$ ,  $0 < x^* < 1$  such that  $\gamma b^* > B$  holds iff  $x = 2t / \lambda \gamma > x^*$ .

**Proof.**  $\gamma b^* > B$  iff  $\gamma(f - t/\lambda) > f - t/\lambda\gamma$ , which can be rewritten as  $f < x(1+\gamma)/2$ . As  $f = (2-a^*)/2$ , this condition can be rewritten as  $2-a^* < x(1+\gamma)$ . As  $a^* = 1 - \sqrt{1-x}$ , this inequality is the same as  $1 + \sqrt{1-x} < x(1+\gamma)$ , where the left hand side is decreasing and concave in  $x$ , and the right hand side increases linearly in  $x$ . Further, when  $x=1$ , the inequality holds, whereas when  $x=0$  it does not. This proves existence of  $0 < x^* < 1$ , such that  $\gamma b^* > B$  iff  $x > x^*$ .

Since the firm probability of getting a bailout under restraints,  $[(1-q)B + q\gamma b^*]/f$ , is smaller than under direct bailout,  $B/f = 1 - t/\lambda\gamma$ , iff  $\gamma b^* < B$ , the lemma implies that this is the case iff  $x < x^*$ , i.e., when the expected “pain” as a result of a crisis,  $\lambda\gamma$ , is sufficiently large. We then obtain

**Proposition 2.** The equilibrium probability for a failing firm to be bailed out under restraint and the fraction of firms undertaking risky projects (hence, the number of failed firms) are smaller than under delegation; they are also smaller than under direct bailout, provided that the expected “pain” as a result of a crisis is large enough.

It is noteworthy that if  $x^* < x < 1$ , then the probability of getting a bailout under restraints is higher than under direct bailout and, further, it increases in  $q$  (because in that case  $\gamma b^* > B$ ), which implies that a larger fraction of benevolent policymakers increases moral hazard incentives. Intuitively, this is the case because the legislature is more attuned to benevolent policymakers’ bailout proposals – which may exceed the stipulated ceiling. A more general point is that bailout restraints are superior to direct bailout (in the sense of reducing bailout probability) only insofar as the expected cost of crises is large enough.

In the above analysis, the outcome – the level of the bailout ceiling  $B$  - is binding *ex post* if and only if the policymaker is biased in favor of firms.<sup>11</sup> This result hinges upon our assumption that the biased policymaker’s type is fully captured by the firms, and so his preferred bailout is largest possible. If the *ex post* preferred bailout for the individuals is below the ceiling, the biased policymaker implements the ceiling; if it exceeds the ceiling, the policymaker implements a bailout that guarantees the individuals the same utility as under the ceiling.<sup>12</sup>

## 5. Differential vulnerabilities and endogenous policymaker’s selection

The above analysis assumes that all individuals are identical, and, in particular, are identically affected by the shock. We now extend this analysis by assuming a differential effect. Thus, let  $\lambda_i$  denote individual  $i$ ’s loss when a shock occurs, assuming for simplicity that it is distributed according to a symmetric single peaked distribution in the interval  $[\underline{\lambda}, \bar{\lambda}]$ ,  $0 \leq \underline{\lambda} < \bar{\lambda}$ .  $\Lambda = (\underline{\lambda} + \bar{\lambda})/2$  denotes the mean of this distribution.

We now consider an alternative mechanism of creating a commitment mechanism to alleviate firms’ moral hazard. Specifically, suppose that the legislature determines first through majority voting the identity of a policymaker, a “bailout czar”,  $\lambda_{pm}$ . This person will be responsible

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<sup>11</sup> The intuition for this is that a good policymaker does not require bailout restrictions. The biased policymaker selects the maximal bailout that does not require an approval,  $B$  if the crisis is not very likely; and when the crisis is likely he selects a bailout level that guarantees the individuals the same utility level as  $B$ .

<sup>12</sup> Were the preferences of the biased policymaker more similar to those of the individuals – such as when he aggregates utilities and firm profits – then the equilibrium bailout ceiling would exceed  $B$ . The reason for this is that, in cases the individuals prefer a larger than stipulated by the ceiling bailout *ex post*, such a policymaker does not need to take into account blocking his proposal because of a low ceiling. Intuitively, when facing a similar policymaker, the individuals raise the bailout ceiling to improve their bargaining position.

for making bailout decisions at the ex post stage.<sup>13</sup> To make the analogy with the policymaker of the preceding sections, we assume that he acquires the needed expertise to tell if the external shock materializes and, further, that he remains faithful to his preferences with probability  $q$ , whereas with probability  $1-q$  he becomes biased toward the firms. Then the firms make their project decisions. After the policymaker makes a determination that the exogenous economy-wide shock is realized, he implements a bailout. We will be interested in a subgame perfect equilibrium where the policymaker is elected through a majority vote in the legislature.

The analysis proceeds backwards. At the last stage, if the policymaker is biased, he will implement full bailout,  $b=f$ ; that is, we posit that he will assert that the economy-wide shock is imminent regardless of whether he actually determines that to be the case. If the policymaker is unbiased then, in case there is no external shock, the bailout amount is zero, and if there is a shock, the bailout magnitude maximizes the policymaker's utility,  $-tb - \lambda_{pm}(f-b)^2/2$ , (i.e., the preferences which were originally endorsed by the legislature), which yields  $b(\lambda_{pm}) = f - t/\lambda_{pm}$ . This implies that the probability of a bailout for a failed firm is  $P(\text{bailout}) = 1-q+q\gamma(1 - t/f\lambda_{pm})$ . Moving to the firms' decision making, recall from the analysis in the preceding section that the threshold for undertaking a risky project is determined by  $1-P(\text{bailout}) = q-q\gamma(1 - t/f\lambda_{pm})$ . This implies that the equilibrium number of failed firms is given by:

$$f = 1 - [q-q\gamma(1 - t/f\lambda_{pm})]/2 \tag{20}$$

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<sup>13</sup> An alternative interpretation is that the legislature elects a committee in which the "bailout czar" is the median voter.

whose total differentiation reveals that  $df/d\lambda_{pm} = (qt\gamma/f\lambda_{pm}^2)/[2 - qt\gamma/f^2\lambda_{pm}] > 0$ : the larger the policymaker's vulnerability to crisis, the larger are the moral hazard incentives, hence the larger the number of failed firms. Further,  $f$  also increases in  $q$ , in  $t$ , and in  $\gamma$ .

Consider now the preferred choice of a policymaker from the viewpoint of legislature member  $i$ . That should maximize

$$EU_i = -tb - \lambda_i\gamma (f-b)^2 / 2$$

The first order condition is (where  $\lambda_{pm}^i$  is shock vulnerability of policymaker  $pm^i$  most preferred by individual  $i$ ):

$$d EU_i / d\lambda_{pm}^i = -t + \lambda_i\gamma (f-b) - \lambda_i\gamma (f-b) df/d\lambda_{pm}^i = 0 \quad (21)$$

and the second order condition implies that the left hand side in (21) decreases in  $\lambda_{pm}^i$ . We can now obtain

**Lemma 2.**  $\lambda_{pm}^i < \lambda_i$ . That is, each individual prefers as a policymaker an individual more vulnerable to the shock than himself; further,  $\lambda_{pm}^i(\lambda_i)$  is an increasing function.

**Proof.** Suppose that individual  $i$  is the policymaker and evaluate equation (21) at his preferred bailout amount,  $b(\lambda_i) = f - t/\lambda_i$ . We then obtain:

$$-t + \lambda_i\gamma (f-b) - \lambda_i\gamma (f-b) df/d\lambda_{pm}^i \Big|_{b=f-t/\lambda_i} = -t (1-\gamma) - \lambda_i\gamma (f-b) df/d\lambda_{pm}^i < 0$$

As the left hand side in (21) decreases in  $\lambda_{pm}^i$ , this proves that  $\lambda_{pm}^i < \lambda_i$ . To prove the second part of the claim, totally differentiate (21).

Lemma 2 in conjunction with the single peakedness of the distribution of lambda directly implies

**Proposition 3.** The median voter is decisive in determining the policymaker's identity. Furthermore,  $\lambda_{pm} < \Lambda$ ; that is, the median voter chooses a policymaker less vulnerable to shock than he is.

Thus, the legislature will select a person with a lower vulnerability relative to that of its median member (accordingly, that of the median voter in the population) as the policymaker. Such selection is motivated by the need to influence the moral hazard incentives faced by the firms and acts as a commitment device for a relatively low scale bailout package, against *ex post* inclinations of a majority of legislators. This result is reminiscent of related work on dynamic inconsistency in the context of monetary policy, e.g., Dal Bo, 2006, Lohmann, 1992, Rogoff, 1985. Figure 1 below illustrates how such a commitment to *ex post* bailout restraint is created through the *ex ante* appointment of a low vulnerability policymaker. The lower of the sloped lines in the figure represents the relationship between an individual's vulnerability to a potential crisis and his *ex ante* most preferred bailout magnitude in the event of the crisis. The upper line represents such relationship *ex post*, in the face of realized firm failures, reflecting the fact that in the absence of a commitment device each individual will support a larger bailout package. Point A in the graph thus represents bailout magnitude preferred by the median voter *ex ante*, point B – what he will prefer *ex post*, while C shows that the *ex post* choice by the appropriately chosen low vulnerability



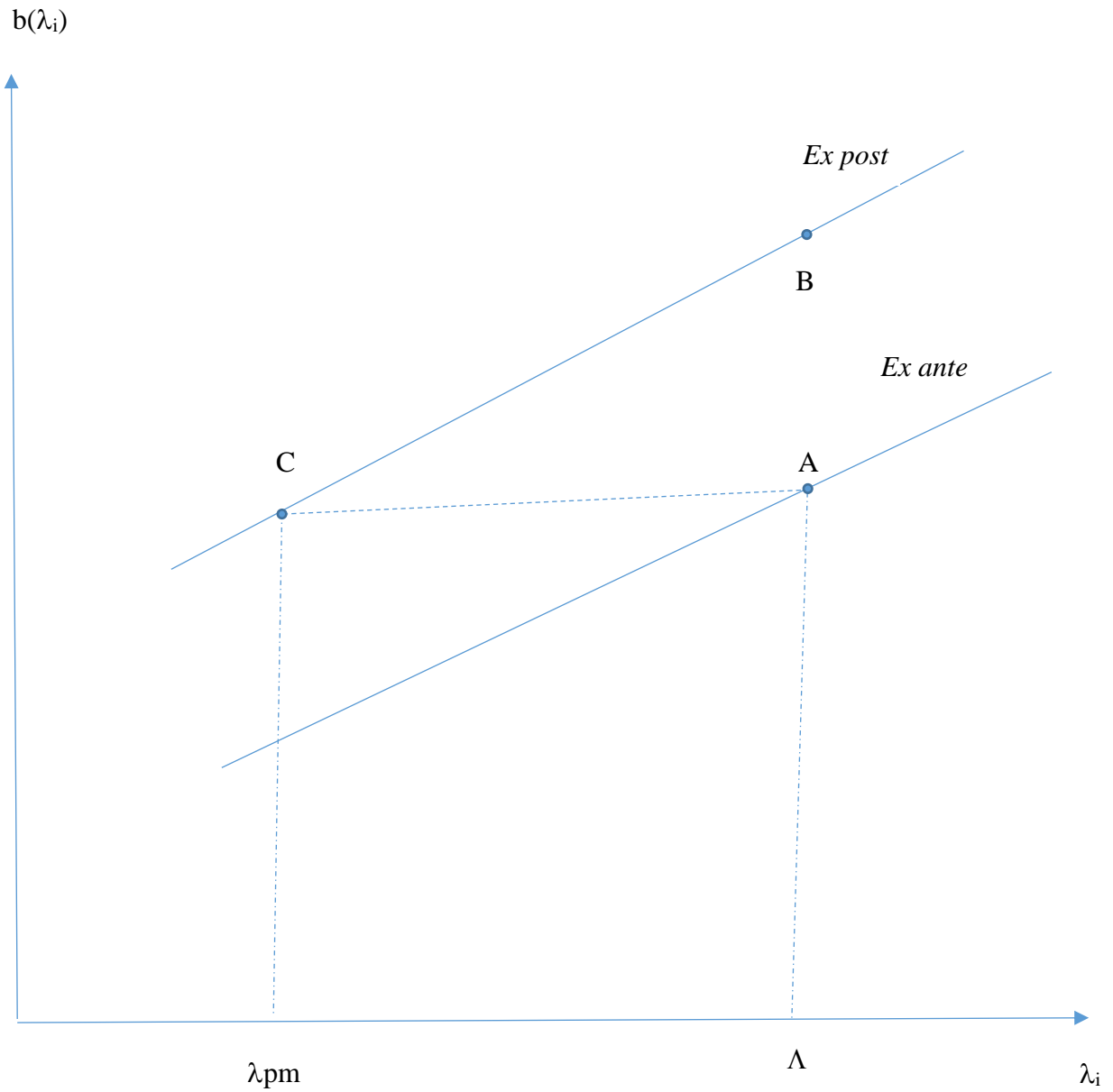


Figure 1. Commitment to *ex post* bailout restraint through the *ex ante* appointment of a low vulnerability policymaker

policymaker ensures the attainment of the median voter's *ex ante* preference, thus qualifying the procedure under consideration as a commitment device ensuring the implementation of the bailout

policy preferred by a majority ahead of a crisis, which helps avoid moral hazard among the firms that would generate more massive their failures, in turn compelling the population to support larger bailouts *ex post*.

Further, totally differentiating (21) while recalling that  $df/d\lambda_{pm}^i$  increases in  $q$  implies that, at equilibrium,  $d\lambda_{pm}/dq < 0$ , i.e., the larger the probability of a policymaker to maintain his benevolent identity *ex post*, the lower the vulnerability level characterizing the person to be selected as one. The intuition for this result is that the choice of policymaker according to his level of vulnerability to crisis will affect bailout policy only if the policymaker remains benevolent *ex post*; in contrast, to the extent that a policymaker ends up being biased in favor of the firms, his vulnerability to the external shock is immaterial.

## 6. Concluding remarks

The importance of preventive regulatory measures to alleviate firms' moral hazard incentives, the so called macro prudential regulation, has been recently emphasized (see Farhi and Tirole, 2012). While the point of departure in this work is that *ex post* bailout mechanisms lead to inefficiencies, this may depend on the effect of *ex post* regulations on moral hazard incentives. This paper set out to explore this issue in the context where a failure of multiple firms may cause an economy wide crisis. The question then is how the bailout decision making procedures in the aftermath of such failures shape firms' moral hazard incentives, when the policymaker's objective may not be congruent with those of the citizens, but instead be biased in firms' favor. Our analysis, in particular, reveals the importance of bailout restraints – a limit on the magnitude of the bailout set by the legislature – and of electing for bailout decisions relatively less vulnerable to shock

consequences individuals. We show that well-structured bailout procedure may help getting rid of an undesirable “crisis equilibrium”, with firms undertaking socially inferior decisions. It then follows that properly crafted ex post bailout decision making procedures have the potential of affecting the equilibrium risk taking behavior. Elements of the legislation undertaken in the aftermath of the recent financial crisis, the Dodd-Frank Act, illustrate the growing awareness of the importance of such structured procedures. In exploring ex post bailout regulation mechanisms the paper is related to Nosal and Ordonez, 2016, which proposes that strategic bailout delay can alleviate moral hazard incentives.

It would be interesting to combine in future work ex post bailout mechanisms as explored here with ex ante macro prudential regulation, from which we have deliberately abstracted. It is conceivable that employing both is advantageous in promoting social welfare relative to the alternative of just using one of these tools. Initial steps toward the understanding of an optimal mix between ex ante and ex post regulatory tools have been undertaken in Jeanne and Korinek, 2016. The interplay between ex ante and ex post considerations and the study of the optimal mix between ex ante and ex post regulation should be an important direction for future research. In particular, it could be interesting to explore under what condition ex post decision making procedures mitigate moral hazard and risk taking with regulatory ex ante risk taking restrictions in place.

Another promising extension would be to endogenize policymakers’ capture by corporate interests in the context of bailout decisions. Lobbying and organization of pressure groups could be invoked to explore such an enriched model. The framework exhibited in this paper seems a potentially useful building block in further exploring these issues.

Finally, incorporating the above considerations in a framework where bailouts provide a signal about the state of the economy, as in Rhee, 2016, is yet another direction to pursue. In particular, as one of the main insights in Rhee, 2016, is that, because of signaling associated with bailouts, the government may engage in excessive bailout activity, the mechanisms exhibited here may prove useful in restraining such activity.

## APPENDIX: Social welfare analysis

Suppose that social welfare is defined as the weighted aggregate of individual expected utilities and firm expected profits:  $-tb - \lambda\gamma (f-b)^2 / 2 + w^*(\text{expected profits})$ , where  $w \geq 0$  is the weight of the latter (the special case of  $w=0$  corresponds to a situation where individual utilities is all that matters for welfare and is highly relevant for the analysis in the text). We explore two scenarios, with and without commitment to bailouts.

### *With commitment*

In this case, the planner (legislature) sets the bailout magnitude  $b$ , anticipating firms' decisions and is committed to implementing this bailout allocation regardless of the resolution of the uncertainties.<sup>14</sup> Note that  $b=0$ , i.e., commitment to have no bailout, is a special case of this scenario. The analysis proceeds backwards. For a given  $b$ , the firms choose what type of projects to pursue. They face the likelihood of  $b/f$  to be bailed out and  $1-b/f$  to not be bailed out.

Therefore, the expected return from a risky project is

$$a_i(1/2) + (-1) (1-b/f) (1/2) \tag{A1}$$

It then follows that there is a threshold,  $a^0$ , such that only the firms above it pursue risky projects; the threshold is given by:

$$a^0 = 1-b/f \text{ and thereby } f = (2- a^0)/2 \tag{A2}$$

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<sup>14</sup> Alternatively, we could make bailout decisions contingent on external crisis realization – again, without changing the qualitative nature of the result.

Note that  $a^o < 1$  whenever  $b > 0$ . This means that bailout policy, even when there is a credible commitment about its any particular magnitude, encourages risk-taking, such that firms' return threshold for taking on a risky project is lower than under the laissez faire benchmark of no bailouts. Relationships (A2) define the threshold  $a^o$  uniquely, as a decreasing function of  $b$ : the larger the bailout the larger is the fraction of the firms undertaking risky projects. (Specifically,  $a^o = [3 - \sqrt{1+8b}]/2$ , and thereby  $f = [1 + \sqrt{1+8b}]/4$ ).

Social welfare then is given as follows:

$$-tb - \lambda\gamma (f-b)^2 / 2 + w^*(1/2) \left[ \int_{a_i > a^o} (a_i - 1 + b/f) \right]$$

Differentiating with respect to  $b$  we obtain (the Leibnitz term equals zero):

$$\begin{aligned} & -t + \lambda\gamma (f-b) - \lambda\gamma (f-b) \left( \frac{df}{da^o} \right) \left( \frac{da^o}{db} \right) + w^*(1/2) \int_{a_i > a^o} \left[ \frac{1}{f} - (b/f^2) \left( \frac{df}{da^o} \right) \left( \frac{da^o}{db} \right) \right] = \\ & -t + \lambda\gamma (f-b) - \lambda\gamma (f-b) \left( \frac{df}{da^o} \right) \left( \frac{da^o}{db} \right) + w^*(1/2) \left( \frac{2-a^o}{2} \right) \left[ \frac{1}{f} - \left( \frac{b}{f^2} \right) \left( \frac{df}{da^o} \right) \left( \frac{da^o}{db} \right) \right] = \quad (A3) \\ & -t + \lambda\gamma (f-b) - \lambda\gamma (f-b) \left( \frac{df}{da^o} \right) \left( \frac{da^o}{db} \right) + w^*(1/2) \left[ 1 - \left( \frac{b}{f} \right) \left( \frac{df}{da^o} \right) \left( \frac{da^o}{db} \right) \right] = 0 \end{aligned}$$

where  $df/da^o = -1/2$ , and  $\frac{da^o}{db} < 0$ . This implies, in particular, that the bracketed term in (A3) is smaller than one, hence, the last term is smaller than  $w$ .

*Without commitment*

In contrast, suppose that the firms make their project decision first, upon which the bailout is determined. With  $f$  failed firms, the bailout maximizes social surplus

$$-tb - \lambda\gamma (f-b)^2 / 2 + w*b$$

where the last term represents the benefit received by the bailed out firms. The optimal bailout magnitude is thus determined from the first order condition:

$$-t + \lambda\gamma (f-b) + w = 0 \tag{A4}$$

Comparing the first order conditions (A3) and (A4) and employing the second order conditions we obtain:

**Proposition A1.** The bailout amount under commitment is smaller than without it.

This result indicates that when bailout commitment is ruled out – as we assume throughout Sections 3 and 4 - the economy operates in the second best environment. (Recall, that in Section 5 we introduce a legislative mechanism which is akin to a commitment device.) Note that this is also the case when  $w=0$ , so that only individual utilities matter for welfare. This is because a lack of commitment to a restrained bailout policy creates moral hazard that leads the firms toward excessive risk taking and the resulting excessive bailouts in equilibrium.

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