Legislative Restraints in 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 as well as the exorbitant cost to the taxpayer. This paper examines the bailout design on behalf of an imperfectly informed legislature aimed at shaping the incentives of a policymaker to whom bailout decisions are delegated. We show that important elements of the more moral hazard-proof design entail various legislative procedural hurdles, which effectively make the bailouts dependent on supermajority support.

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1. Introduction

The financial crisis that erupted in 2007-8 brought forth 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.[1] This, combined with 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. It prominently features car makers, insurance companies, and, of course, banks and other financial institutions.

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 inevitably 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 improve 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 objective and the possibility of policymakers' bias in favor of corporate interests.

While major parts of the Act are explicitly designed to prevent crises by imposing regulatory restrictions on risk-taking, others focus on the need to manage post-crisis situations, should a future crisis occur. For example, ending taxpayer-funded bailouts is among the stated intents of the Act. Specifically to this end, its Title II "Orderly

[1] Similar policies were pursued elsewhere, such as in the UK, Sweden, Iceland, etc.

Liquidation Authority" deals with liquidation of financial institutions, whose failure is certified by one of several relevant regulatory authorities specified by the Act, stipulating limits (and, in most cases, outright prohibition) on taxpayers' money that can be committed in the liquidations . Title XIII deals with the management of potentially non-distributed funds, including those appropriated through the 2008 *Emergency Economic Stabilization Act (EESA)*, by imposing a legislative limit on these funds. (Indeed, *Dodd-Frank* cut the $700 Bln in *TARP* funding commitment originally provided by EESA to $475 Bln.)

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.[2] The government's incentive to provide for a bailout 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 scope of the bailout should be related to the magnitude of firm failures. Several factors at play then emerge. One issue is that of the moral hazard incentives inherent in a bailout mechanism, as the generosity of a bailout can sow the seeds of the next crisis by encouraging excessive risk-taking, which will, in turn, necessitate future generous bailouts in the absence of an effective government commitment to restrain it. Second, as the legislature and general public lack direct expertise to determine the likelihood of a crisis, conditioning bailout policy on the realized crisis probability will require delegating to expert policymakers, which by necessity implies an incomplete contracting approach to the policy design. Indeed, although such an executive agent would possess superior expertise, his/her objectives may not be necessarily aligned with the interests of the general public. In particular, it is conceivable that the policymaker will place greater weight on corporate interests. This, in fact, was a major issue during the recent US bailout that stirred public

[2] 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." See *Secretary Henry Paulson's testimony before the United States House Committee on Financial Services*, November 18, 2008.

concerns.[3]

Under these circumstances, the public (and its representatives in the legislature) faces 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 – between expertise and bias of an appointed executive - is our point of departure in this paper, which more generally explores bailout policies under incomplete contracting.[4] Our benchmark analysis compares the scenario of a direct bailout decision by the expertise-deficient but public welfare driven legislature to that of full delegation of it to an expert policymaker whose type is exogenous but *ex ante* unknown. We demonstrate that the benefits of the latter scenario, owing to policymaker's expertise, can be outweighed by his excessive bias in favor of corporate interests. Both scenarios underscore moral hazard incentives stemming from the legislature's inability to commit to adequate *ex post* bailout restraint in the face of a crisis precipitated by the firms' excessive risk-taking.

We then extend the framework to allow for individual heterogeneity with respect to their vulnerability to the economy-wide shock and demonstrate that such heterogeneity allows for a superior mechanism of ensuring commitment to an optimal restraint in a delegated bailout process. The mechanism we construct also entails the appointment of an executive decision-maker, but this "bailout czar" is endogenously elected *ex ante* as a representative of a segment of the electorate, which is less susceptible to the consequences of a crisis than the median voter. As a result, this agent is by design biased against an excessive, moral hazard-prone bailout. Such mechanism, which boils down to requiring legislative supermajority for *ex post* bailout approval, is shown to offer a commitment

[3] In particular, Secretary Henry Paulson's career as a business executive aroused suspicions of a potential conflict of interests; Johnson and Kwak (2010) document, for example, the revolving door between the Wall Street and the government that, in the authors' view, interferes with policy making. Calomiris and Khan (2015) discuss in detail the role of public concerns about the policymakers' conflicts of interest in the decision against bailing out Lehman Bros. as well as many limitations placed on the eventual bailout measures.

[4] The tradeoff we identify here is similarly applicable in other contexts of policymaking. Fleck and Hanssen (2012) and Maskin and Tirole (2004) identify and analyze this sort of tradeoff in the design of judicial systems, focusing on the comparative virtues and pitfalls of and the needs for checks and balances between the competent but unaccountable judiciary and accountable but lacking in expertise majoritarian government.

device to refrain from too generous bailout packages. These results indicate a potentially important role the regulatory framework and legislative procedural hurdles can play even in the aftermath of the eruption of a crisis.

This paper is related to emerging work on the economics of corporate bailouts: see, for example, Korinek (2015), Nosal and Ordonez (2016) and references therein. Much of this work, however, 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 the procedures for public decision making in a broader context of corporate bailouts. Indeed, besides concerns about liquidity provision resulting from bank failures, important motivation for bailouts also stems from concerns about the perils of a potential economy-wide crisis, such as mass unemployment or major infrastructure breakdowns resulting from multiple firm failures. By the same token, the implications of the design of bailout procedures go beyond their effects on financial institutions and impact, both directly and via bank lending policies, the level of risk-taking in the economy at large. In this broader public policy design context, our paper is most closely related to the literature examining the implications of legislative procedures and delegation, such as Dal Bo (2006), Harstad (2010), and Bai and Lagunoff (2011); see Bendor et al. (2001) for a general review of the delegation literature. It is also related to a substantial public choice literature that brought the attention to the need to control policymakers in order to restrain public spending more generally. Relevant work along these lines includes Buchanan and Tullock's (1962) seminal piece and subsequent work by Brennan and Buchanan (1980); for a more recent example, see Hanssen (2004) exploring a judicial control of policymakers, which is complementary to our approach.[5] Finally, an important work by political scientists discusses delegation to and control of regulatory agencies by the U.S. Congress: see McCubbins (1985) and McCubbins et al. (1987, 1989). This paper can be viewed as advancing some of these ideas for the concrete case of

[5] Also worth mentioning is a connection of our focus on procedures ensuring legislative commitment to the literature on dynamic inconsistency in the context of monetary policy and various mechanisms to alleviate it, such as the papers by Rogoff (1985) and Lohmann (1992) showing that *ex ante* selection of a conservative central banker can serve as a commitment mechanism for restraining future inflation.

corporate bailouts.

The paper is structured as follows. Section 2 sets up the benchmark model with homogeneous population, for which Section 3 analyzes direct and delegated designs of *ex post* bailout mechanism. Section 4 extends the benchmark model by introducing population heterogeneity in terms of individual vulnerability to the effects of a crisis; it then focuses on the *ex ante* political mechanism of selecting a "bailout czar" appropriately committed against its excessive generosity. Section 5 concludes. Most proofs are relegated to Appendix 1. Appendix 2 offers an extension of the benchmark model, which analyzes a possibility of improving the bailout restraint mechanism by adopting a limited commitment mechanism entailing setting up an *ex ante* bailout ceiling.

2. Basic model

Consider an economy populated by a unit measure 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.

Firms

Each firm, assumed risk-neutral, is faced with a choice of a project. The project can be either safe, in which case its net return is certain and normalized to 0, or risky, in which case the return on firm *j*'s project can be either a_j or –1 with equal probabilities, where a_j is distributed in the population of firms according to the uniform distribution in a closed interval, say, [0,2]. Let μ_j be the expected return of a firm undertaking a risky project, i.e., $\mu_j = (a_j - 1)/2$. This implies that, in the absence of government intervention, only top half of the firms, those with $a_j \in [1,2]$, have non-negative expected returns, so they and only they will choose a risky project in a laissez-faire economy. By the law of large numbers exactly one half of the firms undertaking a risky project will fail with the net loss of -1 while the other half of these firms will earn respective positive returns a_j. We refer to firms with a higher a_j as being more productive and assume that this is their private information. The firms are risk neutral, so they value the expected return on their project, μ_j.

Thus, different firms face different risky project opportunities. Firms' choices of projects and their outcomes may have economy-wide implications, on which 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. We denote the number (mass) of firms getting a bailout as b. Then the total cost of bailout is tb.

We posit that there is a likelihood of an economy-wide shock, generated by two 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 caused by an external event such as, for instance, an international financial crisis. We assume that such event occurs with a given probability $\gamma \in (0,1)$, which is known to the legislature. The second, endogenous, factor, which can exacerbate the economy-wide cost of the aforementioned downturn should it occur, is the failure of numerous firms. We denote the number (mass) of failed firms in the economy as f. [6]

We further posit that the likelihood of economy-wide consequences of firm failure is related to the number of firms, which failed but have not been bailed out, $f-b$; we denote this probability $P(f-b)$, which is further parametrized this as $P(f-b) = (f-b)^2/2$.[7] Thus, combined with the likelihood γ 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 as a function of the number of failed firms 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.

[6] 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.

[7] This functional form helps us obtain closed form solutions; qualitatively, same results hold under the more general formulation.

The Public and the Governance

We initially assume that each individual citizen's welfare loss in the case of an adverse shock is the same and characterized by coefficient $\lambda > 0$.[8] Then, if f firms fail and b firms are bailed out, the individual's expected welfare loss is given by $\lambda\gamma(f-b)^2/2$. We assume risk neutrality and thereby can express each individual's expected utility as

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

and posit that

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

i.e., the expected "pain" of a crisis exceeds the cost of firm bailout.

We now introduce the structure of governance into the model, dealing with the decisions about bailouts and their implementation. The 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. The legislature, however, lacks some of the required expertise, such as the ability to determine that a systemic crisis is imminent (only the probability γ 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 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 the legislature's, i.e., aimed at maximizing the individuals' expected utility, and those captive to corporate interests seeking to maximize the aggregate of firms' expected payoffs, $\int_0^2 \mu_j dj$.[9] We posit that the probability an appointed

[8] We introduce heterogeneity in this regard in Section 4.

[9] We could alternatively define the former type as caring for a weighted average of individual utilities and firms' profits without altering qualitative results.

policymaker is of the latter type is q, and the probability he is unbiased, i.e., aligned with the legislature, 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.[10] Another informational asymmetry 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.

As noted earlier, in a *laissez faire* economy, i.e., when legislature and/or policymaker can commit to refrain from bailing out any failed firms, the risky project is disadvantageous for all firms with $a_j < 1$. 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 agent, and we consider several possibilities in this regard.

In the first scenario ("*L*") we consider, the legislature makes its bailout policy decision *directly* on its own, while faced with the lack of information about the likelihood of the systemic shock. The second institutional scenario ("*P*") is that of *full delegation* of this decision to policymaker whose agenda, depending on the type of the selected official to be revealed only *ex post*, is either aligned with that of the populace or is biased in favor of corporate interests.[11] We assume that the type of the policymaker is initially unknown and is realized *ex post*, after the constitutional choices have been made. Thus, the formulation of the bailout procedure can be viewed as an incomplete contract between the public and the policymaker. The nature of this contract, in turn, affects firms' decisions, thereby it shapes their incentives to undertake – or not – risky projects.

[10] 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.

[11] In Appendix 2, we offer an extension of this analysis by introducing an additional *"bailout restraint",* scenario 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 legislatures' approval.

Next, in Section 4, where heterogeneity of individuals is introduced, we consider the *endogenous determination* of the policymaker's identity, through a vote in the legislature. Heterogeneity of the population is of essence in this analysis, because it implies individuals' differential vulnerability to a potential crisis. We show that *ex ante* selection, by a simple majority, of a policymaker to whom the determination of future potential bailout magnitude is delegated, gives decisive *ex post* power to individuals with below average vulnerability to a crisis (i.e., equivalent to requiring *ex post* supermajority support), which effectively ensures a commitment of sorts against yielding to potentially magnified *ex post* pro-bailout pressures resulting from an *ex ante* excessively risky moral hazard-ridden firm behavior.

Discussion

One important simplifying assumption we make is that a representative member of the public does not have ownership over the firms, which can be due, for instance, to incomplete equity markets, and thereby firm failure does not directly translate into individuals' financial losses. Allowing firm ownership by individuals would enrich the model at the cost of added complexity. Instead, the model features the social cost of the crisis incurred by the individuals, which can be interpreted as the societal hardship of unemployment resulting from it, i.e., the cost to the economy and society 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 in the framework with heterogeneous individuals, in Section 4, by introducing a legislative procedure of policymaker selection, which in itself does constitute a commitment device.[12] Finally, there is the assumption that a fraction of potential policymakers are captive to corporate interests. In support of this view, Johnson and Kwak (2010), document the existence of a revolving door in the interaction between the financial industry and the government in the US, resulting in regulatory capture. More specifically, Acemoglu et al. (2016) show that

[12] Note, however, that this is a commitment to a decision-making *procedure*, not a decision itself, direct commitment to which is ruled out.

returns of firms connected to Timothy Geithner, who was appointed as Treasury Secretary at the height of the crisis, were abnormally high in its aftermath. Further, Blau et al., 2013, document that firms with political connections were able to receive a larger amount (and sooner) of bailout funds than otherwise. More generally, Faccio et al., 2006, show that firms with political connections in 35 different countries are more likely to receive government bailouts in times of economic distress than the non-connected firms.

3. Direct and delegated bailout procedures

Here, we consider two benchmarks scenarios, which serve as a baseline for the main analysis thereafter.

Direct bailout determination by legislature

We consider the following chain of events in this scenario, which we labeled "*L*". First, firms decide on projects to undertake. (Those choosing the risky project face the probability 0.5 of a failure.) Upon the realization of firms' projects – but under the veil of ignorance about the realization of the external shock – the individuals, through the legislature, determine the magnitude of the bailout. We are interested in characterizing the resulting subgame perfect equilibrium.

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

$$-t + \lambda\gamma(f-b) = 0 \qquad (3)$$

Therefore, $f-b = t/\lambda\gamma$ and, assuming that $t < \lambda\gamma$, we get $b = \max\{f - t/\lambda\gamma, 0\}$. The obtained value of b, in turn, determines a failing firm's probability to get a bailout, that is $P^{L}_{bailout} = b/f = 1 - t/f\lambda\gamma$ and, accordingly, the probability $1-b/f = t/f\lambda\gamma$ to carry the full loss associated with failure.

This then enables us to calculate each firm's expected return when undertaking the

risky project as

$$\mu_j = \frac{a_j + (-1)(1 - P^L_{bailout})}{2} = \frac{a_j - t / f\lambda\gamma}{2} \tag{4}$$

This implies that a risky project will be undertaken iff $a_j > t/f\lambda\gamma$. Therefore, the equilibrium is characterized by the threshold for upside risk $a^L = t/f\lambda\gamma$. In other words, only the firms with upside returns above this threshold will undertake risky projects, so the number of failed firms is given by

$$f^L = 1 - a^L / 2 \tag{5}$$

i.e., half of the total number of firms undertaking risk $2 - a^L$, recalling that all firms form the mass of 2. Combined with the above, this yields

$$a^L = \frac{t}{\left(1 - a^L / 2\right)\lambda\gamma} \tag{6}$$

Only the smaller of the two possible roots in (6) is relevant in the sense of constituting a productivity threshold which, when crossed, ensures expected profitability of the risky project for a firm. Further, as is established in Appendix 1 (see Lemma 1 there) under parametric restrictions, which we will assume to hold throughout, equation (6) has a solution. Note that the resulting equilibrium value $a^L < 1$, which 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) where all firms whose $a_j < 1$ choose the safe project. In other words, some of the firms whose risk-taking is individually irrational and socially inefficient in the absence of government subsidy, are now, as the bailout policy is instituted, encouraged to take on such risk, which will, in turn, create the need for greater bailout magnitude *ex post*. 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*.

The above outline defines the equilibrium of the bailout process administered directly by the legislature, which can be summarized as follows.

Definition. The *equilibrium of the direct bailout process* (scenario "*L*") is given by the bailout policy (i.e., bailout magnitude as a function of the number of failed firms $b^L(f)$ and the firms' threshold for upside risk a^L) such that

(i) The legislature chooses bailout policy to maximize the expected utility (1), i.e., minimize the expected loss, to the population, from the crisis, given that all firms whose return on risky project exceeds threshold a^L will take the risk.

(ii) The firms' threshold for upside risk a^L is determined by their decisions whether to pursue the risky project, taking as given the bailout policy $b^L(f)$ set by the legislature.

The following result establishes the existence of the equilibrium (proofs are collected in Appendix 1):

Lemma 1. Assuming that the following parametric condition holds

$$x = \frac{t}{\lambda\gamma} < \frac{1+2\gamma}{2(1+\gamma)^2} \tag{7}$$

equation (6) has a solution, and the equilibrium of the direct bailout process exists and is unique.

Remark. The parametric condition (7) requires the value $\lambda\gamma$, the expected "pain" resulting from a crisis, to be sufficiently large. As shown by the Lemma's proof, this meaningful condition is essential for the existence of equilibrium, and we will assume it to hold.

Delegated bailout

We now consider the scenario "*P*" where the bailout decision is fully delegated to a policymaker. When the policymaker represents the firms' interests, which occurs with probability *q*, he will choose to bail out as many firms as possible, that is $b(f)=f$, so each firm faces a certain prospect to be bailed out by policymaker is of this type.

In contrast, a policymaker who is aligned with the public's interest will bail out no firm, if he concludes that no crises will take place, which will be the case with *ex ante* probability $1-\gamma$. Alternatively, with probability γ, his *ex post* bailout provision will

maximize the individuals' utility, $-tb-\lambda(f-b)^2/2$, for which the first order condition is given by

$$-t + \lambda(f-b) = 0, \text{ so that unbiased policymaker } b(f) = f - t/\lambda \quad (8)$$

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 $1 - t/f\lambda$.

We can proceed from this, similarly to our analysis of the direct bailout scenario "*L*", to derive each firm's expected returns from the risky project and, accordingly, the threshold for upside risk a^P under the delegated bailout process (see the details in Appendix 1, in the proof of Lemma 2 stated below). Likewise, this leads to the definition of equilibrium of the delegated bailout process:

Definition. The *equilibrium of the bailout process delegated to a policymaker* (scenario "*P*") is given by the alternative bailout policies by the respective policymaker types (i.e., bailout magnitudes as functions of the number of failed firms $b^P(f)$ and the firms' threshold for upside risk a^P such that

(i) The legislature appoints a policymaker whose type determines his bailout policy $b^P(f)$, taking as given the firms' threshold for upside risk a^P, which determines the number of failed firms f.

(ii) The firms' threshold for upside risk a^P is determined by their decisions whether to pursue the risky project, taking as given bailout policies chosen by alternative policymaker types and the probabilities of the types' occurrence.

We obtain the following equilibrium existence result:

Lemma 2. The parametric restriction (7) of Lemma 1 ensures that equilibrium of the delegated bailout process exists and is unique. Furthermore, the equilibrium threshold for upside risk a^P decreases as a function of q, the probability that a policymaker is biased in favor of firms.

Now, having derived the equilibria for the bailout process scenarios "*L*" (direct) and "*P*" (delegated), we compare these outcomes in the following proposition.

Proposition 1. There is a threshold value $\bar{q} \in (0,1)$ such that $a^P = a^L$ when $q = \bar{q}$. Furthermore, subject to parametric restriction (7), when $q > \bar{q}$, then $a^P < a^L$, and thereby $f^P > f^L$, implying that the delegated bailout determination procedure is inferior to direct bailout decision making by the legislature in that it is more encouraging of excessive risk-taking by less productive firms. When $q < \bar{q}$, then the opposite holds: $a^P > a^L$ and therefore $f^P < f^L$.

The Proposition demonstrates relative merits of the two scenarios. The obvious advantage of delegating decisions to expert policymakers can be outweighed by their bias diverging from public interest. When the likelihood of this bias is low (q is close to 0), delegating bailout decision to a policymaker is a superior option compared to direct bailout decision making by the legislature, but the comparison reverses for larger values of q indicating greater likelihood of policymaker's bias.

We note that a key assumption underlying both scenarios examined above is that the legislature is unable to make a commitment regarding (restraint on) bailout magnitude. This in itself leads to an inferior outcome relative to a hypothetical alternative that would exist if the legislature were be able to make such commitment. To illustrate this argument, consider social welfare defined as the aggregate of individual expected utilities.[13] Assuming the possibility of a *commitment*, the legislature sets the bailout magnitude b, anticipating firms' decisions and is committed to implementing this bailout allocation regardless of the resolution of uncertainties.[14] Note the distinction from the baseline of our analysis, i.e., the situation *without commitment*, where the final determination of a bailout magnitude is made *after* firms make their project decision. The following result proved in the Appendix 1 affirms the intuitively predictable effect of the legislature's inability to

[13] Extension to the case where firm profits also enter the social welfare calculation is straightforward.

[14] Commitment to have no bailout, i.e., b=0, is a special case of this scenario. Note that, generally, commitment to no bailout may not constitute the equilibrium, as some firms choose risky projects even without anticipating a bailout, hence a positive probability of a crisis always exists; this can be seen from the proof of Proposition 2.

uphold a commitment:

Proposition 2. The bailout amount under commitment is smaller than without it.

This result indicates that when bailout commitment is ruled out, the economy operates in the second best environment. This is due to the fact that 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. The proof, placed in Appendix 1, demonstrates welfare dominance of a hypothetical scenario where the legislature is able to commit to its *ex ante* decision of bailout magnitude, over the alternative, the absence of an ability to uphold a commitment, represented by scenario *L*, i.e., direct bailout decision by the legislature. Note that under both these alternatives a bailout gets implemented, since the legislature lacks the expertise to assess whether crisis is imminent, but the bailout magnitude will depend on whether commitment is possible. A straightforward extension of this analysis can show that legislature's ability to commit will remain welfare dominant when the implementation of bailout is contingent on the resolution of uncertainty about the crisis shock, which can be provided by an expert policymaker, provided that his interests are aligned with those of social welfare maximization. In another extension, placed in Appendix 2, we consider a hybrid between the two scenarios considered above, whereby a bailout limit is set, which can only be overcome *ex post* through the legislature's consent. This is shown to have the potential of being superior to both scenarios above.

4. Heterogeneous vulnerability and supermajority requirement for bailout approval

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 λ_i denote individual i's loss when a shock occurs, to which we refer as the individual's *crises vulnerability*, and assume for simplicity that it is distributed according to a single peaked distribution in the interval $[\underline{\lambda}, \bar{\lambda}]$, where $0 \leq \underline{\lambda} < \bar{\lambda}$. Alternatively, λ_i can

be interpreted as a taste parameter, with its larger values indicating aversion to the economy wide shock. Let M be the individual with median shock vulnerability – or shock aversion – given by λ_M .

We now introduce a political mechanism creating a commitment device aimed at alleviating firms' moral hazard problem. Specifically, suppose that the legislature determines first through simple majority voting the identity of a policymaker, a "bailout czar", whose vulnerability to crises is denoted Λ. This person will be delegated responsibility to make bailout decisions at the *ex post* stage. To make the analogy with the policymaker of the preceding sections, we assume that he acquires the needed expertise to determine whether 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. The firms then 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 simple majority vote in the legislature. As we plan to demonstrate, the essence of the commitment device thus chosen *ex ante* by a simple majority is selection of an *ex post* decider who is more restrained toward bailout than the median voter will be *ex post*, effectively requiring a supermajority for the bailout approval.

The analysis proceeds backwards. At the last stage, the outcomes and their respective probabilities can be classified as follows:

(a) If the policymaker is biased, which occurs with probability $1-q$, 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. Note that in view of the implementation of full bailout, the crisis will be prevented in any case, so the *ex post* individual utility (defined in terms of loss) will only contain the cost of the bailout: $U_{\lambda_i} = -tb$, or, in light of the above, $U_{\lambda_i} = -tf$ where we now index individual's utility functions by their crises vulnerability levels λ_i in order to underscore the role of their heterogeneity.

(b) If the policymaker is unbiased and there is no external shock (an event with probability $(1–q)(1–\gamma)$), the bailout amount b = 0, and clearly *ex post* individual utility $U_{\lambda_i} = 0$.

(c) If the policymaker is unbiased but there is an external shock (an event with probability $(1-q)\gamma$), the bailout magnitude maximizes the policymaker's utility, $-tb - \Lambda(f-b)^2/2$, (i.e., the preferences which were originally endorsed by the legislature), which yields $b(\Lambda) = f - t/\Lambda$. Factoring in the latter, individual i's *ex post* individual utility is given by

$$U_{\lambda_i} = -tb - \lambda_i(f-b)^2/2 = -t\left(f - t/\Lambda\right) - \lambda_i\left(t/\Lambda\right)^2/2 .$$

The above distribution of probabilities faced *ex ante* by individual *i* regarding bailout magnitude and effect, yields the following expected utility function for the individual:

$$\begin{aligned} EU_{\lambda_i}(\Lambda) &= -t\left[qf\left(\Lambda\right) + (1-q)\gamma\left(f\left(\Lambda\right) - t/\Lambda\right)\right] - \frac{\lambda_i(1-q)\gamma}{2}\left(t/\Lambda\right)^2 \\ &= -t(q+(1-q)\gamma)f\left(\Lambda\right) + (1-q)\gamma\, t/\Lambda - \frac{\lambda_i(1-q)\gamma}{2}\left(t/\Lambda\right)^2 \end{aligned} \tag{9}$$

expressed as a function of the identity of policymaker (more specifically, his vulnerability to crisis Λ). Indeed, in the scenario under consideration, the choice of policymaker, to be analyzed shortly, will determine *ex post* outcomes for each individual.

Turning now to firms' decision making, the above implies that the probability of a bailout for a failed firm is $P(bailout) = q+(1–q)\gamma(1 – t/\Lambda f)$. Recall from the analysis in the preceding section that the threshold for undertaking a risky project is determined by $1–P(bailout) = 1–q–(1–q)\gamma(1 – t/\Lambda f)$. This implies that the equilibrium number of failed firms is given by the larger root of the following equation (which corresponds to the smaller root of the equivalent equation reformulated, as in the previous analysis, in terms of the productivity threshold for risk-taking):

$$f = 1 – [(1–q) – (1–q)\gamma(1 – t/\Lambda f)]/2 \tag{10}$$

Totally differentiating (10) yields

$$\frac{\partial f}{\partial \Lambda} = \frac{t(1-q)\gamma f}{\Lambda\left(2\Lambda f^2 - tq\gamma\right)} > 0 \tag{11}$$

i.e., the larger the policymaker's vulnerability to crisis, the larger are the moral hazard incentives, hence the larger the number of failed firms (where the inequality in (11) can be directly verified by explicitly solving quadratic equation (10)).

We shall now examine the process, in the legislature, of choosing a policymaker. The identity of policymaker most preferred by individual (legislature member) i is determined by maximizing this individual's expected utility (9) as a function of crises vulnerability Λ of the (to be chosen) policymaker. Consider the function's derivative:

$$\begin{aligned}\frac{\partial EU_{\lambda_i}(\Lambda)}{\partial \Lambda} &= -t(q+(1-q)\gamma)\frac{\partial f}{\partial \Lambda} - \frac{t^2(1-q)\gamma}{\Lambda^2} + \frac{\lambda_i t^2(1-q)\gamma}{\Lambda^3} = \\ &= -t(q+(1-q)\gamma)\frac{\partial f}{\partial \Lambda} + \frac{t^2(1-q)\gamma}{\Lambda^2}\left(\frac{\lambda_i}{\Lambda} - 1\right)\end{aligned} \tag{12}$$

One can immediately see, with the help of inequality in (11), that the sign of (12) when evaluated at $\lambda_i = \Lambda$ is negative, implying that each individual prefers as a policymaker an individual less vulnerable to crises than himself, or $\Lambda_i < \lambda_i$, where Λ_i denotes crises vulnerability of the policymaker most preferred by individual i.

Further, expression (12) strictly increases in λ_i, that is, $\frac{\partial}{\partial \Lambda} EU_{\lambda_i}(\Lambda) < \frac{\partial}{\partial \Lambda} EU_{\lambda_k}(\Lambda)$ for all individuals i and k, such that $\lambda_i < \lambda_k$. This implies that individuals' preferences over the identity of their favored policymaker satisfy the single crossing property – thus ensuring the existence of a majority voting equilibrium (see Persson and Tabellini, 2000, Ch. 2). We therefore denote the crisis vulnerability level of the majority-chosen policymaker by Λ_M, as it is the most preferred one by the median voter. Summarizing the above yields

Proposition 3. The policymaker's identity is determined *ex ante* by the median voter, whose crisis vulnerability is given by Λ_M. However, $\Lambda_M < \lambda_M$, i.e., he has a lower vulnerability to crises than the population's median.

Thus, a simple majority of the legislature will select a policymaker whose crisis vulnerability is lower than that of its median member (accordingly, that of the median voter in the population). Such selection is motivated by the need to influence the moral hazard incentives faced by the firms and effectively acts as a commitment device to authorize a relatively low scale bailout package, against *ex post* inclinations of a majority of legislators. This, in effect, is equivalent to requiring a supermajority *ex post* endorsement of a bailout package, which could be considered as a form of commitment device in this context.

The above result shows that such a commitment to *ex post* bailout restraint is created through the *ex ante* appointment of a low vulnerability policymaker, which is reminiscent of related work on dynamic inconsistency in the context of monetary policy, e.g., Lohmann (1992) and Rogoff (1985). Figure 1 below offers an intuitive illustration to the mechanics of this result. 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 E in the graph thus represents bailout magnitude preferred by the median voter *ex ante*, point G – what he will prefer *ex post*, while F shows that the *ex post* choice by the appropriately chosen low vulnerability policymaker ensures the attainment of the median voter's *ex ante* preference, thus qualifying the procedure under consideration as a commitment device ascertaining 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 their more massive failures, in turn compelling the population to support larger bailouts *ex post.*

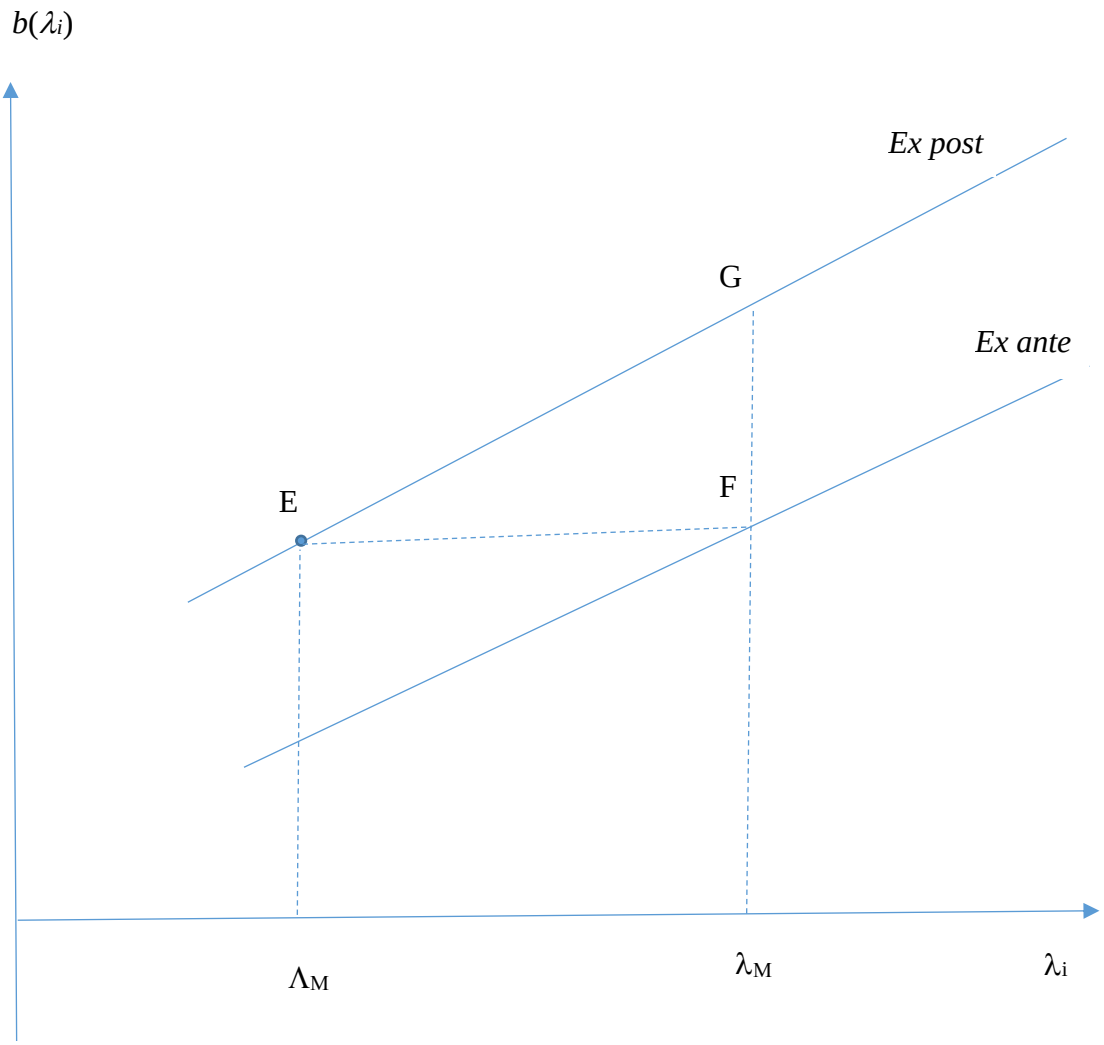

Figure 1. Commitment to *ex post* bailout restraint through the *ex ante* appointment of a low vulnerability policymaker

Interpretation and evidence

Recall that λ_i can be interpreted as a crisis aversion parameter, which characterizes the individual's susceptibility to a potential crisis. In this vein, our results indicate that the individual selected as bailout czar in equilibrium is characterized by a relatively stronger

resilience to the economy-wide shock[15] and hence more conservative approach to bailouts than exhibited by the population's median. This is analogous to the rationale for appointing a conservative central banker – one with especially high aversion to inflation – in the context of monetary policy, as articulated by Rogoff (1985).

The following sequential legislative bargaining procedure offers another interesting and perhaps more far-reaching interpretation of the above results. Suppose that, beginning with benchmark status quo provision of no bailouts, the legislature directly determines *de novo* the scope of the bailout through the following iterative process. At each iteration, a supermajority's approval is needed in order to incrementally increase the bailout amount and, once the approval is granted, the newly approved amount becomes the new status quo. The equilibrium of this process can be shown (based on the insights in Gradstein, 1999, and Dal Bo, 2006, in a related context) to coincide with the bailout choice made by the appointed policymaker as outlined above.

With this interpretation in mind, our results can be directly linked to the real-life institutional arrangements. Supermajority requirements are commonly used as a restraining device in political process, e.g., when it comes to increasing or introducing new taxes. For instance, a three-fifth supermajority requirement in the U.S. Senate is the hurdle that all federal spending measures have to overcome[16]. This hurdle played a major role in the development of responses to the financial crisis of 2008. Both key such measures, the Emergency Economic Stabilization Act (EESA, which included the TARP program) of 2008 and the American Recovery and Reinvestment Act (ARRA) of 2009, which was

[15] In the case of selecting policymakers with bailout authority, this "resilience" requirement would qualify individuals who are less politically or financially beholden to interests strongly affected by the crisis. The provision that members of the executive must place their assets in blind trust also underscores the need to ensure their greater independence on the consequences of the policy decisions.

[16] More specifically, this hurdle is required to stop the debate (with potential "filibuster") in the Senate, i.e., to pass a "cloture" motion. The procedural device of filibuster is what technically imposes a supermajority requirement for passing any measure opposed to by a minority (see Heitshusen and Beth, 2017). Until 2013, the same hurdle was required for approving all senior executive and judicial appointments. Supermajorities varying between three-fifth and three-quarters are also required in 14 US State legislatures for raising taxes (see Hiltz and Martel, 2015), as well as, to the same end, in multiple local jurisdictions (Brooks et al., 2016).

aimed at providing economic stimulus, passed the three-fifth supermajority hurdle by razor-thin margins. An earlier attempt to pass EESA did in fact fail in the Senate; the ripple effects of the fall of Lehman Bros. on September 15, 2008 facilitated the ultimate passage of the bill on October 1. This means, to clarify the parallels with the results of our theoretical analysis, that the passage of bailout programs and establishing their scope in response to financial crisis of 2008 in the US required overcoming supermajority hurdle in the Senate. Furthermore, while the authority to administer the programs was delegated to executive policymakers, the congressional acts imposed additional contingency limitations on the bailout magnitudes. For example, of the $700 Bln. funding nominally provided by the TARP program, the Treasury Secretary was only given direct access to $250 Bln., whereas the rest required additional certification by the President and Congress. The total cap on TARP funding was in fact slashed by $225 Bln. in 2009, as a provision of Title XIII of the Dodd-Frank Act.

Swagel (2015) and Calomiris and Khan (2015) document numerous further limitations embedded in both EESA/TARP and ARRA programs and survey the literature arguing that government response could have been more effective, in terms of direct cost-benefit calculus, had it proceeded with greater speed and fewer limitations. Calomiris and Khan (2015) underscore, however, that moral hazard concerns are essential for evaluating the *indirect* benefits and costs of the programs, and may therefore justify the constraints imposed. On the flip side, Calomiris et al. (2005), who offer a wide-ranging taxonomy of government responses to financial crises across countries and times, argue that weak institutions, including those plagued by political connections between regulators and banks and the lack of enforcement of risk-taking discipline, were largely responsible for the instances of failures of successful resolutions of the crises.[17]

[17] For example, they draw attention to the full guarantee on bank deposits in Japan as a factor in its failure to adequately resolve the protracted crisis in the 1990s.

5. Concluding remarks

The importance of preemptive regulatory measures to alleviate firms' moral hazard incentives, the so called macroprudential regulation, has been recently emphasized (see Farhi and Tirole, 2012 and Jeanne and Korinek, 2016). While the point of departure for our analysis is that *ex post* bailout mechanisms lead to inefficiencies, this phenomenon may depend on the effect of *ex post* regulations on the moral hazard incentives. This paper sets out to explore this issue in the context where a failure of multiple firms may facilitate an economy-wide crisis. The question then is how the bailout decision-making procedures in the face of such failures shape firms' moral hazard incentives, when the policymaker's objective may not be congruent with those of the citizens, but instead may be biased in firms' favor. Our analysis reveals, in particular, the importance of legislative procedural hurdles, such as a selection as a "policymaker" of an individual relatively less vulnerable to consequences of a crisis than a majority of the population, effectively representing *ex post* supermajority support for the bailout. We show that well-structured bailout procedure may help getting rid of an undesirable "crisis equilibrium", with firms undertaking socially inferior excessively risky 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. Our work suggests that details of *ex post* bailout mechanisms matter a good deal in shaping moral hazard incentives.

It would be interesting to combine, in future work, *ex post* bailout mechanisms as explored here with *ex ante* macroprudential regulation, from which we have presently deliberately abstracted. It is conceivable that employing both is advantageous in promoting social welfare relative to 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 is an important direction for future research. In particular, it would be interesting to explore

under what conditions *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.

APPENDIX 1

Lemma 1. Assuming that $x = \frac{t}{\lambda\gamma} < \frac{1+2\gamma}{2(1+\gamma)^2}$, equation (6) has a solution.

Proof

The parametric condition (7) stated in the Lemma is equivalent to the requirement that, under the considered scenario, $f^L - b^L = \frac{t}{\lambda\gamma} < \frac{1+2\gamma}{2(1+\gamma)^2}$.

Note. The last expression is clearly less than 1/2 and can be compared against the fact that $f^L = (1\text{-}a^L/2) > 1/2$ (because $a^L < 1$) to produce numerical localizations for the equilibrium values for f^L and b^L.

Equation (6) can be rewritten as

$$(a^L)^2 - 2a^L + 2t/\lambda\gamma = 0 \qquad \text{(A.1)}$$

so its smaller root is given by

$$a^L = 1 - \sqrt{1 - 2t/\lambda\gamma} \qquad \text{(A.2)}$$

This solution exists as long as $2t/\lambda\gamma \le 1$, which is clearly ensured by the Lemma's condition.

Expression (A.2) implies the following explicit expressions the corresponding numbers of failed firms

$$f^L = \frac{1 + \sqrt{1 - 2t/\lambda\gamma}}{2} \qquad \text{(A.3)}$$

so therefore, according to (3), the corresponding number of bailed out firms is given by

$$b^L = f^L - t/\lambda\gamma = \frac{1 + \sqrt{1 - 2t/\lambda\gamma}}{2} - t/\lambda\gamma \qquad \text{(A.4)}$$

completing the proof. □

Proof of Lemma 2

Recall that the probability that a firm undertaking the risky project will succeed is 0.5 and the probability that a failing firm gets bailed out is b/f , where b is the bailout magnitude given by a chosen policy. Given the earlier derived bailout policy functions $b(f)$ of the alternative policymaker types and the probabilities of their selection, we obtain that the overall *ex ante* probability, for a risk-taking firm, of failing and being bailed out is given by $[q + (1-q)\gamma(1-t/f\lambda)]/2$. Thereby, its probability of failing and not getting bailed out is $0.5 - [q + (1-q)\gamma(1-t/f\lambda)]/2 = [(1-q)(1-\gamma) + (1-q)\gamma t/f\lambda]/2$.

We can therefore calculate firm j's expected return if it undertakes the risky project:

$$\mu_j^P(risky) = [a_j - (1-q)(1-\gamma) - (1-q)\gamma t/f\lambda]/2 \quad \text{(A.5)}$$

It then follows that there is a threshold level of return a^P such that only the firms with $a_j > a^P$ undertake risky projects. It can be expressed as

$$a^P = (1-q)(1-\gamma) + (1-q)\gamma t/f^P\lambda \quad \text{(A.6)}$$

while

$$f^P = [1-a^P/2] \quad \text{(A.7)}$$

implying that a^P is the smaller root of the equation

$$a^P = (1-q)(1-\gamma) + (1-q)\gamma t/\lambda[1-a^P/2] \quad \text{(A.8)}$$

which can be rewritten as

$$(a^P)^2 - (2+(1-q)(1-\gamma))a^P + 2(1-q)(1-\gamma) + 2(1-q)\gamma t/\lambda = 0 \quad \text{(A.9)}$$

so its smaller root is given by

$$a^P = 1+(1-q)(1-\gamma)/2 - \sqrt{(1-(1-q)(1-\gamma)/2)^2 - 2(1-q)\gamma t/\lambda} \quad \text{(A.10)}$$

We thus need to show that the parametric restriction of Lemma 1 ensures that inequality

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

also holds; in other words, that inequality $1 - (1-q)(1-\gamma) + ((1-q)(1-\gamma)/2)^2 > 2(1-q)\gamma t/\lambda$ is true. The latter will certainly be ensured if $1 - (1-q)(1-\gamma) > (1-q)\gamma t/\lambda$, is true. Since q is non-negative, the last inequality is in turn ensured if $\gamma > (1-q)\gamma t/\lambda$, or equivalently, $1 > (1-q)t/\lambda$ holds, for which the restriction (7) is indeed sufficient since $\gamma < 1$.

It remains to note that the fact $\frac{\partial a^P}{\partial q} < 0$ follows directly from expression (A.6). □

Proof of Proposition 1

We first note that if $q=1$, then, according to (A.6), $a^P=0$, i.e., all the firms will take on the risky project, so the asserted result is obvious according to the above expressions.

Now consider the case $q=0$. It is straightforward to show, recalling (A.2) and (A.6), that the value $S = sign(a^P - a^L)$ is the same as the value

$$sign\left\{(1-q)(1-\gamma)/2 + \sqrt{1-2t/\lambda\gamma} - \sqrt{\left(1-(1-q)(1-\gamma)/2\right)^2 - 2(1-q)\gamma t/\lambda}\right\},$$

which in turn, upon squaring of components, can be shown equal to

$$S = sign\left\{(1-q)(1-\gamma) + 2(1-q)\gamma t/\lambda + (1-q)(1-\gamma)\sqrt{1-2t/\lambda\gamma} - 2t/\lambda\gamma\right\} \quad (A.11)$$

Given $q=0$, this can be further transformed as

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

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

Observe now that if $(1+\gamma)2t/\lambda\gamma - 1 \le 0$, then automatically the above is positive: $S = +1$, so $a^P > a^L$. Let now $(1+\gamma)2t/\lambda\gamma - 1 > 0$ be true (which is, of course, consistent with condition (7)). Then, again by squaring components and then factoring out common terms, we obtain

$$S = sign\left\{1-2t/\lambda\gamma-\left[(1+\gamma)^2(2t/\lambda\gamma)^2-(1+\gamma)(4t/\lambda\gamma)+1\right]\right\}=$$

$$sign\left\{(1+\gamma)(4t/\lambda\gamma)-2t/\lambda\gamma-(1+\gamma)^2(2t/\lambda\gamma)^2\right\}=sign\left\{1+2\gamma-(1+\gamma)^2\,2t/\lambda\gamma\right\}$$

which is positive according to condition (7).

Now recall that $\frac{\partial a^P}{\partial q}<0$, according to Lemma 2, while a^L does not depend on q. The Proposition's results then follow from the continuity of the argument of the sign function in (A.7) with respect to q. (It is easy to see, for example, that the sign is positive under q=0.5 if $\gamma<0.6$). □

Proof of Proposition 2

Given legislature's commitment to a bailout magnitude 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

$$a_i(1/2) + (-1)(1-b/f)(1/2) \qquad \text{(A.12)}$$

It then follows that there is a threshold, a^o, such that only the firms above it pursue risky projects. This threshold is given by:

$$a^o = 1 - b/f \text{ and thereby } f = (2 - a^o)/2 \qquad \text{(A.13)}$$

Note that $a^o < 1$ whenever $b > 0$. This means that bailout policy, even when there is a credible commitment about its any particular (positive) 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 (A.13) define the threshold a^o uniquely (specifically, $a^o=\left(3-\sqrt{1+8b}\right)/2$, and thereby $f=\left(1+\sqrt{1+8b}\right)/4$), and it is a decreasing function of b : the larger the bailout the larger is the number of the firms undertaking risky projects.

Differentiating the expected value of individual utility with respect to b we obtain:

$$-t + \lambda\gamma(f\text{-}b) - \lambda\gamma(f\text{-}b))(df/da^o)(\frac{da^o}{db}) = 0 \quad \text{(A.14)}$$

where df/da^o= -1/2, and $\frac{da^o}{db} < 0$.

Without the possibility of commitment, with f failed firms, the bailout follows scenario A, such that the optimal bailout magnitude satisfies the first order condition (3). Comparing it to (8) and employing the second order conditions proves the statement.□

APPENDIX 2

The bailout procedures considered in the text can be considered as polar cases of either the policymaker or the legislature retaining full decision-making power. A more balanced perspective is offered by an approach whereby some kind of an *ex post* bargaining between them takes plans in the wake of firms' failures. It turns out that the details of such bargaining procedure and, specifically, the allocation of bargaining power between the legislature and the policymaker are important in shaping the equilibrium outcome and, in particular, the firms' incentives to undertake risky projects.

Specifically, consider the following mode of their interaction. 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, $B \in [0, f]$, which can be interpreted as the magnitude of the bailout fund that is set up well in advance of the emergence of the potential for a crises, and indeed before the firms decide on the levels of risk-taking. 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 bailout of any magnitude within the fund scope *B*. In contrast, any bailout above the limit *B* requires the legislature's approval of additional appropriations. Unless it is granted, the bailout is implemented within the limit *B*. We assume that, whereas the policymaker's type is not known at the constitutional stage of formulating the bailout limit, it becomes known at the bargaining stage *ex post*.[18] Before we proceed with the formal analysis of this situation, it is important to carefully lay out the features of the bailout procedure that are determined *ex ante* the firms' actions as opposed to those determined *ex post*. In particular, the general nature of the bargaining between the policymaker and the legislature is determined *ex ante*, at the constitutional stage; however, its details – specifically, the magnitude of the bailout fund – is only determined *ex post*. Arguably, this captures some

[18] The second part of this assumption facilitates the analysis but can be relaxed; the first part, condition that the policymaker's identity is not known at the constitutional stage, is the essential element. We also assume throughout that after a policymaker is chosen his type becomes known to the legislature.

of the realistic features of the Dodd-Frank's Title XIII, which sets a legislative limit on the magnitude of corporate bailout in the context of the 2007-8 crisis.

We will analyze the subgame perfect equilibrium of this decision making sequence backwards. At the last stage, 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* under any realization of the crisis shock, as this is the best he can do for the firms under any circumstances. Consider now the benevolent (pro-public) policymaker's proposals. If he observes that there is no shock (the state whose *ex ante* probability is $1-\gamma$), he will implement no bailout, $b=0$. In contrast, in case he determines that the crisis is imminent, his bailout proposal will be $b(f) = f - t/\lambda$, specifically its value corresponding to the case of delegated bailout where the policymaker is aligned with the legislature ($q=0$). 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:

$$EU_i = q\left[-tB - \lambda\gamma\left(f-B\right)^2/2\right] + (1-q)\gamma\left[-tb(f) - \lambda\left(f-b(f)\right)^2/2\right] \qquad \text{(A15)}$$

and its maximization yields $B(f) = f - t/\lambda\gamma$, as in the formula that results from equation (3), which arises under direct bailout decision process. A failing firm's probability of getting a bailout is then

$$P^R_{bailout} = [qB(f) + (1-q)\gamma b(f)]/f = (q+(1-q)\gamma) - (q+(1-q)\gamma^2)t/f\lambda\gamma \qquad \text{(A16)}$$

using index "*R*" in reference to variables characterizing this scenario featuring bailout restraint. Direct comparison reveals that, for a given *f*, this expression is smaller than the probability of a bailout for a failed firm under delegation (scenario *P*), which is given by $[q + (1-q)\gamma(1-t/f\lambda)]$. Since firms' payoff is $\mu_j = a_j(1/2) + (-1)(1-P^R_{bailout})(1/2)$, they will undertake risky project iff

$$a_j > a^R = 1 - P^R_{bailout} \qquad \text{(A17)}$$

Therefore, in equilibrium, the number of failed firms is given by

$$f^R = 1 - a^R / 2 \tag{A18}$$

Similarly to the derivation of equation (6), a^R is given by the smaller root of equation

$$a^R = (1-q)(1-\gamma) + (q+(1-q)\gamma^2)t/\lambda\gamma\left(1 - a^R/2\right) \tag{A19}$$

Similarly to the analyses of Section 3, the above establishes the existence of equilibrium subject to the parametric condition (7) and leads to the following result (the proof is available from the authors upon request):

Proposition A1. Let q ∈ (0, 1), i.e., the probability of selecting either type of policymaker is positive. Then, subject to condition (7), *ex post* bargaining between the legislature and the policymaker with a restrained bailout process is superior to both the delegated and the direct decision making procedures. Specifically, it yields a higher upside risk threshold a^R and thereby lower number of failed firms f^R than under either of those scenarios, implying that it is better at discouraging excessive risk-taking by less productive firms.

In the above analysis, the outcome – the level of the bailout fund *B* - is binding *ex post* if and only if the policymaker is biased in favor of firms.[19] This analysis rested on two fundamental assumptions about the limitations of direct bailout decision making: (i) Legislators represent the interests of the public, but lack the expertise to determine whether a systemic crisis is imminent and thereby bailout action is indeed required; (ii) Even if the legislature could hire a reliable expert policymaker, the legislature lacks the ability to overcome its own time-inconsistency: namely, faced with firms' moral hazard-motivated risk-taking, the legislature will lack the commitment to follow its own *ex ante* first best and will instead be forced to choose an optimal *ex post* response.

[19] 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*.

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