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Antonio E. Bernardo
University of California, Los Angeles, antonio.bernardo@anderson.ucla.edu

Eric L. Talley
Columbia Law School, etalley@law.columbia.edu

Ivo Welch
University of California, Los Angeles, ivo.welch@anderson.ucla.edu

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Antonio E. Bernardo   *University of California, Los Angeles*

Eric L. Talley   *Columbia University*

Ivo Welch   *University of California, Los Angeles*

Abstract

Although common economic wisdom suggests that government bailouts are inefficient because they reduce incentives to avoid failure and induce excessive entry by marginal firms, in practice bailouts are difficult to avoid for systemically significant enterprises. Recent experience suggests that bailouts also induce litigation from shareholders and managers complaining about expropriation and wrongful termination by the government. Our model shows how governments can design tax-financed corporate bailouts to reduce these distortions and points to the causes of inefficiencies in real-world implementations such as the Troubled Asset Relief Program. Bailouts with minimal distortion depend critically on the government's ability to expropriate shareholders and terminate managers.

1. Introduction

In the autumn of 2008, the US federal government made an unprecedented $85 billion bailout loan to the American International Group (AIG)—an amount that would later escalate to nearly $200 billion at the height of the recession. The terms were draconian: AIG's chief executive was forced out, the interest rate was three times that for other bailout recipients, and AIG shareholders were forced to surrender an 80 percent (eventually 92 percent) dilution to the government. Nevertheless, AIG's bailout was unpopular at the time. Regulators viewed it as a necessary lesser evil, given the collapse in liquidity that had overcome the world economy and the metastatic role AIG had played in it. To most observers' surprise (and to the government's great relief), AIG was eventually able to repay the loan in full, and the federal government managed to unwind its ownership.

Although history has largely rehabilitated the AIG bailout in the public's eyes, its terms remain a sore spot among AIG's shareholders. Shares that had traded for over $1,000 in 2007 (1 year before the bailout) were worth approximately $50

in 2014. From the incumbent shareholders' perspective, the bailout had been a one-sided contract of adhesion executed in the shadow of heavy-handed government pressure. To them, the government's actions were unnecessary, unfair, unauthorized, and (in the opinion of several participants) un-American. A group of incumbent AIG shareholders, including former chair and chief executive officer Maurice (Hank) Greenberg, countered with something exceedingly American—they sued. Their complaint asserted that banking laws do not allow the state to "trample shareholder and property rights even in the midst of a financial emergency" and that the government's strong-arm tactics violated constitutional protections against the taking of property without due process (*Starr Int'l. Co. v. United States of America,* Verified Class Action Complaint, US Court of Federal Claims, C.A. 1:11-cv-00779-TCW [November 21, 2011], p. 4).

In June 2015, Judge Thomas Wheeler surprised many in holding that the government was prohibited under the Federal Reserve Act from taking equity positions in bailed-out companies and that the bailout constituted an unlawful exaction, borne out of a "complete mismatch of negotiating leverage in which the Government could and did force AIG to accept whatever punitive terms were proposed" (*Starr Int'l Co. v. United States,* 121 Fed. Cl. 428, 435 [2015]). Nevertheless, he awarded no damages, holding that "if not for the Government's intervention, AIG would have filed for bankruptcy. In a bankruptcy proceeding, AIG's shareholders would most likely have lost 100 percent of their stock value." Consequently, he concluded, shareholders had suffered no economic loss from the government's conduct, however impermissible and untoward it may have been.

The careening nature of the AIG opinion mirrors an analogous indecision that pervades economic debates about bailouts. Prior to 2007, most academics viewed government bailouts as aberrations of developing countries, artifacts of political patronage, or idiosyncrasies of the banking industry. Indeed, the academic consensus view of government interventions generally—and corporate bailouts specifically—has remained largely negative in light of the potential moral-hazard problems. The literature often comes to the conclusion that bailouts distort incentives ex ante and beget more bailouts and are thus best avoided at all costs. And yet, to the academics' consternation, governments (even when advised by prominent academic economists) have time and again ridden to the rescue of firms considered too big to fail during economic crises. The AIG opinion recognizes, echoes, and even reinforces their ambivalence between deterring moral hazard on the one hand and yielding to systemic significance on the other. This indecision gives unclear prospective guidance for policy makers in the United States and elsewhere, who will no doubt have to grapple with the same issues again: to bail out or not and, if so, on what terms?

The goal of this paper is to examine a stylized model that captures the concern that owners and managers can take future government bailouts into account when making business decisions. The model clarifies when the moral-hazard implications are insufficient to condemn bailouts writ large. In Section 4, we discuss more subtle reasons and realistic changes in assumptions that can restore an appropriate skepticism.

Our model's argument turns on considering the payoffs of relevant stakeholders of the bailed-out firm. Such stakeholders could consist of existing and future customers, suppliers, employees, creditors, the broader community, and possibly even other firms and their stakeholders. Their presence implies that the firm's owners and managers may not internalize all social costs and benefits of a shutdown. In particular, stakeholders also benefit from the firm's operation but are too diffuse to allow the firm to capture their surplus (and they have little or no influence over corporate decisions). Section 4.3 discusses these externalities in great detail, but good examples are the socially inefficient components of additional unemployment, the costs of moving capital resources if the firm shuts down, and inframarginal wages for employees. If the net noninternalized stakes are positive, then the government may have a legitimate interest in keeping a moribund firm alive. If the government is benevolent and efficient, we show that it can improve outcomes. The model does not have to assume that the government has access to unique information or special powers. It is not an omniscient social planner with the power to micromanage wages or to coerce owners or managers. Rather, its abilities are very limited and akin to those afforded to any other outside buyout party, either inside or outside of formal bankruptcy: it can offer funds if owners continue to operate the firm, and it can insist on firing employees and managers if owners accept the bailout funding. We assume that it cannot take an active management role, but it can tax firms to finance bailouts (though only in a nondiscriminatory fashion).

Yet, in our model, there is a parsimonious policy that (usually) preserves the social externalities without worsening the direct ex ante incentives of firms and employees. Thus, if the only concerns are direct incentives distorted by the desire to be bailed out, our model suggests that their negative incentive effects could be relatively easily mitigated by the following two policies: First, incumbent managers should be fully expropriated in a bailout. They are then no more or less eager to be bailed out a priori than they are in the absence of government intervention. Their effort incentives remain the same. Second, corporate owners should be fully expropriated in a bailout. They are then no more or less eager to be bailed out a priori than they are in the absence of government intervention.

In addition, there are funding consequences. Corporate owners should be taxed on profits (revenues net of all costs, including up-front investment costs) to fund bailouts. Such a corporate tax is proportional to net present value (NPV), so any project that is positive (negative) NPV in the absence of taxation remains positive (negative) NPV in the presence of taxation. Firms are then no more or less eager to invest a priori than they are in the absence of government intervention. Note that governments cannot fund bailouts through extraordinary taxes on bailed-out firms. Any such tax simply increases the bailout amount that the government must offer to get the firm to continue. In effect, such a tax would be on itself. The only closed-system option is a redistributive tax, for which healthy firms pay into an actuarially balanced fund.

Models' assumptions always cause conclusions, but the ex ante consequences

of ex post expropriation powers are often not appreciated: it is not necessarily true that bailouts beget bailouts. In the absence of other problems, the direct moral-hazard temptations can be extinguished, and social welfare can be improved. Thus, our model's assumptions are not enough in themselves to categorically condemn government intervention or even to state that bailouts beget bailouts. The problems arise not because of the bailouts per se but because there must be other forces in play. Our paper does not claim that real-world bailouts do not create social net costs or benefits. Instead, we show where these costs can and cannot lie. We view our model's results as a background indifference theorem against which the possible distortions should be assessed. In Section 4, we discuss the real-world deadweight losses that our model assumes away and that are necessary to return an appropriate degree of skepticism to advocacy for bailouts.

Our paper proceeds as follows. Section 2 describes the model in the absence of government. Section 3 shows how a well-structured bailout need not change either the investment behavior or the managerial effort. Section 4 considers the model and its implications in more detail: what is required for bailouts to create or destroy social value? Section 5 discusses the Troubled Asset Relief Program (TARP) in light of our model. Section 6 reviews related work. Because most bailouts have occurred in the financial services industry, this literature in turn appears mostly in the academic banking literature. Section 7 concludes.

2. A Model without Government Intervention

Our base model starts with one firm and one representative manager (with a possible replacement) who must provide effort. The owners make decisions about investment and about hiring and firing. There is no distinction between shareholders and debt holders, either because one party holds both instruments or because the firm is not credit financed. Our model is not about financial distress or corporate bankruptcy but about continuation versus termination. Naturally, because a loss in value is usually associated with both financial distress and economic shutdown, a common venue in which governments may execute bailouts may well be bankruptcy proceedings (as in the General Motors [GM] and Chrysler cases, but not in the AIG case). We assume that there is no conflict of interest between a judge (if involved) and the firm (on whose behalf the judge acts) or between a judge and the government (or society as a whole)—exceptions such as Burton Lifland's 1990 Eastern AirLines bankruptcy notwithstanding. Our model allows firms to be complex enough to have separated ownership (shareholders) and control (managers). There are two time periods with no intertemporal discounting.

Time 1.   At time 1, the firm decides whether to invest in a project with initial cost $I_1 > 0$. Firms have sufficient funds to begin the project. The project can be a success, yielding gross payoff $R_1 > 0$, or a failure, yielding a gross payoff of 0.

The probability of success depends on managerial effort. For simplicity, the probability of success is the manager's effort level e_1. Thus, the project fails with

probability $1 - e_1$. The manager bears a private cost of providing effort $ce_1^2/2$, where $c \gg 0$ is assumed to be large relative to other parameters.[1] Effort should not be taken literally here. It is a modeling device to characterize a conflict of interest between managers and owners that can be remedied by paying success-contingent compensation. The conflict could equally well be a desire to build empires or not to perform unpleasant tasks (such as fighting bureaucracy or unions).[2]

The project's payoff is then realized, and the firm must pay the manager the success-contingent wage $w_1 \geq 0$. It is straightforward to show that the firm will choose not to pay wages if the project fails and has no revenues. As is customary in this literature, we do not allow the manager to purchase the firm and thereby circumvent the main incentive problem.[3]

Time 2.   At time 2, the firm has a real option to either abandon the project or restart it for an additional investment of $I_2 > 0$. If the firm restarts, it can dismiss or keep the manager, FF = {Fire, Retain} (where FF is fire by firm). The replacement manager is assumed to have ability equal to that of the initial manager, which in our model maps onto the same cost of effort c. (Section 3 discusses the equal-ability assumption.)

The restarted project proceeds much like the first-period project, except there are no additional restarts, and its payoff is related to the performance of the project in the first period. Thus, if the restarted project fails, it again yields a gross payoff of 0. If it succeeds, it yields gross payoff $R_{2,j}$, where $j = \{H, L\}$ indicates whether the time 1 project was a success (H) or failure (L). We assume that $R_{2,H} \geq R_{2,L}$—after a successful start, future payoffs are higher than after a botched start. The probability of success in the restarted project in state j depends on managerial effort at time 2, $e_{2,j}$. The manager again bears a private cost of providing effort $ce_{2,j}^2/2$.

After the project's payoff at time 2 has been realized, the firm must pay the manager the success-contingent wage $w_{2,j} \geq 0$. (Again, it is optimal not to pay managers if revenues are 0.) The game then ends. Figure 1 illustrates the sequential nature of the game, where M denotes the manager in the decision to fire by firm or retain.

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[1] We assume that $c \geq R_1 + S$. This is necessary and sufficient to keep the first-best effort a valid probability weakly less than 1.

[2] At the cost of tractability, we could introduce alternative algebraic specifications translating effort into the probability of success. That said, because effort has no natural measuring unit, we lose little generality from our current setup, which uses convex effort costs and basic parameter restrictions ($c > R_1 + S$) to bound $0 \leq e_1 \leq 1$.

[3] The nonnegativity of wages is the functional equivalent of limited liability for the manager. It would be straightforward to introduce private managerial benefits if the project succeeds, which, in contrast to wages, would obtain even without managerial effort. Like wages, they would accrue only on success. The conclusions of our model would remain unaltered, because such benefits would merely reduce the wage that the firm needs to pay managers.
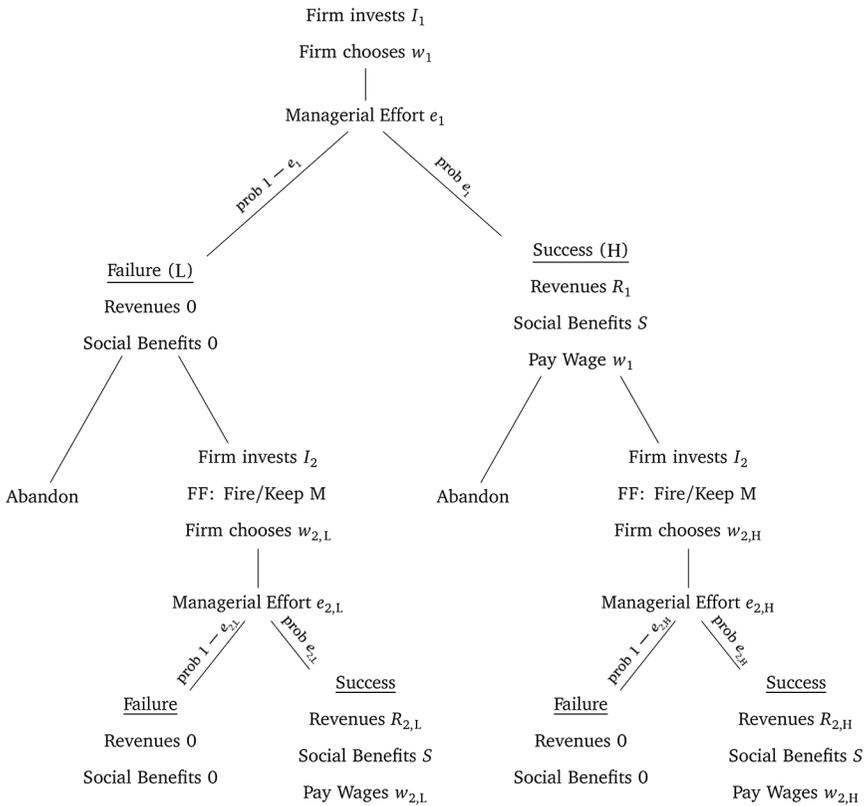
Firm invests I_1

Firm chooses w_1

Managerial Effort e_1

prob $1 - e_1$ prob e_1

Failure (L)

Revenues 0

Social Benefits 0

Success (H)

Revenues R_1

Social Benefits S

Pay Wage w_1

Abandon

Firm invests I_2

FF: Fire/Keep M

Firm chooses $w_{2,L}$

Abandon

Firm invests I_2

FF: Fire/Keep M

Firm chooses $w_{2,H}$

Managerial Effort $e_{2,L}$

prob $1 - e_{2,L}$ prob $e_{2,L}$

Managerial Effort $e_{2,H}$

prob $1 - e_{2,H}$ prob $e_{2,H}$

Failure

Revenues 0

Social Benefits 0

Success

Revenues $R_{2,L}$

Social Benefits S

Pay Wages $w_{2,L}$

Failure

Revenues 0

Social Benefits 0

Success

Revenues $R_{2,H}$

Social Benefits S

Pay Wages $w_{2,H}$

Figure 1. Sequential game structure without government intervenion

We assume that the project has additional fixed social benefits S that do not depend on the managerial effort or the presence of bailouts[4] but accrue whenever the firm operates successfully.[5] These social benefits embody the payoffs of other stakeholders if the firm succeeds. The same S applies at time 2 in the event of success in both the H and the L states. Neither the firm nor the manager can capture and thereby internalize this surplus, for example because the stakeholders are too diffuse and heterogeneous.

To make this an interesting problem and for all solutions to stay in the correct

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[4] From a policy perspective, the presence of a metapolicy of bailing out can create externalities and/or surplus even for owners and managers who are fully expropriated in a bailout. In the extreme, the entire firm or industry may be nonviable without a government bailout policy.

[5] Our qualitative implications would hold if we assumed instead that social benefits accrued whenever the firm operates, regardless of success or failure.

Table 1
Model without Government Intervention

Parameter	Variable
Exogenous:	
Investment costs	I_1 and I_2
Success-contingent revenues	$R_1, R_{2,L}, R_{2,H}$
Managerial effort cost parameter	c
Stakeholder benefits	S
Endogenous:	
Success-contingent wages	$w_1, w_{2,L},$ and $w_{2,H}$
Managerial effort	$e_1, e_{2,L},$ and $e_{2,H}$

domains, we add some parametric assumptions. First, we consider only cases in which the model's parameters render it optimal for firms to invest at time 1:[6]

$$\frac{1}{c}\left(\frac{R_1}{2} + \frac{3R_{2,H}^2}{16c} - \frac{I_2}{2}\right)^2 \geq I_1. \tag{1}$$

Second, we assume that the project is positive (negative) NPV at time 2 if the initial project succeeds (fails) at time 1:

$$\frac{R_{2,L}^2}{4c} \leq I_2 \leq \frac{R_{2,H}^2}{4c}. \tag{2}$$

Third, we assume that the continuation project's NPV at time 2 in the H state is not too high:

$$\frac{R_{2,H}^2}{4c} - I_2 \leq 2c - R_1. \tag{3}$$

This ensures that equilibrium effort is below 1, which is required to allow us to map effort onto a valid probability of success.

   In sum, our model's ingredients are as canonical as possible. A firm has a project that has an up-front investment cost and positive revenues if the project succeeds. The probability of success increases with the effort of a manager who dislikes effort but can be motivated with a success-contingent wage. In all, it has seven exogenous parameters and six endogenous continuous variables (see Table 1). In addition, the firm has some discrete choices: it can decide whether to start a project and/or whether to continue it, and if the firm operates the project, it can decide whether to fire or retain the manager (FF) at time 2 after the state j is revealed.

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[6] In real life, it may well be that firms produce social externalities that are large enough to warrant even further government incentives for success. However, this is not the problem at hand. Section 4 discusses this further.

2.1. First-Best Effort

To illustrate the model, we first derive the socially first-best effort. The expected social welfare consists of firm revenues and social externalities (wages are transfers), net of effort costs and investment, $sv_{t,j}(e_t) = e_t(R_{2,j} + S) - ce_t^2/2 - I_t$. The ex ante total expected social welfare is therefore $SV = sv_1(e_1) + e_1 \times sv_{2,H}(e_{2,H}) + (1 - e_1)sv_{2,L}(e_{2,L})$.

At time 2, the first-best effort levels are $e_{2,j}^{FB} = (R_{2,j} + S)/c$. Substituting this back into $sv_{2,j}$ yields $sv_{2,j} = (R_{2,j} + S)^2/2c - I_2$. When $R_{2,L} + S$ is large enough relative to c and I_2, it is worthwhile to continue projects even in the L state.

At time 1, if it is socially optimal to continue the project regardless of its initial outcome, the socially optimal effort solves

$$SV = \max_{e_1} e_1(R_1 + S) + e_1\left[\frac{(R_{2,H} + S)^2}{2c} - I_2\right]$$
$$+ (1 - e_1)\left[\frac{(R_{2,L} + S)^2}{2c} - I_2\right] - \frac{ce_1}{2} - I_1.$$

Solving the first-order condition yields $e_1^{FB} = (R_1 + S)/c + [(R_{2,H} + S)^2 - (R_{2,L} + S)^2]/2c^2$. First-best social welfare is

$$SV^{FB} = \frac{\{R_1 + S + [(R_{2,H} + S)^2 - (R_{2,L} + S)^2]/2c\}^2 + (R_{2,L} + S)^2}{2c} - I_1 - I_2.$$

2.2. Equilibrium

In the real world, firms cannot force their managers to provide the socially optimal level of effort. They can only motivate them by paying success-contingent wages. We assume that firms cannot commit to long-term compensation contracts at time 1 that are suboptimal at time 2. Therefore, we consider only subgame-perfect equilibria of our model.

Definition 1. A subgame-perfect equilibrium is a set of success-contingent wages $\{w_1, w_{2,L}, w_{2,H}\}$, managerial efforts $\{e_1, e_{2,L}, e_{2,H}\}$, the firm's decision to retain the manager in states L and H (FF), and the firm's continuation decision in states L and H (FC being the decision to continue), such that, at time 2,

1) $e_{2,j}(w_{2,j}) = \arg\max m_{2,j} \equiv e_{2,j}w_{2,j} - (c/2)e_{2,j}^2$,
2) $w_{2,j}(e_{2,j}) = \arg\max \pi_{2,j} \equiv e_{2,j}(R_{2,j} - w_{2,j}) - I_2$,
3) and the firm continues (FC = 1) in state j if and only if $\pi_{2,j} \geq 0$,

and such that, at time 1,

4) $e_1(w_1, w_{2,j}, FF, FC) = \arg\max e_1(w_1 + mc_H) + (1 - e_1)mc_L - (c/2)e_1^2$, where $mc_j = m_{2,j}$ if the incumbent manager is retained in state j, and $mc_j = 0$ if not, and
5) $\{w_1(e_1, e_{2,j}, FF, FC); FF\} = \arg\max e_1(R_1 - w_1 + \max\{0, \pi_{2,H}\}) + (1 - e_1)$ $\times \max\{0, \pi_{2,L}\} - I_1$.

We can now solve for this equilibrium.

Under assumption 2, the firm does not restart the project at time 2 if the initial project was a failure, $w_{2,L} = e_{2,L} = 0$. Therefore, suppose that the initial project was a success (H) and the firm has already restarted the project. At this point, I_2 is sunk. The firm offers the manager a contract paying $w_{2,H}$ if the project succeeds and 0 if it fails (which turns out to be optimal). The manager now expects to receive $m_{2,H} \equiv e_{2,H} w_{2,H} - c e_{2,H}^2/2$. Her payoff-maximizing effort is $e_{2,H}(w_{2,H}) = w_{2,H}/c$, which results in expected continuation profits (π) for the firm of $\pi_{2,H} = e_{2,H}(w_{2,H}) \times (R_{2,H} - w_{2,H})$. Therefore, the firm optimally pays the success-contingent wage $w_{2,H}^* = R_{2,H}/2$. This wage induces a managerial effort level $e_{2,H}^* = R_{2,H}/2c$. This is half the first-best effort in the absence of social externalities. The continuation value for the manager after a successful project at time 1 is therefore $m_{2,H}^* = e_{2,H}^* w_{2,H}^* - c e_{2,H}^{*2}/2 = R_{2,H}^2/8c$. The firm's expected time 2 profits are $\pi_{2,H}^* = e_{2,H}^*(R_{2,H} - w_{2,H}^*) - I_2 = R_{2,H}^2/4c - I_2$. Given behavior at time 2, we can now determine the firm's optimal behavior at time 1.

At time 1, the firm can decide whether to fire or retain the manager on the basis of whether the project returned R_1 or 0. At time 1, the manager expects to receive $e_1(w_1 + mc_H) - ce_1^2/2$, where mc_H is the amount a manager expects to receive at time 2 in the H state. If she expects to be replaced by another manager, then $mc_H = 0$; if she expects to continue, $mc_H = m_{2,H}^*$. (Recall also that $mc_L = 0$.) The optimal managerial effort is $e_1(w_1) = w_1/c + mc_H/c$. Anticipating this effort, the firm maximizes $\Pi \equiv (w_1/c + mc_H/c) \times (R_1 - w_1 + \pi_{2,H}^*) - I_1$, which implies a profit-maximizing wage of $w_1^* = R_1/2 + R_{2,H}^2/8c - I_2/2 - mc_H/2$. At this wage, the optimal managerial effort is $e_1^* = R_1/2c + R_{2,H}^2/8c^2 - I_2/2c + mc_H/2c$, and the firm's maximized profits are

$$\Pi = \frac{1}{c}\left[\frac{R_1}{2} + \frac{f}{16}\frac{R_{2,H}^2}{c} - \frac{I_2}{2}\right]^2 - I_1,$$

where

$$f = \begin{cases} 3 & \text{if } mc_H = m_{2,H}^* \text{ and } mc_L = 0 \\ 2 & \text{if } mc_H = mc_L = 0. \end{cases}$$

Clearly, Π is larger when mc_H is $m_{2,H}^*$. Managers work harder if they expect to be retained upon success. Therefore, firms prefer to retain successful managers.

Collecting results, we have the following optimal firm and managerial policies:

Theorem 1. Under the parameter restrictions in expressions (1)–(3), there is a unique subgame-perfect equilibrium in which the firm invests in the project at time 1 if and only if $1/c \times (R_1/2 + 3R_{2,H}^2/16c - I_2/2)^2 \geq I_1$. The firm pays managerial wage w_1 soliciting managerial effort e_1 at time 1 of $w_1^* = R_1/2 + R_{2,H}^2/16c - I_2/2$ and $e_1^* = R_1/2c + 3R_{2,H}^2/16c^2 - I_2/2c$. A firm continues the project only in case of early success (H). If it continues, it retains the manager and pays managerial wage $w_{2,H}$

soliciting managerial effort $e_{2,H}$ at time 2 of $w^\star_{2,H} = R_{2,H}/2$ and $e^\star_{2,H} = R_{2,H}/2c$. So-
cial welfare is $SV = e^\star_1(R_1 + S) - (c/2)e^{\star 2}_1 - I_1 + e^\star_1[e^\star_{2,H}(R_{2,H} + S) - (c/2)e^{\star 2}_{2,H} - I_2]$.

3. Government Intervention

3.1. The Model

Our model is designed to explore questions about how governmental taxation
and bailout policies affect investment decisions, wages, and effort. Thus, we now
add a government that can set a bailout policy at an initial time 0. The govern-
ment internalizes the social and the managerial surplus that firms do not. It can
make three choices: It can tax firms (at rate τ). It can give firms a bailout amount
(g). And if it bails out a firm, it can decide whether to retain or fire the manager
(FG = {Fire, Retain}, where FG is fire by government).

As mentioned in the Introduction, in designing its bailout policy, the govern-
ment must break even actuarially. It is a closed system. This is designed to capture
the point in Calomiris (1999) that not only the fund distribution (the bailout) but
also the fund raising (the taxation) can distort behavior and thus have welfare
implications. Again, our model is a sketch: if the government can tax other activ-
ities with fewer harmful distortions, it could well be appropriate to be even more
interventionist than our model suggests.

By expression (2), the firm is already continuing in the H state, so we do not
need to consider a government subsidy in this state. The interesting case is one in
which the government bailout induces the firm to continue after an initial failure
(state L). We now show that government intervention can keep the firm in busi-
ness even in the L state (thereby capturing diffuse surplus) without depressing
managerial effort and without distorting investment decisions. This is not obvi-
ous: both taxation of success to pay for the bailout and extra bailout funding in
the L state can potentially reduce the incentives of the manager.

We now show that there is a nondistortionary intervention that consists of a
bailout subsidy for firms in the L state, financed with proportional taxes on prof-
its (revenues net of costs, including wages and upfront investment costs) of suc-
cessful firms.[7] The bailout subsidy is just sufficient to motivate the firm to con-
tinue operations and forces out management to preserve incentives.

For what follows, we need one additional parametric assumption. We assume
that the continuation project's NPV at time 2 in the L state is not too low.

$$I_2 - \frac{R^2_{2,L}}{4c} \le \left[\frac{1}{c} \times \left(\frac{R_1}{2} + \frac{3R^2_{2,H}}{16c} - \frac{I_2}{2}\right)^2 - I_1\right] \bigg/ \left[1 - \frac{R_1}{2c} - \frac{3R^2_{2,H}}{16c^2} + \frac{I_2}{2c}\right].$$

This ensures that the tax rate satisfying the budget constraint for the government

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[7] The tax deduction on investment can be provided at the instant of the investment. The propor-
tional tax yields a tax credit for unsuccessful firms so that the government becomes de facto a full
partner to avoid distorting the firm's investment decisions.

is less than 100 percent. Above this threshold, government intervention would be incomplete.

3.2. Analysis

The analysis proceeds as before. At time 2, assume again that the firm has already restarted the project, and I_2 is sunk. The firm offers the manager a contract paying $w_{2,j}$ in the event that the project succeeds at time 2 and 0 otherwise. The manager now expects to receive $m_{2,j} \equiv e_{2,j} w_{2,j} - c e_{2,j}^2/2$. Her payoff-maximizing effort is $e_{2,j}(w_{2,j}) = w_{2,j}/c$, which, given tax rate τ, results in expected continuation profits for the firm of $\pi_{2,j} = (1 - \tau)[e_{2,j}(w_{2,j}) \times (R_{2,j} - w_{2,j}) - I_2]$. Therefore, the firm optimally pays a success-contingent wage $w_{2,j}^\star = R_{2,j}/2$. This induces a managerial effort level $e_{2,j}^\star = R_{2,j}/2c$. The managerial effort is the same as it was in the absence of taxation. Furthermore, profit in the H state is $1 - \tau$ times the profit in the absence of taxation. This clarifies the effect of taxation in the second period.

Lemma 1.

1) A proportional tax on profits (revenues net of wages and investments) does not affect the wage offered by firms and therefore does not affect managerial effort at time 2.

2) A proportional tax on profits does not reduce the incentives of the firm to restart the project (in the good state H) at time 2.

The continuation value for a retained manager is $m_{2,j}^\star = e_{2,j}^\star w_{2,j}^\star - c e_{2,j}^{\star 2}/2 = R_{2,j}^2/8c$, and the firm's expected time 2 profits are $\pi_{2,j}^\star(g_j, \tau) = (1 - \tau)[e_{2,j}^\star(R_{2,j} - w_{2,j}^\star) - I_2] = (1 - \tau)(R_{2,j}^2/4c + g_j - I_2)$, where g_j is the possible bailout funding in state j.

In the H state, expression (2) assures that the firm continues without government intervention ($g_H^\star = 0$). In the L state, the government provides $g_L^\star$ such that $R_{2,L}^2/4c + g_L^\star - I_2 = 0$. This is enough to induce the firm to operate the project, which is sufficient for the government to maintain the social benefits S. The tax rate is irrelevant, because the firm earns no profit.

Lemma 2.

1) In the L state, the government bailout amount $g_L^\star = I_2 - R_{2,L}^2/4c$ leaves the original owners of the firm exactly as well off as they were in the absence of government intervention, even though the bailout induces firms not to abandon operations.

2) In the L state, taxes cannot increase incremental tax revenues. Any tax revenue would have to be offset by an equally large increase in the bailout in order for the firm not to abandon operations.

This intervention leaves existing owners with a continuation value of 0. A tax on bailed-out firms does not change the government's budget constraint. In effect, any tax would simply be on itself.

The final piece of the puzzle concerns the behavior at time 1. The manager chooses an effort level that maximizes $e_1(w_1 + mc_H) + (1 - e_1)(0 + mc_L) - ce_1^2/2$, where mc_j is the expected managerial benefit to continuing on if retained in state j, that is, $m_{2,H}^*$ or $m_{2,L}^*$, or 0 if fired. The choice of optimal effort at time 1 as a function of the wage is $e_1(w_1) = w_1/c + (mc_H - mc_L)/c$. Given this wage-dependent effort, the firm maximizes its profits by setting a wage $w_1^* = R_1/2 + R_{2,H}^2/8c - I_2/2$. At wage w_1, the incumbent owners of the firm receive

$$\Pi \equiv (1 - \tau)\left\{\left[\left(\frac{w_1}{c} + \frac{mc_H - mc_L}{c}\right)\right]\left[R_1 - w_1 + \left(\frac{R_{2,H}^2}{4c} - I_2\right)\right] - I_1\right\}.$$

This uses the facts that the government leaves the firm with a net profit of 0 in the L state and that the continuation value $R_{2,H}^2/4c - I_2$ is taxed only once. The firm sets a wage that translates into in-equilibrium effort $e_1^* = R_1/2c + R_{2,H}^2/8c^2 - I_2/2c + (mc_H - mc_L)/2c$. Corporate profits are

$$\Pi = (1 - \tau)\left[\frac{1}{c}\left(\frac{R_1}{2} + \frac{f}{16}\frac{R_{2,H}^2}{c} - \frac{I_2}{2}\right)^2 - I_1\right],$$

where

$$f = \begin{cases} 3 & \text{if } mc_H = m_{2,H} \text{ and } mc_L = 0 \\ 2 & \text{if } mc_H = mc_L. \end{cases}$$

Thus, the maximum private profit is obtained if the manager is retained in H and fired in L.

Lemma 3.   A government bailout does not change managerial effort at time 1 if the government forces the manager to be fired in case of a bailout at time 2 and replaces her with an (equally good) manager.

This result depends on the assumption that an equally good replacement manager is available, so that the government can punish the original manager by firing her without repercussions on the efficiency of the firm in the L state. This is discussed in more detail in Section 4.

We can now collect these results, which state how the government can bail out firms (in state L) without affecting managerial effort and the firm's investment choices.

Theorem 2.   If the social externality S and net managerial benefits are large enough to outweigh the negative corporate NPV of the project $S \geq 2cI_2/R_{2,L} - 3R_{2,L}/4$, then the government can improve social welfare without distorting managerial effort or investment choices by adopting the following policy:

1) provide a bailout $g_L^* = I_2 - R_{2,L}^2/4c > 0$ at time 2 if and only if the project at time 1 is a failure (L),

2) replace the incumbent manager in a bailout ($mc_L^* = 0$), and

3) finance bailouts with a proportional tax on firm profit (gross payoff net of wages and investment), where the tax rate is

$$\tau^* = \left[\left(1 - \frac{R_1}{2c} - \frac{3R_{2,H}^2}{16c^2} + \frac{I_2}{2c}\right)\left(I_2 - \frac{R_{2,L}^2}{4c}\right)\right] \Big/ \left[\frac{1}{c}\left(\frac{R_1}{2} + \frac{3R_{2,H}^2}{16c} - \frac{I_2}{2}\right)^2 - I_1\right].$$

The social welfare is

$$SV = e_1^*(R_1 + S) - \frac{c}{2}e_1^{*2} - I_1$$

$$+ e_1^*\left[e_{2,H}^*(R_{2,H} + S) - \frac{c}{2}e_{2,H}^{*2} - I_2\right]$$

$$+ (1 - e_1^*)\left[e_{2,L}^*(R_{2,L} + S) - \frac{c}{2}e_{2,L}^{*2} - I_2\right].$$

Diffuse stakeholders and replacement managers are better off than they are in the absence of government intervention, incumbent firm owners are worse off, and incumbent managers are equally well off.

Proof. Managerial effort at time 2 is exactly as it was in the absence of government intervention. Firm participation at time 2 is exactly as it was in the absence of government intervention. However, in the H state, firms are now taxed. In the L state, they have a continuation value of 0. The tax rate τ^* is determined by the government's budget constraint

$$\tau^*\left[\frac{1}{c}\left(\frac{R_1}{2} + \frac{3R_{2,H}^2}{16c} - \frac{I_2}{2}\right)^2 - I_1\right] = (1 - e_1^*)g_L^*.$$

The threshold social externality is determined by setting the social NPV of the investment at time 2 (after an initial failure at time 1) equal to 0: $e_{2,L}^*(R_{2,L} + S^c) - ce_{2,L}^{*2}/2 - I_2 = R_{2,L}/2c \times (R_{2,L} + S^c) - R_{2,L}^2/8c - I_2 = 0$, which solves to a minimal level of diffuse social benefits of $S_c = 2cI_2/R_{2,L} - 3R_{2,L}/4$. Q.E.D.

There are three features of nondistortionary bailouts: a complete expropriation of owners (capital), a complete expropriation of managers (labor), and a tax on profits net of wages and investments (not a revenue-based or flat tax) that finances a redistribution of wealth from successful corporate owners to diffuse stakeholders.

4. Implications

Our model's key point is that the costs of bailouts cannot simply be due to a reduction in direct incentives, because this type of moral hazard can be eliminated (or at least greatly diminished) when the government can expropriate the sur-

plus. Thus, the real costs of bailouts must be more subtle. In this section, we consider how changes in our assumptions can create more complex tradeoffs (both working in favor of or against a policy of bailouts) and, in particular, restore the economists' concern that bailouts beget bailouts. The two most important changes arise when the government acts differently than our model hypothesizes and when the social externalities are themselves dependent on other parameters of the model.

4.1. Taxation

The tax in our model was nondistortionary, because it was effectively proportional to NPV. Investment had a 1-year life and was immediately fully expensed. Therefore, accounting profit was equal to economic profit (or economic value added), and a proportional tax on accounting profit was equivalent to a proportional tax on NPV. When investment has a long life, the investment NPV can be redefined as the discounted stream of per-period economic value added, itself defined as cash flow net of a fair-market rental rate for the use of capital (Grinblatt and Titman 2001). Therefore, a proportional tax on per-period economic value added could implement an optimal tax in our bailout policy, of course provided that the tax authority uses the appropriate rental rate (the weighted average cost of capital). The current corporate tax code, which bases taxation on accounting profits rather than economic profits, may, however, distort the entry decision if the accounting charge for depreciation does not equal the fair-market rental rate on capital.

The model's taxation recommendation should not be taken too literally. The reason why the model so clearly prescribes taxing only firms is that NPV-maximizing capital has no escape margin. In contrast, labor has its escape margin (provision of effort). The recipients of the externalities do not even need to be considered, because it is already possible to fund bailout costs in a first-best manner. A more realistic perspective should be more concerned with comparative escape margins for all resources. For capital, (1) corporations may well move their operations to other domiciles where they are taxed less. (2) Owners may well substitute from taxed project investments to untaxed leisure. Contrary to a common view, bailouts are not socially harmful because they attract too many bad firms that should never have been started and now exist because they want to take advantage of government funding. Instead, in our model, bailouts are harmful because they require taxation on successful firms, which reduces at the outset the number of (good) firms that would be started.

The taxation concerns in the context of bailouts are not intrinsically different from those of any other taxation in the economy. The efficiency losses are highest where the escape elasticities are highest. Proportional taxes on NPV cause no immediate distortions on managers maximizing NPV, which is an insight that may apply also in some other economic models. But, of course, there is no free lunch. In real life, it is more plausible that taxes on NPV reduce but do not eliminate tax-related distortions.

To the extent that the government cares also about distributional fairness rather than just efficiency considerations, it could attempt to identify and tax the diffuse stakeholders (and/or replacement labor) that are the ultimate beneficiaries of the bailout, either ex post or ex ante. This is beyond our scope, and the economic tradeoffs are familiar to economists.[8]

4.2. Government

Our model considers a limited, benevolent, efficient, and smart government. In real life, the government has different levers, skills, information, and conflicts of interest. Its special nature may give it a functioning that may make it more or less efficient in executing buyouts (compared with private parties and bankruptcy proceedings). To conduct bailouts efficiently, it must have an infrastructure, possibly with fixed and variable costs, capable of dealing with the execution of bailouts and with the (variable) costs to collect the extra taxes necessary to fund bailouts. As important, it may have incentives that differ not only from those of firms but also from those of society.

Our model does not grant the government unusual powers to break contracts. We assume that it could force the termination of existing management and owners during a rescue. However, private parties infusing funds typically receive the same powers, and not only in formal bankruptcy proceedings but also in private negotiations. Many of the issues faced by the government as a corporate buyer are similar to those faced by private buyers.

A dilemma arises when existing managers or owners have specialized expertise. Terminating them then incurs a cost. But keeping them (allowing them to retain surplus) would hamper their incentives to work efficiently prior to distress. In contrast to private buyers, governments care about the economy-wide effect of distorting slack incentives.[9] In addition, the cost of categorical firing by the government may be different: private buyers may have more expertise to discriminate among managerial talent and thus keep some managers (with expertise and talent) and discard others. With less expertise, the government may find it more or less optimal to fire managers indiscriminately. Finally, if the government bails out firms preferentially in crisis times, competent replacement managers may be more readily and cheaply available than they are in other times.

On the whole, governments could be more inclined than private buyers to fire management. Yet, even in nonpublic sales of distressed firms, evidence suggests that existing management rarely survives distress. In corporate Chapter 11 bankruptcies, for example, active claims trading by hedge funds has expedited

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[8] An earlier draft discusses distributional aspects. In our model, in any one bailout, stakeholders gain, managers remain the same, and owners lose (from taxation). If firms are heterogeneous, some firms would lose more than others in actuarial (tax) terms. However, a bailout metapolicy itself changes the social surplus. In this case, firms could experience a net gain or loss when the government commits to bailing out firms as opposed to not bailing out firms.

[9] Some private buyers may want to signal to others that they fire poor managers. However, wanting to have an individual reputation for toughness is different from the government's social incentive motive.

the ouster of incumbent managers and shareholders (as in Baird and Rasmussen 2010). Management that has just run a firm into distress increasingly appears to be dispensable. In all cases in which the US government has bailed out private firms, it has replaced management immediately, apparently without great loss of expertise. None of this existing evidence demonstrates categorically that termination is always optimal. However, it does suggest that reducing owners' and managers' surplus in past bailouts has been feasible.

In addition to the more common ability to terminate existing owners and managers, the government can legally use both carrots and sticks not easily available to private buyers. Acting in its regulatory capacity, the government can credibly threaten to impose costs on holdouts. It usually faces neither the same hurdles to assert legal action against firms nor the same bar in procuring relevant information to assist such action. Moreover, the government has the unique power to bring criminal indictments against both individuals and organizations. By the same token, the government can credibly undertake not to use these tools for cooperating firms, via regulatory settlements, deferred-prosecution agreements, and future government contracts (which generally require the recipients to be in good standing on regulatory grounds).

Our model is designed to explore only how the government can conduct bailouts without changing effort or investment choices. We consider intervention only in the bad-outcome states in the second period. Our model does not consider any more aggressive government interventions. As in all moral-hazard models, the government could aid firms in pushing managerial effort toward first-best outcomes. After all, it has access to a technology that the firm does not: it could further subsidize revenues when successful.

Similarly, we do not consider a role for government in the first stage. We simply consider firms that are operating and thus producing surplus. Yet firms in private markets typically do not supply enough public goods in ordinary times either. To the extent that the public goods in the bailout and nonbailout states are correlated, the recommendation of limited bailouts in our model may understate the optimal government involvement.

Our model is especially naive in assuming that the government would act on behalf of the social good. Efficient social welfare optimization is a defensible modeling assumption in our context (and, within limits, as a justification for the existence of any government in the first place), but it is also a utopian extreme that requires careful assessment.

First, the government may not share our view of its objective function. For example, in the TARP (discussed in more detail in Section 5), the government at times considered even explicitly maximizing the return on investment in bailed-out firms.[10] A taxpayer-sponsored vulture fund seems ill-suited to address problems of social externalities.

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[10] For example, the Congressional Oversight Panel (2011, p. 185) for the Troubled Asset Relief Program notes that the US Treasury officials at times tended to alternate inconsistently between articulating social welfarist goals (such as employment, economic growth, and investment) and recouping a return on investment for taxpayers.

Second, the government may not be organized in an efficient single-minded fashion. At the highest levels, checks and balances may make it difficult to take action. There may be coordination and agreement issues involving when and which parties should be taxed, and these issues may become more or less difficult in moments of economic crises when bailout funds would have to be provided. At lower levels, government may simply not have the necessary talent and expertise to execute policy efficiently.

Third, the government may behave as a time-inconsistent collection of political agents rather than as a single-purposed optimizer. Politicians often bargain over policies in bundles. Decisions may not be made to maximize social value but by voting and the desire of politicians to appeal to the median voters in their constituencies in the next election.

Finally, government and its constituents often harbor other objectives. Tullock (1967) and Becker (1983) point out how lobbying is likely to help determine who is and who is not taxed, subsidized, and/or expropriated. In our context, this implies that the best capitalized parties would be bailed out and not those most in need of maintaining for the public good (S).

In sum, imperfect government undermines the attractiveness of interventions writ large. However, our model is robust to the introduction of moderate violations, which tend to shrink—but not necessarily eliminate—the contingencies in which efficient bailouts are feasible and desirable. When governmental misbehavior and waste grow prohibitively large relative to the social benefits of bailouts, the efficiency case for intervention can disappear altogether.

4.3. Externalities

In our model, government intervention improves efficiency by preserving social externalities S at the time of the bailout. These externalities induce owners' thresholds for continuation to be lower than that of society. But what exactly are the source and nature of these externalities? We can distinguish between two kinds of externalities: those that are concurrent with and occur in a specific bailout and those that are realized because of the government's policy of bailouts (their possible presence before any specific bailout). In terms of our model, we now relax the assumption that social externalities are fixed. If they are not, other tradeoffs between externality maximization and moral-hazard control arise.

4.3.1. Concurrent Externalities

Consider first the social externalities that are manifest at the time of the bailout. In general, these externalities take the form of surplus rents received by nonshareholder and nonmanagerial constituencies. A firm may pay monopoly prices to its suppliers (inputs), pay excess wages to its workforce (labor), be unable to charge its customers the entire buyer's surplus for its products (output), and so forth. (We refer to these parties collectively as the stakeholders.) Social externalities would not include the normal competitively priced uses at which the assets

can be redeployed at will, because shutting down the firm would not reduce their flow. Instead, S must be the value of the resources that would not be easy to redeploy to other uses—for example, because these resources have already been customized to their current firms.

It is also plausible that the shutdown of firms operating within a social structure can have economic repercussions beyond a first set of direct links, both positive and negative. For example, the firm's operation may provide benefits to the economic, political, or social communities in which the firm operates. More subtly, the firm's competitors may earn higher profits on shutdown (a plus) at the expense of customers and suppliers (a minus), which would lead to a net social loss. It is the entire net change in social surplus, positive or negative, that should be credited to S.

In addition, firms must not be able to price and appropriate the social externalities. (For example, heterogeneity among its consumers may prevent the firm from effectively capturing their differential surpluses.) Otherwise, the Coase theorem suggests that the firm could bargain with its stakeholders to extract the social surplus by itself. In turn, the firm would internalize the benefits it creates and would make the socially optimal continuation decision without government intervention.

Moreover, in the absence of government intervention, the optimal response for the firm must be to shut down or at least reduce its operation. Otherwise, no intervention is necessary.

The predicate conditions for justifying a bailout in our model are usually difficult to assess. The costs of investigating whether to preserve or shutter a firm, for example, can itself have nontrivial costs, too. In Bris, Welch, and Zhu (2006), legal and administrative lobbying expenses consume more or less the entire firm. It is only for large firms that creditors are left with any funds. Unlike in Bris, Welch, and Zhu (2006), however, the relevant direct net cost to bailouts in the current context is the incremental cost of bailout and lobbying costs over and above liquidation costs (and net of surplus accruing to legal and financial advisers). Note, however, that our model does not assume that the government would manage or run the firm. Rather, the direct costs are limited to identifying the appropriate conditions for a bailout, identifying plausible replacement management, and effecting the transfer to new owners and managers.

Admittedly, our description understates the complexity of distress and the execution of a bailout. Implementation and transfers can be subject to many other frictions and delays. For example, bilateral bargaining and holdup costs can be exacerbated under conditions of asymmetric information, which hinders the implementation of the optimal solution. Free riding can prevent diffuse owners or stakeholders from agreeing. (This can occur even in the case of multiple concentrated owners, such as in the presence of debt-overhang conflicts, which can induce owners to take actions that are not collectively in their interests.) Nevertheless, governmental actors are plausibly in the most opportune position to coordinate action and deter wasteful posturing when the gulf between social and private motives is large.

4.3.2. Prior to but Induced by Bailouts

Our model shows that if bailouts are structured appropriately, then many of the direct firm-specific prebailout moral-hazard implications can be held in check. Yet, even with the complete elimination of owner and manager surplus, the metapolicy of bailouts (available to them or even to others) can itself invite additional social externalities prior to the firm's distress and a bailout decision.

For example, one direct channel induced by the future prospect of bailouts is that firms and workers may spend excessively on governmental lobbying efforts. They may make campaign-related expenditures and/or try to place themselves in a more sympathetic light among legislators and executives for a future bailout. Relatedly, firms may try to improve their positions prospectively by investing in personnel, skills, and activities that make it easier for them to lobby, be bailed out in the future, and be less dispensable in the future. Such spending would be especially valuable to firms and managers if it not only improved their prebailout operating environments but also weakened the government's resolve to expropriate them in case of a bailout. The prospect of a bailout may induce prospective recipients to structure themselves in a manner that invites the inevitability of later governmental intervention. Such steps might include firms increasing their ex post holdup stakes (too big to fail); focusing more on purchasing goods, hiring labor, selling products, or embedding in communities that rely more on bailout guarantees; and networking themselves more deeply into the economy. Owners investing more in the kinds of products and activities that are more likely to be bailed out is a less direct form of the aphorism "bailouts beget bailouts." It is not the specific bailouts that cause harm or gain but the metapolicy of bailing out versus not bailing out companies.

The effects of such activities in our model are more subtle than they are in many other contexts. Typically, the aforementioned activities that bailouts might invite are plausible only to the extent that they are self-serving. But, as noted above, if a bailout fully expropriates managers and shareholders, the attractiveness of such measures would be naturally limited. Moreover, firms become more attractive bailout targets in our model by engaging in ex ante activities that convey greater positive externalities on other stakeholders. Even if such decisions are strategic from the firm's perspective, they tend to alleviate the problem that social externalities are generally undersupplied by the market in the first place. Consequently, the anticipated distortions here could even be in a direction that enhances social welfare.[11]

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[11] Yet it is also possible that bailout guarantees could still lead to too much social investment. For example, in the presence of bailouts, agents may overinvest in activities and products that require aftermarket services—for example, firms may become more active selling cars that require after-sales service. In the absence of a barometer of how (in-)efficient long-warranty cars are relative to short-warranty cars, it remains difficult to assess whether the degree to which the government policy encourages this consumption is beneficial or detrimental. Banking is a classic example in which, despite decades of study, it is not clear how well the financial retail market could function without deposit insurance. Theoretical arguments run the gamut from a positive to a negative net value for deposit insurance. Financial empiricists have yet to provide a quantitative measure of the social value of this government guarantee.

The presence of bailouts may contribute to the choices of some firms to become too big to fail. There were numerous companies that were too big to fail in the 2008 crisis. Yet even this is not simple to assess. First, size and scale can provide economic benefits even in the absence of bailouts. Second, bigger firms provided more social externalities, and these could have been smaller in the absence of bailouts. Judging from the experience of shareholders and managers in these bailouts, the moral hazard of wanting to be bailed out was likely modest. Instead, the externalities that economists must consider when judging bailouts would likely have to be in the product and other markets well before the bailout.

In the model, the government could offer owners a reservation price that is an epsilon above what they would receive if they shut down. However, if owners know that the social surplus that would be rescued in a bailout is high, and if they can threaten to force the firm to shut down, then they may refuse to accept a low buyout price. (Attempts by shareholders and board-level managers to use their positions to retain direct surplus in the 2008 bailouts were arguably not very successful.) Although surplus sharing in itself would be simply a redistribution at the time of the bailout, it would distort actions and create incentives for other firms to become too big to fail in the first place (and in turn overincentivize firms to invest). Again, in this case, bailouts beget bailouts.[12]

Bailouts can also affect specialization and training. Managers are not merely passive participants. They can invest more in expertise and skills that leave them with more surplus in case of bailouts. As with the product market and the community engagement just discussed, expertise can be useful in good states and other firms, too, and be socially efficient or inefficient. There are again no clear benchmarks for how much investment in expertise is socially valuable.

As in the case of firms that are too big to fail, when managers have good alternatives but the rescued firms do not (because of needed managerial expertise), it is then more difficult for the government to drive the bailout surplus of managers down to 0. In anticipation of surplus in a bailout, managers could then slack off at the outset, and again bailouts beget bailouts. Full expropriation (managerial indifference) is more feasible if or when alternatives with equally good expertise are readily available and/or if the government is capable of committing to expropriating existing parties, even if this increases its own cost at bailout time.

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[12] We could adapt our model to assume that the firms that are the recipients of a bailout are able to hold out for some fraction of the total available public surplus sv_2. Introducing such holdups into the model would have negative welfare effects, because it would sharpen the government's budget constraint and reduce firms' incentives to avoid bailouts. In turn, such holdups would require the government to levy a larger tax on successful firms. When the holdup problems are sufficiently large, bailouts could even become unjustified on efficiency grounds and impossible to implement. One possible way to contend with this possibility is to give government the power to force a company to accept a bailout (and its attendant terms). Interestingly, our model is robust to inside information about corporate revenues R_1 because the best equilibrium policy is to expropriate both management and shareholders fully in case of failure. Thus, they do not have an incentive to pretend to have failed. Extant inside-information issues would make it even more difficult to implement policies in which owners and/or managers are allowed to continue.

In the bailouts of 2008, first-tier managers and boards were generally fired. This determination did not extend universally to lower tiers. To the extent that such employees would have worked harder and smarter to avoid economic distress, bailouts introduced moral hazards. It seems unlikely that lower-tier employees individually considered their marginal roles as pivotal enough to be motivated by distress. It seems likely, however, that the United Auto Workers Union was pivotal and would have acted differently if its members had felt that government bailouts were categorically impossible.

4.3.3. Judging Magnitudes

A related question is how the government should assess the magnitude of social externalities. This can be an extremely difficult question in practice. The preservable surplus may turn not only on the moment in time but also on the situation of other firms in the economy (which may themselves be requesting bailouts). In a larger setting, multiple firms shutting down simultaneously may carry additional consequences. And ex ante metapolicy externalities are even more difficult to assess.

The difficulty in quantifying the social gains and losses from letting firms fail has likely contributed to the discrepancy between the common existing academic prescription and real-world implementation. Policy makers were advised by leading economists and well aware of the academic arguments against bailouts—and yet unanimously supported them. Although some quantification problems come from the noisy influence of lobbying (as discussed above), it is simply true that economists still lack a deep understanding of low-probability worst-case scenarios in the complex economic networks during moments of crises. The closest we have come to an economic experiment with letting a large interconnected firm fail was Lehman Brothers, although it is admittedly not clear that its lessons are generalizable to other bailouts. On the announcement on September 15, 2008, the stock market tumbled by 4.4 percent, far more than any bailout package would have cost. This decline reflects a (noisy) market assessment of the costs of Lehman's interconnectedness and reduction in the probabilities of bailout in the public stock markets. And even to the extent that it did, the Lehman bankruptcy was not free from governmental help. The Federal Reserve System intervened partially to rescue some of Lehman's positions and preserve some of its operating components (such as Neuberger-Berman). The negative aggregate fallout of this single modest bank failure likely contributed to convincing the Federal Reserve not to risk other such failures. This is despite absence of a clear accounting of the social cost, even in hindsight, and even in this one modest case.

In the end, the genuine difficulty of quantifying magnitudes does not ineluctably mandate regulatory passivity at moments of crisis. The government may find it difficult to draw an exact line, but setting the requisite threshold for intervention too high can ensure errors of omission that can be just as bad as those of commission. Moreover, contexts in which information is poor may even justify well-designed policy interventions, which can facilitate dynamic regulatory

learning (Spitzer and Talley 2014). Viewed in this light, ruling out bailouts categorically in the absence of a quantified cost-benefit assessment seems both unreasonable and unrealistic.

5. The Troubled Asset Relief Program

5.1. American International Group and the Financial Sector

The $170 billion AIG bailout (discussed in the Introduction) was executed largely through government coercion when AIG became financially insolvent. Arguably, AIG's role in the network of the highly levered financial sector was so critical that it was too big to fail. The social net gain or loss was not limited to the payments to AIG's creditors and customers. Instead, the presence of a government financial bailout metapolicy, rather than just the AIG bailout itself, may itself have helped facilitate the presence of a large US financial services sector.

Viewed in this light, Judge Wheeler's opinion in *Starr v. United States* fits within our model, albeit somewhat uneasily. Governmental regulators were, in the end, substantially able to oust management and expropriate shareholders, all without having to pay compensation later. But the government was not particularly ambitious in attempting to displace many of the managers and traders who had presided over the banks' declines, much less to claw back managers' and traders' accrued salaries and benefits over the decade (Bebchuk, Cohen, and Spamann 2010). Our model suggests that expropriation, not only of the shareholders and their boards but also of the managers, traders, and other high-level employees, should have been a presumptive aspect of a bailout as a contributor for deterring future crises. One can interpret the continued presence of many of the managers and traders (who had failed to curb the risks of these financial firms) as due to the fact that they were so socially valuable that they were irreplaceable or that they possessed enough residual holdup and lobbying power to prevent the government from conducting an efficient bailout.

That said, the AIG shareholders' victory on the liability issue raises difficult questions for future bailouts. The government would presumably be enjoined from expropriating shareholders unless it were able to vest equity ownership in the hands of nongovernmental parties (such as existing creditors or third-party purchasers), a move that could prove difficult in the midst of a financial crisis. More problematically, regulators' use of heavy-handed bargaining tactics may now constitute an illegal exaction that shareholders could conceivably enjoin (even if they cannot procure a large damages award). If Wheeler's decision is interpreted as giving incumbent shareholders substantial holdup power, many of the benefits of an optimal bailout regime would be lost.

5.2. The Automobile Bailout

In contrast to AIG, the $80 billion Chrysler bailout and the $50 billion GM bailout (beginning with President George W. Bush's $17 billion emergency loan)

were executed through the standard Chapter 11 process (just as any private buy-out would have been) and thus remained essentially voluntary. The government offered packages, which the boards and the court accepted.

Rattner (2010) provides more inside detail and color to the automobile bailouts than what can be found for the financial bailouts. Rattner describes how the White House was greatly concerned about any government intervention in the private sector. It was convinced that the federal government was not particularly well equipped to run car companies. Thus, the appointed task force started with the directive only to consider and potentially execute a distress turnaround with transfers to other private parties but not to run the car companies itself.

Early on, the task force explicitly estimated the direct administrative costs of a bailout compared with the direct administrative costs of a shutdown. It was also well aware that any subsidies could become additive if a bailout was insufficient to prevent an eventual shutdown.

The White House and the task force were quite concerned about direct-channel moral hazard, especially with respect to other firms (such as Ford and car suppliers) not working hard enough to avoid bailouts if any were provided. They were not concerned about either indirect-channel moral-hazard concerns—that bailouts could induce firms and managers to alter themselves in order to become more sympathetic bailout recipients in the future—or the slowing down of the flow of resources from worse old-economy uses to better uses for the long run. In this sense, the task force did not even attempt to consider time consistency. Its emphasis was the crisis, not the long term.

The task force actively wrestled with estimating the size of at least some of the social externalities. Rattner (2010, pp. 119–20) describes that the first estimates of a Chrysler bankruptcy included not only the loss of 40,000 Chrysler jobs but also the loss of 260,000 jobs at suppliers and dealers. The political advisors were also concerned about the greater impact on the Michigan region.[13] However, some weeks later, Austan Goolsbee and the Council of Economic Advisers began arguing that other firms, and in particular GM, would race into the gap if Chrysler were left to fail. Because of extra demand, GM would benefit by picking up about one-quarter of Chrysler's 300,000 car sales per year, which would add $2.4 billion per year in profit and $10 billion in market capitalization. This reduced Goolsbee's analysis of job losses from about 300,000 to about 30,000. Presumably, free-market substitutes could then also have reduced other negative social externalities, such as those on dealers or on the Detroit region. Rattner notes, "[W]e did some rough, back of the envelope math on the question you raise but it was difficult/impossible to quantify and we had so much else to do that we didn't spend too much time on that exercise. We simply knew that having the Big 3 shut

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[13] Rattner (2010) describes that there was little political interference with one notable exception: the White House political advisors overrode the task force's recommendation to permit a move of General Motors's headquarters out of Detroit. It can be argued that the White House was concerned not just with the automobile rescue and reelection concerns but with the implications of broader social-economic externalities for the region.

down would be a disaster economically."[14] Combined with the narrative in Ratt-
ner (2010), it is fair to state that the task force felt that it was difficult to draw a
specific line but that the social cost-benefit analysis for GM was so far above the
line that a bailout was warranted. Chrysler was closer to the line, and Timothy
Geithner, Lawrence Summers, and the president ultimately made a difficult judg-
ment call.

Rattner (2010, pp. 109, 142) also provides a vivid account of the negotiations.
Shareholders received nothing. He describes how creditors ended up accepting
29 cents on the dollar, despite early posturing. Early on, the existing management
and boards of both GM and Chrysler were replaced. Rattner (2010, p. 138) notes
that specialized managerial skills were of little concern: "I was stunned by com-
mentaries suggesting that the government was somehow overreaching by replac-
ing a CEO who had lost $11 billion of taxpayer money in three months—and had
been asking for more. No private-sector investor would have put up with that;
it was commonplace to make large infusions of new capital contingent upon a
management change." Nonmanagement labor was treated unevenly. The treat-
ment of other employees has remained more controversial. Only some unions
were expropriated. For example, while GM workers' pensions remained largely
unaffected, workers at Delphi (a subsidiary of GM) lost all their health-care ben-
efits and had their pensions reduced by 70 percent. Nevertheless, 65 percent of
Chrysler and 17.5 percent of GM were eventually given to the union and put to-
ward pension funds. To the extent that their continued stakes signal future sur-
plus, it will depress unions' incentives to avoid future bailouts.

5.3. Assessment

Our view of the TARP and the automobile task force is generally favorable
but not in all aspects. The government's intermittent emphasis on generating an
investment return from bailout funds was misguided. In virtually every TARP
bailout, the government functionally levied an extraordinary tax on recipients by
structuring its cash infusions as either loans or stock purchases. The political ap-
peal of generating a return from ownership stakes is apparent. However, limiting
bailouts to such NPV-justified contexts arguably focuses precisely on those firms
for which a private market solution exists; our model points out that for such
firms, government taxation and/or ownership simply reduce the price that pri-
vate investors are willing to pay. Moreover, if the demand for investment recoup-
ment leads the government to run these firms longer than it should (assuming
that governments are less efficient than the private sector in running companies),
this would create another inefficiency. Of course, when existing owners are not
fully displaced, the extra tax may be merely a second-best attempt to expropriate
their existing holdings.

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[14] Steven Rattner, former lead adviser to the Presidential Task Force on the Auto Industry, email
to the authors, July 22, 2015.

Bailouts must generally be funded through special taxes on healthy firms rather than through retrospective assessments on bailout recipients (in the form of government-owned debt and equity). Early drafts of the 2010 Dodd-Frank Act proposed the creation of a $50 billion bailout fund financed by healthy firms deemed to be systemically significant. Ironically, opponents in the Senate ultimately blocked this proposal, asserting that it would exacerbate the moral hazard (Schwarcz 2011). Our model suggests, quite to the contrary, that the presence of such a fund should not influence the moral hazard if bailouts are well administered. The presence of such a fund—over the vocal objection of industry lobbies—may, however, be the only way that socially beneficial bailouts can be sold to voters.[15]

Our model's implication and the TARP task force largely agree. Incumbent shareholders lost most of the value of their stock, senior management and board members were fired, and labor unions and dealers accepted some concessions. The expropriations contributed to motivating other managers (specifically, those of Ford) to work harder to avoid the same fate. However, employees and labor unions were not equally expropriated. The domestic car industry remained viable, with buyers less fearful of future closure. Of course, it is difficult to judge in ex ante terms a onetime outcome draw (during a general economic recovery). In the end, Chrysler lost the government about $1.3 billion, and GM lost it about $10.5 billion.

6. Related Literature

Most of the extant literature on bailouts has focused on banks. Banks are peculiar because many of their incentive problems derive from large financial debt obligations that are intrinsic to their normal operations. (The present paper is more suitable to analyzing situations in which the distortionary effects of leverage play a secondary role, for example, as in the case of the car company bailouts.) Yet bailouts remain controversial in the banking literature too. Early perspectives focus on the negatives. In 1873, Walter Bagehot wrote: "If the banks are bad, they will certainly continue bad and will probably become worse if the Government sustains and encourages them. The cardinal maxim is, that any aid to a present bad bank is the surest mode of preventing the establishment of a future good bank" (Bagehot 1873, p. 104).

Bagehot's admonition remains popular among economists. For example, Calomiris (2003, p. 261) opens with

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[15] It is debatable what commitment power the government will have going forward to implement bailouts and, if so, on what terms. Our model suggests that a commitment to expropriate the corporate owners and managers may be more effective than a commitment to withhold bailout funds categorically. In late November 2015, the Federal Reserve issued a final rule implementing its emergency lending powers under the Dodd-Frank Act. The rule facially prohibits the Federal Reserve from bailing out insolvent entities or specific firms on an ad hoc basis, but it also permits financial authorities some latitude in interpreting those terms. See Regulation A: Extensions of Credit by Federal Reserve Banks, 12 C.F.R. pt. 201 (2015).

Problem 1: Counterproductive financial bailouts of insolvent banks, their creditors, and debtors by governments, often assisted by the IMF [International Monetary Fund], have large social costs.   Bailouts are harmful for several reasons. First, they entail large increases in taxation of average citizens to transfer resources to wealthy risk-takers. Tax increases are always distortionary, and serve to accentuate the unequal wealth distribution. Second, by bailing out risk takers local governments and the IMF subsidize, and hence encourage, risk taking. Moral-hazard incentive problems magnify truly exogenous shocks that confront banking systems. Excessive risk taking by banks results in banking collapses and produces the fiscal insolvency of governments that bail out banks, leading to exchange rate collapse. Banks willingly and knowingly take on more risks—especially default risks and exchange risks—than they would if they were not protected by government safety nets.

However, some newer papers discuss the welfare-enhancing aspects of bailouts. The closest paper to ours is Philippon and Schnabl (2011), in which a reduction in lending by one bank can reduce other banks' investments. Thus, the benefit of a government bailout is a reduction in the systemic debt overhang, which enhances economically efficient investment. The optimal contract makes each bank pivotal by conditioning a systemic bailout on wide participation.[16] The cost of the bailout is paid for by taxes on household endowments, which causes a parametrically assumed loss in efficiency that is linear in the tax required.

Our model shares some features but has different foci. For example, in our model, the social benefits do not accrue to active and taxable participants. Thus, it is not possible to design a contract that makes all parties willing to participate—after all, it is not the firms that lose if a bailout does not take place. (The equivalent of the Philippon and Schnabl [2011] contract would be to make a bailout contingent on participation of each stakeholder.) Philippon and Schnabl (2011) point out the social externalities among many banks, where all banks benefit from more financial system stability. Our model focuses on bailouts, in which individual firms can be in trouble, rescuing one does not make it easier or harder to rescue another, and multiple firms need not be rescued at the same time. (Our model can capture some time-varying and cross-sectional variation in the exogenous *S* parameter.) Yet another difference of our model from that in Philippon and Schnabl (2011) is that inefficient investment in our model can be avoided. There is no debt overhang. In fact, we do not view our model as a model of bailouts for banks but as a model of government bailouts for generic nonbank firms, such as GM and Chrysler. But like Philippon and Schnabl (2011), we focus on the socially inefficient aspects of firms' behavior. Bailouts are needed because it is too costly for firms to finance continuation, given their struggle with their internal moral-hazard (managerial agency) problems. Our paper focuses on the internal and external moral-hazard problems and their best remedies. Our (endogenous)

[16] Philippon and Schnabl (2011) also show that if there is excessive participation in the bailout by banks that privately know that they already have good projects, then the regulator can improve efficiency by demanding junior securities. It would probably not be difficult to think of a situation in which the problem is too high an uptake by banks that know that they should (socially) not be bailed out. In this case, debt may be a better contract.

tax implications are not linear as in Philippon and Schnabl (2011). We also offer specific policy recommendations (for managerial and owner retention, bailout funding, and so on) different from those in Philippon and Schnabl (2011) and show that firms and managers—the chamber of commerce—will lobby for a system in which they do not face a priori taxation to cover future bailouts.

Philippon and Skreta (2012) and Tirole (2012) study adverse-selection models in which firms differ in the publicly unknown qualities of their existing assets. In contrast, our model studies moral-hazard problems in firms with known assets and opportunities. In their models, the government ends up subsidizing only the worst types, whereas in our model, the government ends up subsidizing only the marginal types. In their models, the parameterized cost of public funds is exogenous, whereas in our model, the costs of raising bailout revenue (through taxes) is endogenous. In Philippon and Skreta (2012), the acceptance of government assistance sends a negative signal to outside capital-market participants, which increases the recipients' private borrowing costs outside of the program. The government objective in Philippon and Skreta (2012) is to obtain a target level of investment that is the cheapest for taxpayers. In our model, the government maximizes total social value instead. Their optimal government intervention is a debt contract; ours is a direct subsidy (because any government stake raises the required subsidy to entice private participants). In Tirole (2012), there is a spillover aspect of bailouts. The bailout of one firm increases the cost of the next bailout. Firms become progressively more hesitant to participate as progressively weaker banks are bailed out before them. As in Philippon and Skreta (2012), the government takes stakes in exchange for its subsidy, though in equity and direct purchases of firm assets, whereas in our model the government should take no such stake.[17]

There are also pre-2008 crisis papers in the banking literature in which bailouts can be valuable. For example, in Diamond (2001), banks lose socially valuable information if they are allowed to disappear. In Gorton and Huang (2004), asset prices depend on liquidity, and the government can enhance asset values by tapping its effectively unlimited credit. In Aghion, Bolton, and Fries (1999), managers can be reluctant to liquidate underperforming loans when bank regulators close bankrupt banks aggressively. Bailouts are designed to minimize such welfare losses. The classic paper advocating some government involvement is Diamond and Dybvig (1983), which shows how the private market can fail and how deposit insurance or convertibility restrictions can enhance the social outcome. As expected, deposit insurance immediately raises moral-hazard concerns, for example as in Gorton and Rosen (1995), Chan, Greenbaum, and Thakor (1992), Boyd and Runkle (1993), or Calomiris (1999). Ex ante regulation of the banking sector is usually recommended as a corollary to ex post deposit insurance.

Similarly, in a number of papers on the subject of government procurement and intervention, Tirole emphasizes how firms can game the system. For exam-

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[17] Like us, Tirole (2012) suggests "just enough" intervention. Although moral hazard is not central to his analysis, he demonstrates (as do we) that bailouts can exacerbate moral-hazard concerns. Tirole (2012) does not derive an optimal bailout in the presence of moral hazard.

ple, in Farhi and Tirole (2012, pp. 61–62, 60), firms correlate exposures so as to benefit more from government bailouts:

[T]he central argument of the paper is that private leverage choices depend on the anticipated policy reaction. . . . An accommodating interest rate policy involves (a) an invisible subsidy from consumers to banks (the lower yield on savings transfers resources from consumers to borrowing institutions), (b) current costs, such as the (subsidized) financing of unworthy projects by unconstrained entities, and (c) deferred costs (the sowing of seeds for the next crisis, both through incentives for maturity mismatch, going forward, and the authorities' loss of credibility). . . . When everyone engages in maturity mismatch, authorities have little choice but intervening, creating both current and deferred (sowing the seeds of the next crisis) social costs.

Finally, Diamond and Rajan (2005) is unusual in that governmental bailouts can backfire even ex post and themselves cause further insolvencies. Of course, although we do not allow for an additional direct-waste parameter in the process of government intervention, we do not suggest that the governmental rent-seeking issues first raised in Tullock (1967) and Tirole (1994) should be ignored. Although these papers raise significant real-world problems, our own view of government intervention, though skeptical, is decidedly less pessimistic. Our model's assumption of an optimizing government is a useful analysis device, not a description of real life. To the extent that rent seeking makes government intervention more costly, it shrinks the regions in which governmental intervention is beneficial. However, the main insight—that when social externalities are large, bailouts can have low welfare costs under well-designed bailouts—is robust. As far as we know, no other model of bailouts has focused on the effect of nondistortionary a priori effort incentives of tying bailouts to both owner expropriation and managerial dismissals.

7. Conclusion

In its final report to Congress, the Congressional Oversight Panel (2011, p. 155) offered the following assessment of the automotive industry bailout:

Treasury's interventions in the automotive industry, in particular, raise moral-hazard concerns. In some ways, Treasury actually mitigated moral hazard through its very strict approach to these companies: it forced GM and Chrysler to enter bankruptcy, a step not required of other major TARP-recipient institutions. However, the mere fact that Treasury intervened in the automotive industry, rescuing companies that were not banks and were not particularly interconnected within the financial system, extended the "too big to fail" guarantee and its associated moral hazard to non-financial firms. The implication may seem to be that any company in America can receive a government backstop, so long as its collapse would cost enough jobs or deal enough economic damage.

Our model was designed to help frame and assess these concerns. It extends a canonical agency model that explores the trade-offs of governmental interventions with tax-financed bailouts. Thus, its principal ingredients and sources of distortion are social externalities, taxation, and moral-hazard channels.

Taxation.   The tax-financing distortions are largely identical to those financing ordinary government activities. As in nonbailout cases, government activities should be funded by taxation in which agents have no escape margin. (In our model, this turns out to be healthy firms.) Unlike in nonbailout cases, bailouts cannot be funded by the firms being bailed out, because this amounts to a self-tax.

Moral Hazard.   The moral-hazard dimension is the aspect of bailouts that usually draws condemnation—the fact that bailouts beget bailouts. Yet this is easy to remedy: If owners are expropriated in a bailout, the government can maintain the same prebailout investment incentives that prevailed in the absence of intervention. If managers and employees are expropriated in a bailout, the government can maintain the same prebailout managerial effort incentives that prevailed in the absence of intervention. Therefore, the objection that bailouts beget bailouts is too simplistic. A better perspective is that government bailouts are not necessarily the bane they are often considered to be, because they can be executed without greatly increasing the direct moral hazard of recipients.

If executed correctly, bailouts are more akin to ordinary government interventions (to which they should be compared) than they are different. Our model suggests that the reasons either to justify or to condemn bailouts have to be more subtle. They require assessments that go far beyond their immediate incentive distortions.

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