2013

Designing Corporate Bailouts

Antonio E. Bernardo
antonio.bernardo@anderson.ucla.edu

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

Ivo Welch
ivo.welch@gmail.com

Designing Corporate Bailouts

Antonio E. Bernardo, Eric Talley, and Ivo Welch*

April 7, 2014

Abstract

Common economic wisdom suggests that government bailouts are inefficient because they reduce incentives to avoid failure and induce excessive entry by marginal firms counting on future bailouts. Our model shows how governments can design tax-financed corporate bailouts to avoid these distortions and points to the causes of inefficiencies in real-world implementations, such as TARP.

JEL: P16, P14, D72.

Keywords: Government Bailout. Moral Hazard. TARP. General Motors. Chrysler.

*Contact antonio.bernardo@anderson.ucla.edu, etalley@law.berkeley.edu, or ivo.welch@gmail.com.

Prior to 2007, most academic economists viewed government bailouts as aberrations of developing countries, artifacts of political patronage, or idiosyncrasies of the banking industry. The academic consensus view of governmental interventions generally—and corporate bailouts specifically—is largely negative in light of the potential moral-hazard problems caused by such interventions. Even in the banking literature, where a few exceptions (discussed below) can be found, bailouts rarely garner more than grudging approval. This academic skepticism has a long pedigree. As early as 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.

Almost a century and a half later, Bagehot's admonition remains popular among economists. For example, in his "Blueprints for a New Global Financial Architecture," Calomiris (1999) opens with:

> *Problem 1: Counterproductive financial bailouts of insolvent banks, their creditors, and debtors by governments, often assisted by the IMF, 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.

And yet, to the consternation of many economists, and contrary to much received academic wisdom, governments have time and again ridden to the rescue of banks and other "too big to fail" institutions during economic crises. Notable recent examples include the controversial bailouts of General Motors and Chrysler in December 2008. Although the federal government provided more than $80 billion in assistance, both companies had to file for Chapter 11 bankruptcy protection by June 2009. And although we are again in a state of relative calm, there is little reason to believe that 2008 was the last government bailout. More than likely, policymakers in the U.S. and elsewhere will have to grapple with the same issues again: to bailout or not to bailout—that is the question. Reading many academic discussions, it is easy for them to come

to the conclusion that bailouts inevitably distort incentives ex-ante and thus inevitably beget more bailouts. But is this really true?

Our paper develops a simple model to help assess bailouts.

In our model, the government's objective differs from those of firms in that it cares about social externalities. Our specification can capture a wide variety of social benefits and costs. Stakeholders with surplus can include existing and future customers, suppliers, employees, creditors, entrepreneurs, and "communities" that benefit from the firm's operation. Their interests can be diffuse and difficult to isolate (and to coordinate), and they possess little real or formal influence over corporate decisions. The social costs can also include the inefficient components of additional unemployment, the costs of moving capital resources, etc. If the non-internalized stakes are positive, then the government can have a legitimate interest to keep a moribund firm alive.

Our government has no special powers, managerial skills, or access to unique information. It is not an omniscient social planner with the power to micro-manage wages or coerce effort. Rather, its abilities are very limited: It can only provide funds to keep the firm solvent; it can insist on firing employees if it provides bailout funding; and it can tax firms to finance bailouts but only in a non-discriminatory fashion. We do not even assume that the government is capable of committing itself to a future bailout policy.

Yet, in our model, there is a surprisingly parsimonious policy that (usually) preserves the social externalities, without affecting the incentives of firms and employees. Thus, if distorted incentives from government taxation and funding were the only concerns in real-world bailouts, our model suggests that their negative incentive effects could be relatively easily reduced or eliminated. Importantly, our paper does not show that real-world bailouts do not create social net costs. Instead, our paper shows where these costs can and cannot lie. We view our results as a background "indifference theorem" against which the effects of distortions should be assessed.

Although the results may seem obvious in retrospect, following from our assumptions, they are not widely appreciated. The key point of our paper is that bailouts do not necessarily beget more bailouts. The moral-hazard issues arise not because of the bailout per se, but because of assumptions about the treatment of stakeholders in bailouts. This is as simple a point as it is important. It is not often brought out in informal discussions of bailouts—and there is no existing formal literature on government bailouts in non-financial contexts.

The model suggests the following policies:

- Incumbent employees should be fully expropriated[1] in a bailout. (This is possible if/when alternatives are readily available.) 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.
- 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.
- 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 NPV, so that 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 tax on bailed-out firms simply increases the bailout amount that the government must offer to get the firm to continue. In effect, any tax would be on itself. The only "closed-system" option is a redistributive tax, where healthy firms pay into an actuarially-balanced fund.

With good policies, society may be better off when it bails out firms that cannot internalize diffuse and often silent social externalities.[2] But this is not a Pareto improvement. The government creates winners and losers. In our basic model, the intervention is a wealth transfer from corporations to stakeholders. Corporations pay to cover these interventions with corporate taxes, and gain nothing in case of failure. Thus, government involvement would likely incur resistance from the Chamber of Commerce and the Business Roundtable. However, in an extended model, there could be a second effect. It is possible that profits are themselves elastic with respect to social externalities. For example, car buyers are classic stakeholders who rely on the presence of after-market support. The presence of an implicit bailout guarantee may well be critical to attracting car buyers in the first place. In this case, even the car companies may be better off and welcome the presence of the government as a guarantor of last resort.[3]

[1] For both capital and labor, expropriation means that they do not receive rents in bailouts. For capital, this is accomplished by a minimum subsidy. For labor, this is accomplished by removing the manager. In both cases, expropriation is not worse than what they would receive absent the bailout.

[2] In some models of [bank] bailouts, such externalities may occur even among explicit stakeholders, as in holdout problems in the presence of debt overhang.

[3] A similar argument can be made about deposit insurance. Our model suggests that if deposit insurance were raised on bank profits (rather than deposits, which does not take costs into account), the "deposit insurance tax" would not encourage or discourage banks from taking on good (positive-NPV) deposits. The loss of all stakes in default would make bank owners and employees as averse to failure in the presence as in the absence of deposit

With little intrinsic increase in moral hazard, our perspective is that government bailouts are not necessarily the bane they are often considered to be. They are more alike ordinary government interventions than they are different. The model then shines light on the real sources of the social costs and benefits of bailouts:

- If firms are not NPV optimizers and/or if there is a margin along which the government cannot tax firms (e.g., leisure by the original investors or non-domestic operations), then the presence of taxes can discourage firms from partaking. The taxes necessary to fund bailouts then impose negative social externalities. Of course, similar inefficiencies also apply if the bailout funding originates from taxes on third parties elsewhere in the economy. In general, the tax inefficiencies of bailouts are not intrinsically different from those of *any* tax in the economy.

  The net result of tax distortions is that fewer firms would be started. It is a consequence of taxation on successful firms. It implies that bailouts are not harmful because they attract (bad) firms that should never have been started and exist because they want to take advantage of government funding. Instead, bailouts are harmful because they reduce the number of (good) firms that do not start.

- If owners or employees succeed in creating inefficient bailout rules that preserve some of their stakes, then they have less incentive *a priori* to avoid failure. Owners may then take on projects that are negative NPV, and employees may slack off, less afraid of failure. This issue can become worse if they can "hold up" a government that is eager to keep the social externalities in the firm alive.

  The net result of residual-stake distortion is that there would be too much entry into the industry subject to bailouts, not enough effort, too many failures, and too many bailouts.

- If the government is inefficient and/or if there are reputational spillover effects, it is unclear what the outcome will be. For example, if the government fails to recognize the full social benefits that a reallocation of resources to other industries would produce, or if the government's costs of administering bailouts are much higher than the social costs of administering bankruptcy or liquidation, then it may bail out too many firms. If the government has coordination problems that make it difficult to raise the funding necessary for bailouts (e.g., in an economic crisis situation), then it may bail out too few firms. If the party in power has a desire to satisfy its voters rather than maximize social welfare (e.g., favoring bailouts on the left and opposing them on the right), then there could be too few or too many bailouts.

insurance. The fact that bank equity and/or internal traders like to take on excessive risk is a cost of equity or of internal governance, and occurs with or without government intervention. If bailouts induce lenders to provide risky capital, they should count as equity and be expropriated, too.

The net results of the inefficient-government distortion are unclear.

In sum, our model provides an alternative perspective to the dominant sentiment in the academic literature that emphasizes the negative aspects of bailouts, market failures, and the distortions that interventions and their accompanying taxes cause. The argument that bailouts beget further failures is too simplistic. Well-designed bailouts are not intrinsically more worrisome than other common taxation or government interventions. Thus, they should be compared, on the margin, to ordinary government intervention.

Our paper now proceeds as follows. Section 1 describes the model in the absence of government. Section 2 shows how a well-structured bailout need not change either the investment behavior or managerial effort. Section 3 considers the implications: What is actually required for bailouts to create or destroy social value? Section 4 discusses the TARP in light of our model. Section 5 reviews related work. Because most bailouts occurred historically in the financial-services industry, this literature has in turn appeared mostly in the academic banking literature. And Section 6 concludes.

1 Model Without Government Intervention

Our base model starts with a firm and a representative employee (with a possible replacement). The firm makes investment and hiring/firing decisions. The employee (a manager or worker) provides effort. There are two time periods with no inter-temporal discounting.

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 a gross payoff $R_1>0$, or a "failure," yielding gross payoff 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 of $c \cdot e_1^2/2$, where $c \gg 0$ is assumed "large" relative to other parameters.[4] 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).[5]

[4]Specifically, 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.

[5]At the cost of tractability, one could introduce alternative algebraic specifications translating effort into success probability. 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 $0 \leq e_1 \leq 1$.

The project payoff is then realized and the firm must pay the manager the success-contingent wage of $w_1 \geq 0$. 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.[6]

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, the firm can dismiss or keep the manager, $FF = \{\text{FIRE}, \text{RETAIN}\}$ (**F**ire by **F**irm). The replacement manager is assumed to have equal ability to the initial manager, which in our model maps into the same cost of effort c. (Section 3 discusses the equal-ability assumption.)

The "restarted" project proceeds much like the first-period project, except (i) there are no additional restarts, and (ii) its payoff is related to the performance of the project in the first period. Thus, if the restarted project fails, it again yields gross payoffs 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 $R_{2,H} \geq R_{2,L}$—after a successful start, future project 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 of $c \cdot e_{2,j}^2/2$.

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

[Insert Figure 1 here]

We assume that the project has additional social benefits S, which do not depend on the managerial effort but accrue whenever the firm operates and succeeds.[7] 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, e.g., because the stakeholders are too diffuse and heterogeneous.

To make this an interesting problem and for all solutions to stay in the correct domains, we add some parametric assumptions. First, we consider only cases in which model parameters

[6] The non-negativity 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 upon success. The conclusions of our model would remain unaltered, because such benefits would merely reduce the wage that the firm needs to pay managers.

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

render it optimal for firms to invest at time 1:[8]

$$\frac{1}{c} \cdot \left(\frac{R_1}{2} + \frac{3 \cdot R_{2,H}^2}{16 \cdot c} - \frac{I_2}{2} \right)^2 \geq I_1 \quad . \tag{A1}$$

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

$$\frac{R_{2,L}^2}{4 \cdot c} \leq I_2 \leq \frac{R_{2,H}^2}{4 \cdot c} \quad . \tag{A2}$$

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

$$\frac{R_{2,H}^2}{4 \cdot c} - I_2 \leq 2 \cdot c - R_1 \quad . \tag{A3}$$

This insures that equilibrium effort is below 1, which is required to allow us to map effort into 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 success probability 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:

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

and six endogenous continuous variables:

Success-Contingent Wages	w_1, $w_{2,L}$, $w_{2,H}$
Managerial efforts	e_1, $e_{2,L}$, $e_{2,H}$

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.

[8] In real life, it may well be that firms produce social externalities that are high enough to warrant even further government incentives upon success. However, this is not the problem at hand. Section 3 discusses this further.

1.1 First-Best

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,

$$sv_{t,j}(e_t) \;=\; e_t \cdot \big(R_{2,j} + S\big) - \frac{c \cdot e_t^2}{2} - I_t \quad .$$

The ex-ante total expected social welfare is therefore

$$SV \;=\; sv_1(e_1) + e_1 \cdot sv_{2,H}(e_{2,H}) + (1 - e_1) \cdot sv_{2,L}(e_{2,L}) \quad .$$

At time 2, the first-best effort levels are

$$e_{2,j}^{\text{FB}} \;=\; \frac{R_{2,j} + S}{c} \quad .$$

Substituting this back into the $sv_{2,j}$ yields

$$sv_{2,j} \;=\; \frac{(R_{2,j} + S)^2}{2 \cdot c} - I_2 \quad .$$

When $R_{2,L} + S$ is large enough relative to c and I_2, it is worthwhile to continue firms 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 is

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

Solving the FOC yields

$$e_1^{\text{FB}} \;=\; \frac{R_1 + S}{c} + \frac{(R_{2,H} + S)^2 - (R_{2,L} + S)^2}{2 \cdot c^2} \quad .$$

First-best social welfare is

$$SV^{\text{FB}} \;=\; \frac{\left[R_1 + S + \frac{(R_{2,H}+S)^2 - (R_{2,L}+S)^2}{2 \cdot c}\right]^2 + (R_{2,L} + S)^2}{2 \cdot c} - I_1 - I_2 \quad .$$

1.2 Equilibrium

In the real world, firms cannot force their employees to provide the socially-optimal 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. $e_{2,j}(w_{2,j}) = \arg\max \; m_{2,j} \equiv e_{2,j} \cdot w_{2,j} - (c/2) \cdot e_{2,j}^2$,
2. $w_{2,j}(e_{2,j}) = \arg\max \; \pi_{2,j} \equiv e_{2,j} \cdot (R_{2,j} - w_{2,j}) - I_2$,
3. *and the firm continues (FC=1) in state j iff* $\pi_{2,j} \geq 0$;

and such that at time 1

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

We can now solve for this equilibrium.

At time 2, under Assumption (A2), 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 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

$$m_{2,H} \equiv e_{2,H} \cdot w_{2,H} - c \cdot e_{2,H}^2/2 \ .$$

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

$$\pi_{2,H} = e_{2,H}(w_{2,H}) \cdot (R_{2,H} - w_{2,H}).$$

Therefore, the firm optimally pays the success-contingent wage $w_{2,H}^* = R_{2,H}/2$. This wage induces a managerial effort level of

$$e_{2,H}^* = \frac{R_{2,H}}{2 \cdot c} \ .$$

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

$$m^*_{2,H} \;=\; e^*_{2,H} \cdot w^*_{2,H} - \frac{c \cdot e^{*2}_{2,H}}{2} \;=\; \frac{R^2_{2,H}}{8 \cdot c} \quad .$$

The firm's expected time 2 profits are

$$\pi^*_{2,H} \;=\; e^*_{2,H} \cdot \left(R_{2,H} - w^*_{2,H}\right) - I_2 \;=\; \frac{R^2_{2,H}}{4 \cdot c} - I_2 \quad .$$

Given behavior at time 2, we can now determine the optimal firm behavior at time 1.

At time 1, the firm can decide whether to fire or retain the manager, based on whether the project returned R_1 or 0. At time 1, the manager expects to receive

$$e_1 \cdot (w_1 + mc_H) - \frac{c \cdot e_1^2}{2} \quad ,$$

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

$$e_1(w_1) \;=\; \frac{w_1}{c} + \frac{mc_H}{c} \quad .$$

Anticipating this effort, the firm maximizes

$$\Pi \;\equiv\; \left(\frac{w_1}{c} + \frac{mc_H}{c}\right) \cdot \left(R_1 - w_1 + \pi^*_{2,H}\right) \;- I_1 \quad ,$$

which implies a profit-maximizing wage of

$$w^*_1 \;=\; \frac{R_1}{2} + \frac{R^2_{2,H}}{8 \cdot c} - \frac{I_2}{2} \;- \frac{mc_H}{2} \quad .$$

At this wage, the optimal managerial effort is

$$e^*_1 \;=\; \frac{R_1}{2 \cdot c} + \frac{R^2_{2,H}}{8 \cdot c^2} - \frac{I_2}{2 \cdot c} \;+ \frac{mc_H}{2 \cdot c} \quad ,$$

and the firm's maximized profits are

$$\Pi \;=\; \frac{1}{c} \cdot \left[\frac{R_1}{2} + \left(\frac{f}{16}\right) \cdot \left(\frac{R^2_{2,H}}{c}\right) - \frac{I_2}{2}\right]^2 - I_1 \quad ,$$

where

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

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 (A1-A3), there is a unique subgame-perfect equilibrium in which the firm invests in the project at time 1 if and only if*

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

Firms pay managerial wage w_1 soliciting managerial effort e_1 at time 1 of

$$w_1^* = \frac{R_1}{2} + \frac{R_{2,H}^2}{16 \cdot c} - \frac{I_2}{2} \quad , \quad e_1^* = \frac{R_1}{2 \cdot c} + \frac{3 \cdot R_{2,H}^2}{16 \cdot c^2} - \frac{I_2}{2 \cdot c} \ .$$

Firms continue the project only in case of early success (H). If they continue, they retain the manager and pay managerial wage $w_{2,H}$ soliciting managerial effort $e_{2,H}$ at time 2 of

$$w_{2,H}^* = \frac{R_{2,H}}{2} \quad , \quad e_{2,H}^* = \frac{R_{2,H}}{2 \cdot c} \ .$$

Social welfare is

$$SV = e_1^* \cdot (R_1 + S) - \left(\frac{c}{2} \right) \cdot e_1^{*2} - I_1 + e_1^* \cdot \left[e_{2,H}^* \cdot (R_{2,H} + S) - \left(\frac{c}{2} \right) \cdot {e_{2,H}^*}^2 - I_2 \right] \ .$$

2 Government Intervention

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 government internalizes the social and the managerial surplus that firms do not. It can make three choices:

1. It can tax firms (at rate τ).
2. It can give firms a bailout amount (an amount g).
3. If it bails out a firm, it can decide whether to retain or fire the manager ($FG = \{\text{FIRE}, \text{RETAIN}\}$).

As already mentioned in the introduction, in designing its bailout policy, the government must break even actuarially, i.e., it is a closed system. This is designed to capture Calomiris (1999) point 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 activities with fewer harmful distortions, it could well be appropriate to be even more interventionist than our own model suggests.

By (A2), 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 where the government bailout induces the firm to continue after an initial failure (state L). We will now show that government

intervention can keep the firm in business even in the L state (thereby capturing diffuse surplus) without depressing managerial effort and without distorting investment decisions. This is not obvious: 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 will now show that there is a non-distortionary intervention that consists of a bailout subsidy for firms in the L state, financed with proportional taxes on profits (revenues net of costs, including wages and upfront investment costs) on successful firms.[9] The bailout subsidy is just sufficient to motivate the firm to continue 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.

$$I_2 - \frac{R_{2,L}^2}{4 \cdot c} \;\leq\; \frac{\frac{1}{c} \cdot \left(\frac{R_1}{2} + \frac{3 \cdot R_{2,H}^2}{16 \cdot c} - \frac{I_2}{2} \right)^2 - I_1}{1 - \frac{R_1}{2 \cdot c} - \frac{3 \cdot R_{2,H}^2}{16 \cdot c^2} + \frac{I_2}{2 \cdot c}} \quad .$$

This insures that the tax rate satisfying the budget constraint for the government is less than 100%. Above this threshold, government intervention would be incomplete.

2.1 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 zero otherwise. The manager now expects to receive

$$m_{2,j} \;\equiv\; e_{2,j} \cdot w_{2,j} - c \cdot e_{2,j}^2/2 \quad .$$

Her payoff-maximizing effort is

$$e_{2,j}(w_{2,j}) \;=\; w_{2,j}/c \quad ,$$

which, given tax rate τ, results in expected continuation profits for the firm of

$$\pi_{2,j} \;=\; (1-\tau) \cdot \left[e_{2,j}(w_{2,j}) \cdot (R_{2,j} - w_{2,j}) - I_2 \right] \quad .$$

Therefore, the firm optimally pays a success-contingent wage of $w_{2,j}^* \;=\; R_{2,j}/2$. This induces a managerial effort level of

$$e_{2,j}^* \;=\; \frac{R_{2,j}}{2 \cdot c} \quad .$$

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:

[9] The tax deduction on investment can be provided at the instant of the investment. The proportional 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.

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

$$m^*_{2,j} \;=\; e^*_{2,j} \cdot w^*_{2,j} - \frac{c \cdot e^{*2}_{2,j}}{2} \;=\; \frac{R^2_{2,j}}{8 \cdot c} \;\;,$$

and the firm's expected time 2 profits are

$$\pi^*_{2,j}(\, g_j, \tau\,) \;=\; (1-\tau) \cdot \left[e^*_{2,j} \cdot \left(R_{2,j} - w^*_{2,j} \right) - I_2 \right] \;=\; (1-\tau) \cdot \left(\frac{R^2_{2,j}}{4 \cdot c} + g_j - I_2 \right) \;\;.$$

where g_j is the possible bailout funding in state j.

In the H state, (A2) assures that the firm continues without government intervention (g^*_H=0). In the L state, the government provides g^*_L such that $R^2_{2,L}/(4 \cdot c) + g^*_L - I_2 \;=\; 0$. 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 zero profit.

Lemma 2

1. *In the L state, the government bailout amount of $g^*_L \;=\; I_2 - R^2_{2,L}/(4 \cdot c)$ leaves the original firm owners 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 raise 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 zero. 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

$$e_1 \cdot (w_1 + mc_H) + (1 - e_1) \cdot (0 + mc_L) - \frac{c \cdot e_1^2}{2} \;\;,$$

where mc_j is the expected managerial benefit to continuing on *if* retained in state j, i.e., $m^*_{2,H}$ or $m^*_{2,L}$, or zero *if* fired. The optimal effort choice at time 1 as a function of the wage is

$$e_1(w_1) = \frac{w_1}{c} + \frac{mc_H - mc_L}{c} \quad .$$

Given this wage-dependent effort, the firm maximizes its profits by setting wage of

$$w_1^* = \frac{R_1}{2} + \frac{R_{2,H}^2}{8 \cdot c} - \frac{I_2}{2} \quad .$$

At wage w_1, the incumbent owners of the firm receive

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

This uses the facts that (a) the government leaves the firm with a net profit of 0 in the L state and (b) the continuation value $R_{2,H}^2/(4 \cdot c) - I_2$ is only taxed once. The firm sets a wage that translates into in-equilibrium effort of

$$e_1^* = \frac{R_1}{2 \cdot c} + \frac{R_{2,H}^2}{8 \cdot c^2} - \frac{I_2}{2 \cdot c} + \frac{mc_H - mc_L}{2 \cdot c} \quad .$$

Corporate profits are

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

where

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

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 will be discussed in more detail in Section 3.

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*

$$S \geq \frac{2 \cdot c \cdot I_2}{R_{2,L}} - \frac{3 \cdot R_{2,L}}{4} \quad ,$$

then the government can improve social welfare without distorting managerial-effort or investment choices by adopting the following policy:

- *Provide a bailout* $g_L^* = I_2 - R_{2,L}^2/(4{\cdot}c) > 0$ *at time 2 if and only if the project at time 1 is a failure (L).*
- *Replace the incumbent manager in a bailout* ($mc_L^* = 0$).
- *Finance bailouts with a proportional tax on firm profit (gross payoff net of wages and investment), where the tax rate is*

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

The social welfare is

$$\begin{aligned} SV &= e_1^* \cdot (R_1 + S) - \left(\frac{c}{2}\right){\cdot}e_1^{*2} - I_1 \\ &+ e_1^* \cdot \left[e_{2,H}^*{\cdot}(R_{2,H} + S) - \left(\frac{c}{2}\right){\cdot}{e_{2,H}^*}^2 - I_2\right] \\ &+ (1 - e_1^*){\cdot}\left[e_{2,L}^*{\cdot}(R_{2,L} + S) - \left(\frac{c}{2}\right){\cdot}{e_{2,L}^*}^2 - I_2\right] \ . \end{aligned}$$

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 zero. The tax rate, τ^*, is determined by the government's budget constraint

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

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 zero:

$$e_{2,L}^* \cdot (R_{2,L} + S^c) - \frac{c{\cdot}e_{2,L}^{*2}}{2} - I_2 = \frac{R_{2,L}}{2{\cdot}c} \cdot (R_{2,L} + S^c) - \frac{R_{2,L}^2}{8{\cdot}c} - I_2 = 0 \ ,$$

which solves to a minimal level of diffuse social benefits of $S^c = 2{\cdot}c{\cdot}I_2/R_{2,L} - 3{\cdot}R_{2,L}/4$. ■

There are three features of non-distortionary bailouts:

1. A complete expropriation of owners (capital).
2. A complete expropriation of managers (labor).
3. 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. This is effectively a proportional tax on NPV.

It is important not to tax the success and effort of labor, because labor has an "escape" margin (effort provision) that NPV-maximizing capital does not have.

3 Implications

Theorem 2 is interesting not because we believe that its assumptions always or even regularly apply in the real world, but because it clarifies where one should look for efficiency gains and losses of government bailouts. It can guide the evaluation of when and how government intervention should be conducted.

1. Bailouts are more advantageous when they maintain project operations to capture the diffuse social value of continued operation that firms cannot capture by themselves. The social benefits (including managerial surplus) should exceed the negative NPV of the project for the firm itself. They have to be calculated net of the benefits that would arise from deployment of resources to other activities in the economy.
2. Bailouts are more advantageous when their presence does not reduce but enhance project revenues. For example, if assurance of non-abandonment increases product revenues (e.g., as in deposit insurance increasing stakeholder participation), bailouts are relatively more attractive.
3. Bailouts are more advantageous if firms have no alternative margins. It is this assumption that made proportional taxation on profits not distort the (maximum-NPV) capital budgeting decisions of firms. There are two margins of particular concern:

   - Corporations may well move their operations to other domiciles where they are taxed less.
   - Owners may well substitute from taxed project investments to untaxed leisure.

   Contrary to the common view, the second point makes it clear that the efficiency cost of well-designed bailouts is less likely to be too much entry by firms that count on bailouts

in case of failure, but more likely to be too little entry by firms that want to avoid being taxed in case of success.

In real life, taxation may be more or less efficient and more or less "fair" than our model has assumed. An immediate "fairness" suggestion would be to tax the diffuse stakeholders (and/or replacement labor) that are the ultimate beneficiaries of the bailout, either ex-post or ex-ante. Of course, from an efficiency perspective, "fairness" is not even important. Taxes should be raised where the efficiency losses are lowest. Taxes on NPV can avoid distortions in our model.

4. Bailouts are more advantageous if the government conducts them efficiently. Our analysis has presumed that the government is a friction-free social-welfare optimizer. This is defensible as a modeling assumption, but admittedly a utopian extreme. The effect of its violation needs to be carefully assessed.

   In real life, government often harbor other objectives. The most obvious issue is that government itself is conflicted. Tullock (1967) has pointed out how lobbying is likely to help determine who is and who is not taxed, who is and who is not subsidized, and who is and who is not expropriated. Yet, not all government choices may be rent-seeking. Politicians and the public may have their own non-social objectives, too. For example, in the TARP (discussed in more detail in the next section), the government explicitly considered maximizing the return on investment in bailed-out firms.[10] If government really views itself as a taxpayer-sponsored vulture fund, then it is likely ill-suited to address the social-externalities problems.

   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 where efficient bailouts are feasible and desirable. Of course, when governmental misbehavior and waste grow prohibitively large relative to the social benefits of bailouts, the efficiency case for intervention disappears altogether.

5. Bailouts are more advantageous if replacement managers and employees are as efficient as incumbent managers and employees (i.e., if their cost of effort, c, is equal). The government can then (commit to) expropriate them fully in a bailout without adverse consequences in the L state—and without suffering time inconsistency concerns. Expropriating existing manager allows the government to maintain the same managerial incentives that prevailed in the absence of intervention. Expropriating owners allows

[10] For example, in its March 2011 report, the TARP Congressional Oversight Panel notes that the US Treasury officials at times tended to alternate inconsistently between articulating social welfarist goals (e.g., employment, economic growth, investment) and recouping a return on investment for taxpayers (Congressional Oversight Panel 2011, page 188).

the government to maintain the same investment incentives that prevailed in the absence of intervention. Even when bailouts are justified on efficiency grounds, they are unlikely to win popular support among the most focal (or vocal) constituencies. Indeed, we have already argued that efficient bailouts would likely augur resistance among the Chamber of Commerce and the Business Roundtable. (Of course, the same parties may not fight bailouts in actual distress if they can then avoid complete expropriation.) In many situations, it is a plausible assumption that failed incumbents were not particularly good. However, if the replacements are even worse, then government bailouts becomes a tradeoff. If the government can commit itself to fire employees and managers at time 2, it can retain incentives at time 1 (on pre-bailout firms) at the loss of operational efficiency at time 2.

An even more extreme form of holdup can occur if firms or their employees can threaten to turn down the bailout, holding out for larger transfer payments from the government. This danger may be particularly acute for "too big to fail" firms (e.g., Citibank, Bank of America), where S is also known to be very high.

We could adapt our model to assume that the bailout recipient firms are able to hold out for some fraction of the total available public surplus, sv_2. Introducing such hold ups 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 hold ups would require the government to levy a larger tax on successful firms. When the hold-up 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).[11]

Our model was designed to explore how bailouts can be conducted without distorting effort or investment choices. Our model did not consider even more aggressive government interventions. Yet, as in all moral-hazard models, the government could push managerial effort towards first-best. After all, it has access to a technology that the firm does not: it could further subsidize revenues when successful. With higher revenues in the good state, firms would choose to pay higher wages in the good states in order to motivate labor to work harder. Yet, in order to fund this policy, the government would have to find sources of tax revenues. Because it cannot tax failure (there are no funds) and because it does not want to tax success, its only remaining tax lever is on firm entry. In effect, the government would want to confiscate the

[11] 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 on.

NPV of the projects up-front and use the resulting tax revenue to subsidize future success. This result is an implication that also arises in Chamley (1986) and Judd (1985). These models show that taxing capital is inefficient, because capital accumulation can bring forth greater gains than labor accumulation. Chamley and Judd highlight only that the optimal policy in these models is to tax labor instead of capital, but the government could also expropriate all capital opportunities at the outset, and use the resulting revenues to subsidize later investment success. Of course, such policies suffer from subgame-perfect credibility problems: if the government can expropriate capital owners at the outset, can it commit not to do so later on?

In focusing on the sources of efficiency gains and losses of government intervention, we have neglected the difficult issue of redistribution among different participants in the economy. We have mentioned that the losers are investors, and the winners are diffuse stakeholders and potential replacement managers. However, this problem is even more complex than we have let on so far. In our model, firms are homogeneous. The government's budget must be in actuarial balance. That is, the expected tax revenues must cover the expected costs of the bailout. Tax revenues are collected from "winner" firms. The notion of an actuarial balance is critical, because a single firm cannot both succeed and thus pay taxes, and also require a bailout. This form of actuarial budget balancing is identical to an alternative budget balance condition that requires *aggregate* tax revenues to offset *aggregate* outlays across a population of firms. In essence, the population of "winner" firms (first-period successes) underwrite the bailout population of "loser" firms (first-period failures). Of course, ex ante, because all firms are identical, each is probabilistically both a payer of taxes and a recipient of bailout money.

Yet the isomorphism between actuarial and aggregate budget balance may no longer hold when firms are heterogeneous. (For example, they may face different values of R_1.) Firms with high enough R_1 may require no bailouts, because they will finance their own restarts. Firms with low enough R_1 may also require no bailouts, because it is inefficient to rescue them. It is only for some firms in the middle that bailouts may be "fair."

Redistribution may also be easier if bailouts are randomly distributed: the winner firms can cover the loser firms. However, in a crisis, many firms may simultaneously need capital, possibly making government less inclined to hand out subsidies. On the other hand, it is plausible that deadweight losses arising from liquidation are higher during crises, which should induce government to be more inclined to bail out firms.

4 TARP

In the automobile bailout of 2008, incumbent shareholders were wiped out, senior management and board members were fired, and labor unions and dealers accepted some concessions. Despite strong initial skepticism, some commentators now portray the $80-billion automobile bailouts in more charitable tones. For example, in November 2010, BusinessWeek reported:

> General Motors Co.'s initial public offering showed that while U.S. President Barack Obama's administration may lose billions on the auto-industry bailout, the national budget and economy might be better off for it.
>
> The U.S. sold almost half of its stake in the nation's largest automaker for $33 a share—about $10 less than it needs to break even. The remaining shares will need to sell for about $20 higher to make up the difference. GM opened at $35 and stayed within $1.11 of that price all day. Selling the remaining shares at that price would produce a loss of about $9 billion.
>
> That may go down as a bargain. The U.S. would have lost $28.6 billion in spending on social services and missing tax revenue if not for the bailout of GM, its former lending arm and Chrysler Group LLC, according to a study released Nov. 17 by the Center for Automotive Research in Ann Arbor, Michigan.
>
> "GM ends up an economic contributor to the U.S. economy,...It's manufacturing products, it's creating jobs, it's buying wholesale parts, it's doing what an industrial company is supposed to do."

The government sold its last Chrysler shares in 2011, losing $\$12.5 - \$13.8 \approx \$1.3$ billion. It sold its last GM shares in December 2013, losing $\$49.5 - \$39 \approx \$10.5$ billion. Treasury Secretary Lew suggested that the rescue saved 1 million jobs and stopped the American auto industry from collapsing.

Of course, significant academic skepticism remains to this day about the wisdom of bailouts as a categorical matter. Our model provides the means for assessing the interventions under the Troubled Asset Relief Program (TARP) in 2008-9 from an academic economic perspective.

First, our model endorses the decisions of the Treasury to squeeze out both existing shareholders and incumbent managers of GM and Chrysler. The managerial expropriations are consistent with our model. They succeeded in motivating other managers (specifically, those of Ford) to work harder to avoid the same fate. However, employees and labor unions were not equally expropriated.

Rattner (2010) provides some color to the process in the Chrysler and GM bailouts. The aforementioned holdout problems were significant. On page 108, Rattner recalls a conversation

with Jimmy Lee Bainbridge of J.P. Morgan, a major creditor, who seemed to count on the government interest in keeping the firm alive:

> In our phone calls, he also relentlessly reminded me that creditors deserve to be paid. "When you lend somebody $6.9 billion," he would say, "you expect to get $6.9 billion back. And not a penny less."...Chrysler debt was trading at around 15 cents on the dollar (admittedly, infrequently), and according to Chrysler's own analysis, the liquidation value of the company was perhaps as low as $1 billion. Clearly, Jimmy didn't believe that the Obama administration would be willing to push back and let the banks take over Chrysler rather than cave in to their demands.

It was only after Pres Obama's televised speech, in which Obama signaled his willingness to liquidate Chrysler, that this creditor changed perspective:

> Jimmy Lee of JPMorgan called. "We need to talk!" he barked. "I thought there was nothing for us to talk about," I said innocently. "You said $6.9 billion and not a penny less', and that's not going to work for us." "That was then and this is now," he said...This was precisely what we had hoped to accomplish when we'd urged the President to set a firm deadline for Chrysler, with liquidation to follow unless all the stakeholders agreed that the sacrifice would be shared.

The treatment of creditors has remained a controversial subject to this day. Some conservative academic and business-oriented publications lament a "strong-arming" of the process by the Government and a claimed breakdown of the rule of law in the bankruptcy proceedings (despite its court approval). For example, in June 2012, the *Liberty Law Talk* reports "that Professor Zywicki stresses that the Chrysler bailout abandoned the bankruptcy code's clear and known rules regarding creditor interests that derive from the code's 19th century origins. This allowed for the sinister use of the public trough by special interests that benefited from the bailouts. Moreover, Professor Zywicki highlights the fallout in corporate bond markets from the subversion of the legitimated process for corporate bankruptcy worked by the Obama administration." Our model does not take a stance on relative creditor priorities, but it argues that the government's chief concern is the preservation of the firm, while avoiding giving owners (now the creditors) incentives to welcome bailouts. Infusing its own funding, the government had no strong economic reason to treat existing creditors in order of the non-bailout priority. (The lenders ended up receiving 29 cents on the dollar.)

The treatment of employees has remained similarly controversial. Some but not all employees and unions were not expropriated. Rattner (2010, p.138) reports that

> ...our groundbreaking rescue plan ended up having to compete with the news of Rick Wagoner's ouster...I was stunned by commentaries suggesting that the government

> was somehow overreaching by replacing 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.

Non-management labor was treated unevenly. For example, while GM worker pensions remained largely unaffected, those of Delphi (a subsidiary of GM) had to take a cut of all their healthcare benefits and 70% of their pension. Nevertheless, 65% of Chrysler and 17.5% of GM was eventually handed over to the union (pension funds). To the extent that their continued stakes depress labor's incentives to avoid future bailouts, the government bailout was not efficient.

In contrast to the car bailouts, in many of the bank bailouts, the government was *not* particularly ambitious in attempting to displace the owners, managers, and traders who received bailout funds and who had presided over the banks' declines, much less to claw back managers' and traders' accrued salaries and benefits (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 employees, should be a presumptive aspect of a bailout as a means for deterring future crises. We believe that it is difficult to argue that the managers and traders that had failed to curb the risks of these financial firms were so valuable that they were irreplaceable. More likely, the financial firms possessed enough residual holdup and lobby power to prevent the government from conducting an efficient bailout.

Second, our model points out that 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 appeal of generating a return from ownership stakes is apparent. However, our model points out that government taxation and/or ownership simply reduced the price that private investors were willing to pay. If this demand led the government to run these firms longer than it should have (assuming governments are less efficient than the private sector in running companies), this would have created another inefficiency.[12] Of course, when existing owners were not fully displaced, the extra tax may have been merely a second-best attempt to expropriate their existing holdings.

[12]In one sense, perhaps, under the GM and Chrysler bailouts the government arguably enjoyed competence that rivaled that of private owners. Its task force, responsible for the initial stage of the resuscitation, consisted of a team of unusually competent outside private-equity capitalists with business expertise. Moreover, it appears that the task force was not as motivated by a desire to enrich itself, as by a desire for public service (which our model does not allow for). Thus, the government may have followed not the letter, but the spirit of our model's recommendation. And, as our model suggests, by 2010, the government had begun to divest its stake in GM. The divestment is on track for full divestment by 2014.

Third, our model suggests that 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* 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.[13]

Fourth, our model suggests that the opposition to bailouts from owners and managers and the opposition from business groups was to be expected. Such opposition is an unavoidable side-effect of any good bailout.

5 Related Literature

The most important difference of our paper from the existing literature is our focus not on the fact that bailouts *can* have efficiency costs, but on the fact that they *need not* have efficiency costs. Our model emphasizes that when owners and managers can be fully expropriated and NPV can be proportionally taxed, there are no obvious efficiency losses. More realistically, our model contributes to prescriptions of when and how to conduct bailouts.

Most of the extant literature on bailouts has focused on bank bailouts. Banks are peculiar, because many of their incentive problems derive from large financial debt obligations that are intrinsic to their normal operations. Our own paper seems more suitable to analyzing situations in which the distortionary effects of leverage plays a secondary role, e.g., as in the case of the car company bailouts.

The single closest paper to our own 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.[14] The cost of the bailout is paid for by taxes on household endowments,

[13] It is debatable whether the government will have the capability not to intervene if it will be catastrophic not to intervene. Our model suggests that a commitment to expropriate the corporate owners and managers may be more effective than an attempt to limit the pool of funds for bailouts in the future. After all, there was no such fund in place in 2008-9, either, and yet the government did rescue firms.

[14] The paper also shows that if there is excessive participation in the bailout by banks which privately know that they already have *good* projects, then the regulator can improve efficiency by demanding junior securities. It

which causes a parametrically assumed efficiency loss 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 upon 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 bail-outs, 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 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 much a model of banks, as we view it of a model of government bailouts for generic non-bank firms, such as the GM and Chrysler. But like Philippon and Schnabl (2011), we focus on the socially-inefficient aspects of firm behavior. Bailouts are needed because it is too costly for the firm to finance continuation, given their struggle with their own internal moral-hazard (managerial agency) problems. Our paper focused on on the internal and external moral-hazard problems and their best remedies. Our (endogenous) tax implications are not linear as in Philippon and Schnabl (2011). We also offered specific policy recommendations (on managerial and owner retention, bailout funding, etc.) different from those in Philippon and Schnabl (2011), and showed 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 (2011) and Tirole (2011) 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 (2011), 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. Philippon and Skreta's (2011) government objective is to obtain a target level of investment that is the cheapest to taxpayers. In our model, the government maximizes total social value instead. Their optimal government intervention is a debt contract. Our's is a direct subsidy (because any government stake raises the required

would probably not be difficult to think of a situation in which the problem is too high an uptake by banks which know that they should (socially) not be bailed out. In this case, debt may be a better contract.

subsidy to entice private participants). In Tirole (2011), there is a spillover aspect of bailouts. The bailout of one firm raises the cost of the next bailout. Firms become progressively more hesitant to participate as progressively weaker banks have already been bailed out before them. Like Philippon and Skreta (2011), 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.[15]

There are also pre-2008 crisis papers in the banking literature in which bailouts can be valuable. For example, in Diamond (2001), banks would lose socially-valuable information if 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 showed 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, e.g., as in Gorton and Rosen (1995), Chan, Greenbaum, and Thakor (1992), Boyd and Runkle (1993), Calomiris (1999), etc. *Ex-ante* regulation of the banking sector is usually recommended as a corollary to *ex-post* deposit insurance.

Similarly, in a long number of papers on the subject of government procurement and intervention, Tirole emphasizes how firms can game the system. For example, in Farhi and Tirole (2011), firms correlate on exposures in order to benefit more from government bailouts:

> ...the 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 our paper has not

[15]Like us, Tirole 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. The paper does not derive an optimal bailout in the presence of moral hazard.

allowed for an additional direct waste parameter in the process of government intervention, we do not suggest that one should ignore the governmental rent-seeking issues first raised in Tullock (1967) and Tirole (1994). Although these papers raise significant real-world problems, our own view of government intervention, though skeptic, is decidedly less pessimistic. Our model's assumption of an optimizing government was 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 non-distortionary *a priori* effort incentive effects of tying bailouts both to owner expropriation and managerial dismissals.

6 Conclusion

In its final report to Congress in March 2011, the TARP Congressional Oversight Panel (COP) 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. (Congressional Oversight Panel (2011), at 185).

Our model was designed to help frame and assess these concerns. It extended a canonical agency model that explored the trade-offs of governmental interventions with tax-financed bailouts. Our analysis suggests that bailouts are not the taxation and moral-hazard bane that they are often considered to be. When the diffuse stakes are high, government intervention can be conducted efficiently when:

1. Owners can be and are fully expropriated in a bailout,
2. Managers and employees can be and are fully expropriated in a bailout, and
3. Bailouts can be and are funded through proportional taxation on profits that owners and their firms cannot escape.

In addition, given a first-best bailout, the government cannot finance bailouts through extraordinary levies on bailed-out firms, but only through levies on healthy firms. It is only when these prescriptions are violated that bailout inefficiencies are likely to be large.

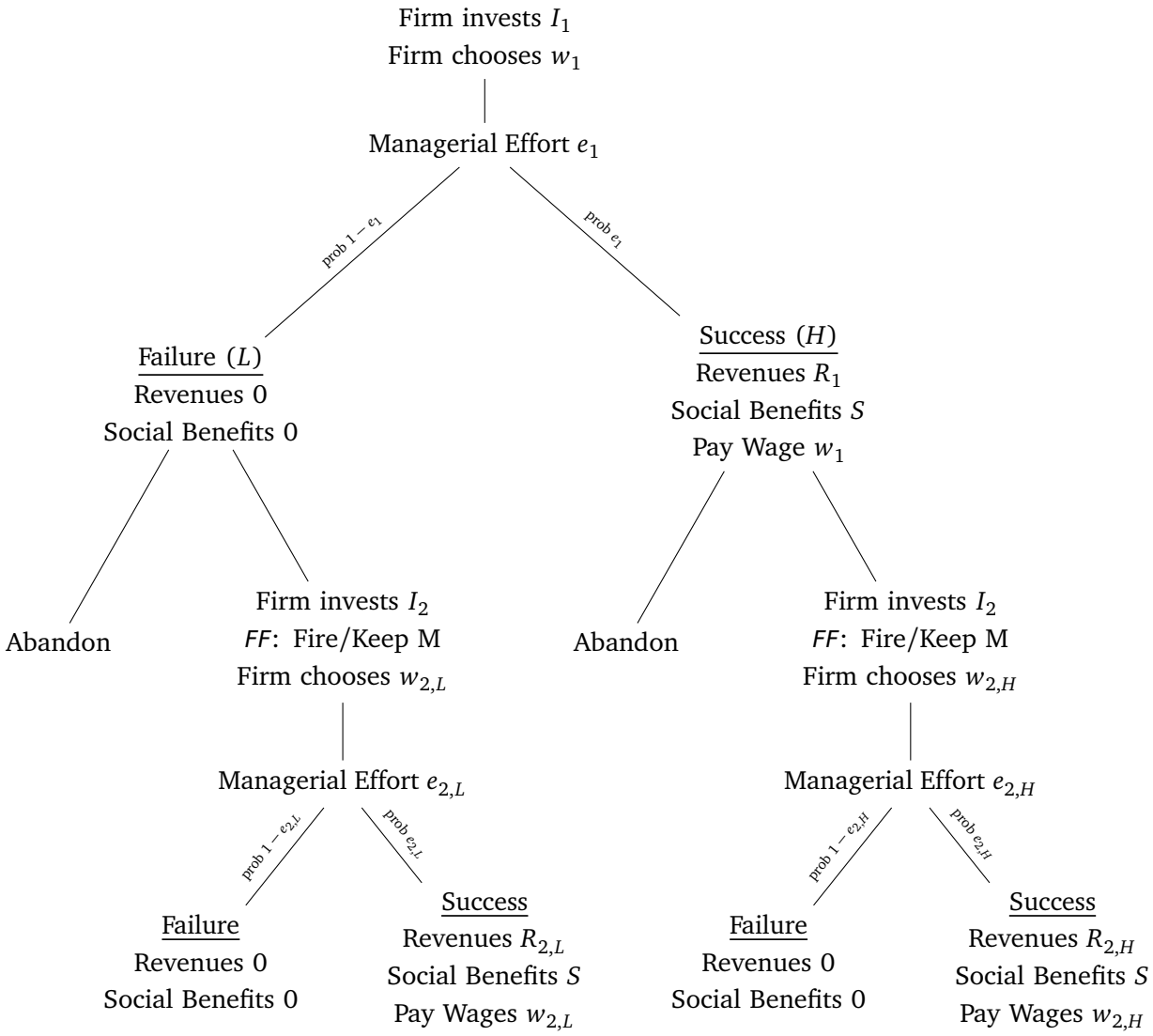

Figure 1: Game Structure without Government

This shows the sequential structure of the game, assuming that the firm decides to begin the project. The manager decides on her effort, which determines the success probability.

References

Aghion, P., P. Bolton, and S. Fries, 1999, "Optimal Design of Bank Bailouts: The Case of Transition Economies," *Journal of Institutional and Theoretical Economics*, 155, 51–70.

Bebchuk, L. A., A. Cohen, and H. Spamann, 2010, "The Wages of Failure: Executive Compensation at Bear Stearns and Lehman 2000-2008," *Yale Journal on Regulation*, 27, 257–282.

Boyd, J. H., and D. E. Runkle, 1993, "Size and performance of banking firms – testing the predictions of theory," *Journal of Monetary Economics*, 31, 47–67.

Calomiris, C. W., 1999, "Building an incentive-compatible safety net," *Journal of Banking and Finance*, 23, 1499–1519.

Chamley, C., 1986, "Optimal Taxation of Capital Income in General Equilibrium with Infinite Lives," *Econometrica*, 54, 607–622.

Chan, Y.-S., S. I. Greenbaum, and A. V. Thakor, 1992, "Is fairly priced deposit insurance possible?," *The Journal of Finance*, 47, 227–245.

Congressional Oversight Panel, 2011, "The Final Report of the Congressional Oversight Panel," Discussion paper, Congress of the United States.

Diamond, D. W., 2001, "Should Japanese Banks Be Recapitalized?," *Monetary and Economic Studies*, 2, 1–20.

Diamond, D. W., and P. H. Dybvig, 1983, "Bank Runs, Deposit Insurance, and Liquidity," *The Journal of Political Economy*, 91, 401–419.

Diamond, D. W., and R. G. Rajan, 2005, "Liquidity Shortages and Banking Crises," *The Journal of Finance*, 60, 615–647.

Farhi, E., and J. Tirole, 2011, "Collective Moral Hazard, Maturity Mismatch, and Systemic Bailouts," Discussion paper, Harvard and MIT.

Gorton, G. B., and L. Huang, 2004, "Liquidity, Efficiency and Bank Bailouts," *American Economic Review*, 94, 455–483.

Gorton, G. B., and R. J. Rosen, 1995, "Corporate-control, Portfolio choice, and the Decline of Banking," *The Journal of Finance*, 50, 1377–1420.

Judd, K. L., 1985, "Redistributive Taxation in a Simple Perfect Foresight Model," *Journal of Public Economics*, 28, 59–83.

Philippon, T., and P. Schnabl, 2011, "Informational Rents, Macroeconomic Rents, and Efficient Bailouts," Discussion paper, NYU.

Philippon, T., and V. Skreta, 2011, "Optimal Interventions in Markets with Adverse Selection," Discussion paper, New York University, forthcoming, American Economic Review.

Rattner, S., 2010, *Overhaul: An Insider's Account of the Obama Administration's Emergency Rescue of the Auto Industry*, Houghton Mifflin Harcourt.

Schwarcz, S. L., 2011, "Keynote Address – Identifying and Managing Systemic Risk: An Assessment of Our Progress," Discussion paper, AGEP Advanced Policy Institute on Financial Services Regulation, George Mason University.

Tirole, J., 1994, "The Internal Organization of Government," *Oxford Economic Papers*, 46, 1–29.

Tirole, J., 2011, "Overcoming Adverse Selection: How Public Intervention Can Restore Market Functioning," Discussion paper, Toulouse School of Economics, forthcoming, American Economic Review.

Tullock, G., 1967, "The Welfare Costs of Tariffs, Monopolies, and Theft," *Western Economic Journal*, 5, 224–232.