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Nationalizations and effciency

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Abstract

We develop a theoretical model in which firms are either private or state-owned. When firms become insolvent, the government can intervene with general measures, like subsidies, or by nationalizing firms. The government only intervenes when the bankruptcy of a firm entails social costs. In a stylized model, we analyze how government interventions affect allocative and productive efficiency. Nationalization of private firms in case unprofitable investments were made, leads to increased allocative efficiency despite private ownership. The effort level chosen by the managers working for firms is also affected by government intervention with an impact on productive efficiency.

JEL Codes: L33, P31, P51.

Key Words: nationalization, efficiency.

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1 Introduction

The demand for and implementation of government interventions is one of the main characteristics of the most recent global financial crisis. In the banking and insurance sectors, for example, Fortis, HypoRealEstate, Goldman Sachs and AIG were either nationalized or bailed out. On the other hand, governments try to help firms with general measures, like tax reductions or, as in Germany or the United Kingdom, a bonus when buying a new car. The current popularity of government intervention contrasts with the period of transformation of economies after the collapse of communism, when privatization was used to reduce the role of the government. In this paper we look at what transition economics could teach us about interventions by the government in the financial crisis.

Our paper focuses on two efficiency arguments commonly used in transition economics. The first one, *productive efficiency*, claims that production is more efficient in a private firm because better incentives can be given to managers and employees. The intuition is that private firms face a larger risk of liquidation than public firms, and managers thus face a larger risk of losing their job when choosing an effort level that is not high enough. The second argument, *allocative efficiency*, claims that public firms are socially more efficient because the government cares about social welfare and internalizes externalities, whereas the private owners just maximize their payoff. The demand for government intervention, to mitigate the consequences of the financial crisis, is often motivated by the second argument, while the first one is not discussed.

In transition economics it is argued that a privatization enhances efficiency by

hardening the budget constraint.[1] Privatization, however, does not eliminate the soft budget constraint. Schaffer (1989, 1998) and Maskin (1999) argue that the government is unable to stick ex post to a hard budget constraint and Schleifer and Vishny (1994) point out that the government may rescue firms in return for political support. In line with this, Lin and Li (2008) explain soft budget constraints by the existence of policy burdens on enterprises, such as keeping redundant workers or providing retirement and other social services. Similarly, in the financial crisis governments helped private firms, like the car industry, as well as (semi-) public firms, like FannieMae and FreddieMac.

We argue that there are two possible forms of government intervention. The first is general intervention, in the form of for example tax reductions or deductions, and the other one consists of bailouts and nationalizations. One difference between the two is that nationalizations are, logically, impossible in the case of public firms. A difference for the board of directors of a private firm is that general intervention is normally preferred over a nationalization, as the latter may imply that they lose their jobs or that they have to repay their bonuses. Managers and workers have similar incentives, since nationalization may imply that they have to repay their bonuses or that they may lose the shares they own in their company. The government, however, prefers nationalization over general intervention in cases where the latter becomes politically too costly. We contend that this is the case when firms have grown too large, when nationalization is politically more feasible since the ownership of the firm

[1]The concept of soft budget constraint was developed by Kornai (1980, 1986, 1998). For a review of the theoretical and empirical literature see, for example, Maskin (1999), Dewatripont and Roland (2000), Maskin and Xu (2001), Kornai et al. (2003) or Laffont and Tirole (1991).

changes, and this can be used as a justification towards the electorate.[2]

Our main findings are that allocative efficiency is higher in private firms and that productive efficiency can be equal in public and private firms. These results differ substantially from those in the existing literature. Schmidt and Schnitzer (1993) and Schmidt (1996), for example, argue that public ownership of firms enhances allocative efficiency by subsidizing unprofitable public firms when liquidation of these firms would entail externalities. This subsequently decreases productive efficiency, as managers and workers run a smaller risk of losing their job. We argue, however, that subsidization or other governmental interventions are sometimes unfeasible and then managers and workers in public and private firms face the same risk so that productive efficiency in both sectors is the same.

Moreover, the government can also intervene in favor of private firms (also see Kornai 2001), and we show that this possibility implies that allocative efficiency can be bigger in private firms. This follows from the fact that the subsidization of unprofitable public firms implies that risky investment in public firms takes place more often, so there might be overinvestment from a social welfare point of view.[3] Allocative efficiency can therefore be higher in private firms since less overinvestment takes place, as risky investments could induce painful nationalizations.

Our results on allocative and productive efficiency thus contrasts with those of the existing literature, and add to the literature on transition economics. These results also imply that government interventions in the financial crisis can have detrimen-

[2]Additionally, nationalization can be less costly as it can be done with (partial) expropriation.

[3]One could argue that the (partially) public firms FannieMae and FreddieMac overinvested in mortgages.

tal effects on allocative and productive efficiency, as it can lower the incentives for managers and employees and increase overinvestment.

The remainder of the paper is organized as follows: Section 2 introduces the formal model and Section 3 the socially optimal outcome that we use as a benchmark in our analysis. Sections 4 and 5 discuss the choices made in public and private firms, respectively. Section 6 contains a discussion of the results and several extensions and Section 7 concludes.

2 The Model

In this section we introduce and compare two governance structures for a firm. We assume that either the firm is owned by a private holding company or it is part of a government agency. In the economy, there may be more holding companies and government agencies each controlling several firms, but we do not model this explicitly.

Each firm employs managers and employees, who have to decide on the amount of effort they put into their work. The investment opportunities and thus firm values are influenced by this effort level. The standard approach to giving managers and employees the right incentives is to link salaries to the firm's performance. Stock options, however, are not a good possibility to shape the incentives as this exposes managers and employees to a considerable risk in their earnings, while they have only limited influence on stock prices. We therefore assume that they get a flat incentive

scheme.[4]

Incentives are also shaped by career concerns. A liquidation of a firm implies that the managers and employees lose their jobs, while nationalization may also result in job-losses due to accompanying reorganizations. A liquidation or a nationalization can, moreover, be interpreted as signals about the managers ability, lowering future job prospects.

The board of directors or the government agency takes two decisions: an investment and a liquidation decision. We assume that they maximize firm-value, either because they have stock options or are owners of the firm (in the case of the private firm) or due to political pressure or career concerns (in the case of the public firm).

A potential liquidation of a firm can imply negative external effects, and these social costs are not taken into account by a profit-maximizing owner but may induce the government to intervene. As we mention in the Introduction, negative externalities are associated with the social burdens of a firm (see, e.g. Lin and Li 2008), independently of whether it is a public or a private firm (see Kornai 2001). For example, a high level of long-lasting unemployment associated with the liquidation of large public or private companies could be associated with social unrest in the absence of an adequate social security system (Hardy 1992). A big bank in financial distress may also generate contagion effects on other banks or financial institutions, causing macroeconomic and political instability. The liquidation of other public or private firms, however, may result in negligible social costs. The government's objective is to avoid social costs of a potential liquidation.

[4]See Holmström and Milgrom (1987) for a formal model of this argument.

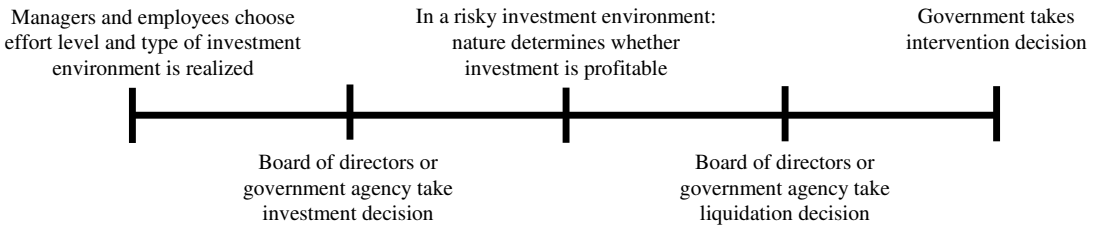

Figure 1: Time structure of the model.

The game extends over several periods, for an illustration see Figure 1. In period 1, the manager chooses an effort level $e \geq 0$. This effort level is neither observed by the board of directors nor by the government agency. In period 2, the type of the investment environment is realized and observed by the board of directors or the government agency. After that, an investment decision is made. The investment $I > 0$ can be used, for example, to modernize or to extend the firm. With probability $p(e)$, the investment environment is "safe" and with probability $1 - p(e)$, the investment environment is "risky". The probability $p(e)$ is increasing and strictly concave in the level of effort e, with $0 < p(e) < 1$ for all e.

In case the investment was made in a safe environment, investing is always profitable. In a risky environment, however, the investment is profitable only with probability α, with $\alpha \in [0, 1]$. The investment payoffs are the net present value of the firm. The board of directors or the government agency observe these payoffs and they (not the managers and employees) have to decide whether to close down and liquidate the firm or to keep it in operation. In the last period, the government decides whether and how to intervene.

Now consider the value of the firm before the government takes its decision. These values are known to the government, the board of directors and the government agency. If an investment is profitable then firm value will be $\overline{V} > 0$, while an unprofitable investment will yield a firm value of $\underline{V} < 0$. In contrast, if no investment was made, the value of the firm will be 0.

The board or the agency can choose to close down the firm, that is, to liquidate its assets. The value of the liquidated assets of a firm where no investment is made is given by $V^L > 0$, while this value is $V^L + I$ when an investment is made. We assume that $\overline{V} > V^L + I$, thus when an investment was made in a firm, and this investment is profitable, the firm's value is larger than its liquidation value.

The social cost that the liquidation of a firm may generate is denoted by $\Delta > 0$. The government, the board of directors and the government agency know whether liquidation entails social costs but these social cost are unobservable to the manager and employees of the firm. If the decision is to liquidate the firm, the government may intervene with general measures, like tax reductions or by nationalizing the private firm.

The decision of the manager

The manager and employees of the firm choose a level of effort e. Independently of the governance structure of the firm, they get a fixed salary $\underline{w}$. When the firm is closed down or when a private firm is nationalized, the manager incurs a utility loss $\Delta^m > 0$. This utility loss is related to the risk of losing a job and other career concerns. Let $x \in \{0, 1\}$ denote the final decision whether to close down the firm

($x = 0$) or to keep it in operation ($x = 1$). Then the manager's utility U is given by

$$U = \underline{w} - (1 - x)\Delta^m - e$$

Note that the manager does not know whether the firm will be closed down when he chooses his effort level. The manager thus chooses e to maximize his expected utility.

The decisions of the board and the agency

The board of directors and the government agency make two decisions. In the second period, they have to decide whether to invest in the firm. For this decision, the board and the agency observe whether there is a safe investment environment. In a safe environment, investing is always profitable and we therefore assume that in a safe environment, the board and the agency always decide to invest. In the second decision, the board and the agency first observe the firm value and then have to decide whether to liquidate the firm.

The board and the agency maximize firm value, but do not take possible social costs into account when taking the liquidation decision. If the value of a firm is smaller than its liquidation value, then a profit-maximizing owner will shut it down and sell off its assets. Without government intervention, the firm is thus closed down when an investment was not profitable (since $V^L + I > \underline{V}$) or when no investment was made (since $V^L > 0$). When an investment is profitable, however, the firm's value is larger than its liquidation value. We therefore assume that the board or the agency only plans to close down firms in which unprofitable or no investments were

made.

The decision of the government

After the board of directors or the government agency plans to close down the firm, the government may intervene and avoid a shutdown of the firm. The government may intervene with general measures, for example with tax reductions or cheap loans, or by nationalizing the private firm. When general measures are used, this intervention can be seen as a transfer to the board or the agency, depending on the continuation of the firm's operations. When an investment was made, this transfer should be $V^L + I - \underline{V}$ to make the board or agency indifferent between closing down and continuing. When no investment was made, this transfer is V^L. For public as well as private firms, we assume that $\Delta > V^L + I - \underline{V}$, so the social costs of a liquidation are higher than the costs of avoiding one.

The government could alternatively nationalize the firm. Note that this is only relevant for private firms. In this case, we assume that the government pays the board of directors an amount V^F and the firm continues in operation as a public firm. We assume that $V^L + I - \underline{V} > V^F > V^L$. When an investment was made, the costs of a nationalization V^F are lower than the costs of general measures $V^L + I - \underline{V}$, because the government can, for example, use expropriation. The political costs are also lower, since the government owns the company after nationalization, and this change in ownership can be presented to the electorate as a justification. When no investment was made, however, general measures cost less and such an electoral justification is less important. The costs of nationalization V^F are, therefore, lower than the costs V^L of general measures, as the government then does not take on

additional entrepreneurial and social responsibilities.

3 The socially optimal allocation

In this section, we consider the unconstrained first-best allocation. We use this as a benchmark for the allocations in public and private firms. In the following, we first look at the government's decision, then at the investment decision and finally at the manager's effort.

From a social point of view, the government should neither intervene when there are no social costs of liquidation, nor when the firm continues to operate. A general intervention should thus only be conducted when a firm is unprofitable, and liquidation would entail social costs.

Now, consider the investment decision. In a safe investment environment, investment is always profitable and should therefore always be undertaken. In a risky environment, an investment should only be made when it has a higher expected payoff than not investing. These payoffs, however, depend on the social costs of closing down the firm. In case liquidation does not entail social costs, not investing and subsequently closing down the firm would yield the liquidation value of the firm. Investing would be profitable with probability α, but an unprofitable investment would again yield the liquidation value of the firm, net of the investment costs. An investment should thus be made when

$$\alpha\overline{V} + (1-\alpha)\left(V^L + I\right) - I > V^L.$$

That is, when $\overline{V} - V^L > I$, i.e. when the firm value $\overline{V}$ after a successful investment is high enough. In case liquidation entails social costs, not investing would yield a payoff equal to zero. Investing would again be profitable with probability α, but an unprofitable investment would yield a loss $\underline{V}$. An investment should thus be made when

$$\alpha\overline{V} + (1-\alpha)\underline{V} - I > 0.$$

That is, when $\alpha\overline{V} + (1-\alpha)\underline{V} > I$, i.e. when the firm value $\overline{V}$ after a successful investment is high enough and the loss $\underline{V}$ after an unsuccessful investment not too big.

Since the investment decision depends on whether liquidation would entail social costs, the welfare-maximizing effort level of the manager also does. In case liquidation does not entail social costs, the welfare-maximizing effort level satisfies

$$e = \arg\max_e \; p(e)\overline{V} + (1-p(e)) \max\left\{\alpha\overline{V} + (1-\alpha)\left(V^L + I\right) - I, V^L\right\} - e$$

and this effort level is uniquely characterized by

$$p'(e) \min\left\{(1-\alpha)\left(\overline{V} - V^L\right) + \alpha I, \overline{V} - V^L\right\} = 1.$$

In case there are social costs of liquidation, the effort level should satisfy

$$e = \arg\max_e \; p(e)\overline{V} + (1-p(e)) \max\left\{\alpha\overline{V} + (1-\alpha)\underline{V} - I, 0\right\} - e$$

and this welfare-maximizing effort level is uniquely characterized by

$$p'(e) \min \left\{ (1-\alpha) \left(\overline{V} - \underline{V} \right) + I, \overline{V} \right\} = 1.$$

In both cases, the manager's effort level equalizes the marginal social benefits and the marginal costs of effort.

4 The public firm

We solve the model by backward induction, first looking at the government's decision, then the agency's and finally at the effort level chosen by the manager.

The government neither intervenes when there are no social costs of liquidation, nor when the firm continues in operation. A general intervention thus only takes place when the government agency plans a liquidation that would entail social costs.

When the government agency decides on investment, the agency knows whether a liquidation would entail social costs and whether there is a safe or a risky investment environment. When the investment decision is made, the agency also takes the social costs of a potential liquidation into account, since these costs influence the intervention decision of the government in the case of a potential liquidation and thus the investment's expected payoff.

In the case without social costs of liquidation, the agency decides to invest when

the expected payoff after investing is larger than without, thus when

$$p(e)\overline{V} + (1 - p(e)) \left[\alpha\overline{V} + (1 - \alpha) \left(V^L + I\right)\right] - I > V^L.$$

That is, when $\left(\overline{V} - V^L - I\right) (p(e)(1 - \alpha) + \alpha) > 0$. Since $\overline{V} > V^L + I$ this is always the case and the agency chooses to invest when there are no social costs of liquidation. When there are social costs of liquidation and the agency plans a liquidation, the government intervenes such that the government agency is indifferent between continuing and closing down the firm. In other words, the payoffs with and without investment are the same as in the case discussed above, and it thus follows that the agency also invests when liquidations are costly. The agency thus always chooses to make an investment. In Section 3, however, we show that under certain circumstances, it is socially optimal not to invest in a firm. Thus from a social point of view, overinvestment takes place in the public firm.

Now consider the decision of the manager. The manager will lose his job if the firm is shut down, that is, when there are no social costs of liquidation and the firm is not profitable. The manager does not know whether there are social costs of liquidation, but has a prior belief q^G about the probability that there are. As we have discussed above, the government agency always decides to invest. With probability $p(e)$, there is a safe investment environment and the firm is always profitable after investment. With probability $1 - p(e)$, however, this investment is made in a risky environment and with a probability $(1 - \alpha)$ the firm will make a loss after the investment. The manager thus anticipates a chance $(1-p(e))(1-\alpha)(1-q^G)$ of losing his job. Therefore,

the manager chooses e such that

$$e = \arg\max_{e} \; w - (1 - p(e))(1 - \alpha)(1 - q^G)\Delta^m - e$$

and the utility-maximizing effort level is uniquely characterized by

$$p'(e)(1 - \alpha)(1 - q^G)\Delta^m = 1. \tag{1}$$

Note that for a higher q^G, the prior belief of the manager that there are social costs of liquidation, the manager chooses a lower effort level e.

5 The private firm

We solve the model backwards, first looking at the government's decision, then the board's and finally at the effort level chosen by the manager.

First note that the government neither intervenes when there are no social costs of liquidation, nor when the firm continues to operate. In case an unprofitable investment was made and the board of directors plans a socially costly liquidation, the government chooses nationalization instead of the implementation of general measures since

$$\Delta + \underline{V} - V^F > \Delta - (V^L + I - \underline{V}),$$

that is, since $V^L + I > V^F$. In case no investment was made and the board plans a socially costly liquidation, the government prefers general measures over national-

ization since

$$\Delta - V^L > \Delta - V^F,$$

that is, since $V^F > V^L$.

When the board of directors decides on investment, the board knows whether there is a safe or a risky investment environment and it knows whether liquidation would entail social costs. In a safe environment, the board invests in the company since $\overline{V} > V^L$. In a risky environment and if liquidation does not entail social costs, the board chooses to invest when the expected payoff after investing is larger than without, that is, when

$$\alpha\overline{V} + (1-\alpha)\left(V^L + I\right) - I > V^L.$$

Since $\overline{V} > V^L + I$, the board invests. In section 2.1, however, we show that it is socially optimal to invest only when $\alpha(\overline{V} - V^L) > I$, so in a risky investment environment without social costs of liquidation, overinvestment takes place in the private firm.

In a risky investment environment with socially costly liquidations, the board chooses to invest when

$$\alpha\overline{V} + (1-\alpha)V^F - I > V^L.$$

That is, when $\alpha\overline{V} + (1-\alpha)V^F - V^L > I$. So the board will invest if the firm values $\overline{V}$ after a successful and V^F after an unprofitable investment are large enough. In this case, it is socially optimal to invest when $\alpha\overline{V} + (1-\alpha)\underline{V} > I$. When $V^F = \underline{V} +$

$V^L/(1-\alpha)$, these two conditions are equivalent, and the government can thus induce private firms to choose the optimal level of investment. When V^F is smaller than this value, the board of directors invests too little, since potential nationalizations after investments are too costly, while with a V^F bigger than this value, the board would invest too much.

Now consider the decision of the manager. The manager will lose his job if the firm is shut down, that is, when there are no social costs of liquidation and the firm is not profitable. The manager does not know whether there are social costs of liquidation, but has a prior belief q^P about the probability that there are. As we have discussed above, the board of directors chooses to invest in the firm when there is a safe investment environment and the firm is always profitable after this investment. However, the manager does not know whether the board will invest in a risky environment, nor whether such an investment will be profitable. From the discussion above it follows that in a risky investment environment without social costs of liquidation the board of directors always invests and, by assumption, an investment is profitable with probability α. So the manager knows that there is a probability of $(1-q^P)(1-\alpha)$ of losing his job in a risky environment without social costs. When there are social costs of liquidation, the manager expects that there is a probability $\mu \in [0,1]$ that the board invests in a risky environment and, by assumption, such an investment is profitable with probability α. The manager knows that there is a probability of $q^P\mu(1-\alpha)$ of losing his job in a risky environment with social costs of liquidation. Since the probability that there is a risky investment environment is $1-p(e)$, the manager faces a probability of $(1-p(e))(1-\alpha)[(1-q^P)+q^P\mu]$.

Therefore, the manager chooses e such that

$$e = \arg\max_{e} \; w - (1 - p(e))(1 - \alpha) \left[(1 - q^P) + q^P \mu \right] \Delta^m - e$$

and the utility-maximizing effort level is uniquely characterized by

$$p'(e)(1 - \alpha) \left[(1 - q^P) + q^P \mu \right] \Delta^m = 1. \tag{2}$$

Note that for a higher q^P, the prior belief of the manager that there are social costs of liquidation, the manager chooses a lower effort level e.

6 Discussion and extensions

In this section, we compare the investment levels in the public and private firm and then we discuss the effort levels chosen in both cases. As a robustness check, we then change the assumption that the board of directors of a private firm observes the social costs of a potential liquidation. Finally, we extend the model by additional periods to discuss the effect that an intervention has on effort levels.

Allocative efficiency: Investment levels

Now look at the investment levels I^G and I^P chosen by the government agency and the board of directors, respectively. Recall that the agency always chooses to invest, so $I^G = I$. The board, however, chooses $I^P = I$ only in (i) a safe investment environment or (ii) a risky environment when liquidation does not entail social costs

or (iii) a risky environment when liquidation entails social costs where $\overline{V}$ and V^F are big enough. Moreover, when the government chooses $V^F = \underline{V} + V^L/(1-\alpha)$, investment levels are socially optimal in private firms where a potential liquidation would entail social costs. Public firms, however, always invest and there is thus more investment in public firms than socially optimal so that allocative efficiency is lower than in private firms. These considerations are summarized in the following proposition.

Proposition 1 *Private firms achieve higher allocative efficiency than public firms.*

This result contrasts with the existing literature. In Schmidt and Schnitzer (1993) and Schmidt (1996), for example, allocative efficiency is higher in public firms, since socially costly liquidations are avoided. In the existing literature, however, it is often assumed that public firms cannot be liquidated or that the government cannot avoid the liquidation of private firms. We contend, on the contrary, that governments can also intervene in private firms. Additionally, the investment incentives are often not studied explicitly, and the results on allocative efficiency are only based on liquidation decisions, even though public ownership can distort the investment decision.

Productive efficiency: Effort levels

Now look at the manager's effort levels e^G and e^P in the cases where the manager is working for either a public or a private firm, respectively. The levels of effort are implicitly given by first order conditions. That is, for the public firm $p'(e^G)(1-\alpha)(1-q^G)\Delta^m = 1$, and for the private firm $p'(e^P)(1-\alpha)[(1-q^P)+q^P\mu]\Delta^m = 1$. Note that e^P is bigger than e^G if and only if $q^P + q^P\mu > 1 - q^G$.

In the existing literature, it is often assumed that the managers and employees of private firms believe that the government does not intervene in case of a liquidation of the firm, so $q^P = 0$, while the managers and employees of the public firm believe that the government does, so $q^G = 1$. In this case, clearly e^P is higher than e^G. This is a typical extreme case analyzed, for example, in the model of governance structures in Schmidt and Schnitzer (1993). In private firms, managers and employees choose higher effort levels because there is a bigger probability that otherwise they will lose their jobs and productive efficiency is thus higher in private firms. In the Introduction, however, we argue that the liquidation of private firms can also entail social costs and that the government can also intervene in favor of public firms. We therefore additionally consider the case $q^P = q^G$.

When the managers of private and public firms believe that the government will not intervene after a potential liquidation of these firms, that is if $q^P = q^G = 0$, then the effort levels are the same in both cases and are defined by $p'(e)(1 - \alpha)\Delta^m = 1$. This could be the case when, for example, a competition authority prevents interventions or when liquidations do not entail social costs. The latter could be the case when the firms are small. When for instance banks are small their liquidation would not pose systemic risks and thus entail limited or no social costs, so the government would not intervene after a liquidation. When managers and employees of public and private firms, however, believe that liquidation might entail social costs, that is if $q^P = q^G => 0$, then the manager's effort level is higher in the private firm than in the public firm, This is summarized in the following proposition.

Proposition 2 *Private firms achieve higher productive efficiency than public firms*

only when governmental interventions are possible.

When the government does not intervene, neither in public nor in private firms, managers and employees face the same risk of losing their jobs and thus choose the same effort levels, so that productive efficiency is the same in public and private firms. When the government may intervene, however, the managers and employees of private firms face a higher risk and productive efficiency is then higher in private firms.

Social costs not known to board of directors

In this part, we assume that the board of directors does not know whether liquidation of the private firm would entail social costs. This captures the idea that the public differs from the private sector in that it knows whether liquidation entails social costs. However, it does not observe whether there is a safe investment environment, while in the private sector the liquidation costs are not known but it is known whether the investment environment is safe or not. In this subsection we show that the results do not change qualitatively, only the notation is slightly more complicated.

First note that the intervention decision made by the government remains the same after changing this assumption, so we can use the results discussed in Section 5. Now look at the investment decision. The board of directors does not know whether there are social costs of liquidating the firm, but has a prior belief about the probability that there are. To economize on notation, assume this is the same prior q^P the manager has. When there is a safe investment environment, the board invests. When the board invests in a risky environment, the expected value of the firm is $\alpha\overline{V}+(1-\alpha)V^F-I$ if there are social costs of liquidation and $\alpha\overline{V}+(1-\alpha)\left(V^L+I\right)-I$

if there are no social costs. The board therefore invests if

$$q^P \left[\alpha\overline{V} + (1-\alpha)V^F - I\right] + \left(1-q^P\right)\left[\alpha\overline{V} + (1-\alpha)\left(V^L + I\right) - I\right] > V^L.$$

That is, when $\alpha\overline{V} + q^P(1-\alpha)V^F - \left(\alpha + q^P - \alpha q^P\right) I > \left(\alpha + q^P - \alpha q^P\right) V^L$. So the board invests if the firm values $\overline{V}$ and V^F after investment are large enough. Note that the manager can also make these calculations and therefore knows whether the firm invests in a risky environment. In case it does, the manager's effort level is given by (2) with $\mu = 1$, otherwise (2) with $\mu = 0$.

After an intervention

In this subsection, we look at an extension with two periods in which the government intervened in the first period and we subsequently look at the incentives in the second period. Crucial for this is that, after an intervention, the manager learns that a liquidation of the firm would entail social costs. In the following discussion, we assume that an intervention took place in the first period. Note that in the period after an intervention, the government has the same incentives to intervene as before. Nationalization, however, changes the incentives of the government since a private firm becomes public, making nationalization no longer an option. The investment decision after an intervention is also the same since also in the first stage the agency and the board of directors by assumption know whether liquidation of the firm would entail social costs. Nationalizing a private firm thus induces overinvestment. After an intervention, the manager of a public firm also adjusts (i.e. increases) his prior belief of the probability q^G that liquidation would entail social costs and (1) implies

that he chooses a lower effort level. The manager who works for a nationalized firm knows that liquidation is unlikely, and (1) again implies that he chooses a low effort level. Finally, an intervention implies that the manager of a private firm also adjusts (i.e. increases) his prior belief of the probability q^P that liquidation would entail social costs and from (2) it follows that he chooses a lower effort level, too.

7 Concluding remarks

We develop a theoretical framework in which there are public and private firms and a government. When a firm becomes insolvent, the government can intervene with general measures like tax reductions or by nationalizing the private firm. The government only intervenes when the bankruptcy of a firm entails social costs and these interventions may therefore enhance allocative efficiency. Since the government can intervene in public as well as private firms, allocative efficiency of private firms does not need to be smaller. Nationalization takes place when there are social costs of a potential liquidation and loss-making investments were made in a private firm. This implies that there is less overinvestment in private firms, and for this reason allocative efficiency can actually be higher in private firms.

The model also suggests which impact a potential intervention has on the effort levels chosen by the managers working for the firms. When the managers of private and public firms believe that liquidation of these firms entails no social costs or that government intervention is unfeasible then the effort levels and productive efficiency are the same in public and private firms. On the other hand, when the managers

of private and public firms believe that liquidation of these firms entails social costs then the manager's effort level is higher in the private firm than in the public firm. Managers and employees of private firms choose higher effort levels because there is a bigger probability that otherwise they will lose their jobs.

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