This is the published version of a paper published in *Journal of Economic Policy Reform*.

Citation for the original published paper (version of record):

Nationalizations, bailouts and efficiency
*Journal of Economic Policy Reform*
https://doi.org/10.1080/17487870.2019.1566065

Access to the published version may require subscription.

N.B. When citing this work, cite the original published paper.

Permanent link to this version:
http://urn.kb.se/resolve?urn=urn:nbn:se:kau:diva-71739
Nationalizations, bailouts and efficiency

Ernesto Crivelli & Klaas Staal

To cite this article: Ernesto Crivelli & Klaas Staal (2019): Nationalizations, bailouts and efficiency, Journal of Economic Policy Reform, DOI: 10.1080/17487870.2019.1566065

To link to this article: https://doi.org/10.1080/17487870.2019.1566065

© 2019 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.

Published online: 26 Feb 2019.

Submit your article to this journal

Article views: 93

View Crossmark data
Nationalizations, bailouts and efficiency

Ernesto Crivelli\textsuperscript{a} and Klaas Staal\textsuperscript{b,c}

\textsuperscript{a}International Monetary Fund, Washington, DC, USA; \textsuperscript{b}Karlstad Business School, Karlstad University, Karlstad, Sweden; \textsuperscript{c}Institute for International Economic Policy, Bonn University, Bonn, Germany

ABSTRACT

We develop a theoretical model in which there are public and private firms and a government. When firms become insolvent, the government can intervene with bailouts or nationalizations. The government only intervenes when the bankruptcy of a firm entails social costs. In this setting, we analyze how government interventions affect allocative and productive efficiency. Nationalizations of private firms after unprofitable investments lead to increased allocative efficiency despite private ownership. The effort level chosen by the managers and employees working for a firm is also affected by the possibility of government interventions, reducing the productive efficiency advantage of private firms.

Policy Highlights

- Standard arguments in the literature are that employees of private firms work harder, but that public firms allocate resources more efficiently if externalities exist.
- This paper provides a stylized model reflecting the fact that governments often bailout (or even nationalize) bankrupt private firms in the presence of social welfare considerations.
- The standard results in the literature are contested. In fear of government intervention, private firms partially internalize externalities, while public firms tend to overinvest, thus reducing the productive-efficiency lead of public firms.
- Additionally, government interventions have negative effects on the incentives of employees to work, thus resulting in lower productive efficiency in the private sector.

Introduction

The privatization of state-owned enterprises figures prominently in transition economics where attention is given to the replacement of hierarchical decisions in a formerly centrally planned economy with the incentives of multiple profit-maximizing producers. This paper focuses on two efficiency arguments commonly used in transition economics. The first one, productive efficiency, claims that production is more efficient in a privatized firm because better incentives can be given to managers and employees.
The intuition is that privatized firms face a larger risk of liquidation than public firms, and managers and employees thus face a larger risk of losing their jobs 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 associated with firm liquidations, whereas the private owners just maximize their payoff.

In transition economics it is argued that a privatization enhances efficiency by hardening the budget constraint. 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 Shleifer and Vishny (1994) point out that the government may rescue firms in return for political support. Foarta (2016) studies the political feasibility of targeted and untargeted transfers aimed at helping firms. Using a model in which voters have less information than politicians, she argues that voters can induce politicians to shift towards untargeted transfers. 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, 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). Hence, in an extensive survey of the empirical literature, Mühlenkamp (2015) finds that there is no support for the claim that private firms are more efficient than public firms.²

We consider two possible forms of government intervention: bailouts and nationalizations. One of the main differences with the closely-related existing theoretical literature is that the government can also intervene in private firms. For the board of directors of a private firm, a bailout is preferred over a nationalization, as the latter may imply that they lose their jobs or that they have to repay their bonuses. Managers and employees have similar incentives, since nationalization may imply reputation damage and the loss of the shares they own in their company.³ The government, however, prefers nationalization over a bailout in cases where the latter becomes more costly. We contend that this is the case when firms have grown too large.

Our main findings are that allocative efficiency is higher in private firms, while productive efficiency decreases when government intervention becomes more likely.⁴ The theoretical framework follows Schmidt and Schnitzer (1993) and Schmidt (1996a, 1996b), but our result on allocative efficiency differs substantially. In these three papers, allocative efficiency is larger in public firms, as private owners only consider profitability. We argue that allocative efficiency can be larger in private firms, however, since the subsidization of unprofitable public firms induces overinvestment. This provides a rationale for public ownership, as the possibility of nationalization increases the allocative efficiency of private firms. Besides, it is argued in these papers that productive efficiency is lower in the public sector, as managers and employees run a smaller risk of losing their jobs. We argue, however, that government interventions in favor of private firms have a similar negative effect on productive efficiency in the private sector as subsidization of unprofitable firms in the public sector.⁵ These differences are due to the fact that we do not exclude the possibility that public firms, like private firms, can be liquidated and that the government can intervene in private firms.
Our results have also implications for the policy responses to the Great Recession. Several governments intervened with bailouts and nationalizations in the operations of (semi-)public as well as private firms, for example HypoRealEstate, Bayerische Landesbank, General Motors, AIG, FannieMae and FreddieMac. Our findings imply that these interventions can have detrimental effects on productive efficiency, as it can lower the incentives for managers and employees. Moreover, our results suggest that allocative efficiency may get even worse after these interventions, as overinvestment may become more prevalent after nationalizations. Our results also lend support to the EU directive on bank recovery and resolution, which ensures that bank’s shareholders and creditors bear losses (European Parliament, Council 2014). We show that this reduces the incentives for overinvestment and thus improves allocative efficiency.

Hart, Shleifer, and Vishny (1997) model privatization as governments contracting out the provision of goods, while, e.g. Bennet and Iossa (2006), Chen and Chiu (2010) and Martimort and Pouyet (2008) also consider the difference between public and privatized firms due to contract incompleteness, as private owners have the residual control rights and therefore an incentive to cut costs and/or quality. These approaches, however, do not consider both allocative and productive efficiency in the way we do in this paper. De Fraja (1993) uses a principal-agent model and Lülfesmann (2007) contains, as we do, that a government can intervene in private firms. Both papers do not present a similar allocative-efficiency result as we do in this paper. Productive efficiency, however, can be lower in private firms as the owners of private firms only consider profitability when making decisions over wages while a welfare-maximizing government also takes the potentially larger effects on social welfare into account.

Some studies on privatization focus on the political features of the privatization process. The political benefits and costs of privatization and government intervention in firms is studied by, e.g. Shleifer and Vishny (1994) and Choi (2011). This approach has a different focus (the tradeoff between quality and cost reduction or between tax revenue and social welfare) and usually other models are used than the one in this paper, with the exception of Börner (2004), who argues that both voter-oriented and egoistic governments can have inefficiently high incentives to privatize, and that these inefficiencies can be reduced by improving the institutional environment.

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.

The model

In this section we introduce and compare two governance structures for a firm. We assume that a firm is either privately or publicly owned. We do not model explicitly the possibility of multiple companies.

Each firm employs managers and employees, who have to decide on the amount of effort to put into work. The investment opportunities and thus firm values are influenced by this effort level. A possible 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. Career concerns also shape incentives. A liquidation of a firm implies that managers and employees become unemployed, while a liquidation or a nationalization can be interpreted as a signal of 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 both 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 create negative external effects. These social costs are not taken into account by a profit-maximizing owner but may induce the government to intervene. The government’s objective is to avoid these social costs of a liquidation.

The game extends over several periods, for an illustration see Figure 1. In period 1, the managers and employees choose 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 \( I > 0 \) is used to enlarge 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 \( \alpha \), with \( \alpha \in [0, 1] \). The investment payoffs are the net present value of the firm. The board of directors or the government agency observes these payoffs and they (not the managers or 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 \( \bar{V} > 0 \), 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 \( \underline{V}L > 0 \), while this value is \( V^L + I \) when an investment is made. We assume that \( \bar{V} > V^L + I \), thus when an investment was made in a firm, and this investment is profitable, the firm’s value is larger than its liquidation value. Moreover, \( V^L + I > \underline{V} \), so when an unprofitable investment was made, the value of the liquidated assets is larger than the firm’s value when the firm continues in operation.

The social costs 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 costs are unobservable to the manager and employees of the firm. If the decision is to liquidate the firm, the government may intervene with a bailout or by nationalizing the private firm.
Managers and employees choose effort level and type of investment environment is realized

In a risky investment environment:
   nature determines whether investment is profitable

Board of directors or government agency take investment decision

Government takes intervention decision

Board of directors or government agency take liquidation decision

Figure 1. Time structure of the model.
The decision of the managers and employees

The managers and employees of the firm choose a level of effort \( e \). Independently of the governance structure of the firm, they get a fixed salary \( w \). When the firm is closed down or when a private firm is nationalized, the managers and employees incur a utility loss \( \Delta^m > 0 \). This utility loss relates 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 \((x = 1)\). Utility \( U \) is then given by

\[
U = w - (1 - x)\Delta^m - e.
\]

Note that the managers and employees do not know whether the firm will be closed down when choosing an effort level, they thus choose \( e \) to maximize 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 thus 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 \( V^L + I > V \)) 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 to prevent the social costs of a firm liquidation. The government may intervene with a bailout, for example with subsidized loans, or by nationalizing the private firm. When a firm is bailed out, this intervention can be seen as a transfer \( V^B_G \) to the board or the agency, to make the board or agency indifferent between closing down and continuing. The government could alternatively nationalize the private firm. A nationalization can be seen as a transfer \( V^N_G \) to the board of directors, and the continuation of the firm as a public one. When there are social costs of liquidation, then \( \Delta > V^B_G \) and \( \Delta > V^N_G \), so the social costs of a liquidation of a public or a private firm are higher than the costs of avoiding one.
The socially optimal allocation

In this section, we consider the unconstrained first-best allocation in which an omniscient benevolent planner takes decisions. 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 effort level chosen by the managers and employees.

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 bailout 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 \( \alpha \), 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

\[
a \bar{V} + (1 - \alpha)(V^L + I) - I > V^L.
\]

Since \( \bar{V} > V^L + I \), it is always socially optimal to invest when there are no social costs of a potential liquidation. In case liquidation entails social costs, not investing would yield a payoff equal to zero. Investing would again be profitable with probability \( \alpha \), but an unprofitable investment would yield \( V \). An investment should thus be made when

\[
a \bar{V} + (1 - \alpha)\bar{V} - I > 0.
\]

(1)

That is, when the values \( \bar{V} \) and \( \bar{V} \) are high enough.

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

\[
e = \arg \max_e p(e)\bar{V} + (1 - p(e))\{a\bar{V} + (1 - \alpha)(V^L + I) - I\} - e
\]

and this effort level is uniquely characterized by

\[
p'(e)((1 - \alpha)(\bar{V} - V^L) + \alpha I) = 1.
\]

(2)

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

\[
e = \arg \max_e p(e)\bar{V} + (1 - p(e))\max\{a\bar{V} + (1 - \alpha)\bar{V} - I, 0\} - e
\]

and this welfare-maximizing effort level is uniquely characterized by

\[
p'(e)\min\{(1 - \alpha)(\bar{V} - \bar{V}) + I, \bar{V}\} = 1
\]

(3)
In both cases, the welfare-maximizing effort level of managers and employees equalizes the marginal social benefits and the marginal costs of effort.

**The public firm**

We consider a subgame-perfect Nash equilibrium, solving 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 and employees.

The government neither intervenes when there are no social costs of liquidation, nor when the firm continues in operation. A bailout 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 a safe investment environment, the agency invests in the firm since \( \bar{V} > V^L \). In a risky environment and if liquidation does not entail social costs, the agency chooses to invest when the expected payoff after investing is larger than without, that is, when

\[
\alpha \bar{V} + (1 - \alpha)(V^L + I) - I > V^L.
\]

Since \( \bar{V} > V^L + I \) 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 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 follows that the agency 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 and employees. They will become unemployed if the firm is shut down, that is, when there are no social costs of liquidation and the firm is not profitable. The manager and employees do not know whether there are social costs of liquidation, but have 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 and employees thus anticipate a chance \( (1 - p(e)) (1 - \alpha)(1 - q^G) \) of becoming unemployed. Therefore, they choose \( e \) such that

\[
e = \arg \max_e \left[ w - (1 - p(e))(1 - \alpha)(1 - q^G) \Delta^m - e \right]
\]
and the utility-maximizing effort level is uniquely characterized by

\[ p'(e)(1 - \alpha)(1 - q^G)\Delta^m = 1 \]  

(4)

Note that a higher \( q^G \), the prior belief that there are social costs of liquidation, results in a lower effort level \( e \). A comparison with the socially optimal effort level (cf. expressions 2 and 3) reveals that the manager and employees do not take into account the losses the firm could make, but only the potential individual utility loss \( \Delta^m \) of unemployment.

**The private firm**

We again consider a subgame-perfect Nash equilibrium, solving the model backwards, first looking at the government’s decision, then the board’s and finally at the effort level chosen by the manager and employees.

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, however, the government can make the board indifferent between closing down and continuing (i.e. bailout the firm) by making a transfer \( V_B^G = V_L + I - V \). When no investment is made, such a bailout would cost the government \( V_B^G = V_L \). Alternatively, the government could nationalize the firm and make a transfer \( V_N^G \) to the board of directors. From the discussion of the investment incentives of the board of directors below it follows that the government chooses \( V_N^G = V + V_L/(1 - \alpha) \) to induce private firms to choose the socially optimal investment level. When no investment is made and a socially costly liquidation is planned, the government therefore prefers a bailout over a nationalization since \( V_B^G = V_L < V + V_L/(1 - \alpha) = V_N^G \). When an investment is made and a socially costly liquidation is planned, the government prefers a nationalization over a bailout if \( V_N^G = V + V_L/(1 - \alpha) < V_L + I - V = V_B^G \), that is when \( I > 2V + \frac{\alpha}{1 - \alpha}V_L \), so when the investment \( I \) exceeds a cutoff value. To simplify the discussion of the results, we will focus on the case in which the investment indeed exceeds this cutoff value. We formalize the above in Lemma 1.

**Lemma 1** In case the board of directors plans a socially costly liquidation, the government chooses to bailout if no investment was made by making a transfer \( V_B^G = V_L \), while the government chooses to nationalize if an investment was made, making a transfer \( V_N^G = V + V_L/(1 - \alpha) \) to the board of directors.

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 a liquidation would entail social costs. In a safe environment, the board invests in the company since \( V > V_L \). 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

\[ \alpha V + (1 - \alpha)(V_L + I) - I > V_L. \]
Since $\bar{V} > V^L + I$, the board invests. This is the same investment decision as the one presented in Section 3 and the investment decision in a private firm is thus socially optimal when there is a risky investment environment and no social costs of a potential liquidation.

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

$$\alpha \bar{V} + (1 - \alpha) V^N_{G} - I > V^L.$$  

So the board will invest if the firm values $\bar{V}$ after a successful and $V^N_{G}$ after an unprofitable investment are large enough. In this case, it is socially optimal to invest when $\alpha \bar{V} + (1 - \alpha) V > I$ (cf. expression 1). When $V^N_{G} = V + V^L/(1 - \alpha)$, these two conditions are equivalent, and the government can thus induce private firms to choose the optimal level of investment. Note that when $V^N_{G} < V + V^L/(1 - \alpha)$, the board of directors would invest too little, since potential nationalizations after investments are too costly, while with a bigger $V^N_{G}$, the board would invest too much.

Now consider the decision of the managers and employees. They will become unemployed if the firm is shut down, that is, when there are no social costs of liquidation and the firm is not profitable. The manager and employees do not know whether there are social costs of liquidation, but have a prior belief $q^p$ about the probability that there are. As we discuss 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 and employees do 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 $\alpha$. So the managers and employees know that there is a probability of $(1 - q^p)(1 - \alpha)$ becoming unemployed in a risky environment without social costs. The managers and employees will also incur a utility loss when the firm is shut down, that is, when there are social costs of liquidation and the firm is not profitable. When there are social costs of liquidation, the manager and employees expect 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 $\alpha$. The manager and employees know that there is a probability of $q^p \mu (1 - \alpha)$ of a nationalization in a risky environment with social costs of liquidation. Since the probability that there is a risky investment environment is $1 - p(e)$, the likelihood of liquidation or nationalization is $(1 - p(e))(1 - \alpha) [(1 - q^p) + q^p \mu]$ of becoming unemployed. Therefore, the managers and employees choose $e$ such that

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

and the utility-maximizing effort level is uniquely characterized by

$$p'(e)(1 - \alpha) [(1 - q^p) + q^p \mu] \Delta^m = 1 \quad (5)$$

Note that a higher $q^p$, the prior belief that there are social costs of liquidation, results in a lower effort level $e$. A comparison with the socially optimal effort level (cf.
expressions 2 and 3) reveals that the managers and employees do not take into account the losses the firm could make, but only the potential individual utility loss $\Delta^m$ due to liquidations or nationalizations.

**Main results and extensions**

In this section, we first present the main results of this paper on allocative and productive efficiency, respectively. As robustness checks, we then change the assumptions that the government agency observes whether there is a safe investment environment in the public firm and subsequently, that the board of directors knows whether there are social costs of a liquidation of the private firm. As an additional robustness check, we show that the main results also carry over when some of the investment is a sunk cost. We further discuss in more detail the assumptions on the wages in public and private firms and the utility losses due to liquidation and nationalization.

**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 $\hat{V}$ and $V^N_G$ are big enough. Moreover, since the government chooses $V^N_G = \hat{V} + V^L/(1 - \alpha)$, 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 allocative efficiency is lower. 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 (1996a), for example, allocative efficiency is higher in public firms, since socially costly liquidations are avoided. In these papers, however, it is 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 not studied explicitly in these papers, 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 managers’ and employees’ effort levels $e^G$ and $e^P$ in the cases where they are working for either a public or a private firm, respectively. The levels of effort are implicitly given by first order conditions, that is, by Equations (4) and (5). Note that $e^P$ is bigger than $e^G$ if and only if $q^P(1 - \mu) < q^G$.
In, e.g. Schmidt and Schnitzer (1993), it is 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 \( e_G \). 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 private firms. We therefore additionally consider the case \( q_P = q_G \).

When the managers and employees 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 given 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 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, and productive efficiency decreases when governmental interventions are more likely.

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 than in public firms.

**Investment environment not known to government agency**

As a robustness check, assume now that the government agency does not know whether there is a safe investment environment. This captures the idea that the public differs from the private sector in that it knows whether there are social costs of a potential liquidation but not whether there is a safe investment environment.

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 4. Now look at the investment decision. The government agency does not observe whether the investment environment is safe. When there are no social costs of liquidation, the agency decides to invest when the expected payoff after investing is larger than without, thus when

\[
p(e)\bar{V} + (1 - p(e))\left[\alpha\bar{V} + (1 - \alpha)(V^L + I)\right] - I > V^L.
\]
That is, when \((V - V^L - I)(p(e)(1 - \alpha) + \alpha) > 0\). Since \(\bar{V} > V^L + I\) 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 the agency also invests when liquidations are costly, so the government agency always chooses to make an investment. It thus follows that not only the intervention and investment decisions are the same as discussed in Section 4, but also the effort decision made by managers and employees, so the results do not change qualitatively.

**Social costs not known to board of directors**

We assume here that the board of directors does not know whether a potential liquidation of the private firm would entail social costs. This captures the idea that the private differs from the public sector in that it observes whether there is a safe investment environment, but not whether a potential liquidation entails social costs. 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 \(q^p\) as the managers and employees have. 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 \(\alpha \bar{V} + (1 - \alpha)V^N_G - I\) if there are social costs of liquidation and \(\alpha \bar{V} + (1 - \alpha)(V^L + I) - I\) if there are no social costs. The board therefore invests if

\[
q^p[\alpha \bar{V} + (1 - \alpha)V^N_G - I] + (1 - q^p)[\alpha \bar{V} + (1 - \alpha)(V^L + I) - I] > V^L.
\]

That is, when \(\alpha \bar{V} + q^p(1 - \alpha)V^N_G - (\alpha + q^p - \alpha q^p)I > (\alpha + q^p - \alpha q^p)V^L\). So the board invests if the firm values \(\bar{V}\) and \(V^N_G\) after investment are large enough. Note that the managers and employees can also make these calculations and therefore know whether the firm invests in a risky environment. In case it does, the effort level is given by (5) with \(\mu = 1\), otherwise (5) with \(\mu = 0\). In both cases, however, the results on allocative and productive efficiency do not change qualitatively.

**Investments as sunk costs**

An alternative assumption is that some of the investment is a sunk cost, that is, the liquidation value of an investment \(I\) is \(\lambda I\), with \(0 < \lambda < 1\). When an investment was made in a firm, the liquidation value thus becomes \(V^L + \lambda I\). In addition, we slightly alter one assumption, as we now suppose that \(V^L + \lambda I > V^N_G\). We show below that the main results on allocative and productive efficiency then do not change qualitatively.
First, consider the socially optimal allocation. We consecutively look at the government’s decision and the investment decision. As in Section 3, the government should only intervene when a firm is unprofitable, and liquidation would entail social costs. When there are no social costs of liquidation, an investment should be made when

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

That is, when $$\tilde{V} - V^L > \frac{1}{a} \left[ 1 - (1 - \alpha)\lambda I \right]$$, so analogous to Section 3 when the firm value $$\tilde{V}$$ after a successful investment is high enough. In case liquidation entails social costs, the decision to invest is the same as discussed in Section 3.

Now, consider the public firm. We now consecutively look at the government’s decision, the investment decision and the effort level. As in Section 4, the government should only intervene when a liquidation would entail social costs and the government agency plans a liquidation. When there are no social costs of liquidation, the agency decides to invest when

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

That is, when $$\tilde{V} - V^L > f(\lambda)I(p(e)(1 - \alpha) + \alpha) > 0$$ with $$0 < f(\lambda) < 1$$. Since $$\tilde{V} > V^L + I > V^L + f(\lambda)I$$, this is always the case and the agency thus always chooses to invest when there are no social costs of liquidation. Following the same reasoning as in Section 4, the agency also always chooses to make an investment when there are social costs of liquidation. From a social welfare point of view, overinvestment thus takes place in the public firm. Finally, it is straightforward to see that the effort level chosen by the manager and employees is given by expression (4).

Now, consider the private firm. We consecutively look at the government’s decision, the investment decision and the effort level. As in Section 5, the government should only intervene when a liquidation would entail social costs and the government agency plans a liquidation. When an investment was made, then the government prefers nationalization over a bailout since

$$\Delta + \tilde{V} - V^N_G > \Delta - (V^L + \lambda I - \tilde{V}),$$ 

that is, since $$V^L + \lambda I > V^N_G$$. As in Section 5, the government will prefer a bailout if no investment is made. When there are no social costs of liquidation, the board of directors decides to invest when

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

That is, when $$\tilde{V} > V^L + f(\alpha, \lambda)I$$ with $$f(\alpha, \lambda) > 1$$. The board thus invests when the firm value $$\tilde{V}$$ after a successful investment is high enough, so there might be over- or underinvestment from a social welfare point of view. In case liquidation entails social costs, the decision to invest is the same as discussed in Section 5, so also in this case, there might be over- or underinvestment. With choosing the right value of $$V^N_G$$, however, the government can ensure socially optimal investment levels. Finally, it is straightforward to see that the effort level chosen by the managers and employees is given by expression (5).
From the above, it follows that there is always overinvestment in the public firm while, depending on the parameters, there might be over- or underinvestment in the private firm. The government can nonetheless ensure socially optimal investment levels when there are social costs of liquidation, and private firms can thus still achieve higher allocative efficiency than public firms. The effort levels of the managers and employees are similar to the levels discussed in Sections 4 and 5, so the discussion of productive efficiency does not change qualitatively either.

**The objective of the public firm**

In the model, public firms are like private firms profit maximizers. The government can impose profit maximization as a way to increase productive efficiency in public firms. Alternatively, if allocative efficiency is deemed to be more important for the government, for example because it is seen as having a bigger impact on social welfare than productive efficiency, the government could choose to give the maximization of allocative efficiency as an objective for the government agency that takes the investment decision in public firms.

With an allocative-efficiency objective and given the effort levels of the manager and employees, the government agency takes the socially optimal investment decision as discussed in Section 3. Anticipating this investment decision, the effort level chosen by managers and employees is the same as in expression (4), as their risk of becoming unemployed does not change. Obviously, a different objective for the public firm does not change the investment and effort-level decisions in private firms. Private firms thus still achieve higher productive efficiency than public firms. Recall that if the government chooses the transfers given in Lemma 1, then for the effort levels chosen by managers and employees the board of directors takes the socially optimal investment decisions. The higher effort levels in private firms thus implies that allocative efficiency in private firms remains higher than in public firms, as the probability of a successful investment is higher in private firms.

**The incentives for managers and employees**

In the above, we assume that the managers and employees earn the same wage in public and private firms. de Castro, Salto, and Steiner (2013) indeed show that, depending on the job position, wages can be higher or lower in the public sector (with negative at higher and positive wage premia at lower positions). We also assume so far that the utility loss incurred by the managers and employees is the same due to liquidation or nationalization of the firm. The former loss can be based on career concerns due to becoming unemployed, the latter on losing the shares in the nationalized firm (as mentioned in the introduction) or on, for example, the organization of Congressional hearings and forced resignations of some of the firm’s managers and employees as in the nationalization of General Motors. Therefore, we now assume that political decision-makers have the possibility to make the managers and employees either better or worse off after nationalization.

First note that this does not change the social optimum or the outcome of the public firm. The investment and liquidation decisions of the board of directors and the choice by the government to bailout or to nationalize do not change either. Then consider the
decision of the managers and employees. Following the same reasoning as in Section 5, the probability of becoming unemployed is \((1 - p(e))(1 - \alpha)(1 - q^P)\) and the probability of a nationalization is \((1 - p(e))(1 - \alpha)q^P\mu\). Therefore, the managers and employees choose \(e\) such that
\[
e = \arg\max_e \left[ w - (1 - p(e))(1 - \alpha)\left[(1 - q^P)\Delta^m_U + q^P\mu\Delta^m_N\right] - e \right]
\]
where \(\Delta^m_U\) and \(\Delta^m_N\) denote the changes in utility due to unemployment and nationalization, respectively. The utility-maximizing effort level is uniquely characterized by
\[
p'(e)(1 - \alpha)\left[(1 - q^P)\Delta^m_U + q^P\mu\Delta^m_N\right] = 1. \tag{6}
\]
From this expression and the socially optimal levels characterized by (2) and (3) it follows that the government chooses a (dis)utility \(\Delta^m_N\) of nationalization given by
\[
\Delta^m_N = \frac{(1 - \alpha)(1 - q^P)}{q^P\mu} \Delta^m_U - \frac{(1 - \alpha)(\bar{Y} - \bar{V}) + \alpha I}{q^P\mu},
\]
the former when there are no social costs of liquidation, the latter when there are. These expressions imply that only if \(\Delta^m_U\), the individual disutility of unemployment, is large compared to a weighted sum of the firm and investment values then the government will choose \(\Delta^m_N > 0\): only in this case, the payoff of managers and employees of a private firm would increase due to a nationalization. Another result follows from comparing the effort level (6) with the socially optimal effort levels (2) and (3): only if the government chooses a \(\Delta^m_N\) that exceeds a (negative) threshold, the private firm will be less productive than the public firm.

**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 a bailout 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 lower. 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; for this reason and in contrast with the existing literature, allocative efficiency can be higher in private firms. This provides an additional indirect rational for public intervention, as a potential nationalization forces private firms to increase allocative efficiency.

The model also suggests which impact a potential intervention has on the effort levels chosen by the managers and employees working for the firms. When managers and employees of private and public firms believe that liquidation of these firms entails no social costs or that government intervention is unfeasible then, also in contrast with the existing literature, the effort levels and productive efficiency are the same in public and private firms. On the other hand, when the managers and employees of private and public
firms believe that liquidation of these firms entails social costs then their effort level is higher in the private firm than in the public firm, but overall lower than without intervention.

Notes


2. Closely related to the latter is the discussion of the conditions favoring public enterprises in Del Bo and Florio (2012). Based on a panel of transition countries, Crivelli (2012) shows that privatization indeed cannot eliminate soft budget constraints unless it restraints access to soft financing.


4. Estache and Trujillo (2008), for example, write that in many cases in Latin America, privatization was associated with improvements in allocation efficiency, while based on 21 studies of privatization, Hanousek, Kocenda, and Svenjar (2008) conclude that private ownership has primarily positive or insignificant effects on labor productivity. Based on evidence from Chinese firms, Shi and Sun (2016) show that privatization has positive effects on productive efficiency, while (Tian 2001) shows that privatization has positive effects on allocative efficiency and hence economic growth in China. Toyofuku (2013) relates the detrimental effects of soft budget constraints on efficiency to macroeconomic dynamics that result in more severe recessions. For a review of the literature on the impacts of nationalizations and privatizations ("denationalizations") see, e.g. Gonzalez-Perez and Sosa (2015).


6. This is also discussed in Pomfret (2010) and in the two-page research note Crivelli and Staal (2010).

7. A similar assumption is made by Schmidt and Schnitzer (1993) who refer to Holmstrom and Milgrom (1987) for a formal model of this argument.

8. Assuming that the government agency behaves like a bureaucracy, trying to increase budget and sphere of influence instead of maximizing profits would not change our results on allocative and productive efficiency.

9. In Section 6 we show that the main results carry over to the case in which some of the investment is a sunk cost, that is, when the liquidation value of an investment \( I \) is \( \lambda I \), with \( 0 < \lambda < 1 \).

10. In Section 6 we show that our results are robust to changes in this information structure.

11. We discuss these assumptions in more detail in Section 6.

12. Our results on productive and allocative efficiency do not change qualitatively when smaller investments are also taken into account.

13. We are grateful to an anonymous reviewer for the suggestions which are discussed in this and the next subsection.

14. Some public firms in Great Britain did indeed not behave as pure profit maximisers before the privatization wave (see, e.g. Rees 1984; Vickers and Yarrow 1988), and different objectives for public firms have implications for allocative and productive efficiency (see, e.g. De Fraja 1993; Willner and Parker 2007).

15. This can also be motivated by noting that the opposite of nationalization, i.e. privatization, can be seen as a way to reduce labor rents (see, e.g. Bradburd 1995; Newbery 2000).
Acknowledgements

We are grateful to Stefanie Brilon, Valeriya Dinger, Christoph Engel, Peter Friedrich, Jürgen von Hagen, Christa Hainz, Klaus Schmidt, Jean Tirole, Jason Scott Seligman, Anya Kalayda, the editor Judith Clifton, anonymous reviewers, and participants of the BGSE Micro/Finance/PublicFinance Workshop (Bonn), the 5th SFB Workshop (Berlin), the IAES Conference (Boston), and the IIPF Conference (Lake Tahoe). Financial support from the German Research Foundation through SFB/TR15 is gratefully acknowledged. Views and errors are ours alone, and should not be attributed to the International Monetary Fund, its Executive Board, or its management.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by the DFG [SFB TR15].

ORCID

Klaas Staal http://orcid.org/0000-0003-3719-8594

References


