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The political economy of mass privatization and the risk of expropriation

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Abstract

The privatization process in Eastern Europe is not irreversible. Future governments may want to (partially) expropriate successful private firms in order to subsidize unsuccessful ones. We use a simple median voter model to predict the policy of future governments. It is shown that there will be less expropriation the more shares were distributed for free to the population. Diversified mass privatization is better than insider privatization. Furthermore, people should be discouraged to sell their shares for cash. Finally, we show that some free distribution of shares may induce more investment and increase expected profits and privatization revenues for the government. © 2000 Elsevier Science B.V. All rights reserved.

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1. Introduction

What are the most important determinants of success for large-scale privatization programs? Drawing on recent comparative analyses of privatization programs in several western and less developed countries in the 1980s, Pablo Spiller (1995) concludes that by far the most important condition for success is

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the commitment of the government to refrain from discretionary interventions that lead to an ex post expropriation of the returns of the industry. Without such commitment long-term investments and restructuring do not take place.

This is consistent with recent experiences in Eastern Europe. For example, the amounts of restructuring and of foreign direct investment flowing into some Eastern European countries such as Bulgaria, Romania, or Ukraine are much smaller than in Hungary, Poland or the Czech Republic (see also footnote 14) which is often attributed to 'political uncertainties' in the former countries. Another indication for lacking safeguards against expropriation is the very low stock market valuation of privatized companies. Boycko et al. (1995a) estimate that the value of total Russian industry at stock market prices is only about 12 billion US$, roughly the size of a medium Fortune 500 company such as Kellogs. Again this is due to the rational expectation of the market that almost all of the returns of these companies will be captured either by insiders of the firms or by the local and/or federal government.

Most western countries can rely on a long tradition of democratic institutions and constitutional safeguards which – by and large – protect investors against discretionary expropriation by the state. In Eastern Europe, however, the institutional framework is still in its infancy and it cannot be ruled out that a communist or nationalist government takes over that does not respect the property rights granted by its predecessor. Hence, a reform government that engages in large-scale privatization should not only be concerned with revenue maximization, an efficient allocation of ownership rights, and a 'fair' distribution of wealth, but also with the long-term political sustainability of privatization.

Many political advisors have argued that governments should give away a large fraction of the shares of former state-owned enterprises to the general population as a safeguard against future policy reversals.[1] This paper is an attempt to analyze the case for give-aways more systematically. We endogenize the policy of future governments in a model of the privatiation process. We assume that a democratically elected new government can (to any degree) expropriate the profits of successful firms in order to cross-subsidize unsuccessful firms which otherwise would have to be liquidated. Expropriation serves two purposes: it redistributes wealth from the rich to the poor, and it insures workers

[1] For example, this argument was an important motivation for the Czech voucher privatization scheme. A very similar argument was put forward already during the French revolution. In 1789 all real estate belonging to the catholic church had been expropriated. Montesquiou, a delegate to the French assemblé nationale, suggested to divide the land in small portions and to distribute it as evenly as possible to the general population. It is interesting to note that he did not justify his proposal with equity arguments but referred only to the long-term strategic argument that this policy creates a safeguard against future policy reversals. See Göhring (1951, p. 89). I am grateful to Jean Rosenthal and Lothar Schilling for pointing this out to me.

against the risk that their company fails and that they become unemployed. But expropriation and cross-subsidization are ex post inefficient and they reduce the ex ante incentives of core-owners to engage in restructuring. We analyze the preferences of each individual voter towards the degree of expropriation as a function of his private wealth, his risk aversion, and his ownership stake in privatized firms. We show that several key parameters of a mass privatization scheme can be designed to systematically affect the preferences of the electorate over expropriation and to make privatization politically more sustainable in the long run.

Our main results are as follows: First, there will be more expropriation the poorer a country, the more skewed its income distribution, the more risk averse the population, and the more rigid the labor market. Second, the more shares are distributed to the general population, the lower is the degree of ex post expropriation. Third, distributing shares to the general population is more efficient and induces less expropriation than insider privatization, i.e. giving the shares of a firm to the workers of that particular firm. Furthermore, a reform government should discourage people to sell their shares for cash. Finally, giving more shares to the general population reduces the degree of ex post expropriation, but it also reduces the fraction of profits going to core investors which may adversely affect their restructuring efforts. It may also reduce revenues of the government. Nevertheless, we show that it is possible that a mass privatization scheme which includes substantial free distribution of shares induces more investment, higher expected profits and higher privatization revenues for the government than a policy that relies exclusively on selling shares to the highest bidder.

The assumption that future policies are determined only by the electorate is clearly overly optimistic. In reality, lobbies and interest groups play an important role in the formation of policies. Furthermore, at least in some Eastern European countries organized crime has a strong impact on the economic and political development. We do not deny the importance of these effects. Our model is rather meant to focus on one aspect, namely the impact of the preferences of the electorate on future policies. We hope that the better understanding of this aspect is useful even if in every given country there are many other important considerations that have to be taken into account.

There is a large theoretical literature on privatization in Eastern Europe by now. Most of this literature assumes a benevolent government and addresses the question of how to design an optimal privatization scheme in order to achieve an efficient allocation of ownership rights, to maximize revenues, and to induce privatized firms to restructure efficiently.[2] This literature implicitly assumes that

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[2] See e.g. Blanchard et al. (1991), Lipton and Sachs (1990), Schmidt and Schnitzer (1993), and Tirole (1991).

the benevolent government can commit to never expropriate in the future. Boycko et al. (1994a) take the opposite view of a self-interested government. They argue that nationalized firms are inefficient because they address the objectives of politicians rather than maximize efficiency. Thus privatization schemes should be designed so as to drive a wedge between politicians and managers and to restrict political discretion as much as possible. However, they also ignore the possibility of a future policy reversal. Both strands of the literature take the objectives of the government as exogenously given.

There is a small but growing literature on the political economy of the transition process. Boycko et al. (1994b) argue that giving away a large fraction of shares to insiders (such as workers, managers, or local governments) as well as to the general public is important to get the necessary political support for mass privatization. They are mainly concerned with how to push through privatization in the first place. Our paper complements their analysis by focussing on the long-term political sustainability of privatization.

Vickers (1993) shows that it is theoretically possible that some give-aways to the general population maximize sales proceeds from privatization if they reduce the risk of expropriation. Roland and Verdier (1994) and Laban and Wolf (1993) argue that the probability of a policy reversal depends on the success of the privatization policy which in turn depends on the level of investment and restructuring effort of private investors. If private investors expect a policy reversal, they will not invest, the privatization policy will fail and there will indeed be a policy reversal. On the other hand, if all investors expect to enjoy the returns of their investments, they are going to invest and they will not be expropriated. Roland and Verdier (1994) show in addition that free distribution of shares to the population is an instrument to eliminate the incentives of the government to renationalize, but multiple equilibria may still exist. This result is closely related to our results in Section 6.

There is a very recent paper by Biais and Perotti (1997) that is close in spirit to our work. In their model a right-wing party privatizes and uses underpricing in order to shift the political preferences of the middle class. They show that underpricing can be used to keep the right wing party in power and to make sure that shareholders will not be expropriated by a future government. However, in contrast to our model they focus only on redistribution and do not consider risk-sharing motives for expropriation. Furthermore, they are only concerned about the price at which shares are sold to the public and do not analyze the other dimensions of a mass privatization scheme.

The rest of the paper is organized as follows: Section 2 introduces a simple model of mass privatization and the political economy of ex post expropriation. In Section 3 we derive the optimal degree of expropriation for a given voter as a function of his private wealth, his risk aversion, and his ownership stake in privatization. There we assume that some fraction of all firms is distributed for free to the general population. Section 4 compares this privatization scheme to 'insider mass privatization' where some fraction of the shares of each firm is given to the workers of that firm. Section 5 analyses the case where some shareholders sell their shares for cash before the next election takes place. In Section 6 we consider the effect of different mass privatization schemes on the incentives of core investors to restructure and on the revenues from privatization for the government. Section 7 concludes. All proofs are relegated to the appendix.

2. The basic model

Consider a reform government that wants to privatize a large group of state-owned enterprises. For simplicity, assume that there is a continuum of identical firms to be privatized, each of which employs L workers. Firms are indexed by $k \in [0, 1]$ and have mass one. After privatization each firm will be controlled by a 'core investor' (also called 'owner') who owns fraction α of the shares of his firm. The core investor could be a foreign or domestic outside investor who bought a controlling stake from the government. However, since it will be very difficult to find such an investor for many firms, it may be more realistic to think of the 'core investor' as the manager of this firm who was given α for free or as part of a compensation package. In any case, we assume that the owner exercises effective control. The remaining shares will be distributed to the general population according to some mass privatization scheme.

At *date 0* the reform government comes to power and decides on how to organize privatization. It has two main policy instruments at hand. First, it may choose α, i.e., what fraction of shares of each firm to give or sell to a core investor. The remaining fraction, $1 - \alpha$, is distributed (for free) to the population. Second, it may decide on how to structure the free distribution of shares. One possibility is to distribute the shares of all firms more or less evenly across the general population. This could be done, for example, through a voucher scheme which enables each citizen to buy the shares he most prefers on a pseudo-stock-market in exchange for his vouchers.[3] The crucial feature of this form of privatization is that each citizen ends up with a diversified portfolio which does not mainly consist of shares of the firm he is employed with. We will call this option 'diversified mass privatization'. An alternative possibility for the government is to give the free fraction of shares of each firm to the workers of

[3] Such a voucher scheme has been used in former Czechoslovakia. In Poland, shares have been given to large investment funds which are owned in turn by the general population. See OECD (1995) for detailed descriptions of the various mass privatization schemes employed in Eastern Europe.

that particular firm.[4] In this case workers' portfolios are not diversified. We call this option 'insider mass privatization'. The basic model considers the case where share-holding is diversified. In Section 4 we compare this diversified mass privatization method to insider mass privatization.

At *date 1* core investors take over and have to restructure the privatized firms. For example, a core investor may have to reorganize the company, develop new products, experiment with new production technologies, switch to new suppliers for inputs, and so on.[5] Furthermore, the owner may have to bring in new capital in order to modernize the capital stock of his firm. The probability that these activities are successful in improving the firm's efficiency depends on the effort and capital costs the core investor is willing to incur. We model this by assuming that with some probability p_k, which is affected by how much effort and money the owner spends, restructuring is successful, in which case firm k, $k \in [0, 1]$, will make a positive profit $\bar{V} > 0$ at date 3. With probability $1 - p_k$, restructuring fails. In this case, the firm would make a negative profit $\underline{V} < 0$ if it is kept in operation without subsidies from the state.[6] We assume that the probability of success is stochastically independent across firms and that each owner chooses chooses p_k directly at cost $G(p_k)$.[7]

At *date 2*, after restructuring took place but before nature decides on success and failure of each firm, a policy shift is possible. The reform government is free to design the privatization scheme, but it cannot bind future governments to honor the ownership rights it granted at date 0. At date 2 a new government is elected which may decide to expropriate some firms and to subsidize others. The

[4] This has been done to a large extent in Russia. Russia also used a voucher scheme, but workers and managers could use the vouchers to pay for shares of their own firms. Managers and workers could choose one of three privatization options. 75% of all firms that participated in the mass privatization scheme opted for 'variant two' in which workers and managers hold a majority of at least 51% of all equity. An additional 23% of all firms chose 'variant one' according to which workers and managers hold a substantial stake of 25–35%. See Boycko et al. (1995b) for a detailed description of the Russian privatization scheme.

[5] In former socialist countries restructuring of many firms has to be radical. Production may have to switch from military to civilian production or from manufacturing to services. The firm has to take up new activities such as marketing and financial management, while other activities such as supply assurance or the political 'education' of workers have to be deemphasized or given up. The capital stock has to be upgraded, workers to be retrained, production processes to be reorganized. A successfully restructured firm may have little resemblance to its socialist predecessor. See Boycko et al. (1995a, p. 128ff) and McMillan (1997) for a survey on different routes to restructuring.

[6] $\bar{V}$ and $\underline{V}$ can be interpreted as the expected net present value of the firm given that restructuring was successful (failed, respectively).

[7] The assumption that the probability of success is stochastically independent across firms is a simplification that is clearly not met in reality. Roland and Verdier (1994) have shown that there can be substantial externalities between privatized firms and that the probability of success of each firm may crucially depend on how many other firms engage in restructuring which may lead to 'critical mass effects'. However, the analysis of these effects is beyond the scope of this paper.

new government is assumed to reflect the preferences of the electorate at date 2, e.g. the preferences of the median voter.

The term 'expropriation' is meant to capture all policies that adversely affect the private value of the privatized assets. For example, a future government may impose additional regulation which reduces profits, it may raise all kinds of taxes, or it may return the firm to public ownership at 'unfair' terms. Outright expropriation without any compensation is only the extreme case. We model this by assuming that the government may choose the degree of expropriation, $\tau \leq 1$, i.e., a successful firm is forced to pass over $\tau \bar{V}$ to the government.[8] On the other hand, the government uses the proceeds from the expropriation of successful firms either to finance unemployment benefits for workers of the firms that failed or to cross subsidize these firms in order to keep them in operation. From this perspective, expropriation and soft budget constraints are just two sides of the same coin.

Finally, at *date 3*, the uncertainty about which firms are successful resolves and final payoffs are realized. If a firm succeeds, it keeps all its workers at the exogenously given wage rate $\hat{w}$. If a firm fails, there are two possibilities. Either all workers become unemployed and have to depend on unemployment benefits paid for by the government. Alternatively, the government can pay wage subsidies to an unprofitable firm in order to keep it in operation. Both alternatives are equivalent in our model and yield the same results. While the analysis of unemployment benefits is somewhat simpler, the case of cross subsidization of unsuccessful firms seems to be more realistic. Therefore we will focus on the latter interpretation.

For concreteness, let w_0 be the wage at which an unsuccessful firm would just break even. Recall that such a firm would make negative profits $\underline{V} < 0$ if it had to pay the exogenously given wage $\hat{w}$. At lower wages, however, it may be possible to keep the firm in operation. In addition to w_0 the government can pay a wage subsidy, $\underline{w}$. If $w_0 + \underline{w} < \hat{w}$ workers of unsuccessful firms suffer from a wage cut, but they cannot find better employment elsewhere.[9]

[8] Note that τ is not simply a tax rate on net profits. In this case the costs $G(p_k)$ incurred for restructuring would be tax deductible, so a tax rate would apply to $V - G(p_k)$. In contrast, the new government expropriates the firms' quasi-rents, $\bar{V}$. Thus, the possibility of expropriation creates a classical hold-up problem (Williamson, 1985) with underinvestment in restructuring. See also Section 6.

[9] This is clearly a rather special form of subsidization, but it does not seem too unrealistic given the experiences in many eastern European countries. In some of these countries unemployment is still surprisingly low. In Russia, for example, workers are often not laid off by unprofitable firms. Instead, their wages are reduced often quite drastically because the firm (or the government, if the firm is still in state-ownership) is simply unable to pay for them. Workers have no incentive to quit, because they cannot find employment elsewhere. Note that we assume that a successful firm cannot cut $\hat{w}$. It does have enough money to pay for this wage and can be forced by the courts to honour its wage obligations. Nor can a successful firm replace its workers by hiring workers from unsuccessful firms at a lower wage rate. The wage $\hat{w}$ is fixed and enforced by trade unions or by the government.

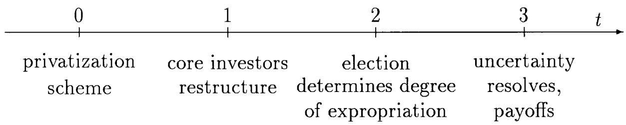

Fig. 1. The time structure.

The time structure of the model is summarized in Fig. 1.

The only revenues of the government to finance wage subsidies come from the expropriation of successful firms.[10] Expropriation and cross subsidization are inefficient, however. Not only do they affect the ex ante incentives of the owner to restructure, as will be analyzed in Section 6 below, they are also ex post inefficient. Some of the money will drain away when passing through the hands of the new government. Successful firms will try to avoid expropriation by hiding their profits or investing them immediately in (possibly inefficient) projects. The form of expropriation (through taxation, regulation, forced investments, etc.) is likely to distort relative prices, and, last but not least, expropriation may have serious long-term incentive effects on restructuring efforts and investments. We model this in a very simple way: Of every dollar expropriated only fraction $\lambda < 1$ can be used for wage subsidies, while $1 - \lambda$ is a deadweight loss.

The amount of wage subsidies the government can pay is determined by its budget constraint. If fraction p of all firms succeed and if the government chooses the expropriation rate τ, then the budget constraint is given by

$$\lambda p \tau \bar{V} = (1 - p)L\underline{w}. \tag{1}$$

Hence,

$$\underline{w} = \frac{\lambda p \tau \bar{V}}{(1 - p)L} = \frac{\lambda p \tau}{1 - p}\,\bar{v}, \tag{2}$$

where $\bar{v} = \bar{V}/L$ is profit per worker of a successful firm.

3. Diversified mass privatization

In this section we analyze the preferences of the electorate (workers and owners) towards expropriation given that the government employed a

[10] In principle, revenues could also be generated through taxation of wages or consumption. However, in socialist times government revenues were raised mainly through the transfer of profits to the state budget. In many countries there has been little progress to build up an efficient tax system so far. The qualitative results of the paper are unaffected if some fixed part of the government's budget can be financed through regular taxes.

diversified mass privatization scheme at date 0. Consider a situation in which all owners engaged in the same restructuring effort p at date 1 and the expropriation rate chosen at date 2 is given by τ. Then total income of worker i, $i \in [0, L]$, at date 3 is given by

$$x_i = \hat{z}_i + (1-\alpha)(1-\tau)p\bar{v} + w_i. \tag{3}$$

The variable $\hat{z}_i$ reflects worker i's income from private wealth, e.g. his savings, real estate, etc., but excluding income from shareholding. Workers are indexed such that $i > j$ implies $\hat{z}_i \geq \hat{z}_j$, $i, j \in [0, L]$. Income from shareholding is given by $(1-\alpha)(1-\tau)p\bar{v}$ which is a worker's share of total profits of all successful firms. Note that with a continuum of firms and a perfectly diversified portfolio the income from shareholding is deterministic. The only random term is the worker's effective wage, w_i, which is given by $\hat{w}$ if his firm succeeds and $w_0 + \underline{w}$ if it fails. It will be convenient to define

$$\bar{w} = \hat{w} - w_0$$

and to add the term w_0 to worker i's income from private wealth

$$z_i = \hat{z}_i + w_0.$$

Thus, his income at date 3 is given by

$$\bar{x}_i = z_i + (1-\alpha)(1-\tau)p\bar{v} + \bar{w}, \tag{4}$$

$$\begin{aligned} \underline{x}_i &= z_i + (1-\alpha)(1-\tau)p\bar{v} + \underline{w}, \\ &= z_i + (1-\alpha)(1-\tau)p\bar{v} + \frac{\lambda\tau p\bar{v}}{(1-p)}, \end{aligned} \tag{5}$$

if his firm was successful (failed, respectively).

Workers are risk averse and have the same von Neumann–Morgernstern utility function $U(x_i)$, $U'(x_i) > 0$, $U''(x_i) < 0$.[11] What is the optimal expropriation rate at date 2 from worker i's point of view? He wants to maximize his expected utility which is given by

$$\begin{aligned} \mathrm{E}U_i(\tau) = {} & pU(z_i + (1-\tau)(1-\alpha)p\bar{v} + \bar{w}) \\ & + (1-p)U\left(z_i + (1-\tau)(1-\alpha)p\bar{v} + \frac{\lambda\tau p\bar{v}}{1-p}\right). \end{aligned} \tag{6}$$

[11] Note that at date 2, when the election takes place, workers differ only with respect to their private wealth. Proposition 2(c) below also considers the case where workers differ in their degree of risk aversion.

Clearly, it is never optimal to choose τ such that $\underline{w} > \bar{w}$.[12] This implies

$$\tau \leq \frac{(1-p)\bar{w}}{\lambda p \bar{v}}, \tag{7}$$

so the upper bound on the feasible expropriation rate is

$$\tau \leq \bar{\tau} = \min\left\{\frac{(1-p)\bar{w}}{\lambda p \bar{v}}, 1\right\}. \tag{8}$$

Differentiating Eq. (6) with respect to τ we get the first-order condition for an interior maximum:

$$\frac{\mathrm{d}EU_i}{\mathrm{d}\tau} = -p^2(1-\alpha)\bar{v}U'(\bar{x}_i) + (1-p)\left[\frac{\lambda p \bar{v}}{1-p} - (1-\alpha)p\bar{v}\right]U'(\underline{x}_i) = 0, \tag{9}$$

which is equivalent to

$$\frac{\lambda - (1-\alpha)(1-p)}{p(1-\alpha)} = \frac{U'(\bar{x}_i)}{U'(\underline{x}_i)}. \tag{10}$$

Note that the instrument τ can be used to serve two purposes: *redistribution* and *risk-sharing*. Suppose first that workers are risk neutral, so risk-sharing is not an issue. In this case $U'(\bar{x}_i)/U'(\underline{x}_i) = 1$ for all τ. Thus, if

$$\lambda - (1-\alpha)(1-p) > p(1-\alpha) \Leftrightarrow \lambda > 1-\alpha,$$

all workers prefer full expropriation: If one dollar of profits per worker is expropriated and redistributed equally across the population, each worker loses his share $(1-\alpha)$ of this dollar and gains λ through redistribution. Hence, if $\lambda > 1-\alpha$ all workers unanimously agree to fully expropriate ($\tau_i^* = \bar{\tau}$). On the other hand, if $\lambda < 1-\alpha$, no redistribution is optimal ($\tau_i^* = 0$).

Suppose now, that $\alpha = 0$. In this case redistribution is not an issue (since nothing can be taken away from core investors) and (10) reduces to

$$\frac{\lambda - 1 + p}{p} = \frac{U'(\bar{x}_i)}{U'(\underline{x}_i)}.$$

If workers are risk averse, some expropriation may still be optimal for insurance purposes. Expropriation can be used to shift income from the good state of the world to the bad state. In particular, if $\lambda = 1$, i.e., if there is no ex post efficiency

[12] Otherwise unsuccessful firms would receive more subsidies than necessary to fulfill their wage obligations which would just increase their profits. Of these additional profits workers as a whole receive fraction $(1-\alpha)$. However, since $\lambda < 1$, they have to give up more in terms of expropriated profits from successful firms in order to finance this transfer, which is inefficient.

loss, full insurance is optimal. The smaller λ, the more expensive insurance is and the less attracive is expropriation.

The following proposition fully characterizes the optimal expropriation rate of worker *i*.

Proposition 1. The most preferred expropriation rate of worker i is given by

$$\tau_i^* = \begin{cases} 0 & \text{if } \dfrac{\lambda-(1-\alpha)(1-p)}{p(1-\alpha)} \leq \dfrac{U'(\bar{x}_i|\tau=0)}{U'(\bar{x}_i\tau=0)}, \\ \hat{\tau}_i & \text{if } \dfrac{U'(\bar{x}_i|=0)}{U'(\underline{x}_i|\tau=0)} < \dfrac{\lambda(1-\alpha)(1-p)}{p(1-\alpha)} \leq \dfrac{U'(\bar{x}_i|\tau=\bar{\tau})}{U'(\underline{x}_i|\tau=\bar{\tau})}, \\ \bar{\tau} & \text{if } \dfrac{U'(x_i|\tau=\bar{\tau})}{U'(\underline{x}_i|\tau=\bar{\tau})} < \dfrac{\lambda-(1-\alpha)(1-p)}{p(1-\alpha)}, \end{cases} \tag{11}$$

where $\hat{\tau}_i$ is uniquely defined by

$$\frac{\lambda-(1-\alpha)(1-p)}{p(1-\alpha)} = \frac{U'(z_i+(1-\hat{\tau}_i)(1-\alpha)p\bar{v}+\bar{w})}{U'\left(z_i+(1-\hat{\tau}_i)(1-\alpha)p\bar{v}+\dfrac{\lambda\hat{\tau}_i p\bar{v}}{1-p}\right)}. \tag{12}$$

Proof. See the appendix.

Note that $EU_i(\tau)$ is strictly concave which immediately implies the following corollary:

Corollary 1. Worker i's preferences with respect to τ are single peaked for all $i \in [0, L]$.

Preferences of owners are also single peaked. All of them prefer to have no expropriation, and their expected profit is strictly decreasing with τ. Hence, if the expropriation and subsidization policy of the government is the only issue voters care about, we can apply the median voter theorem to predict the outcome of the election. However, most of the following results are more general. They show that the preferences of *all* voters shift in the same direction in response to changes in certain parameters of the model.

All of the following results refer to all voters $i \in [0, L+1]$. However, since all owners ($i \in [L, L+1]$) always prefer $\tau_i^* = 0$, these results are only interesting as far as workers ($i \in [0, L]$) are concerned and will be discussed only with respect to them.

The next proposition gives more general comparative static results on the optimal expropriation rate.

Proposition 2. (a) *An increase of* $\bar{w}$ *increases voter* i*'s optimal expropriation rate* τ_i^*.

(b) *Suppose voter i's utility function satisfies non-increasing absolute risk aversion* (*NIARA*). *Then an increase in* z_i *weakly reduces* τ_i^*.

(c) *Suppose all voters have constant absolute risk aversion* (*CARA*). *The higher the degree of risk aversion* r_i *of voter i, the higher is* τ_i^*.

Proof. See the appendix.

The intuition for Proposition 2 is straightforward. First, an increase of $\bar{w}$ increases the difference in income between the two states of the world and thus the risk to which each voter is exposed. Hence, it is not surprising that the higher $\bar{w}$ the more insurance is desirable and the higher is the optimal expropriation rate. Second, with NIARA, a voter's willingness to pay for insurance for a given lottery is a decreasing function of his income. Thus, the richer he is, the less he is willing to engage in costly redistribution in order to better insure himself. Finally, for any given level of wealth, a voter prefers more insurance and thus more expropriation the more risk averse he is.

Proposition 2 has interesting empirical implications. Part (b) suggests that the risk of expropriation becomes smaller the richer a country is, at least if we accept the very mild assumption of non-increasing absolute risk aversion.[13] This is confirmed by the observation that the richer countries of Eastern Europe, such as Hungary, the Czech Republic or Poland are considered to be politically more stable and to offer better safeguards against expropriation as compared to poorer countries such as Bulgaria, Rumania, Ukraine, or the former Soviet republics in Asia.[14] However, the distribution of wealth also matters. A change in the distribution of income increases the risk of expropriation if this change reduces the income of the median voter. From this perspective the development in Russia, where the income gap between the new rich and the average citizen widens dramatically, gives cause for concern.

[13] The richer a country, the higher is $\hat{z}_i$, i.e. the personal wealth in the form of housing, real estate, etc. of its citizens. Furthermore, a richer country is more productive, so w_0, the level of wages at which unsuccessful firms just break even, is presumably higher.

[14] This is very clearly reflected in the amounts of foreign direct investments (FDI) that have been flowing into these countries: Hungary (1186), Czech Republic (619), Poland (102), Russia (20), Bulgaria (46), Romania (47) and Ukraine (35). The numbers in brackets are cumulative FDI inflows per capita in US$ from 1988 to June 1996. Source: United Nations (1996, p. 117, Table 5.2.8).

Part (c) of Proposition 2 says, that the more risk averse the population of a country, the more likely expropriation is. The degree of risk aversion could be interpreted as a cultural parameter. It is often claimed that in countries like Hungary, the Czech Republic or Poland there is more of an 'entrepreneurial spirit' alive as compared to Russia where socialism ruled for an additional generation. If people in the former countries are more willing to accept risk as a basic ingredient of a market economy, they are less inclined to costly insure this risk through ex post expropriation.

Finally, a high $\bar{w}$ can be interpreted as a rigid labor market. Workers in successful firms have a considerably higher wage as compared to workers in unsuccessful firms, and the labor market is not very effective in reducing this gap, for example because of powerful trade unions or low worker mobility. On the other hand, if $\bar{w}$ is low, income disparities have been reduced by competition and there is no need to insure through expropriation.[15] But, even in this case, the incentive to expropriate in order to redistribute income (from core investors to workers) remains.

All of these implications have a strong intuitive appeal and may give some confidence in the model. Our main interest, however, is in the effect of α on the rate of expropriation, since α is a policy parameter that can be chosen through the design of the mass privatization scheme. The following proposition shows that the more shares are distributed to the population the lower is the degree of ex post expropriation.

Proposition 3. Suppose voter i's utility function satisfies NIARA. Then an increase in α increases his optimal expropriation rate.

Proof. See the appendix.

The intuition is again straightforward. If $(1-\alpha)$ goes down, expropriation becomes less costly to a worker. Furthermore, the smaller $(1-\alpha)$ the lower is a worker's income. With NIARA he thus has a stronger incentive to better insure himself through more expropriation.

Proposition 3 shows that free distribution of shares may be desirable because it reduces the degree of ex post expropriation and leads to more political stability. Again, there is casual empirical evidence from Eastern Europe confirming this result. The politically most stable of all former socialist countries which puts most emphasis on the protection of property rights clearly is the Czech Republic which also was the first to employ a voucher mass privatization

[15] Competitive pressure on wages is of course not modelled explicitly here. The assumption that $\bar{w}$ is exogenously given and fixed is, admittedly, rather crude but necessary to keep the model tractable.

scheme which distributed a large fraction of most large enterprises to the general population.[16]

4. Insider mass privatization

The previous section assumed that fraction $(1-\alpha)$ of all shares was distributed evenly across the population. A possible alternative is to give a fraction of the shares of each firm to the employees of that particular firm. This route has been followed to a large extent in Russia. We will assume that employees get non-voting shares only. There are many additional problems involved if insiders of the firm can exercise control rights, but in this paper we want to focus on the political effects of different mass privatization schemes. Therefore we leave these additional problems out of the picture.

Like in the previous section we assume that if the government expropriates fraction τ of the profits of all successful firms, it can distribute $\lambda\tau p\bar{v}/(1-p)$ to each worker of all unsuccessful firms. Thus voter i's income at date 3 is given by

$$\bar{y}_i = z_i + (1-\tau)(1-\alpha)\bar{v} + \bar{w}, \tag{13}$$

$$\underline{y}_i = z_i + \frac{\lambda\tau p\bar{v}}{1-p}, \tag{14}$$

in the good (bad, respectively) state of the world. Thus voter i's expected payoff as a function of τ is given by

$$\mathrm{E}U_i(\tau) = pU(z_i + \bar{w} + (1-\tau)(1-\alpha)\bar{v}) + (1-p)U\left(z_i + \frac{\lambda\tau p\bar{v}}{1-p}\right). \tag{15}$$

The first-order condition for an interior maximum is

$$\frac{\mathrm{dE}U_i}{\mathrm{d}\tau} = -(1-\alpha)p\bar{v}U'(\bar{y}_i) + \lambda p\bar{v}U'(\underline{y}_i) = 0 \tag{16}$$

which is equivalent to

$$\frac{\lambda}{1-\alpha} = \frac{U'(\bar{y}_i)}{U'(\underline{y}_i)}. \tag{17}$$

[16] It is interesting to note that this form of privatization has been chosen not for economic but mainly for political reasons. The Czech government argued from the very beginning that it wanted to distribute shares widely across the population in order to create a broad class of capital owners with a personal stake in the capitalist economy. This was considered to be the best safeguard against future backlashes against the institution of private property (Klaus, 1995).

The interpretation is very similar to the interpretation of Proposition 1. The following proposition gives a full characterization of the optimal expropriation rate.

Proposition 4. With insider privatization the most preferred expropriation rate of voter i is given by

$$\tau_i^* = \begin{cases} 0 & \textit{if} \quad \dfrac{\lambda}{1-\alpha} < \dfrac{U'(\bar{y}_i|\tau = 0)}{U'(\bar{y}_i|\tau = 0)}, \\[2ex] \hat{\tau}_i & \textit{if} \quad \dfrac{U'(\bar{y}_i|\tau = 0)}{U'(\bar{y}_i|\tau = 0)} < \dfrac{\lambda}{1-\alpha} < \dfrac{U'(\bar{y}_i|\tau = \bar{\tau})}{U'(\bar{y}_i|\tau = \bar{\tau})}, \\[2ex] \bar{\tau} & \textit{if} \quad \dfrac{U'(\bar{y}_i|\tau = \bar{\tau})}{U'(\bar{y}_i\tau = \bar{\tau})} < \dfrac{\lambda}{1-\alpha}, \end{cases} \tag{18}$$

where $\hat{\tau}_i$ is uniquely defined by

$$\frac{\lambda}{1-\alpha} = \frac{U'(z_i + (1-\tau)(1-\alpha)\bar{v} + \bar{w})}{U'\left(z_i + \dfrac{\lambda \tau p \bar{v}}{1-p}\right)}. \tag{19}$$

The proof is a straightforward adaptation of the proof of Proposition 1. The main difference to the previous section is that with insider privatization workers have to put all their eggs in one basket. If their firm fails, they do not only lose their wage $\bar{w}$ but also their total income from share ownership. Clearly, from a risk allocation point of view, insider mass privatization is less desirable than diversified mass privatization.

It is easy to demonstrate that Proposition 2 carries over to the case of insider privatization. Thus, voter i's preferred expropriation rate is higher the lower his private wealth z_i, the higher his Arrow–Pratt measure of absolute risk aversion, and the higher the wage premium $\bar{w}$. The interpretation is also very much the same.

But, it is no longer true that τ_i is a monotonically increasing function of α, i.e., an equivalent of Proposition 3 does not hold. If α increases, there are two effects on τ_i^* working in opposite directions: On the one hand, worker i owns less of the company he is employed with, so redistribution is more attractive and he wants to expropriate more. On the other hand, the difference between his income in the good and in the bad state of the world goes down, so he has less of an incentive to insure himself, which has a negative effect on his optimal expropriation rate.

Nevertheless, the following proposition shows that insider privatization always leads to more expropriation than diversified distribution of shares, which is the most important result of this section.

Proposition 5. For any α and any given set of other parameters, voter i always prefers a higher expropriation rate under insider mass privatization than under diversified mass privatization.

Proof. See the appendix.

The intuition for this result is as follows: For any given level of α a voter is exposed to more risk if he holds the shares of the firm he is employed with as compared to the case where he owns a well-diversified portfolio with shares of many firms. Hence, there is a stronger incentive to insure which implies a higher expropriation rate.

Proposition 5 provides a strong argument against insider mass privatization. Not only does insider privatization lead to an inefficient allocation of risk, it also generates a political climate which is more prone to expropriation as compared to a diversified mass privatization program. However, as pointed out by Boycko et al. (1994b, 1995a), insider privatization may be the only possibility for a reform government to push through privatization at all.

5. Trading shares between workers and core investors

An important question is whether the reform government should allow people to sell their shares for cash. Trading shares can be beneficial if it yields a more efficient allocation of ownership rights. If some workers are credit constrained, they may want to sell their shares in order to smooth consumption. Furthermore, allowing workers to sell their shares may increase the political support for privatization in the first place. On the other hand, if all workers sold their shares immediately, then $\alpha = 0$ and all workers would prefer full expropriation at date 2. In equilibrium expropriation would be anticipated by the stock market, so share prices would be very low.

In this section we analyze the effect on the election outcome if some, but not all, workers want to sell their shares to core-investors. We restrict attention to the case of diversified mass-privatization. The case of insider privatization is straigthforward and briefly discussed below. Suppose that, for exogenously given reasons, some fraction β, $0 \leq \beta < 1$, of all workers is hit by a liquidity shock and has to sell their shares between dates 1 and 2, i.e., before the election takes place. We discuss below how β may be affected by the government.

The outcome of the election at date 2 is determined by the median voter. If no shares are sold ($\beta = 0$), the median voter is the worker with index $m = (L + 1)/2$ and private wealth (net of shareholding) z_m.[17] Given α and p that have been

[17] Note that $L > 1$ implies that the median voter is always a worker.

determined at dates 0 and 1, respectively, his most preferred expropriation rate is characterized by Proposition 1 and denoted by $\tau^*_m(\alpha, p)$. Now, consider a worker $i \in [0, L]$ who sold his shares before the election. Because this worker has no stake in the privatized firms, he prefers to expropriate as much as possible, $\tau_i = \bar{\tau}$. If $i < (L+1)/2$ this does not affect the median voter. If, however, $i > (L+1)/2$ then the median voter shifts downwards to a worker with less private wealth and a higher prefered expropriation rate.

For concreteness let us assume that each worker $i \in [0, L]$ sells his shares with probability β which is independent of his private wealth and the same for all workers. The following proposition summarizes the outcome of the election for this case:

Proposition 6. Suppose that for each worker the probability that he is going to sell his shares before date 2 is given by $\beta \in [0, 1)$.

- *If $\beta > (L+1)/2L$, then the median voter is a worker who sold his shares and the outcome of the election is the maximum degree of expropriation.*
- *If $\beta < (L+1)/2L$, the median voter did not sell his shares. He is indexed by*

$$m(\beta) = \frac{L(1-2\beta)+1}{2L(1-\beta)+2}(L+1) \leq \frac{L+1}{2} \tag{20}$$

with strict inequality if $\beta > 0$ and $m(\cdot)$ strictly decreasing with β. The outcome of the election is given by $\tau^*_{m(\beta)}(\alpha, p) \geq \tau^*_m(\alpha, p)$.

The proof is straigthforward and left to the reader. The proposition suggests that a reform government that wants to prevent future expropriation should encourage people to keep their shares by offering tax or other incentives to do so. It is interesting to note that there is no problem if only the 'poor' sell their shares for cash – at least if the 'poor' do not form the majority of the population. The median voter becomes less wealthy and more inclined to expropriate only if members of the 'middle class', i.e. workers who are in the top 50% wealth percentile, give up shareholding. Hence, the government may want to encourage shareholding by offering tax-incentives that are particularly appealing to the middle-class.

Finally, it is important to note that under insider privatization each worker has a stronger incentive to sell his shares as compared to the case of diversified mass privatization. Since his risks of becoming unemployed and of loosing his income from share-ownership are perfectly correlated, he has an additional incentive to sell in order to better insure himself. If he sells his shares for cash, he is going to vote for full expropriation at date 2. However, if he trades his shares for the shares of other companies in order to diversify his portfolio, we are back to the case of diversified mass privatization as discussed above. Therefore, the government should encourage workers to trade shares against shares, but make it more difficult to sell shares for cash.

6. Free distribution of shares and the effort to restructure

The previous sections have shown that giving a fraction of the shares of all firms to the general population is an important safeguard against future expropriation. In fact, future expropriation decreases monotonically with $(1-\alpha)$ which suggests to give away as much as possible for free to the general popoulation. But, of course, there is a trade-off. First, core investors have to be given a minimal fraction of shares, $\underline{\alpha}$, otherwise they cannot exercise effective control. The threshold $\underline{\alpha}$ may be considerably smaller than 50%, in particular if non-voting shares are distributed to the population, but some minimum fraction is clearly necessary.

Second, the smaller α, the smaller is the return for core investors and the lower is the incentive to engage in restructuring, in particular if a core investor has to incur costs which cannot be paid for upfront by the returns of his firm. This is the case if the core investor has to spend effort in order to restructure, or if he brings in fresh capital which is sunk before the expropriation decision is taken.

Finally, revenues for the government may be an additional important concern at the privatization stage. The more shares are given away for free, the less can be sold profitably to foreign or domestic investors.

Despite these costs we will demonstrate that giving away a substantial fraction of all firms to the general population may not only reduce future expropriation but also increase restructuring effort *and* revenues from privatization. We will restrict attention to diversified mass privatization in this section. All the qualitative results extent to the case of insider mass privatization, but the outcome will be less efficient.

Suppose for simplicity that there are only two effort levels, $p_k \in \{\underline{p}, \bar{p}\}$ for all $k \in [0, 1]$, $0 < \underline{p} < \bar{p}$. A high effort level $\bar{p}$ means that the core investor actively tries to restructure his firm and to bring in fresh capital at total cost $G > 0$ to himself. In this case he is successful with probability $\bar{p}$. If the core investor chooses low effort he does not engage in substantial restructuring. In this case his costs are normalized to 0, and his firm will succeed with probability $\underline{p} < \bar{p}$.

We consider two policy options: The government may either sell a large fraction α to domestic or foreign investors and to give away few shares to the general population. Or, the government may distribute a large share to the general population in order to create a safeguard against future expropriation.

In this section we ignore the possibility that some workers may have sold their shares before date 2. Hence, the expropriation rate is determined by the median voter with index $m = (L+1)/2$. Let $\tau_m^*(p, \alpha)$ denote his most preferred expropriation rate.

Case 1: $\alpha \geq 1-\lambda$.

Suppose the government decided to distribute very few shares to the general population but to sell a large fraction $\alpha \geq 1-\lambda$ to domestic and foreign core investors. Note that

$$\alpha \geq 1-\lambda \Leftrightarrow \frac{\lambda-(1-\alpha)(1-p)}{p(1-\alpha)} \geq 1 \quad \forall p \in (0,1). \tag{21}$$

We know from the analysis of Sections 3 and 4 that in this case a corner solution with $\tau_i^* = \bar{\tau}$ for all $i \in [0, L]$ obtains, so $\tau_m^* = \bar{\tau}$.

An individual core investor is going to restructure if and only if

$$\bar{p}\alpha(1-\bar{\tau})\bar{V} - G \geq \underline{p}\alpha(1-\bar{\tau})\bar{V}. \tag{22}$$

Note that $\bar{\tau} = \min\{(1-p)/p\ \bar{w}/\lambda\bar{v}, 1\}$ may depend on p, where $p \in [\underline{p}, \bar{p}]$ denotes the average restructuring effort of all core investors. Restructuring of one firm has a positive external effect on all other firms. The more firms are successful, the less firms have to be subsidized and the lower is the expropriation rate at date 2. The following proposition characterizes the equilibria of the restructuring game.

Proposition 7. Suppose $\alpha > 1-\lambda$. *If either* $\bar{\tau} = 1$, *or*

$$(\bar{p}-\underline{p})\alpha\bar{V}\left[1-\frac{1-\bar{p}}{\bar{p}}\frac{\bar{w}}{\lambda\bar{v}}\right] < G, \tag{23}$$

then there is a unique equilibrium in which nobody restructures, $p_k^* = \underline{p}$ *for all* $k \in [0,1]$, *and expropriation is high,* $\tau_m^* = \min\{(1-\underline{p})\underline{p}/\bar{w}/\lambda\bar{v}, 1\}$. *If* $(1-\bar{p})/\bar{p}\ \bar{w}/\lambda\bar{v} < 1$ *and if*

$$(\bar{p}-\underline{p})\alpha\bar{V}\left[1-\frac{1-\bar{p}}{\bar{p}}\frac{\bar{w}}{\lambda\bar{v}}\right] \geq G \geq (\bar{p}-\underline{p})\alpha\bar{V}\left[1-\frac{\bar{p}}{\underline{p}}\frac{\bar{w}}{\lambda\bar{v}}\right], \tag{24}$$

then there exists a second equilibrium, where all owners choose to restructure, $p_k^* = \bar{p}$, *and expropriation is moderate,* $\tau_m^* = (1-\bar{p}/\bar{p})\ \bar{w}/\lambda\bar{v}$.

The proof and the intuition for this result are straightforward. Clearly, if $\bar{\tau} = 1$ restructuring never pays. Recall that the expected expropriation rate is smaller the more firms engage in restructuring. Consider a core investor and suppose that all other investors have chosen $\bar{p}$. If even in this case restructuring does not pay, then it is a dominant strategy for everybody not to invest which is the unique equilibrium. On the other hand, if in this case the expropriation rate is sufficiently small to make restructuring profitable, then there exists a second equilibrium. In this equilibrium it is optimal for each firm to invest given that all other firms invest, too. Due to the high level of investments there are few firms that fail. Hence, the degree of expropriation is going to be moderate which in turn supports the investments. Note, however, that the first equilibrium in which no firm restructures and expropriation is high remains if G is not too small.

Case 2: $\alpha < 1 - \lambda$

Giving away a large share $(1-\alpha)$ for free only makes sense if this creates a safeguard against future expropriation. Suppose that there exists an α such that $\tau_m^*(\alpha, p) < \bar{\tau}(p)$ for all $p \in [\underline{p}, \bar{p}]$. If such an α does not exist we are back to the analysis of Case 1.

Proposition 8. For G sufficiently small and/or $\bar{V}$ sufficiently large there exists an $\alpha < 1 - \lambda$ such that there is a unique equilibrium in which all firms restructure and the rate of expropriation is low.

Proof. See the appendix.

The intuition is again straightforward. A core investor chooses to restructure if and only if

$$(\bar{p} - \underline{p})\alpha[1 - \tau_m^*(\alpha, p)]\bar{V} > G. \tag{25}$$

If this condition holds for all $p \in [\underline{p}, \bar{p}]$ restructuring is a dominant strategy and there is a unique equilibrium. This is the case if the investment cost G is sufficiently small or the 'price' $\bar{V}$ is sufficiently large. Note that if Eq. (25) holds for $p = \bar{p}$ but is reversed for $p = \underline{p}$, then we do have multiple equilibria again.

The analysis of Cases 1 and 2 shows that giving away a substantial fraction of shares for free to the general population may be a necessary condition for an equilibrium with significant restructuring to obtain. The following proposition demonstrates that this policy may also maximize privatization revenues for the government.

Proposition 9. Suppose that $(1-\bar{p})/\bar{p}\ \bar{w}/\lambda\bar{v} > 1$. *If G is sufficiently small and/or $\bar{V}$ sufficiently large, then there exists an $\alpha^* < 1 - \lambda$ which maximizes the privatization revenues of the government.*

Proof. See the appendix.

The intuition for Proposition 9 is as follows. Under the stated condition we know by Proposition 7 that if the government chooses $\alpha > 1 - \lambda$ then there is a unique equilibrium with no restructuring, full expropriation, and zero profits for all core investors. Hence, the revenues of the government are also 0. On the other hand, we know by Proposition 8 that if G is sufficiently small and/or $\bar{V}$ is sufficiently large, then there exists an $\alpha < 1 - \lambda$ such that all firms restructure, expropriation is low, and firms make positive profits. Thus, if the government sells α to core investors, revenues are positive, too. Hence, the government maximizes revenues if it gives away for free some fraction $(1-\alpha) > \lambda$ to the general population.[18]

The analysis in this section has been even more stylized than in the first part of the paper. Therefore, Propositions 6–8 should be seen as possibility results. They show that there are cases where some substantial free distribution of shares to the general population is a necessary ingredient to a successful mass privatization scheme, and that some give-aways may maximize revenues.

7. Conclusions

The threat of future expropriation is real and probably the main obstacle to more investments and restructuring efforts in Eastern Europe. We have shown that this threat is more severe if the country is poor, if income disparities are large, and if there is a socialist mentality resulting in a high degree of risk aversion. Our analysis suggests that in these cases some free distribution of shares may be an important safeguard against future expropriation, which in turn induces higher restructuring efforts and higher privatization revenues for the government. We have also shown that insider privatization is dominated by diversified mass privatization which distributes shares to the general population.

In order to keep the analysis tractable we used a highly stylized model of the privatization process. In particular, we assumed that the design of the mass privatization scheme does not affect the allocation of control rights which (by assumption) are exercised effectively by the core investor. This assumption clearly is too optimistic. In all Eastern European countries an important consideration is to restrict the political influence exercised by workers, managers, local politicians and other special interest groups on the firm's decisions.[19] We hope to address these questions in a richer model of the political economy of privatization in future research.

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[18] A similar result has been shown by Roland and Verdier (1994). As in their analysis, there may be multiple equilibria here if the condition on G and $\bar{V}$ is not satisfied.

[19] For a discussion of the experiences in Russia see Boycko et al. (1995a).

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Appendix

Proof of Proposition 1. Note first that the expected utility of worker i is strictly concave in τ:

$$\frac{d^2 EU_i}{d\tau^2} = p^3(1-\alpha)^2\bar{v}^2 U''(\bar{x}_i) + (1-p)\left[\frac{\lambda p\bar{v}}{1-p} - (1-\alpha)p\bar{v}\right]^2 U''(\underline{x}_i) < 0. \tag{A.1}$$

Hence, there exists a unique maximum. Suppose that

$$\frac{\lambda-(1-\alpha)(1-p)}{p(1-\alpha)} \le \frac{U'(\bar{x}_i|\tau=0)}{U'(\underline{x}_i|\tau=0)}. \tag{A.2}$$

In this case $dEU_i(\tau=0)/d\tau \le 0$, so a corner solution with $\tau=0$ obtains. If

$$\frac{U'(\bar{x}_i|\tau=\bar{\tau})}{U'(\underline{x}_i|\tau=\bar{\tau})} \le \frac{\lambda-(1-\alpha)(1-p)}{p(1-\alpha)}, \tag{A.3}$$

we have that $dEU_i(\tau=\bar{\tau})/d\tau \ge 0$ in which case $\tau=\bar{\tau}$ is optimal. Finally, if

$$\frac{U'(\bar{x}_i|\tau=0)}{U'(\underline{x}_i|\tau=0)} < \frac{\lambda-(1-\alpha)(1-p)}{p(1-\alpha)} < \frac{U'(\bar{x}_i|\tau=\bar{\tau})}{U'(\underline{x}_i|\tau=\bar{\tau})} \tag{A.4}$$

there exists a unique interior optimal $\hat{\tau}_i$ which satisfies $dEU_i(\hat{\tau}_i)/d\tau = 0$. □

Proof of Proposition 2. (a) Using the implicit function theorem, $d\hat{\tau}/d\bar{w} > 0$ if and only if $d(9)/d\bar{w} > 0$.

$$\frac{d(9)}{d\bar{w}} = -p^2(1-\alpha)\bar{v}U''(\bar{x}_i) > 0. \tag{A.5}$$

There is no problem with a corner solution since $U'(\bar{x}_i|\tau=0)/U'(\underline{x}_i|\tau=0)$ decreases with $\bar{w}$ (because $U'(\underline{x}_i|\tau=0)$ does not depend on $\bar{w}$ while $U''(\bar{x}_i|\tau=0)<0$).

(b) Suppose that the voter's maximization problem has an interior solution, $\hat{\tau}_i$. Implicitly differentiating τ_i with respect to z_i yields:

$$\frac{d\tau_i}{dz_i} = -\frac{d(9)/dz_i}{d(9)/d\tau} \le 0 \Leftrightarrow \frac{d(9)}{dz_i} \le 0, \tag{A.6}$$

since $\mathrm{d}(9)/\mathrm{d}\tau = \mathrm{d}^2 \mathrm{E}U_i(\hat{\tau}_i)/\mathrm{d}\tau^2 < 0$.

$$\frac{\mathrm{d}(9)}{\mathrm{d}z_i} = -p^2(1-\alpha)\bar{v}U''(\bar{x}_i) + (1-p)\left[\frac{\lambda p\bar{v}}{1-p} - (1-\alpha)p\bar{v}\right]U''(\bar{x}_i) \le 0 \quad \text{(A.7)}$$

$$\Leftrightarrow \quad [\lambda - (1-\alpha)(1-p)]p\bar{v}U''(\underline{x}_i) \le p^2(1-\alpha)\bar{v}U''(\bar{x}_i) \quad \text{(A.8)}$$

$$\Leftrightarrow \quad \frac{\lambda - (1-\alpha)(1-p)}{p(1-\alpha)} \ge \frac{U'(\bar{x}_i)}{U''(\underline{x}_i)}. \quad \text{(A.9)}$$

Recall that the FOC for an interior τ_i^* requires

$$\frac{\lambda - (1-\alpha)(1-p)}{p(1-\alpha)} = \frac{U'(\bar{x}_i)}{U'(\underline{x}_i)}. \quad \text{(A.10)}$$

Hence, Eq. (A.9) is equivalent to

$$\frac{U'(\bar{x}_i)}{U'(\underline{x}_i)} \ge \frac{U''(\bar{x}_i)}{U''(\underline{x}_i)} \quad \text{(A.11)}$$

$$\Leftrightarrow -\frac{U''(\underline{x}_i)}{U'(\underline{x}_i)} \ge -\frac{U''(\bar{x}_i)}{U'(\bar{x}_i)} \Leftrightarrow NIARA, \quad \text{(A.12)}$$

since $\underline{x}_i \le \bar{x}_i$.

Suppose now that the voter's maximization problem has a corner solution. Note that $U'(\bar{x}_i)/U'(\underline{x}_i)$ increases with z_i if and only if the consumer's preferences satisfy NIARA:

$$\frac{\mathrm{d}\left[\dfrac{U'(\bar{x}_i)}{U'(\underline{x}_i)}\right]}{\mathrm{d}z_i} = \frac{U''(\bar{x}_i)U'(\underline{x}_i) - U''(\underline{x}_i)U'(\bar{x}_i)}{U'(\underline{x}_i)^2} \ge 0 \quad \text{(A.13)}$$

$$\Leftrightarrow U''(\bar{x}_i)U'(\underline{x}_i) \ge U''(\underline{x}_i)U'(\bar{x}_i) \quad \text{(A.14)}$$

$$\Leftrightarrow -\frac{U''(\bar{x}_i)}{U''(\bar{x}_i)} \le -\frac{U''(\underline{x}_i)}{U''(\underline{x}_i)} \Leftrightarrow NIARA. \quad \text{(A.15)}$$

Thus, the range with $\tau_i^* = 0$ becomes larger while the range with $\tau_i^* = \bar{\tau}$ shrinks. Hence, an increase in z_i unambiguously reduces voter i's optimal expropriation rate. □

(c) With CARA we have

$$\mathrm{E}U_i(\tau) = -pe^{-r_i[z_i + \bar{w} + (1-\tau)(1-\alpha)p\bar{v}]} - (1-p)\mathrm{e}^{-r_i[z_i + \lambda\tau p\bar{v}/(1-p) + (1-\tau)(1-\alpha)p\bar{v}]}. \quad \text{(A.16)}$$

Consider first an interior solution for τ_i^* which must satisfy

$$\frac{\mathrm{d}EU_i(\tau)}{\mathrm{d}\tau} = -pr_i(1-\alpha)p\bar{v}e^{-r_i\bar{x}_i} - (1-p)r_i\left[(1-\alpha)p\bar{v} - \frac{\lambda p\bar{v}}{1-p}\right]\mathrm{e}^{-r_i\underline{x}_i} = 0. \tag{A.17}$$

Using the implicit function theorem, we have

$$\frac{\mathrm{d}\tau_i}{\mathrm{d}r_i} = -\frac{\mathrm{d(A.17)/d}r_i}{\mathrm{d(A.17)/d}\tau} > 0 \Leftrightarrow \frac{\mathrm{d(A.17)}}{\mathrm{d}r_i} > 0, \tag{A.18}$$

since $EU_i(\tau)$ is strictly concave.

$$\begin{aligned}
\frac{\mathrm{d(A.17)}}{\mathrm{d}r_i} &= -p(1-\alpha)p\bar{v}\mathrm{e}^{-r_i\bar{x}_i} + pr_i(1-\alpha)p\bar{v}\cdot\bar{x}_i\mathrm{e}^{-r_i\bar{x}_i} \\
&\quad - (1-p)\left[(1-\alpha)p\bar{v} - \frac{\lambda p\bar{v}}{1-p}\right]\mathrm{e}^{-r\underline{x}_i} \\
&\quad + (1-p)r_i\left[(1-\alpha)p\bar{v} - \frac{\lambda p\bar{v}}{1-p}\right]\underline{x}_i\mathrm{e}^{-r_i\underline{x}_i} \\
&= \underbrace{-p(1-\alpha)p\bar{v}\mathrm{e}^{-r_i\bar{x}_i} - (1-p)\left[(1-\alpha)p\bar{v} - \frac{\lambda p\bar{v}}{1-p}\right]\mathrm{e}^{-r_i\underline{x}_i}}_{=\frac{(A.17)}{r_i}=0} \\
&\quad + pr_i(1-\alpha)p\bar{v}\cdot\bar{x}_i\mathrm{e}^{-r_i\bar{x}_i} + (1-p)r_i\left[(1-\alpha)p\bar{v} - \frac{\lambda p\bar{v}}{1-p}\right]\underline{x}_i\mathrm{e}^{-r_i\underline{x}_i} \\
&= \bar{x}_i\underbrace{\left[pr_i(1-\alpha)p\bar{v}\mathrm{e}^{-r_i\bar{x}_i} + (1-p)r_i\left[(1-\alpha)p\bar{v} - \frac{\lambda p\bar{v}}{1-p}\right]\mathrm{e}^{-r_i\underline{x}_i}\right]}_{=-(A.17)=0} \\
&\quad - \underbrace{(\bar{x}_i - \underline{x}_i)}_{>0}\underbrace{(1-p)r_i}_{>0}\underbrace{\left[(1-\alpha)p\bar{v} - \frac{\lambda p\bar{v}}{1-p}\right]}_{<0}\underbrace{\mathrm{e}^{-r_i\underline{x}_i}}_{>0} > 0.
\end{aligned} \tag{A.19}$$

Note that the second last term must be negative. Otherwise Eq. (A.17) cannot hold and we do not have an interior solution.

Consider now a corner solution of voter i's maximization problem. Note that

$$\frac{\mathrm{d}[U'(\bar{x}_i)/U'(\underline{x}_i)]}{\mathrm{d}r_i} = -[\bar{x}_i - \underline{x}_i]\mathrm{e}^{-r_i[\bar{x}_i - \underline{x}_i]} < 0. \tag{A.20}$$

Thus, if the voter becomes more risk averse, the range with $\tau_i^* = 0$ shrinks while the range with $\tau = \bar{\tau}$ becomes larger. Hence, an increase in the degree of risk aversion unambiguously increases the optimal expropriation rate. □

Proof of Proposition 3. Consider an interior optimal τ_i^*. Implicitly differentiating with respect to α yields

$$\frac{\mathrm{d}\tau_i^*}{\mathrm{d}\alpha} = -\frac{\mathrm{d}(9)/\mathrm{d}\alpha}{\mathrm{d}(9)/\mathrm{d}\tau} > 0 \Leftrightarrow \frac{\mathrm{d}(9)}{\mathrm{d}\alpha} > 0, \tag{A.21}$$

since $\mathrm{E}U(\tau)$ is concave.

$$\frac{\mathrm{d}(9)}{\mathrm{d}} = p^2\bar{v}U'(\bar{x}_i) + p^2(1-\alpha)\bar{v}(1-\tau)p\bar{v}U''(\bar{x}_i) \tag{A.22}$$

$$+ (1-p)pvU'(\underline{x}_i) - (1-p)\left[\frac{\lambda p\bar{v}}{1-p} - (1-\alpha)p\bar{v}\right](1-\tau)p\bar{v}U''(\underline{x}_i) \tag{A.23}$$

$$= p\bar{v}\underbrace{\{pU'(\bar{x}_i) + (1-p)U'(\underline{x}_i)\}}_{>0} \tag{A.24}$$

$$+ p\bar{v}(1-\tau)\underbrace{\left\{p^2(1-\alpha)\bar{v}U''(\underline{x}_i) - (1-p)\left[\frac{\lambda p\bar{v}}{1-p} - (1-\alpha)p\bar{v}\right]U''(\underline{x}_i)\right\}}_{= -\frac{\mathrm{d}(9)}{\mathrm{d}z_i} \geq 0 \Leftrightarrow NIARA} \tag{A.25}$$

$\geq 0.$

To see that there is no problem with a corner solution note that

$$f(\alpha) = \frac{\lambda - (1-\alpha)(1-p)}{p(1-\alpha)}$$

is increasing with α since

$$f'(\alpha) = \frac{(1-p)p(1-\alpha) + p\lambda - p(1-\alpha)(1-p)}{p^2(1-\alpha)^2} = \frac{\lambda}{p(1-\alpha)^2} > 0. \tag{A.26}$$

On the other hand, $g(\alpha) = U'(\bar{x}_i|\tau = 0)/U'(\underline{x}_i|\tau = 0)$ is decreasing with α since

$$g'(\alpha) = \frac{-p\bar{v}U''(\bar{x}_i|\tau = 0)U'(\underline{x}|\tau = 0) + p\bar{v}U''(\underline{x}_i|\tau = 0)U'(\bar{x}_i|\tau = 0)}{[U'(\underline{x}_i|\tau = 0)]^2} \leq 0 \tag{A.27}$$

$$\Leftrightarrow -U''(\bar{x}_i|\tau = 0)U'(\underline{x}_i|\tau = 0) \leq -U''(\underline{x}_i|\tau = 0)U'(\bar{x}_i|\tau = 0) \tag{A.28}$$

$$\Leftrightarrow -\frac{U''(\bar{x}_i|\tau = 0)}{U'(\bar{x}_i|\tau = 0)} \leq -\frac{U''(\underline{x}_i|\tau = 0)}{U'(\underline{x}_i|\tau = 0)} \Leftrightarrow NIARA. \tag{A.29}$$

Hence, as α increases a strictly positive τ^* becomes more likely. □

Proof of Proposition 5. Let τ_1^* denote voter i's optimal expropriation rate under diversified distribution of shares and τ_2^* his optimal expropriation rate under insider privatization. The reference to voter i's index i is omitted. Furthermore, let $\bar{x}(\tau)[\underline{x}(\tau)]$ be voter i's total income under general ownership if the expropriation rate τ is applied and his firm was succesful [not successful, respectively]. Define $\bar{y}(\tau)$, and $\underline{y}(\tau)$ correspondingly as voter i's income under insider privatization.

Suppose that there is an interior solution for τ_1^*. Then the first-order condition for a maximum requires

$$-p^2(1-\alpha)\bar{v}U'(\bar{x}(\tau_1^*)) + (1-p)\left[\frac{\lambda p\bar{v}}{1-p} - (1-\alpha)p\bar{v}\right]U'(\underline{x}(\tau_1^*)) = 0, \tag{A.30}$$

which is equivalent to

$$-(1-\alpha)[pU'(\bar{x}(\tau_1^*)) + (1-p)U'(\bar{x}(\tau_1^*))] + \lambda U'(\underline{x}(\tau_1^*)) = 0. \tag{A.31}$$

Consider now the case of insider privatization. The first derivative of voter i's expected utility with respect to τ at τ_1^* is given by

$$\begin{aligned}\frac{\mathrm{d}EU(y(\tau_1^*))}{\mathrm{d}\tau} &= -p(1-\alpha)\bar{v}U'(\bar{y}(\tau_1^*)) + p\lambda\bar{v}U'(\underline{y}(\tau_1^*)) \\ &= p\bar{v}[-(1-\alpha)U'(\bar{y}(\tau_1^*)) + U'(\underline{y}(\tau_1^*))].\end{aligned} \tag{A.32}$$

Note that $\underline{y}(\tau_1^*) < \underline{x}(\tau_1^*)$ which implies

$$\lambda U'(\underline{y}(\tau_1^*)) > \lambda U'(\underline{x}(\tau_1^*)). \tag{A.33}$$

Furthermore, $\bar{y}(\tau_1^*) > \bar{x}(\tau_1^*) \geq \underline{x}(\tau_1^*)$ which implies

$$U'(\bar{y}(\tau_1^*)) < pU'(\bar{x}(\tau_1^*)) + (1-p)U'(\underline{x}(\tau_1^*)), \tag{A.34}$$

$$\Leftrightarrow -(1-\alpha)U'(\bar{y}(\tau_1^*)) > -(1-\alpha)[pU'(\bar{x}(\tau_1^*)) + (1-p)U'(\underline{x}(\tau_1^*))]. \tag{A.35}$$

Therefore $\mathrm{d}\mathrm{E}U(y(\tau_1^*))/\mathrm{d}\tau > 0$. Since $\mathrm{E}U(y(\tau))$ is strictly concave in τ, it must be true that $\tau_2^* > \tau_1^*$.

Now suppose that we have a corner solution with $\tau_1^* = \bar{\tau}$ under diversified mass privatization, i.e.

$$\frac{U'(\bar{x}(\tau = \bar{\tau}))}{U'(\underline{x}(\tau = \bar{\tau}))} \leq \frac{\lambda - (1-\alpha)(1-p)}{p(1-\alpha)}. \tag{A.36}$$

Note that

$$\bar{x}(\bar{\tau}) \leq \bar{y}(\bar{\tau}) \;\Rightarrow\; U'(\bar{x}(\bar{\tau})) \geq U'(y(\bar{\tau})),$$

$$\bar{x}(\bar{\tau}) \geq \underline{y}(\bar{\tau}) \;\Rightarrow\; U'(\underline{x}(\bar{\tau})) \leq U'(\underline{y}(\bar{\tau}).$$

Hence,

$$\frac{U'(\bar{y}(\tau = \bar{\tau}))}{U'(\underline{y}(\tau = \bar{\tau}))} \leq \frac{U'(\bar{x}(\tau = \bar{\tau}))}{U'(\underline{x}(\tau = \bar{\tau}))}. \tag{A.37}$$

Furthermore,

$$\frac{\lambda}{1-\alpha} \geq \frac{\lambda - (1-\alpha)(1-p)}{p(1-\alpha)}, \tag{A.38}$$

$$\Leftrightarrow -\lambda(1-p) \geq -(1-\alpha)(1-p), \tag{A.39}$$

$$\Leftrightarrow (1-\alpha) \geq \lambda. \tag{A.40}$$

Note that $\lambda \leq 1-\alpha$ is the only relevant case here. If $\lambda > 1-\alpha$ there is full expropriation anyway. Hence, if there is full expropriation with diversified portfolios, then it must be the case that

$$\frac{U'(\bar{y}_i|\tau = \bar{\tau})}{U'(\underline{y}_i|\tau = \bar{\tau})} \leq \frac{\lambda}{1-\alpha}, \tag{A.41}$$

i.e., there must also be full expropriation with insider privatization. □

Proof of Proposition 8. If this condition (25) holds for all $p \in [\underline{p}, \bar{p}\,]$ restructuring is a dominant strategy and there is a unique equilibrium. Hence, a sufficient condition for a unique equilibrium with significant restructuring is that

$$g(\alpha) \equiv \alpha[1 - \tau_m^*(\alpha, p)] > \frac{G}{\bar{V}(p - \underline{p})} \quad \forall p \in [\underline{p}, \bar{p}] \tag{A.42}$$

We assumed that there exists an $\alpha < 1 - \lambda$ such that $\tau_m^* < \bar{\tau} \leq 1$. Thus, there also exists an $\alpha < 1 - \lambda$ such that $g(\alpha) > 0$. Hence, if G is sufficiently small and/or $\bar{V}$ is sufficiently large Eq. (A.42) is satisfied. □

Proof of Proposition 9. If $(1-\bar{p})/\bar{p}\,\bar{w}/\lambda\bar{V} > 1$ then $\bar{\tau}(p) = 1\ \forall p \in [\underline{p}, \bar{p}]$. Thus, if the government chooses $\alpha \in [1-\lambda, 1]$ there will be full expropriation by Proposition 7, no core investor is going to restructure and profits of core investors are 0. Hence, when the government tries to sell the firms to core investors its revenues are also 0.

Suppose the government chooses $\alpha \in [0, 1-\lambda]$. If G is sufficiently small and/or $\bar{V}$ is sufficiently large, we know from Proposition 8 that there is an $\alpha \in [0, 1-\lambda]$ such that a unique equilibrium obtains in which all core investors restructure and make positive profits

$$\Pi(\alpha) = \alpha(1 - \tau^*_m(\alpha, \bar{p}))\bar{p}\bar{V} - G = g(\alpha)\bar{p}\bar{V} - G. \tag{A.43}$$

Note that $g(\alpha)$ is continuous and bounded above with $g(0) = g(1-\lambda) = 0$ and $g(\alpha) > 0$ for some $\alpha \in (0, 1-\lambda)$. Hence, by the theorem of the maximum there exists an $\alpha^* \in (0, 1-\lambda)$ maximizing $\Pi(\alpha)$. If the government sells $\alpha^*\%$ of the shares of all firms to core investors through a competitive auction, its revenues are also maximized at α^*. □

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