

Political Incentives to Privatize

B. Pablo Montagnes*
University of Chicago

Baur Bektemirov†
University of Chicago

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Abstract

The scope of the public sector (i.e. what activities are undertaken by public rather than private entities) is a decision made by politicians. While there are economic costs and benefits to privatization, there is also a political benefit to incumbents: By privatizing today, politicians transfer future revenues (when they might not be in office) to the present. This political benefit leads to over-privatization. We show that this political benefit persists even if politicians are able to borrow against public assets. We analyze the relationship between privatization and over-privatization with the political environment, as well as complete a normative analysis of the costs and benefits to society of allowing politicians to privatize assets.

*Assistant Professor, Harris School of Public Policy, 1130 E. 60th Street, Chicago, IL 60637

†MPP Candidate, Harris School of Public Policy, 1130 E. 60th Street, Chicago, IL 60637

1 Introduction

In December of 2008, Chicago leased the city's parking meters and the associated revenue stream to a private consortium in exchange for \$1.15 billion. A later investigation by the city's inspector general conservatively estimated the net present value of the revenue stream at more than \$2.13 billion.¹ Why did the city effectively leave \$947 million on the table? The inspector general is clear in his judgment:

The temptation of entering into [asset sales] in order to receive upfront payment to solve short-term financial problems, without properly considering the long-term implication of the deal [lead to the inefficient privatization]. - Inspector General Report, June 2, 2009, (Hoffman (2009))

This paper considers the *political* determination of what remains in the public sphere and what is sold to the private sector. Such assets constitute much of the total wealth of governments, and the sale of these assets is as important as borrowing to the long-term fiscal health of governments. Technological advancement such as electronic tolling makes it feasible to charge for and privatize services that have previously been provided as public or semi-public good such as urban highways. While current federal law prohibits the use of tolls on existing federally funded interstate highways, recent proposals suggest allowing states to charge tolls.^{2,3}

While there exists a large literature characterizing the political determination of the size of the government [Meltzer and Richard (1981), Boix (1998), Boix (2001), Blais et al. (1993), Iversen and Cusack (2000), Iversen and Soskice (2006), Miller and Moe (1983), Coughlin et al. (1990) Alesina and Tabellini (1990)], much less attention has been focused on the politician determination of the scope of government. Previous studies have focused on the economic consequences of privatization, but have ignored the political incentives of those making the privatization decision.⁴

While privatization can have economic effects, the privatization decision is inherently a political decision. In this paper, we consider the political costs and benefits for politician making the privatization decision in light of existing economic trade-offs.⁵ By privatizing

¹The estimate was conservative in that it used a discount of 7%, 2 percentage points greater than the city's actual borrowing costs.

²Exceptions to the prohibition included grandfathered sections of the system such as the New Jersey turnpike, pilot projects and specially built HOV lanes

³Washington Post April 29, 2014, Ashley Halsey III

⁴Model have focused on information asymmetries [Tirole and Laffont (1993), Levin and Tadelis (2010)], incentive provision [Trebilcock and Iacobucci (2003), Hart et al. (1997)], innovation [Bouché and Volden (2011)], self-regulation [Ostrom and Ostrom (1999)], and the classic market failures associated with natural monopoly and externalities (see Roland (2008) for a summary).

⁵One paper that does explicitly consider the political nature of the privatization decision is Biais and Perotti (2002). While we focus on difference between the value that politicians and voters attach to priva-

today, politicians transfer future revenues (when they might not be in office) to the present (when they are certain to use them). We examine the privatization decision from the politician's perspective and contrast it to the voter's optimal choice. Our approach sheds light on positive questions (e.g., when will privatization occur?), as well as normative concerns (e.g., when is privatization beneficial to voters?).

We find that the political benefit associated with privatization can lead to over-privatization. When politicians are confident that they will be reelected, they behave more like long-term owners and retain and invest in public assets. This is optimal for voters as private owners ignore externalities associated with the asset. As political uncertainty increases, public control becomes less appealing for voters as politicians discount the future more and invest less. However, as political uncertainty increases, the political benefit of privatization increases as well, and this distorts the politician's decision, making it different from the voter's preference. For intermediate levels of political uncertainty, politicians privatize assets to enjoy the immediate windfall, even though voters prefer public ownership to privatization. As uncertainty increases, the public failure associated with government control exceeds the private failure associated with privatization and both voters, and politicians prefer privatization. Therefore, the ability to privatize has an ambiguous effect on voters' welfare. We relate this phenomena to political and market features such as term lengths and the existence of a borrowing market. We show that the interaction between political and market institutions affects both the desirability and likelihood of privatization, and we emphasize the importance of the political process to understanding privatization.

An important contribution of our model is that it allows us to examine a variety of institutional features related to elections and financial markets and how both affect the benefits of privatization from the voters' perspective. We find that electoral features that increase the patience of politicians, such as longer terms and higher term limits, have two distinct effects. First, they increase the quality of public control. Second, they reduce the likelihood of over-privatization. Additionally, increased access to asset specific borrowing markets such as revenue bonds reduce the incentives to over-privatize. In fact, access to borrowing can greatly increase voter welfare by reducing over-privatization precisely when it is most costly to voters. This result demonstrates how the presence of markets can ameliorate, but not eliminate, political failure by increasing the set of options that politicians have to achieve their aims.

We proceed as follows. In section 2, we describe the details of the model. In section 3, we characterize the investment behavior of both public and private owners illustrating that both may deviate from the socially optimal level. We further demonstrate that depending on initial parameters, either public or private ownership, each with its attendant shortcomings, may be optimal for the voter. In section 4, we compare the optimal ownership structure to the one chosen by the politician and characterize the factors that drive privatization. We show that over-privatization can occur and characterize when it is most likely and most costly. We then ask how unbundling control rights and cash flow rights through borrowing

tization, Biais and Perotti consider the effect of privatization on the preferences of voters and focus on the means of privatization and thus consider a different set of questions.

affects privatization. We conclude by connecting the theoretical insights of the model to existing literatures in political science and macro political economy.

2 Model Preliminaries

The model consist of a representative voter and a politician who must make a decision about the control of a public asset and a profit-maximizing private investor. The asset is valuable as it generates revenue in the future, but it requires investment in the present. In addition to generating revenue that can be used for government spending, the asset generates an externality that could be negative or positive. Voters care about the quality of government services, which are a function of government spending and the quality and ability of the politician, as well as the externality generated by the asset. The politician can decide to privatize the asset. In this case, the government receives a lump-sum payment equal to the expected profitability of the asset in private hands. If the politician decides to retain control of the asset, she must decide on the level of investment.

The politician values social welfare and enjoys rents from holding office. However, the politician faces an election between the time the asset ownership and investment decisions are made and the time that the asset produces returns in the form of revenue and externalities. A private owner is a profit maximizers and faces no uncertainty in his role as owner. Consequently, he invests to maximize the long-term profitability of the asset.

2.1 Timing, Investment Costs and Returns

The model proceeds over three periods. Let $t \in \{0, 1, 2\}$ denote the period. In period 0, the politician decides whether to privatize the asset and how much to borrow. In period 1, the owner of the asset decides on the level of investment. Between periods 1 and 2, voters observe the level of government service and decide whether to retain the incumbent through an election. In period 2, the asset produces revenue and externalities that depends on the amount invested and the game ends.

Let x denote both the level and the cost of investment (we assume linear cost to facilitate exposition). The output of the asset consists of two components. The first is the market appropriable return of the asset: For a fixed investment of x the asset returns $R(x)$ units of revenue in the second period, where the technology exhibits decreasing returns to scale with $R' > 0$, $R'' < 0$, and $R(0) = 0$. The market appropriable returns are the only element of production that a private owner considers when making an investment decision and when valuing the asset. If the politician does not privatize the asset, these market returns become revenue for the government. In addition to the market appropriable returns, we assume that the asset generates non-appropriable externality $S(x)$. If these are negative externalities such as with pollution, then we assume that $S' < 0$ and $S'' < 0$. If these are positive

externalities such as increases in the value of neighboring properties due to investment, then we assume that $S' > 0$ and $S'' < 0$. To ensure interior solutions, we assume that $R'(x) + S'(x) \rightarrow \infty$ as $x \rightarrow 0$

Let Q denote the amount the government receives for selling the asset. We assume a perfectly competitive market for asset control. Hence, the value of the asset is equal to the expected profit of the asset, $Q = R(x) - x$, where the level of investment is decided by the private owner and is anticipated by the politician.⁶

2.2 Utilities

In periods 1 and 2, the voters experience government services that depend separably on the level of government spending and the quality of the office holder. In period 2, the voter also experiences the externality (positive or negative) generated by the asset. Let ν_t denote the quality of the politician in office at period t . We assume that government revenue raised through taxes is fixed and generates revenue flow, B_t in each period. Apart from the borrowing against the asset considered in an extension, we assume the government neither borrows nor saves.

If the politician retains control, the quality of government services experienced in period 1 consists of the quality of the politician and government revenue net of investment costs.

$$E_1^G = \nu_1 + B_1 - x \quad (1)$$

In period 2, the level of government services is equal to government revenue plus the returns of the asset, the externality generated by the asset, and the quality of the politician:

$$E_2^G = \nu_2 + B_2 + R(x) + S(x) \quad (2)$$

If privatized, the quality of government services in the first period consists of government revenue plus the value of the asset in private hands (the sale price of the asset) plus the quality of the politician:

$$E_1^P = \nu_1 + B_1 + Q = \nu_1 + B_1 + R(x) - x \quad (3)$$

In period 2, the level of services is equal to government revenue, politician quality, and

⁶The main results of the model are robust to relaxing the assumption that the politician gets the full value for the asset. If the politician is not able to extract the full value of the asset from the buyer, it reduces the appeal of privatization for both the politician and the voter, but the same wedge introduced by the political benefit of privatization still exists.

the level of externality under private control.

$$E_2^P = \nu_2 + B_2 + S(x) \tag{4}$$

The total utility of the voter is simply the sum of government services experienced over the two periods. Differences in ownership matter to the voter only to the degree to which they affect investment decisions.

The utility of the politician is assumed to equal the per-period utility of the voter plus exogenous rents to office $\gamma > 0$ if in office and zero otherwise. Government services are valued by the politician as they allow him to achieve partisan goals and to enjoy greater rents. Private owners are assumed to be profit-maximizing and ignore any externalities associated with production. We characterize the investment behavior of the two possible owners, but begin by first describing the voter's optimal as a benchmark.

3 Investment Behavior

3.1 Optimal Investment

Let x_{FB} denote the optimal level of investment from the voter's perspective and note that it is defined as the solution to the following first order condition (given our assumptions this is both necessary and sufficient) :

$$S'(x) + R'(x) - 1 = 0 \tag{5}$$

As we demonstrate in the next section, the actual level of investment under private and public control varies from this optimal benchmark in different ways, suggesting that there is a trade-off between privatization and retained public control.

3.2 Investment under Privatization

If the asset is privatized, the private owner makes an investment x in period 1, obtains returns $R(x)$ in period 2, and ignores the externalities generated by the asset. Let x_P denote this profit-maximizing investment level and note that it is defined as the solution to the following first order condition which are again both necessary and sufficient:

$$R'(x) - 1 = 0 \tag{6}$$

Comparing equation (6) to (5), it is immediately apparent that in the presence of a negative (*resp.* positive) externality, the firm overproduces (*resp.* underproduces) relative to the first best.

3.3 Investment under Political Control

Unlike the benchmark case or private investment, the investment decision under public control depends on the incumbent's political calculus. The representative voter conditions her reelection decision on the quality of government services, which is determined by the size of the budget, the level of investment, and the competence of the incumbent politician.

As the level of investment is fixed in period 1, the only factor that the voter can affect is the quality of the office holder in period 2. The voter thus forms an expectation about the incumbent type and chooses to retain if the expected type of the incumbent is greater than the expected type of the challenger (see Persson and Tabellini (2002), Ashworth (2005), Ashworth and Mesquita (2006) for related models).

We assume that the challenger's quality ν_C is unknown and is distributed uniformly on the interval $[-\frac{\xi}{2}, \frac{\xi}{2}]$. Therefore, the expected challenger quality is $E[\nu_C] = 0$. We assume that the incumbent's quality ν_I is also unknown to the voter and the politician and is distributed uniformly on $[-\frac{\xi}{2} + I, \frac{\xi}{2} + I]$ with the associated cumulative distribution function $F = \frac{1}{\xi}(X + \frac{\xi}{2} - I)$. The expected incumbent quality $E[\nu_I] = I$ can be greater or less than the expected challenger quality, where $I > 0$ corresponds to an advantaged incumbent and $I < 0$ to a disadvantaged incumbent. We additionally assume that I lies within the range of possible challenger types, $I \in [-\frac{\xi}{2}, \frac{\xi}{2}]$

In order to determine the amount that a politician invests in equilibrium, we suppose the voter conjectures that the politician will choose level of investment equal to x^* . We then determine the politician's actual investment decision in light of this conjecture and impose consistent beliefs upon the voter in order to derive the equilibrium level of investment.

For a given conjecture of investment x^* , the voter who observes spending E_1^G and knows budget B_1 has the following estimate of the incumbent's type:

$$\hat{\nu}_I = E_1^G - B_1 + x^* \tag{7}$$

where E_1^G is the observed level of spending equal to $B_1 - x + \nu_I$. The politician is reelected if the voter's updated belief about his quality is greater than the expected quality of the challenger. That is if $\hat{\nu}_I \geq E[\nu_C] = 0$, (i.e. $\nu_I \geq x - x^*$.)

Given the voter's conjecture about the level of investment, the politician believes he is reelected with probability:

$$Pr(\nu_I \geq x - x^*) = 1 - Pr(\nu_I < x - x^*) = 1 - F(x - x^*) \quad (8)$$

Given such a belief, the politician chooses x to maximize her total expected utility:

$$\underbrace{B_1 - x}_{\text{First Period Spending}} + \underbrace{(1 - F(x - x^*))}_{\text{Reelection Probability}} \left[\underbrace{B_2 + (R(x))}_{\text{Second Period Spending}} + \underbrace{\gamma}_{\text{Second Period Office Rent}} + \underbrace{S(x)}_{\text{Second Period Externality}} \right] \quad (9)$$

where γ represents the additional benefits of holding office. The first order condition for this problem defines the level of investment as a function of the voter's conjecture and the primals of the model. Given our assumption about the distribution of politician type and the returns to production, we are guaranteed an interior solution, and the first order conditions are necessary and sufficient::

$$-1 - F'(x - x^*)[\gamma + B_2 + (R(x) + S(x))] + (1 - F(x - x^*))(R'(x) + S'(x)) = 0 \quad (10)$$

Substituting in for the functional form of the uniform CDF and PDF and multiplying by $\frac{1}{\xi}$, we arrive at the following:

$$\left(\frac{\xi}{2} - x + x^* + I\right)(R'(x) + S'(x)) - (R(x) + S(x)) - (\xi + \gamma + B_2) = 0 \quad (11)$$

In order for the investment decision to be a sequential equilibrium, the beliefs of the voter must be consistent: Hence, $x^* = x$. Imposing this condition on equation (11), we can characterize the politician's choice of investment under government control as a function of the incumbent's advantage (or disadvantage), I , the benefits of holding office in the second period (γ and B_2), and the degree of electoral uncertainty ξ . Formally, $x_G(\gamma, \xi, I, B_2)$ is defined by the following condition:

$$-(R(x_G) + S(x_G)) + \left(\frac{\xi}{2} + I\right)(R'(x_G) + S'(x_G)) = \xi + \gamma + B_2 \quad (12)$$

3.4 Comparative Statics on Public Investment Decisions

The degree to which the incumbent is either advantaged or disadvantaged plays a significant role in much of the analysis that follows. As the incumbent enjoys a greater advantage, the degree of political uncertainty decreases and the politician preferences become more aligned with that of the voter. As electoral reforms such as longer terms or increased term

limits also reduce political uncertainty, the results presented in terms of incumbent advantage can be re-interpreted in terms of institutional reforms that lead to longer terms of service by incumbents.

The temporal nature of the investment decision has two distinct components. First, the voter does not directly observe incumbent quality or the level of investment. Instead, she observes government services, which are a function of both: Reduced investment and an increase in an incumbent's quality both lead to increased spending on government services. This creates an opportunity for incumbents to manipulate voters learning about their quality and introduces an *electoral effect* on investment. While the voter anticipates this behavior and is not fooled in equilibrium, the temptation to boost short-term spending by reducing investment nonetheless exists. As the benefits of being in office increases, so too does the incentive to obfuscate the voter's updating. The benefits of office in our model consist of both the level expected government revenue in the second period B_2 and the non-budgetary benefits of office γ . As either of these increase, investment in the asset in the first period decreases.

A separate effect on investment is the *political impatience effect* which is related to the politician's belief that he be in office in the future. An incumbent who is less sure about being reelected places less weight on the future returns generated by current investment. As the incumbent's advantage (disadvantage) increases, the probability that the incumbent is reelected increases (decreases), and he weighs the future returns to investment more (less). We formalize these results in remark 1:

Remark 1. *The level of investment under political control $x_G(\gamma, \xi, I, B_2)$ is strictly decreasing in benefits to office γ and second period fixed revenues B_2 and strictly increasing in the advantage of the incumbent I*

Proof. This and all subsequent proofs are found in appendix A. □

As mentioned, an alternative interpretation of electoral advantage is increased term lengths or other electoral features that lead to longer political careers. As the political horizon of the incumbent increases, the political impatience he faces decreases, and he places more value on future outcomes.

Political impatience also depends on the amount of uncertainty that the voter and the politician have about the incumbent's type. However, the relationship between uncertainty and investment depends on whether the incumbent is advantaged or not. For an advantaged incumbent, increased uncertainty about his type leads to increased uncertainty about the degree of advantage and reduces the value of the advantaged. This leads to increased political impatience and decreased investment. For a disadvantaged incumbent, the effect is reversed, and increased uncertainty about type leads to decreased political impatience and increased investing. As uncertainty about type becomes great, there is essentially no advantage or disadvantage, and all incumbents behave similarly. Remark 2 formalizes these results.

Remark 2. *If an incumbent is advantaged (disadvantaged) such that $I > 0$ ($I < 0$), then the level of investment under political control is strictly decreasing (increasing) in the degree of uncertainty about types ξ . As the degree of uncertainty increases, investment by all types approaches the investment of the neutral type. That is as $\xi \rightarrow \infty$, $x_G(\gamma, \xi, I, B_2) \rightarrow x_G(\gamma, \xi, O, B_2)$ for all $I \in [-\frac{\xi}{2}, \frac{\xi}{2}]$.*

The effects of political impatience and a temptation to fool the electorate are in the same direction, and the politician under-invests relative to the social optimum, a result we formalize in lemma 1.

Lemma 1. *The level of investment under political control x_G is strictly less than the voter optimal level of investment x_{FB} .*

As mentioned, the electoral effect is driven by the temptation to boost short-term spending in order to increase the voter's assessment of the incumbent, which depends on the assumption that the voter cannot observe investment. If we instead assumed that the voter can observe spending, would we still observe under-investment? The answer is yes and illustrates that the *electoral* and *political impatience* effects act independently of each other. This result is also of use when we consider the politician's decision to privatize later.

Consider a variation of the model where the voter observes both the level of expenditure E_1^G and investment level x . The voter has complete information about the politician's quality $\nu_I = E_1^G - B_1 + x$ and reelects him if $\nu_I \geq 0$. In other words, the probability of re-election is equal to $1 - F(0) = \frac{1}{2} - \frac{I}{\xi}$, which we now denote by $\pi(I, \xi)$ for simplicity. When choosing his level of investment, the politician maximizes:

$$B_1 - x + \pi(I, \xi)[\gamma + B_2 + R(x) + S(x)] \quad (13)$$

Let \hat{x}_G be the level of public investment under observable investment. As the politician maximizes (13), \hat{x}_G is defined by the following first order condition:

$$\pi(I, \xi)(R'(\hat{x}_G) + S'(\hat{x}_G)) - 1 = 0 \quad (14)$$

Comparing this condition with (11), we can verify that $x_G < \hat{x}_G$. If the voters can observe the level of investment, the politician faces the same reelection chances but invests more. However, as the next lemma establishes the level of investment is still less than the socially optimal level.

Lemma 2. *If investment is observed by the voter, the level of investment under political control is strictly less than the socially optimal level of investment but strictly higher than the level of investment when investment is not observable. Additionally, that investment is not sensitive to the returns to office in the second period.*

Previously, the returns to office affect investment by increasing the temptation to attempt to fool the voter. With observable investment, obfuscation no longer plays a role, and investment is distorted only by political uncertainty about whether the politician will be in office in period 2.

Discussion of investment

Both public and private ownership have shortcomings. Private owners ignore the externalities associated with their activities whereas public owners are overly concerned with the electoral effects of short-run spending and discount the future due to political uncertainty. From the voter's perspective, either ownership structure can dominate. However, the choice of the ownership structure lies with the incumbent and is subject to many of the same distortions. We turn to this problem in the following section.

4 Privatization Decisions

4.1 Socially Optimal Privatization

We characterize the optimal ownership structure from the perspective of the voter to serve as a benchmark when considering the actual privatization decision in period 0. Privatization is optimal from the voter if government services under private control ($E_1^P + E_2^P$) is greater than under public control ($E_1^G + E_2^G$).⁷ Substituting in the equilibrium choices of investment and suppressing the arguments of $x_G(\gamma, \xi, I, B_2)$, privatization is optimal if:

$$\underbrace{B_1 + (R(x_P) - x_P) + B_2 + S(x_P)}_{\text{Utility under Privatization}} > \underbrace{B_1 + -x_G + B_2 + R(x_G) + S(x_G)}_{\text{Utility under Public Control}} \quad (15)$$

which can be rewritten as

$$\underbrace{(R(x_P) - x_P) - (R(x_G) - x_G)}_{\text{Gains in Profitability under Privatization}} > \underbrace{S(x_G) - S(x_P)}_{\text{Difference in Externality under Government Control}} \quad (16)$$

The left-hand side of equation (16) represents the gains in profitability from moving from a government owner to a private owner. Since x_P is the unique maximizer of profit, the difference between profit under private control and public control is weakly positive and

⁷We assume that if government services are equal under public and private control that the voter prefers government ownership. This has no effect on our results.

generically strictly positive. The right-hand side is a measure of the gains in the externality under government control. While the gains in profit under private control are always positive, it is possible that the value of the externality is higher under private control if the externality associated with the asset is positive and the public underinvestment problem is severe enough. In fact, for either a positive or a negative externality, if the politician sufficiently discounts the future or is influenced by electoral concerns, then the underinvestment problem can dominate and privatization is preferred.

While future benefits from office and uncertainty about incumbent quality both contribute to public failure, we characterize the voter's preference for privatization in terms of the incumbent's electoral advantage. The quality of the incumbent serves as a parameterization of the overall probability of winning: For a fixed level of γ, ξ , and B_2 , a higher quality (higher I) increases the incumbent's chance of winning. As I varies from the lower bound of challenger quality ($-\frac{\xi}{2}$) to the upper bound ($\frac{\xi}{2}$), the probability of reelection varies monotonically and continuously from 0 to 1. Consequently, the level of investment under public control varies from 0 (when reelection is impossible) to the socially optimal level as the probability of reelection reaches 1.

In certain cases, the voter always prefer public ownership to private ownership. Public investment always generates a strictly positive level of welfare even if it is far from optimal. Therefore, if the level of investment under private control generates weakly negative welfare, then private ownership is strictly dominated by even very inefficient public control. We define an asset to be *private feasible* if output under privatization is welfare positive. That is, if $R(x_P) + S(x_P) - x_P > 0$. For a private feasible asset there exists a level of public failure at which a voter prefers privatizations.

Lemma 3. *If an asset is private feasible, there exists $\bar{I}_V(\gamma, \xi, B_2)$ such that the voter prefers privatization if and only if $I < \bar{I}_V$.*

Whether or not the politician's preference for privatization corresponds with the voter's depends upon the benefits and costs to privatization for the politician, which we expand upon in the next section.

4.2 Political Asset Sale

When deciding whether to privatize, the incumbent trades off the immediate benefit against the loss of control. If privatized, the asset generates a windfall for the politician, but constitutes a loss of control over the use of the asset. Since the windfall is experienced in the present and the benefits of control are born out over time, a politician facing sufficient political uncertainty is willing to privatize.⁸

⁸Our results regarding the desirability of the privatization are framed in terms of over-privatization relative to the social optimal. An alternative interpretation of these results consistent with the model is that politicians are willing to accept lower prices for assets than is socially desirable. Assuming that the

While the politician values the transfer of the value of the asset from the future to the present due to political uncertainty, privatization could also be appealing for electoral reasons. The windfall from the asset could allow the politician to boost short-run spending and further affect the voter's belief about her quality. The second effect is ruled out by our assumption that privatization is observable and voters update their belief about the resources available for government services from B_1 to B_1+Q . If politicians are able to secretly privatize the asset, the appeal of privatization would increase. Since we are interested in establishing over-privatization, assuming public observability of privatization biases us away from finding the result.

Under observable privatization, voters update their beliefs about spending levels and are able to perfectly infer the politician's type. As before, the politician is reelected with probability $\pi(I, \xi)$, and the value of privatization to the politician is:

$$\underbrace{R(x_P) - x_P}_{\text{Market Value of Asset}} + B_1 + \pi(I, \xi)[B_2 + \gamma + \underbrace{S(x_P)}_{\text{Externality Under Private Control}}] \quad (17)$$

We begin by noting that under both privatization and retained control, the reelection rate faced by the incumbent is the same value $\pi(I, \xi)$. As with the voter, simply comparing utilities under each regime gives us the condition under which privatization is pursued by the politician:

$$\underbrace{B_1 + (R(x_P) - x_P) + \pi(I, \xi)(B_2 + \gamma + S(x_P))}_{\text{Utility under Privatization}} > \underbrace{B_1 + -x_G + \pi(I, \xi)(B_2 + \gamma + R(x_G) + S(x_G))}_{\text{Utility under Public Control}} \quad (18)$$

which can be also be written as:

$$\underbrace{(R(x_P) - x_P) - (R(x_G) - x_G)}_{\text{Gains in Profitability under Privatization}} > \pi(I, \xi) \underbrace{(S(x_G) - S(x_P))}_{\text{Difference in Externality under Government Control}} + \underbrace{(\pi(I, \xi) - 1)R(x_G)}_{\text{Delayed value of revenue under Government Control}} \quad (19)$$

As before, the left-hand side of (19) represents the gains in profitability from moving from a government owner to a private owner and the right-hand side the gains to public ownership. However, these gains are discounted by the politician. Comparing the relative weight the politician places on privatization and public control, we see that he discounts public control more than the voter does. As result, the politician never prefers public ownership when the voter does not, and we can establish that under-privatization never occurs.

politician gets the highest prices simply frames the results in terms of *likelihood* of over-privatization rather than *quality* of privatization.

Proposition 1. *If the voter prefers privatization, then the politician prefers privatization.*

This distortion or wedge is driven by two distinct differences in the preferences. First, while both the politician and the voter value gains in the profitability of the asset, the relative value of the trade-off between profitability and the externality is different for the politician and the voter. Due to political uncertainty, the politician is willing to accept greater decreases in welfare in the *future* for increased revenue in the *present*. Second, the politician values the transfer of revenue that would have accrued to the government under public control from the future to the present. The voter is indifferent between revenue in the present and the future as he does not discount the second period. These distortions contribute to our second result, which states that over-privatization occurs when the degree of public failure is sufficient for the politician to prefer privatization but not so great that the voter prefers privatization. We characterize over-privatization relative to the overall probability of winning which is parameterized by the expected incumbency advantage.

Proposition 2. *There exists $\bar{I}_{POL} > \bar{I}_V$ such that the politician prefers privatization if and only if $I < \bar{I}_{POL}$.*

4.3 Discussion of Over-privatization

While privation occurs for $I < \bar{I}_{POL}$, it is only excessive from the voter's perspective if $I \in (\bar{I}_v, \bar{I}_{POL})$. If the incumbent discounts the future sufficiently (i.e. $I < \bar{I}_V$), then the degree of public failure is such that both the voter and politician prefer privatization. Similarly, if $I > \bar{I}_{POL}$ then both the politician and the voter prefer retaining public control. It is only for intermediate values of political uncertainty that a conflict regarding the privatization decision emerges.

Privatization is most costly for the voter when the preferences between the voter and incumbent regarding the privatizations decision are furthest apart. Consider two values of the political advantage $I_1, I_2 \in (\bar{I}_v, \bar{I}_{POL})$ where $I_1 > I_2$. For both I_1 and I_2 , there is excessive privatization, but the cost to the voter in terms of forgone welfare is higher for I_1 , since it is further from her indifference point. Reforms that reduce over-privatization by reducing the incumbent's threshold are especially valuable as they reduce over-privatization precisely when the associated costs are highest. This emerges as one of the benefits of a borrowing market considered in the next section.

4.4 Borrowing

Privatization is appealing for the politician as it allows for the transfer of future revenues to the present. Borrowing is an alternative means of transferring revenue to the present with the added benefit of retaining control. Whenever privatization is not preferred by the voter, it is because the politician's equilibrium use of the asset is closer to the the voter's optimal than

a private owners. If borrowing induces a politician to forgo privatization in these states, then it has the possibility of eliminating the burdens of over-privatization. As we demonstrate, while borrowing is welfare-improving, it nonetheless fails to eliminate over-privatization. The reason is that by retaining control the politician generates a commitment problem with lenders. Unable to make binding commitments to use the asset in a profit maximizing manner, lenders anticipate the politician's investment and do not lend an amount equal to privatization value of the asset.

This highlights a fundamental distinction between privatization—which entails the sale and transfer of both beneficial and control rights—and borrowing—which entails the sale of transfer of only beneficial rights. Privatization generates a commitment as to the future use of an asset that borrowing cannot recreate.

To most closely connect the borrowing problem to the privatization problem we model a revenue bond market where the asset is sold in period 0 and repaid using revenues generated by the asset in period 2.

To focus on the moral hazard issue that exists between politicians and lenders, we assume the politician's investment decision is observed by voters. As discussed this effectively shuts down the incentive for the politician to manipulate spending, and, therefore, the reelection probability is fixed and only depends on the quality of the incumbent.

For a fixed loan amount, L , the politician chooses investment level x to maximize her expected utility noting that revenue generated by the asset only flows to government coffers once the loan amount as been repaid:

$$L + B_1 - x + \pi(I, \xi)[S(x) + \text{Max}\{0, R(x) - L\}] \quad (20)$$

The problem is that (20) is generally not concave or differentiable so the standard first order approach is not valid. However, the politician is either facing an investment decision where the loan is small enough such that it does not affect the marginal investment decision or large enough such that she expects no revenue from the project in the second period, as loan repayment will take all of the generated income for all relevant levels of investment.

The lowest possible loan that the politician could receive is $\underline{L} = 0$ and the politician faces his standard problem without borrowing:

$$B_1 - x + \pi(I, \xi)(S(x) + R(x) + \gamma + B_2) \quad (21)$$

This loan of 0 provides the politician with the highest incentive to invest as he is able to recoup all the financial rewards of the asset in the second period. We label the unique solution to this problem \bar{x} (we suppress its arguments I, ξ) and note that it is the most the politician would ever invest. For investments greater than \bar{x} , the return to investment is negative regardless of the loan amount.

We now want to consider a loan amount large enough such that the politician knows that the entire income stream from the project is allocated to paying back the loan. Facing such a loan, the politician does not consider the revenue generated by the project when making an investment decision. If $\bar{L} > R(\bar{x})$, the revenue generated by the project is insufficient to pay back the loan as all feasible investment levels ($x \leq \bar{x}$) generate income below \bar{L} . Put another way, for all feasible investment levels $Max\{0, R(x) - \bar{L}\} = 0$, and the politician chooses investment level x to maximize:

$$\bar{L} + B_1 - x + \pi(\nu_c)(S(x) + \gamma + B_2) \quad (22)$$

This loan amount provides the lowest possible incentive to invest, and we label the unique solution to this problem \underline{x} .

Having established that a feasible investment must be in the range $[\underline{x}, \bar{x}]$, we now show that any optimal solution must in fact be one of these two extremes. That is, any solution must be in the set $\{\underline{x}, \bar{x}\}$.

Consider an arbitrary loan \hat{L} and investment level \hat{x} and denote the value to the politician for such a loan and investment $V(\hat{x}|\hat{L})$. We show that \hat{x} is dominated by either \underline{x} or \bar{x} . If $\hat{x} \in (\underline{x}, R^{-1}(\hat{L}))$, it would be dominated by \underline{x} . To see this, note that $V(\underline{x}|\hat{L}) - V(\hat{x}|\hat{L}) = \pi(\nu_c)S(\underline{x}) - \underline{x} - [\pi(\nu_c)S(\hat{x}) - \hat{x}]$, which is strictly positive as \underline{x} is the unique maximizer of $\pi(\nu_c)S(x) - x$. , for investment level $\hat{x} \in [R^{-1}(\hat{L}), \bar{x}]$, $V(\bar{x}|\hat{L}) - V(\hat{x}|\hat{L})$ is strictly positive. In either case, the solution to the politician's borrowing investment problem is \underline{x} , \bar{x} or both.

Because the politician discounts period 2 revenue relative to period 1, the politician's utility is increasing in the period 0 loan amount, and he seeks the largest possible loan. However, the lender lends only up until an amount that he expects to be paid back. Thus, if the investment level is x , the lender is willing to make any loan in $[0, R(x)]$. Clearly investment level \bar{x} supports a larger loan. However, as the loan amount increases the incentive to invest less increases, and the politician is tempted to switch from investing \bar{x} to \underline{x} . To find the largest possible loan that the politician qualifies for (and therefore the amount he borrows), we need to find the largest loan L that is consistent with investment level \bar{x} . That is, we need to find the largest loan that is incentive compatible with an investment level \bar{x} .

Our task is to find the highest L such that $V(\bar{x}|L) \geq V(\underline{x}|L)$ and \bar{x} is one of the solutions to the problem. For $L = 0$, $V(\bar{x}|0) > V(\underline{x}|0)$ and for $L' \geq \bar{L}$, $V(\bar{x}|L') < V(\underline{x}|L')$. Define $D(L) = V(\bar{x}|L) - V(\underline{x}|L)$, by above $D(\underline{L}) < 0$ and $D(\bar{L}) > 0$. As $D(L)$ is linear in L , it is both continuous and monotone, so by the mean value theorem there exists L^* such that $D(L^*) = 0$ which implies $V(\bar{x}|L^*) = V(\underline{x}|L^*)$ and for $L > L^*$, $V(\bar{x}|L) < V(\underline{x}|L)$.

At L^* , both investment levels \bar{x} and \underline{x} are solutions, but only investment level \bar{x} supports repayment of the loan. We assume that if indifferent, the politician invests \bar{x} .⁹

⁹For example, all else equal, the politician would prefer not to default on the loan if in office.

Because the size of the loan is structured so that the politician has a marginal incentive to value increased output, the level of investment with borrowing is the same as without borrowing, and social welfare under political control is unaffected. However, because the politician has transferred wealth from period 2 to period 1, the politician strictly prefers public control with borrowing to public control without.

Over-privatization and Borrowing

When borrowing is allowed, the politician has more options when controlling the asset. While borrowing allows for some of the fiscal transfer effects of privatization, we show that there are still conditions under which privatization dominates public control.

As shown in the previous section, the politician's utility increases with the amount she can borrow. If the asset remains under public control, the politician borrows L^* and invests the same level as in the case without borrowing. This unambiguously increases the benefits of retaining public control. We proceed by showing that over-privatization occurs, albeit less often than in the previous case. As before, the politician compares her utility under privatization and retained control:

$$\underbrace{B_1 + (R(x_P) - x_P) + \pi(\nu_c)(B_2 + \gamma + S(x_P))}_{\text{Utility under Privatization}} > \underbrace{B_1 + L^* - x_G + \pi(\nu_c)(B_2 + \gamma + R(x_G) - L^* + S(x_G))}_{\text{Utility under Public Control}} \quad (23)$$

which can be also be written as:

$$\underbrace{(R(x_P) - x_P) - (R(x_G) - x_G)}_{\text{Gains in Profitability under Privatization}} > \underbrace{\pi(\nu_c)(S(x_G) - S(x_P))}_{\text{Difference in Externality under Government Control}} + \underbrace{(\pi(\nu_c) - 1)(R(x_G) - L^*)}_{\text{Delayed Value of Revenue under Government Control}} \quad (24)$$

However, since the loan must leave some residual incentive for the politician ($R(x_G) - L^*) > 0$, the last term $(\pi(\nu_c) - 1)(R(x_G) - L^*)$ is greater than before but remains negative. Consequently, while the wedge between voter and politician is smaller, it still exists and over-privatization still occurs. We formalize these results in the following proposition:

Proposition 3. *If the politician is able to borrow, there exists $\bar{I}_{Borrow} \in (\bar{I}_V, \bar{I}_{Pol})$ such that the politician prefers privatization if and only if $I < \bar{I}_{Borrow}$.*

Borrowing is beneficial, however, as politician's privatize less often. It is also the case that conditional on retaining public control, a politician's utility is strictly larger when she

can borrow. Conditional on privatization occurring, the social cost of privatization remains the same. Therefore, allowing borrowing is weakly preferable for the social planner.

We conclude that the absence of adequate borrowing instruments may force privatization to occur in situations where political control would be optimal. Thus, better functioning capital markets reduce over-privatization, especially when the social losses from over-privatization are highest. The logic is not one of competitive outside options. Instead the introduction of a borrowing market reduces the appeal of socially inefficient privatization. Nonetheless, even if borrowing is available, over-privatization can still occur.

5 Conclusion

An asset consists of both the right of control and the right to the proceeds generated by an asset. While control rights are exercised and investment costs are borne in the present, benefits in the form of revenues accrue over the long-run. Thus, the alignment of control and interest depends on the term of ownership. In a well-functioning democracy, the ownership rights of private owners are secure, and they can make investment with long-term rewards. Public ownership, on the other hand, delegates control over the asset to politicians who face elections. When voters learn about the quality of politicians through the quality of public services, elections generate distortions that aren't present with long-term private owners.

The connection between electoral incentives and the short-run decisions of incumbents highlighted in our model echoes insight from work by Mayhew (1974) and Tufte (1975). The effects of incumbent decisions on the economy is noted by Bartels (2009) and a literature in macroeconomics formalizes political incentive to manipulate the economy in the theory of a political business cycle (see Drazen (2001) for a review).

We also view this paper as contributing to an emerging literature that explores the politics of infrastructure and highlights the durable nature of public investment. Callandar and Raiha (2013) develop a model where investment in different infrastructures can effect the relative appeal of incumbents in the future by creating commitment problems for challengers. Glazer (1989) emphasizes that one of the benefits of durable investment (even when it is inefficient) is that it generates commitment relative to short-run investments that are subject to whims of collective choice. The commitment problem that exists between the lending market and the politician in our model, highlights that one of the benefits of privatization is that it generates a commitment to invest in profit-maximizing manner.

Our electoral model is built around a career concerns framework [Holmström (1999), Ashworth (2005)] where voter seek to reelect high quality politicians and politicians seek to influence the learning by voters. The phenomenon we identify is a form of populism: Politicians sell future revenues in the present to support current spending at the expense of future welfare. We also demonstrate that even if politicians are not directly able to affect the choices of future office holders or to alter the preferences of voters, there nonetheless exists

an electoral incentive to deviate from the optimal policy. We view this as complementary to the results of Besley and Coate (1998) as we derive it a model without ideology.¹⁰

Privatization becomes more appealing to politicians and more pernicious to voters in the absence of a borrowing market. This suggests that consideration of the desirability of policies that make privatization more likely—such as recent proposals regarding tolling on federal highways—should be considered in light of political institutions as well as market conditions. The dynamic commitment problem with borrowers suggests that other instruments such as regulation and tax policy may introduce further commitment problems for politicians. Questions regarding tax policy, privatization and other instruments where dynamic consideration may create a wedge between the preferences of voters and politicians require further examination.

¹⁰Besley and Coate (1998), Alesina and Tabellini (1990), and others adopt an ideological model of politics and assume that politician care policy outcome. Thus, the degree to which they discount the future depends on the likely identity of future office holders. If an incumbent is likely to be replaced by someone with similar preferences, they do not discount the future as much as if they are replaced by someone with much greater preferences. As we are interested in the windfall and rents of office, we model only the quality of politicians and assume rents are proportional to government performance.

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Appendix

Proof of Remark 1: Differentiating equation (12) with respect to γ and B_2 will give us

$$\begin{aligned} -\frac{\partial x_G}{\partial \gamma}(R'(x_G) + S'(x_G)) + \frac{\partial x_G}{\partial \gamma}\left(\frac{\xi}{2} + I\right)(R''(x_G) + S''(x_G)) &= 1 > 0 \\ -\frac{\partial x_G}{\partial B_2}(R'(x_G) + S'(x_G)) + \frac{\partial x_G}{\partial B_2}\left(\frac{\xi}{2} + I\right)(R''(x_G) + S''(x_G)) &= 1 > 0 \end{aligned}$$

Since $R'(x) + S'(x) > 0$ and $R''(x) + S''(x) \leq 0$, $-(R'(x_G) + S'(x_G) + (\frac{\xi}{2} + I)(R''(x_G) + S''(x_G))) < 0$. Therefore $\frac{\partial x_G}{\partial \gamma}$ and $\frac{\partial x_G}{\partial B_2}$ are both negative, i.e. x_G is strictly decreasing in benefits to office, γ and second period fixed revenues, B_2 .

Differentiating equation (12) with respect to I :

$$\begin{aligned} -\frac{\partial x_G}{\partial I}(R'(x_G) + S'(x_G)) + \frac{\partial x_G}{\partial I}\left(\frac{\xi}{2} + I\right)(R''(x_G) + S''(x_G)) + (R'(x_G) + S'(x_G)) &= 0 \\ \frac{\partial x_G}{\partial I} &= \frac{R'(x_G) + S'(x_G)}{(R'(x_G) + S'(x_G)) - (\frac{\xi}{2} + I)(R''(x_G) + S''(x_G))} \end{aligned}$$

Since $R'(x) + S'(x) > 0$ and $R''(x) + S''(x) \leq 0$, the right-hand-side of the equation is positive, i.e. $\frac{\partial x_G}{\partial I}$ is positive and x_G is strictly increasing in the advantage of the incumbent, I .

Proof of Remark 2: Suppose that $I \leq 0$, then from (12) we deduce that

$$R'(x) + S'(x) = \frac{\xi + \gamma + B_2 + R(x) + S(x)}{\frac{\xi}{2} + I} \geq \frac{\xi + \gamma + B_2 + R(x) + S(x)}{\frac{\xi}{2}} > \frac{\xi}{\frac{\xi}{2}} = 2$$

Now, differentiating equation (12) with respect to ξ :

$$\begin{aligned} -\frac{\partial x_G}{\partial \xi}(R'(x_G) + S'(x_G)) + \frac{\partial x_G}{\partial \xi}\left(\frac{\xi}{2} + I\right)(R''(x_G) + S''(x_G)) + \frac{1}{2}(R'(x_G) + S'(x_G)) &= 1 \\ \frac{\partial x_G}{\partial \xi} &= \frac{1 - \frac{1}{2}(R'(x_G) + S'(x_G))}{-(R'(x_G) + S'(x_G)) + (\frac{\xi}{2} + I)(R''(x_G) + S''(x_G))} \end{aligned}$$

Both numerator and denominator of the fraction in the right-hand side are negative, therefore $\frac{\partial x_G}{\partial \xi}$ is positive, i.e. the level of investment under political control is strictly increasing in the degree of uncertainty about types ξ .

We can rewrite 12 as

$$R'(x_G) + S'(x_G) = \frac{\xi}{\frac{\xi}{2} + I} + \frac{\gamma + B_2 + R(x_G) + S(x_G)}{\frac{\xi}{2} + I} = R'(\hat{x}_G) + S'(\hat{x}_G) + \frac{\gamma + B_2 + R(x_G) + S(x_G)}{\frac{\xi}{2} + I}$$

Now, not that $\gamma + B_2 + R(x_G) + S(x_G)$ is limited from above, therefore as ξ grows, the second

fraction decreases and goes to 0 as degree of uncertainty approaches infinity. In other words, as $\xi \rightarrow \infty$, $x_G \rightarrow \hat{x}_G$.

Proof of Lemma 1: Note that

$$-(R(x_{FB})+S(x_{FB}))+(\frac{\xi}{2}+I)(R'(x_{FB})+S'(x_{FB})) = -(R(x_{FB})+S(x_{FB}))+\frac{\xi}{2}+I < \xi+\gamma+B_2$$

because $R(x) + S(x) > 0$, $\xi \geq \frac{\xi}{2} + I$ and $\gamma + B_2 \geq 0$. Since the left-hand side of (12) is decreasing in x_G , the level of investment under political control is strictly less than the socially optimal level of investment x_{FB} .

Proof of lemma 2: Easy to see that \hat{x}_G does not depend on neither γ nor B_2 . Now,

$$\pi(I, \xi)(R'(x_{FB}) + S'(x_{FB})) = \pi(I, \xi) < 1 = \pi(I, \xi)(R'(\hat{x}_G) + S'(\hat{x}_G))$$

Therefore $R'(x_{FB}) + S'(x_{FB}) < R'(\hat{x}_G) + S'(\hat{x}_G)$. Since $R' + S'$ is a decreasing function ($R'' + S'' < 0$), $x_{FB} > \hat{x}_G$.

Given that $\gamma, B_2 \geq 0$ and $R(\hat{x}_G) + S(\hat{x}_G) > 0$,

$$\begin{aligned} -(R(\hat{x}_G) + S(\hat{x}_G)) + (\frac{\xi}{2} + I)(R'(\hat{x}_G) + S'(\hat{x}_G)) &= -(R(\hat{x}_G) + S(\hat{x}_G)) + (\frac{\xi}{2} + I)\frac{1}{\pi(I, \xi)} \\ &= -(R(\hat{x}_G) + S(\hat{x}_G)) + (\frac{\xi}{2} + I)\frac{\xi}{\frac{\xi}{2} + I} = -(R(\hat{x}_G) + S(\hat{x}_G)) + \xi < \xi + \gamma + B_2 \\ &= -(R(x_G) + S(x_G)) + (\frac{\xi}{2} + I)(R'(x_G) + S'(x_G)) \end{aligned}$$

But $-(R(x) + S(x)) + (\frac{\xi}{2} + I)(R'(x) + S'(x))$ is decreasing in x , since $-(R'(x) + S'(x)) + (\frac{\xi}{2} + I)(R''(x) + S''(x)) < 0$. Therefore $\hat{x}_G > x_G$

Proof of lemma 3: The voter prefers privatization if and only if

$$R(x_P) + S(x_P) - x_P > R(x_G) + S(x_G) - x_G$$

The left-hand side of this inequality does not depend on I, γ, ξ or B_1 . Let's prove first that $R(x_G) + S(x_G) - x_G$ is increasing in the advantage of the incumbent, I

Note that $R''(x) + S''(x) < 0$, i.e. $R'(x) + S'(x)$ is a decreasing function. By lemma 1 we have $x_G < x_{FB}$. Therefore

$$R'(x_G) + S'(x_G) > R'(x_{FB}) + S'(x_{FB}) = 1$$

Taking first derivative of $R(x_G) + S(x_G) - x_G$ with respect to I gives us

$$\frac{\partial x_G}{\partial I}(R'(x_G) + S'(x_G) - 1) > 0$$

since x_G is increasing in I by remark 1. Therefore $R(x_G) + S(x_G) - x_G$ is increasing in I .

Note that for $I = -\frac{\xi}{2}$, we have $\pi(I, \xi) = 0$ and $x_G = 0$, in which case $R(x_P) + S(x_P) - x_P \geq 0 = R(x_G) + S(x_G) - x_G$. Now, if

$$R(x_P) + S(x_P) - x_P > R(x_G) + S(x_G) - x_G$$

for all values of x_G , then \bar{I}_V is just the upper bound for I , i.e. $\bar{I}_V = \frac{\xi}{2}$, in which case $\pi(I, \xi) = 1$ and $x_G = x_{FB}$, since the politician does not face any re-election uncertainty. But then $R(x_P) + S(x_P) - x_P \leq R(x_{FB}) + S(x_{FB}) - x_{FB} = R(x_G) + S(x_G) - x_G$ with equality only when $x_{FB} = x_P$, i.e. when $S(x) \equiv 0$. Now, if for some values of (γ, ξ, B_1) , $R(x_P) + S(x_P) - x_P \leq R(x_G) + S(x_G) - x_G$, by Mean Value Theorem there exist \bar{I}_V such that corresponding \bar{x}_G satisfies $R(x_P) + S(x_P) - x_P = R(\bar{x}_G) + S(\bar{x}_G) - \bar{x}_G$. Since $R(x_G) + S(x_G) - x_G$ is increasing in I , $I < \bar{I}_V$ if and only if $R(x_P) + S(x_P) - x_P > R(x_G) + S(x_G) - x_G$.

Proof of Proposition 1: If the voter prefers privatization, then

$$(R(x_P) - x_P) - (R(x_G) - x_G) > S(x_G) - S(x_P)$$

Suppose that the politician prefers retaining control, then

$$\pi(I, \xi)(S(x_G) - S(x_P)) + (\pi(I, \xi) - 1)R(x_G) \geq (R(x_P) - x_P) - (R(x_G) - x_G) > S(x_G) - S(x_P)$$

Since $R(x_G) > 0$ and $\pi \leq 1$, we must have $S(x_G) - S(x_P) < 0$, but then

$$(R(x_P) - x_P) - (R(x_G) - x_G) > 0 > \pi(I, \xi)(S(x_G) - S(x_P)) + (\pi(I, \xi) - 1)R(x_G)$$

which contradicts our assumption. Therefore, whenever voters prefer privatization so does the politician.

Proof of Proposition 2: The politician prefers privatization if and only if

$$(R(x_P) - x_P) - (R(x_G) - x_G) > \pi(I, \xi)(S(x_G) - S(x_P)) + (\pi(I, \xi) - 1)(R(x_G))$$

Note that for any $I = -\frac{\xi}{2}$, $\pi(I, \xi) = 0$, therefore $x_G = 0$ and it satisfies the inequality. Now, suppose that there exist \bar{I}_{POL} , such that corresponding x_G satisfies

$$(R(x_P) - x_P) - (R(x_G) - x_G) \leq \pi(I, \xi)(S(x_G) - S(x_P)) + (\pi(I, \xi) - 1)(R(x_G))$$

Since both sides are differentiable in x_G and I , by the Mean Value Theorem there exist \bar{I}_{POL} such that for corresponding $x_G(\bar{I}_{POL})$,

$$(R(x_P) - x_P) - (R(x_G(\bar{I}_{POL})) - x_G(\bar{I}_{POL})) = \pi(\bar{I}_{POL}, \xi)(S(x_G(\bar{I}_{POL})) - S(x_P)) + (\pi(\bar{I}_{POL}, \xi) - 1)(R(x_G(\bar{I}_{POL})))$$

or

$$R(x_P) - x_P = -x_G(\bar{I}_{POL}) + \pi(\bar{I}_{POL}, \xi)(R(x_G(\bar{I}_{POL})) + S(x_G(\bar{I}_{POL}))) - \pi(\bar{I}_{POL}, \xi)S(x_P)$$

Then for any $I < \bar{I}_{POL}$, since $\pi(I, \xi)$ and x_G are both increasing in I ,

$$R(x_P) - x_P > -x_G + \pi(I, \xi)(R(x_G) + S(x_G)) - \pi(I, \xi)S(x_P)$$

Suppose that $\bar{I}_V > \bar{I}_{POL}$, then there exist some $I \in (\bar{I}_{POL}, \bar{I}_V)$, such that with corresponding x_G , the voter prefers privatization, while the politician does not, which contradicts Proposition 1.

Suppose that $\bar{I}_V = \bar{I}_{POL} = I$, but then

$$-x_G + \pi(I, \xi)(R(x_G) + S(x_G)) - \pi(I, \xi)S(x_P) = R(x_G) + S(x_G) - x_G - S(x_G)$$

i.e. $\pi(I, \xi) = 1$ or $I = \frac{\xi}{2}$ and $\pi(I, \frac{\xi}{2}) = 1$, but then $x_G = x_{FB}$ and

$$R(x_P) + S(x_P) - x_P \leq R(x_{FB}) + S(x_{FB}) - x_{FB} = R(x_G) + S(x_G) - x_G = -x_G + \pi(I, \xi)(R(x_G) + S(x_G))$$

i.e. the politician prefers retaining control, unless $S(x) = 0$. In all other cases, \bar{I}_V must be less than \bar{I}_{POL} .

Proof of Proposition 3: The politician prefers privatization if and only if

$$(R(x_P) - x_P) - (R(x_G) - x_G) > \pi(I, \xi)(S(x_G) - S(x_P)) + (\pi(I, \xi) - 1)(R(x_G) - L^*)$$

where $R(x_G) \geq L^*$. For any $I = -\frac{\xi}{2}$, $\pi(I, \xi) = 0$, therefore $L = 0$ and $x_G = 0$, which satisfies the inequality. Suppose that there exist I such that for the corresponding x_G

$$(R(x_P) - x_P) - (R(x_G) - x_G) \leq \pi(I, \xi)(S(x_G) - S(x_P)) + (\pi(I, \xi) - 1)(R(x_G) - L^*)$$

Since both sides are differentiable in x and I , there exist \bar{I}_{Borrow} , for which

$$(R(x_P) - x_P) - (R(x_G) - x_G) = \pi(I, \xi)(S(x_G) - S(x_P)) + (\pi(I, \xi) - 1)(R(x_G) - L^*)$$

Since $\pi(I, \xi)$ and x_G are both increasing in I and $R(x_G) + S(x_G) \geq L^*$, for all $I < \bar{I}_{Borrow}$,

$$R(x_P) - x_P > -x_G + \pi(I, \xi)(R(x_G) + S(x_G) - L^*) - \pi(I, \xi)S(x_P) + L^*$$

and for $I > \bar{I}_{Borrow}$

$$R(x_P) - x_P < -x_G + \pi(I, \xi)(R(x_G) + S(x_G) - L^*) - \pi(I, \xi)S(x_P) + L^*$$

It suffice to prove now that $\bar{I}_{Borrow} \in (\bar{I}_V, \bar{I}_{POL})$. Suppose that $\bar{I}_{Borrow} < \bar{I}_V$, then there exist $I \in (\bar{I}_{Borrow}, \bar{I}_V)$ such that

$$S(x_G) - S(x_P) < (R(x_P) - x_P) - (R(x_G) - x_G) < \pi(I, \xi)(S(x_G) - S(x_P)) + (\pi(I, \xi) - 1)(R(x_G) - L^*)$$

but $\pi(I, \xi) \in [0, 1]$ and $R(x_G) \geq L^*$, we arrive at a contradiction. If $\bar{I}_{Borrow} = \bar{I}_V = I$, then there are two cases. If $\pi(I, \xi) = 0$, i.e. $I = -\frac{\xi}{2}$ and $x_G = 0$, $L^* = 0$, in which case the voter

always prefers privatization and we have a contradiction. If $\pi(I, \xi) = 1$, then $I = \frac{\xi}{2}$, then $\bar{I}_V = \bar{I}_{POL}$, in which case the politician prefers retaining control as proven in Proposition 8. Thus, $I_{Borrow} > \bar{I}_V$, unless $S = 0$ and $I = \frac{\xi}{2}$, in which case both politician and voter are indifferent between selling or retaining the rights. Suppose that $I_{Borrow} > \bar{I}_{POL}$, then there exist $I \in (\bar{I}_{POL}, I_{Borrow})$, for which

$$\begin{aligned} \pi(I, \xi)(S(x_G) - S(x_P)) + (\pi(I, \xi) - 1)(R(x_G)) &> (R(x_P) - x_P) - (R(x_G) - x_G) > \\ \pi(I, \xi)(S(x_G) - S(x_P)) + (\pi(I, \xi) - 1)(R(x_G) - L^*) & \end{aligned}$$

i.e. $L^*(\pi(I, \xi) - 1) > 0$, but $L^* \geq 0$ and $\pi(I, \xi) \leq 0$, we arrive at another contradiction. If $\bar{I}_{POL} = \bar{I}_{Borrow} = I$, then $L^*(\pi(I, \xi) - 1) = 0$. There are two cases. If $\pi(I, \xi) = 1$, then, as proved in Proposition 8, the politician must always prefer to retain public control, unless $S = 0$. If $L = 0$, then it means that $\pi(I, \xi) = 0$ or $I = -\frac{\xi}{2}$ and $x_G = 0$, in which case the politician always prefers privatization, i.e. we have a contradiction to the result of Propositions 6 and 8. Therefore $I_{Borrow} < \bar{I}_{POL}$ and $\bar{I}_{Borrow} = \bar{I}_{POL} = \bar{I}_V$ if and only if they equal to $\frac{\xi}{2}$ and $S(x) \equiv 0$.