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THE POLITICAL RISKS OF FIGHTING MARKET FAILURES: SUBVERSION, POPULISM AND THE GOVERNMENT SPONSORED ENTERPRISES

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ABSTRACT

There are many possible ways of reforming the Government-Sponsored Enterprises that insure mortgages against default, including a purely public option, complete privatization or a hybrid model with private firms and public catastrophic insurance. If the government is sufficiently capable and benign, either public intervention can yield desirable outcomes; the key risks of any reform come from the political process. This paper examines the political risks, related to corruption and populism, of differing approaches to the problems of monopoly, externalities and market breakdowns in asset insurance. If there is a high probability that political leadership will be induced to pursue policies that maximize the profitability of private entities at the expense of taxpayers, then purely public options create lower social losses. If there is a high probability that leaders will pursue a populist agenda of lowering prices or borrowing costs, then catastrophic risk insurance can lead to lower social losses than either complete laissez-faire of a pure public option.

Edward L. Glaeser
Department of Economics
315A Littauer Center
Harvard University
Cambridge, MA 02138
and NBER
eglaeser@harvard.edu

I. Introduction

The Federal Housing Finance Agency projects that the bailouts of the Federal Home Loan Mortgage Corporation (Freddie Mac) and the Federal National Mortgage Association (Fannie Mae) will require between 220 and 311 billion dollars ("FHFA Updates"). It is striking that two enterprises, allegedly operating without any government guarantee, received a bailout bigger than the gross domestic product (GDP) of Ireland or Egypt, but the financial distress and ensuing bailout were hardly unexpected. For many years before the downturn, analysts warned of ensuing disaster, while the market treated their securities as if they were essentially backed with the full faith and credit of the United States government (Jaffee 2006).

In response the crisis, observers have offered the full range of reform proposals ranging from complete public control of Fannie and Freddie to total government exit from the mortgage-insurance business. These proposals have swirled within a larger debate over banking sector regulation and taxation, where advocates have urged bank size limitations, bans on proprietary trading, and Tobin taxes, and even temporary nationalization. In some cases, it is difficult to understand what even the most well-managed public intervention would achieve, but in every case, it is difficult to assess the political risks that may distort any reform operation.

Freddie Mac and Fannie Mae might be privatized with stern assurances that even though the government has bailed them out in the past, this will never, ever happen again, but should investors believe those assurances? The institutional rules may be written to prevent bailouts, but those rules can be changed; profit-making mortgage insurance giants will certainly have the resources and incentives to influence congress and regulators. The institutional arrangements for Fannie Mae and Freddie Mac will face the twin political risks of subversion, where private companies capture policy (Stigler 1971), and political favoritism, where public leaders use government policy to pursue their own pet objectives, such as populism.

These risks help determine the consequences of any institutional reform. If private mortgage insurer entities are replaced with a purely public mortgage entity, then political leaders may seek to use that entity for political benefits that are barely related to general welfare. If the private entities are re-privatized, then their new leaders may be able to influence the system and again obtain de facto free public insurance for a private entity.

Such political risks are endemic in any public response to market failure, and the benefits of reducing market failures can be offset by the risks of political failure. Public ownership once seemed like a reasonable response to the downsides of natural monopolies, which is why distinguished Progressive Era economists, such as Ely (1901) argued for municipal ownership of utilities and transit systems. Yet public ownership has often been associated with operating losses, and allegations of excessively generous union contracts (Pashigian 1976). Since Stigler (1971), economists have argued that regulatory agencies, such as the Interstate Commerce Commission, are often captured by the industries that they are meant to control.

This paper examines the impact of the competing political risks of corruption and political favoritism in three settings with market failures. The paper follows the institutional design literature (e.g. Laffont and Tirole 1991) and assumes that the broad contours of the policy are set optimally, but that the implementation of the policy faces the risks of private influence and public malfeasance. In these settings, the risk of corruption is modeled by assuming that with some probability policies are implemented to maximize the profits of a favored firm (or firms). The risk of political favoritism is addressed by assuming that, with some probability, political leaders just seek to maximize the well-being of some segment of society. In this paper, I typically refer to favoritism as populism and assume that populist leaders favor the poor, but a more realistic assumption might be that politicians favor the strongest political groups, which might mean public sector unions or agricultural workers or the wealthy.

In the formal models, the risks of corruption and populism are treated as exogenous variables that help determine optimal institutions. Section II of this paper discusses the forces that determine these risks. While there is significant evidence suggesting that cultural norms strongly influence corruption (Fisman and Miguel 2007), there is also

ample room for using the tools of economics to make sense of the incidence of corruption (Becker and Stigler 1974). For example, the scale of profits that can be achieved by subverting public officials will surely help determine whether public officials are subverted. Political favoritism will be more likely if politicians are tied to particular population subgroups (Alesina, Baqir and Easterly 1999) or if subgroups have an unusually powerful role in determining elections.

Section III then re-examines two problems which provide a clear motivation for public intervention—monopoly and externalities—in light of the risks of corruption and populism. I consider four possible approaches to the problem of a natural monopoly: laissez-faire, price regulation, quantity-subsidies and total public ownership. I assume away all of the standard reasons why any particular intervention cannot achieve the first best, so that in the model, a benevolent leader can and will achieve economic efficiency with any of the interventions. In my framework, the case for and against particular interventions depends on their strength at resisting the rival risks of corruption (serving the interests of the monopoly) or populism (serving the interest of those citizens who do not pay taxes and do not own the corporation).

Laissez-faire creates the standard welfare losses due to underproduction, but there are no extra risks from either corruption or populism. If the political leader is potentially corruptible, public ownership will continue to yield the first best outcome, since it does not produce a private entity able to bribe the public official. In the case of populism, however, public ownership leads to high social losses from under-pricing (the good will literally be free in the model), over-consumption and large operating losses.

In the case of a corrupt official, price controls produce the laissez-faire outcome, as the price ceiling is set at the profit maximizing level, which is the same level chosen by the monopolist in the absence of the price regulation. Populist produces monopsony level price controls which produces shortages, but unless the shortages lead to misallocation across consumers (Glaeser and Luttmer 2003), the social welfare from monopsony may well be higher than the social welfare from monopoly, depending on whether supply is more or less elastic than demand.

If there is either corruption or populism, the public official will set subsidies at the highest possible permissible level. This strange congruence, where completely different motives produce identical policy distortions, reappears regularly in this paper. Maximal subsidies occur under corruption because subsidies increase the monopolist's profits. Populism produces maximal subsidies because the politician's poorer constituents do not pay for the taxes needed to pay for the subsidies, yet they benefit from the lower prices that subsidies produce. The implicit subsidy, through implicit government insurance, enjoyed by Fannie Mae and Freddie Mac may well reflect a combination of influence by those companies and a desire by some politicians to favor middle-income borrowers.

When populism is the larger risk, price controls produce more losses, but when corruption is more common, public ownership leads to higher levels of social welfare. These results may explain why public ownership seemed natural to many as a solution to monopoly pricing in late 19th century America. If the political risks of corruption and populism are sufficiently high, then laissez-faire may produce higher levels of public welfare than interventions.

When externalities are the problem, instead of monopoly, I consider quantity controls instead of price controls. Otherwise, the results are similar to the monopoly setting. Public ownership continues to yield optimal social welfare with corruption and low pricing with populism. A quantity control leads to the monopoly outcome with corruption, and either laissez-faire or a monopsony-related quantity limitations with populism.

If the externality is negative and calls for a Pigouvian tax, then the downside from corruption or populism is relatively limited if the taxes are used to reduce the other taxes paid by wealthier taxpayers. Corruption will lead to no regulation, and populism will lead to a tax between zero and the optimal Pigouvian tax. If the tax does benefit the politicians' supporters, then Pigouvian taxes create the danger of significant over-taxing for revenue purposes. In some circumstances, the risks of populist over-taxing can mean that there are lower losses from revenue-less taxes (where the tax is pure social loss) than from revenue raising taxes. This result provides conditions when public campaigns that

vilify smoking or drinking sugary soda, which are sometimes linked with libertarian paternalism may be desirable (Sunstein and Thaler 2009).

If the externality was positive, which calls for a Pigouvian subsidy, then both corruption and populism again lead to maximal subsidies. As in the monopoly case, these subsidies can lead to significant welfare losses. As such, political risks create an important difference between positive and negative externalities and suggest that there is considerably more risk from subsidies than from taxes, because taxes have a natural barrier at zero.

In Section IV, I turn to default insurance and regulation in a model that loosely follows Diamond and Dybvig (1983). Investors lend to borrowers and receive claims on future income, but they investors may turn out to be impatient and seek to resell those securities. Private information about the quality of those securities creates the possibility for a lemons market breakdown that leads to higher borrowing costs ex ante. Default insurance creates a means of mitigating that problem, but private and public default insurance creates its own problem. Private insurance companies have an incentive to issue too little equity, in order to maximize the returns on equity for shareholders during good states of the world. Limited liability limits the losses during bad states. In some cases, the public may end up covering the losses of the private insurer to avoid a market breakdown.

The significant risk in this scenario is the private mortgage insurers have an incentive to leave themselves under-capitalized. Protected by limited liability, insurers would like to have negative profits in bad states and higher profits, per unit of investment, in the good state. By under-capitalizing, the firm increases profitability in the good state and creates no added costs to shareholders in the high default state, since insurer profits are zero in the adverse state of nature with high default levels. This creates the risk of under-funded insurers, which can lead to a breakdown of the entire market.

Again, the public sector can react to this problem with capital requirements, asset fees, catastrophic risk insurance or outright nationalization. As in the case of banking, corruption and populism push in the same direction—more subsidized risk-taking.

Nationalization tends to be more efficient in the case of corruption, but it creates the greatest losses from populism. The case for private for public ownership depends on the relative risks of populism and corruption.

In Section V, I apply this model briefly to the case studies of Freddie Mac and Fannie Mae. Populism seems to have motivated some political support for these entities, but they were also aggressive in lobbying and funding political campaigns. Their political support seems to have generally limited attempts to strongly regulate their activities. By contrast, public entities, like the Federal Housing Administration (FHA) and Ginnie Mae, have performed somewhat better which may suggest that populism is less risk than corruption.

While the model is quite stylized, it does provide some insight relating to the current debates over Freddie Mac and Fannie Mae. Public intervention of any sort in these markets is fraught with political risk. The possibility of populism or subversion both push to excessive risk-taking and insufficient capital reserves. Private ownership creates none of the protection it provides in more standard scenarios, since the public sector is still able to spend without limit. If the risk of corruption is sufficiently high, public ownership may be safer for taxpayers than privatization.

II. Political Risks, Dictatorship and Disorder

The new institutional economics (Djankov, Glaeser, LaPorta, Lopez-de-Silanes and Shleifer 2003) presents institutional design as a tradeoff between different private and public welfare losses. In most societies, there is no means of achieving perfection, just the chance to trade off between public abuses, sometimes referred to as dictatorship, and private abuses, sometimes referred to as disorder. Countries face an institutional possibilities frontier offering choices between systems with more dictatorship (communism) and more disorder (laissez-faire capitalism). The shape of that frontier depends on cultural and economic fundamentals, such as the level of human capital. One explanation for Wagner's Law, the fact that government spending increases more than proportionally with national income, is that as countries develop the institutional

possibilities frontier shifts and citizens increase their ability to control the government more effectively. As citizens become better at disciplining the state, public interventions becomes more attractive.

In this paper, I will also address welfare losses coming from two different sources, and one of those sources is tied to private initiative (corruption) while the other reflects purely public malfeasance (political favoritism or populism). Yet both issues are basically examples of "dictatorship," in the sense that social costs occur through the action of the state. In the examples, I consider there will also be social losses from laissez-faire policies and those represent "disorder."

In the model, I treat the probability of facing a corrupt or populist public leader as fixed and exogenous but these probabilities actually reflect deeper economic and political variables. This preliminary section briefly discusses the forces that shift those probabilities.

The Beckerian (1968) approach to corruption suggests that corruption occurs when the benefits of accepting money or favors in exchange for subverting public policy outweigh the costs to the individual. Those costs are likely to include both real penalties, such as going to jail or losing an election, and psychic costs, which may differ from culture to culture. In a Coasian world where bargaining is easy, a corrupt bargain should occur whenever the total benefits of the deal to the private entity exceed the costs to the public leader.

That logic suggests that the magnitude of the benefits that can accrue from corruption should help determine the level of corruption. As the economic scale of an activity increases, the gains from corruption should also increase. Glaeser and Shleifer (2003) argue that the increasing size of industrial concerns during the 19th century meant that firm's ability to bribe increased as well, and that led to a subversion on many institutions, such as the courts, during the Gilded Age. The move from a tort-based system of addressing railway-related externalities to greater regulation may have been a response to the fact that the costs to judges of being corrupt were overwhelmed by the increasingly large economic rents that came from skewing justice.

If bargaining across firms is difficult, especially when trying to arrange for large bribes, then competition will lead to less corruption risk than monopoly. The political dangers from concentrated economic entities have led observers from Woodrow Wilson to Simon Johnson (Johnson and Kwak 2011) to call for size limitations on particular firms, like large banks. One argument for why larger firms may find regulations attractive is that there are returns-to-scale in rent-seeking that enable those firms to particularly excel in subverting the regulator and getting the rules changed to suit their own needs (Peltzman 1976). In the models, I treat the probability of corruption as being identical in the case of regulating a natural monopoly and regulating a competitive market with externalities, but it seems likely that the risk is higher in the case of monopoly.

Finally, the possible rents from corruption depend heavily on the nature of the intervention itself. In principle, the problem of combating monopoly under-production can be addressed with either a price ceiling or a subsidy to production. The profits gained from subverting the price ceiling are capped at the standard monopoly earnings, but the profits gained from subverting a subsidy are virtually limitless.

While the benefits that come from corruption may be quite obvious, the costs that prevent corruption are often less clear. Fisman and Miguel (2007) provide striking evidence that diplomats from cultures that are thought to be less corrupt are also less likely to rack up parking tickets while at the United Nations. There is no legal penalty for these tickets, but still the diplomats from less corrupt cultures have fewer tickets. Does this reflect a complicated set of social enforcement mechanisms, where Swedish diplomats are informally punished if they abuse their host community, or has Swedish culture inculcated a taste for honesty?

While culture surely matters, it certainly seems possible for a strong central leader, like Lee Kwan Yew, to radically reduce corruption through a combination of severe penalties and lower standards for proof.[i] The Beckerian approach may omit important psychological and cultural forces around wrong-doing, but the probability of arrest and the size of the punishment still help deter crime. In highly corrupt societies, the

probability of arrest often appears to be extremely low, partially because everyone is in on the game.

When political cultures work to limit corruption, typically officials end up enforcing rules on each other. Fishback, Kantor and Wallis (2006), for example, present evidence suggesting that the federal bureaucracy created by New Deal programs significantly reduced American municipal corruption. The process of creating documents for a different branch of government created a natural outside observer. American history is replete with examples, such as the famous Lexow Committee of 1894, where corruption was investigated by politicians representing a different party who were in power within a different level of government.

One impact of increasingly tough penalties on overt corruption is that corruption will take more opaque and more legal forms. If it is no longer possible to pay senators with paper bags full of cash, then campaign donations and the promise of future favors will have to suffice. Being forced to use more roundabout and inefficient means of subversion is essentially a tax on corruption which should reduce its incidence, but that hardly means that subversion is likely to vanish altogether.

Across countries, corruption is correlated with ethnic fragmentation (Mauro 1995), French legal origin (Djankov, LaPorta, Lopes-de-Silanes and Shleifer 2003) and education. That latter correlation also holds for U.S. states (Glaeser and Saks 2006). These facts may say something about the culture created by education and English common law or they may reflect political institutions in well educated, former English colonies that discipline corrupt politicians.

The second political risk is that a political leader may subvert policies in order to achieve some objective other than maximizing social welfare. As maximizing social welfare is rarely well-defined, outside of economists' mathematical models, political favoritism or populism is rarely punished with criminal sanctions. Instead the costs that can occur are limited to punishment at the voting booth or perhaps psychic costs to the politician. Moreover, while corruption is perhaps reasonably approximated with the assumption of discrete choices—take the bribe or don't—political favoritism is almost

surely a matter of degree in almost every case—how much to slant policies towards a favored group.

Since we understand so little about the costs of political favoritism to individual politicians, most of the literature discussing its incidence has focused on the benefits of such favoritism. Ethnic and cultural fragmentation appear to be associated with favoritism (Alesina, Baqir and Easterly 1993), either because fragmentation reduces the consensus on the common good or because it leads to politicians who have close ties with a particular national subgroup (Glaeser and Shleifer 2005). Politicians who are closely tied to a particular subgroup are likely to support that group both because of innate preferences and because they perceive their political futures as being tied to the well-being of that group. Jim Crow politicians, such as Theodore Bilbo, appear to have advanced racist policies for both reasons.

Political favoritism should also be more common when particular groups have disproportionate political influence. For example, critical swing voters should attract favoritism. Well organized political groups, like public sector unions, should elicit favoritism. Finally, those groups that are specifically favored by political institutions, as farmers are by the U.S. Senate, should attract targeted support.

Political favoritism may be less costly if the impact on the favoritism on general well-being is easy to observe and if the political leader is held electorally accountable for the community's success. For that reason, executives, such as mayors, are often thought to be less prone to such favoritism than legislators, such as city council members, who are not held responsible for the general success of their locale. Indeed, the tendency to punish political leaders for widespread local problems is sufficiently strong so that governors are punished for the pure bad luck of low oil prices or a national recession (Wolfers 2006).

The political risks of corruption and favoritism do vary greatly across time and space, but they are never actually non-existent. The next section examines their impact on standard models of monopoly and addressing externalities.

III. Management of Monopoly and Externalities

When there are either externalities or a natural monopoly, laissez-faire fails to produce the socially optimal outcome. Yet public responses generate their own risks when politicians are not perfectly benevolent. Here I first examine monopoly and then externalities and in each setting, I consider four institutional options: (1) laissez-faire; (2) quantity or price controls; (3) taxes and/or subsidies; and (4) pure public ownership and control. When the costs of public ownership will only be paid by the rich, I also consider the possibility that taxes on firms will be given as transfers to the poor.

Following the discussion above, I assume that the government constrained by the basic institutional options. Laissez-faire gives the government no options whatsoever. Quantity controls means that the government can reduce firm production as much as it likes, including shutting the firm down altogether, and price controls can act as either a floor or a ceiling. In either case, the government cannot force firms to produce more than they would like given the existing price. Taxes and subsidies can only be levied per unit produced and there will be an upper limit on the subsidy denoted $\overline{s}$. This upper limit is necessary because otherwise, corruption and populism would lead to infinite subsidies. Moreover, if there is supposed to be a tax it cannot be turned into a subsidy and a subsidy cannot be turned into a tax. There are no constraints on prices or quantities in the case of public ownership, except that the government must charge the same price to all consumers.

In all cases discussed here, I assume that a benevolent government could achieve first best outcomes under any of the activist regimes. I don't mean to suggest that there aren't informational or organization barriers to producing first best outcomes, even if political leaders are benign. I assume these issues away to focus on the political risks that may influence optimal policy. As such, the barriers on government behavior will only become important if the government is less than benign.

I consider two risks that might afflict the government that is administering policies, with the limits imposed by the institutional regime: corruption and populism. Corruption

occurs with probability π_C and implies that the government has been bribed into doing the will of the business sector. Government policies will then maximize profits.

Populism occurs with probability π_P, and this state means that the government will choose policies to maximize the well-being only of the poor citizens. The welfare losses of populisms will be particularly stark because I assume a starkly utilitarian welfare function. If the welfare function was more egalitarian, then the social costs of this regime will be somewhat mitigated.

Managing Monopoly

In this first example, I consider the management of a natural monopoly. The technological basics of the model are standard. There is a single producer, that has perhaps paid fixed costs to enter, and that pays a cost C(Q) to produce Q units that are shared among the N consumers.

Each consumer is ex ante identical, but who randomly become wealthy with probability λ or poor with probability $1-\lambda$. If they are wealthy, they earn a higher income, own the shares of all produces and pay all taxes. If they are poor, they earn a lower income, own no shares and pay no taxes. The utility functions of both groups are V(q)+Income-pq, where q is the quantity consumed of the product, p is its price and V(q) is weakly concave, and that V'(q)=0 for a finite level of q, which is denoted q_{Max}. The demand curve for every person rich or poor is V'(q)=p, so everyone consumes the same amount of the product.

While I will discuss issues of egalitarianism at length, I will assume evaluate different positive outcomes based on individual's expected utility as of birth or—equivalently—the equally weighted purely utilitarian welfare function, which reduces to NV(q)-C(Nq)+Other Income. Holding consumption of the good constant, the price paid for the good is essentially a transfer. I will ignore the other income, which does not change across settings, and let $U(q) = V(q) - \frac{C(Nq)}{N}$, describe the relevant social welfare function, which will change across different institutions and political outcomes. The optimal level of "q," denoted q_{Comp} satisfies $V'(q_{Comp}) = C'(Nq_{Comp})$ and produces

welfare $U(q_{Comp})$. I assume that U(.) is globally concave, i.e. $0 > V"(q) - NC"(Nq)$, so welfare always falls as the quantity moves further away from the otptimal amount.

The first order condition for demand is $V'(q) = p$, which as q=Q/N, delivers the inverse demand curve: $V'(Q/N) = p$). The laissez-faire quantity of output, denoted q_{LF} will satisfy the monopolists first order condition $V'(q_{LF}) + q_{LF}V''(q_{LF}) = C'(Nq_{LF})$. As $q_{LF}V''(q_{LF}) < 0$, $q_{LF} < q_{Comp}$ and $U(q_{LF}) < U(q_{Comp})$.

If the government is benign and perfectly informed, the problem can be solved in any number of ways. Most drastically, the government can nationalize the monopoly and choose to produce the efficient quantity, Q^* , of the good and set a price that clears the market.

Less severely, the government can impose a price maximum of $\overline{P}$ which equals $C'(Q^*)$. Given that price, the firm maximizes $C'(Q^*)Q - C(Q)$, which leads to the efficient output level. The maximum price limit eliminates the firm's incentive to under-produce, since it cannot raise prices.

Finally, the government can engage in quantity-based subsidy scheme that would pay the firm a bonus of "t" units per unit produced. If this bonus was paid for with a lump sum tax, the firm would choose the optimal quantity and price if the bonus equals P/ε at the efficient output level or $-q_{Comp}V''(q_{Comp})$. When the firm maximizes $V'\left(\frac{Q}{N}\right)Q - q_{Comp}V''(q_{Comp})Q - C(Q)$, it will also produce the optimal quantity of output.

Given identical consumers that own the monopolist, there are no equity issues. I have assumed away any inefficiency of government ownership, or information limitations that might mean that price limits or production subsidies are chosen incorrectly, which is the best case scenario for anti-monopoly intervention. In the case of either populism or corruption, the key assumption is that the politicians' preferences are not perfectly aligned with the welfare of voters.

I now turn to the performance of these institutions in the presence of political risks. In the case of corruption, public ownership continues to produce the optimal quantity.

There is no private entity to bribe the politicians and thus even when the politicians are venal, there is no one to take advantage of their venality. Hence welfare remains $U(q_{Comp})$. In reality, a sufficiently corrupt politician will still figure out ways to extract rents from public ownership, like overpaying for inputs and providing outputs free of charge in exchange for kickbacks, but these are outside of the scope of the model.

In the case of a price restriction, a corrupt politician serving the monopolies' interests cannot do better for the firm than putting the price at the monopoly price. This means that output will be q_{LF} and welfare will be $U(q_{LF})$.

In the case of a subsidy, the problem of corruption automatically leads to the maximal subsidy, as firm profits are always increasing in the level of the subsidy. The level of output in the case, denoted $q_{\overline{s}}$ satisfies $V'(q_{\overline{s}}) + q_{\overline{s}}V''(q_{\overline{s}}) + \overline{s} = C'(Nq_{\overline{s}})$, as the subsidy regime must admit the optimal subsidy, $\overline{s} \geq -q_{Comp}V''\left(q_{Comp}\right)$. The subsidy must increase the firms' quantity produced, which will lower welfare beyond the optimal amount, so higher subsidy limits will always reduce well-being. If $\overline{s}$ is sufficiently high, the firm may produce beyond the point where the price of the good is zero, and the welfare from the corrupt regime will be worse than in either alternative institutional setting or in the case of laissez-faire.

What will populism do under the three different regimes? Since the losses born by the public company are born by the rich, whom the populism ignores, the populist will set p=0, which leads to consumption $q_{Max} > q_{Comp}$.

In the price control, the populist will over-restrict setting essentially the monopsony price for the good. The populist will choose $\overline{p}$ to maximize $V\ \ (q(\overline{p})) - \overline{p}q(\overline{p})$, where $q(\overline{p})$ is the supply delivered at that given price maximum, which satisfies $\overline{p}$ =C'$(Nq(\overline{p}))$. I define the quantity implied by the populist's ideal restriction as q_{Mon}. In the appendix, I prove that:

Claim 1: If NC$''\left(\mathrm{N}q(\overline{p})\right) > -V''(q(\overline{p}))$, then the populists' ideal price restriction leads to lower consumption and social welfare levels than monopoly pricing, and the

populists' idea restriction leads to higher consumption and social welfare levels than monopoly pricing if $\mathrm{NC}''\left(\mathrm{N}q(\overline{p})\right) < -V''(q(\overline{p}))$.

That claim reminds us that the distortion created by a monopsony price cap can be larger or smaller than the distortion created by monopoly pricing. The monopsony distortion is generally smaller when supply is more elastic, i.e. C"(.) is greater, and the monopoly distortion will be larger when demand is more elastic, i.e. V"(.) is greater.

Finally, I turn to the subsidy. Since the populist is just maximizing V(q)-pq, it will choose the subsidy that minimizes price, which means that maximal subsidy. Oddly, the corrupt politician, completely in the pay of the company, and the populist that puts the poor first, both agree on production subsidies for the monopolistic firm, because their costs are born by the wealthy taxpayers. The following small table captures the outcomes in the eight possible situations:

	Corrupt Politician	Populist Politician
Laissez-Faire	Monopoly Outcome	Monopoly Outcome
Public Ownership	Competitive Outcome	Free Good
Price Control	Monopoly Outcome	Monopsony Outcome
Subsidize Quantity	Maximum Subsidy	Maximum Subsidy

I assume that the maximum subsidy is always less desirable than either the monopoly outcome or the monopsony outcome, which means the in the presence of political risk, quantity subsidies are never desirable. The desirable of the other options are described by the following proposition:

Proposition 1: If the free, good outcome is better than the monopsony outcome, then public ownership always dominates price controls, but if the free, good outcome is worse, then price controls dominate public ownership if and only if $\pi_P > \frac{U(q_{Comp})-U(q_{LF})}{U(q_{Mon})-U(q_{Max})}\pi_C$. Laissez-faire dominates public ownership if and only if $\pi_P > \frac{U(q_{Comp})-U(q_{LF})}{U(q_{Comp})-U(q_{Max})}$ and dominates price controls if and only if $\frac{U(q_{Comp})-U(q_{Mon})}{U(q_{Comp})-U(q_{LF})}\pi_P + \pi_C > 1$.

The proposition provides the basic results on how political risks shape the desirable policies. If high subsidies lead to socially undesirable outcomes, then addressing the monopoly problem by subsidizing output leads to bad outcomes in the case of either populism or corruption.

The tradeoff between public ownership and price controls depends on the relative probability of corruption or populism. In settings where corruption is normal, but populism is rare, then this makes public ownership more attractive, for public ownership's great strength is that it is it does not produce a private entity ready to bribe the politician. This result may explain why public ownership was relatively popular during the Progressive Era. In those years, corruption seemed like a great threat and the perils of populist politicians who could run public utilities at massive losses in order to placate their constituents may have seemed less apparent.

But political risks also tend to make any intervention less attractive, even when there is an obvious monopoly problem. If the risks of populism are relatively high, then public ownership becomes less attractive than laissez-faire. If monopsony is worse than monopoly and if the risks of both populism and corruption are high, then price controls may be worse than just allowing the monopolist to function.

Managing Externalities

We now consider a setting where the case for intervention reflects an externality—good or bad—and making two alternations to the model. First, supply is now made by measure one of competitive firms, each with cost functions C(Q). In the absence of subsidies or quantity controls, this leads to first order condition P=C'(Q) which determines supply. This keeps the core functions identical to the monopoly case, but drops the assumption that the firm sets prices. I do however assume that if the politicians are corrupt they will try to maximize the earnings of the entire industry not just a single firm. Furthermore, I assume that individual welfare equals V(q)+x*Average Level of q+ Income-Pq, where x represents the size of the externality (x may be positive or negative). Social welfare is now $U(q) = V(q) + xq - \frac{C(Nq)}{N}$, which is optimized at q_{xOpt} that

satisfies $V'(q) + x = C'(Nq)$, which will be greater than q_{Comp} if and only if the externality is positive, i.e. x>0.

The pure laissez-faire case actually yields q_{Comp} which would be the first best output in monopoly case discussed above, but is suboptimal here because of the externalities. The first best can be achieved through public ownership, which just chooses the optimal level of output, or through a Pigouvian tax or subsidy equal to "x." A quantity control fixing output at Nq_{xOpt} would also yield the optimal quantity with a negative externality. Quantity controls do not provide a natural means of handling a positive externality. In principle, a fixed price level could also achieve the optimal quantity, but it would do so by creating shortages and the possibility of misallocation across consumers, so I ignore that option.

We now consider the impact of corruption and populism on these three interventionist options. In the case of corruption, public ownership continues to produce the first best outcome; there is again no private entity to corrupt the political leaders. In the case of a populist politician, who ignores the wealthy taxpayers costs of funding the operation, the good is produced and sold to maximize $V(q) - pq + xq$, which means p=0 and quantity is set so that either $V'(q) = -x$ (if x is negative) or $V'(q) = 0$ if the externality is positive. In the case of a negative externality, the good is sold at a price of zero, and rationed to individuals. In the case of a positive externality, you would like to force people to consume beyond the point where V'(q)=0, but that is impossible. I denote the quantity as q_{xMax}, which will equal q_{Max} when x>0 and will be less than q_{Max} if x<0. This seems likely to be an extremely poor outcome from an efficiency perspective.

In the case of quantity controls and negative externalities, corruption will lead to the monopoly outcome for firms, called q_{LF} in the previous section; since the corrupt politician essentially internalizes the firms' desire to collectively restrict production. This quantity may actually be above q_{xOpt} if the externality is negative and severe, but will lie below q_{xOpt} if the externality is moderate or positive.

In this case of populism, the government will choose "q" to maximize the value of $V(q) - p(q)q + xq$, which means that if x<0, quantity will satisfy $V'(q) - p(q) -$

$p'(q)q + x = 0$. The populist is interested in lowering the prices paid by consumers, and that will reduce its willingness to reduce quantities. Since restricted quantity creates a gap between supply and demand, price is set by the demand curve and p'(q)=V"(q). The quantity-controlling populist sets q so that $-V"(q)q - x = 0$ as long as the "q" implied by this is below the free market quantity. I denote this quantity q_{xqMon} (the monopsony quantity in the presence of an externality). If x is sufficiently large so that the optimal quantity, implied by $V'(q) - p(q) - p'(q)q + x = 0$, is greater than the free market quantity, a populist government with quantity controls will not intervene since it can only force firms to produce less than they normally would, not to produce more.

Subsidies, used in the case of a positive externality, will be set to the maximum amount allowable if the politician is corrupt. If the politician is populist, then the subsidy will be chosen to maximize $V(q) - p(s)q + xq$. This will also lead to maximum possible subsidy, since prices fall with the subsidy and there is the added benefit of increasing the positive externality.

Taxes, used in the case of negative externality, will be set to zero if the politician is corrupt and trying to maximize industry profits. In the case of a negative externality and tax, the populist politician's behavior depends on whether the politician's poorer constituents are able to benefit from the tax or whether the tax goes to defray the other tax costs paid by the wealthy. If the tax revenues benefit only the richer voters, the populist will choose the tax to maximize $V(q(t)) - p(t)q(t) - xq(t)$, which leads to the same condition as in the case of the quantity control with a negative externality: $-V"(q)q = x$. Just as in that case, the politician chooses a tax to produce either q_{xqMon} (the monopsony amount in the presence of an externality) or the free market quantity, whichever is smaller. This provides another setting where populism and corruption can lead to exactly the same outcome.

If the politician's constituents can benefit from the tax revenues, then the populist maximizes$V(q(t)) - p(t)q(t) + tq(t) + xq(t)$. I assume that they cannot be targeted towards the poor in particular, but they can be remitted back to everyone in some form, like spending on public services. The preferred tax satisfies $t = -x + NqC"(Q)$, which

is higher than the optimal tax. I denote the associated quantity as $q_{xTransfer}$ because the tax is transferring from firms to the populists constituents.

The table again represents the different outcomes

	Corrupt Politician	Populist Politician
Laissez-Faire	Externality not internalized	Externality Not Internalized
Public Ownership	First Best Outcome	Free Good or Good Priced at Externality Alone
Quantity Control (Negative Externality)	Monopoly Outcome	Monopsony Quantity with Externality or Free Market
Subsidize Quantity (Positive Externality)	Maximum Subsidy	Maximum Subsidy
Tax Quantity (Negative Externality) No revenues for the poor	Externality not internalized	Monopsony Quantity with Externality or Free Market
Tax Quantity (Negative Externality) Revenues help the poor	Externality not internalized	Tax equals externality plus transfer

Proposition 2a describes the welfare tradeoffs between the options when there is a negative externality. Proposition 2b describes the tradeoffs when the externality is positive.

Proposition 2a (Negative Externality): If the Pigouvian tax is rebated to wealthier citizens, then Pigouvian taxes dominate quantity controls if and only if welfare under free competition is greater than welfare with monopoly production levels; if $q_{Comp} < q_{xqMon}$, then Pigouvian taxes always strictly dominate laissez-faire, and dominate public ownership if and only if $\pi_P > \frac{U(q_{xOpt})-U(q_{Comp})}{U(q_{Comp})-U(q_{Max})}\pi_C$. If the Pigouvian tax is not rebated to wealthier citizens, then the Pigouvian tax yields higher expected welfare than the quantity

control if and only if

$\pi_C U(q_{Comp}) + \pi_p U(q_{xTransfer})) > \pi_C U(q_{LF}) + \pi_p U(Min(q_{Comp}, q_{xqMon})$.

The proposition highlights the relative strength of Pigouvian taxes, especially when they are not vulnerable to being used for political favoritism. The Pigouvian tax always dominates laissez-faire, because even if it is subverted, it is likely to only produce the laissez-faire outcome. As long as free competition is preferable to the monopoly outcome generated by a corrupt quantity regulator, then the Pigouvian tax is also preferable to a quantity control, because it is somewhat less vulnerable to abuse. The comparison with public ownership again depends on the probability of populism vs. corruption. When corruption is a far greater threat, then public ownership remains the safer reform. When populism is more common, then the Pigouvian tax yields higher expected welfare.

When revenues can serve populist purposes, it is not necessarily true that Pigouvian taxes become worse, but there do appear to be more cases where the Pigouvian tax is dominated by quantity controls. The revenue-raising tax may not be so bad at all, but it can be, and the Pigouvian tax can produce less welfare than the quantity control even if free competition provides better outcomes than the monopoly-like outcome that is created by a corrupt politician using a quantity control to restrict production.

Proposition 2b (Positive Externality): The Pigouvian subsidy dominates public ownership if and only if $\pi_P > \frac{U(q_{xOpt})-U(q_{\bar{s}})}{U(q_{\bar{s}})-U(q_{Max})}$ and dominates laissez-faire if and only if $\frac{U(q_{xOpt})-U(q_{Comp})}{U(q_{xOpt})-U(q_{\bar{s}})} > \pi_P + \pi_C$. Public ownership dominates laissez-faire if and only if $\frac{U(q_{xOpt})-U(q_{Comp})}{U(q_{xOpt})-U(q_{Max})} > \pi_P$.

This proposition suggests that there are many more occasions when laissez-faire is dominant when externalities are positive than when externalities are negative. Political risks are relatively contained with Pigouvian taxes, because there is a natural barrier at zero, but there is rarely such a natural risk with a subsidy. Pigouvian taxes are therefore relatively safe, even with these political risks, while Pigouvian subsidies are not.

Laissez-faire is more attractive than subsidies whenever the combined risk of populism and corruption are sufficiently high and more attractive than public ownership as long as the risk of populism is sufficiently great. The tradeoff between public ownership and subsidies depends on the relative risks of populism, which can make public ownership riskier, and corruption which increases the risks associated with Pigouvian subsidies.

One implication of this discussion is that limiting the incentives for government malfeasance may be quite desirable and such limits might be using tax-like instruments that raise no revenues. One interpretation of psychological approaches to paternalism, such as advertising depicting the health consequences of smoking to people's lungs, is that they are revenue-less taxes that reduce the pleasure of the activity without generating any associated returns to the treasury. While sometimes these interventions can be justified as providers of information, there is little evidence supporting the view that smokers are ignorant of the risks of smoking (Viscusi 1992). The alternative view is that these interventions create psychological costs when people consume the depicted goods. George Loewenstein and Glaeser (2009) have both questioned the value of these policies precisely on these grounds. If politicians were always benevolent, then these taxes would always be suboptimal relative to using standard Pigouvian taxes.

Yet the presence of political risk, and especially the risk of populist politicians who like taxing externalities to provide benefits for their constituents, makes such policies somewhat more attractive. I now consider the possibility that the government can use a tax, imposed directly on consumers, that generates no revenues. I only treat the case with negative externalities and I assume, as above, that the tax benefits everyone, not just the populist politicians' constituents.

I assume that $C(Q) = c_0 Q + .5c_1 Q^2$ and $V(q) = v_0 q - .5v_1 q^2$.

Proposition 3: If the politicians are benevolent, then the revenue-raising tax is preferable to the revenue-less tax, and if the politicians are corrupt then no taxes are raised in either case, but if the politicians are populist, then revenue-less taxes dominate revenue-raising taxes when x is sufficiently close to zero.

The conditions under which a revenue-less tax dominates a revenue-raising tax are fairly extreme, yet the basic point remains. The revenue-less tax may be subject to less abuse by a populist politician looking to raise revenues for his favorite constituents. In extreme cases, this benefit may offset the apparent waste of an intervention that causes harm to consumers without raising any offsetting revenues.

IV. Bank Runs, Liquidity and Mortgage Insurance

I now turn to the particularly relevant issue of political risks and financial regulation. I begin with a model of banks and bank runs, borrowing heavily from Diamond and Dybvig's classic model of bank runs. I then turn to a model of security-insurance, which can be interpreted as the mortgage insurance provided by the Government-Sponsored Enterprises (GSEs). In both cases, laissez-faire creates significant welfare losses, but the presence of political risks creates potential losses from interventions.

Default Insurance and Political Risk

The following model is an adaptation of Diamond and Dybvig (1983). At time zero, there are three classes of individuals: investors, non-discretionary borrowers and discretionary borrowers. Borrowers, of both varieties, are endowed with no units of the consumption good in periods zero or one, but they may receive one unit of the consumption good in period two. Non-discretionary borrowers are completely impatient and only care about consumption at time zero, which is denoted c_0. Discretionary borrowers maximize $\vartheta c_0 + c_2$, where $\vartheta < 1$,. It will be socially inefficient for discretionary borrowers to consume in period zero, rather than period two, and this creates a potential welfare loss from overly subsidized borrowing. But since these borrowers will not enter the market unless borrowing is highly subsidized, they will not figure in the discussion of the model until I turn to government interventions.

Borrowers, of either type have an ex ante probability δ of receiving no income in period two. If this occurs, they will default and there is no method of punishing them or otherwise extracting resources from them. At time one, it is revealed whether default

levels among borrowers will be high or low. The unconditional probability of either state is equal to one-half, and if the default level is high then a proportion $\delta + \Delta$ of the borrowers will default. If the probability of default is low, then a proportional $\delta - \Delta$ of the borrowers will default.

I will primarily consider a lending market where investors give money to borrowers in period zero and in exchange they receive a claim to the borrowers' potential income in period two. These claims are meant to be a stylized version of a mortgage contract (albeit without collateral) or any other loan, and I will refer to them as debt contracts. These claims can be traded in period one, but there is a potentially a lemons problem that can compromise the tradability of the debt contracts. I will later compare this market in which lending operates through tradable securities with a market served by financial intermediaries.

At time zero, all investors are endowed with units to invest. I will assume that there are enough investors, and they have enough income in every period, so that there is never any shortfall in funds to lend. There are two types of investors—patient and impatient—and investors learn their type at time one. With probability t, investors are impatient and receive utility equal to $c_0 + c_1 + \gamma c_2$. With probability 1-t, individuals are patient and have utility equal $c_0 + c_1 + c_2$. As in Diamond and Dybvig (1983), the possibility of impatient investors creates a benefit from period one liquidity. By assuming that investors have abundant funds, I ensure that the prices of debt contracts will equal their expected value to investors in every period. Since discretionary borrowers value the future more than investors (of either variety), they will not borrow unless borrowing is subsidized by the state.

In period one, investors learn the aggregate state of the world and whether they are impatient. They also receive specific information about debt contracts that they have purchased. Investors who lend to a specific borrower learn whether that individual is low risk, in which case the probability of default is zero, or high risk, in which case the probability of default is 1/v. I assume that only one investor will directly learn the quality of any one asset, which follows a tradition of considering asymmetric information in the mortgage market (Glaeser and Kallal 1997). It is simpler to assume that there is

only one investor for each borrower, which I do, but a lemons problem would also result even if the asset was shared among investors, as long as only one person knew the borrower's quality.

The equilibrium price as of time zero for a claim on one unit of borrower's consumption in time two is denoted p_0. Investors are not able to resell these claims until period one, when they have learned whether or not they are patient and whether or not their borrower is high risk. Importantly, only the investor knows his own type and the type of the lender, so that traded securities are effectively anonymous in period one. The price of a claim for one unit of borrower consumption in period two, as of period one denominated in period one consumption, is denoted p_1.

The equilibrium price in period one is determined by the willingness-to-pay of patient investors, and since their utility function is $c_0 + c_1 + c_2$, the price will equal the expected value of the asset in period two. In period one, there are essentially "types" of debt contracts that might be sold, categorized by the following box:

Asset	Held by patient investors	Held by impatient investors
High Risk	Expected Value=(v-1)/v Share of Assets Outstanding: $(1-t)v(\delta+\Delta)$ or $(1-t)v(\delta-\Delta)$	Expected Value=(v-1)/v Share of Assets Outstanding: $tv(\delta+\Delta)$ or $tv(\delta-\Delta)$
Low Risk	Expected Value=1 Share of Assets Outstanding: $(1-t)(1-v(\delta+\Delta))$ or $(1-t)(1-v(\delta-\Delta))$	Expected Value=1 Share of Assets Outstanding: $t(1-v(\delta+\Delta))$ or $t(1-v(\delta-\Delta))$

Impatient investors who hold high risk securities will always want to sell their assets, and if they are the only group that sells the price of the asset will be one minus the default rate or (v-1)/v. However, impatient investors with low risk securities would also like to front load consumption, and they will always do this if $1-\frac{1}{v} > \gamma$. If that condition holds, the impatient investors with the safe securities will want to sell, even if

they are sure to be perceived as selling high risk securities. It is socially efficient for those impatient investors to sell, since they value earlier consumption while there is an abundance of patient investors who do not.

While there is never any welfare gain from patient investors selling their securities in the first period, patient investors with high risk securities will still want to sell as long as the sales price is greater than (v-1)/v, as it will be if any low risk, impatient investors are also selling. Any equilibrium where both groups of impatient investors sell will also have patient investors dumping risky securities. By contrast, the patient investors with low risk securities will never sell.

As Proposition 4 describes, there typically are multiple equilibria. The proposition also describes the time zero price, which will be determined by the expected benefits to investors of buying the securities in the first place.

Proposition 4: (a) If $\gamma > \frac{v-1}{v}$, then there exists an equilibrium where, in either state of the world, only impatient investors who have high risk investments sell their securities and the market price of these securities equals $\frac{v-1}{v}$ and the price in period zero equals $1-\delta-t(1-\delta v)(1-\gamma)$.

(b) If $\gamma < \frac{t+(v-tv-1)(\delta+\Delta)}{t+(1-t)v(\delta+\Delta)}$, then there also exists an equilibrium where, in either state of the world, all impatient investors sell their securities in period one and the price in period zero equals $1-\delta$. This equilibrium Pareto dominates the equilibrium with less trade.

(c) If $\frac{t+(v-tv-1)(\delta-\Delta)}{t+(1-t)v(\delta-\Delta)} > \gamma > \frac{t+(v-tv-1)(\delta+\Delta)}{t+(1-t)v(\delta+\Delta)}$, then there also exists an equilibrium where impatient investors sell all their securities when default rates are low, but only impatient investors with high risk debts sell when aggregate default rates are high.

The proposition notes that as long as $\frac{t+(v-tv-1)(\delta-\Delta)}{t+(1-t)v(\delta-\Delta)} > \gamma > \frac{v-1}{v}$, there is the possibility for multiple equilibria. In one equilibrium, securities are thought by buyers to be low quality, prices are low, and only low quality securities are sold. In a second

equilibrium, securities are assumed to be mixed in quality, prices are higher and as a result, impatient investors sell their securities. In the high trade equilibrium, patient securities with high default risks also sell their securities during the first period. There is also a mixed equilibrium where a fraction of investors with high quality investors sell their securities in period one. Since that equilibrium is essentially unstable, I will not discuss it at length.[ii]

It is also possible that there is a market breakdown if the aggregate default rate is expected to be high, since in that case, there are more patient security owners with high risk securities. Their greater presence in the market reduces the price that impatient investors with good securities receive in the high trade equilibrium, and lower prices may cause these groups to leave the market altogether and for a complete lemons market breakdown to result.

The model can explain why the liquidity of securities is likely to become more of a problem during periods of greater distress. When the probability of default is low, then it is easier to sustain the high trade equilibrium, because the number of impatient security holders with low risk securities is a large share of the selling pool. As the share of sellers who have high risk securities increases, the quality of pool deteriorates, eventually causing impatient sellers to just sit on their good securities.

The proposition focuses on equilibria that involve pure strategies, although there typically also exists (when $\frac{t+(v-tv-1)(\delta-\Delta)}{t+(1-t)v(\delta-\Delta)} > \gamma > \frac{v-1}{v}$) an additional equilibrium where some, but not all, of the impatient investors with low risk securities sell. In that case, the first period price must equal γ to make those investors indifferent between selling and not. That equilibrium is somewhat less interesting because it is inherently unstable. If a slightly larger fraction of the impatient investors with good securities sell, then the price of those securities will rise causing all impatient investors to sell. If a slightly lower fraction of the impatient investors with good securities sell, then the price of those securities will fall and no investors with good strategies will sell

The potential for a lemons market breakdown creates scope for public interventions. If the public sector, or the private sector, is able to homogenize the assets,

so that all of them carry equivalent risk, then the breakdown can be avoided and borrower's welfare will be improved because they will receive higher prices for selling their claim to second period consumption.

One solution for avoiding the social losses associated with the low trade equilibrium is for securities to be insured by a public or private entity. The public entity can be entirely self-financing, although it is also possible to use tax revenues in the second period. For example, the simplest system would be to charge an up-front fee of δ to provide complete insurance against default. This would cover the expected costs of the system, but the system would earn excess profits in low default states and losses in high default states. The profits could be returned to taxpayers and the losses could be funded with taxes on investors (as a group) during the second period. Alternatively, if I embedded this in a multi-period model, the agency could expect, like the Federal Housing Administration (a real world analog to public insurance) to earn losses in bad times and offset them with profits during good times.

The public entity could also totally finance itself with a tax of $+\Delta$. This higher fee would cover losses in the high default state, and the profits could be returned to the investors in the form of a 2Δ per security refund if the default rate proves to be low. In either case, the period zero price of securities equals $1-\delta$, their expected value to patient investors. If politicians are neither corrupt nor populist, then the public insurance system creates no problems and achieves a liquid market and the first best outcome.

Moreover, since the public insurance company earns no profits, it cannot corrupt politicians. Just as in the discussion of monopoly and externalities above, if the political system is corrupt, public insurance will continue to yield the first best outcome. Populism however creates greater social costs.

I assume that populist politicians are interested in benefitting borrowers, at the expense of investors. This will lead populists to charge a desultory amount (effectively zero) for default insurance and finance losses with general tax revenues imposed on investors. This will represent redistribution from investors to borrowers. Since the

security yields a return of one, for sure, in the second period, the period zero price will also be one.

But this high price also creates an efficiency loss because of the discretionary borrowers. If the discretionary borrowers sell their claim for period two consumption during period zero, they will receive one unit of consumption and will receive welfare of one. But if they don't borrow, they only receive period two consumption with probability $1-\delta$. As long as $1 > \vartheta(1-\delta)$, the populism will lead to inefficient over-borrowing even by highly patient borrowers. Since they are trading an uncertain claim to future consumption for the expected value of a sure claim, their borrowing is subsidized.

Public insurance is not the only solution for this lemons breakdown problem. In principle, private insurance can also homogenize the securities and allow them to be traded without fear during period one. In this case, borrowers would pay a premium of δ for insurance, and the insurance company would also raise equity of at least $\frac{\Delta}{1-\delta-\Delta}$ per security insured. The insurance and investment fees would then be lent to borrowers, and this would provide enough returns to cover investors' losses in the bad state, and profits in the good state equal to $e\frac{1-\delta+\Delta}{1-\delta}+\frac{\Delta}{1-\delta'}$, or twice the value of the initial investment. Investors would be willing to buy equities since the expected return is one, and since there is no asymmetric information about the insurance company risk, its securities could be readily traded during period one.

The great danger with a private insurance company is that it will issue too little equity to cover its losses in the high default state of the world. For example, assume that an insurance company that has raised EQ units of equity to cover an existing portfolio of Q securities with potential defaults, where E equals $\frac{\Delta}{1-\delta-\Delta}$ so that the first Q mortgages were fully insured. The company now decides to insure an extra q mortgages, for which it will raise eq units of equity.

If "e" is not observable to investors who are insuring their mortgages, then the incentive to raise too little equity is obvious. If the firm sets e<$\frac{\Delta}{1-\delta-\Delta}$ and is able to continue charging δ for insurance, then existing shareholders stockholders will earn

nothing in the high default state (which was always true) and $\mathrm{EQ}\frac{1-\delta+\Delta}{1-\delta}+\frac{EQ}{EQ+eq}*\frac{\Delta(Q+q)}{1-\delta}$ in the good state, which is strictly decreasing in e. Existing shareholders will benefit from issuing too little equity to cover losses in the bad state, since they stand to earn more in the good state.

The insurance company could continue to be able to charge δ if consumers incorrectly assess the lack of equity capital by the insurer, or if they believe that the government will cover the shortfall in the high default state. Indeed, recent events do suggest that in a high default state, nominally private mortgage insurers, Fannie Mae and Freddie Mac, will see their obligations paid by the government. This leads security holders to continue to pay the full fee of δ, even if the insurance company has insufficient capital to cover the shortfall.

If the government doesn't regulate equity and cannot commit not to cover losses in the adverse state of the world, then competition among insurance companies will reduce insurance costs to $\delta - \Delta$. This is enough to cover losses in the low default state, and the government will cover extra costs in the bad state. Higher insurance costs would lead to positive profits that would be competed away. Borrowers will be able to sell their security for $1 - \delta + \Delta$, and in this case, there is an implicit public subsidy that occurs to lending, and this can lead the discretionary borrowers to borrow excessively. Discretionary borrowers will also borrow if $(1 - \delta) < \vartheta(1 - \delta + \Delta)$, or $\vartheta\Delta > (1 - \vartheta)(1 - \delta)$.

Yet even if the government were able to commit to letting the mortgage insurer fail, there would still be a problem if equity was raised sequentially. If the initial capital was sufficient to cover shortfalls, then those original shareholders would still have an incentive to want the firm to issue too little capital to cover losses, even if the investors buying mortgage insurance correctly anticipate that their mortgages will be insufficiently covered. This effect continues to reflect the limited liability nature of the company:

Proposition 4: A private insurer with an existing stock of Q insured securities, that is trying to maximize the expected value of its raised equity, which equals $\frac{\Delta Q}{1-\delta-\Delta}$, will

want to minimize the equity raised to cover losses from any further insurance contracts, even if the buyers of those further insurance contracts recognize the risks of insufficient equity, as long as those risks do not cause a market breakdown in period one.

Any firm with an existing set of insured securities, for which it is has issued sufficient capital to withstand all losses in good times and bad, has an incentive to raise too little equity to cover the losses from any further insurance contracts. Even though the fees paid by the new contracts will be lower, since the insurer recognize the downside of insufficient equity, the fees paid by the old contracts will not change (they have already been paid) and those old contracts will also pay the cost of too little equity. The benefit of having too little equity is that the firms existing equity holders will earn more in the good state of the world, because their profits in the good state do not get diluted by being shared with new equity-holders.

In the extreme, after the first share is issued, the company will never want to issue any more equity and the insurance company becomes equity-free. With equity-less insurance, individuals will pay a premium of $\frac{\delta-\Delta}{1-\delta+\Delta}p_0$ and as long as the insurance firms invests in the traded securities, this will provide enough to fully insure defaults during low default states of the world. During high default states of the world, the insurance company will be unable to fully cover its obligations, and individuals with borrowers who default will receive $\frac{(1-\delta-\Delta)(\delta-\Delta)}{(1-\delta+\Delta)(\delta+\Delta)} < 1$ in the high default state, since that is all the funding that is available. With equity-less insurance, there can continue to be a period one market breakdown.

Proposition 5: With equity-less private insurance, if $1-\gamma > \frac{\Delta}{(t+(1-t)v(\delta+\Delta))(1-\delta+\Delta)}$, then an equilibrium exists where impatient investors and patient investors with high risk securities sell their partially insured securities in both states of the world and the initial security price is $1-\delta$. With equity-less private insurance, if $1-\gamma > \frac{2\Delta}{v(\delta+\Delta)(1-\delta+\Delta)}$ then an equilibrium exists where impatient investors and patient investors with high risk securities sell their partially insured securities in the

low default state, but only investors with high risk securities sell in the high default state. In this case, the initial security price is $1-\delta-.5t(1-\gamma)\big(1-v(\delta+\Delta)\big)(1-\delta+\Delta)$.

The existence of incomplete insurance delivers lower welfare, in the case of the market breakdown, than complete insurance which avoids such meltdowns. But incomplete insurance is certainly better than no insurance at all, since without insurance there can be a market breakdown in good and bad states, but with insurance the breakdown only occurs in bad states of the world.

I now consider two public interventions when there is private insurance: (1) public backstop insurance with equity regulation, (2) public backstop insurance with an insurance fee charged to asset issuers. The government will have the option whether to extend the insurance scheme to some or all competitors in the industry.

Both schemes can easily produce the first best if the public sector manages them appropriately. If firms are required to raise equity of at least $\frac{\Delta}{1-\delta-\Delta}$ per security insured, then the first best outcome result, and the government will never need to step in. If firms are charged a catastrophic risk fee of $\frac{\Delta}{1-\delta-\Delta}$, then this amount will cover losses in the bad state, and the excess can be refunded to security owners in the good state.

What are the political risks of the two systems? Populist politicians attempt to ensure that borrowers get the best deal, and that will result in government backstop insurance without either fees or equity requirements. Just as in the case of no pre-commitment, competition will ensure that insurance costs $\delta-\Delta$, and securities will sell for one minus that amount. Discretionary borrowers will again borrow if $\vartheta\Delta> (1-\vartheta)(1-\delta)$.

In the case of equity requirements, the possibility for corruption occurs because the state will be able to choose whether or not to grant backstop insurance to any particular entity. This discretion is assumed to be automatic, as it is hard to imagine that the state would not have the ability to decide that some firms or not operating with this support. Despite the government's difficulties in committing not to bail out Fannie Mae

and Freddie Mac, it certainly managed to let large numbers of investors take the hits for defaults in the subprime market.

A corrupt politician will choose a unique firm to receive the benefit of this backstop insurance. It will impose neither equity requirements, nor a fee, on that firm. That firm's ability to extract profits will still be limited by competition with an uninsured competitive fringe. In the good state, for each unit of insurance, if the insurance company charges p_I, the company will earn $\frac{1-\delta+\Delta}{p_0}p_I - \delta + \Delta$, and p_0 in equilibrium will equal $1 - p_I$, which creates another reason for the company to want to boost insurance costs. Higher costs mean lower security costs which mean higher profits.

There are two constraints on p_I. The secure public insurance must be more attractive than unsupported private insurance. If equity-less private insurance leads to no market breakdown, then p_I will have to be less than or equal to δ in order to insure that investors will prefer the publicly backed insurance to equity-less private insurance. In that case, the public company will earn profits of $\frac{\Delta}{1-\delta}$ in the good state per unit of insurance. If equity-less insurance leads to a lemons breakdown in the bad state, then the firm with publicly backed insurance can charge $\delta + .5t(1-\gamma)\big(1 - v(\delta+\Delta)\big)(1 - \delta + \Delta)$ and earn commensurately higher profits.

If the insurance price is denoted p_I, then the initial security price will equal $1 - p_I$, and the extra profits from attracting sales to discretionary borrowers can induce the publicly backed corrupt company from lowering the insurance cost. Discretionary borrowers will sell the claim on their second period consumption if $\vartheta(1 - p_I) \geq (1 - \delta)$, which requires that $1 - (1 - \delta)/\vartheta \geq p_I$. This means that the price must be lower than δ. I denote the ratio of non-discretionary borrowers to total borrowers as r_{non}. The following proposition illustrates the optimal behavior of the publicly supported company:

Proposition 6: If equity-less private insurance does not lead to a lemons market breakdown, then the public asset insurance firm charges $1 - (1 - \delta)/\vartheta$ and sell to discretionary and non-discretionary borrowers if $\vartheta(1 - \delta + \Delta) > (1 - \delta + r_{non}\Delta)$ and will charge δ and sell only to non-discretionary borrowers otherwise. If equity-less

private insurance does lead to a lemons market breakdown, then the public asset insurance firm charges $1-(1-\delta)/\vartheta$ if $\vartheta(1-\delta+\Delta) > (1-\delta+r_{non}\Delta) + (1-\delta+\Delta)r_{non}\frac{q}{1-\delta-q}$ and $\delta+q$ otherwise, where q denotes $.5t(1-\gamma)\big(1-v(\delta+\Delta)\big)(1-\delta+\Delta)$.

This proposition shows that if equity-less private insurance competes with the publicly supported insurance, the publicly-supported firm will charge a low enough price to attract the discretionary borrowers if ϑ is close to one and if r_{non} is small. In this case, there will be welfare losses from excessive borrowing.

If equity-less insurance does lead to a lemons-style breakdown, then the publicly supported company has more market power with the non-discretionary borrowers and this makes it less likely that the company will charge a lower price to attract the non-discretionary borrowers. Even if ϑ is arbitrarily close to one, it is possible that the company will ignore those borrowers and continue to charge a higher fee.

The following table summarizes the potential outcomes. In all cases, except for laissez-faire, there are no social losses if the government is benign.

	Corrupt Politician	Populist Politician
Laissez-Faire, No Insurance	Possible Market Breakdown in Both States	Possible Market Breakdown in Both States
Laissez-Faire, Equity-Less Insurance, government commits to no bailouts.	Possible Market Breakdown if Defaults are High	Possible Market Breakdown if Defaults are High
Laissez-Faire, Equity-Less Insurance, government bails out in high default state.	No breakdown, subsidized lending, over-borrowing if $\vartheta(1-\delta+\Delta) > (1-\delta)$	No breakdown, subsidized lending, over-borrowing if $\vartheta(1-\delta+\Delta) > (1-\delta)$.
Public Insurance	First Best Outcome	Free Default Insurance, overborrowing if $\vartheta > 1-\delta$.

Public Backstop Insurances with either equity regulation or default fee.	Preferred company faces no fees or no equity requirements. Company either matches equity-less competitors or charges less and creates over-borrowing.	No equity requirements or fees—subsidized borrowing and over-borrowing if $\vartheta(1-\delta+\Delta) > (1-\delta)$.

These different systems all involve both redistribution and potential losses from either market breakdowns or over-supplying credit. Market breakdowns can occur either if there is no default insurance or if the government can commit not to bail out private insurance. These systems, however, have the advantage of not creating social losses from over-borrowing. There are also no transfers from investors to borrowers and borrowers ultimately pay the cost for the market breakdowns.

If the government cannot avoid bailing out insolvent insurance firms and ensuring that defaults are still insured against, then the government will involve any social losses from market breakdowns. However, there will be an implicit subsidy of borrowing, which transfers from investors to borrowers. There will also be the risk of over-borrowing.

Public insurance also eliminates market breakdowns, and is free from the risks of corruption. But it creates the most risks in the case of a populist politician. A public insurance company with populist leadership will essentially deliver default insurance for free, which creates the greatest transfer to borrowers from investors and makes over-borrowing more likely than in any other scenario.

Private insurance with backstop public insurance has risks from either corruption or populism. In the case of populism, the public regulator will require neither fees nor equity and this will create an implicit borrowing subsidy. This represents a transfer from lenders to borrowers and creates a risk of overborrowing. The over-borrowing risk,

however, in this case is less extreme than in the case of a populist public insurance entity because the size of the subsidy will be smaller.

If the public regulator is corrupt, rather than populist, then this will lead to monopoly power by a single insurance entity (or perhaps by a cartel of such entities). This will result either in transfers from investors to the shareholders of this entity and potentially also to borrowers. Borrowers receive some of the benefits if the firms decides to cut prices by enough to encourage over-borrowing results.

The decision between the more hard-edged approaches and various public interventions involves a tradeoff between the risk of market breakdowns and the social costs of over-borrowing. If the government cannot commit not to bail out private lenders, then public backstop insurance generally dominates an official system of no backstop insurance, at least in terms of aggregate welfare, because the government will end up bailing out the firms anyway. At least if the government functions well, backstop insurance can produce the first best. If the government suffers from either corruption or populism, the results will be no worse (again from the perspective of total social welfare) than in the case of implicit insurance.

The decision between public insurance and backstop insurance with fees or equity regulation depends on the relative risks of populism and corruption. The public insurance system is strong if corruption is more likely, but weakest in the case of populist politicians. Backstop insurance is the better scheme when populism is the greater threat.

The next proposition summarizes the welfare conclusion. To consider social welfare, I will ignore any transfers across classes of citizens, and assume an additive social welfare that simply sums up the ex ante expected utility across the three different groups of investors. This creates two potential sources of social losses: over-borrowing and illiquidity. If over-borrowing occurs then there is a social loss equal to the number of discretionary borrowers times the amount that they are lent (and consume) in period zero times $1-\vartheta$, which represents the welfare loss from consuming during the first period.

If illiquidity occurs, the social loss equals the number of non-discretionary borrowers times the amount of their endowment that is consumed by impatient borrowers

during the second period times $1-\gamma$. I will not consider banning private insurance and compare the other four options in the next proposition.

If there is no market breakdown in the high default state with equity-less private insurance, then laissez-faire without bailouts yields no social losses and is an optimal outcome. I will therefore assume in the proposition that there is a market breakdown in the high default state if the government pursues a pure laissez-faire option without bailouts.

Proposition 7: If $1-\delta > \vartheta$, then there is never over borrowing and laissez-faire with bailouts, public backstop insurance or direct public insurance yields no social losses. If $1-\delta < \vartheta < \frac{1-\delta}{1-\delta+\Delta}$, then laissez-faire with bailouts or public backstop insurance, but not direct public insurance, yield no social losses.

If $\frac{1-\delta+\Delta r_{non}}{1-\delta+\Delta} + r_{non}\frac{.5t(1-\gamma)(1-v(\delta+\Delta))(1-\delta+\Delta)+\Delta}{1-\delta-.5t(1-\gamma)(1-v(\delta+\Delta))(1-\delta+\Delta)} > \vartheta > \frac{1-\delta}{1-\delta+\Delta}$, then public backstop insurance dominates either laissez-faire with bailouts or direct public insurance, and it leads to lower social losses than laissez-faire without bailouts if and only if $r_{non} > r^*_{non}$, where r^*_{non} is increasing with π_P, γ, v, δ and Δ and falling with t and ϑ.

If $\vartheta > \frac{1-\delta+\Delta r_{non}}{1-\delta+\Delta} + r_{non}\frac{.5t(1-\gamma)(1-v(\delta+\Delta))(1-\delta+\Delta)+\Delta}{1-\delta-.5t(1-\gamma)(1-v(\delta+\Delta))(1-\delta+\Delta)}$, the public backstop insurance always dominates laissez-faire with bailouts and dominates direct public insurance if and only if $\pi_C < \frac{(\delta-\Delta)\vartheta}{1-\delta}\pi_P$. Laissez-faire without bailouts dominates the interventionist options if and only if $r_{non} < r^*_{non}$ where r^*_{non} is increasing with π_P, γ, and v, and falling with t and ϑ. If $\pi_C < \frac{(\delta-\Delta)\vartheta}{1-\delta}\pi_P$, then r^*_{non} is also increasing with π_C and if $\pi_C > \frac{(\delta-\Delta)\vartheta}{1-\delta}\pi_P$, then r^*_{non} is also increasing with δ and Δ.

The proposition first emphasizes that if there is no lemons market breakdown in the high default state, there is little reason to have public intervention in the market. The interesting issues occur only when that market breakdown occurs.

The appropriate policy response depends critically on ϑ, which captures both the amount of loss from over-borrowing, and more critically the probability that

overborrowing will occur. It essentially captures the tendency that cheap credit will distort the borrowing market.

If over-borrowing is unlikely because ϑ is low, then any of the public interventions can avoid social losses even with political risks. Even if a populist politician makes credit very cheap, this will not distort the lending market and therefore lead to no social losses. As ϑ rises, the risk of over-borrowing increases and the tradeoffs between different interventions becomes trickier.

For moderate values of ϑ, backstop insurance or laissez-faire with bailouts both produce no social losses. These interventions do not create any distortion to increase over-borrowing, while the pure public model will lead to distort the credit market.

At higher levels of ϑ, backstop insurance comes to dominate laissez-faire with bailouts, essentially because backstop insurance only leads to over-borrowing when the leaders are populist, but laissez-faire with bailouts always leads to over-borrowing. The critical tradeoff becomes the decision between laissez-faire without bailouts (if that is possible) and public backstop insurance. In that case, the critical parameter is the share of the borrower population that is discretionary. As there are more discretionary borrowers, the case for laissez-faire without bailouts becomes better.

Finally, at the highest levels of ϑ is possible for either the pure public model or backstop insurance or laissez-faire without bailouts to be optimal. If the risk of corruption is high relative to the risk of populism, then pure public insurance dominates the backstop insurance model. If the number of discretionary borrowers is high, then both models lead to higher losses than laissez-faire without bailouts. The backstop insurance model dominates laissez-faire with bailouts in this range as well.

A Comparison with Credit Intermediaries

Credit intermediaries, like banks, provide an alternative to the credit contracts and default insurance described above. These intermediaries collect investments from the

investors during period zero. Some of this money is lent to borrowers and some must be held to allow impatient investors to withdraw their funds in period one.

In the best case scenario, where there is not a bank run, the bank must set aside tD units of consumption if it takes in D deposits. The remaining (1-t)D units will be lent to non-discretionary borrowers. Since there is an abundant amount of investments, the interest rate paid to depositors will equal zero for both periods. The interest rate charged to borrowers is denoted r_2, and that will equal $\frac{\delta}{1-\delta}$. The bank must also issue equity equal to $\frac{\Delta(1-t)D}{(1-\delta-\Delta)}$ if it is going to be able to cover its losses in both states of the world. In the good state of the world, equity returns $\frac{2\Delta(1-t)D)}{(1-\delta-\Delta)}$, so the investors are exactly compensated in expected value.

A bank faces the same incentive to issue too little equity, just like the default insurers in the previous section. The limited liability nature of securities means that the bank wants to issue too little equity to cover its full losses in the high default state. This will increase profits per shareholder in the low default, but lead to difficulties in the bad state. Since the bank will not have enough capital to cover its obligations in the high default state, depositors anticipating the problem will create a run in period one causing the bank to sell of its securities. As the bank attempts to sell claims to investors, it may also be subject to a lemons-market problem, since investors may believe that the claims that are being sold are high risk assets. As Diamond and Dybvig discuss, deposit insurance is one means of limiting the difficulties associated with a run and limitations on withdrawals represent a second approach.

Deposit insurance, however, creates some of the same issues associated with default insurance on tradable securities. If there is a federal regulator who provides deposit insurance, and imposes appropriate capital requirements (or insurance fees) on banks, it is relatively easy to achieve the first best outcome. However, a populist regulator will also allow banks to operate with minimum fees and insufficient capital because this decrease the interest rates paid by borrowers. Since the banks shareholders

want to make some returns in the good state, this will limit the size of the subsidy relative to having a pure public lender.

Corrupt politicians will similarly cut fees and capital requirements, but with the aim of increasing the profits of a monopoly bank or banking cartel. The situation will also be essentially identical to the situation where there is a corrupt politician providing backstop default insurance to a purely public entity.

V. Interpreting the History of the Government-Sponsored Enterprises

The Government-Sponsored Enterprises began in the 1930s, in an attempt to strengthen a mortgage market that had been battered by the Great Depression. The Federal Housing Act of 1934 enabled the creation of the Federal Housing Administration and the Federal National Mortgage Association (Fannie Mae) which was established in 1938. The FHA has always been part of the government and it has long insured mortgages, which meet certain clear criteria, against default. The government had originally hoped that there would be private associations that would manage the resale of these insured mortgages, but when, according to Jaffee and Quigley (2012) no private association developed, they started Fannie Mae.

Fannie Mae has operated as an insurance fund for banks, and it enabled new, standardized, insured mortgages to be sold on a secondary market. The role that the FHA and Fannie Mae played in essentially creating this market suggests that the lemons problem was presumably fairly large, as banks don't seem to have been able to resell their mortgages without this public support. When the Veterans' Administration began insuring mortgages after World War II, Fannie Mae also got into the business of selling these securities as well.

While later events would underscore the risks associated with public default insurance, the early years do suggest that there were real benefits associated with tradable securities. As the model suggests, this insurance enhanced liquidity. Given that banks and other savings institutions were capable of imposing large costs on taxpayers if they

failed, for example during the Savings and Loan Crisis, their ability to acquire liquidity and shift risks to a broader class of investors may have had significant social benefits.

Moreover, there were also benefits that do seem to have benefitted borrowers. The FHA and Fannie Mae were associated with the rise of relatively low rate, very long term, fixed rate mortgages. Before the Great Depression mortgages were far more likely to have maturities less than ten years. Fetter (2010) documents the substantial increase in American home ownership between 1940 and 1960, and finds that loan availability played some role in generating this shift.

During the early years, when the FHA and Fannie Mae were entirely public entities, the primary risk was populism, not corruption. That remains the risk associated with the FHA, which remains as part of HUD. While Gyourko (2011) has documented signficant risks associated with massive FHA insuring activity during the recent Great Recession, over the course of its history, the FHA has not yet required an infusion of taxpayer dollars. There was considerable concern over FHA solvency after the housing downturn of the late 1980s, but the FHA has customarily been criticized for taking too few risks, and discriminating against minority lenders, rather than for taking on too many risks.

Fannie Mae began the transition to private enterprise in 1954, when it started selling shares to private investors, typically the banks that it insured. In 1968, the government split the Government National Mortgage Association (Ginnie Mae) off from Fannie Mae and privatized the remainder of the entity. Ginnie Mae guarantees only those mortgages that are supported by some other government agency, like the Veterans Administration, and like the FHA it has also remained solvent. While populism would seem to create risks for Ginnie Mae, they do not seem to have yet evolved.

In order to create competition in the mortgage insurance and resale business, the government also created the Federal Home Loan Mortgage Corporation (Freddie Mac) in 1970. At this point, the government loosened the restrictions on Fannie Mae, allowing it, for example, to trade in non-insured mortgages. After this point, there were two

essentially private entities that were insuring mortgages and trading in them, which meant that there were risks from both populism and corruption.

During the 1970s, Fannie and Freddie cooperated with financial entrepreneurs, primarily at Salomon Brothers, to create a global market for securitized mortgages. The secondary mortgage market became a multi-trillion dollar business that further enabled the flow of lending. A healthy literature now exists examining whether the able to securitize mortgage led to a decrease in lending standards (see e.g. Mian and Sufi 2009).

Despite repeated statements that Freddie and Fannie were allegedly operating without a federal guarantee, investors typically treated Freddie and Fannie debt as if they were almost treasury bonds. The interest rates that they paid were typically far lower than any other AAA corporate securities and recent events have illustrated that the government was indeed willing to take over their debts in the event of a default crisis. The ability of Fannie and Freddie to borrow so cheaply meant that they had the possibility of earning large profits simply by borrowing and investing in mortgage-backed securities. By 2006, they had jointly acquired a 1.5 trillion dollar portfolio of retained mortgages, which they claimed was appropriate for maintain market liquidity.

Over the past forty years, Fannie and Freddie seem to have experienced the impact of populist politicians eager to see them ease lending standards, and they seem to have engaged in serious action to ensure political support for their profit-making activities. One reports finds that Fannie and Freddie spent over $178 million on lobbying activities since 1998 and $16.6 million on campaign contributions (http://sunlightfoundation.com/blog/2011/02/11/proposed-policies-to-end-fannie-freddie-stem-from-lobbying-prohibition/). Repeated failures to control the risks associated with their mortgage business were stymied by legislators, who may have been influenced either by campaign contributions or by a desire to ensure easy terms for home borrowers. In 1992, for example, the government-sponsored entities were charged with promoting affordable housing in the Housing and Community Development Act.

As the model suggests, Fannie and Freddie enjoyed large profits during boom years. Between 1992 and 2003, “the GSEs’ reported annual return on equity (ROE) was

generally higher than 20 percent and rose as high as 47.2 percent for Freddie Mac in 2002," (http://www.huduser.org/periodicals/cityscpe/vol11num3/ch11.pdf). However, during bad years, the companies relied on significant government assistance. During the early 1980s, Fannie Mae also received assistance with significant tax breaks that helped cover its losses. Yet despite the attempts at tightening the regulations on the companies, their profitability and appeal to pro-lending legislators left them only lightly controlled. The recent crash has seen the most substantial bailout, with taxpayers paying $169 billion according to Jaffee and Quigley (2011).

The history of Fannie and Freddie points to risks from both populism and corruption, yet on net, the performance of government-controlled entities, like the FHA and Ginnie Mae, appears to have been better than their profit-making competitors, Fannie Mae and Freddie Mac. This fact does not mean that a public entity is in any sense risk-free, but it may suggest that the American taxpayer has less to fear from populism than from corruption. If so, then keeping the enterprises under total public control may well reduce the possible public losses.

VI. Conclusions: Reforming the Government-Sponsored Enterprises

In the model, the rival threats of corruption and populism threaten any public intervention related to default insurance. A populist politician wants to ensure that borrowers get the best deal possible, even if they must be paid for with tax revenues. A corrupt politician wants to ensure maximum profits for mortgage insurers, even if that requires taxing. No system can be immune from these threats.

In standard scenarios, where there are externalities or monopoly power, there are difficult tradeoffs between forms of intervention. Public ownership of a monopoly, for example, yields protection against corruption but creates the possibility for extreme waste under populism. Pigouvian taxes, against a negative externality, may be relatively safe, but Pigouvian subsidies also create a huge potential for waste.

Yet in the case of default insurance, there is relatively little protection provided by continuing private ownership, as long as the public sector remains the insurer of last resort. Either a populist or a corrupt politician will allow the private mortgage insurer to set aside minimal reserve, either to maximize lending or to maximize profits. The net result will be that the public insurance must be paid for with considerable taxation.

The model suggests that a public entity can engage in far more extreme behavior than a private entity with backstop insurance. It can reduce default insurance costs to zero, which will do far more to encourage over-borrowing than reducing costs to a level that maintains profitability in low default periods. Still, a public entity provides protection against corruption. Since private enterprise creates no limit on the extent of public spending, the advantages of public ownership seem higher than in other settings. The case against public ownership must be that the scope for abuse with populism is greater than in the case of public support for private insurance, or other welfare costs associated with public insurance.

The ultimate implication is that in many settings, private ownership at least provides a bulwark against populism and spending to favored interest groups. It is not obvious that this is true in the case of default insurance. The government can support favored interest groups even with private insurance, by allowing enough public support for private insurances. This result will be reduced if populism took the form of particularly favoring sub-groups of the population, other than borrowers, as a whole, who could be favored with a public insurer, but who would be harder to support with a private insurer.

It is impossible to leap from these highly theoretical musings to any concrete recommendations concerning the Government-Sponsored Enterprises. Yet the model still provides a degree of warning. Privatization is not protection against populism, and corruption will create more risk if there is a private entity than a public insurance provides. It may well be safer to keep the GSEs in public hands, as long as their management can be subject to significant limits.

Proofs of Propositions:

Proof of Claim 1: The first order condition for the populist price regulator is: $V'\big(q(\overline{p})\big) - \overline{p} = \mathrm{N}q(\overline{p})\mathrm{C}''(\mathrm{N}q(\overline{p}))$ or $\frac{V'(q(\overline{p}))-\mathrm{C}\prime(q(\overline{p}))}{q(\overline{p})} = \mathrm{NC}''(\mathrm{N}q(\overline{p}))$ and the first order condition for the monopolist can be written $\frac{V'(q_{LF})-C'(Nq_{LF})}{q_{LF}} = -V''(q_{LF})$. The function $\frac{V'(q)-\mathrm{C}\prime(\mathrm{q})}{q}$ is declining with q, so if $\mathrm{NC}''\big(\mathrm{N}q(\overline{p})\big) > -V"(q(\overline{p}))$, then $q_{LF} < q(\overline{p})$ while if $\mathrm{NC}''\big(\mathrm{N}q(\overline{p})\big) < -V"(q(\overline{p}))$, then $q_{LF} > q(\overline{p})$. Since quantities are all below the social optimum, the higher level of consumption always leads to more welfare.

Proof of Proposition 1: The expected welfare level under public ownership is $(1-\pi_P)U\big(q_{Comp}\big) + \pi_P U(q_{Max})$. The expected welfare level under laissez-faire is $U(q_{LF})$. The expected welfare level under price controls is $(1-\pi_P-\pi_C)U\big(q_{Comp}\big) + \pi_C U(q_{LF}) + \pi_P U(q_{Mon})$. The expected welfare level under the subsidy is $(1-\pi_P-\pi_C)U\big(q_{Comp}\big) + (\pi_P+\pi_C)\,U(q_{\overline{s}})$. Given that $U(q_{\overline{s}})$ is assumed to be less than either $U(q_{Mon})$ or (q_{LF}), the subsidy regime is always dominated by the price control regime. The rest of the proposition follows by just comparing the three remaining expected welfare levels.

Proof of Proposition 2a: In the case of laissez-faire, expected welfare equals $U(q_{Comp})$. In the case of public ownership, expected welfare equals $\big(1-\pi_p\big)U\big(\,q_{xOpt}\big) + \pi_p U(q_{Max})$. In the case of a quantity control, expected welfare equals $\big(1-\pi_p-\pi_C\big)U\big(\,q_{xOpt}\big) + \pi_C U(q_{LF}) + \pi_p U\big(Min(q_{Comp}, q_{xqMon}\big)$. In the case of a Pigouvian tax that is rebated to wealthier consumers, expected welfare is $\big(1-\pi_p-\pi_C\big)U\big(\,q_{xOpt}\big) + \pi_C U\big(q_{Comp}\big) + \pi_p U\big(Min(q_{Comp}, q_{xqMon})\big)$. In the case of a Pigouvian tax that is rebated to poor consumers, expected welfare is $\big(1-\pi_p-\pi_C\big)U\big(\,q_{xOpt}\big) + \pi_C U\big(q_{Comp}\big) + \pi_p U\big(q_{xTransfer}\big)$. The comparison between Pigouvian taxes and quantity controls depends entirely on the welfare in the case of a corrupt politician who creates

monopoly conditions in the case of quantity controls and just guts the tax in the case of Pigouvian taxes. The other results come from simple comparisons of the welfare levels.

Proof of Proposition 2b: In the case of laissez-faire, expected welfare equals $U(q_{Comp})$. In the case of public ownership, expected welfare equals $(1-\pi_p)U(q_{xOpt}) + \pi_p U(q_{Max})$. In the case of a Pigouvian subsidy, expected welfare is $(1-\pi_p-\pi_C)U(q_{xOpt}) + (\pi_p+\pi_C)U(q_{\bar{s}})$. The Pigouvian subsidy dominates public ownership if and only if $\pi_P > \frac{U(q_{xOpt})-U(q_{\bar{s}})}{U(q_{\bar{s}})-U(q_{Max})}\pi_C$ and dominates laissez-faire if and only if $\frac{U(q_{xOpt})-U(q_{Comp})}{U(q_{xOpt})-U(q_{\bar{s}})} > \pi_P + \pi_C$. Public ownership dominates laissez-faire if and only if $\frac{U(q_{xOpt})-U(q_{Comp})}{U(q_{xQpt})-U(q_{Max})} > \pi_P$.

Proof of Proposition 3: Given these assumptions, the price paid by the consumer will satisfy $v_0 - v_1 q = p = t + c_0 + c_1 qN$, or $q = \frac{v_0-t-c_0}{Nc_1+v_1}$ and $p = \frac{(t+c_0)v_1+Nc_1v_0}{Nc_1+v_1}$. Social welfare is defined as $(v_0 + x - c_0)q - .5(v_1+Nc_1)q^2$. With a revenue-raising tax and a populist politician, the tax is chosen to maximize $V(q(t)) - p(t)q(t) + tq(t) + xq(t)$, (as before, the tax is assumed to be paid directly by the producer) which implies that the tax satisfies $t = -x + v_1\frac{v_0-t-c_0}{Nc_1+v_1}$ or $t = \frac{-x(Nc_1+v_1)+v_1(v_0-c_0)}{Nc_1+2v_1}$, which is too high relative to the first best of $t = -x$. In this case, q equals $\frac{v_0-c_0+x}{Nc_1+2v_1}$ and welfare equals $\frac{.5(Nc_1+3v_1)(v_0+x-c_0)^2}{(Nc_1+2v_1)^2}$

In the case of a populist politician, the revenue-less tax maximizes $v(q) - p(t)q(t) + xq(t)$, and no tax will be imposed if $\frac{v_1(v_0-c_0)}{Nc_1+v_1} > -x$ which I assume. In this case, q equals $\frac{v_0-c_0}{Nc_1+v_1}$ and overall welfare equals $\frac{.5(v_0-c_0)^2+x(v_0-c_0)}{Nc_1+v_1}$. Welfare with the revenue-less tax will always be greater if $v_1^2(v_0-c_0)^2 > (Nc_1+3v_1)(Nc_1+v_1)x^2 - 2x(v_0-c_0)v_1^2$, and which must hold if x is sufficiently small.

In the case of corruption, both taxes will yield the same outcome (no tax) and in the case of benevolent politician, the revenue raising tax clearly dominates, since the taxes are clearly better when they aren't wasted.

Proof of Proposition 4: If only high risk securities are sold, then the default probability associated with each securities equals 1/v. In that case, the patient investors will only be willing to buy these securities if the price is less than or equal to (v-1)/v. A sufficient supply of patient investor income in period one, which I assume, ensure that competition among patient will keep prices equal to (v-1)/v. At this price, impatient investors with good securities will prefer not to sell their securities. In period zero, the expected payoff to an investor from buying a security that pays one if there is no default equals $1-\delta-t(1-\delta v)(1-\gamma)$ and that must equal the price in period zero.

If high and low risk securities are resold in period one, then the default probability of the resold securities depends on the state of the world. If the high default state, the probability of default, conditional upon being resold equals $\frac{\delta+\Delta}{t+(1-t)v(\delta+\Delta)}$. In the low default state, the probability of default, conditional upon being resold equals $\frac{\delta-\Delta}{t+(1-t)v(\delta-\Delta)}$. In the high default state, the price in period one of securities equals $\frac{1-t+(tv-1)(\delta+\Delta)}{1-t+tv(\delta+\Delta)}$ and in the low default state, the price in period one of securities will equal $\frac{t+(v-tv-1)(\delta-\Delta)}{t+(1-t)v(\delta-\Delta)}$. The condition for low risk, impatient investors to resell in either state is that these prices are greater than γ. If the impatient investors all resell in either state, then the period zero security price will equal $1-\delta$. If the impatient investors will no risk securities resell only in the low default state, then the period zero security price will equal $1-\delta-.5t((1-v(\delta+\Delta))(1-\gamma))$.

Investors are indifferent between all possible equilibria, since they are always indifferent between buying the securities and autarky. The borrowers are worse off in the low trade equilibria because they receive less in period zero in exchange for committing their future returns.

Proof of Proposition 5: If the company is to issue an addition Q units of mortgages, and raise only e units of equity per unit, then investors in new securities should understand that they are not fully insured. If they pay a premium of $\hat{\delta}$ (which may be less than δ), then the ratio of the company's assets to the company's liabilities in the event of a high default state will equal $\frac{(1-\delta)(\delta+\Delta)Q+(1-\delta-\Delta)(e+\hat{\delta})q}{(1-\delta)(\delta+\Delta)(Q+q)}$, so buyers of insurance recognize that this will be the extent of their insurance in the high default state. Assuming that this partial insurance does not cause a market breakdown in period one, insurance will still be attractive to purchase as long as $\hat{\delta}$ is less then $.5(\delta-\Delta)+.5(\delta+\Delta)\frac{(1-\delta)(\delta+\Delta)Q+(1-\delta-\Delta)(e+\hat{\delta})q}{(1-\delta)(\delta+\Delta)(Q+q)}$, which is the expected benefit of the insurance. This puts an upper limit on the premium of $\delta-.5q\frac{\Delta-(1-\delta-\Delta)e}{(1-\delta)Q+.5q(1-\delta+\Delta)}$, where the term $.5q\frac{\Delta-(1-\delta-\Delta)e}{(1-\delta)Q+.5q(1-\delta+\Delta)}$ represents the reduction in willingness to pay because of the non-payment of insurance. Yet still even with this unwillingness to pay.

Given this premium, the profits in the good state equal for the initial shareholders equal:

$$\frac{Q\Delta(1-\delta+\Delta)}{(1-\delta)(1-\delta-\Delta)}+\frac{Q\Delta}{Q\Delta+(1-\delta-\Delta)qe}\left(q^2e\frac{(1-\delta+\Delta)(1-\delta-\Delta)}{2(1-\delta)^2Q+q(1-\delta)(1-\delta+\Delta)}+(Q+q)\frac{\Delta}{1-\delta}-q^2\frac{(1-\delta+\Delta)\Delta}{2(1-\delta)^2Q+q(1-\delta)(1-\delta+\Delta)}\right)$$

The derivative of this with respect to "e" equals $\frac{-2(Q+q)qQ^2\Delta^2(1-\delta-\Delta)}{(2(1-\delta)Q+q(1-\delta+\Delta))(Q\Delta-(1-\delta-\Delta)qe)^2}$, which means that expected profits in the good state are always declining in the level of e. They are no profits in the bad state unless e is over $\frac{\Delta}{1-\delta-\Delta}$, and in that case, total profits cannot be higher than in the case where e equals $\frac{\Delta}{1-\delta-\Delta}$.

Proof of Proposition 5: With equity-less private insurance and no market breakdown, the price of uninsured securities in the first period will continue to be $1-\delta$, so insurance premia of $\frac{(1-\delta)(\delta-\Delta)}{1-\delta+\Delta}$ that is invested in securities in period zero, will yield $\delta-\Delta$ in period two in the low default state. This is enough to guarantee securities

against any default risk in the low default state of the world. As such, insured securities will be fully safe and will trade at face value period one.

The same premium will yield $\frac{(1-\delta-\Delta)(\delta-\Delta)}{1-\delta+\Delta}$ in the high default state. This will mean that defaulting securities are paid $\frac{(1-\delta-\Delta)(\delta-\Delta)}{(1-\delta+\Delta)(\delta+\Delta)}$ in high default state. This means that the expected value of low risk securities in period one equals 1 and the expected value of high risk securities equals $1-\frac{2\Delta}{v(1-\delta+\Delta)(\delta+\Delta)}$. If everyone with high risk securities and all impatient investors sell their securities in period one, the expected value (and price) of those securities will equal $1-\frac{v\Delta}{v(t+(1-t)v(\delta+\Delta))(1-\delta+\Delta)}$. This can only be an equilibrium if $1-\gamma>\frac{\Delta}{(t+(1-t)v(\delta+\Delta))(1-\delta+\Delta)}$, which is the condition that ensures that the low risk impatient investors will sell. The first period price will continue to equal $1-\delta$.

A second equilibrium exists where even insurance does not eliminate the lemons breakdown. In that case, the period zero price of securities can be written as p_0. The insurance premium will be $\frac{p_0(\delta-\Delta)}{1-\delta+\Delta}$, which will fully insure in the good state. In the high default state, the premium will yield $\frac{(1-\delta-\Delta)(\delta-\Delta)}{1-\delta+\Delta}$ and defaulting securities will again be paid $\frac{(1-\delta-\Delta)(\delta-\Delta)}{(1-\delta+\Delta)(\delta+\Delta)}$. The expected value of high risk securities will equal $1-\frac{2\Delta}{v(1-\delta+\Delta)(\delta+\Delta)}$, and the high risk individuals will not sell as long as $1-\gamma>\frac{2\Delta}{v(\delta+\Delta)(1-\delta+\Delta)}$. In this case, a period zero price of $1-\delta-.5t(1-\gamma)\big(1-v(\delta+\Delta)\big)(1-\delta+\Delta)$ will make investors indifferent between lending or not, and since this is below the price in the other equilibrium, social welfare is unambiguously lower.

Proof of Proposition 6: If the equity-less private insurance does not lead to a lemons problem, then an insurance cost of δ ensures that the price of period zero assets equals $1-\delta$ and profits are $\frac{\Delta}{1-\delta}$ times the number of non-discretionary borrowers. If the firm instead sets price equal to the lower cost of $1-(1-\delta)/\vartheta$, then the period zero asset price will equal $(1-\delta)/\vartheta$. Profits will equal $\frac{(1-\delta)(1-1/\vartheta)+\Delta}{(1-\delta)/\vartheta}$ times the number of

discretionary and non-discretionary buyers. These profits will be higher if and only if $\vartheta(1-\delta+\Delta) > (1-\delta+r_{non}\Delta)$.

If the equity-less private insurance does lead to a lemons problem then the publicly backed insurance company can charge $\delta + .5t(1-\gamma)\big(1-v(\delta+\Delta)\big)(1-\delta+\Delta)$ and profits will equal: $\frac{.5t(1-\gamma)\big(1-v(\delta+\Delta)\big)(1-\delta+\Delta)+\Delta}{1-\delta-.5t(1-\gamma)\big(1-v(\delta+\Delta)\big)(1-\delta+\Delta)}$ times the number of non-discretionary borrowers. The strategy of charging $1-(1-\delta)/\vartheta$ will be more profitable if and only if and only if

$$\vartheta(1-\delta+\Delta) > (1-\delta+r_{non}\Delta) + (1-\delta+\Delta)r_{non}\frac{.5t(1-\gamma)\big(1-v(\delta+\Delta)\big)(1-\delta+\Delta)+\Delta}{1-\delta-.5t(1-\gamma)\big(1-v(\delta+\Delta)\big)(1-\delta+\Delta)}.$$

Proof of Proposition 7: I first calculate expected social losses in all four cases. If the government commits not to bail out the insurers, then either there is no market breakdown in the high default state, in which case, there are no social losses and this is the first best. If there is a market breakdown in the high default state, then the expected social losses equals the number of non-discretionary borrowers times .5 times $t(1-\gamma)\big(1-v(\delta+\Delta)\big)(1-\delta+\Delta)$.

If government follows a "laissez-faire" policy but it still bails out private insurers in the high default state, then there is no market breakdown, but if $1-\delta < \vartheta(1-\delta+\Delta)$, then there will be overborrowing even with a benevolent government and the social losses will equal the number of non-discretionary borrowers times $(1-\vartheta)(1-\delta+\Delta)$, which is the amount that they consume during the first period.

If there is public insurance, then the only social losses occur if the government is populist, and if $1-\delta < \vartheta$. In that case, with probability π_P, the social loss will equal $1-\vartheta$ times the number of discretionary borrowers.

If there is public backstop insurance for the private insurers, then the first best occurs if the politician is neither populist nor corrupt. If politician is populist then the condition for over-borrowing again is $1-\delta < \vartheta(1-\delta+\Delta)$, and the social loss is again the number of discretionary borrowers times $(1-\vartheta)(1-\delta+\Delta)$.

If the politician is corrupt, then there will be no social loss if the company only sells insurance to non-discretionary borrowers. If the strategy of selling insurance to discretionary borrowers dominates, which requires, that $\vartheta(1-\delta+\Delta) > (1-\delta+r_{non}\Delta) + (1-\delta+\Delta)r_{non}\frac{.5t(1-\gamma)\left(1-v(\delta+\Delta)\right)(1-\delta+\Delta)+\Delta}{1-\delta-.5t(1-\gamma)\left(1-v(\delta+\Delta)\right)(1-\delta+\Delta)}$for example, if there is a lemons market breakdown in the market for equity-less private insurance in the high default state, then the social losses will equal the number of discretionary borrowers times $1-\vartheta$ times $(1-\delta)/\vartheta$, which is the period zero asset price received by borrowers.

If there is no lemons market breakdown in the high default state, then laissez-faire with no bail-outs yields the first best. For the rest of the proposition, I assume that there is a lemons market breakdown without public intervention in the high default state.

If $1-\delta > \vartheta$, there is never over-borrowing. In that case, all strategies except for laissez-faire with no bail outs yield the first best.

If $1-\delta < \vartheta < \frac{1-\delta}{1-\delta+\Delta}$, then laissez-faire with bail outs and public backstop insurance both yield the first best, while public insurance and laissez-faire without bailouts do not.

If $\frac{1-\delta+\Delta r_{non}}{1-\delta+\Delta} + r_{non}\frac{.5t(1-\gamma)\left(1-v(\delta+\Delta)\right)(1-\delta+\Delta)+\Delta}{1-\delta-.5t(1-\gamma)\left(1-v(\delta+\Delta)\right)(1-\delta+\Delta)} > \vartheta > \frac{1-\delta}{1-\delta+\Delta}$ and if there is a lemons market breakdown in the high default state, then all systems lead to social losses, but backstop insurance only leads to losses in the populist state, and those losses are less than public insurance and equivalent to those in the case of the laissez-faire insurance with bail-outs. But since laissez-faire with bail outs leads to losses in all states of the world, backstop insurance dominates.

In this case, public backstop default insurance dominates laissez-faire without bailouts if and only if $(1-r_{non})\pi_P(1-\vartheta)(1-\delta+\Delta) < .5(r_{non}t(1-\gamma)\big(1-v(\delta+\Delta)\big)(1-\delta+\Delta)$ or $\frac{\pi_P(1-\vartheta)}{\pi_P(1-\vartheta)+.5t(1-\gamma)\left(1-v(\delta+\Delta)\right)} < r_{non}$. As such, there exists a value of r_{non}, denoted r_{non}^*, between zero and one, at which public backstop insurance yields the same social losses as laissez-faire without bailouts and that value of r_{non}^* equals

$\frac{\pi_P(1-\vartheta)}{\pi_P(1-\vartheta)+.5t(1-\gamma)(1-v(\delta+\Delta))}$. For values of r_{non}, above r^*_{non}, public backstop insurance dominates laissez-faire without bailouts and for values of r_{non}, below r^*_{non}, laissez-faire without bailouts dominates backstop insurance. Differentiation yields that r^*_{non} is increasing with π_P, γ, v, δ and Δ and falling with t and ϑ.

If $\frac{1-\delta+\Delta r_{non}}{1-\delta+\Delta} + r_{non}\frac{.5t(1-\gamma)(1-v(\delta+\Delta))(1-\delta+\Delta)+\Delta}{1-\delta-.5t(1-\gamma)(1-v(\delta+\Delta))(1-\delta+\Delta)} < \vartheta$, then public backstop insurance leads to overborrowing in both the corrupt and populist states. The expected loss from the public backstop insurance equals the number of discretionary borrowers times $(1-\vartheta)(\pi_P(1-\delta+\Delta)+\pi_C(1-\delta)/\vartheta)$. The cost of laissez-faire with bailouts is $(1-\vartheta)(1-\delta+\Delta)$ times the number of borrowers, and as $\vartheta > \frac{1-\delta}{1-\delta+\Delta}$, $\frac{1-\delta}{\vartheta} < (1-\delta+\Delta)$ which means that public backstop insurance always dominates laissez-faire with bailouts.

This cost of public backstop insurance is less than the social cost of pure public default insurance if and only if $\pi_C < \frac{(\delta-\Delta)\vartheta}{1-\delta}\pi_P$. For laissez-faire without bailouts to dominate it must be that $.5(r_{non}t(1-\gamma)(1-v(\delta+\Delta))(1-\delta+\Delta)$ is less than the minimum of $(1-r_{non})(1-\vartheta)\pi_P$ (losses under pure public insurance) or $(1-r_{non})(1-\vartheta)(\pi_P(1-\delta+\Delta)+\pi_C(1-\delta)/\vartheta)$, so that r_{non} must be smaller than $\frac{\pi_P(1-\vartheta)}{\pi_P(1-\vartheta)+.5t(1-\gamma)(1-v(\delta+\Delta))(1-\delta+\Delta)}$ and $\frac{(1-\vartheta)(\pi_P(1-\delta+\Delta)+\pi_C(1-\delta)/\vartheta)}{(1-\vartheta)(\pi_P(1-\delta+\Delta)+\pi_C(1-\delta)/\vartheta)+.5t(1-\gamma)(1-v(\delta+\Delta))(1-\delta+\Delta)}$. There will still exist a value of r^*_{non} which determines whether laissez-faire without bailouts dominates the other options. If $\pi_C < \frac{(\delta-\Delta)\vartheta}{1-\delta}\pi_P$, so backstop insurance dominates pure public insurance, then the value of r^*_{non} equals $\frac{(1-\vartheta)(\pi_P(1-\delta+\Delta)+\pi_C(1-\delta)/\vartheta)}{(1-\vartheta)(\pi_P(1-\delta+\Delta)+\pi_C(1-\delta)/\vartheta)+.5t(1-\gamma)(1-v(\delta+\Delta))(1-\delta+\Delta)}$, and this is increasing with π_P, π_C, γ and v and decreasing with t and ϑ. If $\pi_C > \frac{(\delta-\Delta)\vartheta}{1-\delta}\pi_P$, then pure public insurance dominates laissez-faire and the value of r^*_{non} equals $\frac{\pi_P(1-\vartheta)}{\pi_P(1-\vartheta)+.5t(1-\gamma)(1-v(\delta+\Delta))(1-\delta+\Delta)}$. In that case, r^*_{non} is increasing with π_P, γ, v, δ and Δ and falling with t and ϑ.

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[i] Evidence of high spending levels is enough to prove corruption in Singapore even without explicit proof of wrong-doing.

[ii] If a slightly higher number of high quality investors sell, then prices will rise and all high quality impatient investors will want to sell. If a slightly lower number of high quality investors sell, then prices will fall and no high quality impatient investors will want to sell.