Strategic Legislative Subsidies: Informational Lobbying and the Cost of Policy*

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November 2017

Abstract

We consider the strategic considerations inherent in legislative subsidies and develop an informational lobbying model with costly policy reforms. In contrast to other models of informational lobbying we focus on the implications of a policymaker's and a lobby's resource constraints for lobbying activities. We allow both a policymaker and a lobby to gather information, and each can either fund or subsidize policy making. Our analysis highlights that legislative subsidies are both chosen strategically by lobbyists, and strategically induced by policymakers, dependent upon the circumstances. These involve which resource constraints bind, the policymaker’s prior beliefs, the salience of policy, and the policymaker’s expertise and the lobby’s expertise or credibility. We also illustrate when an interest group may lobby a friendly, opposing, or undecided policymaker. Furthermore, we explain how an interest group may strategically waste resources and when informational lobbying and transfers are complements, substitutes, or independent.

Keywords: Informational Lobbying, Legislative Subsidies, Resource Constraints

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*We thank Christopher Cotton, Matthias Dahm, Arnaud Dellis, Gabriele Gratton, Martin Gregor, Alexander Hertel-Fernandez, Björn Kauder, Michelle Mello, Giacomo Ponzetto, James Snyder, Francesco Trebbi, and Jonathan Woon for helpful discussions and suggestions. We also benefited from seminar participants at Harvard University, Laval University, and Queen’s University as well as participants at the IEB Workshop on Corruption, Lobbying and Public Policy 2015, the PET 15, IIPF 2015, MPSA 2016, SEA 2016, and EEA 2017 conferences. A previous version was circulated under the title “Informational Lobbying and Legislative Subsidies”. All errors are our own.

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1 Introduction

It is well known that the evaluation and implementation of policy is an expensive process. Policymakers faced with finite budgets must therefore decide how to allocate their limited resources between activities associated with information acquisition or policy enactment.\footnote{In 2009 Congress had 535 members, where each House member employed an average of 16 staffers, and each Senator averaged 43 staffers (Petersen et al. (2010); Nownes (2013)). The Congressional Budget Office (CBO) employs about 235 economic and other experts (CBO website). In addition, there are hundreds of experts in various government agencies who write reports or give testimonies.} This presents opportunities to special interest groups’ intent on influencing ultimate policy decisions.\footnote{Common lobbying activities include legislative testimonies, research reports, campaign contributions, and campaigning. A very common legislative subsidy is legislative drafting (Baumgartner et al. (2009), Nownes (2013)). For example, lobbyists employed by Genentech, a Roche subsidiary, and two law firms provided talking points to 42 House members, equally distributed across both parties, who submitted them with minor to no changes to the Congressional Record (Pear (2009)). Similarly, lobbyists of Citigroup proposed language to the House Financial Services Committee which turned into a bill of 85 lines with two crucial paragraphs of 70 lines provided by Citigroup. Only two words were changed for proper grammar (Lipton and Protess (2013)). Lobbies even provide external consultants and staffers on site to relieve ministries’ understaffing (Bank (2008), Gathmann and Weisensee (2007)).} Furthermore, policymaking is a sequential process such that by strategically supplying information and other resources at the different stages special interest groups may influence what a policymaker learns and what policy actions they subsequently take. That interest group exercise such multistage influence is well documented but only partially understood.

In the analysis that follows we formally model lobby and policymaker resource constraints and their implications for individual incentives to gather information and support policies. Our setup allows us to gain new insights into the strategic considerations that underlie legislative subsidies. This leads to several contributions. We are able to explain in which circumstances, in terms of their prior beliefs, a policymaker will gather information themselves or will rely on information supplied by a lobby. We can provide explanations for when an interest group may lobby a friendly, opposing, or undecided policymaker. Furthermore, we are able to understand the circumstances when the provision of information and other types of resource transfers from a lobby to a policymaker are complements, substitutes, or independent. Last, we can show that a lobby may waste resources so as to strategically restrict the choices available to a policymaker.

The significance and implications of budget constraints has been recognized by Hall and Deardorff (2006) as well as Lessig (2011) who point out how constrained policymakers rely heavily on support from lobbies, to relax their own resource constraints; and how interest groups become de facto “service bureaus” (Hall and Deardorff (2006)).\footnote{Esterling (2004) points out that Congress often lacks the ability to gather “the current research-based state of knowledge for the full array of policies”. Curry (2015) documents how the lack of time and resources for individual Congress members results in stronger reliance on the recommendations of legislative leaders.} This reliance by policymakers on lobbies for resources seems to be growing and can be explained by increasing policy complexity and decreasing congressional capacity (Drutnam (2015)). Congressional capacity with respect to
Congressional staff has been declining as illustrated in Figure 1(a) and congressional workload has been constant with respect to the introduction and passage of bills but increasing in the number of votes and pages in the Federal Register, which hints at greater policy complexity.\textsuperscript{4} There is also growing pressure on legislators’ resources for policies because of the growing costs of electoral competition fundraising (Daley and Snowberg (2009)).\textsuperscript{5} On the other hand, lobbying spending, total and per lobbyist, has increased as documented in Figure 1(b).\textsuperscript{6} Given these trends it seems that lobbyists are increasingly involved in both making and implementing policies. For example, Mello et al. (2012) provide a case study of Merck’s extensive involvement in the US policymaking process behind the introduction and mandating of vaccinations for the cervical cancer causing papillomavirus. This has proven to be very politically controversial. In an attempt to advocate for the vaccination, and increase its profits, Merck provided significant policy relevant information and other resources to policymakers. Its advocates lobbied policymakers, mobilized female legislators and physicians, drafted legislation, conducted marketing campaigns, and filled gaps in the provision of vaccinations. Within a year 41 states and the District of Columbia introduced the vaccination, and 24 states proposed legislative bills that would mandate the vaccination for teenage girls. Though there was concern about mandatory vaccination and Merck’s involvement, policymakers admitted that they mostly relied on Merck’s efforts and resources to change policies.

In this study we focus on strategic transfers of information and other resources from an interest

\textsuperscript{4}Figure 9 and Figure 10 in Supplemental Appendix B.1 document the trends in congressional support agency staff and congressional workload for the time period of 1985 to 2015/16.

\textsuperscript{5}Figure 11 in Supplemental Appendix B.1 documents the growing costs of winning Congressional seats.

\textsuperscript{6}The number of registered lobbyists has been declining since the Honest Leadership and Open Government Act in 2007. It has been strongly argued that the decline is due to lobbyists dropping just below the reporting thresholds so as to circumvent the costs and restrictions associated with reporting (that is there is a growing number of “shadow lobbyists”). Nevertheless, the reported total amounts of lobbying are mostly constant.
group to a policymaker. We distinguish between resources expended for gathering policy relevant information such as research reports, polling and surveys, and testimonies and those expended for making policy such as the costs of legislative drafting, gaining majorities, and following institutional protocols. Both the policymaker and interest group are assumed to face budget constraints. In the case of the interest group resources may be spent on gathering information or for transfers to a policymaker. The policymaker may spend resources (that may include transfers from the interest group) on information acquisition or policy implementation. There is no presumption that the policymaker and interest group share common policy goals or that their resource constraints are or are not binding. We are also agnostic on whether a lobbyist gathers verifiable or non-verifiable information. Rather we apply an information structure which allows for a wide range of observed informational lobbying activities, and captures either a lobby’s expertise in providing (truthfully) information of a certain quality, or, a lobby’s credibility in a cheap talk environment.

Our analysis highlights the strategic manipulation of legislative subsidies by interest groups when both they and the policymakers they lobby may face binding budget constraints. Policymakers require resources both to gather information and enact policies, they have initial priors over what policy is desirable and attach a level of salience to each policy issue (Baumgartner et al. (2009)). Two basic forms of manipulation arise: For a policymaker who does not initially favor the lobby’s preferred policy, but can be persuaded to do so by sufficient appropriate information, the lobby either supplies information directly or relaxes the policymaker’s budget constraint to induce them to gather information themselves. This implies that policymakers who \textit{ex post} support the lobbies’ preferred policies were not necessarily \textit{ex ante} “friends” (Hall and Deardorff (2006), Hall and Miler (2008)). Surprisingly, a resource-constrained policymaker – though at a resource disadvantage initially – may actually gather own information for a wider range of beliefs. The policymaker, anticipating a policy implementation subsidy, bears de facto lower policy costs and takes advantage of the interest group’s incentives and gathers more own costly information to become more informed. For a policymaker who initially favors the lobby’s preferred policy the lobby may manipulate the budget such that the policymaker cannot afford information that may change their position. The strategic incentive to waste resources and being uninformative to the policymaker is contrary to the “money burning” incentive of enhancing credibility in models of costly signaling.

\footnote{These information and resource transfers may be institutionalized or provided through lobbyists. For example, industry sponsorship of clinical trials by drug companies, which provides information to regulators for approval, was over $14 billion in 2003 with an increasing trend (Moses et al. (2005)). Furthermore, there have been between 10 to 15 thousand lobbyists per year registered under the Federal Lobbying Disclosure Act of 1995 and reported lobbying spending, excluding campaign contributions, has been between $1.5 to $3.3 billion. These expenditures exceeded annual campaign contributions.}

\footnote{A policymaker’s ability to gather information is similar to Rasmusen (1993) and Cotton and Delli (2016).}
(Potters and van Winden (1992), Austen-Smith and Banks (2000, 2002)) or gaining attention in models of costly access (Austen-Smith (1995, 1998), Lohmann (1995), Cotton (2009, 2012), Cotton and Delli (2016)), where the lobby’s expenditure is informative in equilibrium. Furthermore, our results provide a unifying explanation for the seemingly contradictory findings in the literature of whether interest groups lobby undecided, or unbiased, decision-makers (Eggers and Hainmueller (2009), Bertrand et al. (2014)), target opponents (Austen-Smith and Wright (1994, 1996), de Figueiredo and Cameron (2008)), or target supporters (Kollman (1997), Hojnacki and Kimball (1998), Mian et al. (2013), Igan and Mishra (2014)).

Our analysis also highlights that if an interest group has to bear the cost of both information and policy implementation, then the lobby’s optimal strategy is to provide transfers to the policymaker in stages and not commit all resources up front as is common in costly access models (Austen-Smith (1995, 1998), Lohmann (1995), Cotton (2009, 2012)). We also illustrate how informational lobbying and contributions arise endogenously and can be either substitutes (Bennedsen and Feldmann (2006); Dahm and Porteiro (2008a,b), Groll and Ellis (2014, 2017)), complements (Austen-Smith (1995, 1998), Lohmann (1995), Cotton (2009, 2012)), or independent.

Some studies of financial transfers appear to support the view that they constitute money-for-favors (Grossman and Helpman (1994), Bennedsen and Feldmann (2006)) or perhaps even outright bribery. In our analysis we show that these payments may involve subsidies that allow the policymaker to engage in information gathering that may then persuade the policymaker to adopt a policy favored by the lobby. The change in the policymaker’s position may then appear empirically as money-for-favors. We do not claim that money is non-distortionary, but rather that its role can be different from the one described by the money-for-favors view.

The other related literature that looks at the transfer of resources from lobbyists to policymakers may be divided into three general categories. The first associated primarily with Hall and Deardorff (2006) considers transfers of information or other resources as “legislative subsidies” whereby special interests subsidize the activities of policymakers with whom they share common interests (Hall and Wayman (1990), Hall (1996)). The idea being that this either permits...
the realization of the interest group’s desired policies, or influences the policymaker to prioritize policies related to their common goals. In contrast to the more pessimistic traditional views of lobbying, this implies that such partnerships between policymakers and special interests enable time and resource constrained policymakers to perform their public duties. In a second strand, interest groups provide policymakers with information. Many of these models involve private, non-verifiable information and cheap talk games with partitioning equilibria (Crawford and Sobel (1982), Potters and van Winden (1992)), costly signaling (Austen-Smith and Banks (2000, 2002)), private but verifiable information (Milgrom and Roberts (1986), Bull and Watson (2004, 2007)), or access-conditional information provision of non-verifiable or verifiable statements (Austen-Smith (1995, 1998), Lohmann (1995), Cotton (2009, 2012), Cotton and Dellis (2016), Schnakenberg (2017)). Finally, another strand of the literature focuses on lobbyists’ strategic considerations when supplying either information or financial resources to policymakers (Bennedsen and Feldmann (2006), Dahm and Porteiro (2008a,b), Groll and Ellis (2014, 2017)). Felli and Merlo (2007) analyze interest groups’ trade-offs between providing financial transfers to candidates before and after elections. In their sequential lobbying process interest groups make financial contributions to their initial supporters but then donate to elected opponents to induce a compromise.

We extend the idea of legislative subsidies and model a sequential lobbying process in which a lobby may subsidize both information gathering and policy implementation. Our informational lobbying setup allows for either private, non-verifiable information or private, verifiable information and recapitulates previous approaches. The lobby’s policy implementation subsidy may relax a policymaker’s agenda constraint of implementing costly policies or incentivize the policymaker to gather information. We do not model money-for-favors in our analysis but we will discuss at the end how policy subsidies may appear as money-for-favors and provide policy recommendations.

The studies closest to our own are Cotton and Dellis (2016) and Dellis and Oak (2016). However, both focus on purely informational lobbying and policy agendas. Their studies consider a policymaker who is considering multiple policy issues but cannot implement them all. Their focus is on how competitive informational lobbying may affect a policymaker’s ranking of proposals when the policymaker’s resource constraint is binding. We allow for only one lobby and one policymaker who play a game whereby the interest group makes strategic transfers – of both information and resources – that relax a policymaker’s resource constraint and are best responses to the

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13Recent empirical work supports the notion of cooperative partnerships between lobbyists and policymakers. Blanes i Vidal et al. (2012) focus on the importance of personal relationships between lobbyists and policymakers by analyzing the “revolving door” phenomenon in which politicians and staff members become lobbyists during their careers. They emphasize connections through common work experience and overlaps in party membership. Bertrand et al. (2014) show that lobbyists, measured by campaign donations and reported policy issues, follow their political contacts and change their policy issues when those contacts change offices or committees and policy issues.
policymaker’s expenditures which in turn are a best response to the interest group’s transfers. In our analysis we are especially interested in how an interest group chooses to strategically relax the policymaker’s resource constraint with legislative subsidies and consider the marginal policy that could be implemented by a constrained policymaker (Hall and Deardorff (2006)). Obviously this is part of some meta-game whereby policymakers decide which interest groups to interact with and interest groups in turn choose the policymakers to lobby. We do not formally model this larger game but our analysis can be thought of as providing some understanding of the form in which transfers take place and their consequences given that they are in some casual sense sufficiently large to ensure that the game we analyze is played. Despite this qualification we are able to gain several new insights into the lobbying process and explain some of the stylized facts heretofore unexplained in the literature.

The rest of this paper is organized as follows. Section 2 presents the model of informational lobbying and costly policymaking with transfers. In Section 3 we provide the benchmark of informational lobbying with no binding constraints. In Section 4 the policymaker is resource constrained and in Section 5 both the policymaker and the lobby are constrained. We discuss additional implications and conclude in Section 6.\footnote{The details of all proofs can be found in the Appendix or Supplemental Appendix.}

2 Model

Our model involves a policymaker, $P$, and a single lobby, $L$. The policymaker faces a policy choice between maintaining the status quo, $s$, or implementing a reform, $r$. We hence write the policy $\pi$ as $\pi \in \{\pi^s, \pi^r\}$. The policymaker’s payoff depends on their policy action and an unknown state of the world, $\theta$, which either calls for the status quo or a reform – i.e., $\theta \in \{\theta^s, \theta^r\}$. The policymaker’s and lobby’s expected payoffs depend on the policymaker’s prior about the state of the world and the signals received from gathering information. The policymaker’s belief is the common prior over the likelihood that the state of the world is $\theta^r$, and thus reform is desirable, written as $\lambda = \Pr[\theta = \theta^r]$ where $0 \leq \lambda \leq 1$. The complimentary likelihood is simply $1 - \lambda = \Pr[\theta = \theta^s]$, and the lobby knows the policymaker’s prior. The policymakers state-dependent payoff is $\alpha$ if her action corresponds to the state of the world and 0 otherwise. We refer to the parameter $\alpha$ as the salience of the policy in question.\footnote{This may be motivated in a number of different ways including; the attention the policy is currently being given by the electorate, the actual importance of the issue in some welfare sense, or the importance of the issue in terms of the policymakers self-interest.} A policymaker’s policy position is then characterized by their prior belief about the desirability of a policy change and the salience they attach to the policy.
The lobby’s payoff is state-independent and depends exclusively on the policymaker’s action – i.e., the lobby receives a payoff of 1 if the policymaker implements a reform and 0 otherwise.\(^{16}\)

The policymaker has a resource endowment of \(y^P \geq 0\) that may be spent on gathering information about the policy matter at a fixed cost of \(e^P > 0\) and/or on implementing reform at a fixed cost of \(c > 0\).\(^{17}\) Maintaining the status quo is costless. To make the problem interesting, we assume \(\alpha > c\) and \(\alpha > e^P\). The lobby has an endowment of \(y^L \geq 0\) that can be used for gathering information at a fixed cost of \(e^L > 0\), or to finance a variable transfer to the policymaker, denoted \(\tau \geq 0\). Any parts of endowments that are not spent are retained as private benefits. These elements capture costly information collection by both the lobby and the policymaker as well as the means by which policy changes are financed. The results that follow do not depend in any significant way on the discreteness of information and the cost of gathering it.\(^{18}\)

Employing the payoffs and budget constraints discussed above, we have that the policymaker maximizes

\[
E[U^P(\pi, \theta)] + y^P + \tau - fe^P - gc,
\]

and the lobby maximizes

\[
E[U^L(\pi)] + y^L - he^L - \tau,
\]

where \(U^P(\pi, \theta)\) and \(U^L(\pi)\) are as described above and \(f\), \(g\), and \(h\) are indicator variables such that \(f, g, h \in \{0, 1\}\). If the policymaker or the lobby gathers information, then \(f = 1\) or \(h = 1\); if the policymaker enacts a reform, then \(g = 1\).

The information gathered by the lobby and policymaker takes the form of the signals \(x\) and \(z\) respectively. Each of these signals is binary and correlated with the state of the world – i.e., \(x \in \{x^r, x^s\}\) and \(z \in \{z^r, z^s\}\). Conditional beliefs, based on a common prior and any publicly observed signals, are then \(\lambda(x, z) = Pr[\theta = \theta^r | x, z]\). The information signals are noisy but informative, that is correct signals are more likely than incorrect ones. We denote the signal functions as \(Pr[x = x^r | \theta^r] = \epsilon^L, Pr[z = z^r | \theta^r] = \epsilon^P, Pr[x = x^s | \theta^s] = \eta^L,\) and \(Pr[z = z^s | \theta^s] = \eta^P\) with \(\epsilon^k, \eta^k \in (\frac{1}{2}, 1]\) with \(k = L, P\). These signals and likelihoods may be interpreted as arising in two possible informational environments, they may reflect: expertise in gathering private, verifiable

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\(^{16}\)The analysis that follows is equally applicable to the case where the lobby wishes to preserve the status quo. The cost of reform must then be reinterpreted as the cost of retaining the status quo, such costs may arise if, for example, an electorate is impatient for reform.

\(^{17}\)These two assumptions ensure that the policymaker has an incentive to invest in information and policies. The costs of a policy change can include – but are not limited to – the staffing resources for legislative research and drafting, communicating policy positions to constituents, organizing a winning coalition with costly promises of reciprocity, and budgetary implications for rolling out the policy change.

\(^{18}\)This follows quite directly from the discreteness of the policy choice. Suppose for example that a policymaker can choose to purchase more signals or more informative ones. They would make this choice up to the point where the new information could effect their priors sufficiently to change their ultimate policy choice. Less information would be wasteful as it would not change their policy choice and more would not be expected to produce a different decision. Hence continuous information acquisition adds little to the model. The same argument applies to the lobby’s acquisition of information.
information, or credibility in providing private, non-verifiable information. In an environment of verifiable information the information signals can be interpreted as the accuracy of the information technologies possessed by the lobby and policymaker.\footnote{Our setting is equivalent to an interest group that gathers verifiable information and a policymaker who can observe this (Milgrom and Roberts (1986)). A lobby finds it in their best interest to disseminate information as a policymaker would otherwise infer that a lobby is withholding unfavorable information.} Alternatively, the lobby’s signal likelihoods can be interpreted as the lobby’s credibility in providing private, non-verifiable information in a cheap-talk environment in which a policymaker may doubt the lobby’s truth-telling incentives.

The players’ information gathering choices depend on their expected signals conditional on their beliefs at the respective stage of the game, and we state these signal likelihoods in Appendix A.1.1. We denote the posterior beliefs with $\lambda^L \in \{\lambda, \lambda(x)\}$ after any information gathering by the lobby and $\lambda^P \in \{\lambda, \lambda(x), \lambda(z), \lambda(x,z)\}$ at the last stage of the game. We state the detailed posterior beliefs in Appendix A.1.2.

The sequence of play is illustrated in Figure 2 and follows: First, the lobby chooses whether to gather information, $h \in \{0,1\}$ at the cost $e^L$, given the policymaker’s prior $\lambda$.\footnote{Note that the policymaker’s prior $\lambda$ has been generated by a history of own or other information signals. Our focus is on the lobby’s ability to influence the policymaker with any given prior.} The policymaker observes the lobby’s public signal $x$ and makes an appropriate inference. The policymaker then chooses whether to gather information, $f \in \{0,1\}$ at cost $e^P$, and generate a publicly observable signal $z$. The lobby observes the signal, forms an appropriate inference about the policymaker’s belief, and chooses a subsidy amount $\tau$. Finally, the policymaker also updates her belief and chooses her policy $\pi$. We solve the game backwards for the Perfect Bayesian Equilibrium.\footnote{The extensive forms of the game are illustrated in Figures 12 and 13 in Supplemental Appendix B.2.} The equilibrium involves solutions for the policy choice, the lobby’s subsidy, the policymaker’s gathering information, and the lobby’s information gathering.

### 3 Purely Informational Lobbying

Initially, consider the unconstrained case where a lobby and a policymaker both have sufficient resources for information gathering and policy implementation.\footnote{Mathematically, the policymaker’s and lobby’s resource constraints are $y^P \geq e^P + c$ and $y^L \geq e^L + c$. For this case and its equilibrium outcomes it would make no difference to constrain the lobby’s resources to $e^L \leq y^L < e^L + c$. Figures 12 and 13 in Supplemental Appendix B.2 illustrate the game of interest.} The focus is then on the lobby’s ability to influence the policymaker and increase the likelihood of a policy reform. Clearly, when
the policymaker is unconstrained only informational lobbying will occur and the lobby will not pay a subsidy to the policymaker. We illustrate when informational lobbying occurs, and whether this acts as a substitute for, or complement to, information gathering by the policymaker. It also provides us a natural benchmark for our later analysis when we focus on the very specific implications of a binding constraint for either a policymaker or both a policymaker and a lobby.\cite{footnote:1}

### 3.1 The Policy Choice

At the last stage of the lobbying game the policymaker has a posterior $\lambda^P$ and chooses whether to keep the status quo or to implement a reform. Reform is costly and therefore is only chosen when its expected payoff exceeds that of the status quo. We define the policymaker’s reform implementation threshold $\lambda^*$ as the probability the policymaker attaches to the state being “reform” such that they are indifferent between the policies reform and status quo. Hence, we get

$$\lambda^P \geq \frac{1}{2} + \frac{c}{2\alpha} \equiv \lambda^*.$$  \hspace{1cm} (3.1)

We see that the policymaker’s reform implementation threshold is higher the more costly is reform, or the lower is the policy salience. Notice that a policymaker with sufficiently high salience (perhaps for ideological, reelection, or career concerns reasons) or facing a relatively low reform cost, will implement any policy reform that offers at least a fifty-fifty chance of being the correct choice – i.e., $\lambda^P \to \frac{1}{2}$ when $\alpha \to \infty$ or $c \to 0$.

### 3.2 The Policymaker’s Information Choice

The policymaker knows that they will implement reform in the final round if (3.1) is satisfied, and also the expected payoffs they will experience based on this choice. Their information choice then depends on its cost and a potential change in their belief. This in turn depends on the likelihoods and accuracy of the signals they may receive and their belief at this stage. The belief at this stage depends on the initial prior updated using Bayes’ rule according to any informational signals that have been generated by the lobby.

The policymaker’s options are to (i) never gather information and never reform, (ii) never gather information but always reform, or (iii) gather information and decide based on the signal. Consider first the case when the policymaker would neither gather information nor reform. In this case the policymaker is termed *negatively convinced*, and their prior is such that they view reform as undesirable and the policy issue not worth further costly investigation. In the second case the

\footnote{The welfare implications for when the policymaker’s constraint is non-binding are not very enlightening but can be found in Supplemental Appendix B.4.1.}
policymaker is termed *positively convinced* since their prior is such that they will always reform and view further information as unnecessary. The third case describes the range of beliefs for which the policymaker is in doubt and would be willing to gather costly information. This range is further divided into subintervals dependent on the policy choice the policymaker would make based only on their prior. If they would choose reform in the absence of new information, then we term them *optimistic*; on the other hand, if they would choose status quo in the absence of new information, we term them *pessimistic*. Let $\lambda$ and $\bar{\lambda}$ denote the upper and lower thresholds of the range of priors for which the policymaker investigates. It follows that the lower threshold is defined as the belief for which the policymaker is indifferent between cases (iii) and (i). Similarly, the upper threshold is defined as the belief for which the policymaker is indifferent between the cases (iii) and (ii). We illustrate the four ranges with their respective thresholds and the policymaker’s policy of (3.1) in Figure 3. For the policymaker’s information choice we can state the following.

**Lemma 1.** The policymaker gathers information if $\lambda < \min\{\bar{\lambda}, 1\}$, which is equivalent to $(\alpha - c/\alpha)(\eta^p + e^p - 1) - 2e^p > 0$.

That this interval exists requires that; the policymaker’s information signals ($e^p$ and $\eta^p$) are sufficiently accurate, policy salience compared to the reform cost is sufficiently high ($c/\alpha < \alpha$), and that the policymaker’s cost of information is sufficiently low. We illustrate in Figure 4 the range of beliefs at this stage on the horizontal axis and the probability that a reform will be implemented on the vertical axis. The probability of reform is of course zero for $\lambda^L < \lambda < \bar{\lambda}$ and equal to one for $\lambda^L > \bar{\lambda}$. Over the range $\lambda^L \in (\lambda, \bar{\lambda})$ the probability of reform is equal to the probability of the policymaker receiving the reform signal $z^r$ which is increasing in $\lambda^L$.

The comparative statics effects of changes in the models parameters on the threshold values of the policymaker’s range of beliefs for gathering information can be summarized the following.

$$\lambda = \lambda \left( \begin{array}{cccc} \alpha & c & e^p & \eta^p \\ (--) & (+) & (+) & (+/-) \end{array} \right)$$

and

$$\bar{\lambda} = \lambda \left( \begin{array}{cccc} \alpha & c & e^p & \eta^p \\ (+/-) & (+) & (-) & (+/-) \end{array} \right).$$

(3.2)

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Note that if $\lambda < 1 < \bar{\lambda}$, then the cases of interest reduce to three without a decision-maker being positively convinced; meaning, a policymaker would either investigate and choose a policy based on the signal, or not investigate and always keep the status quo.
The signs under the variables indicate the direction of the comparative statics effects for the two thresholds. A greater policymaker’s salience makes a policymaker that is indifferent between choosing the status quo and gathering information more likely to gather information as getting the policy right becomes more important to them. More interesting is that a policymaker just indifferent between gathering information and choosing reform without further information responds ambiguously to a change in the policy salience. A greater policy salience implies that a policymaker gains more from the right policy choice, which would increase the threshold, but it also implies that the policymaker is more likely to adopt a reform, so the policy threshold as described in equation (3.1) may fall, and imply an ambiguous effect.

The effect of a greater reform cost shifts the range of beliefs for gathering information to the right, implying that the policymaker is becoming more conservative in their information and reform choices. This is because the expected net benefit from reform is lower but the expected benefit from the status quo remains the same, so the belief for which the policymaker is indifferent between the status quo and gathering information that can lead to reform must be higher; similarly, the belief for which he is indifferent between gathering information and reform must also be higher such that the whole range of beliefs for gathering information expands. If the policymaker’s information cost increases, then he gathers information for a narrower range of initial beliefs and will be more likely to make their policy decision based on these beliefs. This is simply because the net expected benefits of gathering information decline for all beliefs.

Changes in the precision of the information signals have complicated effects. If the policymaker’s reform signal is more informative (greater $\epsilon^P$), then a policymaker that initially prefers the status quo policy to an investigation (negatively convinced in Figure 3) may switch to investigating as a more precise signal could change their beliefs sufficiently to lead them to adopt a

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{thresholds.png}
\caption{Policymaker’s Thresholds and Probability of Reform.}
\end{figure}

\footnote{The derivations of the thresholds are in Appendix A.2.1 and the quantitative comparative statics are in B.3.1.}
reform. However, the effect close to the upper threshold is ambiguous. If information is inexpensive, $e^P < \eta^P(\alpha+c)$, then a more accurate reform signal induces a policymakers whose belief is just above the upper threshold (positively convinced in Figure 3) to investigate. However, if the information is expensive, then the improvement in reform signal accuracy may induce a policymaker whose prior is just below the threshold $\lambda$ to act on that belief without further information. If the status quo signal becomes more accurate, $\eta^P$ is greater, then a policymaker that initially prefers reform without acquiring additional information, $(\lambda^L > \lambda)$, could choose to gather information since a status quo signal would affect the belief sufficiently so as to change behavior. However, an increase in the accuracy of the reform signal has an ambiguous effect on the lower threshold of the range of beliefs for gathering information and thus the policymaker’s choices.

3.3 The Lobby’s Information Choice

We now turn attention to the lobby’s decision whether or not to engage in costly information gathering. The lobby correctly anticipates the policymaker’s strategies described above and considers now the following questions. Can the lobby induce the policymaker to change their information and policy choices, and does the lobby want to given the cost? Recall that the lobby’s expected payoffs are increasing in the probability that the policymaker will implement a reform. There are two basic ways the lobby might accomplish this: First, it might gather costly information which, if it is a reform signal, induces the policymaker to update their prior to a value above the threshold $\lambda$, guaranteeing that the policymaker will not gather any additional information and will implement reform with probability one. Second, the lobby might gather information which, if it is a reform signal, raises the policymaker’s prior above $\lambda$ but below $\lambda^*$ which induces the policymaker to gather more information which, if it is also a reform signal, may induce them to implement the reform policy. Hereafter, we only consider the interesting cases, where the lobby’s choices can change the probability of reform and which are illustrated in Figure 5.

At the case denoted C1 the policymaker’s belief is sufficiently low that unless they receive information from the lobby they will not gather information and will keep the status quo. If the lobby receives a status quo signal, then clearly the policymaker immediately keeps the status quo. If, however, the lobby receives a reform signal, then the policymaker updates and their prior moves into the range over which they will gather information themselves, as indicated by the arrow on

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26 The policymaker and lobby will never gather information or choose reform if $\lambda^* > \lambda(x^*, z^*)$, which implies that even the most optimistic information signals will not convince the policymaker. Similarly, neither the lobbyist nor the policymaker will gather information and the policymaker will always choose reform if $\lambda^* \leq \lambda(x^*, z^*)$, which implies that even the most pessimistic information signals cannot push the likelihood of the state being reform low enough to keep the status quo.
the diagram pointing rightwards from C1, their policy is then determined by this second signal.

Cases C2-C4 can be interpreted similarly. At C2 a reform signal gathered by the lobby is sufficient to make the policymaker “positively convinced” and triggers a reform. At C3 a status quo signal generated by the lobby will not prevent the policymaker gathering own information and basing their policy the signal, but a reform signal has the same effect as in case C2, immediate reform. In this case the asymmetry of precision in the lobby’s signals plays a decisive role – i.e., a convincing reform signal but a vague status quo signal. In case C4 the lobby’s information, either a status quo or reform signal, causes the policymaker to choose not to gather information, and is alone sufficient to determine the policymaker’s policy choice. Whether a reform signal leads the policymaker to gather further information then clearly depends on the initial priors and the accuracy of the lobby’s reform signal. We can state the following results for the cases of interest.27

Proposition 1. The lobby is more likely to engage in informational signaling if; i) a reform signal is relatively more precise, or, ii) the information cost is low. The accuracy of the policymaker’s information technology has ambiguous effects and depends on whether the lobby’s and policymaker’s information choices are complements, independent, or substitutes in the political process.

Before discussing the cases and results in more detail, we also want to emphasize that in all of the cases above the policymaker’s ideology or salience, as captured by α, affects the thresholds of the various cases themselves but not the lobby’s informational choices within these cases. In other words, whenever a lobby considers informational lobbying in one of the cases the policymaker’s prior is more important than the policymaker’s salience.

An Initially Negatively Convinced Policymaker Suppose a policymaker is initially negatively convinced, and would choose the status quo policy unless they receive a reform signal gathered by the lobby, that is \( \lambda < \bar{\lambda} \) as in cases C1 or C2 in Figure 5. The lobby may find it worthwhile to gather information to induce the policymaker to gather information (C1) or induce an immediate reform (C2).28 For the first case C1 the lobby’s trade-off is between choosing to not

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27In Table 1 of the Appendix we summarize the comparative static effects for all four cases. A positive (negative) sign indicates an increase (decrease) in the lobbyist’s incentives to gather information.

28Mathematically, we have for the case of C1 that \( \lambda \leq \hat{\lambda} \leq \lambda(x^r) \leq \bar{\lambda} \) and for C2 that \( \lambda \leq \hat{\lambda} \leq \bar{\lambda} \leq \lambda(x^r) \).
gather information, and thus the policymaker will choose status quo with certainty, and to gather
information and have the policymaker choose reform with some positive probability. A reform
would only take place if both the lobby and policymaker receive a reform signal. A lobbyist is
more likely to gather information if; i) the lobby’s and policymaker’s reform signals are more
accurate, ii) the less informative are the lobby’s and policymaker’s status quo signals, iii) the less
costly the lobby’s information signal, and iv) the less pessimistic the initial prior, which implies
that beliefs of interest are close to $\lambda$. Notice that in this case, the lobby’s and policymaker’s infor-
mation activities are complementary (with the probability of the lobby receiving a reform signal),
an informational reform signal by a lobby leads to information gathering by a policymaker.

For the case C2 a lobby’s reform signal would induce a policymaker to implement reform
without further gathering of information. Here a lobbyist is more likely to gather information; i)
the more informative is the lobby’s reform signal, ii) the less informative is the lobby’s status quo
signal, iii) the less costly the lobby’s information signal, and iv) the less pessimistic the initial
common prior, which again implies a range of beliefs close to $\lambda$; the policymaker’s information
choice is independent of the lobby’s choice.

An Information Gathering Policymaker  Now suppose that a policymaker will choose to
gather information if the lobby does not provide information. That is the policymaker’s prior
is in the range of $\underline{\lambda} \leq \lambda \leq \bar{\lambda}$. This involves cases C3 and C4 in Figure 5.29 In case C3 the
policymaker will gather information if the lobby gathered a status quo signal, and will reform
without gathering information if the lobby gathered a reform signal. Here a lobbyist is more likely
to gather information; i) the more accurate the lobby’s reform signal or policymaker’s status quo
signal, ii) the noisier and less influential the lobby’s status quo signal and policymaker’s reform
signal, and iii) the less costly the lobby’s information signal. The effects of the initial common prior
are ambiguous and depend on $e^{L} - e^{P} - \eta^{P} + \eta^{F} \eta^{P} \geq 0$, which implies that the beliefs of interest
are in the intermediate range and not close to the thresholds. Here informational lobbying is a
substitute for the policymaker’s information choice when the lobby’s receives the signal reform,
or independent if their signal is status quo.

Finally, in case C4, if the lobby gathers information, then the policymaker will not and the
signal that the lobby gathered will determine the policy choice. A lobbyist is now more likely to
gather information; i) the more informative the lobby’s reform signal and policymaker’s status quo
signal, ii) the less informative both the lobby’s status quo signal and the policymaker’s reform
signal, and iii) the less costly the lobby’s information signal. The effect of the initial common

29Mathematically, we have for the case of C3 $\underline{\lambda} \leq \lambda(x^{s}) \leq \lambda \leq \bar{\lambda} \leq \lambda(x^{r})$ and for C4 $\lambda(x^{s}) \leq \underline{\lambda} \leq \lambda \leq \bar{\lambda}$.
prior depends on $\epsilon^L - \epsilon^P + \eta^L - \eta^P \geq 0$. When the lobby’s information technology is overall more accurate, or influential, then the lobby lobbies for a wider range of initial beliefs with own information rather than relying on the policymaker’s information. Notice that here the gathering of information signals by the lobby and policymaker are substitutes.

4 Informational Lobbying and Policy Implementation Subsidies

Now suppose that the policymaker’s resource constraint binds such that they cannot afford to both gather information and pay to implement the reform policy. Further, assume that the lobby is resource rich in the sense that it can afford to gather information and supply a policy implementation subsidy to the policymaker should they choose to do so.\(^{30}\) In this section we shall show that the key effect of the policymaker’s resource constraint binding is, somewhat surprisingly, to cause them to gather information for priors for which they would not do so if unconstrained. To be precise, we show that a policymaker that is close to, but below, the lower threshold for information gathering when unconstrained chooses to gather information if their resource constraint binds. Similarly, a policymaker that is just above the upper threshold when unconstrained chooses to gather information if constrained.\(^{31}\) This follows because the lobby internalizes the policymaker’s resource constraint and serves as a form of insurance to the policymaker.\(^{32}\)

4.1 Policy Choice and Resource Transfers

At the last stage of the lobbying game the policymaker chooses whether to keep the status quo or to implement a reform. The policymaker wishes to choose reform if her belief at the last stage is above the policy implementation threshold as described in (3.1). The lobby correctly anticipates the policymaker’s preferred policy, and, in the case where they prefer reform, knows if the policymaker has the resources required for a reform. The lobby thus knows the transfer that would be just sufficient to allow the policymaker to implement reform, hence this involves

$$
\tau(z) = \begin{cases} 
\epsilon^P + c - y^P & \text{iff } z^r \text{ and } 1 \geq \epsilon^P + c - y^P \\
0 & \text{otherwise.}
\end{cases}
$$

\(^{30}\)Mathematically, we have $\max\{c, \epsilon^P\} \leq y^P < c + \epsilon^P$ for the policymaker’s constraint and $y^L \geq \epsilon^L + c$ for the lobby’s constraint. The implications are then very similar to a policymaker’s constraint of $c > y^P \geq \epsilon^P$. In both cases the policymaker has sufficient resources for an investigation. Only two differences arise when a policymaker cannot afford a reform on their own: i) the policymaker does not internalize the reform cost at the lower and upper threshold and ii) the upper threshold is greater, implying the policymaker investigates for a wider range of beliefs.

\(^{31}\)This happens if the information signals are approximately equally precise.

\(^{32}\)The welfare implications of a binding policymaker’s constraint can be found in Supplemental Appendix B.4.2.
If the policymaker has not spent resources on an investigation or does not want to reform, then the lobby has no incentive to relax the policymaker’s constraint and the transfer is zero. The lobby only contributes when the policymaker has gathered information – leaving them requiring a subsidy to implement a reform policy – and when that signal indicates that the state is reform. Notice that a policy subsidy is then more likely, the greater is the likelihood that the policymaker will receive a reform signal and the smaller is the transfer needed to subsidize a reform.

4.2 The Policymaker’s Information Choice

Given that a policymaker knows that they will receive a subsidy from the lobby if they receive a reform signal but cannot afford to implement reform they are de facto unconstrained. Dependent on the prior the policymaker chooses to (i) never investigate and never reform, (ii) never investigate but always reform, or (iii) investigate and decide based on their signal. Further, if the policymaker investigates, then they do not fully internalize the reform cost as this is subject to a lobby’s subsidy. From the policymaker’s perspective the key difference between this case and the preceding one is that the policymaker’s investigation thresholds change because of this anticipated subsidy.

**Proposition 2.** *Comparing the resource constrained policymaker’s updating thresholds \((\lambda', \overline{\lambda}')\) with those of a resource unconstrained policymaker \((\lambda, \overline{\lambda})\), we get*

\[
\lambda' < \lambda \quad \text{and} \quad \overline{\lambda}' \geq \overline{\lambda};
\]

*and if \(\epsilon^P = \eta^P\), then \(\overline{\lambda}' > \overline{\lambda}\).*

This is perhaps somewhat counter-intuitive, a resource constrained policymaker engages in a costly investigation for a wider set of beliefs than an unconstrained one. The reason is that the constrained policymaker has a strategic incentive to spend on information so as to extract the subsidy from the lobby. Figure 6 illustrates the likelihood that a resource constrained policymaker will enact a reform and compares this to the unconstrained case (for \(\epsilon^P \approx \eta^P\)). The description is similar to Figure 4 with the identical thresholds \(\lambda\) and \(\overline{\lambda}\) as well as the thresholds \(\lambda'\) and \(\overline{\lambda}'\) for the constrained policymaker. The likelihood of reform is zero for priors \(\lambda^L < \lambda'\), one for priors \(\lambda^L > \overline{\lambda}'\), and follows the probability of receiving a reform signal for all other beliefs.

The intuition here is quite simple; the expected subsidy makes the policymaker more willing to expend resources on information as this will not reduce their ability to implement a reform. The range of initial priors for which they gather information thus increases. Hence, reform becomes more likely for “low” priors, and less likely for “high” priors.
We now consider the comparative static effects of changes in the models parameters on the
range of beliefs for gathering information. We may write

\[ \lambda' = \lambda \left( \alpha_{(-)}, c_{(0)}, c_{(+/-)}, c_{(-)}, \eta_{(+/-)}, \frac{y_{(+)}}{y_{(+)}} \right) \] and \[ \lambda' = \lambda \left( \alpha_{(+//-)}, c_{(+)}, c_{(+/-)}, c_{(+/-)}, \eta_{(+/-)}, \frac{y_{(+)}}{y_{(+/-)}} \right). \] 

The signs under the variables again indicate the direction of the comparative static effects.\(^{33}\)

These are mostly the same as in the unconstrained case described in (3.2) and follow from the
same intuition. However, while the effect of an increase in the policymaker’s information cost
unambiguously reduces the range of beliefs for which there is information gathering in the unconstrained
case, it has an ambiguous effect on the range here. This reflects that an increase in the
information cost is partially offset by the subsidy received from the lobby in the constrained case.

The effects of an increase in reform costs also differ across the constrained and unconstrained
cases. In the unconstrained case an increase in reform costs raises both the upper and lower
thresholds of the range of beliefs for information gathering. However, in the constrained case the
lower threshold is unresponsive to a change in reform costs. Here the policymaker is choosing
between not gathering information and a status quo policy or gathering information and choosing
the policy indicated by the signal. However, if the signal is reform, then the marginal additional
cost of a reform implementation is covered by an increase in the subsidy paid by the lobby. Hence,
the changes in the cost of reform do not effect the lower threshold.

4.3 The Lobby’s Information Choice

Here again we focus on the lobby’s incentives to gather information. As before these incentives
come from the effect information has on the probability that the policymaker will implement a

\(^{33}\)The derivations of the thresholds are in Appendix A.2.3 and the quantitative comparative statics are in B.3.2.
reform policy. Here there is the additional complication that in equilibrium this may also trigger
the need for the lobby to pay a subsidy to the policymaker. As established above, and illustrated
in Figure 6, the existence of a possible subsidy from the lobby changes the thresholds of the
policymaker’s range of beliefs for gathering information (Proposition 2). This, of course, feeds
back and affects the lobby’s choices. The lobby may engage in costly informational lobbying for
two possible reasons; first, the policymaker is inactive and would neither gather information nor
reform; or, second, the policymaker would gather information but the lobby decides to supply its
own information as a substitute for the policymaker’s information. We consider again the four
cases of interest as illustrated in Figure 5 that only differ in the policymaker’s thresholds.34

**Proposition 3.** When the lobby internalizes the policymaker’s constraint, its instruments can
be either independent, complements, or substitutes. The qualitative comparative statics of the
information signals, lobby’s information cost, and policymaker’s prior are unaffected by a binding
constraint.

We shall work through the possibilities in turn. Consider first case C1’ where if the lobby
receives a reform signal, this induces the policymaker to gather information. Here the lobby
acquires its own signal and, in the case where the policymaker also receives a reform signal,
subsidizes the implementation of the reform policy. Here the lobby’s instruments are complements.
Further, the lobby’s and policymaker’s information gathering choices are also complementary. In
the case C2’ if the lobby gathers information and receives a reform signal, then reform is immediate;
if however they receive a status quo signal or does not gather information, then the status quo
policy follows. Here the gathering of information by the lobby and policymaker is independent.

In the case C3’ if the lobby gathers information and receives a reform signal, then the policymaker
does not gather information and immediately implements reform. It follows then that the
policymaker is able to pay the policy implementation cost and receives no subsidy. Information
gathering by the lobby and policymaker are then substitutes. However, if the information signal is
status quo, then the policymaker also gathers information and the lobby has to potentially provide
a policy implementation subsidy. So here there is a complementary relationship between information
gathering by the lobby and policymaker, and between information gathering and the subsidy.
The subsidy serves as “damage control” but – in contrast to Bennedsen and Feldmann (2006)
and Dahm and Porteiro (2008a,b) who also consider contributions after lobbying has revealed
unfavorable information – not to purchase a policy favor but rather to enable the policymaker to
afford the second information signal, and if appropriate implement reform.

34Table 2 in Appendix A.3.2 summarizes the comparative statics effects of all cases.
Finally, consider the case C4'. If the lobby gathers information here the signal they receive convinces the policymaker to enact the corresponding policy. The lobby’s and policymaker’s information gathering are clearly substitutes, as are the lobby’s information and financial transfer.

4.4 The Implications of a Policymaker Facing a Binding Constraint

A resource constrained policymaker lacks the resources for both information gathering and policy implementation, but knows that the lobby would provide the necessary subsidy to implement a reform. This relaxes the policymaker’s constraint, and results in the policymaker no longer fully internalizing the cost of a policy when considering information gathering. This implies that a resource constrained policymaker who, if unconstrained, would have otherwise been “negatively convinced”, is now more likely to gather information such that the likelihood of a reform increases; however, an unconstrained policymaker who would have been “positively convinced” to reform, now is more likely to gather information such that a reform becomes less likely.

A lobby that interacts with a resource constrained policymaker internalizes the policymaker’s resource endowment, information and reform costs as well as the expected quality of the information the policymaker would gather. The resultant strategic incentives determine the relationships between the lobby instruments, and their relationship to the policymaker’s choices, in terms of whether they are substitutes, complements or independent. These results differ from those in the previous literature. For example, Hall and Deardorff (2006) show that a lobby would provide policy implementation subsidies to supportive policymakers. In our analysis this holds ex post if the policymaker engages in information gathering and consequently lacks the resources to implement a reform. However, we have shown that an anticipated policy implementation subsidy increases the likelihood that a resource constrained policymaker gathers information, becomes better informed, and implements a reform. This tells us that to understand the role of legislative subsidies in politics it is necessary to specify and analyze the preceding lobbying process.

Furthermore, our analysis also provides an alternative explanation for “damage control” as in Bennedsen and Feldmann (2006) and Dahm and Porteiro (2008a,b). In their lobbying models information and other resources are substitutes and the lobby provides either financial resources to buy policy favors or information to persuade the decision-maker. When the lobby’s information proves to be unfavorable they counteract this by increasing the transfer of financial resources. Here the mechanism is different. In our analysis the instruments can be either independent, substitutes or complements. If the lobby generates a status quo signal they may provide a transfer to the policymaker so as to allow them to purchase a second signal. In this sense they engage in “damage
control”, but this is not the same as purchasing a policy.

4.5 A Very Constrained Policymaker and Contributions in Stages

Suppose now that the policymaker’s resource constraint binds even more tightly such that they can afford neither information nor to implement a reform. There are two possible cases here. One case involves policy subsidies as before; the other case independent subsidies for information gathering and implementing reforms.\(^\text{35}\)

**Proposition 4.** *If the policymaker’s constraint is very binding and the lobby contributes in stages, then the lobby’s choices of gathering and subsidizing information follow the same patterns of complements, substitutes, and independence as when the policymaker can afford information.*

The lobby’s trade-offs between informational lobbying, subsidizing information, and policy implementation subsidies follow from the same strategic considerations as before. The differences are that; i) a lobby’s policy subsidy is always complementary to its other two instruments, and, ii) a lobby can induce a reform the lower standard, \(\lambda^L \geq \lambda^L \geq \lambda^*\). The lobby can achieve the latter by strategically withholding an information subsidy from the policymaker, leaving them with the decision to implement reform or not given their prior.

The lobbying instruments of information subsidies and informational lobbying follow the same pattern and illustrate when the lobby chooses to use its own information technology, prefers to subsidize the use of the policymaker’s, or does both.\(^\text{36}\) For example, when the policymaker is negatively convinced, reform may require two reform signals, and the lobby may engage in informational lobbying and subsidizing the policymaker’s information gathering as complimentary instruments. Similarly, when a policymaker would like to gather information, then the lobby may either gather information on its own and de facto prevent a policymaker gathering information by denying an information subsidy or subsidize the policymaker to gather information and implement a reform – which would imply that both lobbying instruments are substitutes.

The lack of resources implies that a lobby can achieve a reform with greater probability than when the policymaker’s constraint is less binding. The possibility of contributions in stages allows the lobby more flexibility such that it has the option of subsidizing the policymaker to gather information and then choosing whether or not to subsidize a reform. However, this comes at two

\(^{35}\text{Mathematically, the policymaker’s resource constraint is } y^P < \min\{c, e^P\}. \text{ Information subsidies from the lobby to the policymaker may arise when the policymaker cannot afford neither to investigate or implement a policy (presented as an illustration), or when the policymaker has sufficient resources for a policy change but not for gathering information, } e^P > y^P \geq c. \text{ The implications of the latter are very similar and we discuss here the more extensive case.}\)

\(^{36}\text{Table 4 in Supplemental Appendix B.3.4 illustrates details on the lobbying patterns.}\)
costs: i) the lobby has to provide greater resources to achieve its policy goals, and, ii) the lobby’s choices may not involve the socially optimal level of information gathering.\footnote{The welfare implications follow from our analysis that can be found in Supplemental Appendix B.4.}

5 Informational Lobbying or Policy Implementation Subsidies

Finally, we consider the case in which both the policymaker and lobby are resource constrained. We assume that a policymaker has insufficient funds for both gathering information and implementing a policy. Similarly, the lobby has insufficient funds for both gathering information and subsidizing a reform.\footnote{Mathematically, we have \( \max\{c, e^P\} \leq y^P < c + e^P \), \( \max\{e^L, e^P + c - y^P\} \leq y^L < e^L + c + e^P - y^P \) and \( y^L + y^P - e^L \geq c \). The last condition ensures that the combined resources are sufficient for one information signal and a reform.} This introduces some new possibilities as the lobby’s binding constraint may operate as a form of (pre-)commitment. For example, the lobby may gather information so as to be unable to provide a policy implementation subsidy and thus discourage the policymaker from gathering information, or, it may refrain from informational lobbying so as to be able to subsidize a policy change if the policymaker gathers information. Our casual intuition might suggest that a “poor” lobby facing a binding budget constraint might be less likely to achieve its reform objective than an unconstrained one. However, we will show that this is not necessarily the case and illustrate how a lobby may strategically waste resources to take advantage of a less informed policymaker.

5.1 The Policy Choice and Policy Implementation Subsidy

As before the policymaker may either choose the status quo or to implement a reform. Comparing the expected payoffs from both options, the policymaker will again use the decision rule from (3.1). However, the policymaker’s posterior belief cannot be generated from information gathering by both the policymaker and lobby. If there was information gathering, then the constraints would make reform infeasible, and hence this would never be part of a lobby’s optimal strategy.

The lobby’s optimal contribution schedule also reflects the scarcity in endowments. Given that it cannot afford both information gathering and a policy implementation subsidy we have

\[
\tau(x, z) = \begin{cases} 
  e^P + c - y^P & \text{iff } \{x = 0, z^r\} \text{ and } 1 \geq e^P + c - y^P \\
  0 & \text{otherwise.}
\end{cases}
\] (5.1)

If the policymaker has not gathered information or would not want to implement a reform, then there would be no contribution. Similarly, there would be no contribution if the lobby gathered information and exhausted own resources. Hence, the lobby only provides a policy subsidy if it
has not engaged in information gathering but the policymaker did and would choose to reform.

5.2 The Policymaker’s Information Choice

If the lobby has gathered information, then the policymaker has no incentive to investigate as resources would be exhausted and a reform impossible. We immediately have that the policymaker will choose reform without gathering information if the policymaker’s belief at this stage is above the implementation threshold, and choose status quo without gathering information if below.

If the lobby did not engage in information gathering, then the policymaker correctly anticipates a policy implementation subsidy in the case where they generate a reform signal. The policymaker is then de facto unconstrained in their information choice and may (i) never investigate and never reform, (ii) never investigate but always reform, or (iii) investigate and decide based on her signal. Deriving the thresholds for the range of beliefs for which the policymaker would gather information and comparing them to the previous thresholds in Proposition 2, we can state the following.

Lemma 2. If a resource constrained lobby has sufficient resources to fund a policy implementation subsidy, then a resource constrained policymaker gathers information for the same range of beliefs of \( \lambda \in (\lambda', \overline{\lambda}) \) as it does when faced by an unconstrained lobby.

Important for the resource limited policymaker’s information choice is that the lobby can relax the policymaker’s constraint in the case of a planned reform; therefore the resource constrained policymaker’s trade-off is unaffected at this point. The policymaker gathers information if her belief is between the two updating thresholds \( (\lambda' < \lambda < \overline{\lambda}) \) and chooses reform if there is a reform signal and status quo if not. Observing the policymaker’s signal, the lobby contributes according to (5.1) the necessary amount for reform if there is a reform signal or nothing if there is not.

5.3 The Lobby’s Information Choice

In the previous cases a lobby engaged in informational lobbying to either induce the policymaker to gather information or to reform without gathering information. Here a lobby can no longer induce the policymaker to gather information because neither the policymaker nor the lobby could then fund a possible reform. Hence, as before, a lobby may gather information if an information signal can induce the policymaker to reform immediately, or if the lobby wants to substitute its information gathering for the policymaker’s. However, here there is another interesting and novel case in which the lobby strategically exhausts its resources to prevent anticipated information gathering by the policymaker and achieve a reform with certainty. The three cases of interest are
Figure 7: Cases of Lobby’s Information Choice – Constrained Policymaker and Lobby.

illustrated in Figure 7. For the resource constrained lobby’s information choices we can state.\(^{39}\)

**Proposition 5.** A resource constrained policymaker enacts a reform with no further information for lower priors than compared to the unconstrained scenario. The lobby facing a resource constrained policymaker is more likely to gather information than facing an unconstrained policymaker when its information costs are low and its information technology is asymmetrically precise. The lobby’s instruments can be either independent or substitutes when its constraint is binding.

Consider the case C2" in which a policymaker would neither gather information nor reform because of a low initial prior (\(\lambda < \bar{\lambda} \)) and in which the lobby may consider informational lobbying. The lobby’s reform signal would have to be accurate enough, and therefore change the policymaker’s prior sufficiently, to induce the policymaker to reform. However, it does not have to be as accurate as in the cases C2 and C2’ before. The reform signal has to achieve \(\lambda(x^r) \geq \lambda^*\) for a reform but not \(\lambda(x^r) \geq \{\lambda, \lambda'\}\) as before. In other words, a resource constrained lobby can induce a politically inactive policymaker to reform with a less accurate and convincing information technology. The lobby is more likely to engage in informational lobbying when its information costs are low and the more asymmetrically accurate its information signals. Clearly, the lobby’s instruments are independent as the lobby would never contribute in such a scenario.

For the novel last case, denoted (CS) in Table 3, a lobby may actually engage in informational lobbying to strategically diminish its own resources making it unable to subsidize information gathering by the policymaker and therefore achieving reform with certainty.\(^{40}\) Notice that here the lobby simply wants to use up resources while effecting the policymaker’s beliefs as little as possible. This wasteful lobbying is more likely the noisier the policymaker’s reform signal and more precise the policymaker’s status quo signal. Here information gathering by the lobby is a substitute for both policy subsidies and information gathering by the policymakers.

\(^{39}\)The comparative statics effects are summarized in Table 3 in Appendix A.3.3.

\(^{40}\)Mathematically, we have \(\lambda' < \lambda(z^*) < \lambda^* < \lambda(x^*) < \lambda < \{\lambda(z^r), \lambda(x^r)\}\).
5.4 The Implications of Both Constraints Binding

The incentives for a resource constrained lobby to engage in information gathering differ significantly here from the previous cases. There is no incentive to try and persuade the policymaker to investigate as this then makes reform not affordable. However, there is an incentive for a lobby to strategically waste resources on information so as commit to not paying a policy subsidy. This forces the policymaker with a sufficiently high prior to immediately choose reform. The strategic incentive to waste resources in this scenario is different to the traditional notion of “burning money” in signaling and access models where a lobby is trying to enhance its credibility with costly signals (Potters and van Winden (1992), Austen-Smith and Banks (2000, 2002)) or trying to get the policymaker’s attention with contributions (Austen-Smith (1995, 1998), Lohmann (1995), Cotton (2009, 2012), Cotton and Dellis (2016)). Somewhat surprisingly, if the lobby does not choose to gather information, then the range of priors for which the policymaker investigates is unchanged from the unconstrained case. This follows from the fact that the policymaker correctly anticipates a policy subsidy that will relax their budget constraint in the last stage of the game.

6 Discussion and Conclusion

Here we relate our results to the empirical facts and anecdotal evidence concerning current lobbying practices. We conclude that several of our predictions are in line with the evidence.

1. A lobby lobbies supporting, opposing, or undecided policymakers.

Our analysis has highlighted that a lobby lobbies policymakers depending on their initial beliefs, the characteristics of their information technologies, and the distribution of resources and costs. The policymaker’s initial beliefs may be reinterpreted as representing how favorably they initially view reform, or share the lobby’s objective. These findings are generally consistent with de Figueiredo and Richter (2014)’s review of empirical studies on lobbying activities which shows that lobbies lobby mostly policymakers in their favor. However, there are empirical studies that show that lobbies approach opposing policymakers to change their initial positions (Austen-Smith and Wright (1994, 1996), de Figueiredo and Cameron (2008)), which is generally consistent with our analysis of both informational lobbying and reform subsidies. In our analysis a lobby engages in informational lobbying with an opposing policymaker to gain her support or to induce her to gather further information. If the policymaker is also resource constrained and does not have sufficient resources for a policy change, then the lobby, if its resources are sufficient, would also provide a reform subsidy and actually support the policymaker throughout the political process.
This is also consistent with Mello et al. (2012)’s case study of Merck discussed in the introduction.

Other empirical studies document that undecided, or moderate, policymakers are lobbied (Hojnacki and Kimball (1999, 2001), Mian et al. (2010)). In our analysis a lobby approaches those policymakers when informational lobbying is relatively inexpensive and effective enough to influence the policymaker who would otherwise gather their own information. Reform subsidies, as a lobbying strategy, would be provided if a moderate policymaker has, from the lobby’s perspective, an accurate information technology but not sufficient resources for reform. Finally, there is also evidence that lobbies support friendly policymakers (Kollman (1997), Hojnacki and Kimball (1998), Eggers and Hainmueller (2009), Mian et al. (2013), Igan and Mishra (2014), Schnakenberg (2017)). In our analysis friendly policymakers are lobbied via policy subsidies when they have insufficient resources to implement a policy, which is similar to Hall and Deardorff (2006).

2. Policy implementation subsidies may appear as bribery.

Our results address the empirical challenge of distinguishing between the possible roles of financial transfers. These may function as legislative subsidies to support policies, costly signals to enhance credibility, or bribes that purchase political favors. These contributions may be made to “friendly” or “opposing” policymakers. Recent empirical research by Facchini et al. (2011) and Igan and Mishra (2014) comes to the conclusion that it is difficult to distinguish whether lobbying and campaign expenditures are information revealing, a negotiated compromise, or resources for policy favors. In our analysis we neglect bribery but one of our results predicts that legislative subsidies – in the form of financial transfers such as campaign contributions or fees for speeches – may appear to be corruption even though they are actually made so as to allow a doubting policymaker to use own resources to gather information and make a better informed decision.

To further illustrate this, suppose a policymaker expresses publicly their opposition or doubts about a reform. But then we observe a financial contribution and the policymaker implements that reform policy. The empirical evidence based on financial contribution data and public statements could suggest that the contribution served as a bribe to purchasing a policy change. However, we may not be able to distinguish empirically between this story and one where the policymaker changed their mind because the contribution allowed them to gather more information.\footnote{This hypothetical dilemma is illustrated by Warren and Tyagi (2003) who document how Hillary Clinton was a strong supporter of tighter financial regulation before she became Senator of New York – “It is our job to stop that awful [bankruptcy] bill. You help me, and I’ll will help you” (p.124). However, once in office, she changed her position, which then raised questions whether that may or may not have been caused by contributions from financial intermediaries. However, she may have changed her position because of learning about New York’s gains from deregulation, or in Elizabeth Warren’s words “As New York’s newest senator, however, it seems that Hillary Clinton could not afford such a principled position” (p.126).}
6.1 Conclusion

We have developed and analyzed a model of informational lobbying that combines various features of observed lobbying activities and politics. A policymaker can gather their own costly information or rely on the information provided by a lobby; and the policymaker can use her own resources to implement a policy change or use legislative subsidies supplied by the lobby. Incorporating these wider trade-offs into our analysis, we show that legislative subsidies have a role beyond the traditional view of allowing policymakers to consider more policies. Legislative subsidies in the form of information and implementation can allow critical policymakers to gather their own information and subsequently reconsider their positions by taking advantage of interest groups’ resources. However, we also illustrated how lobbies with different endowments can gain strategic advantages in the policy making process and take advantage of resource constrained policymakers.

Our study has also shown that a lobby engages in informational lobbying to influence a policymaker who is either negatively convinced or inclined to gather further information, and provides policy implementation subsidies to a policymaker who is ex ante either negatively convinced or willing to gather further information – rather than to their initial “friends”. Allowing for a wider space of strategies, we explain many observed lobbying activities and identify under which circumstances information and policy implementation subsidies are complements, substitutes, or independent. Furthermore, we showed that tracking only financial records such as campaign contributions and lobbying reports’ revenues by policymaker name, and correlating this information with changes in policymakers’ positions, may appear to reveal bribery or capture when in fact this is a consequence of further information acquisition funded by lobbies’ policy subsidies.

Our model provides several novel implications for the understanding of lobbying, and, we believe that it can be extended in various ways. One interesting extension would be to consider the lobby’s and policymaker’s choice of expertise, and how expertise is allocated across lobbies and policymakers who may rely partially or fully on lobbies. Another extension would be to consider how lobbies collect funds and thus resource constraints may arise endogenously as part of a wider lobbying strategy.
References


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Appendix

A.1 Further Details

A.1.1 Expected Information Signals

Given the sequence of play described in Figure 2 the players’ information gathering choices depend on their expected signals conditional on their prior beliefs which may be written as

\[
x^r(\lambda) \equiv \Pr\{x = x^r|\lambda\} = \epsilon^L \lambda + (1 - \eta^L)(1 - \lambda)
\]  
and

\[
x^s(\lambda) \equiv \Pr\{x = x^s|\lambda\} = \eta^L(1 - \lambda) + (1 - \epsilon^L)\lambda
\]  

and similarly for the policymaker as

\[
z^r(\lambda_L) \equiv \Pr\{z = z^r|\lambda_L\} = \epsilon^P \lambda^L + (1 - \eta^P)(1 - \lambda^L)
\]  
and

\[
z^s(\lambda_L) \equiv \Pr\{z = z^s|\lambda_L\} = \eta^P(1 - \lambda^L) + (1 - \epsilon^P)\lambda^L,
\]

where \(\lambda^L\) reflects the policymaker’s and lobby’s posterior belief and reflects the sequence of play in which policymakers gathers information after observing a lobby’s signal. The corresponding policymaker’s expected signals conditional on the lobby’s observed information signal are

\[
z^r(\lambda(x^j)) \equiv \epsilon^P \lambda^L(x^j) + (1 - \eta^P)(1 - \lambda^L(x^j))
\]  
and

\[
z^s(\lambda(x^j)) \equiv \eta^P(1 - \lambda^L(x^j)) + (1 - \epsilon^P)\lambda^L(x^j) \text{ for } j = r, s.
\]

A.1.2 Posterior Beliefs

We denote the lobby’s posterior belief and policymaker’s prior belief given any information signals as \(\lambda(x^r) \equiv \Pr[\theta = \theta^r|\lambda, x^r]\) and \(\lambda(x^s) \equiv \Pr[\theta = \theta^r|\lambda, x^s]\) – i.e., also \(\lambda^L \in \{\lambda, \lambda(x)\}\). Similarly, the policymaker’s posterior is \(\lambda^P \equiv \Pr[\theta = \theta^r|\lambda^L, z]\) and depends on the history of information signals – i.e., also \(\lambda^P \in \{\lambda, \lambda(x), \lambda(z), \lambda(x, z)\}\).

If the lobby gathers information, then the probabilities of signals \(x^r\) and \(x^s\) are as defined in (A.1) and (A.2) and the corresponding updated beliefs given the signals are

\[
\lambda^L(x^r) \equiv \Pr[\theta = \theta^r|\lambda, x^r] = \frac{\epsilon^L \lambda}{\epsilon^L \lambda + (1 - \eta^L)(1 - \lambda)}
\]  
and

\[
\lambda^L(x^s) \equiv \Pr[\theta = \theta^r|\lambda, x^s] = \frac{(1 - \epsilon^L)\lambda}{\eta^L(1 - \lambda) + (1 - \epsilon^L)\lambda}.
\]

If the policymaker also gathers information and receives either \(z^r\) and \(z^s\), then using Bayes’ rule again, these posteriors are either \(\lambda^P(z^r)\) or \(\lambda^P(z^s)\) depending on their received signal, and
where

$$\lambda^P(z^r) \equiv Pr(\theta = \theta^r|\lambda^L, z^r) = \frac{e^P\lambda^L}{e^P\lambda^L + (1 - \eta^P)(1 - \lambda^L)} \quad (A.9)$$

$$\lambda^P(z^s) \equiv Pr(\theta = \theta^r|\lambda^L, z^s) = \frac{e^P(1 - \eta^P)\lambda^L}{\eta^P(1 - \lambda^L) + (1 - e^P)\lambda^L}. \quad (A.10)$$

Note that $\lambda^L = \lambda$ if the lobby did not gather information; otherwise we substitute (A.7) or (A.8).

### A.2 Proofs

#### A.2.1 Proof of Lemma 1

The lower threshold $\lambda$ follows from the policymaker’s trade-off between the expected payoff from costly information with uncertain information signal and policy outcome and the expected payoff from the costless status quo without information choice. Note that the policymaker considers the posterior belief about the state of the world, $\lambda^P(z)$, for the expected payoff associated with the expected information signal, $z(\lambda^L)$.

The policymaker gathers information if

$$z^r(\lambda^L) [y^P - e^P - c + \lambda^P(z^r)\alpha] + z^s(\lambda^L) [y^P - e^P + (1 - \lambda^P(z^s))\alpha] \geq y^P + (1 - \lambda^L)\alpha. \quad (A.11)$$

Applying each information signal’s probability, the updating choice reduces to

$$\lambda^L \geq \frac{(1 - \eta^P)(\alpha + c) + e^P}{\alpha(1 + e^P - \eta^P) + c(1 - e^P - \eta^P)} \equiv \underline{\lambda}. \quad (A.12)$$

which defines the lower updating threshold. Note that $\underline{\lambda} > 0$ because of $\alpha > c$.

The upper threshold $\lambda$ follows from the policymaker’s trade-off between the expected payoff from costly information with uncertain information signal and policy outcome and the expected payoff from a costly reform without gathering information. The policymaker gathers information if

$$z^r(\lambda^L) [y^P - e^P - c + \lambda^P(z^r)\alpha] + z^s(\lambda^L) [y^P - e^P + (1 - \lambda^P(z^s))\alpha] \geq y^P - c + \lambda^L\alpha. \quad (A.13)$$

Solving for $\lambda^L$, we can write

$$\lambda^L \leq \frac{\eta^P(\alpha + c) - e^P}{\alpha(1 - e^P + \eta^P) + c(e^P + \eta^P - 1)} \equiv \bar{\lambda}, \quad (A.14)$$

which defines the upper updating threshold.

The comparative statics for $\lambda$ and $\bar{\lambda}$ can be found in Supplemental Appendix B.3.2.

42In other words, the policymaker solves the Monty Hall problem rationally.
Existence of Updating Range  The updating range exists iff $\underline{\lambda} < \min\{\bar{\lambda}, 1\}$. Solving for $\underline{\lambda} < \bar{\lambda}$, we get

$$\left(\alpha - \frac{c}{\alpha}\right) (\eta^P + \epsilon^P - 1) - 2\epsilon^P > 0. \quad (A.15)$$

That this interval exists requires that; the information signals, $\eta^P$ and $\epsilon^P$, are sufficiently accurate, policy salience compared to the reform cost is sufficiently high, that is $c/\alpha < \alpha$, and that the cost of information, $\epsilon^P$, is sufficiently low. This corresponds to the final part of Lemma 1, and is represented on the diagram by the intercepts of the $E[z]$ being sufficiently high.

Illustration of Payoffs, Reform Probability, and Existence  We can illustrate the policymaker’s updating thresholds, expected payoffs from gathering or not gathering information, and the likelihood of a policy change. Figure 8 illustrates the policymaker’s belief $\lambda^L$ at this stage after the lobby’s information gathering choice for which the policymaker will choose to gather information, and the likelihood that this will then lead to a policy reform. Figure 8 is drawn for the case where there exist a range of priors $\lambda^L \in [\underline{\lambda}, \bar{\lambda}]$ for which the policymaker gathers information and is illustrated by the shaded triangle.

In the upper panel of Figure 8 the line denoted $E^P[\pi^s]$ gives the policymaker’s expected payoff from choosing the status quo policy without gathering information for all possible values of their beliefs at this stage, $\lambda^L \in [0, 1]$. Similarly, the line denoted $E^P[\pi^r]$ gives the policymaker’s expected payoff from choosing the reform policy without gathering information for all values of their belief, $\lambda^L \in [0, 1]$. The line denoted $E^P[z]$ gives the policymaker’s expected payoff from gathering information, again for all possible beliefs at this stage, $\lambda^L \in [0, 1]$. 

Figure 8: Policymaker’s Expected Payoffs and Probability of Reform.
The comparative statics are simply

\[ x = \begin{pmatrix} x^L \cr \eta^P \cr \eta^L \cr \lambda \end{pmatrix}. \]

The lobby’s lobbying decision follows from the policymaker’s thresholds \( \lambda \) and \( \bar{\lambda} \) described in Lemma 1 and the four possible informational lobbying cases of C1, C2, C3, and C4.

For the first case C1 with \( \lambda \leq \lambda \leq \lambda(x^r) \) the lobbyist finds it beneficial to gather information if \( x^r(\lambda)z^r(\lambda(x^r)) \geq e^L \), which, using (A.1) and (A.5), implies

\[ e^L \lambda + (1 - \eta^P)(1 - \lambda)(1 - \lambda) \geq e^L. \]

(A.16)

The comparative statics are simply \( x_1 = x \begin{pmatrix} x^L \cr \eta^P \cr \eta^L \cr \lambda \end{pmatrix} \).

For the case C2 with \( \lambda \leq \lambda \leq \lambda \leq \lambda(x^r) \) a lobby’s reform signal would induce a policymaker to implement reform without further gathering of information. The lobby finds it beneficial to provide an information signal if \( x^r(\lambda) \geq e^L \), which, using (A.1), implies

\[ 1 - \eta^L - \lambda(1 - e^L - \eta^L) \geq e^L. \]

(A.17)

The comparative statics are simply \( x_2 = x \begin{pmatrix} x^L \cr \eta^P \cr \eta^L \cr \lambda \end{pmatrix} \).

In case C3 with \( \lambda \leq \lambda \leq \lambda \leq \lambda(x^r) \) the policymaker will gather information if the lobby gathered a status quo signal, and will reform without gathering information if the lobby gathered a reform signal. The lobby thus chooses to gather information if \( x^r(\lambda) + x^r(\lambda)z^r(\lambda(x^r)) - e^L \geq z^r(\lambda) \), which implies, using (A.1), (A.2), and (A.6), that

\[ (e^L - e^P)\lambda + (\eta^P - \eta^L)(1 - \lambda) + e^P \eta^L(1 - \lambda) + (1 - \eta^P)(1 - e^L)\lambda \geq e^L. \]

(A.18)

The comparative statics are simply \( x_3 = x \begin{pmatrix} x^L \cr \eta^P \cr \eta^L \cr \lambda \end{pmatrix} \).

Finally, in case C4 with \( \lambda(x^r) \leq \lambda \leq \lambda \leq \lambda(x^r) \), if the lobby gathers information, then the policymaker will not and the signal that the lobby gathered will determine the policy choice. In such a situation the lobby gathers information if \( x^r(\lambda) - e^L \geq z^r(\lambda) \), which implies, using (A.1) and (A.3), that

\[ (e^L - e^P)\lambda + (1 - \lambda)(\eta^P - \eta^L) \geq e^L. \]

(A.19)
The comparative statics are simply
\[ x_4 = x \begin{pmatrix} \epsilon_L^{(+)} \epsilon_P^{(-)} \epsilon_L^{(-)} \epsilon_P^{(+)} \lambda \end{pmatrix} \]

We summarize the comparative static results in Table 1 of the Appendix.

A.2.3 Proof of Proposition 2

The lower threshold \( \lambda' \) follows again from the policymaker’s trade-off between the expected payoff from costly information with uncertain information signal and policy outcome and the expected payoff from the costless status quo without gathering information. Note that the policymaker anticipates a policy implementation subsidy of \( \tau = e^P + c - y^P \) in the case of a reform signal and zero otherwise. The policymaker gathers information if

\[
z^r(\lambda^L) \left[ y^P - e^P - c + \tau(z^r) + \lambda^P(z^r) \alpha \right] + z^s(\lambda^L) \left[ y^P - e^P + \tau(z^s) + (1 - \lambda^P(z^s)) \alpha \right] \geq y^P + (1 - \lambda^L) \alpha
\]

\[
= z^r(\lambda^L) \lambda^P(z^r) \alpha + z^s(\lambda^L) \left[ y^P - e^P + (1 - \lambda^P(z^s)) \alpha \right] \geq y^P + (1 - \lambda^L) \alpha
\]

\[
\geq y^P + (1 - \lambda^L) \alpha. \tag{A.20}
\]

Applying each information signal’s probability, the updating choice reduces to

\[
\lambda^L \geq \frac{(1 - \eta^P)(\alpha + y^P) + \eta^P e^P}{(1 - \eta^P)(\alpha + y^P - e^P) + e^P(\alpha + e^P - y^P)} = \lambda', \tag{A.21}
\]

which defines the new lower updating threshold. Note again that \( \lambda' > 0 \) because of \( \alpha > c \).

The upper threshold \( \lambda' \) follows again from the policymaker’s trade-off between costly information and costly reform without gathering information. The policymaker gathers information if

\[
z^r(\lambda^L) \left[ y^P - e^P - c + \tau(z^r) + \lambda^P(z^r) \alpha \right] + z^s(\lambda^L) \left[ y^P - e^P + \tau(z^s) + (1 - \lambda^P(z^s)) \alpha \right] \geq y^P + (1 - \lambda^L) \alpha
\]

\[
= z^r(\lambda^L) \lambda^P(z^r) \alpha + z^s(\lambda^L) \left[ y^P - e^P + (1 - \lambda^P(z^s)) \alpha \right] \geq y^P + (1 - \lambda^L) \alpha
\]

\[
\geq y^P - c + \lambda^L \alpha. \tag{A.22}
\]

Solving for \( \lambda^L \), we can write

\[
\lambda^L \leq \frac{(\alpha + y^P - e^P)\eta^P + c - y^P}{(\alpha + y^P - e^P)\eta^P + (\alpha - y^P + e^P)(1 - \eta^P)} = \lambda', \tag{A.23}
\]

which defines the new upper updating threshold.

Comparison of Thresholds  For the comparison of the lower thresholds we have for \( \lambda - \lambda' \geq 0 \), using (A.12) and (A.21) such that
that the one from no reform with certainty. The lobby gathers information with \(\tau\) expected payoff from gathering information and a potential second information gathering with \(\lambda<\lambda\) signal would induce a policymaker to gather information or to implement an immediate reform – to the cases C1, C2, C3, and C4 with the difference in the thresholds of \(\lambda\) and the four possible informational lobbying cases of C1’, C2’, C3’, and C4’, which are equivalent to the cases C1, C2, C3, and C4 with the difference in the thresholds of \(\lambda\) and \(\lambda\) instead of \(\lambda\) and \(\lambda\).

\[\begin{align*}
\frac{(1-\eta^P)(\alpha+c)+e^P}{\alpha(1+e^P-\eta^P)+c(1-e^P-\eta^P)} & \quad \frac{(1-\eta^P)(\alpha+y^P)+\eta^P e^P}{(1-\eta^P)(\alpha+y^P-e^P)+\eta^P e^P} \quad \lambda \neq 0 \\
\frac{(c+e^P - \eta^P)(e^P \eta^P + e^P - 1) + 2\alpha(1-\eta^P)e^P}{(\alpha(1+e^P-\eta^P)+c(1-e^P-\eta^P))} & \quad \frac{(\alpha(1+e^P-\eta^P) + (y^P - e^P)(1-\eta^P))}{(\alpha+e^P-y^P)} \quad \lambda \neq 0
\end{align*}\]

\((a): \alpha(1-\eta^P) + c(\alpha-c) + (1-\eta^P) > 0 \Rightarrow (a) \to (+)\)

\((b): \alpha > c > y^P - e^P \text{ and } 1 + e^P - \eta^P > e^P + \eta^P - 1 \Rightarrow (b) \to (+)\)

\[\Rightarrow \lambda - \lambda' > 0 \iff \lambda > \lambda'. \quad (A.24)\]

For the comparison of the upper thresholds we have \(\overline{\lambda} - \overline{\lambda} \geq 0\), using (A.14) and (A.23) such that

\[\frac{\eta^P(\alpha+c) - e^P}{\alpha(1-e^P+\eta^P) + c(e^P+\eta^P - 1)} - \frac{(\alpha+y^P-e^P)e^P + c-y^P}{(\alpha+y^P-e^P)e^P + (\alpha-y^P+e^P)(1-e^P)} \geq 0. \quad (A.25)\]

If \(e^P = \eta^P\), then the comparison of the upper thresholds is

\[\begin{align*}
\frac{\eta^P(\alpha+c) - e^P}{\alpha(1-\eta^P+\eta^P) + c(\eta^P+\eta^P - 1)} & \quad \frac{(\alpha+y^P-e^P)e^P + c-y^P}{(\alpha+y^P-e^P)e^P + (\alpha-y^P+e^P)(1-\eta^P)} \\
= \frac{(c+e^P - \eta^P)(\alpha+c(2\eta^P - 1) - 2\eta^P (-\alpha\eta^P + \alpha + e^P) + e^P)}{(\alpha+c(2\eta^P - 1))(\alpha+(2\eta^P - 1)(y^P - e^P))} \quad \geq 0
\end{align*}\]

\((c): \Rightarrow \overline{\lambda} - \overline{\lambda} < 0 \iff \overline{\lambda} < \overline{\lambda}'. \quad (A.26)\]

The comparative statics for \(\lambda\) and \(\lambda\) can be found in Supplemental Appendix B.3.2.

A.2.4 Proof of Proposition 3

The lobby’s lobbying decision follows from the policymaker’s thresholds described in Proposition 2 and the four possible informational lobbying cases of C1’, C2’, C3’, and C4’, which are equivalent to the cases C1, C2, C3, and C4 with the difference in the thresholds of \(\lambda\) and \(\lambda\) instead of \(\lambda\) and \(\lambda\).

For the lobby’s problem to lobby a politically inactive policymaker we have that a reform signal would induce a policymaker to gather information or to implement an immediate reform – i.e., \(\lambda < \lambda' \leq \lambda(x^r) < \tilde{\lambda}'\) and \(\lambda < \lambda' < \tilde{\lambda} < \lambda(x^r)\). For the first case C1’ a lobbyist compares the expected payoff from gathering information and a potential second information gathering with the one from no reform with certainty. The lobby gathers information with \(\tau(z)\) from (4.1) if

35
\[ x^r(\lambda)z^r(\lambda) (1 - \tau(z)) \geq e^L \]
\[ (\epsilon^P \epsilon^L \lambda + (1 - \eta^P)(1 - \eta^L)(1 - \lambda)) (1 - e^P - c + y^P) \geq e^L. \tag{A.27} \]

The comparative statics are simply \( x_{1'} = x \left( \frac{\epsilon^L}{(+)}, \frac{\epsilon^P}{(+)}, \frac{\epsilon^L}{(-)}, \frac{\eta^L}{(-)}, \frac{\eta^P}{(+)}, \frac{\lambda}{(+)}, \frac{y^P}{(0)}, \frac{\epsilon^P}{(0)}, \frac{c}{(0)} \right). \)

For the other case C2' the trade-off follows the expected payoff from gathering information and a potential immediate reform with no reform with certainty. The lobby gathers if
\[ x^r(\lambda) \geq e^L \]
\[ 1 - \eta^L - \lambda(1 - e^L - \eta^L) \geq e^L, \tag{A.28} \]
which is the same as (A.17) as the policymaker finances the implementation of the reform. The comparative statics are therefore simply \( x_{2'} = x \left( \frac{\epsilon^L}{(+)}, \frac{\epsilon^P}{(0)}, \frac{\epsilon^L}{(-)}, \frac{\eta^L}{(0)}, \frac{\eta^P}{(+)}, \frac{\lambda}{(0)}, \frac{y^P}{(0)}, \frac{\epsilon^P}{(0)}, \frac{c}{(0)} \right). \)

For the cases for which the lobby is considering a substitution of the policymaker’s information, a lobby’s reform signal would induce an immediate reform and a status quo signal would either (C3') not affect the policymaker’s choice or (C4') result in an immediate rejection of the reform proposal – i.e., \( \lambda' \leq \lambda(x^a) \leq \lambda \leq \lambda' \leq \lambda(x^r) \) and \( \lambda(x^a) \leq \lambda' \leq \lambda \leq \lambda' \leq \lambda(x^r) \). For the case of “forgivingness” C3' the lobby compares the expected payoff from gathering information and a potential immediate reform with the expected payoff when only the policymaker gathers information. The lobby gathers information with \( \tau(z) \) from (4.1) if
\[ x^r(\lambda) + x^s(\lambda)z^r(\lambda(x^a)) (1 - \tau(z)) - e^L \geq z^r(\lambda) (1 - \tau(z)) \]
\[ (1 - e^L)\lambda(\epsilon^L e^P \lambda + (1 - \eta^L)(1 - \eta^P)(1 - \lambda)) (1 - c - e^P + y^P) - e^L + \epsilon^L \lambda + (1 - \eta^L)(1 - \lambda) + \eta^L L(1 - \lambda) \]
\[ \geq (\epsilon^P \lambda + (1 - \eta^P)(1 - \lambda)) (1 - c - e^P + y^P) \tag{A.29} \]

The comparative statics are simply \( x_{3'} = x \left( \frac{\epsilon^L}{(+)}, \frac{\epsilon^P}{(-)}, \frac{\epsilon^L}{(-)}, \frac{\eta^L}{(-)}, \frac{\eta^P}{(+)}, \frac{\lambda}{(+/-)}, \frac{y^P}{(+)}, \frac{\epsilon^P}{(+/-)}, \frac{e^P}{(+)}, \frac{c}{(+)}, \frac{c}{(-)} \right). \)

For the last case C4' the lobby compares the expected payoff of gathering information with the risk of rejection and the expected payoff from a policymaker’s information gathering only. The lobby gathers information if
\[ x^r(\lambda) - e^L \geq z^r(\lambda) (1 - e^P - c + y^P) \]
\[ \epsilon^L \lambda + (1 - \eta^L)(1 - \lambda) - e^L \geq (\epsilon^P \lambda + (1 - \eta^P)(1 - \lambda)) (1 - c - e^P + y^P). \tag{A.30} \]
The comparative statics are simply \( x_{L'} = x \begin{pmatrix} \epsilon^L, \epsilon^p, \epsilon^L, \eta^L, \eta^p, \lambda, y^p, e^p, c \end{pmatrix}. \)

We summarize the comparative static results in Table 2 of the Appendix.

A.2.5 Proof of Proposition 4

See Supplemental Appendix B.3.3 and B.3.4.

A.2.6 Proof of Lemma 2

The derivation of the thresholds is identical to the derivation provided in the proof of Proposition 2. The derived thresholds are therefore identical and an additional proof is redundant.

A.2.7 Proof of Proposition 5

In the cases of interest a resource constrained lobby can induce a resource constrained policymaker to reform if \( \lambda^L(x) \geq \lambda^* \). If the policymaker or the lobby were not constrained, then the policymaker would gather information for \( \lambda^L(x) \leq \{ \bar{\lambda}, \bar{\lambda} \} \) even when \( \lambda^L(x) \geq \lambda^* \). Hence, the resource constrained lobby can induce a reform at a lower standard.

For the lobby’s problem to lobby a politically inactive policymaker in case C2” we have that a reform signal would induce a reform — i.e., \( \lambda < \bar{\lambda} \). Here, and different to the previous cases, a lobby can induce an immediate reform for lower beliefs with \( \lambda^* < \lambda(x^r) \) rather than \( \lambda^* < \bar{\lambda} < \lambda(x^r) \). In other words, a lobby may choose to gather information and receive the benefit of the doubt as the policymaker is unable to gather information. Hence, a lobby may choose to gather information for \( \lambda < \lambda^r < \lambda^* < \{ \lambda(x^r), \bar{\lambda} \} \) if

\[
x^r(\lambda) \geq e^L
\]

\[
\epsilon^L \lambda + (1 - \mu^L)(1 - \lambda) \geq e^L,
\]

which is the same as (A.17) as the policymaker finances the implementation of the reform. The comparative statics are therefore simply \( x_{2''} = x \begin{pmatrix} \epsilon^L, \epsilon^p, \epsilon^L, \eta^L, \eta^p, \lambda, y^p, e^p, c \end{pmatrix}. \)

For the case C4’ the lobby compares the expected payoff of gathering information with the expected payoff from a policymaker’s information only. The lobby gathers information if

\[
x^r(\lambda) - e^L \geq z^r(\lambda) \left( 1 - e^p - c + y^p \right)
\]

\[
\epsilon^L \lambda + (1 - \eta^L)(1 - \lambda) - e^L \geq \left( \epsilon^p \lambda + (1 - \eta^p)(1 - \lambda) \right) \left( 1 - c - e^p + y^p \right).
\]

(A.32)
The comparative statics are simply \( x_{i''} = x \begin{pmatrix} e^L_t, e^P_t, e^L_t, e^L_t, \lambda, \eta^P_t, \lambda, \eta^P_t, \lambda, \eta^P_t \end{pmatrix} \).

For the special case a lobby may actually choose to gather information and diminish own resources to prevent a policymaker’s information gathering and realize a reform with certainty – i.e., \( \Delta' < \lambda(z^*) < \lambda^* < \lambda(x^r) < \lambda < \{\lambda(z^r), \lambda(x^r)\} \). The engages in informational lobbying if

\[
1 - e^L \geq z^r(\lambda) (1 - c - e^P + y^P)
\]

\[
1 - e^L \geq (e^P \lambda + (1 - \eta^P) (1 - \lambda)) (1 - e^P - c).
\]

(A.33)

The comparative statics are simply \( x_{i''} = x \begin{pmatrix} e^L_t, e^P_t, e^L_t, e^L_t, \lambda, \eta^P_t, \lambda, \eta^P_t, \lambda, \eta^P_t \end{pmatrix} \).

For the case C2" the lobby’s instruments are independent as the lobby would only engage in informational lobbying but in neither alternative provide a policy implementation subsidy. For the case C4" and its special case the policymakers either gather information and the lobby finances the reform or the lobby gathers information and the policymaker finances the reform. Hence, the lobbying instruments are substitutes in this scenario.

We summarize the comparative static results in Table 3 of the Appendix.

### A.3 Overview Comparative Statics

#### A.3.1 Purely Informational Lobbying

<table>
<thead>
<tr>
<th>Case</th>
<th>( \lambda ) ( \leq \lambda(x^r) &lt; \bar{\lambda} )</th>
<th>( \Delta )</th>
<th>( \lambda(\cdot) )</th>
<th>( \lambda^r )</th>
<th>( \lambda^P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>( \lambda &lt; \Delta \leq \lambda(x^r) &lt; \bar{\lambda} )</td>
<td>( + )</td>
<td>( + )</td>
<td>( - )</td>
<td>( - )</td>
</tr>
<tr>
<td>C2</td>
<td>( \lambda &lt; \Delta &lt; \lambda \leq \lambda(x^r) )</td>
<td>( + )</td>
<td>( 0 )</td>
<td>( - )</td>
<td>( 0 )</td>
</tr>
<tr>
<td>C3</td>
<td>( \lambda \leq \lambda(x^s) \leq \lambda \leq \bar{\lambda} \leq \lambda(x^r) )</td>
<td>( + )</td>
<td>( - )</td>
<td>( - )</td>
<td>( + )</td>
</tr>
<tr>
<td>C4</td>
<td>( \lambda(x^s) \leq \lambda \leq \bar{\lambda} \leq \lambda(x^r) )</td>
<td>( + )</td>
<td>( - )</td>
<td>( - )</td>
<td>( + )</td>
</tr>
</tbody>
</table>

Table 1: Comparative Statics for the Lobby’s Updating – Both Unconstrained.
### A.3.2 Informational Lobbying and Policy Implementation Subsidies

<table>
<thead>
<tr>
<th>Case</th>
<th>$\lambda &lt; \lambda' \leq \lambda(x^r) &lt; \tilde{\lambda}'$</th>
<th>$d\epsilon^L$</th>
<th>$d\epsilon^P$</th>
<th>$d\eta^L$</th>
<th>$d\eta^P$</th>
<th>$d\lambda$</th>
<th>$dy^P$</th>
<th>$de^P$</th>
<th>$dc$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C1'$</td>
<td>$\lambda &lt; \lambda' \leq \lambda(x^r) &lt; \tilde{\lambda}'$</td>
<td>(+)</td>
<td>(+)</td>
<td>(-)</td>
<td>(-)</td>
<td>(+)</td>
<td>(+)</td>
<td>(-)</td>
<td>(-)</td>
</tr>
<tr>
<td>$C2'$</td>
<td>$\lambda &lt; \lambda' \leq \lambda(x^r)$</td>
<td>(+)</td>
<td>(0)</td>
<td>(-)</td>
<td>(-)</td>
<td>(0)</td>
<td>(+)</td>
<td>(0)</td>
<td>(0)</td>
</tr>
<tr>
<td>$C3'$</td>
<td>$\lambda(x^s) \leq \lambda \leq \lambda(x^r)$</td>
<td>(+)</td>
<td>(-)</td>
<td>(-)</td>
<td>(-)</td>
<td>(+)/(-)</td>
<td>(+/-)</td>
<td>(-)</td>
<td>(+)</td>
</tr>
<tr>
<td>$C4'$</td>
<td>$\lambda(x^s) \leq \lambda \leq \lambda(x^r)$</td>
<td>(+)</td>
<td>(-)</td>
<td>(-)</td>
<td>(-)</td>
<td>(+)</td>
<td>(+/-)</td>
<td>(-)</td>
<td>(+)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Case</th>
<th>$\lambda &lt; \lambda' \leq \lambda(x^r) \leq \tilde{\lambda}'$</th>
<th>$d\epsilon^L$</th>
<th>$d\epsilon^P$</th>
<th>$d\eta^L$</th>
<th>$d\eta^P$</th>
<th>$d\lambda$</th>
<th>$dy^P$</th>
<th>$de^P$</th>
<th>$dc$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C2''$</td>
<td>$\lambda &lt; \lambda' \leq \lambda(x^r)$</td>
<td>(+)</td>
<td>(0)</td>
<td>(-)</td>
<td>(-)</td>
<td>(0)</td>
<td>(+)</td>
<td>(0)</td>
<td>(0)</td>
</tr>
<tr>
<td>$C4''$</td>
<td>$\lambda(x^s) \leq \lambda \leq \lambda(x^r)$</td>
<td>(+)</td>
<td>(-)</td>
<td>(-)</td>
<td>(-)</td>
<td>(+)</td>
<td>(+/-)</td>
<td>(-)</td>
<td>(+)</td>
</tr>
</tbody>
</table>

Table 2: Comparative Statics for Lobby’s Updating – Constrained Policymaker.

### A.3.3 Informational Lobbying or Policy Implementation Subsidies

<table>
<thead>
<tr>
<th>Case</th>
<th>$\lambda &lt; \lambda' \leq \lambda(x^r)$</th>
<th>$d\epsilon^L$</th>
<th>$d\epsilon^P$</th>
<th>$d\eta^L$</th>
<th>$d\eta^P$</th>
<th>$d\lambda$</th>
<th>$dy^P$</th>
<th>$de^P$</th>
<th>$dc$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C2''$</td>
<td>$\lambda &lt; \lambda' \leq \lambda(x^r)$</td>
<td>(+)</td>
<td>(0)</td>
<td>(-)</td>
<td>(-)</td>
<td>(0)</td>
<td>(+)</td>
<td>(0)</td>
<td>(0)</td>
</tr>
<tr>
<td>$C4''$</td>
<td>$\lambda(x^s) \leq \lambda \leq \lambda(x^r)$</td>
<td>(+)</td>
<td>(-)</td>
<td>(-)</td>
<td>(-)</td>
<td>(+)</td>
<td>(+/-)</td>
<td>(-)</td>
<td>(+)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Case</th>
<th>$\lambda(x^s) &lt; \lambda^* &lt; \lambda(x^s)$</th>
<th>$d\epsilon^L$</th>
<th>$d\epsilon^P$</th>
<th>$d\eta^L$</th>
<th>$d\eta^P$</th>
<th>$d\lambda$</th>
<th>$dy^P$</th>
<th>$de^P$</th>
<th>$dc$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$CS$</td>
<td>$\lambda(x^s) &lt; \lambda^* &lt; \lambda(x^s)$</td>
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<td>(-)</td>
<td>(-)</td>
<td>(0)</td>
<td>(+)</td>
<td>(-)</td>
<td>(-)</td>
<td>(+)</td>
</tr>
</tbody>
</table>

Table 3: Comparative Statics for Lobby’s Updating – Both Constrained.
B Supplemental Appendix – Online Only

B.1 Empirical Trends

(a) Total and Personal Congressional Staff.

(b) Committee Staff, Leadership Staff, and Officers.

(c) Support Agencies Staff.

Figure 9: Congressional Staff.

(a) Federal Pages and Recorded Votes.

(b) Bills Introduced and Bills Passed.

Figure 10: Congressional Workload.
Figure 11: Electoral Costs for Congress.

B.2 Extensive Forms

Figure 12: Lobby’s Choices.

Figure 13: Policymaker’s Subgames – Policymaker’s Constraint Not Binding.
B.3 Additional Derivations

B.3.1 Comparative Statics: $\lambda$ and $\bar{\lambda}$

The quantitative comparative statics follow from the first-order derivatives of $\lambda$ and $\bar{\lambda}$.

\[
\frac{\partial \lambda}{\partial \alpha} = \frac{2ce^P(\eta^P - 1) - e^P(1 + e^P - \eta^P)}{(c(e^P + \eta^P - 1) - \alpha(1 + e^P - \eta^P))^2} < 0 \quad \text{and} \quad \frac{\partial \bar{\lambda}}{\partial \alpha} = \frac{2c(e^P - 1)\eta^P + e^P(1 - e^P + \eta^P)}{(\alpha(1 - e^P + \eta^P) + c(e^P + \eta^P - 1))^2} \geq 0; \\
\frac{\partial \lambda}{\partial c} = \frac{2\alpha e^P(1 - \eta^P) + e^P(e^P + \eta^P - 1)}{(c(e^P + \eta^P - 1) - \alpha(1 + e^P - \eta^P))^2} > 0 \quad \text{and} \quad \frac{\partial \bar{\lambda}}{\partial c} = \frac{2\alpha(1 - e^P) + e^P(e^P + \eta^P - 1)}{(\alpha(1 - e^P + \eta^P) + c(e^P + \eta^P - 1))^2} > 0; \\
\frac{\partial \lambda}{\partial e^P} = \frac{2\alpha e^P(1 - \eta^P) + e^P(e^P + \eta^P - 1)}{\alpha(1 + e^P - \eta^P) - c(e^P + \eta^P - 1)} > 0 \quad \text{and} \quad \frac{\partial \bar{\lambda}}{\partial e^P} = \frac{1}{\alpha(1 - e^P + \eta^P) + c(e^P + \eta^P - 1)} < 0; \\
\frac{\partial \lambda}{\partial \eta^P} = \frac{(c - \alpha)(e^P + (\alpha + c)(1 - \eta^P))}{(c(e^P + \eta^P - 1) - \alpha(1 + e^P - \eta^P))^2} < 0 \quad \text{and} \quad \frac{\partial \bar{\lambda}}{\partial \eta^P} = \frac{(\alpha - c)((\alpha + c)\eta^P - e^P)}{(\alpha(1 - e^P + \eta^P) + c(e^P + \eta^P - 1))^2} \geq 0; \\
\frac{\partial \lambda}{\partial \eta^P} = \frac{(\alpha + c)(e^P + (c - \alpha)\eta^P)}{(c(e^P + \eta^P - 1) - \alpha(1 + e^P - \eta^P))^2} \geq 0 \quad \text{and} \quad \frac{\partial \bar{\lambda}}{\partial \eta^P} = \frac{(\alpha + c)(e^P + (\alpha - c)(1 - e^P))}{(\alpha(1 - e^P + \eta^P) + c(e^P + \eta^P - 1))^2} > 0. 
\]

B.3.2 Comparative Statics: $\lambda'$ and $\bar{\lambda}'$

The quantitative comparative statics follow from the first-order derivatives of $\lambda'$.

\[
\frac{\partial \lambda'}{\partial \alpha} = \frac{2y^P e^P(\eta^P - 1) + e^P(e^P + \eta^P - 1 - 2e^P \eta^P)}{(\alpha(1 + e^P - \eta^P) - (y^P - e^P)(e^P + \eta^P - 1))^2} < 0; \\
\frac{\partial \lambda'}{\partial c} = 0; \\
\frac{\partial \lambda'}{\partial e^P} = \frac{\alpha(1 - \eta^P - e^P + 2y^P e^P) - y^P(e^P + \eta^P - 1)}{(\alpha(1 + e^P - \eta^P) - (y^P - e^P)(e^P + \eta^P - 1))^2} \geq 0; \\
\frac{\partial \bar{\lambda}'}{\partial \alpha} = 0; \\
\frac{\partial \bar{\lambda}'}{\partial c} = 0; \\
\frac{\partial \bar{\lambda}'}{\partial e^P} = \frac{\alpha(1 - e^P + 2y^P e^P) - y^P(e^P + \eta^P - 1)}{(\alpha(1 + e^P - \eta^P) - (y^P - e^P)(e^P + \eta^P - 1))^2} \geq 0.
\]
\[
\frac{\partial \lambda'}{\partial P} = \frac{(\alpha - y^P + e^P)((\eta^P - 1)(y^P + \alpha) - \eta^P e^P)}{(\alpha(1 + e^P - \eta^P) - (y^P - e^P)(e^P + \eta^P - 1))^2} < 0; \quad (B.9)
\]

\[
\frac{\partial \lambda'}{\partial \eta^P} = \frac{(\alpha + y^P - e^P)(e^P(1 - e^P) - (\alpha - y^P)e^P)}{(\alpha(1 + e^P - \eta^P) - (y^P - e^P)(e^P + \eta^P - 1))^2} \leq 0; \quad (B.10)
\]

\[
\frac{\partial \lambda'}{\partial y^P} = \frac{2\alpha e^P(\eta^P - 1) + e^P(e^P + \eta^P - 1)}{(\alpha(1 + e^P - \eta^P) - (y^P - e^P)(e^P + \eta^P - 1))^2} > 0. \quad (B.11)
\]

The quantitative comparative statics follow from the first-order derivatives of \( \lambda' \).

\[
\frac{\partial \lambda'}{\partial \alpha} = \frac{y^P(1 - e^P - \eta^P + 2\alpha e^P \eta^P) - c(1 - e^P + \eta^P) - 2\alpha e^P(\eta^P - 1)}{(\alpha(1 + e^P - \eta^P) - (y^P - e^P)(e^P + \eta^P - 1))^2} \leq 0; \quad (B.12)
\]

\[
\frac{\partial \lambda'}{\partial \epsilon} = \frac{1}{(\alpha(1 + e^P - \eta^P) - (y^P - e^P)(e^P + \eta^P - 1))} > 0; \quad (B.13)
\]

\[
\frac{\partial \lambda'}{\partial e^P} = \frac{2\alpha(e^P - 1)\eta^P - (y^P - \alpha)(e^P + \eta^P - 1)}{(\alpha(1 + e^P - \eta^P) - (y^P - e^P)(e^P + \eta^P - 1))^2} \leq 0; \quad (B.14)
\]

\[
\frac{\partial \lambda'}{\partial e^P} = \frac{(y^P - e^P - \alpha)(y^P(1 - \eta^P) - c + (e^P - \alpha)\eta^P)}{(\alpha(1 + e^P - \eta^P) - (y^P - e^P)(e^P + \eta^P - 1))^2} \leq 0; \quad (B.15)
\]

\[
\frac{\partial \lambda'}{\partial \eta^P} = \frac{(e^P - y^P - \alpha)(\alpha - \epsilon + \epsilon^P(e^P - 1) + (\alpha - y^P)e^P)}{(\alpha(1 + e^P - \eta^P) - (y^P - e^P)(e^P + \eta^P - 1))^2} \leq 0; \quad (B.16)
\]

\[
\frac{\partial \lambda'}{\partial y^P} = \frac{(\epsilon - c)(e^P + \eta^P - 1) + \alpha(e^P + \eta^P - 1 - 2\epsilon^P \eta^P)}{(\alpha(1 + e^P - \eta^P) - (y^P - e^P)(e^P + \eta^P - 1))^2} \leq 0. \quad (B.17)
\]

### B.3.3 Extension: Contributions in Stages

Suppose that the policymaker’s resource constraint binds even more tightly such that they can afford neither information gathering nor to implement a reform—i.e., \( y^P < \min\{c, e^P\} \). We consider two possible cases: i) as before the lobby may contribute only before the policy stage, or, ii) we allow contributions before and after a policymaker’s gathering of information. The former exclusively involves policy implementation subsidies; the latter independent subsidies for information gathering and implementing reforms.

In the first case, which is illustrated in Figure 15, the lobby must first decide whether to gather information, then whether to offer a policy implementation subsidy. Hence, if a reform signal is generated they then offer a policy implementation subsidy and the lobbying instruments are complements, if a status quo signal is generated they are independent.

In the second case, a lobby may benefit from the additional flexibility of providing subsidies in stages. Suppose that \( y^P < \min\{c, e^P\} \) and \( y^L \geq e^L + e^P + c - y^P \) and that the lobby can contribute before and after a policymaker’s information stage. The policymaker’s lack of resources implies
that a lobby has to provide a policy implementation subsidy whenever the policymaker wants to implement a reform. Whether to lobby engages in information gathering, or subsidizes information gathering by the policymaker, or both, determines the various possible cases.

B.3.4 Proof of Proposition 4

Solving the game backward, we consider 1) the policymaker’s policy choice, 2) the lobby’s policy implementation subsidy, 3) the policymaker’s information choice, 4) the lobby’s information subsidy, and 5) the lobby’s information choice.

1. The policymaker’s policy choice follows from the expected payoffs from keeping the status quo or implementing a reform. We have

\[
\lambda^P \alpha - c \gtrless (1 - \lambda^P) \alpha \\
\lambda^P \gtrless \frac{1}{2} + \frac{c}{2\alpha},
\]  

which is identical to the other cases.

2. The lobby’s policy implementation subsidy can be described by

\[
\tau(\lambda^L) = \begin{cases} 
  c - \bar{y}^p & \text{if } \lambda^L \geq \lambda^* \text{ and } 1 > c - \bar{y}^p \\
  0 & \text{otherwise,}
\end{cases}
\]  

where \( \bar{y}^p = 0 \) if the policymaker gathered information and \( \bar{y}^p = y^P \) if she did not.

3. The policymaker cannot gather information if the lobby did not provide an information subsidy – i.e., when \( \tau(\lambda^L) = 0 \). However, if the lobby provided an information subsidy, \( \tau(\lambda^L) = e^P - y^P \), then the policymaker can either choose no information gathering and status quo, no information gathering and reform, or information gathering and \( \pi \) based on \( z^j \) with \( j = r, s \). The information choice thresholds, for which a policymaker would anticipate a policy implementation subsidy later, follow the same logic as before: the policymaker chooses
between information and status quo or information and reform. The lower threshold with applied subsidies follows from

\[
z^r(\lambda L) + z^s(\lambda L)(1 - \lambda L(z^r)) \geq \alpha(1 - \lambda L) + y^P \tag{B.20}
\]
\[
\Rightarrow \lambda^L \geq \frac{y^P + \alpha(1 - \eta^P)}{\alpha(1 + \epsilon^P - \eta^P)} \equiv \lambda^\prime'. \tag{B.21}
\]

The upper threshold with applied subsidies follows from

\[
z^r(\lambda L) + z^s(\lambda L)(1 - \lambda L(z^s)) \geq \alpha\lambda L + y^P - c + \tau(\lambda^P).
\]
\[
\Rightarrow \lambda^L \leq \frac{\eta^P}{1 - \epsilon^P + \eta^P} \equiv \lambda^\prime''. \tag{B.22}
\]

4. The lobby’s information subsidy follows the rationale that a policymaker’s information gathering would benefit the lobby in expected terms. If \(\lambda^* < \lambda L\), then a policymaker, who could not gather information, would implement a reform with probability one and the lobby would not gain from a policymaker updating. If \(\lambda L < \lambda^\prime\), then the policymaker would not use an information subsidy for gathering information and the lobby has no rationale to make a contribution. Hence, the lobby would only consider an information subsidy if \(\lambda^\prime < \lambda L < \lambda^* \leq \lambda^L(z^r)\). The lobby’s information subsidy can be described by

\[
\tau(\lambda L) = \begin{cases} 
  e^P - y^P & \text{if } \lambda^\prime < \lambda L \leq \lambda^* \leq \lambda^L(z^r) \text{ and } z^r(\lambda L)(1 - c) \geq 0 \\
  0 & \text{otherwise}.
\end{cases} \tag{B.23}
\]

5. The lobby’s updating choice follows from the rationale that an information signal could induce the policymaker to gather subsidized information or could induce the policymaker to reform. Because of the lobby’s ability to constrain the policymaker’s information gathering, the lobby will not gather information if \(\lambda^* < \lambda\). The four cases of interest are then i) \(\lambda < \lambda^\prime \leq \lambda(x^r) < \lambda^*\), ii) \(\lambda < \lambda^\prime < \lambda^* \leq \lambda(x^r)\), iii) \(\lambda^\prime \leq \lambda(x^s) \leq \lambda \leq \lambda^* \leq \lambda(x^r)\), and iv) \(\lambda(x^s) \leq \lambda^\prime \leq \lambda \leq \lambda^* \leq \lambda(x^r)\), all of which are illustrated in Figure 16.

For i) \(\lambda < \lambda^\prime \leq \lambda(x^r) < \lambda^*\) the lobby compares the expected payoff from gathering information and a potential, subsidized policymaker information gathering with the certain payoff from the status quo. The lobby gathers information if

\[
x^r(\lambda) \left( z^r(\lambda(x^r))(1 - c) - e^P + y^P \right) \geq e^L
\]
\[(e^P e^L + (1 - \eta^P)(1 - \eta^L)(1 - \lambda))(1 - c) - (1 - \eta^L - \lambda(1 - e^L - \eta^L))(e^P - y^P) \geq (B.24)\]

For ii) \(\lambda < \lambda' < \lambda^* \leq \lambda(x^r)\) the lobby compares the expected payoff from gathering information and no policymaker information gathering with the certain payoff from the status quo. The lobby gathers information if

\[x^r(\lambda)(1 - c + y^P) \geq e^L\]
\[(1 - \eta^L - \lambda(1 - e^L - \eta^L))(1 - c + y^P) \geq e^L. \quad (B.25)\]

iii) For \(\lambda' \leq \lambda(x^s) \leq \lambda \leq \lambda^* \leq \lambda(x^r)\) the lobby has to choose whether it would subsidize a policymaker’s information gathering and whether it would subsidize a second information signal. Suppose \(z^r(\lambda(x^s))(1 - c) \geq e^P - y^P\), which implies \(x^r(\lambda)(1 - c) \geq e^P - y^P\), then the lobby would subsidize both information signals. The lobby compares the expected payoff from gathering information and either a reform or a subsidized policymaker information gathering with the expected payoff from a subsidized policymaker information gathering. The lobby gathers information if

\[x^r(\lambda)(1 - c + y^P) - x^s(\lambda(e^P - y^P) + x^s(\lambda)z^r(\lambda)(1 - c) - e^L \geq z^r(\lambda)(1 - c) - e^P + y^P\]
\[(1 - c)((\eta^L - 1)\eta^P(\lambda - 1) - \lambda e^L(e^P - 1)) - e^L + e^P(\eta^L(\lambda - 1) + \lambda(\lambda^L - 1) + 1) \geq (B.26)\]

Now suppose \(z^r(\lambda(x^s))(1 - c) < e^P - y^P\) but \(x^r(\lambda)(1 - c) \geq e^P - y^P\), then the lobby would subsidize a policymaker information gathering but not a second information signal. The lobby compares the expected payoff from information gathering and either a reform or status quo with the expected payoff from a subsidized policymaker information gathering. The lobby gathers information if

\[x^r(\lambda)(1 - c + y^P) - e^L \geq z^r(\lambda)(1 - c) - e^P + y^P\]
\[(\epsilon^L \lambda + (1 - \eta^L)(1 - \lambda))(1 - c + y^P) - e^L \geq (\epsilon^L \lambda + (1 - \eta^L)(1 - \lambda))(1 - c) - e^P \quad (B.27)\]
Table 4: Comparative Statics for Lobby’s Updating – Contributions in Stages.

<table>
<thead>
<tr>
<th>Case</th>
<th>Condition</th>
<th>( d^e )</th>
<th>( d^p )</th>
<th>( d^L )</th>
<th>( d^\eta^c )</th>
<th>( d^\eta^p )</th>
<th>( d\lambda )</th>
<th>( dy^r )</th>
<th>( dc )</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>( \lambda &lt; \lambda^* \leq \lambda(x^r) &lt; \lambda^* )</td>
<td>(+/-)</td>
<td>(+)</td>
<td>(-)</td>
<td>(+/-)</td>
<td>(-)</td>
<td>(+/-)</td>
<td>(+)</td>
<td>(-)</td>
</tr>
<tr>
<td>S2</td>
<td>( \lambda &lt; \lambda^* \leq \lambda(x^r) )</td>
<td>(+)</td>
<td>(0)</td>
<td>(-)</td>
<td>(-)</td>
<td>(0)</td>
<td>(+)</td>
<td>(0)</td>
<td>(-)</td>
</tr>
<tr>
<td>S3</td>
<td>( \lambda^* \leq \lambda(x^r) \leq \lambda \leq \lambda^* \leq \lambda(x^r) )</td>
<td>(+)</td>
<td>(-)</td>
<td>(-)</td>
<td>(+/-)</td>
<td>(0)</td>
<td>(+/-)</td>
<td>(0)</td>
<td>(+/-)</td>
</tr>
<tr>
<td></td>
<td>( \tau(\lambda(x^r)) &gt; 0, \tau(\lambda) &gt; 0 )</td>
<td>(+)</td>
<td>(-)</td>
<td>(-)</td>
<td>(+/-)</td>
<td>(0)</td>
<td>(+/-)</td>
<td>(0)</td>
<td>(+/-)</td>
</tr>
<tr>
<td></td>
<td>( \tau(\lambda(x^r)) = 0, \tau(\lambda) &gt; 0 )</td>
<td>(+)</td>
<td>(0)</td>
<td>(-)</td>
<td>(-)</td>
<td>(0)</td>
<td>(+)</td>
<td>(+)</td>
<td>(+/-)</td>
</tr>
<tr>
<td>S4</td>
<td>( \lambda(x^s) \leq \lambda \leq \lambda^* \leq \lambda(x^r) )</td>
<td>(+)</td>
<td>(-)</td>
<td>(-)</td>
<td>(+/-)</td>
<td>(0)</td>
<td>(+/-)</td>
<td>(0)</td>
<td>(+/-)</td>
</tr>
<tr>
<td></td>
<td>( \tau(\lambda) &gt; 0 )</td>
<td>(+)</td>
<td>(0)</td>
<td>(-)</td>
<td>(-)</td>
<td>(0)</td>
<td>(+)</td>
<td>(+)</td>
<td>(+/-)</td>
</tr>
<tr>
<td></td>
<td>( \tau(\lambda) = 0 )</td>
<td>(+)</td>
<td>(0)</td>
<td>(-)</td>
<td>(-)</td>
<td>(0)</td>
<td>(+)</td>
<td>(+)</td>
<td>(+/-)</td>
</tr>
</tbody>
</table>

Finally, suppose \( z^r(\lambda)(1 - c) < e^P - y^P \) and the lobby would not subsidize any policymaker information gathering, then the comparison would be the one of (B.25).

For iv) \( \lambda(x^s) \leq \lambda \leq \lambda^* \leq \lambda(x^r) \) the lobby has to choose whether it would subsidize a policymaker’s information signal. Suppose \( z^r(\lambda)(1 - c) \geq e^P - y^P \). The lobby then compares the expected payoff from information and either reform or status quo with the expected payoff from a policymaker information gathering. Then the comparison would be the one of (B.27). Finally, suppose the lobby would not subsidize a policymaker’s information gathering, \( z^r(\lambda)(1 - c) < e^P - y^P \), then the comparison would be the one of (B.25).

Table 4 illustrates the qualitative comparative statics and relationships between costly informational lobbying and information subsidy as well as informational lobbying and policy implementation subsidy.

### B.4 Social Welfare Implications

To consider the welfare implications of our analysis, we restrict the social planner’s choices to those made by the lobbyist and the policymaker. Then a deviation of the described market solution from the welfare optimum can occur for only three reasons; firstly, they arise because the lobbyist’s and planner’s objectives differ; secondly, the constraints faced by the planner are less binding than either those faced by the policymaker or lobbyist; or finally, a cost may not be internalized by the lobbyist or policymaker but will be by the planner. Employing (2.1) and (2.1), we write the
social welfare function as

\[ E[U^P(\pi, \theta)] + \sum_{k=L,P} y^k - fe^P - he^L - gc, \]  

where we have assumed that the lobbyist’s benefit from reform is a pure transfer. Hence, \( E[U^L(\pi, \theta)] \) does not appear in the social welfare function. Notice immediately that the incentives of the policymaker and social planner are perfectly aligned and therefore only the three distortions mentioned above may occur. We begin by assuming that neither budget constraint would independently bind on either a lobby or policymaker; then we will consider the scenario in which the policymaker’s budget constraint is binding.

**B.4.1 Neither Budget Constraint is Binding**

In the case where neither of the budget constraints binds, and given that the incentives of the policymaker and planner are aligned, it follows that the deviation of the market outcome from the welfare optimum arises from differences in the lobbyist’s and planner’s objectives, and the lobbyist’s failure to internalize the policymaker’s information and policy implementation cost. Given that for any common prior the policymaker and planner would both make the same information choices and subsequent choice between reform and status quo, it follows that any deviation of the market outcome from the welfare optimum follows from differences between the lobbyist’s and planner’s choices over purchasing the signal \( x \).

We explore this question by asking what initial priors are required for the lobbyist and planner to gather \( x \). We employ the case where two reform signals \( x^r \) and \( z^r \) are required for the policymaker or planner to choose reform. That is

\[ \lambda(x^r, z^r) > \frac{1}{2} + \frac{c}{2\alpha} > \max\{\lambda(x^r), \lambda(z^r)\}. \]  

(B.29)

In this case (A.16) tells us that a lobbyist will choose to gather the signal \( x \) iff

\[ e^P e^L \lambda + (1 - \eta^P)(1 - \eta^L)(1 - \lambda) \geq e^L. \]  

(B.30)

Which is satisfied if

\[ \lambda \geq \frac{e^L - (1 - \eta^P)(1 - \eta^L)}{e^P e^L - (1 - \eta^P)(1 - \eta^L)} \equiv \lambda^L_x. \]  

(B.31)

Whereas employing (A.1)-(A.4) and (A.9)-(A.10) as well as (A.7)-(A.8), we may show that a
The planner will choose to gather information if
\[
\alpha \left[ e^P e^L \lambda - (1 - \eta^P)(1 - \eta^L)(1 - \lambda) \right] \\
\geq e^L + e^P \left[ e^L \lambda + (1 - \eta^L)(1 - \lambda) \right] + c \left[ e^P e^L \lambda + (1 - \eta^P)(1 - \eta^L)(1 - \lambda) \right],
\]
(B.32)
which in turn is satisfied if
\[
\lambda \geq \frac{e^L + e^P (1 - \eta^L) + c(1 - \eta^P)(1 - \eta^L)}{\alpha e^P e^L + (1 - \eta^P)(1 - \eta^L) + e^P [(1 - \eta^L) - e^L] + c [(1 - \eta^P)(1 - \eta^L) - e^P e^L]} \equiv \lambda^*_x. \quad \text{(B.33)}
\]
Notice that $\lambda^*_L$ is invariant with respect to $\alpha, e^P$, and $c$ whereas $\lambda^*_x$ is increasing in each of these variables (since signals are informative). It then follows that for $\alpha, e^P$, or $c$ sufficiently large the social planner will gather less information than the lobbyist. This is just the lobby failing to internalize all costs and benefits. We may isolate the different incentives of the lobbyist and planner to gather $x$ arising purely from their valuation of information by letting $e^P = c = 0$ and $\alpha = 1$, that is effectively “turning-off” the other sources of distortions. Notice that we can interpret $\alpha = 1$ as the lobbyist capturing all the rents from a reform when it is socially desirable. The condition $\lambda^*_L \geq \lambda^*_x$ may then be written
\[
2e^L - e^L e^P - (1 - \eta^L)(1 - \eta^P) \geq 0.
\]
(B.34)
From which we observe that if there are almost equal chances of reform signals and status quo when the state is reform $e^L e^P \rightarrow 1/4$ and/or there are almost always status quo signals when the state is status quo $(1 - \eta^L)(1 - \eta^P) \rightarrow 0$, then there is a tendency for the lobbyist to gather less information than the planner. Conversely, if there are almost always reform signals when the state is reform $e^L e^P \rightarrow 1$ and/or there are almost equal status quo signals and reform when the state is status quo $(1 - \eta^L)(1 - \eta^P) \rightarrow 1/2$, then there is a tendency for the lobbyist to gather more information than the planner.

**B.4.2 The Policymaker’s Budget Constraint is Binding**

The immediate implication of this configuration of constraints is that the lobbyist can choose to gather information by purchasing the signal $x$, in which case there does not exist a transfer that allows the policymaker to both gather information in the form of the signal $z$ and finance the cost of reform $c$. This provides an example of how the lobbyist may strategically gather information so as to limit the transfer they can afford, and hence manipulate the policymaker’s choices via their
budget constraint. A planner who makes all of the choices will in certain circumstances prefer to purchase the signal $z$ rather than the signal $x$.

Employing (2.1) and (2.2), we write the social welfare function as

$$E[U^P(\pi, \theta)] + y^P - e^P - c + y^L - e^L,$$  \hspace{1cm} (B.35)

where we have assumed that the lobby's benefit from reform is a pure transfer. Hence, $E[U^L(\pi, \theta)]$ does not appear in the social welfare function. We begin by assuming that neither budget constraint would independently bind on either a lobby or policymaker.

Here we consider the case

$$\text{Max}\{c + e^L, c + e^P\} < y^L + y^P < e^L + e^P + c \text{ and } y^P < e^P + c.$$  \hspace{1cm} (B.36)

The immediate implication of this configuration of constraints is that the lobby can choose to strategically gather the signal $x$, in which case there does not exist a transfer that allows the policymaker to both gather the signal $z$ and finance the cost of reform $c$. This provides an example of how the lobbyist may gather a signal so as to limit the transfer they can afford and hence manipulate the policymakers choices via their budget constraint. A planner who makes all of the choices will in certain circumstances prefer to gather the signal $z$ rather than the signal $x$. In this case the lobbyist will choose to gather $x$ if (A.30) is satisfied, which may be rewritten as

$$\epsilon^L \lambda + (1 - \eta^L)(1 - \lambda) - e^L \geq (\epsilon^P \lambda + (1 - \eta^P)(1 - \lambda))(1 - c - e^P + y^P),$$  \hspace{1cm} (B.37)

which again may be rewritten as a condition on the initial common prior

$$\lambda \geq \frac{\epsilon^L + (1 - c - e^P + y^P)(1 - \eta^P) - (1 - \eta^L)}{\epsilon^L - (1 - \eta^L) - (1 - c - e^P + y^P)(\epsilon^P - (1 - \eta^P))} \equiv \lambda^L_x.$$  \hspace{1cm} (B.38)

In a similar fashion the planner will choose to gather $z$ rather than $x$ if

$$z^*(\lambda)[\alpha \lambda(z^r) - e^P - c] + z^s(\lambda)[\alpha(1 - \lambda(z^s)) - e^P]
\geq x^r(\lambda)[\alpha \lambda(x^r) - e^L - c] + x^s(1 - \lambda(x^s)) - e^L]
\iff \alpha \epsilon^P \lambda - [\epsilon^P + (1 - \eta^P)(1 - \lambda)] c + \alpha(1 - \epsilon^P)\lambda - e^P
\geq \alpha \epsilon^L \lambda - [\epsilon^L + (1 - \eta^L)(1 - \lambda)] c + \alpha(1 - \epsilon^L)\lambda - e^L,$$  \hspace{1cm} (B.39)
which reduces to the condition on the initial common belief

\[ \lambda \geq \frac{e^L - e^P + c(\eta^L - \eta^P)}{e^L - e^P + c(\eta^L - \eta^P)} \equiv \lambda_z^s. \]  

(B.40)

We can gain some insights into this distortion by choosing parameter values that “turn-off” the lobby’s informational incentives to gather a signal by assuming \( \eta^L = \epsilon^L \rightarrow \frac{1}{2} \) hence any signal the lobbyist receives is uninformative. Further, we assume \( \epsilon^P \rightarrow \frac{1}{2} \) and \( \eta^P \rightarrow 1 \) which provides some incentives for a planner to gather a signal, but is a “worst-case-information-scenario” for the lobby as this maximizes the likelihood of a status quo signal if \( z \) is gathered. With these assumptions (B.38) and (B.40) reduce to

\[ \lambda \geq \frac{2e^L - 1}{c + e^P - \epsilon^P - 1} \equiv \lambda_z^L \quad \text{and} \quad \lambda \geq 1 + \frac{2(e^L - e^P)}{c} \equiv \lambda_z^s. \]  

(B.41)

It can be shown that a simple sufficient condition for there to exist a range of values of the initial prior, \( \lambda \), that satisfy both conditions in (B.41) is \( e^P \leq \frac{1}{2} \).