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discussion papers

**Are We Better Off if Our Politicians Know
How the Economy Works?**

Johan Lagerlöf

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ABSTRACT

Are We Better Off if Our Politicians Know How the Economy Works?

by Johan Lagerlöf*

This paper sheds light on two mechanisms that make some citizens worse off from a political leader's having access to more information. It also addresses the question who are the losers and who are the winners. Moreover, it is discussed how the results of the analysis can be helpful in understanding some normative and positive issues concerning interest group politics.

ZUSAMMENFASSUNG

Geht es uns besser, wenn unsere Politiker wissen, wie die Wirtschaft funktioniert?

In diesem Beitrag werden zwei Mechanismen dargestellt, die dazu führen, daß Bürger schlechter gestellt werden, wenn ein Politiker Zugang zu mehr Information hat. Dabei wird auch auf die Frage eingegangen, wer die Verlierer und wer die Gewinner sind. Darüber hinaus wird erörtert, wie die Analyseergebnisse dazu beitragen können, einige normative und positive Aspekte der Vertretung von Interessengruppenpolitik zu verstehen.

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1. Introduction

There is by now a quite extensive literature studying informational aggregation in the world of politics. In particular, many scholars have tried to understand how policy-relevant information that is dispersed among the citizens of a society can be aggregated in a voting process (see e.g. McKelvey and Ordeshook (1985) or the literature on the Condorcet jury theorem¹). Others have looked at how such information can be credibly transmitted to a political leader prior to her deciding on a public policy (Lohmann (1993)). An implicit presumption often made in this literature is that, if the aggregation is not costly per se, it would be a desirable thing if more information were aggregated. At least at first sight, this seems to be a plausible thing to presume. Access to relevant information is, after all, often useful when making political decisions. Indeed, the presumption is obviously true in, for example, a simple version of the Condorcet jury theorem, since here all citizens have the same preferences and all of them want the correct decision to be made.

However, in a society where the citizens have conflicting preferences, it is not clear whether all of them are better off if public policy is made with access to more information. The aim of this paper is to shed some light on a couple of mechanisms that may indeed make some citizens worse off from the political leader's having access to more information. The paper also addresses the question who are the losers and who are the winners.

My main motivation for studying these questions is that the answers should be helpful in understanding some normative and positive issues concerning interest group politics. For example, in the last few years a small but growing literature that models interest group influence with strategic information transmission has emerged.² This literature on "informational lobbying" takes as its point of departure that lobbyists have access to information that is relevant to the politician in her policy making. Hence, by strategically transmitting this information to the policymaker, the lobbyists may be able to influence public policy. Typically, in the equilibria of the models in this literature, at least some information is transmitted to the policymaker. A welfare analysis of the lobbyist's opportunity to lobby then amounts to asking whether the policymaker's having access to this information induces her to make decisions which are better to people in the society.³ This is precisely the question

¹ In its simplest form, the Condorcet jury theorem states the following (see Piketty (1998) and the literature referenced in there). Suppose n individuals have to make a collective choice between two policies, A and B. There are also two states of the world, ω_A and ω_B . All agents prefer policy A if the state is ω_A and policy B if the state is ω_B . Moreover, all agents have some private, noisy information about the true state; and if they use this information to infer which decision is the correct one, each agent is more likely to be right than wrong. Now suppose there is an election and everybody votes for the policy they think is the right one. Then the probability that the right policy will win a majority of the votes is increasing with n and it tends to 1 as n goes to infinity.

² Two early papers in this literature are Austen-Smith and Wright (1992) and Potters and van Winden (1992). Two recent surveys can be found in Austen-Smith (1997) and Sloof (1997).

³ This question is also studied in Lagerlöf (1997). The present paper extends that analysis.

that is posed in this paper.

The analysis of this paper may also constitute a first step towards a positive theory of the political economy of public information acquisition. Indeed, at least casual empiricism suggests that, prior to public decisions, many governments spend a lot of resources on information acquisition (royal commissions, funding of applied research, etc.). The information that the governments try to acquire often concern the actual effects of different possible policies on various variables that the citizens care about. For example, the information could concern questions such as: What are the effects on growth and unemployment of a membership in the EMU? What would be the effects on the income distribution and the incentives for becoming an entrepreneur if one introduced a new tax system? What are the environmental and growth effects of increased investment in the infrastructure?

Suppose the government indeed became better informed about one of these issues. Then, which citizens should we expect to be better off from this? The results of this paper relate a citizen's interest in the policymaker's being better informed to the citizen's attitude toward the political issue that the policymaker decides on. For example, if the policymaker decides on the amount of investment in the infrastructure and if there is uncertainty about the effects of this decision on the environment, then the question whether a particular citizen wants the policymaker to have access to more information depends on how much this citizen cares about the environment. However, it turns out that it is not necessarily the "environmentalists" who want the policymaker to have more information. Depending on what we mean by "more information," it may instead be the "non-environmentalists" who want this, and the environmentalists want the policymaker to have as little information as possible.

Hence, this paper makes the point that we should indeed expect a conflict of interest between different groups of a society concerning how much policy-relevant information a policymaker should have access to. Moreover, whether a particular group wants the policymaker to be informed or not depends on what we mean by "more information." Being aware of these things should be a first step toward a positive theory of the political economy of public information acquisition.⁴

In the formal model of the paper it is assumed that there are a large number number of citizens (indeed, a continuum) who all have preferences over the amount of roads and the amount of pollution in their country. However, the citizens are heterogenous with respect to how important roads are relative to pollution. A policymaker who is elected by the citizens decides directly only on the amount of roads. Indirectly, however, this decision affects also the amount of pollution: More roads give rise to more pollution.⁵ The exact

⁴ It should be pointed out, however, that any actual influence attempts by interest groups are not modeled here. Such an analysis would be interesting but it is beyond the scope of the present paper.

⁵ This assumption is made for simplicity. Of course, in the real world the relationship between roads and pollution might be more complex.

relationship between the amount of roads and pollution is unknown though. Together, each citizen's utility function and the stochastic relationship between roads and pollution give rise to induced preferences over roads only.

Within the framework of this model, the question is then asked whether all people in the economy would be better off (*ex ante*) if the policymaker had more information about the relationship between roads and pollution. First, given that “more information” is understood as a more informative signal about the realization of the stochastic variable, only those members of the society who are sufficiently responsive to the stochastic variable (i.e., the environmentalists) gain from the policymaker's having more information. Those who are not sufficiently responsive — in the sense that they only to a small extent care about pollution — would be worse off if the policymaker had access to a more informative signal. Second, if “more information” is understood as a smaller variance of the stochastic variable and if the policymaker can improve upon the quality of the signal that she observes by making a greater effort, then those who are sufficiently responsive (i.e., the environmentalists) may be worse off from a lower variance. The reason for this is that the environmentalists want the policymaker to make a great effort, thereby getting access to a more informative signal. However, a lower variance of the stochastic variable induces the policymaker to make a smaller effort.

The remainder of the paper is organized as follows. In Section 2, the basic model, where the signal's quality is exogenous, is presented. In Section 3, this model is analyzed and the first results are stated. Section 4 studies an extension of the model where the signal's quality is endogenous. Section 5 briefly summarizes and concludes. Proofs are found in an appendix.

2. The basic model

Consider a society with a continuum of citizens each having preferences over two public goods, provided in quantities x and y . Citizen i 's preferences are described by the von Neumann–Morgenstern utility function

$$U_i(x, y) = -(x - \bar{x})^2 - \lambda_i (y - \bar{y})^2, \quad (1)$$

where \bar{x} , \bar{y} , and λ_i are fixed parameters. The citizens differ from each other only with regard to the parameter λ_i . The distribution of λ_i among the citizens is described by a cumulative distribution function G with support \mathbb{R}_+ . The (finite) mean and the median of λ_i are denoted by $\bar{\lambda}$ and λ_m , respectively.

Public policy is decided on by a policymaker. The policymaker can control only x . However, there is a stochastic relationship between x and y , given by

$$y = \beta x - \varepsilon. \quad (2)$$

Here $\beta > 0$ is a fixed parameter and ε is a stochastic variable with zero mean. We may think of x as the amount of roads in the country, and y as the amount of pollution caused by the traffic on these roads (or perhaps rather the adverse environmental effects of the pollution). Everybody has some ideal amount of roads, \bar{x} , and some ideal amount of pollution, \bar{y} . The uncertainty as to the exact relationship between the amount of roads and pollution may be due to the fact that the technology giving rise to the relationship is not perfectly known, or to the fact that the amount of pollution also depends on weather conditions which vary in an unpredictable manner.

Substituting (2) into (1) yields citizen i 's induced preferences over x only:

$$u_i(x, \varepsilon) = -(x - \bar{x})^2 - \lambda_i(\beta x - \varepsilon - \bar{y})^2. \quad (3)$$

This means that if ε were known, citizen i would like the policymaker to set x equal to

$$\hat{x} = \psi(\lambda_i) + \varphi(\lambda_i)\varepsilon, \quad (4)$$

where

$$\psi(\lambda_i) = \frac{\bar{x} + \lambda_i\beta\bar{y}}{1 + \lambda_i\beta^2} \quad (5)$$

and

$$\varphi(\lambda_i) = \frac{\lambda_i\beta}{1 + \lambda_i\beta^2}. \quad (6)$$

Hence, since $\varphi(0) = 0$ and $\varphi' > 0$, the parameter λ_i measures how responsive a citizen is to changes in ε . Someone who has a low λ_i (i.e., someone who does not care much about pollution) would like the policymaker to make x contingent on ε to a lesser degree than someone for whom λ_i is large. In the following, the parameter λ_i will often be called citizen i 's responsiveness parameter.

The policymaker is elected among the citizens by majority vote. More specifically, in a *political equilibrium*, the policymaker is a citizen having a responsiveness parameter λ_i such that she cannot be beaten in a pair-wise comparison when each citizen votes for the one of the two candidates that gives him the highest expected utility.⁶ Hence, like all other citizens, the policymaker has preferences according to equation (1), and these will govern her choice of x ; she cannot commit himself to any electoral platform other than her ideal policy.

Concerning the informational structure and the timing of events, the following is assumed. First the policymaker is elected. The stochastic variable ε cannot be observed by anyone, neither before nor after the elections. However, after having taken office, the policymaker observes a signal s , which is correlated with ε . Then the policymaker decides on x . All citizens' preferences are known by all citizens.

⁶ In this model, this is the definition of political equilibrium. Later, the median voter theorem will be used to show that there is unique λ_i that satisfies this definition. Hence, I do not specify an institutional setting (such as an electoral competition with candidates who choose policy platforms and voters who vote) in which the political equilibrium can be derived using some appropriate game-theoretic solution concept.

Let F be the joint cumulative distribution function of ε and s , with density f . The following notation is used:

$$\mu_s = E(s), \quad (7)$$

$$\sigma^2 = Var(\varepsilon), \quad (8)$$

$$\sigma_s^2 = Var(s), \quad (9)$$

and

$$\rho = \frac{Cov(\varepsilon, s)}{\sigma \sigma_s}. \quad (10)$$

(Recall that the expected value of ε equals zero, $E(\varepsilon) = 0$.) $\rho \in [-1, 1]$ is thus the correlation coefficient between s and ε .

The policymaker is assumed to be a Bayesian updater. Thus, after having observed the signal s , the policymaker's beliefs about ε are described by the conditional density function $f(\varepsilon | s)$, defined by

$$f(\varepsilon | s) = \frac{f(\varepsilon, s)}{f(s)}, \quad (11)$$

where $f(s) = \int f(\varepsilon, s) d\varepsilon$ is the marginal density of s . The conditional expectation function is defined by $E(\varepsilon | s) = \int \varepsilon f(\varepsilon | s) d\varepsilon$. Assume that F is such that ε has *linear regression* with regard to s , i.e., that $E(\varepsilon | s)$ is a linear (affine) function of s .⁷ It is well known that if ε has linear regression with regard to s (and if $E(\varepsilon) = 0$), then

$$E(\varepsilon | s) = \rho \frac{\sigma}{\sigma_s} (s - \mu_s). \quad (12)$$

3. Beginning the analysis

Let us denote the policymaker's responsiveness parameter by λ_g (where g stands for government). At the last stage, conditional on her having observed the signal s , the policymaker will implement the policy x which maximizes her expected utility:

$$\max_{x \in \mathbb{R}} \int u_g(x, \varepsilon) f(\varepsilon | s) d\varepsilon. \quad (13)$$

The unique solution to this problem is given by

$$x_g^* = \psi(\lambda_g) + \varphi(\lambda_g) E(\varepsilon | s). \quad (14)$$

Now consider a citizen/voter. At the time of the elections, this person only knows the prior distribution of s and ε . However, he anticipates that a policymaker with responsiveness parameter λ_g will set x equal to x_g^* . Hence, citizen i 's expected utility at the time of

⁷ For instance, a bivariate normal distribution has this property.

the elections, denoted by Eu_i , may be written as

$$\begin{aligned}
Eu_i &= \int \int u_i(x_g^*, \varepsilon) f(\varepsilon, s) d\varepsilon ds \\
&= - (1 + \lambda_i \beta^2) \psi(\lambda_g) [\psi(\lambda_g) - 2\psi(\lambda_i)] \\
&\quad - (1 + \lambda_i \beta^2) \rho^2 \sigma^2 \varphi(\lambda_g) [\varphi(\lambda_g) - 2\varphi(\lambda_i)] \\
&\quad - \bar{x}^2 - \lambda_i (\bar{y}^2 + \sigma^2).
\end{aligned} \tag{15}$$

The expression after the second equality sign in equation (15) was obtained by using equations (3), (12), (14), and by carrying out some algebra.

Eu_i represents citizen i 's preferences over a potential policymaker. The potential policymakers differ from each other along only one dimension, $\lambda_g \in \mathbb{R}_+$. Moreover, in the proof of Lemma 1 below it is shown that Eu_i is single peaked in λ_g . Hence, we can invoke the median voter theorem (see e.g. Mueller, 1989), which states that if those two conditions (i.e., one dimension and single-peakedness) are met then the median voter's favorite policymaker cannot lose under majority rule. This means that, in a political equilibrium, the policymaker will be a citizen preferred by the median citizen/voter. Not surprisingly, the responsiveness parameter of this preferred citizen equals the median voter's, $\lambda_g = \lambda_m$; there is no reason for any member of the electorate to delegate the task of deciding on public policy to someone with other preferences than himself.

Lemma 1. *The policymaker's responsiveness parameter is the same as the median citizen's, $\lambda_g = \lambda_m$.*

Let us now investigate whether members of the society would be better off if the policymaker had access to a more informative signal about the stochastic variable ε . The welfare evaluation will be made ex ante; that is, I will consider citizen i 's expected utility, as measured by Eu_i in equation (15) (with $\lambda_g = \lambda_m$). The expression "more informative signal" will be understood as an increase in ρ^2 .

Let $\tilde{\lambda}$ be defined by

$$\tilde{\lambda} = \frac{\lambda_m}{2 + \lambda_m \beta^2}. \tag{16}$$

Proposition 1. *An increase in ρ^2 benefits those with $\lambda_i > \tilde{\lambda}$ and makes those with $\lambda_i < \tilde{\lambda}$ worse off (i.e., $\frac{\partial Eu_i}{\partial \rho^2} |_{\lambda_g=\lambda_m} \geq 0$ as $\lambda_i \geq \tilde{\lambda}$).*

Accordingly, those members of the electorate who have a sufficiently low responsiveness parameter λ_i are *worse off* if the policymaker has access to better information about the relationship between the amount of roads and the amount of pollution, in the sense

that ρ^2 is larger.⁸ Before looking at the intuition for this result, let us consider the question whether a *majority* of the citizens may be worse off from an increase in ρ^2 . Since $\tilde{\lambda} < \lambda_m/2$ (see equation 16), it follows immediately that the answer to this question is no: Everyone with a responsiveness parameter $\lambda_i \in [\lambda_m/2, \infty)$ is strictly better off from a larger ρ^2 , and this group of citizens form a majority.

However, it may be that a social welfare function that assigns an equal weight to the expected utility of all citizens is decreasing in ρ^2 . Let EW be defined by

$$EW = \int_0^\infty Eu_i dG(\lambda_i). \quad (17)$$

Since the expression for Eu_i in equation (15) is a linear (affine) function of λ_i (cf. the first line of equation (3)), EW is obtained by simply substituting $\bar{\lambda}$ (i.e., the responsiveness parameter of the average citizen) for λ_i in equation (15):

$$\begin{aligned} EW = & - (1 + \bar{\lambda}\beta^2) \psi(\lambda_g) [\psi(\lambda_g) - 2\psi(\bar{\lambda})] \\ & - (1 + \bar{\lambda}\beta^2) \rho^2 \sigma^2 \varphi(\lambda_g) [\varphi(\lambda_g) - 2\varphi(\bar{\lambda})] \\ & - \bar{x}^2 - \bar{\lambda}(\bar{y}^2 + \sigma^2). \end{aligned} \quad (18)$$

For EW to be decreasing in ρ^2 , the distribution G must be sufficiently skewed to the right, so that λ_m is to a sufficient extent greater than $\bar{\lambda}$. If so, it might be that $\bar{\lambda} < \tilde{\lambda}$.

In order to understand the intuition behind the result that those citizens having a low responsiveness parameter are worse off if ρ^2 is larger, let us consider the extreme case where $\lambda_i = 0$. Such a citizen only cares about the amount of roads, and he does not want the policy to be conditioned on ε at all. Instead, his ideal policy always equals \bar{x} (cf. equation (4)). Now consider a policymaker who has a responsiveness parameter $\lambda_g > 0$. If this policymaker can observe a signal about the realization of ε , then she will condition her decision on the signal, and thus make the decision

$$x_g^* = \psi(\lambda_g) + \varphi(\lambda_g) E(\varepsilon | s). \quad (19)$$

From an ex ante perspective this means that the decision will vary. If the policymaker could not observe the signal, then she would make the decision

$$\tilde{x}_g^* = \psi(\lambda_g). \quad (20)$$

Clearly this decision will not vary.

Let us decompose the citizen's gain from the policymaker's not having access to the signal into two parts: (i) the gain the citizen would obtain if he were risk neutral and (ii) the gain that is due to the citizen's being risk averse. If the citizen were risk neutral, he

⁸ The result in Proposition 1 is related to a result in Lagerlöf (1997, Proposition 6). In that paper, however, the identity of the policymaker is exogenous, and the differences in responsiveness between citizens is not — as in this paper — derived from differences in the relative weights on two policy issues and the stochastic relationship between them. Moreover, in Lagerlöf (1997) the stochastic variable has a Bernoulli distribution.

would only care about the expected policy. However, it is easy to see that the expected policy is the same regardless of the policymaker's having access to the signal or not:⁹

$$E_s(x_g^*) = E_s[\psi(\lambda_g) + \varphi(\lambda_g) E(\varepsilon | s)] = \psi(\lambda_g). \quad (21)$$

Hence, the gain the citizen would obtain if he were risk neutral equals zero, and his total gain from the policymaker's not having access to the signal must exclusively be attributed to the citizen's being risk averse. But the citizen's being risk averse manifests itself in his not wanting any variation in the policymaker's decision. Thus the citizen's gain from the policymaker's not having access to the signal is always positive. The same is true for citizens who have a responsiveness parameter λ_i that is strictly positive but still relatively small (smaller than $\tilde{\lambda}$).¹⁰

Before finishing this section, let us consider the question whether all citizens would be better off *ex ante* if σ^2 , the variance of ε , were lower. Not surprisingly, it turns out that this is indeed the case. However, in the next section the model will be expanded by making the quality of the signal that the policymaker observes endogenous, and in that model a smaller variance may be harmful. This finding will be easier to understand in light of the result stated in the following observation, which assumes that the signal's quality is exogenous.

Observation 1. *All citizens are always better off from a lower variance of ε (i.e., $\frac{\partial E u_i}{\partial \sigma^2} |_{\lambda_g=\lambda_m} < 0$ for all λ_i).*

4. The signal's quality being endogenous

In this section it is assumed that the policymaker can make a costly effort and thereby improve upon the quality of the signal that she observes. The informational structure and the timing of events in this extension of the model is as follows. First the policymaker is elected. After having taken office, the policymaker first decides on an effort level e . Then she observes the signal s , which is correlated with ε . Finally the policymaker decides on x .

⁹ This is due to the quadratic functional form.

¹⁰ The intuition for the result in Proposition 1 is related to the intuition for a result in Freixas and Kihlstrom (1984). They consider a situation in which a patient must choose a doctor in the face of imperfect information about the distribution of service quality across doctors. In particular they study the effect of risk aversion on demand for information about this distribution. They write (p. 93): "On this issue, intuition is inconclusive since it suggests that the final effect is a combination of two conflicting effects. On the one hand, more risk-averse decision-makers should have a stronger preference for the *ex post* reduction in uncertainty accomplished by acquiring information. But uncertainty is reduced only *ex post*, i.e. only after the informative message has been received. When the decision to buy information is made, the buyer does not yet know whether he will receive good news or bad when the information arrives. Thus, *ex ante*, the returns to information are uncertain, and more risk averse buyers should be less willing to accept the risks associated with its acquisition." Freixas and Kihlstrom find that, in their model, an increase in the degree of risk aversion unambiguously reduces information demand.

The stochastic variable ε cannot be directly observed by anyone, neither before nor after the elections.

It is assumed that $e \equiv \rho^2$, where as before ρ is the correlation coefficient between s and ε ; hence $e \in [0, 1]$. Thus, by making a greater effort, the policymaker can improve upon the quality of the signal. However, making an effort is costly for the policymaker; the disutility that she incurs from exerting effort level e equals $C(e)$, where $C' > 0$ and $C'' > 0$, with $C'(0) = 0$.

Let $E\tilde{u}_g$ denote the policymaker's expected utility at the stage where she is to decide on the effort level e . It follows from the expression for $E\tilde{u}_i$ in equation (15) that $E\tilde{u}_g$ may be written as

$$E\tilde{u}_g = (1 + \lambda_g \beta^2) [\psi^2(\lambda_g) + e\sigma^2\varphi^2(\lambda_g)] - \bar{x}^2 - \lambda_g(\bar{y}^2 + \sigma^2) - C(e), \quad (22)$$

where the last term is the postulated cost of information acquisition.¹¹ The policymaker solves the problem of maximizing $E\tilde{u}_g$ in equation (22) with respect to e , subject to the constraint $e \in [0, 1]$. Throughout I shall assume that this problem has an interior solution.¹² This interior solution, e^* , is implicitly defined by

$$C'(e^*) \equiv \frac{\beta^2 \sigma^2 \lambda_g^2}{1 + \lambda_g \beta^2}. \quad (23)$$

Note for future use that

$$\frac{\partial e^*}{\partial \lambda_g} = \frac{\beta^2 \sigma^2 \lambda_g (2 + \lambda_g \beta^2)}{C''(e^*) (1 + \lambda_g \beta^2)^2} > 0 \quad (24)$$

and

$$\frac{\partial e^*}{\partial \sigma^2} = \frac{\beta^2 \lambda_g^2}{C''(e^*) (1 + \lambda_g \beta^2)} > 0. \quad (25)$$

That is, as expected, a policymaker who cares more about the environment (has a larger λ_g) makes a greater effort to learn about how much the environment is adversely affected by building roads. Similarly, a larger variance of the stochastic variable also induces the policymaker to make a greater effort.

¹¹ Note that the gross value of information (i.e., $E\tilde{u}_g$ if not counting the cost $C(e)$) is linear in $e = \rho^2$. However, if we had assumed that $e = \rho$, then the gross value of information would have been a convex function of e . This phenomenon is closely related to a result in Radner and Stiglitz (1984). They show that for an important class of decision problems, the value of information is nonconcave. In particular, see their first example where they consider a linear prediction problem.

¹² The problem has an interior solution if the Inada condition $\lim_{e \rightarrow 1} C'(e) = \infty$ holds or if this limit is finite and $\lambda_g < \lambda_c$, where λ_c is defined by $\lambda_c^2 \beta^2 \sigma^2 \equiv (1 + \lambda_c \beta^2) C'(1)$. An example of such a cost function is $C(e) = (1 - \sqrt{1 - e})^2$. The reason why I do not simply assume that the Inada condition holds is that, when studying some examples later in this section, it will be convenient to let $C(e) = e^a$ for $a > 1$.

Let η be defined by

$$\eta = \frac{C''(e^*)e^*}{C'(e^*)}, \quad (26)$$

and let $Z = e^* \left(1 + \frac{1}{\eta}\right)$. By using equations (23) and (25), one may show that

$$\frac{1}{\eta} = \frac{\partial e^*}{\partial \sigma^2} \frac{\sigma^2}{e^*}. \quad (27)$$

Hence, η not only measures the curvature of the cost function C , but is also equal to the inverse of the elasticity of information demand with respect to σ^2 .

Now consider again a citizen/voter with responsiveness parameter λ_i . His expected utility if the policymaker has a responsiveness parameter λ_g and accordingly exerts effort $e^*(\lambda_g)$ is denoted by $E\tilde{u}_i$, and it is obtained by simply substituting e^* for ρ^2 in equation (15):

$$\begin{aligned} E\tilde{u}_i = & - (1 + \lambda_i \beta^2) \psi(\lambda_g) [\psi(\lambda_g) - 2\psi(\lambda_i)] \\ & - (1 + \lambda_i \beta^2) e^* \sigma^2 \varphi(\lambda_g) [\varphi(\lambda_g) - 2\varphi(\lambda_i)] \\ & - \bar{x}^2 - \lambda_i (\bar{y}^2 + \sigma^2). \end{aligned} \quad (28)$$

$E\tilde{u}_i$ thus represents i 's induced preferences over a potential policymaker. Again, for the median voter theorem to hold, these preferences must be single peaked in λ_g . In the Appendix I show that sufficient conditions for this are that $C(e) = e^a$, $a \in (1, \frac{3}{2})$, $\bar{y} \neq \beta \bar{x}$, and that σ^2 is sufficiently close to zero. Here, I will confine myself with showing that when $E\tilde{u}_i$ is single peaked in λ_g , then the policymaker's responsiveness parameter does not necessarily equal the median voter's.

To see this, let us differentiate $E\tilde{u}_i$ with respect to λ_g and evaluate at $\lambda_i = \lambda_m$:

$$\begin{aligned} \frac{\partial E\tilde{u}_i}{\partial \lambda_g} \Big|_{\lambda_i=\lambda_m} = & -2 (1 + \lambda_m \beta^2) \psi'(\lambda_g) [\psi(\lambda_g) - \psi(\lambda_m)] \\ & -2 (1 + \lambda_m \beta^2) e^* \sigma^2 \varphi'(\lambda_g) [\varphi(\lambda_g) - \varphi(\lambda_m)] \\ & - (1 + \lambda_m \beta^2) \sigma^2 \varphi(\lambda_g) [\varphi(\lambda_g) - 2\varphi(\lambda_m)] \frac{\partial e^*}{\partial \lambda_g}. \end{aligned} \quad (29)$$

When $E\tilde{u}_i$ is single peaked, then the median voter theorem applies, and in a political equilibrium the policymaker will be the favorite of the median voter. That is, λ_g will be such that the right-hand side of equation (29) equals zero. Now suppose that $\frac{\partial e^*}{\partial \lambda_g} = 0$. It follows immediately from equation (29) that then the result from Lemma 1 is reobtained, $\lambda_g = \lambda_m$. However, if $\frac{\partial e^*}{\partial \lambda_g} > 0$, then we must have $\lambda_g > \lambda_m$. This can be seen by evaluating (29) at $\lambda_g = \lambda_m$:

$$\frac{\partial E\tilde{u}_i}{\partial \lambda_g} \Big|_{\lambda_i=\lambda_g=\lambda_m} = (1 + \lambda_m \beta^2) \sigma^2 [\varphi(\lambda_m)]^2 \frac{\partial e^*}{\partial \lambda_g} \Big|_{\lambda_g=\lambda_m}. \quad (30)$$

Since this expression is strictly positive, it must be that $\lambda_g > \lambda_m$. The intuition for this

result is clear. A policymaker who cares more about the environment will make a greater effort finding information about the environmental effects of building roads, and it will be in the median voter's interest that the policymaker has access to such information. Thus, the median voter can gain by delegating the task of deciding on public policy to somebody who cares more about the environment than himself.¹³

Let us now turn to the question whether a citizen would be better or worse off if σ^2 , the variance of ε , were smaller.

Proposition 2. *Suppose that $2\beta Z\varphi(\lambda_g) \leq 1$. Then a decrease in σ^2 (strictly) benefits all citizens. Suppose that $2\beta Z\varphi(\lambda_g) > 1$. Then a decrease in σ^2 (strictly) benefits citizen i if and only if*

$$\varphi(\lambda_i) < \frac{\beta Z [\varphi(\lambda_g)]^2}{2\beta Z\varphi(\lambda_g) - 1}. \quad (31)$$

Inequality (31) does not need to hold when the condition $2\beta Z\varphi(\lambda_g) > 1$ is met. That is, it may be that a citizen is *worse* off if the variance of ε is smaller.

To illustrate this I will consider two numerical examples. In both of them it is assumed that $C(e) = e^a$, for $a > 1$. This implies that

$$e^* = \left[\frac{\beta^2 \sigma^2 \lambda_g^2}{a(1 + \lambda_g \beta^2)} \right]^{\frac{1}{a-1}} \quad (32)$$

and that

$$Z = \frac{ae^*}{a-1}. \quad (33)$$

Now consider the first example.

Example 1. $\beta = \lambda_g = 1$, $a = \frac{3}{2}$, and $\sigma^2 = \frac{5}{2}$.

Given the parameter values specified in Example 1, we get $e^* = \frac{25}{36}$, $Z = \frac{25}{12}$, $\varphi(\lambda_g) = \frac{1}{2}$, and $\varphi(\lambda_i) = \frac{\lambda_i}{1+\lambda_i}$. Hence, $2\beta Z\varphi(\lambda_g) = \frac{25}{12} > 1$; and condition (31) now becomes

$$\frac{\lambda_i}{1+\lambda_i} < \frac{25}{52} \Leftrightarrow \lambda_i < \frac{25}{27}. \quad (34)$$

Thus, all citizens with a responsiveness parameter larger than $\lambda_i = \frac{25}{27}$ are strictly worse off if the variance decreases. In order to understand the intuition for this result, let us decompose the total welfare effect of a decrease in the variance into two parts: the effect on welfare which arises in the hypothetical case that the signal's quality is given; and the effect that is due to the fact that the quality's actually being chosen by the policymaker. In Section 3 (Observation 1) we saw that the first part always is positive. Concerning the

¹³ For another example of strategic delegation in a political context, see Persson and Tabellini (1994).

second effect, note that if the variance decreases, this will induce the policymaker to make a smaller effort and thus get access to a less informative signal. This comparative statics result follows from equation (25). From Section 3 (Proposition 1), however, we know that, everything else being equal, those citizens having a sufficiently large responsiveness parameter are worse off from a less informative signal. Hence, for those citizens, the second effect is negative. The algebra shows that the second effect may in fact be stronger than the first effect, making the most responsive citizens worse off from a lower variance of the stochastic variable.

Example 1 shows that also a citizen with the same responsiveness parameter as the policymaker, $\lambda_i = \lambda_g = 1$, may be worse off from a lower variance. My second example helps us understand what is required for this particular result to obtain.

Example 2. $\lambda_i = \lambda_g$.

Condition (31) now becomes

$$Z < \frac{1}{\lambda_i \beta^2} + 1. \quad (35)$$

Thus, a necessary condition for a voter with the same responsiveness parameter as the policymaker to be worse off from a lower variance is that $Z > 1$.¹⁴ This highlights the point that essential for our result that some citizens may be worse off from a lower variance is that the magnitude of $1/\eta$, the policymaker's elasticity of information demand with respect to σ^2 , is sufficiently great. This is in line with our intuition: The reason why a larger σ^2 may be good is that it induces the policymaker to make a greater effort.

5. Summary and concluding remarks

This paper has considered a model where a policymaker decides on the amount of roads in a country. More roads have an adverse effect on the environment, but the exact relationship between the amount of roads and the environmental effects is unknown. There is heterogeneity among the citizens with respect to how serious an issue one thinks the environment is — or, equivalently, concerning one's responsiveness to changes in the stochastic variable. The policymaker is elected among the citizens by a majority vote.

Concerning this model two questions were posed. First, would all citizens be better off ex ante if the policymaker, when making the decision, were having more information about the realization of the stochastic variable? Second, would all citizens be better off ex ante if the variance of the stochastic variable were smaller? The second question was studied

¹⁴ The condition $2\beta Z\varphi(\lambda_g) > 1$ is automatically satisfied if $Z > \frac{1}{\lambda_i \beta^2} + 1$, since, if $\lambda_g = \lambda_i$, the former condition can be rewritten as $2Z > \frac{1}{\lambda_i \beta^2} + 1$.

in two different environments. In the first one the policymaker can, prior to making the decision, observe a noisy signal about the stochastic variable, and the quality of this signal is given exogenously. In the second environment the policymaker can improve upon the quality of the signal by making a greater effort.

Concerning the first question it was shown that only those citizens who are sufficiently responsive to the stochastic variable gain from a more informative signal. That is, the non-environmentalists are worse off. However, it turns out that a majority of the citizens are always better off from the policymaker's having access to a more informative signal. Concerning the second question it was found that, in the environment where the signal's quality is exogenous, everyone gains from the variance of the stochastic variable being smaller. However, when the signal's quality is endogenous, those people who are sufficiently responsive (i.e., the environmentalists) may be worse off from a smaller variance of the stochastic variable.

Another contribution of this paper is the way in which the citizens' preferences are specified. People are heterogeneous with respect to their responsiveness to changes in a stochastic variable, i.e., to what extent they want the policy to be made contingent on the state of the world. This kind of heterogeneity is also found in the models of Lagerlöf (1997), Martinelli (1996), Martinelli and Matsui (1997), and Schultz (1996). However, in those papers the heterogeneity is simply postulated when specifying the functional form. In the present paper, in contrast, the heterogeneity is derived from differences in the relative weights on two policy issues and the stochastic relationship between them. Moreover, the relationship between the policymaker's and the median voter's responsiveness is endogenous to the model. In particular, in the version of the model where the policymaker can acquire information endogenously, the policymaker's degree of responsiveness will in equilibrium be greater than the median voter's.

Appendix

A. Proof of Lemma 1

To be able to invoke the median voter theorem one must show that Eu_i is single peaked in λ_g . Differentiate Eu_i in (15) with respect to λ_g :

$$\frac{\partial Eu_i}{\partial \lambda_g} = -2(1 + \lambda_i \beta^2) \left[\psi'(\lambda_g) [\psi(\lambda_g) - \psi(\lambda_i)] + \sigma^2 \rho^2 \varphi'(\lambda_i) [\varphi(\lambda_g) - \varphi(\lambda_i)] \right]. \quad (\text{A-1})$$

It is easy to check that $\varphi' > 0$ and that ψ' has the same sign as $(\bar{y} - \beta \bar{x})$. By inspecting equation (A-1) one sees that regardless of the sign of ψ' we have: $\frac{\partial Eu_i}{\partial \lambda_g} > 0$ for any $\lambda_g < \lambda_i$, $\frac{\partial Eu_i}{\partial \lambda_g} < 0$ for any $\lambda_g > \lambda_i$, and $\frac{\partial Eu_i}{\partial \lambda_g} = 0$ for $\lambda_g = \lambda_i$. Hence, Eu_i is single peaked in λ_g , and the peak is at $\lambda_g = \lambda_i$. \square

B. Proof of Proposition 1

Differentiating Eu_i in (15) with respect to ρ^2 and evaluating at $\lambda_g = \lambda_m$ yield

$$\frac{\partial Eu_i}{\partial \rho^2} \big|_{\lambda_g = \lambda_m} = - (1 + \lambda_i \beta^2) \sigma^2 \varphi(\lambda_m) [\varphi(\lambda_m) - 2\varphi(\lambda_i)], \quad (\text{A-2})$$

which has the same sign as $(2\varphi(\lambda_i) - \varphi(\lambda_m))$. By using the definition of φ and by carrying out some algebra, one may show that $(2\varphi(\lambda_i) - \varphi(\lambda_m))$ in turn has the same sign as $(\lambda_i - \tilde{\lambda})$. \square

C. Proof of Observation 1

Differentiating Eu_i in equation (15) with respect to σ^2 and evaluating at $\lambda_g = \lambda_m$ yield

$$\begin{aligned} \frac{\partial Eu_i}{\partial \sigma^2} \big|_{\lambda_g = \lambda_m} &= -\rho^2 \varphi(\lambda_m) (1 + \lambda_i \beta^2) [\varphi(\lambda_m) - 2\varphi(\lambda_i)] - \lambda_i < 0 \Leftrightarrow \\ &\varphi(\lambda_i) [2\beta \rho^2 \varphi(\lambda_m) - 1] < \beta \rho^2 \varphi^2(\lambda_m). \end{aligned} \quad (\text{A-3})$$

If $2\beta \rho^2 \varphi(\lambda_m) \leq 1$, then clearly $\frac{\partial Eu_i}{\partial \sigma^2} \big|_{\lambda_g = \lambda_m} < 0$. Suppose that $2\beta \rho^2 \varphi(\lambda_m) > 1$. Then inequality (A-3) may be rewritten as

$$\varphi(\lambda_i) < \frac{\beta \rho^2 \varphi^2(\lambda_m)}{2\beta \rho^2 \varphi(\lambda_m) - 1}. \quad (\text{A-4})$$

We must show that, when $2\beta \rho^2 \varphi(\lambda_m) > 1$, inequality (A-4) always holds. To see that it

does, note that the right-hand side of inequality (A-4) can be rewritten as follows:

$$\frac{\beta \rho^2 \varphi^2(\lambda_m)}{2\beta \rho^2 \varphi(\lambda_m) - 1} = \frac{1}{\beta \rho^2} \left[\frac{[\beta \rho^2 \varphi(\lambda_m)]^2}{2\beta \rho^2 \varphi(\lambda_m) - 1} \right] = \frac{1}{\beta \rho^2} \left[\frac{[\beta \rho^2 \varphi(\lambda_m) - 1]^2}{2\beta \rho^2 \varphi(\lambda_m) - 1} + 1 \right], \quad (\text{A-5})$$

which is greater than or equal to $\frac{1}{\beta}$. On the other hand, the left-hand side of inequality (A-4), $\varphi(\lambda_i)$, is strictly smaller than $\frac{1}{\beta}$. To see this, note that $\varphi' > 0$ and $\lim_{\lambda_i \rightarrow \infty} \varphi(\lambda_i) = \frac{1}{\beta}$. Hence inequality (A-4) must hold. \square

D. Proof of the claim about single-peakedness in Section 4

Here I prove the claim made in Section 4 that $E\tilde{u}_i$ is single peaked in λ_g if $C(e) = e^a$, $a \in (1, \frac{3}{2})$, $\bar{y} \neq \beta \bar{x}$, and σ^2 is sufficiently close to zero. If $C(e) = e^a$ then e^* is given by equation (32). It is a straightforward exercise to show that, under the assumption $a \in (1, \frac{3}{2})$,

$$\lim_{\sigma^2 \rightarrow 0} e^* = \lim_{\sigma^2 \rightarrow 0} \frac{\partial e^*}{\partial \lambda_g} = \lim_{\sigma^2 \rightarrow 0} \frac{\partial^2 e^*}{\partial (\lambda_g)^2} = 0. \quad (\text{A-6})$$

Now differentiate $E\tilde{u}_i$ in equation (28) once with respect to λ_g :

$$\begin{aligned} \frac{\partial E\tilde{u}_i}{\partial \lambda_g} &= -2(1 + \lambda_i \beta^2) \left[\psi'(\lambda_g) [\psi(\lambda_g) - \psi(\lambda_i)] \right. \\ &\quad \left. + e^* \sigma^2 \varphi'(\lambda_g) [\varphi(\lambda_g) - \varphi(\lambda_i)] \right] - (1 + \lambda_i \beta^2) \sigma^2 \varphi(\lambda_g) [\varphi(\lambda_g) - 2\varphi(\lambda_i)] \frac{\partial e^*}{\partial \lambda_g}. \end{aligned} \quad (\text{A-7})$$

Differentiating $E\tilde{u}_i$ once more yields:

$$\begin{aligned} \frac{\partial^2 E\tilde{u}_i}{\partial \lambda_g^2} &= -2(1 + \lambda_i \beta^2) \left[\psi''(\lambda_g) [\psi(\lambda_g) - \psi(\lambda_i)] + [\psi'(\lambda_g)]^2 \right. \\ &\quad \left. + e^* \sigma^2 \left[\varphi''(\lambda_g) [\varphi(\lambda_g) - \varphi(\lambda_i)] + [\varphi'(\lambda_g)]^2 \right] + 2\sigma^2 \varphi'(\lambda_g) [\varphi(\lambda_g) - \varphi(\lambda_i)] \frac{\partial e^*}{\partial \lambda_g} \right] \\ &\quad - (1 + \lambda_i \beta^2) \sigma^2 \varphi(\lambda_g) [\varphi(\lambda_g) - 2\varphi(\lambda_i)] \frac{\partial^2 e^*}{\partial \lambda_g^2}. \end{aligned} \quad (\text{A-8})$$

The assumption $\bar{y} \neq \beta \bar{x}$ implies that $\psi'(\lambda_g) \neq 0$. This means that $\frac{\partial E\tilde{u}_i}{\partial \lambda_g} = 0$ if and only if

$$\begin{aligned} [\psi(\lambda_g) - \psi(\lambda_i)] &= \frac{-\sigma^2}{2\psi'(\lambda_g)} \left[2e^* \varphi'(\lambda_g) [\varphi(\lambda_g) - \varphi(\lambda_i)] \right. \\ &\quad \left. + \varphi(\lambda_g) [\varphi(\lambda_g) - 2\varphi(\lambda_i)] \frac{\partial e^*}{\partial \lambda_g} \right] \\ &\equiv \Theta(\sigma^2) \end{aligned} \quad (\text{A-9})$$

Substituting $[\psi(\lambda_g) - \psi(\lambda_i)]$ for $\Theta(\sigma^2)$ in equation (A-8) and then taking the limit $\sigma^2 \rightarrow 0$ yield

$$\lim_{\sigma^2 \rightarrow 0} \frac{\partial^2 E\tilde{u}_i}{\partial \lambda_g^2} \big|_{[\psi(\lambda_g) - \psi(\lambda_i)] = \Theta(\sigma^2)} = -2(1 + \lambda_i \beta^2) [\psi'(\lambda_g)]^2 < 0. \quad (\text{A-10})$$

By continuity, $\frac{\partial^2 E\tilde{u}_i}{\partial \lambda_g^2}$ evaluated at $[\psi(\lambda_g) - \psi(\lambda_i)] = \Theta(\sigma^2)$ is strictly negative also for some strictly positive σ^2 , which proves the claim. \square

E. Proof of Proposition 2

Differentiating $E\tilde{u}_i(\lambda_g)$ in equation (28) with respect to σ^2 (and making use of equation (27)) yield

$$\frac{\partial E\tilde{u}_i}{\partial \sigma^2} = -\varphi(\lambda_g) (1 + \lambda_i \beta^2) [\varphi(\lambda_g) - 2\varphi(\lambda_i)] Z - \lambda_i. \quad (\text{A-11})$$

Thus, $\frac{\partial E\tilde{u}_i}{\partial \sigma^2} < 0$ is equivalent to

$$\varphi(\lambda_i) [2\beta Z \varphi(\lambda_g) - 1] < \beta Z [\varphi(\lambda_g)]^2. \quad (\text{A-12})$$

If $2\beta Z \varphi(\lambda_g) \leq 1$, then clearly $\frac{\partial E\tilde{u}_i}{\partial \sigma^2} < 0$. Suppose that $2\beta Z \varphi(\lambda_g) > 1$. Then we may rewrite inequality (A-12) as (31). \square

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