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Learning and signalling by advisor selection *

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Abstract. In this paper we consider a model where a policy maker uses advice in order to (1) obtain information about the consequences of an innovation (information motive) and (2) to support political legitimacy of her decision (persuasion motive). We conduct our analysis in the context of a cheap-talk game with three players: (1) a policy maker, (2) the median voter in parliament or of the electorate and (3) an advisor. The advisor has private information about the consequences of policy. Communication between an advisor and a recipient improves as their preferences are closer aligned. If the preferences of the policy maker and the median voter are different the policy maker faces a trade-off. On the one hand, she wants to gain information to judge whether the innovation is worthwhile. On the other hand, she needs to convince the median voter whether the innovation is desirable.

1. Introduction

There is a growing literature in political science and economics that studies the role of asymmetric information in the conduct of policy. One strand in the literature focuses on asymmetries in information between political parties and voters (Letterie and Swank, 1994; Schultz, 1994; Roemer, 1994; and Swank, 1994). In these studies political parties are better informed about the working of the economy than voters. To convince voters that its policy is superior to the policies proposed by the other parties, each party has an incentive to make voters believe in a specific view of the working of the economy. For example, a political party which proposes an increase in taxes to finance some project has an incentive to make voters believe that the distortionary costs of taxes are small. In Roemer and Schultz, political parties try to affect voters' views of the working of the economy by announcements (or talk), while in Letterie and Swank political parties choose policies that signal a specific view of the working of the economy.

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Another, older, strand in the literature revolves around communication between policy makers and experts. In studies on bureaucracy (Niskanen, 1971), bureaucrats are the experts, in some other studies committee members have superior information about policy effects (Gilligan and Krehbiel, 1989) and sometimes policy advisors are experts (Calvert, 1985). In all these studies, policy makers have typically less information about the efficacy of policy than experts. The experts in these studies are ordinary human beings who have their own preferences. When experts' and policy makers' preferences diverge, the experts may have incentives to provide biased information to the policy maker to induce her to implement policies which are in their interests.

These two strands of the literature show that as to information the policy maker plays two roles. In the second strand of the literature, policy maker's demand for information is at the centre of interest, while in the first, the policy maker supplies information. In this paper, we make a first attempt to draw together the two strands in the literature by examining a model in which a policy maker consults experts on the one hand to acquire information about policy effects and on the other hand to convince other agents of the net-benefits of their policies.

The model to be examined builds on Calvert (1985). The policy maker must make a decision about whether or not to undertake a particular project. The net-benefits of the project are surrounded with uncertainty. The policy maker can reduce this uncertainty by consulting an advisor, thereby reducing the probability that he makes a "wrong" decision. Advisors differ in their predisposition towards the project, so that the policy maker is confronted with the problem of the selection of an advisor. The model deviates from Calvert in that game theoretical principles are used to examine the interactions between the policy maker and the advisor. Moreover, in our model the policy maker faces a political constraint: Undertaking the project requires approval by parliament or by voters through a referendum. As a consequence, in our model the advisor is not only a source of information for the policy maker; he may also be used to convince parliament of the net-benefits of the project.

Our model can be regarded as an extension of the models analysed in studies belonging to the first strand in the literature. In these studies the motivation for the assumption that the policy maker is better informed than voters is that policy makers have better access to experts and bureaucrats (see also Cukierman and Tommasi, 1994). We maintain the assumption that policy makers have better access to experts, but model the interactions between policy makers and experts explicitly.

Our analysis shows that when selecting advisors, policy makers may face a trade-off between acquiring information to avoid "wrong" decisions and supplying information to persuade other agents. As in Calvert (1985), to acquire information the policy maker has an incentive to consult an advisor whose predisposition towards the project is close to that of himself (Section 2). This result is common in cheap talk games which show that communication between players usually improves when their preferences are closer aligned (Crawford and Sobel, 1982). In contrast, to convince parliament, the policy maker has an incentive to consult an advisor whose predisposition towards the project is closer to the predisposition of the median voter in parliament (Section 3).

2. The model

In this section we discuss a simple game in which a policy maker and a policy advisor are the players. The policy maker must make a decision about whether a particular project should be undertaken. The policy maker can choose between two alternatives. First, she can retain the status quo (s), in which case her utility is given by $U_p(s) = 0$, and second she can undertake the project (x), in which case her utility is given by:

$$U_p(x \mid \epsilon) = p + \epsilon \tag{1}$$

where ϵ is a stochastic term which has a uniform distribution over the interval $[-t, t]$[1] and p denotes the policy maker's bias towards the innovation. Before the policy maker decides upon the project she can consult an advisor to inform herself about the realization of ϵ.

There exists a continuum of policy advisors in terms of their predispositions towards the project (a_k). If the policy maker chooses to undertake the project, advisor j's utility is given by:

$$U_{aj}(x \mid \epsilon) = a_j + \epsilon. \tag{2}$$

All advisors are assumed to attribute zero utility to the status quo ($U_j(s) = 0$).[2] The parameters a_j and p and the distribution of ϵ are common knowledge. However, the advisors are assumed to have private information about the realisation of ϵ.[3] The advisor can send two messages to the policy maker: the innovation is good or the innovation is bad, implying that messages are imprecise to some extent. This assumption is not crucial in the game we consider. It is valid because the decision about implementing the innovation is a 'yes' or 'no' decision, implying that 'yes' or 'no' messages are suitable.

The existence of different advisors confronts the policy maker with the problem of the selection of an advisor, a_j. This decision is therefore part of the model. It is assumed that apart from advisors' predispositions towards the project, advisors do not differ. Thus all advisors are assumed to be equally competent.

The model is deliberately held as simple as possible. One interpretation of the model is that the benefits of the project are unevenly distributed among citizens (and advisors) and that the costs of the project, which are surrounded with uncertainty (ϵ), are equally distributed among citizens. Then, a_j refers to the net benefits of the project received by advisor j, and p denotes the benefits received by the policy maker or her constituency.

It is evident from (1) that if the policy maker does not consult an advisor, her decision concerning the project depends on p. If the policy maker is biased towards undertaking the project ($p > 0$), then she will undertake the project and if $p < 0$, then she will retain the status quo. From now on, it is assumed that the policy maker is biased in favour of undertaking the project ($p > 0$).[4] Furthermore, it is clear that if $t < p$, then information about ϵ never affects the policy decision, so that advice has no value. Thus, we focus on the interesting case where $t > p$.

Formally, the stages of the game can be described as follows:

1. The policy maker chooses a policy advisor a_j;
2. Nature reveals the value of ϵ to the policy advisors, but not to the policy maker;
3. The advisor chooses message G = {undertake the project} or B = {do not undertake the project};
4. The policy maker revises her belief about ϵ, using Bayes' rule. She makes a decision concerning the project, (S_P, X_P).

2.1. *Equilibria*

The game between the policy maker and the advisor has several perfect Bayesian equilibria. Necessary conditions for these equilibria are that the players' actions must be optimal responses to each other and that the policy maker's belief about ϵ must follow Bayes' rule. Two types of equilibria can be distinguished: pooling and partially pooling equilibria of which the latter type is most interesting. An important feature of a partially pooling equilibrium is that communication between the policy maker and the advisor occurs, in the sense that the advisor's message affects policy maker's decision concerning the project by providing further information about ϵ. Obviously, all advisors with $a_j < -t$ would like the policy maker to believe that the innovation is bad. Messages sent by those advisors are not credible and accordingly do not provide information about ϵ. Likewise, communication cannot occur if $a_j > t$. For this reason, we restrict attention to those cases where a_j lies in the interval $[-t, t]$.

Using (2) we obtain that if $a_j \geqq -\epsilon$, the advisor wants the policy maker to undertake the project. If message G may induce the policy maker to undertake the project, the advisor should send message G if ϵ is an element of $[-a_j, t]$. In contrast if ϵ is an element of $[-t, -a_j)$, the advisor should send message B. Now consider the optimal response of the policy maker to the advisor's strategy. Message G reveals that ϵ lies within the interval $[-a_j, t]$ and message B reveals that ϵ is an element of $[-t, a_j)$. Thus the expected value of ϵ conditional on the advisor's message equals:

$$E(\epsilon \mid B) = \tfrac{1}{2}(-t - a_j) < 0 \tag{3}$$

$$E(\epsilon \mid G) = \tfrac{1}{2}(t - a_j) > 0 \tag{4}$$

and policy maker's expected utility attributed to the innovation becomes:

$$E(U_p(x) \mid B) = p + \tfrac{1}{2}(-t - a_j) \tag{5}$$

$$E(U_p(x) \mid G) = p + \tfrac{1}{2}(t - a_j) > 0 \tag{6}$$

It is evident from (6) that if the advisor sends message G, the policy maker will undertake the project. If the policy maker observes B, her decision concerning the project depends on the advisor's predisposition towards the project, a_j. First, suppose the advisor is strongly biased against the innovation ($a_j < 2p-t$), so that $E(U(x) \mid B) > 0$. Hence, the policy maker still expects higher utility from the innovation than from the status quo and her optimal response to the message is to ignore it. Then, the advisor may send any message. In this case a pooling equilibrium occurs. Second, if $a_j > 2p-t$, expected utility associated with the innovation is negative if message B is observed. As a consequence, if the policy maker observes message B, she retains the status quo. Thus, in this case information is revealed about the realization of ϵ and the policy maker's action depends on the advisor's message: If G is observed the policy maker undertakes the project and if B is observed the policy maker retains the status quo. Then a partially pooling equilibrium holds. As is common in cheap-talk games, also in case $a_j > 2p-t$, a pooling equilibrium may arise, which however is not very likely. If there is an infinitesimal probability that the policy maker follows the policy advise, both the advisor and the policy maker act as in the partially pooling equilibrium. Hence, if we restrict attention to stable equilibria, a pooling equilibrium holds if $a_j < 2p-t$ and a partially pooling equilibrium holds if $a_j > 2p-t$.

2.2. *The optimal policy advisor*

The above analysis concerns the stages 2–4 of our model. In determining the selection of the optimal policy advisor, a_j, we can ignore pooling equilibria, because there the value of the message is zero. In fact, the policy maker should never choose an advisor characterized by $a_j < 2p–t$. In a partially pooling equilibrium, the advisor's message induces policy maker's decision. Policy maker's expected utility is equal to:

$$E(U) = \mathrm{Prob}(G) \cdot E(U(x) \mid G) = \frac{1}{2t}[p(t + a_j) + 1/2(t^2 - a_j^2)] \tag{7}$$

Differentiating (7) with respect to a_j yields the first-order condition: $p – a_j = 0$. Hence, the predisposition towards the innovation of the optimal advisor coincides with that of the policy maker. The intuition of this result is clear. If $a_j = p$, the advisor sends message G if $\epsilon > –p$ and message B if $\epsilon < –p$. This is the information the policy maker needs. Hence, as in most cheap-talk games, communication is optimal if the players' interests are perfectly aligned.

In summary, the following strategies and beliefs form a stable Bayesian equilibrium:

$$\text{Advisor}: \begin{cases} \text{send G if } a_j \geq -\epsilon \\ \text{send B if } a_j < \epsilon. \end{cases} \tag{Ia}$$

$$\text{Beliefs}: \begin{cases} E(\epsilon \mid B) = 1/2(-t - a_j) \\ E(\epsilon \mid G) = 1/2(t - a_j) \end{cases} \tag{Ib}$$

$$\text{Policy maker} \begin{cases} X_p \text{ if message} = G \\ S_p \text{ if message} = B \\ a_j = p. \end{cases} \tag{Ic}$$

3. Political constraints

In the previous section, the policy maker consults an advisor to acquire information about the desirability of an innovation. Implicitly, we have assumed that if the policy maker expects that the innovation increases her utility, she has the power to undertake the project. In many countries, however, policy innovations have to be approved by parliament. Often this confronts the policy maker with the problem of convincing members of parliament that the innovation is in their interests. This political constraint adds a new dimension to the role of advisors. Apart from acquiring information about the desirability of a project, a policy maker may consult an advisor to persuade members of parliament to support the innovation.

In this section we examine the role of the advisor in a political context. The model employed is an extension of the model discussed in the previous section. We maintain the stages 1–4 discussed before and add to the model that the innovation requires approval by parliament. To hold the model simple, we assume that only the policy maker is able to consult an advisor and that the policy maker cannot be forced to undertake the project.

Parliamentary approval requires that a simple majority votes for the innovation. Parliament consists of n members, who differ in their predispositions towards the project. The utility functions of members of parliament are similar to those of the advisors and the policy maker. It is easy to show that in this setting the vote of the median member of parliament (henceforth median voter) is decisive. The median voter's utility function is given by:

$$U_m(x \mid \epsilon) = m + \epsilon \text{ and } U_m(s) = 0. \tag{8}$$

When the policy maker puts forward a proposal to undertake the project to parliament, the median voter can choose between two actions: she can support the proposal (X_m) and she can vote against the proposal (S_m). In the present model, the project is only undertaken when the policy maker chooses X_p and the median voter chooses X_m.

The following assumptions are made about the median voter's and the policy maker's preferences. First, we maintain the assumption that the policy maker is biased towards undertaking the project ($p > 0$). Second, in contrast to the policy maker, the median voter is biased against undertaking the project ($m < 0$). Third, the extent to which the median voter is biased against the innovation is uncertain. This is formalized by assuming that m is distributed uniformly over the interval $[m^e–e, m^e+e]$, where m^e is the expected value of m and e is the half-width of the distribution. Finally, we assume that $m^e+e > –t$.

The resulting model describes a situation where the policy maker's and the median voter's preferences are (partially) opposed. The second assumption implies that in a pooling equilibrium, in which no communication between the advisor and the median voter occurs, the project is not undertaken. As a consequence, if the policy maker wants to undertake the project, she must convince the median voter to vote for the innovation. The last assumption is made to ensure that the problem of the selection of an advisor is an interesting one. If $m^e+e < –t$, the median voter always votes against the innovation, irrespective of the realisation of ϵ. Then the policy maker may choose any advisor, who may send any message, so that a pooling equilibrium occurs.

The extension of the model discussed in Section 2 with the median voter, implies that there are now two receivers of the message sent by the advisor. Basically, the equilibrium concept remains the same. Now the three players' strategies have to be optimal responses to each others' strategies and both receivers must update their beliefs using Bayes' rule. The following strategies and beliefs form a perfect Bayesian equilibrium:

$$\text{Advisor:} \quad \begin{cases} \text{send G if } a_j \geq -\epsilon \\ \text{send B if } a_j < \epsilon \end{cases} \tag{IIa}$$

$$\text{Median voter:} \quad \begin{cases} X_m \text{ if message = G and } m + E(\epsilon|G) \geq 0 \\ S_m \text{ if message = B or if } m + E(\epsilon|G) < 0 \end{cases} \tag{IIb}$$

$$\text{Beliefs:} \quad \begin{cases} E(\epsilon|B) = 1/2(-t - a_j) \\ E(\epsilon|G) = 1/2(t - a_j) \end{cases} \tag{IIc}$$

$$\text{Policy maker:} \quad \begin{cases} X_p \text{ if message = G} \\ S_p \text{ or } X_p \text{ if message = B} \end{cases} \tag{IId}$$

$$\begin{cases} a_j = p \text{ if } m^e - e \geq 1/2(p - t) \\ a_j = 1/3[2(m + e) + t + 2p]+ \\ -1/3\{[2(m + e) + t + 2p]^2+ \\ -12(m + e)p + 3t^2\}^{1/2} \\ \text{ if } m^e - e < 1/2(p - t) \end{cases} \tag{IIe}$$

To show that the above strategies and beliefs form perfect Bayesian equilibria, we distinguish two cases.

3.1. *Case (I):* $m - e \geq 1/2(p - t)$

If $a_j \geq -\epsilon$ the advisor prefers the project to the status quo and if $a_j < -\epsilon$ the advisor prefers the status quo to the project. Hence, sending message G in case $a_j \geq -\epsilon$ and sending message B in case $a_j < -\epsilon$ is optimal if G leads and B does not lead to implementation of the project. Below it is shown that this is indeed the case.

The optimal response of the median voter to the message G is to vote for the proposal X_p, since expected utility of the innovation is positive if G is observed ($m+1/2(t–p) \geq 0$). If the message is B the median voter rejects the proposal X_p, because in that case he expects the innovation to yield a lower utility than the status quo ($m+1/2(–t–p) < 0$).

The strategy of the policy maker concerns a decision whether or not to propose the innovation and a decision which advisor to consult. If the message G is observed the policy maker attains higher expected utility from the innovation than from the status quo because $p + 1/2(t–a_j)$ is positive. In that case the policy maker knows that if she proposes the innovation the median voter will support it. Hence, it is optimal to propose the innovation if G is observed. If the message B is observed the policy maker is indifferent between X_p and S_p, since then the median voter in parliament will reject the innovation.

The discussion of the strategies of the policy maker and the median voter shows that the project is undertaken if the advisor sends the message G. The status quo remains in case message B is sent. Hence, the policy maker's expected utility is the same as in Section 2.2:

$$E(U) = Prob(G) \cdot E(U(x) \mid G) = \frac{1}{2t}[p(t + a_j) + \tfrac{1}{2}(t^2 - a_j^2)] \tag{9}$$

Again, the policy maker can determine the optimal advisor by maximizing (9) with respect to a_j. The solution to this problem yields $a_j = p$.

In the present case, the outcomes of the game with the median voter are similar to the outcomes of the game without a median voter. Of course, the reason for this is that the median voter is only weakly biased against the policy innovation. As a consequence, message G from an advisor whose predisposition coincides with that of the policy maker convinces the median voter that the proposal must be accepted.

3.2. *Case (II):* $m^e - e < \tfrac{1}{2}(p - t)$

In this case uncertainty about the preferences of the median voter affects the characteristics of our model. The median voter's decision concerning the innovation depends on m. If message G is sent by the advisor the median voter votes for the innovation if $m \geq -\tfrac{1}{2}(t-a_j)$ and otherwise he votes against it. As before a message B convinces the median voter that the innovation is not in his interest, because $m < 0$.

It is optimal for the advisor to send message G if $\epsilon \geq -a_j$ and message B otherwise, if there is a positive probability that the project is undertaken when message G is sent. Since the policy maker always puts forward the proposal to parliament if message G is sent ($p > 0$), this requires that $Prob(m+E(\epsilon \mid G)>0) > 0$. In Appendix C it is shown that this inequality holds for the advisor selected by the policy maker.

Since there is a positive probability that the median voter votes for the innovation if message G is sent and $p > 0$, message G induces the policy maker to propose the innovation to parliament. Because message B induces the median voter to vote against the proposal, the policy maker is indifferent between X_p and S_p when message B is sent.

Finally, we have to show that the policy maker selects an advisor characterised by (IIf). Obviously, given the above strategies and beliefs, the policy maker's utility is equal to zero if message B is sent or if the median voter votes against the innovation. The policy maker attains positive utility if the advisor sends message G and the median voter votes for the innovation. Policy maker's expected utility is equal to:

$$E(U_p) = \text{Prob}(G) \cdot E(U(x) \mid G) \cdot \text{Prob}(m + E(\epsilon \mid G) > 0) \\ = \tfrac{1}{2t}[p(t + a_j) + {}^{1\!}/_{2}(t^2 - a_j^2)]\tfrac{1}{2e}[m^e + e + {}^{1\!}/_{2}(t - a_j)] \tag{10}$$

The last term of (10) reflects that if the median voter observes message G there is still a chance that he votes against the proposal. In Appendix A it is shown that maximising (10) with respect to a_j and solving for a_j yield (IIf).

In contrast to the model discussed in Section 2 the present model does not yield a transparent expression for the optimal advisor (at least for $m^e - e < {}^{1\!}/_{2}(p-t)$). To gain insight into the factors determining the nature of the advisor, we differentiate (IIf) with respect to the key parameters of the model yielding:

$$1 > \partial a_j/\partial p > 0; \partial a_j/\partial m^e > 0 \text{ and } \partial a_j/\partial e > 0. \tag{11}$$

(see Appendix B). Hence,

$$\left.\begin{array}{l}\text{the more the policy maker is biased towards the innovation (p)} \\ \text{the less the median voter is biased against the innovation } (m^e) \\ \text{the greater is the uncertainty about m (e)}\end{array}\right\} \begin{array}{l}\text{the} \\ \text{higher} \\ \text{is } a_j\end{array}$$

The above comparative static results clearly illustrate that in selecting an advisor, the policy maker faces a trade off between acquiring information and providing information. On the one hand, the policy maker has an incentive to choose an advisor whose predisposition is near his own predisposition to obtain information about the desirability of undertaking the project. On the other hand, the policy maker is inclined to choose an advisor whose predisposition is closer to that of the median voter to convince the median voter of the desirability of the project. This trade off implies that if the benefits from acquiring information increase or the benefits from providing information decrease the policy maker chooses a higher a_j.

The first comparative static result states than an increase in p induces the policy maker to choose a higher a_j. Communication between the policy maker and the advisor deteriorates if the policy maker would not consult an advisor with a higher predisposition towards the project. Basically, this effect is analogous to the finding in Section 2. However, the effect of an increase in p on a_j is smaller than in Section 2, because an increase in a_j is expected to decrease communication between the median voter and the advisor.

The second result identifies the effect of the median voter's expected predisposition on a_j. A rise in m^e reduces the conflict between the median voter and the policy maker. As a consequence, the benefits of providing information by choosing a low a_j reduce. This finding suggests that the median voter has an incentive to pretend to be more biased against the innovation than he actually is. This provokes the policy maker to choose a lower a_j, so that the median voter obtains more information about ϵ.

Finally, the third result states that greater uncertainty about the median voter's predisposition increases a_j. A higher value of e implies that the median voter's decision concerning the project depends more heavily on the realisation of m and less on a_j. In fact, the policy maker becomes more uncertain about whether communication between the advisor and the median voter occurs. This reduces the benefits from providing information and therefore induces the policy maker to choose a higher value of a_j. This result indicates that although the median voter has an incentive to pretend to be more biased against the innovation than he actually is, he has no incentive to create uncertainty about his predisposition.

4. Discussion

In this paper we have analysed a model in which a policy maker may consult an advisor for two reasons. First, a policy maker may interact with experts in order to gain information about the consequences of the decisions she makes (i.e., information motive). Second, a policy maker may choose an advisor in order to support political legitimacy of her policy decisions. To put it differently, a properly chosen expert may help a policy maker to convince parliament or the electorate about the desirability of policy measures (i.e., persuasion motive).

In our model there are three players: (1) a policy maker; (2) the median voter of parliament or of the electorate; (3) an advisor. The advisor has private information about the consequences of policy. Communication between an advisor and a recipient improves as their preferences are closer aligned. Hence, preferences play an important role in our analysis. We have obtained the following results.

First, if the preferences of the policy maker and the median voter are closely aligned, the policy maker chooses an advisor who provides the precise information she wants. In this case the information motive dominates the persuasion motive.

Second, if the preferences of the policy maker and the median voter become more opposed, then the preferences of the optimal advisor are more in line with the preferences of the median voter. Now the persuasion motive becomes more important.

Third, higher uncertainty about the preferences of the median voter decreases the difference between the preferences of the optimal advisor and the preferences of the policy maker. Thus, uncertainty increases the relative importance of the information motive to the persuasion motive.

Some extensions of the model are left for future research. First, we have assumed that the advisor is for free. Relaxing this assumption does not affect our results as long as (a) payments to the advisor are not state contingent and (b) if the benefits of the advisor to the policy maker (concerning gaining information and convincing the median voter) outweigh the cost. Second, the model can be analysed in a dynamic setting. This raises the issue of the advisor's reputation. Still the same results of our analysis apply, if payments to the advisor's are not state contingent and if the advisor discounts the future heavily. Third, in our model we have assumed that the policy maker can choose only one advisor. Although this is a simplification, in a multi-advisor setting the policy maker still has an incentive to distort information provision to the median voter in order to increase the probability of acceptance of the innovation (like in Section 3). Therefore, we believe the nature of our results to remain if a policy maker can choose more advisors.

Finally, our model revolves around a "yes or no" decision. This raises the question whether our results extend to a decision about how much money to spend on a project. Because the analysis of a model with continuous message and action spaces is very difficult, we have not considered this case. However, we conjecture that the spirit of our model will not change. Crawford and Sobel (1982) show that with continuous action and message spaces, the type space of messages is divided in intervals. In partially pooling equilibria, different types of senders send different messages. In our model, this would imply that the selected advisor makes a statement about the proper range in which the amount of money to spend on the project should lie. Again however, perfect communication between the advisor and the policy maker is possible if their preferences are perfectly aligned. Hence to obtain information, the policy maker should consult an advisor whose predisposition towards the project is equal to that of herself. Adding a political constraint to the model may induce the policy maker to consult an advisor whose predisposition is closer to that of the median voter. If he does not, and the median voter is strongly biased against the innovation, no communication between the advisor and the median voter will occur, so that the proposal will be rejected.

Notes

1. The results of the analysis do not depend on the assumption concerning the distribution of ϵ.
2. This is simply a normalisation. If advisors differ in their attitudes towards the status quo this can be captured by the parameter a_j in (2) without loss of generality.
3. Throughout the paper it is assumed that the advisors know the realisation of ϵ exactly. This assumption is not responsible for the results of this paper. For example, adding another stochastic term to (1) and (2), so that the advisors are also imperfectly informed about the

effects of the innovation does not alter our conclusions. What matters is that the advisors are better informed about the effects of the innovation than the policy maker.

4. The analysis of the opposite case ($p < 0$) is analogous. Moreover, throughout the paper it is assumed that any player in the game who is indifferent between the status quo and the innovation supports the innovation.

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Appendix A

The policy maker chooses the advisor by maximizing her expected utility:[1]

$$E(U_p) = \frac{1}{2t}[p(t+a) + \frac{1}{2}(t^2 - a^2)]\frac{1}{2e}[m^e + e + \frac{1}{2}(t-a)] \tag{A1}$$

with respect to a. To find a maximum we derive the first-order condition

$$\frac{\partial E(U_p)}{\partial a} = \frac{1}{4et}[(p-a)(m^e + e + \frac{1}{2}(t-a)) - \frac{1}{2}[p(t+a) + \frac{1}{2}(t^2 - a^2)]] = 0 \tag{A2}$$

After some straightforward algebra it can be shown, that the above equation holds if

$$\frac{3}{4}a^2 - a[Q + \frac{1}{2}t + p] - \frac{1}{4}t^2 + pQ = 0$$

where $Q = m^e + e$. There are two solutions to this quadratic function:

$$a = \frac{2Q + t + 2p}{3} \pm \frac{\sqrt{(2Q + t + 2p)^2 - 12pQ + 3t^2}}{3} =$$

$$= \frac{2Q + t + 2p}{3} \pm \frac{\sqrt{(t + 2p - Q)^2 + 3(t + Q)^2}}{3}$$

To see which solution yields a maximum we calculate the second-order derivative of $E(U_p)$ with respect to a:

$$\frac{\partial^2 E(U_p)}{\partial a^2} = \frac{1}{8te}(3a - [2Q + t + 2p]) \tag{A3}$$

This equation has to be negative. This holds when

$$a = a^* = \frac{2Q + t + 2p}{3} - \frac{\sqrt{(t + 2p - Q)^2 + 3(t + Q)^2}}{3} \tag{A4}$$

Note

1. To facilitate notation we drop the subscript j of a.

Appendix B

We determine how the expression for the optimal advisor depends on some parameters of the model. First, we derive the partial derivative of a* with respect to m^e. Note that m^e enters as a determinant of a through Q, because $Q = m^e + e$. Hence,

$$\frac{\partial a^*}{\partial m^e} = \frac{\partial a^*}{\partial Q}\frac{\partial Q}{\partial m^e} = \frac{\partial a^*}{\partial Q} \tag{B1}$$

because the first-order derivative of Q with respect to m^e equals 1.

$$\begin{aligned}
\frac{\partial a^*}{\partial m^e} &= \frac{2}{3} - \frac{1}{3}\frac{1}{2}\frac{6(t + Q) - 2(t + 2p - Q)}{\sqrt{(t + 2p - Q)^2 + 3(t + Q)^2}} \\
&= \frac{2}{3} - \frac{2}{3}\frac{2Q + t - p}{\sqrt{(t + 2p - Q)^2 + 3(t + Q)^2}} \\
&= \frac{2}{3}\left[1 - \frac{Q - p}{\sqrt{(t + 2p - Q)^2 + 3(t + Q)^2}} - \frac{Q + t}{(t + 2p - Q)^2 + 3(t + Q)^2}\right]
\end{aligned}$$

Since Q–p $<$ 0 and Q+t $>$ 0, it holds that

$$\begin{aligned}
\frac{\partial a^*}{\partial m^e} &> \frac{2}{3}\left[1 - \frac{Q + t}{\sqrt{(t + 2p - Q)^2 + 3(t + Q)^2}}\right] > \\
&> \frac{2}{3}\left[1 - \frac{Q + t}{\sqrt{3(t + Q)^2}}\right] = \frac{2}{3}\left[1 - \frac{1}{\sqrt{3}}\right] > 0
\end{aligned} \tag{B2}$$

Second, we derive how a* depends on e. Because e enters as a determinant of a* through Q, it follows straightforwardly that

$$\frac{\partial a^*}{\partial e} = \frac{\partial a^*}{\partial Q}\frac{\partial Q}{\partial e} = \frac{\partial a^*}{\partial m^e} > 0 \tag{B3}$$

Third, we derive how a* is related to p.

$$\frac{\partial a*}{\partial p} = \frac{2}{3} - \frac{1}{3}\frac{1}{2}\frac{4(t+2p-Q)}{\sqrt{(t+2p-Q)^2+3(t+Q)^2}} = \tag{B4}$$

$$= \frac{2}{3}\left[1 - \frac{t+2p-Q}{\sqrt{(t+2p-Q)^2+3(t+Q)^2}}\right] > \frac{2}{3}\left[1 - \frac{t+2p-Q}{\sqrt{(t+2p-Q)^2}}\right] = 0$$

Furthermore,

$$\frac{\partial a^*}{\partial p} = \frac{2}{3}\left[1 - \frac{t+2-Q}{\sqrt{(t+2p-Q)^2+3(t+Q)^2}}\right] < \frac{2}{3} < 1 \tag{B5}$$

Appendix C

We have to show that in equilibrium the probability that the median voter votes for the innovation given that message G is sent is positive:

$$\text{Prob}(m + E(\varepsilon \mid G) > 0) = \int_{-\frac{1}{2}(t-a*)}^{m^e+e} \frac{1}{2e} dm > 0$$

The above inequality applies if $-½(t - a^*) < m^e + e$. This holds if $a^* - 2Q - t < 0$. Using

$$a^* = \frac{1}{3}[2Q + t + 2p] - \frac{2}{3}\sqrt{(Q-p)^2 + (Q+t)(p+t)} \tag{C1}$$

we see that

$$\begin{aligned} a^* - 2Q - t &= \tfrac{2}{3}[p - t - 2Q] - \tfrac{2}{3}\sqrt{(Q-p)^2 + (Q+t)(p+t)} = \\ &= \tfrac{2}{3}\left[(p-Q) - (Q+t) - \sqrt{(p-Q)^2 + (Q+t)(p+t)}\right] < \\ &< \tfrac{2}{3}\left[(p-Q) - (Q+t) - \sqrt{(p-Q)^2}\right] = -\tfrac{2}{3}(Q+t) < 0 \end{aligned}$$

since (1) $p > Q = m^e + e$ and (2) $Q + t = m^e + e + t > 0$ by assumption.