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Democracy, visibility and public good provision

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Abstract

We examine the role of *visibility* in influencing government resource allocation across a multiplicity of public goods. We show that a "visibility effect" distorts governmental resource allocation such that it helps explain why governments neglect provision of essential public goods, despite their considerable benefits. We show that greater democratization widens the gap in resource allocation between more visible (such as famine prevention) versus less visible (such as malnutrition prevention) public goods, up to an intermediate level of democracy. Beyond this level, this gap decreases. Furthermore, public goods with low visibility are prone to multiple equilibria in resource allocation, with voter expectations being shown to be important.

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1. Introduction

Many developing countries are characterized by governmental neglect of basic amenities such as adequate access to health and educational services. A number of development economists have wondered how governments that fail to provide public goods with obvious benefits to the electorate have been able to get away with it for so long.[1] In fact, we often observe political

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[1] As Dreze and Sen (1995), speaking of education provision in India, put it: "The empowerment of basic education is so obvious that there is something puzzling in the fact that the promotion of education has received so little attention from social and political leaders... (and) provoked so little political challenge." Indeed this puzzle is reinforced by Psacharapoulous (1994) who documents that the returns to education in many developing countries are in fact quite substantial.

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competition and agitation on issues other than those that may yield the greatest benefits. This paper throws light on these preceding issues and asks the following questions. Why may governments be good at providing some public goods, but not others? Further, what is the impact of the extent of democratization on the nature and extent of public good provision? Our answers focus on the role that differences in the *visibility* of public good outcomes have in affecting governmental responsiveness.

We define public goods as being less visible if it is harder to assess government competence, based on observed outcomes. These differences in visibility can arise because of two reasons. First, if some public good outcomes are intrinsically harder to directly observe or measure. For instance, compare the visibility of the occurrence of malnutrition with that of famines. The loss of life in a famine – concentrated in space and time – is certainly a much more directly observable outcome than the loss of life due to malnutrition. This is despite the much greater loss of life that occurs due to malnutrition. Indeed as pointed out by Dreze and Sen (1989) the loss of life due to malnutrition is equivalent to "three hundred Jumbo Jet crashes a day, with no survivors, and more than half the victims being children". Such differences in visibility are ubiquitous – for example, it is easier to assess the quantity of a public good provided than its quality (Hirschmann, 1967); similarly, short term outcomes are typically more visible than those that occur in the long run (Rogoff, 1990). For citizens trying to infer government competence based on public good outcomes, lower visibility of outcomes makes inference harder. In addition a second reason for lower visibility of a public good arises due to a public good's "complexity" – in that a large number of factors apart from government competence affects its outcome. In the case of such complex public goods, it is harder to isolate the role of the government's competence in determining their outcome – even if the outcome itself is easily observable. For instance, economic outcomes such as the degree of literacy in a population may be easy to observe, but this outcome depends upon a number of factors other than government competence alone – be it parents' attitudes to education and awareness of its value or teachers' commitment – that determines outcomes. In this case too, citizens will find it harder to assess government competence based on the observed outcome. Therefore 'complex' public goods which are easy to directly observe, may have low visibility.

Differences in visibility across public goods affect their provision because of an essential aspect of governance: governments are required to provide *multiple* goods and services – from disaster relief to drinking water, from education to defense – rather than perform a single well-defined task. Accordingly, voters' assessment of a government's competence, and hence their voting decisions, are based on the government's performance on a *vector* of outcomes. If outcomes of some tasks are harder to observe or measure, it is harder for voters to assess a government's ability based on these tasks. Governments, being in the business of maximizing their electoral possibilities, are aware of this. Since outcomes depend both on the ability of the government and the resources allocated by it, the government has an incentive to allocate relatively more resources to high visibility public goods, so as to project high ability. We capture these ideas by adapting Dewatripont et al. (1999a,b) career concerns model to a political economy context. Therefore we emphasize that a government's success in providing one public good may well be related to its failure to provide another. We also show that political salience of a public good outcome has much to do with the relative visibility of its outcome, and little to do with its contribution to voter welfare.

Given visibility differences, we then go on to examine the effects of greater *democratization*, through political competition, on governmental incentives. We show that greater democracy can increase the extent of distortion in the over-allocation of resources to the more visible public good – we call this the "visibility" effect. This effect offsets the standard efficiency effect whereby greater democracy also mitigates the moral hazard in government effort (Ferejohn, 1986).

Thereby, democratization results in a decrease in the *relative* amount of resources allocated to the less visible public good.[2] This is consistent with Sen's (1982) observations about the country's remarkable success in famine prevention, since independence where he argues that: "Given the political system in India, it is essential to avoid famines for any government keen on staying in power…". However, consistent with our argument Sen goes on to observe that " India's record on eliminating endemic non-acute hunger is quite bad It is amazing that in a country with as much politicization as India has, the subject of persistent hunger of a third of the rural population can be such a tame issue…. non-acute, regular starvation does not attract much attention in newspapers'. Our argument here suggests that democratic India's relative success in ensuring famine prevention cannot be studied in isolation, but rather, is closely connected to its abysmal failure in preventing the less visible problem of malnutrition.[3]

Our preceding analysis throws light on how differences in the extent of democracy may affect the provision of less versus more visible public goods across countries. However, such an explanation does not address the fact that there exist large differences in public good provision even for countries at very similar levels of democracy and development.[4] In a simple extension of our benchmark model, we show that public goods with lower visibility are particularly prone to multiple equilibria in resource allocation. Furthermore, we show that the relationship between the degree of democracy and the resource allocation gap between the more and less visible public goods can be non-monotonic: the distortionary gap due to the 'visibility effect' can increase with greater democracy, up to some *intermediate* level of democracy, but beyond this level, the gap narrows. This result is consistent with the fact that lower visibility goods such as health or education do not suffer from neglect in highly democratic countries. For developing countries, the multiplicity of equilibria here suggests that changing voter expectations through greater political activism and media awareness campaigns can help improve provision of low visibility goods.

This paper's emphasis on the role of visibility in affecting government responsiveness complements some of the recent literature on the political economy of government responsiveness in developing countries. For instance, Besley and Burgess (2002) and Stromberg (2004) analyze the role of the media in promoting political competition and thereby increasing government responsiveness in providing public goods. In contrast, we focus on the impact on government incentives of *intrinsic* visibility differences across a *multiplicity* of public goods. Political competition does increase government responsiveness – but more for some public goods than others. A second strand in this literature examines the importance of heterogeneity of preferences in influencing government responsiveness.[5] While acknowledging the importance of heterogeneity (and inequality) in influencing government decisions, we deliberately abstract away this important issue, in order to delineate the impact of differences in visibility of public

[2] Consistent with our analysis, Gauri and Khaleghian (2002) provide cross-country evidence which suggests that democracies have poorer immunization coverage than autocracies. Democracies spend a higher proportion on (arguably the more visible) curative health care rather than the (less visible) preventive health care.

[3] According to Devereux (2000), out of the famine-related death toll of 70 million lives in the twentieth century, less than a hundred thousand have been lost in democratic countries. China and the former Soviet Union account for about 80% of the lives lost. This is despite the fact that democratic India, with amongst the highest rates of malnutrition in the world may be the most vulnerable.

[4] For example, the relative success of Sri Lanka in terms of social sector outcomes (such as literacy and infant mortality) stands in sharp contrast to the abysmal performance of its neighbors in South Asia, such as Bangladesh and India (see Anand and Kanbur, 1989).

[5] This primarily empirical literature includes Betancourt and Gleason (2000), Foster and Rosenzweig (2001) among others. Our analysis suggests that by ignoring the differences in visibility across public goods, these papers could be missing out an important aspect of public good provision.

goods in a transparent manner. However, in an extension we show that such visibility differences are pervasive – and not undermined by heterogeneity (Majumdar et al., 2004). A third strand of the literature on government responsiveness focuses on the role of coalitions and their effectiveness in lobbying for scarce public resources – the most influential work here is by Bardhan (1984, 1998). More broadly, our paper is clearly related to the (large) political economy literature which examines policy inefficiencies due to reputational reasons (for a survey see Chapter 4 in Persson and Tabellini, 2000). Here the paper perhaps closest in spirit, is Coate and Morris (1995). In a signaling framework where there is voter uncertainty about an incumbent's preferences, they show that an incumbent may choose an inefficient (and less visible) policy instrument, in order to conceal the fact that it is making transfers to a special interest. In contrast, in our career concerns framework the choice of the more visible policy is primarily due to voter uncertainty about the incumbent's ability.

Section 2 gives an outline of the benchmark model and then proceeds to examine the impact of democratization on public good provision. In Section 3, we extend the benchmark model to show the existence of multiple equilibria in public good provision especially for low visibility goods, and demonstrate the non-monotonic relationship between democracy and the gap in resource allocation. In Section 4 we discuss additional aspects of the model.

2. The benchmark model

We develop a stylized political economy model of resource allocation across sectors that is based on the career concerns framework.[6] The key elements of our model are as spelt out below.

2.1. Production of public goods

An incumbent government is responsible for the provision of a multiplicity of public goods and services to the electorate, be it education, health, roads or defense. The output for any particular public goods is a stochastic function of the government's competence, the resources allocated by it and other exogenous factors. We capture this by focusing on a government that provides two public goods, A and B, where the production function for each good is a function of the government's ability or talent τ, the government's resource or effort allocation e_j, such that the realized level of public good z_{jt} in period t is given by:

$$z_{jt} = \tau + e_{jt} + \epsilon_j \qquad \text{where} \qquad j \in \{a,b\} \tag{1}$$

Observe that public good output is also affected by exogenous stochastic factors which are captured by a stochastic term ϵ_j where $\epsilon_j \sim N(0,\sigma_j^2)$. Without loss of generality, we assume that there is more noise in the observed outcome for good B than for good A, i.e. $\sigma_a^2 < \sigma_b^2$.[7] This

[6] In what follows, we draw on the Dewatripont et al. (1999a,b) particular formulation of Holmstrom (1982, 1999) career concerns model. Dewatripont et al. (1999b) explore a multi-task version of performance in bureaucracies; their analysis is not about electoral outcomes. More importantly, their analysis largely abstracts away from the issue that is of central interest to us – namely the impact of differences in the visibility across tasks. In contrast their focus is on the level of overall effort put in by an agent.

[7] For expositional ease, we have assumed that government ability τ influences output symmetrically across the two goods. Our model is robust to the case where this symmetry is broken. For instance, our basic framework can easily incorporate scenarios where talent matters *more* for the outcome of the good with the greater noise in observed outcome (good B here), provided the difference in the noise terms across the two goods is large enough. The production function for good B would be modified to $z_b = k\tau_b + e + \epsilon_b$, $k > 1$.

stochastic term also captures the influence of a host of exogenous factors or complementary inputs that affect the observed realization of the public good. For example, the quantity and quality of public education provision is a function not only of the government resource allocation towards education and its ability to design a good school system, but also other factors beyond the government's control, such as the parental education and involvement in their children's education, the competence of teachers and other location or school specific factors.[8] Alternatively, the level of a public good observed and consumed by a citizen may itself be subject to a stochastic shock.[9]

There is a cost associated with providing resources to both goods, captured by the function $C(e_a, e_b)$ which is assumed to be symmetric in both its arguments, and twice continuously differentiable, where e_j is the resources and effort allocated towards provision of public good j. While these resources are allocated across the public goods, we assume (as is standard in the career concerns framework) that the precise allocation is not observable to the citizens. This assumption is particularly easy to defend in a developing country context, where voter illiteracy, corruption and a lack of transparency are rife. Indeed, even if published, information on public good expenditures are notoriously unreliable.

2.2. Information, visibility and voter inference

Governance is a multi-faceted task which requires a unique blend of skills. Not surprisingly, it is ex ante difficult to reliably determine how effective a particular government will be at performing a particular task. This makes the career concerns framework particularly apposite. Accordingly, we assume (as in the standard career concerns model) that the true ability of the incumbent government τ is not known to anyone, including the government itself. However, both the government and the citizen–voters share a common prior that its talent is drawn from a normal distribution with mean $\overline{\tau}$ and variance σ_τ^2.

The economy contains citizens of unit mass who derive utility from consuming the two public goods. We further assume that citizen–voter preferences across the public goods are identical, such that $U_t=\lambda z_{at}+(1-\lambda)z_{bt}$.[10] While these citizen–voters do not know the incumbent government's ability ex ante, they can update their assessment of its ability by examining its performance in providing the public good outputs. Ceteris paribus, a higher realized output of good A, results in the citizen–voter having a more favorable perception of the government's ability, and hence improves the latter's chances of remaining in power. This follows from the fact that a key aspect of the career concerns formulation is that resources e_j are a substitute for ability τ_g. It implies that an increased allocation of resources by a government can favorably affect the

[8] In an earlier version of the paper, we explicitly incorporated the influence of these associated inputs by a simple modification of the production function. In particular, $z_{jt}=\tau+e_{jt}+\epsilon_j+\sum_{i=1}^{n_j}\theta_i$ where the associated inputs θ are such that $\theta_i \sim N(0, \sigma_\theta^2)$. Accordingly, we could assume that the technology of producing public good A requires fewer associated inputs than good B, i.e. $n_a \leq n_b$. In other words, task B is more "complex" than task A in that many more factors outside the government's control affect its outcome. While this is analytically equivalent to our present formulation (in that variance of good B is higher), we dispense with it in order to minimize notational complexity. Nevertheless, we will subsequently refer to this formulation too, since it allows for a richer interpretation of our notion of "visibility".

[9] For instance, the realized level of public good provision – be it irrigation, education or health, may itself be subject to regional, sectoral or temporal shocks.

[10] This assumption helps emphasize that differences in resource allocation may come about even in the absence of voter heterogeneity. This issue is further discussed in Section 4, where we sketch out the implications of relaxing the assumption of voter homogeneity.

citizen–voter's inference of its ability. In turn, this suggests that when scarce resources have to be allocated across a multiplicity of public goods, the government's gains from allocating more resources to the more "visible" public good – i.e. where the citizens' inference process is likely to be sharpest. This is key to our argument: differences in visibility across public goods result in differences in weights attached to these goods' outcomes in inference of government ability. Therefore in what follows, we show how a government interested in enhancing its reputation will have an incentive to skew resources in favor of public goods where the impact on the public's inference is highest.

2.3. The political structure: the government and the degree of democracy

We now sketch out the features of the underlying political game as well as describe the preferences of the various agents in our economy – the government as well as its citizen–voters. We use a simple two period political game that assumes that there is an incumbent politician who wants to retain office for the entire two periods. While in office he allocates effort and resources towards supplying a set of public goods, that may influence political outcomes. Depending on the degree of democratization, this incumbent may face an election, the outcome of which determines whether he will stay in office for the second period. The ability of the incumbent to successfully withstand (a randomly drawn) challenger's threat and retain office depends on two factors – the public's perception of the incumbent's ability as well as his 'charisma', relative to that of the challenger. We now elaborate.

In period one, the incumbent chooses how to allocate resources and effort optimally across public goods. The decision to allocate resources and effort across the public goods is made by an incumbent – who runs the government. The incumbent's preferences are such that he makes policy decisions with the aim of maximizing his chances of remaining in power and earning "ego" rents, at minimal effort.[11] Of course the ability of an incumbent to remain in power, is a function of the underlying political structure – whether it an autocracy, an imperfect or perfect democracy.

An important defining characteristic of a democracy is the degree of political competition. Typically, the more democratic country (i.e. greater political competition) a country is, the more sensitive is the government's ability to stay in power to citizens' perception of its competence. We capture this aspect of democratization in a particularly parsimonious way. Democracy $D \in [0,1]$ is simply defined as the likelihood that elections are held at the end of the first period. Here, the election is really a catch-all term to represent the degree to which the incumbent's ability to retain power in the second period depends on the citizen's perception of its competence. A greater likelihood of elections (higher D) implies that the government will have to put in effort to maximize its reputation for competence among citizens. With probability ψ, it retains power and enjoy "ego" rents R. With no elections, (probability $(1-D)$), it remains in power for sure, independent of its reputation and enjoys the same "ego" rents from doing so for a second period. Therefore the expected two-period payoff of an incumbent is as follows:

$$W_g = \sum_{t=1}^{2} [R + (R(1-D) + RD\psi)] - C(e_{at}, e_{bt}) \tag{2}$$

[11] It is straightforward to relax this assumption and assume that the incumbent also puts some weight on the public good outcomes themselves or on the preferences of the rest of the population.

The incumbent's cost/disutility of supplying resources and effort is given by C, where $C'>0$, $C''>0$ in both arguments.[12]

For reasons spelt out below, the citizen's second period utility from public goods is a function of the government's ability alone. Therefore, the incumbent government allocates resources and effort across the two public goods with a view of enhancing its reputation with the citizen–voters. In making his re-election decision, the citizen–voter assesses the incumbent's competence τ and compares it with the challenger's expected ability (which equals $\bar{\tau}_g$). In addition, there is a second "charisma" factor that citizens care about (see Rogoff, 1990). This is a catch-all term for non-ability based individual attributes of candidates that can affect electoral outcomes – from a candidate's looks, to his ethnicity or his sense of humor. We represent the charisma of the challenger, *relative* to the incumbent, by a variable c where $c \sim U[-c_0, c_0]$. It is realized immediately prior to the elections, after the incumbent has made the first period resource allocation decision. If the citizen–voter's estimate of the incumbent's ability is greater than $\bar{\tau}_g+c$ (i.e. the expected talent plus the relative charisma), he votes to retain the incumbent. If not, the incumbent must leave office at the end of period one.

2.3.1. The timing

We now summarize the timing of the above political game. At the beginning of the first period, the incumbent observes D and then chooses to expend a vector $\mathbf{e}$ of resources across the two public goods. The citizen, who (like the incumbent) does not know the ability of the government, observes the vector of first period public good outcomes $\mathbf{z}_1$ and arrives at a posterior estimate of the government's competence. If elections are held at the end of the first period (with probability D), then the incumbent faces a randomly drawn challenger. In this case, prior to voting the citizen–voters observe the relative charisma of the challenger vis-à-vis the incumbent. Elections are held and the incumbent is either replaced or retained for the second (and last) period. This newly elected (or re-elected) government determines public good output in the second period. At the end of this second period, public good outcomes are realized once again and payoffs are determined. On the other hand, if no elections were held (with probability $1-D$), then the incumbent remains in power for both periods.

2.4. Equilibrium analysis

We begin our analysis by first describing the first-best case, where policy decisions are made by a social planner. Describing this benchmark case will facilitate our understanding of the impact of political considerations on the policy decisions made by a selfish government.

Since the social planner aims to maximize the utility of the citizen–voters, the optimization exercise is straightforward. In particular, each period the social planner's choice of effort and resources is given by the following optimization:

$$\max_{e_a,e_b} \lambda E[(\tau + e_a + \epsilon_a)] + (1-\lambda)[(\tau + e_b + \epsilon_b)] - C(e_a,e_b)$$

[12] For simplicity there is no discounting between the first and second period. Of course, we can proxy for the effects of greater or lesser discounting by examining the effect of changes in the probability of elections D.

Taking first order conditions, the first-best allocation of resources between the two public goods is given by

$$\frac{\lambda}{1-\lambda} = \frac{\partial C(e_a,e_b)/\partial e_a}{\partial C(e_a,e_b)/\partial e_b} \tag{3}$$

where λ and $(1-\lambda)$ are the voter's utility weights attached to goods A and B, and e_j^{FB} is the first-best level of resources allocated towards good j. Therefore, resource allocation across the two public goods is a function of the citizen–voters preferences. For instance, the greater the weight on public good A (higher λ), the higher is the resource allocation towards it, i.e. $e_a^{FB} > e_b^{FB}$. If the citizen–voter cares equally about both public goods (i.e. $\lambda = 1/2$), we have $e_a^{FB} = e_b^{FB}$. We will refer back to this benchmark case, after we have analyzed the equilibrium of our political game, which we do next.

We start our analysis of the equilibrium of this game backwards, by first examining decision making in the second period.

2.4.1. The second period

The government that is in office in the second period has no electoral pressures. As is standard in career concerns models, this makes decision making in the second (and last) period straightforward. Since the incumbent does not care about the welfare of its citizen and has no prospect of re-election, he has no incentive to exert any effort.[13] With $e=0$, the second period public good output is entirely a function of the government's competence τ. If the incumbent is of higher ability, this automatically translates into higher public good output. It is because of this that the voter, in making his decision of whether to re-elect the incumbent at the end of period one, cares only about the government's ability. Keeping this in mind, we now turn to the equilibrium analysis that is of interest to us – namely, the first period.

2.4.2. The first period

In this period, politics matters. Here, the government's policy choices are driven by the fact that it wants to stay on in power. The voter's re-election decision depends upon two factors: the competence and the charisma of the incumbent, relative to those of the challenger.

The citizen–voter compares his updated estimate of the perceived competence, $E(\tau|\mathbf{z}, \mathbf{e}^*)$ with its ex ante estimate of a randomly drawn challenger's competence, $\overline{\tau}$. In addition, the voter takes into account the realization of the challenger's charisma c, which proxies for the all non-ability related stochastic factors that may influence elections. The incumbent is re-elected if $E(\tau|\mathbf{z}, \mathbf{e}^*) - \overline{\tau} \geq c$. For example, if c is positive the incumbent should have a sufficiently higher than average reputation to offset his "charisma" deficit. Keeping this in mind, the incumbent makes resource allocation decisions with a view to maximizing his probability of re-election ψ, where

$$\psi \equiv Pr[E(\tau|\mathbf{z},\mathbf{e}^*) - \overline{\tau} \geq c] = \frac{1}{2c_0}[E(\tau|\mathbf{z},\mathbf{e}^*) - \overline{\tau} + c_0], \tag{4}$$

[13] This assumption is easy to relax and instead the incumbent's preferences can place a positive weight on expected public good output. This will not change the qualitative nature of our analysis.

The last equality follows from the fact that c is uniformly distributed over support $[-c_0, c_0]$. Notice that the probability of re-election ψ is a *linear* function of the incumbent's ex post reputation.[14]

Given the above expression, any incumbent who wants to enhance his re-election chances, will have to boost his perceived ability with the citizen–voter. Of course, neither the resource allocation vector $\mathbf{e}$ nor the ability τ of the government are directly observable. This gives the incumbent an incentive to skew resources towards the public good which is most likely to influence voter perceptions of the ability of the incumbent. We now derive the incumbent's ex post reputation with the citizen–voter.

Here, the fact that all our random variables are normally distributed considerably eases computation. Not only is the posterior normally distributed, but also the following property of Bayesian updating yields a relatively tractable expression (derived in the Appendix A). In particular, if $z_j = \tau + e_j + \epsilon_j$ where $\tau \sim N(\overline{\tau},\ \sigma_\tau^2)$ and $\epsilon \sim N(0,\sigma_\epsilon^2)$, then the distribution of τ, conditional on observing z is also normal with mean $\frac{h_\tau \tau + h_\epsilon z}{h_\tau + h_\epsilon}$ and variance $\frac{1}{h_\tau + h_\epsilon}$, where $h_\tau = \frac{1}{\sigma_\tau^2}$ and $h_\epsilon = \frac{1}{\sigma_\epsilon^2}$ are the precisions of the two distributions.[15]

Using this insight, let us see how the voter would update his prior about the government's ability if he expects the government to choose a resource vector $\mathbf{e}^* = \{e_a^*, e_b^*\}$, and observes an outcome vector $\mathbf{z} = \{z_a, z_b\}$. From Eq. (1), the voter uses each outcome z_j to update his prior of the government's expected ability from $\overline{\tau}$ to $(z_j - e_j^*)$, with its associated variance σ_j^2. Therefore, his mean posterior assessment of the government's ability would be

$$E(\tau|\mathbf{z},\mathbf{e}^*) = \left[\frac{h_\tau \overline{\tau} + h_a(z_a - e_a^*) + h_b(z_b - e_b^*)}{h_\tau + h_a + h_b}\right] \tag{5}$$

where the terms $h_\tau = \frac{1}{\sigma_\tau^2}$ and $h_j = \frac{1}{\sigma_\epsilon^2}$.[16] These terms are the precisions of the different pieces of information, and hence they are used as weights on the prior and the two realizations, respectively.

We analyze a rational expectations equilibrium, so that the voters' expectations of the government's effort levels are realized in equilibrium.[17] For the rest of the paper, we focus on the first period, hence time subscripts are suppressed from now on. As seen from Eq. (5), the citizen's ex post assessment of the incumbent's ability is a random variable that is a function of z_a and z_b. Since the government is risk-neutral, it will maximize the *expected* value of this random variable over the entire *distribution* of possible outputs $\mathbf{z}$. In other words it will allocate effort and resources across the two tasks, to maximize $E[E(\tau|\mathbf{z},\ \mathbf{e}^*)]$ (net of its effort cost), where the first expectation is with respect to public good output $\mathbf{z}$ and the second expectation is with respect to ability of the government τ (the latter as expressed in (5) above).

[14] From a technical standpoint, we need to ensure that the probability that $E[\tau_g|\text{infoset}] - \overline{\tau}_g$ does not exceed c_0 nor is less than $-c_0$. This can be guaranteed (for example) by assuming that the size of c_0 is large, relative to the variances σ_τ^2 and σ_j^2.

[15] If instead, production also entailed a large number of additional inputs as in the production function $z = \tau + \sum_{i=1}^{n} \theta_i + \epsilon$ where $\theta_i \sim N(0,\sigma_\theta^2)$, then the distribution of τ, conditional on observing z is also normal with mean $\frac{h_\tau \tau + h_\epsilon z\theta}{h_\tau + h_{\epsilon\theta}}$ and variance $\frac{1}{h_\tau + h_\epsilon}$, where $h_\tau = \frac{1}{\sigma_\tau^2}$ and $h_{\epsilon\theta} = \frac{1}{\sigma_\epsilon^2 + n\sigma_\theta^2}$ are the precisions of the two distributions.

[16] We spell out the derivation in detail in the Appendix A. Also see DeGroot (1970).

[17] The government expends resources to influence public opinion, but the net effect in equilibrium, is zero. This can be seen from the fact that, given the voter's expected effort level e_j^* for task j, and an actual effort level e_j expended by the government, the voter's ex post assessment of expected value of τ would be $(\tau + e_j - e_j^*)$. Since $e_j = e_j^*$ in a rational expectations *equilibrium*, the government is not successful in influencing the voter's assessment.

The government's objective function for the first period, originally introduced in Eq. (2) can now be written as:

$$\max_{e_a,e_b} F \equiv R + \left[R(1-D) + RD\left[\frac{1}{2c_0}[E(E(\tau|\mathbf{z},\mathbf{e}^*)) - \overline{\tau} + c_0]\right] - C(e_a,e_b)\right] \tag{6}$$

Using Eq. (5) for $E(\tau|\mathbf{z}, \mathbf{e}^*)$ we now have,

$$E[E(\tau|\mathbf{z},\mathbf{e}^*)] = \left[\frac{h_\tau\overline{\tau} + h_a(\overline{\tau} + e_a - e_a^*) + h_b(\overline{\tau} + e_b - e_b^*)}{h_\tau + h_a + h_b}\right] \tag{7}$$

Assuming an interior solution, we can then maximize Eq. (6) with respect to e_a for the first period, which gives rise to,

$$F_a(e_a,e_b;\sigma_a,\sigma_b,D) \equiv \frac{RD}{2c_0}\frac{h_a}{(h_\tau + h_a + h_b)} - \partial C(e_a,e_b)/\partial e_a = 0 \tag{8}$$

Similarly, the equivalent expression for the first order condition with respect to e_b is,

$$F_b(e_a,e_b;\ \sigma_a,\sigma_b,D) \equiv \frac{RD}{2c_0}\frac{h_b}{(h_\tau + h_a + h_b)} - \partial C(e_a,e_b)/\partial e_b = 0. \tag{9}$$

The left-hand sides of (8) and (9) are increasing in h_j, where $h_j = \frac{1}{\sigma_\epsilon^2}$. This implies that the marginal benefit of effort in tasks A and B are decreasing in σ_a^2 and σ_b^2, respectively.[18] The above conditions tell us why a smaller resource allocation to the task with low visibility – either due to greater noise in observed outcomes, or due to a larger number of associated factors that affect outcomes – is an equilibrium.[19] If the voter finds public good A more visible than public good B, then the government will, on the margin, have an incentive to allocate more resources to making available good A rather than good B, provided the two public goods compete for the same set of resources (i.e. they are substitutes – $F_{ab}>0$). This arises because the voter, in assessing the government's competence, (correctly) puts a larger weight on the outcome of public good A than that of good B, since the outcome for good A (i.e. z_a) is less noisy than that for task B, z_b. The government hence responds accordingly, allocating more resources towards the visible public good A. Proposition 1 summarizes this result.

Proposition 1. *Given $F_{ab}>0$, $\forall\lambda\in[0,1]$, resource allocation to good j is decreasing in σ_j and increasing in σ_k where $j\neq k$ and $j, k=\{a, b\}$. In particular, the government allocates a larger share of total resources to the more "visible" public good A rather than the less "visible" public good B, i.e. $e_a^*>e_b^*$ if $\sigma_a^2<\sigma_b^2$.*

Proof. See the Appendix A. □

[18] When we use the interpretation of noise as coming from the number of complementary inputs, the marginal benefit would be decreasing in n_a and n_b.

[19] See the Appendix A for the derivation of Eqs. (8) and (9).

The above proposition makes a simple, though important point – governments with electoral concerns have an incentive to bias resource allocation in favor of the more visible public good.[20]

We highlight two aspects of this insight below.

The first point we emphasize is that visibility need not be construed only in the literal sense of outcomes being innately less or more *observable* to voters. Consider the case of underprovision in important social sectors such as health or education, where outcomes are in fact observable. In the case of many such public goods, there exist several associated factors and inputs that affect the final outcome.[21] This makes it more difficult to isolate the role of the government's competence in determining the outcome – even though the public good outcome itself is observable. In this sense, public goods with a larger number of associated inputs are less visible, whatever be their importance for overall welfare. For instance, in the case of education, literacy outcomes and access to schooling are not just functions of central government resource provision, but also a host of other factors – be it the quality of the bureaucracy, the nature of teachers unions or attitudes of the community and parents to children's education. Given many factors outside the government's control that affect outcomes, it is hard to disentangle the precise effect of the government's competence on the final outcome. Hence, voters are unlikely to place the blame for bad outcomes entirely on the government – just as they are unlikely to credit the government entirely for good outcomes. This is what reduces the government's incentive to put in effort into 'complex' tasks such as education where the outcome depends on several factors.

The second point that the above proposition throws light on is that *political salience* of a public good is not necessarily determined by its contribution to national welfare (α does not matter). This point is best analyzed by comparing the equilibrium to the political game, with the first-best policy decisions of a social planner, as captured in (3). Observe that in the political game, the government allocates resources and effort (e_a^*, e_b^*) such that (from (8) and (9)) the following holds:

$$\frac{h_a}{h_b} = \frac{\partial C(e_a,e_b)/\partial e_a}{\partial C(e_a,e_b)/\partial e_b}. \tag{10}$$

Let us compare the equilibrium allocation of the political game, with that of the social planner captured in (3). Notice that the equilibrium resource allocation in the political game (i.e. (10) above), involves $e_a^* > e_b^*$, so long as $\sigma_a < \sigma_b$. An increase in the ratio of the visibility across the two public goods, σ_a^2/σ_b^2, results in an increase in the gap in resources allocated across the two public goods. However, a change in the relative visibility of the two public goods has no impact on the first-best allocation (as seen from Eq. (3)). Quite strikingly then, our analysis suggests that the

[20] This result is in the spirit of Holmstrom and Milgrom's (1991) classic insight in the context of explicit contracts, applied to a political arena. However, an important point to note here is with respect to their offered *solution*. They suggest that the principal should optimally respond to this inefficiency by giving low powered incentives to bureaucrats, but this insight does not naturally transfer to our context. This is because, in the electoral context where the winner does take all, (the implicit) incentives are inevitably high powered. Thus, the problem pointed by Holmstrom–Milgrom is more acute in our political context. An additional issue is whether if the incumbent knows his own talent, will signaling considerations undermine our basic result. At the outset we should point out that this is not necessarily the case. In fact, even if an incumbent knows its own ability, it does not necessarily imply that signaling issues will arise, since in our benchmark model public good outcomes are additively separable in ability and resource allocation (see Eq. (1)). Therefore, if choice of effort is independent of talent, it is not informative about the incumbent's talent. However, signaling considerations will complicate the analysis if public good output is multiplicative in talent and ability – as is the case in Section 3.

[21] See Footnote 8 for a discussion on the role of multiple inputs.

introduction of political considerations makes the government's equilibrium effort and resource allocation *independent* of the preferences of the public. The distinction between the two scenarios is perhaps made most emphatically by considering the extreme case where the citizen does not derive any utility from the provision of public good A i.e. $\lambda \to 0$. Observe that, while a social planner would have allocated resources such that $e_a^{FB} = 0 < e_b^{FB}$, we have $e_a^* > e_b^*$ in any *political* equilibrium. Therefore, the efficiency cost of government behavior is decreasing in λ and σ_a.

To sum up, the incumbent government is interested in maximizing its chance of retaining power, rather than the level of social welfare. The citizen–voter is forward-looking and wants to have a higher ability government in power during the second period, so as to ensure the best possible public good outcomes in period two. Being aware of this, the incumbent attempts to manipulate the resource allocation across the two public goods with a view to convincing the voter that he is of higher ability. Hence he allocates resources across the public goods, more as a function of the relative differences in visibility of their outcomes, rather than as a function of the utility derived by the citizen–voter from these goods.[22]

The above discussion has highlighted the importance of the visibility of a public good – based either on the observability of its outcome, or on the strength of the link between outcome and government's competence – in understanding governmental incentives for public good provision. We now consider how the nature of the political regime may affect the politics of visibility in public good provision.

2.5. Democracy and public good provision

In this section we analyze the impact of democratization on governmental incentives for allocating resources across various public goods. In the interest of parsimony, we shall henceforth suppress the associated inputs θ_i in the production function. The role of these inputs was simply to highlight a specific, but important aspect of visibility, viz. the complexity of tasks, as discussed in Proposition 1. From now on, we consider output to be a function of the government's competence and effort, i.e. $y = \tau + e$.[23]

Increased democratization of a society has an impact on various aspects of a society. In what follows we focus on the greater political competition that such democratization entails. The theoretical literature has focused on the fact that increased political competition is likely to mitigate the problem of moral hazard (Ferejohn, 1986) and adverse selection (Rogoff, 1990). While these positive incentive effects emphasized in the theory are very plausible, the empirical evidence regarding the effects of greater democracy on various indicators of development is more mixed (for instance, Gauri and Khaleghian, 2002). Therefore, we take a closer look at the impact of greater political competition. Our focus is on how greater democracy, through a rise in political competition, affects a government's incentives to channelize resources *across* public goods of varying visibility.

[22] However, we should also point out that a greater allocation of resources for the more visible public good may be due to other reasons. For instance, heterogeneity in preferences where the majority community prefers the public good that happens also be more `visible'. Therefore if majority preferences rule, then more resources will be allocated to the more visible public good, which is preferred by the majority. Similarly, greater allocation of resources towards the more visible good will arise if there exists a lobby pushing for more of the visible public good, with a simultaneous absence of a countervailing lobby for the less visible public good.

[23] For this altered production function, the modified expression for $[E(E(\tau|\mathbf{z}, \mathbf{e}^*)$ in (5) is $\left[\frac{h_\tau \tau + h_a(\tau + e_a - e_a^*) + h_b(\tau + e_b - e_b^*)}{h_\tau + h_a + h_b}\right]$ where the weights would change to $h_a = 1/\sigma_a^2$ and $h_b = 1/\sigma_b^2$.

Unlike in the two papers cited above, greater political competition under a more democratic regime has *two* distinct effects on governmental incentives in our framework. First, the threat of losing power has a positive incentive effect and spurs the government to greater overall effort. This is the standard benefit that arises when elections mitigate moral hazard on the part of the incumbent. We call this the '*efficiency effect*' of greater democracy. However, with multiple public goods thereis a second less desirable incentive effect – the need to enhance reputation with voters induces the government's incentive to inefficiently skew resources to the more visible public goods, away from the less visible goods. We call this the '*visibility effect*' of elections. What then is the net effect of greater democratization on governmental incentives to mobilize and allocate resources across competing public goods? We address this question in the following proposition.

Proposition 2. *An increase in the degree of democracy D, results in:*

(i) an increase in the aggregate effort allocated towards public good provision and
(ii) a rise in the gap in resource allocation between the more visible and the less visible public good, provided the two tasks are substitutes (i.e. $F_{ab}>0$*) and the costs of production are not 'too convex' (i.e.* $\frac{|C_{ab}+C_{aa}|}{|C_{ab}+C_{bb}|}<\frac{\sigma_b^2}{\sigma_a^2}$*).*

Proof. See the Appendix A. □

Based on Proposition 2, the combination of the efficiency effect and the visibility effect gives rise to three possibilities, with regard to the level of resources allocated to the individual public goods, even as overall resource allocation increases.

In particular, increased democratization can result in one of the following possibilities. First, there could be an increase in the absolute level of resources allocated to the more visible good, with no change in the level of resources allocated to the less visible good. Alternatively, there could be an increase in the absolute amount of resources devoted to both public goods, but with a smaller increase in the resources devoted to the less visible good. This happens if, with greater democracy, the 'efficiency effect' is sufficiently larger that the 'visibility effect'. What is noteworthy here is that, irrespective of the relative magnitude of the 'visibility' and 'efficiency' effects outlined above, an *initial increase* in democracy results in *a rise in the gap in resource allocation* between the less and more visible public goods. This is confirmed in condition (ii) in Proposition 2 states that this gap rises when (a) the two public goods are substitutes, i.e. $F_{ab}>0$ and (b) as long as the cost curve is not 'too convex'. This latter condition is more likely to hold at low levels of democracy, where overall effort will be lower.

Thus, unlike in the theoretical literature cited earlier, our analysis shows that every increase in the extent of democracy need not always imply a uniform improvement – in this case, in the provision of all public goods.

We now examine how these effects of democracy on public good provision under a more general production function, yielding both similar as well as additional insights on the impact of visibility.

3. Do voter expectations matter?

Our analysis so far has shown that low visibility public goods, such as health, sanitation or the quality of education may receive relatively scant attention, particularly in democracies. But it is hard to believe that such relative neglect of low visibility public goods would be true in highly democratic countries. Also, we must readily admit that there is wide variation even in the experience of countries at similar levels of democracy, or even across regions within countries, with respect to such public good provision. For instance, the state of Kerala in India boasts rates of

literacy and child mortality that are far superior to those in other wealthier parts of the country, at levels comparable to those in the developed world. Neighboring Sri Lanka, with a level of democracy and development comparable to that in India, has done a distinctly better job in the provision of education, health and other social welfare services. These issues are of pivotal importance in Sri Lanka's elections.[24]

To address these concerns, we turn to a more general production function that introduces complementarity between talent and effort where output of public good j is given by $y_j=\tau(\mu_j e_j+k_j)+e$ (instead of the additively separable function in talent and effort used earlier).[25] We find that allowing for complementarity between talent and effort in the production function yields some interesting additional insights, while preserving the basic result presented in the earlier section.

As before, the voter updates his assessment of the government's competence, based on the observed outcomes. Given that we use a multiplicative production function here,

$$E(\tau|z_a,\, z_b,\, e_a^*,\, e_b^*) = \frac{1}{[h_\tau + h_a' + h_b']}\left[h_\tau\overline{\tau} + \frac{h_a'(z_a - e_a^*)}{(\mu_a e_a^* + k_a)} + \frac{h_b'(z_b - e_b^*)}{(\mu_b e_b^* + k)}\right] \tag{11}$$

where the weights h_τ, h_a' and h_b' represent the inverse of the variances for τ, $\frac{(z_a-e_a^*)}{(\mu_a e_a^*+k_a)}$ and $\frac{(z_b-e_b^*)}{(\mu_b e_b^*+k)}$ respectively.[26]

As before, the government's objective function is to maximize $E[E(\tau|z_a, z_b, e_a^*, e_b^*)]-C(e_a, e_b)$. For task j (given task $i\neq j$), the optimal effort level under this modified production function is given by the solution to[27]

$$\overline{\tau}D\frac{(\mu_j e_j^* + k_j)(\overline{\tau}\mu_j + 1)}{(\mu_j e_j^* + k_j)^2 + \frac{\sigma_j^2}{\sigma_\tau^2} + (\mu_i e_i^* + k_i)^2\frac{\sigma_j^2}{\sigma_i^2}} = C_j(e_i,e_j) \tag{12}$$

To keep things as close to the original model, we will assume that $\mu_a=0$, $k_a=1$, so that the production function for A reduces to the additive form used before. For task B, we will assume that $\mu_b=1$, $k_b=k>0$, so that the production function for B is of the form $y_b=\tau(e_b+k)+e_b$, multiplicative in talent and effort.

With these parameter values, Eq. (12) for the optimal effort for A reduces to $F_a=0$, i.e.:

$$\overline{\tau}D\frac{1}{1 + \frac{\sigma_a^2}{\sigma_\tau^2} + (e_b^* + k_b)^2\frac{\sigma_a^2}{\sigma_b^2}} = C_a(e_a,e_b) \tag{13}$$

Similarly, for task B, the corresponding expression works out to be $F_b=0$, i.e.:

$$\overline{\tau}D\frac{(e_b^* + k)(\overline{\tau} + 1)}{\frac{\sigma_b^2}{\sigma_a^2} + \frac{\sigma_b^2}{\sigma_\tau^2} + (e_b^* + k)^2} = C_b(e_a,e_b) \tag{14}$$

[24] See Anand and Kanbur (1989) on this.

[25] This production function was introduced by Dewatripont et al. (1999a,b) who also highlight the potential for multiplicity of equilibria. However, their analysis is restricted to visibility problems in the *single* task case or with respect to *aggregate* output. Since we focus on varying visibility across *multiple* tasks, their analysis is not directly transferable to our case.

[26] This expression is the equivalent of Eq. (5) in the additively separable production function, with θ_i dropped.

[27] Here $\lambda=0$, $\delta=1$, for simplicity. See the Appendix A for further details.

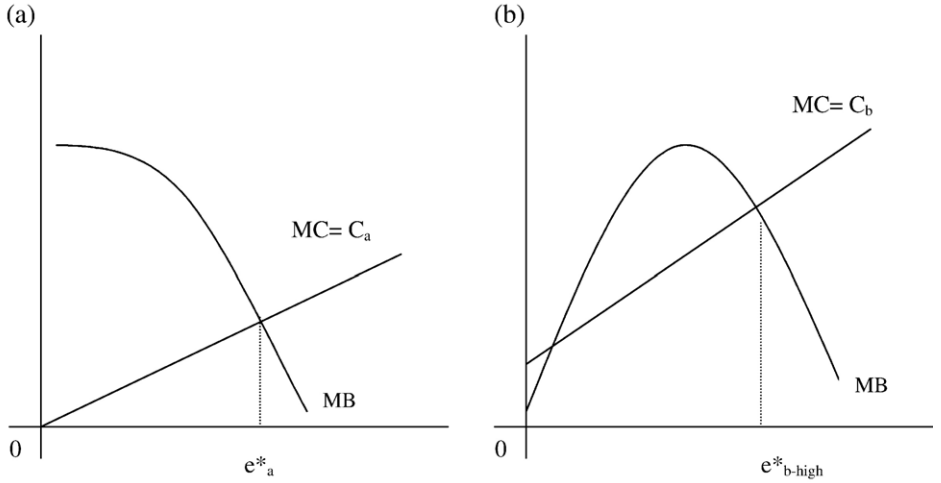

Fig. 1. Uniqueness and multiplicity in public good provision.

The expressions on the left-hand sides of Eqs. (13) and (14) are the marginal benefit from effort for tasks *A* and *B* respectively. For task *A*, the marginal benefit is linear in e_a, as before. Note that, in task *B*, with complementarity between effort and ability, the marginal benefit varies with the effort level.

As seen in Fig. 1(a) and (b) the number of equilibrium effort levels depend upon the shape of the marginal benefit (MB) curve of each public good. For task *A* the MB curve is a straight line. For task *B*, the slope of the MB curve is:

$$\frac{D(\overline{\tau}+1)(e_b^*+k)^2}{\sigma_a^2\sigma_\tau^2\left(\frac{\sigma_b^2}{\sigma_a^2}+\frac{\sigma_b^2}{\sigma_\tau^2}+(e_b^*+k)^2\right)^2}\left[\frac{\sigma_b^2}{(e_b^*+k)^2}\left(\frac{1}{\sigma_\tau^2}+\frac{1}{\sigma_a^2}\right)-1\right] \tag{15}$$

If σ_b^2 were small, the numerator in (10) would be negative for all e_b (because the first term in square brackets would be less than 1). If so, marginal benefit would be monotonically decreasing in effort. However, for large enough values for σ_b^2, the term in square brackets is positive at low levels of effort, so the marginal benefit curve first rises in effort and then falls. Fig. 1(a) and (b) are drawn for low values of σ_a^2 and high values of σ_b^2, respectively.[28]

Further, recall that a noisier outcome in task *B* also increases the optimum effort level in task *A*. Given substitutability of effort across tasks, a large σ_b^2 not only lowers the marginal benefit of resources devoted to *B*, but also raises the marginal cost for *B* (i.e. the *y*-intercept in Fig. 1(b)). Therefore, at zero effort, the marginal cost of effort can exceed the marginal benefit in good *B*. Lemma 1 captures the implication of this fact for equilibrium outcomes.

[28] Observe from Eq. (15) that if task A had a multiplicative production function, a small enough σ_a^2 would result in a downward sloping MB curve. We use the linear production function, and hence the horizontal MB curve for *A* to simplify exposition.

Lemma 1. *Given $\mu_j > 0$ (a multiplicative production function), public goods j with a large σ_j^2 (low visibility) are prone to having multiple equilibria in resource allocation.*

Proof. See the Appendix A. □

Thus, there can be multiple (stable) equilibria for task *B*, including one at zero effort; in task *A*, however, only a unique equilibrium effort level can exist, given a horizontal marginal benefit curve and an upward sloping marginal cost curve. As seen in Fig. 1(b) then, an economy could be caught in a low-equilibrium trap in the provision of low visibility public goods. Intuitively, if the electorate expects low effort by the government but sees a large output realized, it is more likely to credit such an outcome to chance, or to the complementary inputs, rather than to the government's ability; hence the government has little incentive to put in effort, given low expectations. On the brighter side, however, it is precisely in the case of such public goods that there can be a significant improvement in outcomes because of say, public awareness or media campaigns. By increasing voter expectations of government's (equilibrium) effort, such campaigns increase the government's incentive to put in effort. With higher expected effort, good outcomes are attributed more to the government's ability than to the quality of other exogenous factors or to pure luck.

The phenomenon described here accords with the idea that voter apathy can lead to inferior outcomes – although it also suggests that a more demanding electorate can improve outcomes in low visibility public goods such as health (malnutrition), education, etc., through higher expectations. In the absence of such concerted demands for better government, more democratization could actually worsen the provision gap between high and low visibility public goods. This is the next issue that we address.

Proposition 3. *Given Lemma 1 and an equilibrium where $e_B^* = 0$ initially, an increase in D widens the gap in the resources allocated between the more and the less visible public goods, up to some intermediate level of democracy $D' > 0$. However, for $D > D'$, this gap decreases.*

Proof. See the Appendix A. □

Fig. 2(a) and (b) consider the impact of an increase in the degree of democracy on the marginal benefit and marginal cost curves of both tasks. An increase in the degree of democracy shifts the marginal benefit (MB) curve upwards for both tasks (as seen from Eq. (12)).

In the case of the high-visibility good *A*, there is always an increase in the optimum level of effort, starting from the unique initial equilibrium. Given substitutability across goods, this shifts up the marginal cost (MC) curve for good *B*. Starting from $e_B^* = 0$, small increases in the degree of democracy can result in the new MC curve still being higher than the new MB curve. Thus, in spite of an increase in democracy, the low-visibility task could remain stuck at the low equilibrium trap, even as the equilibrium effort in the high visibility task increases – raising the effort gap across tasks. For larger increases in *D*, the upward shift in the marginal benefit curve eventually dominates the shift in the cost curve (provided the degree of substitution across tasks, C_{ab} is not too large). For a sufficiently high degree of democracy then, the outcome in the low-visibility task has a unique high-effort equilibrium as well, such that further increases in democracy bring down the resource-effort gap between the two public goods.

Thus, allowing for interaction between effort and ability in the provision of public goods provides us with two additional insights. First, it shows that voter expectations can play a crucial role in determining outcomes in the provision of low visibility public goods such as health, sanitation or education (as opposed to famine relief or defense during war). To this end, it suggests a role for active public awareness and mass communication campaigns to improve outcomes. Also good governments can have spillover effects beyond their tenure in office: by raising the expectations of the

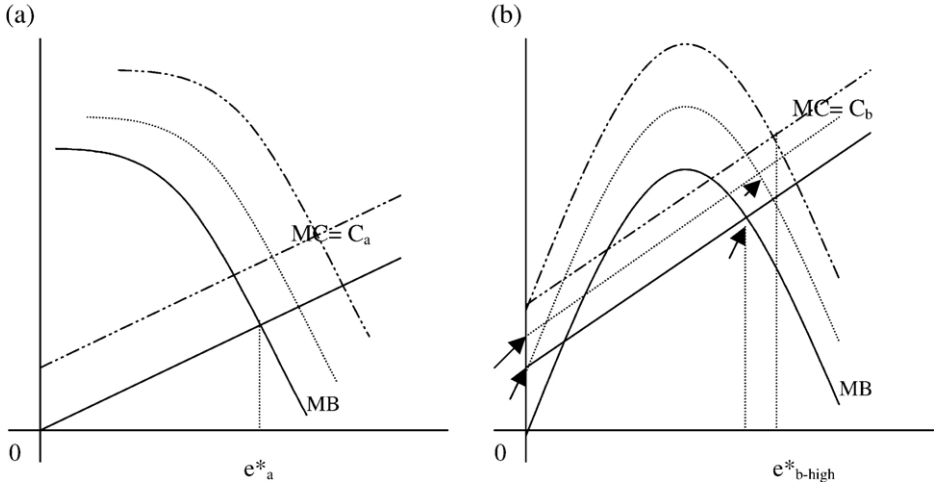

Fig. 2. Non-monotonic change in effort gap as democracy increases.

electorate, they could permanently improve matters. Second, we find that the impact of greater democracy on the provision of low-visibility public goods need not be monotonic – greater democracy can worsen the gap in resource allocation between the high and low visibility public goods at initial stages of democracy; things do however improve at high levels of democracy.

4. Discussion

The previous sections analyzed the role of differences in visibility in affecting public good outcomes. Further, we dissected the impact of greater political competition on public good provision, in the presence of these visibility differences. In this sub-section, we sketch the implications of relaxing some of our modeling assumptions. Finally, we draw on case studies to illustrate the relevance of our analysis to developing countries.

4.1. Heterogeneity

In our analysis of the political economy of public good provision so far, we have relied on a representative voter framework, so as to highlight the impact of differences in the visibility on public good provision. This might suggest that the politics of visibility is only applicable to public policies that engender *low* dimensional conflict amongst a heterogeneous set of voters. In this section we sketch out an example to suggest that visibility can be important even in the presence of heterogeneity among voters.[29]

Heterogeneity can take various forms – with differences not only in preferences of different voters/voter groups, but also in the visibility of various public goods to them. We adapt the benchmark model and describe a simple example where there are two voter groups *a* and *b* that differ from each other in their preferences *and* also the visibility of the two public goods. Accordingly, not only does group *a* (*b*) prefer good *A* (*B*), it is also better positioned to assess

[29] A more complete treatment of the impact of heterogeneity on visibility effects is provided in an urban–rural context in Majumdar et al. (2004).

government performance in providing good A (B) than good B (A). We capture this by assuming that each group can only observe the outcome of the public good they care about. In addition, we assume that members of group a observe outcome in good A with less noise than their counterparts in group b can observe the outcome for good B, i.e. $\sigma^2_{bB} > \sigma^2_{aA}$, where σ^2_{gG} is the noise in the outcome of good G observed by members of group g. Such differences in visibility across groups of voters may arise, for instance, if members of group a are more literate or have better access to information through the media. To keep things interesting, we assume that the proportion p_a of group a voters is larger, i.e. $p_a > 1/2$. In the framework sketched above, we can show that the optimal effort level for good A is given by: $p_a \frac{\sigma^2_\tau \sigma^2_{bB}}{(\sigma^2_\tau \sigma^2_{bB} + \sigma^2_{aA}\sigma^2_{bB} + \sigma^2_\tau \sigma^2_{bB})} = \partial C(e_a, e_b)/\partial e_a$. We similarly obtain an equivalent expression for the optimal effort level for public good B.

In the presence of such heterogeneity, can visibility differences induce the government to bias resources in favor of good A, even if the majority group prefers the other good, B? We can show (using the expressions for optimal effort delineated above) that a bias in resources allocation towards a minority exists if $\frac{p_b}{1-p_b} < \frac{\sigma^2_{bB}}{\sigma^2_{aB}}$. This condition states that as long as either (i) the majority group B is not too large or (ii) the minority group's visibility is sufficiently higher than that of the majority, resources will be skewed in favor of the minority group's preferred public good A.

While extremely simple, the above example captures the essence of our argument – that even with heterogenous preferences among voter groups of different sizes, the impact of visibility can be strong enough to overwhelm the impact of preferences of the majority group.

5. Conclusion

This paper is an attempt to understand the incentives that underlie government responsiveness to various issues (see Bardhan, 2003 for a broader discussion). We make a simple point, that we argue deserves more attention – namely that the 'visibility' of a public good matters. In a world where governments provide a multiplicity of public goods, differences in the extent of visibility across public goods, distort governmental incentives. Governments have an incentive to allocate public resources towards more visible goods. Our model provides an explanation for government neglect in the provision of several essential public goods, despite their considerable benefits and throws light on the even more puzzling phenomena of voter apathy towards such neglect. We demonstrate that greater democratization widens the gap in resource allocation between more versus less visible public goods, up to an intermediate level of democracy. Beyond this level, the gap decreases. Furthermore, public goods with low visibility are more prone to multiple equilibria in resource allocation, with outcomes being a function of voter expectations.

We believe that further exploration of the relationship between governmental responsiveness and the visibility of economic outcomes will be fruitful. A number of issues warrant closer attention. Firstly, democracy has many dimensions though our analysis has focused on political competition. However, democratization is also accompanied with greater transparency and media freedom – which itself may affect the degree of visibility.[30] Similarly, little understood is the relationship

[30] While such a richer notion of democracy would have implications for our analysis, it is unlikely to affect the thrust of our basic argument. In particular, we conjecture that while public officials are likely to be more responsive when a free press exists, their responsiveness will depend on the 'newsworthiness' of individual public good issues/outcomes. However, the 'newsworthiness' of an issue itself, may be related to its visibility. Hence, explicitly incorporating a role for greater press freedom as an aspect of democracy will not completely undermine the role of visibility in determining resource allocation decisions (see working paper version of the paper for a more complete analysis of these issues). As Sen (1982) himself admits in the context of malnutrition: "non-acute, regular starvation does not attract much attention in newspapers. These standard events in India seem not to be newsworthy."

between the quality (talent) of political candidates with increased democratization. Secondly, it would also be useful to further explore different dimensions of the relationship between visibility and voter heterogeneity. Finally, it would be of particular interest to empirically analyze the implications of differences in visibility on government expenditures. We leave these and other issues for future work.

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Appendix A

A.1. Derivation of Eqs. (5) and (7)

For a single task outcome $z=\tau+e+\epsilon$, Bayes' rule says:

$$p(\tau|z,e^*) = \frac{p(\tau)p(z|\tau,e^*)}{p(z|e^*)}$$

Since τ and ϵ are all normally distributed, $z \sim N(\overline{\tau}, \sigma_\tau^2+\sigma_\epsilon^2)$. Then, we can write the conditional distribution (see DeGroot, 1970 for details)

$$p(\tau|z,e^*) = \frac{p(\tau)p(z|\tau,e^*)}{p(z)} = \frac{\frac{1}{\sqrt{2\pi}}\frac{1}{\sqrt{\sigma_\tau^2}}e^{-\frac{1}{2\sigma_\tau^2}(\tau-\overline{\tau})^2}\frac{1}{\sqrt{2\pi}}\frac{1}{\sqrt{\sigma_\epsilon^2}}e^{-\frac{1}{2\sigma_\epsilon^2}(z-\tau-e^*)^2}}{\frac{1}{\sqrt{2\pi}}\frac{1}{\sqrt{\sigma_\tau^2+\sigma_\epsilon^2}}e^{-\frac{1}{2(\sigma_\tau^2+\sigma_\epsilon^2)}(z-e^*-\overline{\tau})^2}}$$

$$= \frac{1}{\sqrt{2\pi}}\frac{1}{\sqrt{v^2}}\exp\left[-\frac{1}{2v^2}\left(\tau^2 - 2\tau\left\{\frac{h_\tau\overline{\tau}+h_\epsilon(z-e^*)}{h_\tau+h_\epsilon}\right\} + \left\{\frac{h_\tau\overline{\tau}+h_\epsilon(z-e^*)}{h_\tau+h_\epsilon}\right\}^2\right)\right]$$

where $v^2 = \frac{\sigma_\tau^2\sigma_\epsilon^2}{\sigma_\tau^2+\sigma_\epsilon^2} = \frac{1}{\frac{1}{\sigma_\tau^2}+\frac{1}{\sigma_\epsilon^2}}$, $h_\tau = \frac{1}{\sigma_\tau^2}$ and $h_\epsilon = \frac{1}{\sigma_\epsilon^2}$.

From the above, we can infer that the conditional distribution of $(\tau|z)$ is normally distributed with mean $\frac{h_\tau\overline{\tau}+h_\epsilon(z-e^*)}{h_\tau+h_\epsilon}$ and variance v^2.

Applying the same logic to the case where the voter's inference is based on two outcomes z_a and z_b, instead of a single z, we obtain Eq. (5), i.e.

$$[E(\tau|\mathbf{z},\mathbf{e}^*)] = \left[\frac{h_\tau\overline{\tau}+h_a(z_a-e_a^*)+h_b(z_b-e_b^*)}{h_\tau+h_a+h_b}\right]$$

where $h_j = \frac{1}{\sigma_j^2}, \quad j=\{a,b\}$.

Then, substituting $E(z_j)=\overline{\tau}+e_j$, we have Eq. (7), i.e.

$$E_z[E(\tau|\mathbf{z},\mathbf{e}^*)] = \left[\frac{h_\tau\overline{\tau}+h_a(\overline{\tau}+e_a-e_a^*)+h_b(\overline{\tau}+e_b-e_b^*)}{h_\tau+h_a+h_b}\right]$$

Substituting the expression for $E_z[E(\tau|\mathbf{z}, \mathbf{e}^*)]$ from the above equation into Eq. (6) and differentiating with respect to effort levels e_a and e_b, we obtain Eqs. (8) and (9), respectively.

Proof of Proposition 1. Differentiate (8) and (9) with respect to σ_a^2 to obtain,

$$F_{aa}\frac{\partial e_a}{\partial \sigma_a^2}+F_{ab}\frac{\partial e_b}{\partial \sigma_a^2}+F_{a\sigma_a^2}=0$$

$$F_{ba}\frac{\partial e_a}{\partial \sigma_a^2}+F_{bb}\frac{\partial e_b}{\partial \sigma_a^2}+F_{b\sigma_a^2}=0$$

We obtain a similar expression by differentiating (8) and (9) with respect to σ_b^2. $|F_{a\sigma_a^2}| = |\frac{-(h_b+h_\tau)h_a^2}{(h_a+h_b+h_\tau)^2}| > |\frac{h_b h_a^2}{(h_a+h_b+h_\tau)^2}| = |F_{b\sigma_a^2}|$ and $|F_{bb}| > |F_{ab}|$ (given symmetric cost functions), where the latter two terms are both negative. This gives us $\frac{de_a}{d\sigma_a^2} = \frac{-F_{a\sigma_a^2}F_{bb}+F_{ab}F_{b\sigma_a^2}}{F_{aa}F_{bb}-F_{ab}F_{ba}} < 0$. In other words, an increase in σ_a^2 results in a reduction in e_a in period one. Similarly, we can calculate the change in effort allocated towards public good *B*, when the variance associated with good *A* goes up. Since we assume that the allocation of effort across the two tasks are symmetric substitutes, we have $F_{ab}=F_{ba}>0$ which results in $\frac{\partial e_b}{\partial \sigma_a^2} = \frac{-F_{aa}F_{b\sigma_a^2}+F_{a\sigma_a^2}F_{ba}}{F_{aa}F_{bb}-F_{ab}F_{ba}} > 0$. A decrease in the variance associated with public good *B* results in an decrease in the effort allocated to public good *A*. □

Proof of Proposition 2. Since the production function being used is $z=\tau+e+\epsilon$, we need to replace h_a and h_b in the first order conditions in (8) and (9) with $h_a=1/\sigma_a^2$ and $h_b=1/\sigma_b^2$, respectively.

Then, differentiating F_a and F_b with respect to D, we have: $F_{aD} = \frac{Rh_a}{h_a+h_b+h_\tau} = \frac{R\sigma_b^2\sigma_\tau^2}{\sigma_a^2+\sigma_b^2+\sigma_\tau^2} > 0$ and $F_{bD} = \frac{Rh_b}{h_a+h_b+h_\tau} = \frac{R\sigma_a^2\sigma_\tau^2}{\sigma_a^2+\sigma_b^2+\sigma_\tau^2} > 0$. Differentiating Eqs. (8) and (9) we have

$$\frac{de_a^*}{dD} = \frac{-F_{bb}F_{aD_m}+F_{bD_m}F_{ab}}{F_{aa}F_{bb}-F_{ab}^2} \quad \text{and} \quad \frac{de_b^*}{dD} = \frac{-F_{aa}F_{bD_m}+F_{aD_m}F_{ab}}{F_{aa}F_{bb}-F_{ab}^2}.$$

Here, for $j=\{a,b\}$, $j'=\{b,a\}$, $F_{jj}=-C_{jj}(e_a, e_b)<0$, $F_{jj'}=-C_{jj'}<0$ and $F_{jD}>0$. Let us define the aggregate change in effort, due to a change in the degree of democracy as $\Delta_+ = \left(\frac{de_a^*}{dD}+\frac{de_b^*}{dD}\right)$ and the change in the effort gap across the two tasks, due to a change in the degree of democracy as $\Delta_- = \left(\frac{de_a^*}{dD}-\frac{de_b^*}{dD}\right)$.

(i) $\Delta_+>0$ provided F_{aa}, $F_{bb}>F_{ab}$, which holds true. Hence aggregate effort always increases with an increase in D.

(ii) $\Delta_->0$ (given $\sigma_a^2<\sigma_b^2$), provided
(1) F_{aa}, $F_{bb}>F_{ab}$ and
(2) $\frac{|F_{aD}|}{|F_{bD}|} > \frac{|F_{ab}+F_{aa}|}{|F_{bb}+F_{ba}|} \Rightarrow \frac{\sigma_b^{22}}{\sigma_a^{22}} > \frac{|C_{ab}+C_{aa}|}{|C_{bb}+C_{ab}|}$.

Condition (1) holds true, as in part (i). Condition (2) holds provided $C(\cdot)$ is not too convex. Weak convexity implies that, for any given $\sigma_a^2<\sigma_b^2$ (that implies $e_a^*>e_b^*$, from Proposition 1), C_{aa} is not too large relative to C_{bb}.[31]

[31] For example, with a twice differentiable symmetric cost function such as $C(e_a, e_b)=(e_a^3+3e_a^2e_bq+3e_b^2e_aq+e_b^3)$, $q\in(0,1)$ being the degree of substitutability across the two tasks, this would simply imply that $\frac{\sigma_b^{22}}{\sigma_a^{22}}$ be large relative to $[6(e_a+e_b)/6(e_b+e_a)]=1$, which will always be true.

Given that Conditions (1) and (2) hold, and $e_a^* > e_b^*$ at any initial degree of democracy, the gap in resource allocation between the more and less visible good increases, as the degree of democracy rises, i.e. $\frac{d(e_a^* - e_b^*)}{dD} > 0$.

Thus, through (i) and (ii), respectively, we have shown that the aggregate effort and the gap in the effort across the two tasks increase with the degree of democracy D. □

1.2. Derivation of Eq. (12)

Using Eq. (11), the expression for $E_{\mathbf{z}}[E(\tau|z_a, z_b, e_a^*, e_b^*)]$ can be derived, so that the objective function of the government, $\text{Max}E[E(\tau|\mathbf{z}, \mathbf{e}^*)] - C(\mathbf{e})$ is now:

$$\max_{e_a,e_b} \frac{1}{h_\tau + h_a' + h_b'} \left[h_\tau \bar{\tau} + h_a' \left(\frac{(\bar{\tau}(\mu_a e_a + k_a) + e_a - e_a^*)}{\mu_a e_a^* + k_a} \right) + h_b' \left(\frac{(\bar{\tau}(\mu_b e_b + k_b) + e_b - e_b^*)}{\mu_b e_b^* + k_b} \right) \right] - C(e_a, e_b) \tag{16}$$

The first order conditions with respect to effort e_j, given $i, j = \{a,b\}$ are:

$$\frac{h_j'}{h_j + h_i' + h_\tau} \left[\frac{\bar{\tau}}{\mu_j + 1} \right] - C_j = 0 \tag{17}$$

The weights $h_\tau = \frac{1}{\sigma_\tau^2}$, $h_a' = \frac{(e_a^* + k_a)^2}{\sigma_a^2}$ and $h_b' = \frac{(e_b^* + k)^2}{\sigma_b^2}$, therefore

$$\frac{h_j'}{h_j' + h_i' + h_\tau} = \frac{(\mu_j + k_j)^2}{(\mu_j + k_j)^2 + (\mu_i + k_i)^2 \frac{\sigma_j^2}{\sigma_i^2} + \frac{\sigma_j^2}{\sigma_\tau^2}}$$

Given the parametric restrictions imposed on μ_a, μ_b, k_a and k_b, the first order conditions are then reduced to the forms expressed in Eqs. (13) and (14).

Proof of Lemma 1. (Refer to Fig. 1 (a) and (b).) Lemma 1 claims that there exist parameters such that there is a unique equilibrium in task A and multiple stable equilibria in task B (one at $e_b^* = 0$ and another at $e_b^* \gg 0$), as shown in Fig. 2(a) and (b). To prove Lemma 1, we spell out the conditions that ensure the existence of such an equilibrium, and the parametric restrictions that satisfy these conditions. We then use these conditions to establish Proposition 3.

Based on the marginal benefit (MB) and marginal cost (MC) curves in Fig. 1(a) and (b), the conditions for a unique equilibrium for good A and multiple equilibria for good B are: (1) The MB curve for good A is decreasing/linear in e_a, while that for good B is first increasing and then decreasing in e_b. (2) Over the rising segment of the MB_b curve, the slope of MC < the slope of MB. (3) MC < MB for good A at $e_a = 0$ and MC ≥ MB for good B at $e_b = 0$.

Condition (1) is a necessary (but not sufficient) condition for the presence of a unique equilibrium in good A and multiple equilibria in good B. Conditions (2) and (3) jointly ensure a unique intersection between the MB_a and MC_a curves, and multiple intersections between the MB_b and MC_b curves. We now demonstrate that for σ_a^2 small enough and σ_b^2 large enough, all the above three conditions are satisfied, hence generating the equilibrium proposed.

Part 1: To begin, fix k, $D = \hat{D}$, where $0 \ll \hat{D} \ll 1$, $\bar{\tau}$ and σ_τ^2. Thus, the only parameters that we perturb from now on, are σ_a^2 or σ_b^2.

From Eq. (13), Condition (1) holds for task A, since the expression for MB_a is linear in e_a. From (15), Condition (1) holds true for task B if the expression within square brackets in (15) is negative at low values of e_b, and positive for high values of e_b. To see that this does hold true note that, at $e_b=0$, this expression in (15) becomes $\frac{\sigma_b^2}{k^2}\left(\frac{1}{\sigma_\tau^2}+\frac{1}{\sigma_a^2}\right)$ which is greater than 1 for σ_a^2 low enough and σ_b^2 high enough. Further, this expression is decreasing in e_b, hence by continuity, there exists an $e_b'>0$ such that for $e_b \geq e_b'$, $\frac{\sigma_b^2}{(e_b+k)^2}\left(\frac{1}{\sigma_\tau^2}+\frac{1}{\sigma_a^2}\right)\leq 1$. Thus, Condition (1) is satisfied for σ_a^2 small enough and σ_b^2 large enough.

Part 2: From Part 1, there exists an e_b' such that $\left[\frac{\sigma_b^2}{(e_b+k)^2}\left(\frac{1}{\sigma_\tau^2}+\frac{1}{\sigma_a^2}\right)=1\right]$ in Eq. (15).[32] Then, Condition (2) requires that, for $e_b \in [0, e_b')$, the slope of the MB_b curve is greater than that of the MC_b curve, i.e.:

$$\frac{\hat{D}(\bar{\tau}+1)(e_b+k)^2}{\sigma_a^2\sigma_\tau^2\left(\frac{\sigma_b^2}{\sigma_a^2}+\frac{\sigma_b^2}{\sigma_\tau^2}+(e_b+k)^2\right)^2}\left[\frac{\sigma_b^2}{(e_b+k)^2}\left(\frac{1}{\sigma_\tau^2}+\frac{1}{\sigma_a^2}\right)-1\right] > C_{bb} \tag{18}$$

By continuity, the LHS of the above equation is positive, hence Condition (2) will hold, provided the cost function is not too convex.

Part 3: Condition (3) claims that there exist parameters such that $e_a^*=0$ is not an equilibrium, while $e_b^*=0$ is an equilibrium. To help demonstrate this claim, we first compute $\frac{de_b^*}{d\sigma_b^2}$. Using (13) and (14), by Cramer's rule:

$$\frac{de_b^*}{d\sigma_b^2}=\frac{-F_{aa}F_{b\sigma_b^2}+F_{ba}F_{a\sigma_b^2}}{F_{aa}F_{bb}-F_{ab}F_{ba}}$$

It can be verified that $F_{aa}<0$, $F_{b\sigma_b^2}<0$, $F_{ba}<0$, $F_{b\sigma_b^2}>0$, $F_{ab}<0$. Since $F_{bb}>0$ on the rising portion of the MB_b curve, it can be verified then, that $\frac{de_b^*}{d\sigma_b^2}>0$ on the rising portion of the MB_b curve (and $\frac{de_b^*}{d\sigma_b^2}<0$ on the falling portion of the MB_b curve, where $F_{bb}<0$).

Now we come to Condition (3). We may represent the cost curve $C(\cdot)\equiv C(e_a, e_b; q)$ where $q\in(0,1)$ is a parameter that captures the degree of substitutability across the two tasks. As with parameters k, D, $\bar{\tau}$ and σ_τ^2, assume a fixed value for q too, so that σ_a^2 or σ_b^2 are the only parameters we may perturb. Then, our claim is that there exist values for these parameters such that Condition (3) holds. This implies that, for σ_a^2 small enough and σ_b^2 large enough, $e_a^* \gg 0$ and $e_b^*=0$ is an equilibrium, i.e. Eqs. (13) and (14) would be:

$$\bar{\tau}\hat{D}\frac{1}{1+\frac{\sigma_a^2}{\sigma_\tau^2}+(e_b^*+k_b)^2\frac{\sigma_a^2}{\sigma_b^2}} > C_a(e_a, e_b^*; q)|_{e_a=0} \tag{19}$$

and

$$\bar{\tau}\hat{D}\frac{(e_b+k)(\bar{\tau}+1)}{\frac{\sigma_b^2}{\sigma_a^2}+\frac{\sigma_b^2}{\sigma_\tau^2}+(e_b+k)^2} \leq C_b(e_a^* \gg 0, e_b)|_{e_b=0} \tag{20}$$

where $e_b^*=0$ in (19). Suppose not. Then, there are three possible cases as listed below.

[32] Hence, for all $e_b\in[0,e_b']$, $F_{bb}\geq 0$, and the MB_b curve is upward sloping.

(i) LHS ≤ RHS in (19) and LHS > RHS in (20),
(ii) LHS > RHS in (19) but LHS > RHS in (20),
(iii) LHS ≤ RHS in (19) though LHS ≤ RHS in (20).

Let us take the first of the three cases above. Since LHS > RHS in (20) under this case, $e_b^* \gg 0$. Now consider how an increase in σ_b^2 would change this condition.[33] The effect on the LHS and the RHS of (19) depends on how e_b^* changes with σ_b^2. As shown above, at the stable positive e_b^*, $\frac{de_b^*}{d\sigma_b^2} < 0$.

Therefore, with a rise in σ_b^2, the LHS of (19) increases, and the RHS decreases. For a large enough increase in σ_b^2, we will have LHS > RHS in (19). Similarly, in (20) the LHS (evaluated at $e_b = 0$) falls due to the rise in σ_b^2, and given that $e_a^* \gg 0$ now, the RHS rises. Thus, with σ_b^2 large enough, Condition (3) is satisfied if case (1) initially holds.

Alternatively, consider the second case to be true initially. Again, an increase in σ_b^2 will increase the gap between the LHS and RHS in (19). In (20), a large enough rise in σ_b^2 will increase e_a^* sufficiently on the RHS, even as the LHS falls with a rising σ_b^2. Eventually, we have LHS ≤ RHS in (20), so that Condition (3) holds again.

Finally, in the third case, $e_b^* = 0$ initially. Then, an increase in σ_b^2 will increase the LHS in (19), with no change in the RHS at $e_a = 0$. For a large enough increase in σ_b^2, LHS > RHS in (19). As for (20), the gap between the LHS and RHS is widened further, so e_b^* remains at zero. Thus, Condition (3) is once again satisfied, for a large enough σ_b^2 (or equivalently, small enough σ_a^2).

Combining Conditions (2) and (3), there is a unique intersection between the MB_a and MC_a curves, but multiple intersections between the MB_b and MC_b curves (as shown in Fig. 1(a) and (b)). Thus, given σ_a^2 small enough and σ_b^2 large enough, Conditions (1), (2) and (3) ensure the existence of a unique equilibrium in task A and multiple equilibria in task B. □

Proof of Proposition 3. (Refer to Fig. 2(a) and (b).)

First, it can be verified that

$$\frac{de_a^*}{dD} = \frac{-F_{aD}F_{bb} + F_{bD}F_{ab}}{F_{aa}F_{bb} - F_{ab}F_{ba}} > 0$$

for $F_{bb} > 0$.

From Condition (3) above, LHS ≫ RHS in (20) for $D \in [0, \hat{D})$. By continuity, there exists a $D' \geq \hat{D}$ such that LHS = RHS in (20). Therefore, for any increase in D in the range from $[0, D')$, e_b^* remains at zero – i.e. there is no increase in e_b^* as D increases. Since e_a* is continuously increasing in this range, the gap between e_a^* and e_b^* is increasing in this range. For $D' \geq \hat{D}'$, $e_b^* \gg 0$, so that the gap between e_a^* and e_b^* drops. □

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[33] Alternatively, we could consider a decrease in σ_a^2. The idea is to lower the ratio $\frac{\sigma_a^2}{\sigma_b^2}$.

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