Centralized decision making and informed lobbying [1]

Rafael Costa Lima. Federal University of Pernambuco (UFPE).
Address: CCSA, Av. dos economistas s/n, Cidade Universitária, Recife-PE, Brazil. 50670-901.
Phone: 55 81 21238380-223.
E-mail: rafael.costalima@ufpe.br.

Humberto Moreira. Fundação Getulio Vargas (FGV/EPGE).
Address: Praia de Botafogo, 190, 11 andar, Botafogo, Rio de Janeiro-RJ, Brazil. 22250-900.
Phone: 55 21 3799 5828
Email: humberto.moreira@fgv.br

Thierry Verdier. Paris School of Economics (PSE).
Address: 48 boulevard Jourdan 75014 Paris France.
Phone: 33 (0)1 43 13 63 08
Email: thierry.verdier@ens.fr

[1] We thank Carlos da Costa, Emanuel Ornelas, Filipe Campante and Giovanni Maggi for useful comments and seminar participants in EPGE-FGV, USP, USP-RP, Ibmec-RJ, LACEA 2008, Rio, EEA 2009, Barcelona, NASM 2012, Evanston, IWGTS 2014, São Paulo, ESEM 2014, Toulouse. A preliminary version of this paper circulated with the title "Lobbying and information transmission in customs unions." Humberto Moreira gratefully acknowledges CNPq of Brazil for financial support.

Centralized decision making and informed lobbying

September 2015

Abstract

We address the tradeoff between centralized and decentralized decision making subject to influence from privately informed lobbies. We identify an information transmission effect under centralized structures. Such effect decreases capture and increases welfare when lobbies have "aligned preferences". The opposite effect holds for "polarized preferences". We apply the model to local public goods and customs unions agreements. Information transmission decreases welfare when the provision of local public goods is centralized through a common pool budget, while it increases welfare when budgets are separate. For customs union agreements, welfare (de)increases when lobbies represent (vertically related) competing industries.

JEL Classification: D72, D82, H41, F15

Keywords: centralization, asymmetric information, lobbying, public goods, custom unions.

1 Introduction

A classical question in Public Economics relates to the costs and benefits of centralization versus decentralization of public decision making and the allocation of decision rights inside governments. In his seminal work on the provision of local public goods, Oates (1972) addressed this issue, emphasizing the tradeoff between,

on the one hand, the internalization of cross-district externalities (favoring centralized systems), and, on the other hand, the reactivity to local citizen preferences (favoring decentralized systems). A subsequent literature extended that discussion to a political economy perspective, recognizing that centralized and decentralized public systems face different political constraints and incentives in terms of public spending and taxation (Inman and Rubinfeld (1997), Lockwood (2002) and Besley and Coate (2003)).

An important dimension along this line of research has been to highlight how different levels of governments may be subject to political influence by special interest groups that compete with each other in order to affect the policy process (Bardhan and Mookherjee (2000)). Two main channels of influence have been thereof emphasized. The first one relates to the presence of private information that can be disclosed and strategically distorted by these specific groups in order to obtain policies better fitting their own agenda. Alternatively, interest groups may also influence policymakers through bribes or financial contributions. In such a context, a number of natural questions arises. How do these channels of influence interact with the structure of decision making inside the government? How do these interactions frame the degree of competition for political influence and what are the consequences for the equilibrium public policies? What are the implications for the analysis of the costs and benefits of centralized and decentralized systems? What should be the optimal structure of government from the point of view of society?

The purpose of this paper is to consider these issues in a simplified context in which the two sources of influence of lobbies, information transmission and contributions, are closely connected. Specifically, we consider situations in which special interest groups have private information on how policies affect their payoffs, and use financial contributions to influence politicians and policymakers. In such a setting, we compare the influence of informed lobbying in centralized and decentralized public decision structures. Our departing point of analysis is to recognize two well-known but important features of centralized systems: (a) they concentrate the political competition for influence at a higher hierarchical and more encompassing level of government than decentralized systems; (b) they also tend to generate more policy uniformity across localities than decentralized structures.

Starting first with the case without private information, we show that feature (a) tends to reduce the degree of political capture in centralized systems. Interestingly, the precise mechanism through which that works depends on the structure of local lobbies' preferences for policies. Namely, whether lobbies' ideal policies lie on the same side of the policy spectrum (the "aligned preferences" case) or on opposite sides (the "polarized preferences" case). In a context with aligned preferences, lobbies wish to shift policies in the same direction, even though they might disagree on the intensity of the shift. In such a case centralization then weakens the competition for influence through what can be called a *preference dilution* effect. As a consequence, centralized policies tend to accommodate more preference tradeoffs across locations. The scope of influence by lobby groups located in different areas is "diluted" compared to decentralized systems. This *preference dilution* effect in turn pushes for policies that are more aligned with the general public interest.

Conversely, in a context with polarized preferences, lobbies want to shift policies in opposite directions. In this case, centralization induces fierce competition since one lobby must overcome her[1] rival's influence to shift the policy in her favor. This strong "Bertrand" type of *competition* effect also tends to reduce capture as lobbies tend to neutralize each other. Only the strongest lobby exert effective influence, and only to the extend her strength surpasses her rival's.

Our main contribution is to show that in a context of asymmetric information, centralization also induces an *information transmission* effect that interacts with the competition between lobbies. This effect arises in centralized systems because policies integrate cross-district specificities and therefore create strategic information interdependencies for lobbies located in these districts. In fact, a centralized policymaker's willingness to grant a favorable policy to a lobby located in one area depends on how much that policy is also serving a rival lobby in another area. The existence of lobby specific private information implies that each interest group's optimal influence contribution depends not only on her own private information but also on the private information possessed by the rival group. Through this channel, strategic information transmission crucially interacts with political influence (i.e., bribes and financial transfers).

[1] We refer to lobbies with feminine pronouns and to policymakers with masculine pronouns.

Under centralization, each lobby proposes financial contributions that may reveal part of her private information to the common policymaker. In equilibrium, this feature allows the common policymaker to learn something about each lobby's private information. Each lobby finds this piece of information relevant for the design of her optimal influence strategy. They have incentive to screen from the policymaker what the latter learned from rival lobbies. Screening, however, is costly and induces lobbies to exert less influence. Conversely, screening increases the common policymaker's bargaining power, and provides him political (informational) rents.

Again, we show that the impact of the *information transmission* effect for the degree of competition between lobbies depends on the preference structures of these lobbies. In the "aligned preferences" case, the *information transmission* effect reduces political capture of centralized decisions. This results from the lobbies' need to screen the policymaker's acquired information. As screening increases the cost of financial contributions, lobbies use less of them and exert less influence. With polarized preferences, the results are reversed. Again screening distorts financial contributions. This effect, however, is now asymmetric and more intense for weaker lobbies. As a consequence strong lobbies end up exerting more influence, leading to an increase in political capture in centralized policies.

Our third contribution is to discuss the conditions under which centralized systems are preferable to decentralized ones and the role that information transmission plays in such tradeoffs. With aligned preferences, the tradeoff weights the *preference dilution* effect and the *information transmission* effect against the standard costs of making a uniform central policy (feature (b) of centralized systems). Specifically, our analysis indicates that the larger the stake of lobbies' private information, the stronger the *information transmission* effect and the *dilution* effect and, therefore, the more likely the centralized regime dominates the decentralized regime from a normative perspective.

In the setting with polarized preferences, the choice between centralization and decentralization tradeoffs the *competition* effect against the policy *uniformity* and *information transmission* effects. In this setting, a higher degree of information asymmetry makes it more likely that decentralized structures dominate centralized structures.

We finally illustrate our model's implications in two classical problems of joint policy making: the provision of local public goods and the setting of an import tariff in customs unions agreements. The first application is quite direct: the amount of public good is a local policy decision. This decision can be undertaken by a specific policymaker for each district (decentralized structure), or by a common policymaker for both districts (centralized structure). In the centralized case, we differentiate the system on the policy space (uniform versus non-uniform policy) and on the financing mode of the public good (separate or common pool budget). This distinction leads to different policy preference structures for lobbies. More precisely, a uniform policy and separated district budgets induce lobbies to have aligned preferences. As a consequence, lobbying competition is weak and information transmission reduces political capture. Conversely when policies are not constrained to be uniform, but that the public good is financed from a common pool budget, then lobbies' preferences get polarized and competition is fierce in centralized structures. Information transmission hinders competition and consequently increases political capture. These features highlight how the design of the efficient policy decision depends on the degree of uniformity in centralized decision as well as on the structure of financing of public budgets.

The second application studies how private information affects political incentives in a customs union trade agreement. In this agreement countries remove all import tariffs between them and set uniform trade policies towards countries outside the union. This type of agreement, therefore, corresponds to a centralized decision structure. Conversely, when countries do not sign an agreement, the choice of the import tariff is decentralized. Abstracting from standard terms of trade effects associated with customs unions, this example shows how the *information transmission* effect can be a driving force for the costs and benefits of a customs union agreement, depending on the sectoral structure of the specific interest groups. Specifically, when lobbies represent similar import competing industries from different countries, their preferences towards tariff protection are aligned and information transmission increases the welfare of a customs unions agreement. Conversely, when lobbies represent vertically related industries, their preferences concerning trade protection are polarized. The upstream industry lobby wants to increase import tar-

iffs on the input while the downstream industry lobby wants an import subsidy for the same input. In this case, information transmission reduces lobbying competition and, as a consequence, decreases the welfare of the customs union agreement.

The plan of the paper is the following. The next sub-section discusses the related literature. Section 2 introduces our basic linear-quadratic model of policy making under lobbying influence with two social entities and one lobby group associated with each entity. It also computes the benchmark policies of the political game under centralization and decentralization under perfect information. Section 3 then considers the case with lobby specific private information. In particular, we provide the fully explicit characterization of the equilibrium policies and contributions schedules. Section 4 discusses the optimality of the centralized and the decentralized structures under both perfect and asymmetric information. Sections 5 and 6 provide the application of our simple parametric examples to the contexts of local public good provision and customs union agreements. Finally, Section 7 concludes and discusses avenues for future research.

Related literature

This paper investigates how capture affects policy decisions according to the structure of public decision making. It is closely related to Bardhan and Mookherjee (2000) and Bordignon et al. (2008) which have also approached this problem. In Bardhan and Mookherjee (2000) centralization is better when lobbies are less well-organized at the national level while decentralization dominates when local districts have a strong preferences for one party. Centralized and decentralized structures have different impacts because voters have different levels of awareness and lobbies have different levels of cohesion in the two decision structures. In particular, policies are uniform under centralized structures. In our case, the centralized and decentralized structures affect differently political competition because of information screening and its implications for lobbying incentives.

Bordignon et al. (2008) also studied the effects of lobbying under centralization and decentralization in a setting with interdistrict externalities. They study the consequences of allowing lobbies to influence policy makers of different districts.

They find that (de)centralization is better when the lobbies' preferences are (not) aligned. Our paper does not include interdistrict externalities. Mostly, we show that the *information transmission* effect that we identify can reverse these results making centralized decision eventually less desirable.

As already mentioned, our paper is related to the classical work of Oates (1972). As in Oates (1972), we allow for heterogeneity in districts' preferences. However, in order to present the effects of lobbying and *information transmission* in the simplest possible way, we do not consider inter-district spillovers. In our setting, decentralization is always welfare superior in the absence of lobbying. The benefits from centralization come uniquely from hindering lobbying influence through *preference dilution* and *information transmission* in the "aligned preferences" setting or through the *competition* effect in the "polarized preferences" setting. As is well known in a perfect information context, introducing district spillovers would make the case for centralization even stronger.

In the context of local public good provision, other papers address different political economy aspects of the tradeoff between centralization and decentralization. Seabright (1996) focuses on the effect of greater accountability of politicians in decentralized decisions versus the increased coordination in centralized decisions. Lockwood (2002) and Besley and Coate (2003) break down the uniformity of policies in centralized decisions, but consider a "common pool" system of financing for local public goods, so one district could end up financing the public good for the other district. As a result, centralization can lead to overspending on local public goods which is the opposite of our result for this setting. Redoano and Scharf (2004) investigate the incentives for policy centralization in direct and indirect democracies.

Our second application to customs unions connects to the large literature on the political economy of trade agreements. Similar to our work, De Melo et al. (1993) also identify a preference dilution effect. They find that a trade agreement (not only a customs union) reduces the relative weight of lobbies in the objective function of decision makers when such policymakers take into consideration the impact of policies on partner countries. Richardson (1993) compares free trade areas (FTAs) and customs unions, and finds the second type of agreement to be welfare superior be-

cause tariffs become a public good for lobbies in the same sector but from different countries. Hence, in customs unions, lobbies free ride on each other's contributions and the overall protection decreases. Grossman and Helpman (1994) and Krishna (1998) also consider the role of politics in the incentives to sign preferential trade agreements (PTAs). In a context where tariffs are endogenously defined by lobbying, they find that trade diverting FTAs were more likely to find political support. Krishna (1998) also finds that the incentives for engaging in multilateral liberalization decrease after joining a FTA. More recently, Ornelas (2005a,b) and Maggi and Rodriguez-Clare (2007) discuss the role for lobbying before and after an agreement is signed. The first two papers show that a FTA decreases the rents that lobbies can capture, which makes welfare decreasing agreements less likely to be implemented. The third paper considers the role of trade agreements as a commitment against future lobbying and finds that trade agreements result in deeper liberalization when countries are more politically motivated. In contrast to these papers, we consider here a lobbying model with asymmetric information which allows us to underline the role of our *information transmission* effect on the political incentives within a customs union.

Compared to the previous literature, our main contribution is to discuss the role of information diffusion between privately informed lobbies and policymakers and to investigate its implications on the choice between centralized and decentralized public governance structures. In this sense, our paper also relates to the large political science literature on the role of lobbies as providers of information, such as Austen-Smith (1995), Austen-Smith and Wright (1992), Potters and Van Winden (1992), and Bennedsen and Feldmann (2006). Along this line of research, a lobby group owns information that is relevant for the decision maker and it may disclose this information, according to its interests. Therefore, lobbying may improve efficiency. Our work follows a different approach, closer to Lima and Moreira (2014) who treat lobbies as rent-seekers with private information about their own preferences or technologies.

From a technical perspective, our analysis borrows from the literature on informed principal problems (Maskin and Tirole (1990)), and the recent theoretical literature on common agency with privately informed principals such as

Martimort and Moreira (2010) and Lima and Moreira (2014). The first literature provides the appropriate framework to analyze our political game under decentralization, while the second allows us to characterize the political game under centralization. We apply the techniques developed therein to contrast how centralized versus decentralized policy structures differently affect political competition between privately informed interest groups. Additionally, our work derives new qualitative results from the "polarized preferences" case which has not yet been analyzed in any of the previous papers. We find that information transmission drives policies away from the agent's (policymaker's) bliss point. This result comes from the interaction between information transmission and lobbying competition and contrasts with Martimort and Semenov (2008). They also analyze a common agency lobby game with polarized preferences for the lobbies (principals) but with private information on the agent's (government) preferences. They find that private information on the government part reduces the lobbies' influence. Hence, our qualitative result for the "polarized preferences" setting is new in this literature. It uncovers precisely when the *information transmission* effect may contribute to political capture in centralized systems.

2 The model

We consider an economy with two distinct entities (groups, districts, communities, countries,...), A and B. In each entity $i \in \{A,B\}$, a policymaker is needed to implement a local policy[2] p_i. Each entity is composed of two types of individuals with different preferences regarding the implementation of policy p_i. There is a continuum of identical individuals (with normalized mass of 1) in entity i having the following preferences

$$W_i(p_i) = -\frac{1}{2}(p_i - \alpha_i)^2,$$

[2]For example, policy p_i can be the amount of a local public good, a specific local tax or a regulation when the entities are geographic districts within the same national territory. It can be a "border" policy such as trade, immigration or international capital flow regulations when the entities themselves are national governments.

where α_i reflects the individual's preferred policy level in entity i. It will be useful to define the average preferred policy $\hat{p} = (\alpha_A + \alpha_B)/2$.

There is also a politically organized lobby i. That lobby reflects the interests of a small fraction of agents in entity i that have different preferences from the individuals in i. On top of that, the lobby can disburse money to influence the policymaker responsible for the implementation of the policy. More precisely, we assume that the lobby's objective function can be described as

$$V_i(\theta_i, p_i, C_i) = -\frac{1}{2}(p_i - \theta_i)^2 - C_i,$$

where θ_i is the lobby's policy bliss point (preferred policy) and C_i the amount of money contributions to influence policymaking. Generically, the two lobbies and the society have distinct bliss points. We will focus on two main settings for the configuration of these bliss points. In the aligned setting the lobbies' bliss points are to the right side of the society's average policy $\hat{p}$ (that is, $\theta_A, \theta_B > \hat{p}$). Lobbies may disagree on their ideal level, but both want to push policies away from the society's average ideal policy.

In the polarized setting, lobby A's bliss point is to the right of $\hat{p}$ while lobby B's bliss point is to the left of $\hat{p}$ (that is, $\theta_B < \hat{p} < \theta_A$). In that case, the lobbies' desire is to push policies in different directions away from the society's average ideal policy.

Under decentralized decision making, each entity i is endowed with one policymaker. As it is common in the influence lobbying literature (Bernheim and Whinston (1986) and Grossman and Helpman (1994, 1995)), we assume that this policymaker cares about the society's welfare, W_i, but also likes money contributions, C_i. His preferences are given by

$$U_i(p_i, C_i) = C_i + \frac{\lambda}{2} W_i(p_i),$$

where λ is the relative preference between contributions and the society's welfare function.

Under centralization, the two entities can delegate the policy decision to a joint policymaker. In that case, this agent cares about the aggregate society's welfare

and can be influenced by both lobbies. Additionally, we assume that the policymaker has to set a common policy p for both entities. This assumption of policy uniformity is natural when, by definition, centralization imposes a common policy instrument between the two entities. For instance, this is the case with a custom union or a regional economic union that uniformly regulates "border" policies of different national entities. In the case of fiscal federalism, this feature is not necessarily satisfied and may demand specific assumptions (see Besley and Coate (2003), Lockwood (2002) and Loeper (2011)). Still, as a first pass, it may be useful to capture the idea that centralized decision making is less sensitive to local specificities than decentralized decision making. Moreover, as will be clear in the sequel, this assumption is not crucial for our conclusions. What is important for the *information transmission* effect that we identify is that the policy of one entity generates externalities (any kind of externality) for the other entity. In this respect, uniformization of policies induces a public good component of centralized policymaking, which is then the simplest case of externalities that we need for our political game.

Specifically, the preferences of the joint policymaker under centralization can be represented as

$$U(p, C_A, C_B) = \Sigma_i \left[C_i + \lambda W_i(p) \right],$$

i.e., the sum of the utilities of the decentralized case over the two entities.

The timing of the game is as follows:

(0) In each entity $i \in \{A, B\}$ nature draws the lobby types θ_i;

(1) Lobbies offer contributions to the policymaker(s);

(2) Policymakers accept or reject the contributions;

(3) Policies are set, and if contributions are accepted, payments are made accordingly.

Benchmarks

To understand the effects of lobbying and political influence, it is useful to present first the benchmark results for decision making under symmetric information.

Decentralization

With decentralized policies and no political influence, each policymaker chooses the policy that maximizes the society's preferences. In our simple setup, this is exactly the society's preferred policy α_i. Therefore, the optimal decentralized policy of district i is $\check{p}_i = \alpha_i$ and the social welfare is given by $W_i(\check{p}_i) = 0$, for all i.

Another important benchmark is the decentralized decision making under lobby influence and perfect information. Following the long literature on rent-seeking we approach this problem assuming the lobby offers contributions to a influenceable policymaker. This political game of influence collapses to a simple principal-agent model where each lobby incentivizes her local policymaker to implement her favored policy p_i. More precisely, given the realization of her specific parameter θ_i, the lobby of each entity i solves the following program:

$$\max_{p} -\frac{1}{2}(p-\theta_i)^2 - C_i,$$

subject to the policymaker's participation constraint

$$C_i - \frac{\lambda}{2}(p-\alpha_i)^2 \geq 0.$$

The policy that solves this problem is given by

$$\tilde{p}_i(\theta_i) = \frac{\theta_i + \lambda\alpha_i}{1+\lambda}, \tag{1}$$

i.e., the optimal policy under political influence is a weighted average between the lobby's and the society's bliss points. In decentralized decisions, there are no interdependencies between entities. As a result, the policy is not a function of the other entity's characteristics.

Centralization

When the policymaker has to set a uniform policy for both entities and there is no political influence, he solves the following program:

$$\max_{p} -\frac{1}{2}\left[(p-\alpha_A)^2+(p-\alpha_B)^2\right],$$

which has the following optimal policy

$$\hat{p}=\frac{\alpha_A+\alpha_B}{2}$$

and is simply the average of the districts' optimal policies. Social welfare under centralization provides $W_A(\hat{p})+W_B(\hat{p})=-\left[(\alpha_A+\alpha_B)/2\right]^2<0$. Obviously this negative value reflects the loss from policy uniformization. We refer to it as the *uniformization* effect. Its magnitude depends on the distance between the entity's bliss points. Without political influence, decentralization yields higher payoffs since policies are tailored to meet the entities' social preferences. Under centralization, neither entity gets its preferred policy. By construction, the model has a "decentralization bias", since we do not introduce any cross-entity externality that is part of the usual argument for policy centralization.

Let us turn to the last benchmark case of political influence. In a centralized structure, the policy is common to both entities. As a consequence, there is a public good component for both lobbies who offer contributions to the common policymaker. While the policymaker now cares about the welfare of both districts, he is also subject to the influence of the two lobbies. After the realization of the specific parameters θ_A and θ_B, the political game becomes a standard common agency game in which each lobby i proposes a contribution schedule $C(p,\theta_i)$ to influence the choice of p. We follow Bernheim and Whinston (1986) and, as usual, assume that lobbies play truthful strategies. Thus, the equilibrium of the political game is equivalent to the solution of the following centralized program:

$$\max_{p} -\frac{1}{2}\left[(p-\theta_A)^2+(p-\theta_B)^2\right]-\frac{\lambda}{2}\left[(p-\alpha_A)^2+(p-\alpha_B)^2\right],$$

whose first-order condition is

$$-\left[(p-\theta_A)+(p-\theta_B)\right]-\lambda\left[(p-\alpha_A)+(p-\alpha_B)\right]=0. \tag{2}$$

The policy that then solves this program, $\bar{p}(\theta_A,\theta_B)$, is such that

$$\bar{p}(\theta_A,\theta_B)=\frac{\theta_A+\theta_B}{2(1+\lambda)}+\frac{\lambda(\alpha_A+\alpha_B)}{2(1+\lambda)}. \tag{3}$$

Notice that as $\theta_A+\theta_B\to\alpha_A+\alpha_B$, the policy tends to the welfare optimal uniform policy $\hat{p}$.

For the aligned setting, $\theta_A,\theta_B>(\alpha_A+\alpha_B)/2$ and the equilibrium policy is greater than the welfare maximizing policy under centralization. Equation (3) shows that, under centralized decision making, the equilibrium policy reflects both the society's average preference and the lobbies' preferences.

When preferences are polarized, we have that $\theta_A>(\alpha_A+\alpha_B)/2>\theta_B$ and the first term of $\bar{p}(\theta_A,\theta_B)$ can be higher or lower than $\hat{p}$, depending on the sign of $\theta_A+\theta_B$. This policy can, therefore, be above or below the welfare maximizing policy. Another way to understand the differences between the polarized and the aligned setting is to transform variables so that both θ's are greater than $(\alpha_A+\alpha_B)/2$, and that lobby B's preference is given by $-(p+\theta_B)^2/2$. This implies that lobby B's bliss point is $-\theta_B$. With this transformation, the equilibrium policy under the polarized setting writes as

$$\bar{p}(\theta_A,\theta_B)=\frac{\theta_A-\theta_B}{2(1+\lambda)}+\frac{\lambda(\alpha_A+\alpha_B)}{2(1+\lambda)}. \tag{4}$$

From now on, we will assume that this transformation holds. Notice that only the lobby with the greatest θ exerts influence, and only up to the amount of the difference between the two bliss points. If $\theta_A-\theta_B=\alpha_A+\alpha_B$, the centralized policy again is equal to the welfare maximizing policy.

3 Lobbying with private information

Consider now the situation where policymakers can be influenced by privately informed interest groups. We model the lobbies as the principals of an agency game. They offer contributions in order to obtain a favorable policy. The lobbies also have private information about their ability to exert influence. We focus on the interplay between lobbying and information asymmetry under centralized and decentralized structures.

Lobbies are privately informed about the parameter θ. As a result, the influence level is unknown ex-ante by the society and the policymaker. To keep the model simple, we consider that the information is not directly policy relevant. The intuition is that the content of private information is on the organizational costs of the lobby or the preferences of the sectors the lobbies represent. It does not have a direct impact on the society's welfare. This obviously contrasts with the basic models of informed lobbying. We, nonetheless, believe this simplification is an interesting (and technically simpler) starting point for understanding how information asymmetries affect the tradeoff between centralization and decentralization. We assume that in each entity i the lobby's type θ_i is drawn from an i.i.d. distribution. For the "aligned preferences" case both θ_i's are drawn from a uniform distribution $f(\theta) = 1/\left(\overline{\theta} - \underline{\theta}\right)$ on the interval $\left[\underline{\theta}, \overline{\theta}\right]$ with $3\underline{\theta} > \overline{\theta}$. For the "polarized preferences" case, the distribution of lobby A's type is identical to the aligned case, while lobby B's type is uniformly distributed within the interval $[-\overline{\theta}, -\underline{\theta}]$. We begin the analysis with the decentralized structure.

Decentralization

In a decentralized structure, each lobby offers contributions to the policymaker of her entity. The political game is thus an informed principal problem. Remember that the policymaker does not care directly about the lobby's type, i.e., we have a private value informed principal problem. In such models the lobby's private information does not affect the policymaker's decision. The policymaker only cares about whether the contribution compensates for shifting him away from his preferred policy. Hence, the policymaker does not take into direct account whether or

not the contribution is revealing.[3] Additionally, different lobbies' types prefer different policies, so it is not optimal to offer pooling contributions. This results in a political game where the lobby has no incentives to withdraw information. Hence, we can focus on informative contributions. As a consequence, there are no distortions due to information asymmetry and the equilibrium policies are the same as in the perfect information decentralized structure, namely $\tilde{p}(\theta_i)$ given by (1).

Centralization

In a centralized structure, lobbies offer contributions to the same policymaker. Remember that we follow the standard influence lobby group literature (Bernheim and Whinston (1986) and Grossman and Helpman (1994, 1995)) that views the determination of policymaking as the outcome of a common agency game. Different lobbies (principals) use contributions as an incentive device to induce the policymaker (agent) to make specific policy choices. The introduction of asymmetry of information between informed principals and uninformed agents, however, requires a specific strategy to find equilibrium policies.

Each lobby is privately informed about the realization of his type and does not know the rival's type. Therefore, the utility maximization problem of each lobby can be tackled as an informed principal problem with the policymaker. Several remarks are in order. First, in this informed principal problem, each lobby has private information about his own type while the policymaker has no direct private information. The policymaker, however, simultaneously receives the contributions from both lobbies. When contributions are separating, the policymaker learns the lobbies' types in equilibrium. Given that different types of lobby ask for different

[3] In informed principal problems, the principal can benefit from delaying information revelation if the agent's decision depends on the realization of a random variable. This requires more complex contracts which allow the policy to be contingent on the information the principal reveals after the contract's acceptance. These complex contracts introduce an *ex-ante* uncertainty to the agent at the moment of acceptance of the contract. Depending on the agent's utility, this uncertainty can help relax his individual rationality and incentive compatibility constraints (these constraints only need to hold in expected term, instead of state-by-state), increasing the surplus of their relationship. Such contracts do not reveal the lobby's private information directly, but the principal would reveal her private information before the implementation of the policy. Nonetheless, Maskin and Tirole (1990) show that revelation delaying creates no surplus gain when preferences are quasi-linear, which is the case we analyze here. That is, there is no benefit in offering a contract with revelation delay.

policy, the type of one lobby is relevant for the other lobby's payoff. Each lobby's problem becomes a principal-agent problem where the policymaker is privately informed about the rival's type.

Second, from Maskin and Tirole (1990), we know that informed principals do not gain from postponing information revelation. This justifies our focus on informative equilibria with separating differentiable contribution schedules.[4] As a consequence, our political common agency game with exogenous asymmetric information between informed principals and an uninformed agent becomes, from the perspective of each principal, a principal-agent problem with an endogenously privately informed agent about the characteristics of the other principal.

We follow closely Martimort and Moreira (2010) and, as stated previously, we restrict ourselves to separating equilibrium strategies reflecting the fact that a given lobby i chooses different contribution schedules as his type changes. We first consider lobby i's best response contribution schedule to the rival lobby j's strategy, assuming that the latter uses a separating strategy. Hence, before choosing the level of the joint policy p in the second stage of the game, the policymaker endogenously learns the private information by simply observing the contribution schedule proposed by the rival j. It follows that lobby i's own optimal contribution schedule has to take into account the information rent that the policymaker obtains from his endogenous knowledge about θ_j. One may then characterize the optimal contribution schedule of lobby i, assuming that the policymaker is perfectly informed on lobby i's type θ_i. As noticed by Martimort and Moreira (2010), the fact that the two lobbies' types do not enter directly into the policymaker's objective function ensures that the corresponding profile of contribution schedules is also a best response in the more general game where lobby i has asymmetric information on θ_i.[5] Applying this approach, it turns out that lobby i's best response is itself separating

[4]This is also in the spirit of equilibrium allocations that are informative as in Spence (1973) and Riley (1979).

[5]The reason is that the incentive and participation constraints of the policymaker do not depend on his beliefs about lobby i's type but only on the schedule that this lobby offers to him. Therefore, it follows that the policymaker' decisions to enter into the bilateral coalition with lobby i and to implement the policy p accordingly are also independent on his beliefs about the lobby's type. Any deviation from the contribution that lobby i would optimally offer if the policymaker were informed about his type is dominated for any off equilibrium path beliefs.

and therefore conveys information on his type to the policymaker. This observation then justifies that the same techniques can be used to compute the rival lobby j's best response. This approach consistently characterizes the informative equilibria we are seeking.

Specifically, we denote the realization of the type of district i lobby by θ_i and the realization of rival lobby j by θ_j. Solving backwards, given that we are in a separating equilibrium, the policymaker's problem has full knowledge about θ_i and θ_j when deciding his policy p. Given the separating contribution schedules $C_i(p,\theta_i)$ and $C_i\left(p,\theta_j\right)$, he then solves:

$$\max_p C_i(p,\theta_i) + C_j\left(p,\theta_j\right) + \lambda W(p), \tag{5}$$

where we denote the utilitarian welfare of both entities by $W(p) = W_A(p) + W_B(p)$. This problem has the following first-order condition

$$\frac{\partial C_i}{\partial p}(p,\theta_i) + \frac{\partial C_j}{\partial p}\left(p,\theta_j\right) + \lambda W'(p) = 0. \tag{6}$$

It is important to note that the equilibrium policy depends on the slopes $\partial C_i/\partial p$ and $\partial C_j/\partial p$ of the contribution schedules which in turn depend on the lobbies' types θ_i and θ_j. It follows that the equilibrium policy $p\left(\theta_i,\theta_j\right)$ satisfying (6) depends as well on the lobbies' types. Moreover, when the necessary second-order conditions of problem (5) hold and the contribution schedules $C_i(p,\theta_i)$ satisfy the Spence-Mirrlees property[6] $\partial^2 C_i/\partial\theta_i\partial p \geq 0$ and $\partial^2 C_j/\partial\theta_j\partial p \geq 0$, simple differentiation of (6) provides that the equilibrium policy $p\left(\theta_i,\theta_j\right)$ is increasing with respect to the lobbies' types θ_i and θ_j in the "aligned preferences" setting. A similar argument shows that the equilibrium policy $p(\theta_A,\theta_B)$ is increasing with respect to θ_A and decreasing with respect to θ_B in the "polarized preferences" setting.

Consider each lobby's utility maximization problem. Since equilibrium policies are monotonic functions of the lobbies' types, the problem of choosing a contribution schedule and a policy can be reduced for each lobby i to the problem of choos-

[6]We have to check this condition after computing the equilibrium contributions $C_A(p,\theta)$ and $C_B(p,\theta)$.

ing a value $\hat{\theta}_i$ that defines the slopes of the contributions, given (6) and given the lobby's true type θ_i. Moreover, lobby i chooses her contribution non-cooperatively, uninformed about her rival's type θ_j. Therefore, she solves the following problem:

$$\max_{\hat{\theta}_i} E\left[-\frac{1}{2}\left[p\left(\hat{\theta}_i,\cdot\right)-\theta_i\right]^2 - C_i\left(p\left(\hat{\theta}_i,\cdot\right),\hat{\theta}_i\right)\right], \tag{7}$$

subject to (6).

The fact that we focus on informative (truthful) strategies implies that the solution of (7) should be $\hat{\theta}_i = \theta_i$, for all $\theta_i \in \left[\underline{\theta},\overline{\theta}\right]$. Following Martimort and Moreira (2010) and focusing on pointwise optimization, we obtain the following proposition characterizing the necessary optimality conditions of each lobby, given his type. All proofs are presented in the Appendix.[7]

Proposition 1. *The optimality conditions of (7) for lobby i are given by the first-order condition*

$$-\left[p-\theta_i\right]+\frac{\partial C_j}{\partial p}\left(p,\theta_j\right)-\lambda\left[2p-\left(\alpha_A+\alpha_B\right)\right]=-H\left(\theta_j\right)\frac{\partial^2 C_j}{\partial\theta_j\partial p}\left(p,\theta_j\right), \tag{8}$$

for all $i,j\in\{A,B\}$, $i\neq j$, *and* $\left(\theta_i,\theta_j\right)\in\left[\underline{\theta},\overline{\theta}\right]^2$, *where* $H\left(\theta_j\right)$ *is the hazard rate*[8] *and the second-order condition is*
i) for the "aligned preferences" case

$$\frac{\partial p}{\partial\theta_i}\left(\theta_i,\theta_j\right)\geq 0,$$

for all $i,j\in\{A,B\}$, $i\neq j$, *and* $\left(\theta_i,\theta_j\right)\in\left[\underline{\theta},\overline{\theta}\right]^2$, *and*

[7] The explicit closed form solution of the equilibrium policies of Proposition 1 are computed in an online appendix.

[8] The hazard rate depends on the preference being aligned or polarized. Se the proof the proposition and the discussion below to see the details.

ii) for the "polarized preferences" case

$$\frac{\partial p}{\partial \theta_A}(\theta_A, \theta_B) \geq 0,$$
$$\frac{\partial p}{\partial \theta_B}(\theta_A, \theta_B) \leq 0.$$

These first-order conditions given in Proposition 1 are standard in screening models. They state that the marginal surplus of the bilateral coalition between lobby i and the policymaker on the left side of (8) is equal to the marginal cost of the latter's informational rent on the right side of (8). It looks similar to the first-order condition obtained under perfect information (2), except for the fact that there is now a new term due to the information distortion. Since lobby i does not know her rival's type θ_j, she has to give incentives to the policymaker to report his type correctly. This means that she has to screen the rival's information from the policymaker. As in most screening problems, information rents must be given to ensure the policymaker reveals this piece of information and chooses a policy p according to the true type of the rival. To save on such rents enjoyed by the high-type rivals in the aligned setting, lobby i distorts the policy it demands when facing low-type rivals, reducing the slope of his contribution schedule with respect to the policy. The second-order condition requires only that the policy is increasing with respect to the lobby's own type. This will be obtained when the second-order conditions of (5) are satisfied and the equilibrium contribution schedules $C_A(p,\theta)$ and $C_B(p,\theta)$ satisfy a Spence-Mirrlees property $\partial^2 C_A/\partial\theta_A\partial p \geq 0$ and $\partial^2 C_B/\partial\theta_B\partial p \geq 0$.

To compute the equilibrium policy p^* and the equilibrium informative contribution schedules $C_A(p,\theta)$ and $C_B(p,\theta)$, we solve the system of first-order conditions (8) together with (6), the policymaker's first-order condition. The equations (6) and (8) define a system of partial differential equations in the contribution schedules $C_A(p,\theta)$ and $C_B(p,\theta)$ with boundary conditions given by the fact that the policymaker's participation constraints should be binding (no informational rent) for low types $\theta_i = \theta_j = \underline{\theta}$. For the aligned case, the hazard rate is $H(\theta_j) = \left[1 - F(\theta_j)\right]/f(\theta_j) = \overline{\theta} - \theta_j$. The second-order conditions then can be checked ex-post in the computed equilibrium. Martimort and Moreira (2010) show

that a solution exists to this system for the symmetric case. We can compute an explicit expression for the equilibrium policy in the "aligned preferences" case

$$p^{*}\left(\theta_i,\theta_j\right)=\frac{3\left(\theta_i+\theta_j\right)-2\overline{\theta}}{4\left(1+\lambda\right)}+\frac{\lambda\left(\alpha_A+\alpha_B\right)}{2\left(1+\lambda\right)}=\overline{p}\left(\theta_i,\theta_j\right)-\frac{2\overline{\theta}-\left(\theta_i+\theta_j\right)}{4\left(1+\lambda\right)}, \quad (9)$$

where $\overline{p}(\cdot)$ is the centralized policy under perfect information, presented in (3). Notice that, in general, the equilibrium policy is smaller than $\bar{p}$, with equality holding only when both lobbies are of the high type (i.e., $\theta_i=\theta_j=\overline{\theta}$). Information asymmetry reduces the joint policy implemented by the policymaker. Moreover, the second-order condition as well as the Spence-Mirrlees condition hold. The full expressions for the contributions are in the online Appendix.

The intuition follows from the fact that, at a best-response, each lobby induces a lower policy level than what would be ex-post efficient for their bilateral coalition with the policymaker. This downward distortion reduces the information rent that the policymaker obtains from his endogenous private knowledge of the other lobby's type. Since both lobbies frame their contribution schedules in a such way, the actual equilibrium policy is reduced compared to the one obtained under perfect information. We refer to this effect as the *information transmission* effect. It endogenously creates informational advantage that the policymaker can exploit, therefore, increasing the cost of influence of the lobbies. As the latter reduces the intensity of their contributions, policy shifts towards the efficient one. The *information transmission* effect brings a new perspective to the design of decision making under political influence. In a context of asymmetric information, centralization through delegation to a common policymaker creates a mechanism that provides informational leverage for the policymaker against interest groups. This results in less influence and reduced policy distortions.

The way that information asymmetry between lobbies and policymaker is translated into two principal agent problems where the agent is informed is very similar when preferences are polarized. The consequences of information transmission are, however, quite different. Remember that under perfect information, a lobby only exerts influence if she is stronger than the rival lobby. The distortions due to screen-

ing the rival's private information from the policymaker induces each lobby to exert less influence. The reduction is, nonetheless, less stringent when the lobbies face lower type rivals, while it is more stringent when they face relatively higher type rivals. Conversely, when a high type lobby faces a low type lobby she is now facing a relatively weaker opponent. She is then able to exert more influence. Information transmission amplifies the relative differences in the lobbies' strengths. Therefore, the stronger lobby exerts more influence.

To compute the expression for $p^*\left(\theta_i,\theta_j\right)$ we follow the same steps as in the aligned case. The main difference is the hazard rate, now given by $H(\theta_j)=F(\theta_j)/f(\theta_j)=\theta_j-\underline{\theta}$. The explicit expression for the policy in this context is given by

$$p^*\left(\theta_i,\theta_j\right)=\frac{3/2\left(\theta_i-\theta_j\right)+\lambda\left(\alpha_A+\alpha_B\right)}{2\left(1+\lambda\right)}=\overline{p}\left(\theta_i,\theta_j\right)+\frac{1}{4}\frac{\left(\theta_i-\theta_j\right)}{\left(1+\lambda\right)}, \tag{10}$$

where $\overline{p}\left(\cdot\right)$ is the centralized policy under perfect information for the polarized setting, presented in (4). It is straightforward to see that lobbying component in the policy has a greater weight in this expression than it does in the truthful policy (4). The algebra leading to this expression is presented in the Appendix.

This common agency influence game with polarized preferences has the same basic setting of Martimort and Semenov (2008). They consider a privately informed agent about his ideology (the policymaker) and find that ideology uncertainty makes the equilibrium policy closer to the policymaker's bliss point. Here we consider the polar case of privately informed principals (the lobbies) and we find opposite results. Inverting the source of asymmetric information also reverses the results: larger information asymmetry leads to greater political influence in our case.

4 Comparing centralization and decentralization

In this section we compare centralized and decentralized structures in terms of welfare. Welfare is defined as the sum of the entities' welfare functions, $W\left(\cdot\right)=W_A\left(\cdot\right)+W_B\left(\cdot\right)$. This criterion excludes the payoffs of the players of the political

game. This is equivalent to assume that the lobbies' and the policymaker's sizes are negligible compared to the society.

Given that we wish to highlight the role of lobbies' information asymmetries and the importance of the *information transmission* effect in the comparison between centralized and decentralized structures, we simplified the way the two entities A and B interact. Indeed, we only included the fact that centralized decision making tends to produce policies less responsive to the local environment than decentralized decision making (i.e., under a uniformity assumption the policies are exactly constrained to be the same). We should keep in mind, however, that this setting avoids important other dimensions discussed in the literature. In particular, our framework does not include features such as environmental externalities or strategic delegation across entities. Those elements are known to be important determinants of the comparison between centralized and decentralized structures.

Under perfect information, our model reproduces many effects that already have been emphasized under different forms in the literature. Namely, the aforementioned *uniformization* effect, *preference dilution* effect (in the aligned setting) and *competition* effect (in the polarized setting). As emphasized by the traditional literature on centralization (Oates (1972)), the *uniformization* effect favors decentralization. The size welfare loss is directly related to the extent of difference between the entities' preferences, $\alpha_A - \alpha_B$.

The introduction of asymmetric information then allows us to highlight a new effect into this tradeoff: the *information transmission* effect. Interestingly, this effect reduces the vulnerability of policy making to political influence in centralized systems in the "aligned preferences" context, but conversely it increases political capture in the "polarized preferences" context. We assume, without loss of generality, $\Delta\alpha = \alpha_A - \alpha_B > 0$ and denote $\Delta\theta = \bar{\theta} - \underline{\theta}$. We start by discussing the "aligned preferences" context, comparing the perfect information benchmark case to the asymmetric information one. Then we repeat in a following section the same exercise for the other "polarized preferences" case.

4.1 Aligned preferences

Perfect information

In addition to the uniformization effect of local policies, centralization induces lobbies to offer contributions to the same (unique) policymaker which creates another effect on the competition for influence. As a matter of fact, the policymaker cannot fully adjust his policy to reflect the preference of one specific lobby. He has to set the policy according to the "mix of political preferences" of the different interest groups he faces. We refer to this effect as a *preference dilution* effect. This effect was first illustrated in the political economy of centralization and regional agreements by De Melo et al. (1993).

The *preference dilution* effect increases social welfare by itself. Indeed, because the welfare function is concave in the policy level p, welfare associated with the average of the two distinct policy levels is greater than the average welfare of these policy levels. Hence, centralized policymaking that is subject to an "average political influence" of two lobbies generates higher social welfare for the two entities than decentralized policymaking subject to the influence. Moreover, this effect increases with the range of lobbies types, $\Delta\theta$, which determines the probability of having distinct lobbies across entities. In this perfect information setup, the tradeoff between centralization and decentralization compares the two following effects: the *preference dilution* effect that favors centralization, and the *uniformization* effect that favors decentralization. Given that the *uniformization* effect (or conversely the *preference dilution* effect) is positively related to $\Delta\alpha$ (or conversely, to $\Delta\theta$), the tradeoff depends on the relative sizes of $\Delta\theta$ and $\Delta\alpha$. Specifically, we can compute a threshold that relates these two key parameters.

Proposition 2. *Suppose that types are perfect information and preferences are aligned. For every $\Delta\alpha$ there exists a threshold value $\widetilde{\Delta\theta}$ such that the expected social welfare under centralization is higher than under decentralization if and only if $\Delta\theta \geq \widetilde{\Delta\theta}$.*

Asymmetric information

Under centralization, Section 3 tells us that the lobbying game between the two interest groups and the joint policymaker generates an *information transmission* effect. This effect reduces the equilibrium level of the centralized policy. Given that lobbies intrinsically have preferences biased towards excessively large policy levels, this effect contributes positively to social welfare under centralization. There is no such effect under decentralization. The *information transmission* effect is directly related to the degree of asymmetric information that exists between the lobbies and the policymaker. Therefore, it depends positively on the range of lobbies types, $\Delta\theta$, and has no impact in this model when $\Delta\theta = 0$. Consequently, the *information transmission* effect provides an additional component of the tradeoff between decentralization and centralization that favors the latter. For parameter configurations that make the two decision making structures socially equivalent under perfect information, it shifts the tradeoff in favor of centralization. The *information transmission* effect adds to the two preceding *uniformization* and *preference dilution* effects already identified under perfect information.

As under perfect information, the tradeoff depends on the relative sizes of $\Delta\theta$ and $\Delta\alpha$. Clearly there is a configuration of these two parameters such that social welfare under centralized and decentralized systems are the same. Departing from this situation, a larger value of $\Delta\theta$ strengthens the *preference dilution* and the *information transmission* effects, and therefore makes centralization superior. On the other hand, a larger value of $\Delta\alpha$ reinforces the *uniformization* effect and therefore makes decentralization superior. Moreover, when lobbies have private information, that same configuration of parameters is more likely to induce centralization than with perfect information. This sums up to the following result.

Proposition 3. *Suppose that types are private information. For every $\Delta\alpha$ there exits a threshold value $\widehat{\Delta\theta}$ such that the expected social welfare under centralization is higher than under decentralization if and only if $\Delta\theta \geq \widehat{\Delta\theta}$. Moreover, for every $\Delta\alpha$, we have that $\widetilde{\Delta\theta} > \widehat{\Delta\theta}$.*

Proposition 3 is quite similar to Proposition 2. The thresholds, however, are not the same. Comparing the two shows how *information transmission* affects the

tradeoff between centralization and decentralization. The last statement of Proposition 3 shows that the range of parameters in which centralization is welfare superior is larger with private information. That is, we can find combinations of $\Delta\theta$ and $\Delta\alpha$ such that centralization is not welfare superior under perfect information while it is welfare superior with asymmetric information (while the opposite, however, cannot occur). The bottom line of this comparison is the fact that centralization is more likely to be welfare superior with private information in the "aligned preferences" context.

4.2 Polarized preferences

With polarized preferences the interaction between lobbies in centralized structures is quite different from the aligned context. The policymaker's preferences are now in the middle ground between the two lobbies' preferences. The influence of one lobby pushes policies further away from the rival's bliss point. This creates strong competitive pressures between lobbies on the market for influence.

Perfect information

While in the aligned setting each lobby benefits from the influence of the other, now the influence of a lobby harms the rival. Each lobby desires to neutralize the rival's influence and, on top of that, to influence the policymaker. As a consequence, the policy is biased towards the preference of the stronger lobby. This is the *competition* effect. With lobbies of equal strength, no effective influence is exerted and the policy follows the districts' preferences.

In this setting, the tradeoff between centralization and decentralization weights this *competition* effect against the *uniformization* effect. The larger $\Delta\theta$, the larger the scope for disagreement among the lobbies, the stronger the *competition* effect and the better it is to have a centralized structure. On the other hand, much like in the "aligned preferences" case, the larger $\Delta\alpha$, the stronger the *uniformization* effect and the worse it is to implement centralization. Interestingly, the value of $\sum\theta := \overline{\theta} + \underline{\theta}$ also matters for welfare comparison. It reflects a measure of the relative distance between the average ideal policy level that each lobby would like

to see implemented.[9] When the lobbies' average bliss point is much higher than the society's, they exert a lot of influence in decentralized structures. Conversely, in centralized structures they are forced to compete strongly as their positions are on average highly opposed. As a consequence their influence gets mitigated. The greater is the lobbies average ideal policy strength compared to the α's, the more likely is centralization beneficial. In other words, the larger $\sum\theta$, the more likely centralization is welfare superior. These observations are summarized in the following proposition:

Proposition 4. *Suppose that types are perfect information. For every $\Delta\alpha$:*
i) there exists a threshold value $\widetilde{\Delta\theta}$ such that the expected welfare under centralization is higher than under decentralization if and only if $\Delta\theta \geq \widetilde{\Delta\theta}$;
ii) there exists a threshold value $\widetilde{\Sigma\theta}$ such that the expected welfare under centralization is higher than under decentralization if and only if $\Sigma\theta \geq \widetilde{\Sigma\theta}$.

Asymmetric information

The *information transmission* effect has quite different implications with polarized preferences. When designing its contribution, each lobby would ideally like to face a moderate opponent, where there is less opposition to her own influence. Importantly though, the policymaker has a natural tendency to lie to the lobby by overstating the policy position of his opponent. The policymaker does so in order to receive the greater marginal contribution that the lobby would be ready to offer to neutralize the opponent's position. Therefore, to make incentives compatible for the policymaker, the lobby increases the contribution he pays when facing a low type opponent. To save on the high contribution, the policymaker reduces the marginal policy he requests when facing a high type opponent. As a consequence, strong opponents face weaker opposition, which induces more influence when the lobbies average ideal positions are unbalanced.

[9] Lobby A's type is uniformly distributed between $\left[\underline{\theta},\overline{\theta}\right]$, while lobby B's type is uniformly distributed between $\left[-\overline{\theta},-\underline{\theta}\right]$. Lobby A's average ideal policy level is simply $\int_{\underline{\theta}}^{\overline{\theta}}\theta\cdot\frac{d\theta}{\Delta\theta}=\frac{\Sigma\theta}{2}$ while lobby B's ideal average policy level is $\int_{-\underline{\theta}}^{-\overline{\theta}}\theta\cdot\frac{d\theta}{\Delta\theta}=-\frac{\Sigma\theta}{2}$. So the difference between the two lobbies average ideal policy levels is exactly $\sum\theta$.

In other words, information transmission weakens the lobbies' competition, making it less effective. Notice, however, that competition will still be effective when the lobbies' types positions are balanced. This indicates that for a given asymmetry between districts preferences $\Delta\alpha$, there still exist ranges of lobbies' types that make centralization welfare superior. Specifically we have the following:

Proposition 5. *Suppose that lobbies types are private information. For every* $\Delta\alpha$*:*
i) there exists a threshold value $\widehat{\Delta\theta}$ *such that the expected welfare under centralization is higher than under decentralization if and only if* $\Delta\theta \geq \widehat{\Delta\theta}$*;*
ii) there exists a threshold value $\widehat{\Sigma\theta}$ *such that the expected welfare under centralization is higher than under decentralization if and only if* $\Sigma\theta \geq \widehat{\Sigma\theta}$*;*
iii) we have that $\widehat{\Delta\theta} > \widetilde{\Delta\theta}$ *and* $\widehat{\Sigma\theta} > \widetilde{\Sigma\theta}$.

Statements (i) and (ii) from Propositions 4 and 5 are quite similar. The difference is stressed in statement (iii) of Proposition 5. It shows that centralization is welfare superior for a smaller range of parameters when lobbies have private information. Indeed, under centralization the *information transmission* effect has a negative impact on welfare. It reduces the effectiveness of the *competition* effect that naturally arises in perfect information when lobbies have polarized preferences. This leads to greater capture by the more extreme lobby.

5 Local public goods provision

In this section we illustrate our previous results in the classical problem of local public goods provision across communities or districts. Much of the political economy literature that goes beyond Oates' classical trade off between centralization and decentralization only considers situations with symmetric information between interest groups and policymakers. Our framework allows us to reconsider this classical problem in the presence of lobbies who are privately informed about their abilities to exert influence. The set-up also allows us to discuss how different structures of public budgets affect the lobbying competition and ultimately, the provision of local public goods.

We, specifically, consider three alternative institutional structures. In the first one the decision is decentralized and public budgets across districts are separate. In the second structure the district budgets are still separate but the policy decision is centralized and constrained to be uniform. Finally, we study a centralized decision structure without policy uniformity, while there is a two stage budgeting process that is integrated across districts (a common pool financing).[10]

We now adapt the model of provision of local public goods to our framework. Two districts, $i \in \{A, B\}$, have to decide how much of a local public good to provide. We assume the following utility function[11] for consumers in district i

$$u_i(p) = \left(\alpha_i - 1 - \frac{p_i}{2}\right) p_i + y_i, \tag{11}$$

where, for consistency, we denote the amount of public good by p_i and income y_i, which is exogenous in this problem. Notice that this is a transformed version of the utility function presented in Section 2.

The lobbies represent organized members of the society with higher valuation for the public good.[12] For example, lobbies could be interpreted as organized elites with preferences not aligned with the average citizen. Specifically, we assume that these elite preferences are given by

$$V(\theta_i, p_i, C) = \left(\theta_i - 1 - \frac{p_i}{2}\right) p_i - C,$$

where $\theta_i > \alpha_i$, and C denotes the money contribution to be paid to influence the

[10] An alternative structure would combine a centralized decision without uniform policy and with a decentralized budget. In absence of inter-district externalities, this last is identical to a decentralized structure.

[11] We derive such utility function departing from a quasi-linear preference specification on public goods (p_i) and money (m_i) represented by

$$u_i(p_i, m_i) = \left(\alpha_i - \frac{p_i}{2}\right) p_i + m_i.$$

Consumers' income is denoted by y_i. The public good is provided by the government and financed through lump-sum income taxes τ_i. It is produced from income on a one-to-one basis. If the budgets are separate, then $\tau_i y_i = p_i$ and the consumer's budget constraint is given by $(1-\tau_i)y_i = m_i$, or $y_i = p_i + m_i$. This allow us to write the consumer's utility as presented below.

[12] Our results would be similar if lobbies had lower valuation for the public good.

policymaker(s). It is straightforward to see that these preferences are also transformations of the lobbies' preferences and correspond to the "aligned preferences" case.[13] We are now in a position to reinterpret our previous results comparing centralization and decentralization.

Decentralization

When the public good decision is decentralized and budgets are separate, the results from the decentralized structure apply. The model is solved as a principal-agent game and information asymmetry has no stake. The solution is efficient for the relationship between a lobby and the policymaker. The lobby, however, exerts influence and the public good is provided up to the point where the lobby's marginal benefit equals the marginal cost of provision. Remember that in decentralized decisions, the policymaker only takes into consideration the welfare of his district. The policy implemented in this structure is given by

$$p_i = \frac{\theta_i + \lambda\,\alpha_i}{1+\lambda} - 1,$$

which is just a re-parametrization of (1).

Centralization: uniform public good provision and separate budgets

Under uniform public good provision with separate district budgets, the lobbies offer contributions to the same policymaker, as in the "aligned preferences" case. Under perfect information, the level of public good is given by

$$\overline{p} = \frac{\theta_A + \theta_B + \lambda\,(\alpha_A + \alpha_B)}{2(1+\lambda)} - 1,$$

which is a simple re-parametrization of (3). Under asymmetric information, when θ_i is private information of lobby i, and it is drawn from a uniform distributions in

[13] An alternative explanation for the difference between θ and α would be a difference in the marginal value of money for the fraction of society organized as a lobby.

$[\underline{\theta}, \bar{\theta}]$, the policy under private information is given by

$$p^* = \frac{3/2(\theta_A + \theta_B) - \underline{\theta} + \lambda(\alpha_A + \alpha_B)}{2(1+\lambda)} - 1,$$

which is a simple re-parametrization of by (9).

Centralization: non-uniform public good provision and two-stage integrated budget

Consider now a centralized system where the income tax is fixed at $\bar{\tau}$ as a result of a two stage budget process and that the budget is a common pool such that $\overline{\tau}(y_A + y_B) = p_A + p_B$. Consequently, we have that $p_i = R - p_{-i}$, where $R = \overline{\tau}(y_A + y_B)$ is the amount of resources available for the provision of local public goods. Now an increase in the public good provided for district A decreases the amount of resources available for district B. The district social preferences in this case write as[14]

$$\begin{aligned} W_A(p_A) &= (1-\overline{\tau})\, y_A + \frac{1}{2}(\alpha_A - p_A)\, p_A, \\ W_B(p_A) &= (1-\overline{\tau})\, y_B + \frac{1}{2}(\alpha_B - R + p_A)(R - p_A). \end{aligned}$$

The lobby's preferences are similar to these and are given by

$$\begin{aligned} V_A(\theta_A, p_A, C_A) &= (1-\overline{\tau})\, y_A + \frac{1}{2}(\theta_A - p_A)\, p_A - C_A(p_A), \\ V_B(\theta_B, p_A, C_B) &= (1-\overline{\tau})\, y_B + \frac{1}{2}(\theta_B - R + p_A)(R - p_A) - C_B(p_A). \end{aligned}$$

With a non-uniform public good decision and a two-stage integrated budget process, the model generates a context with polarized preferences for the lobbies. The reason is that the budget is now already set when lobbies offer contributions to the policymaker, so the public good decision does not take into account the marginal cost of provision. The policy that emerges under perfect information within this

[14]Notice however, that the preferences are not directly comparable to the preferences derived in (11). The indirect utility form derived in (11) considers that the income tax is not fixed, so that consumers pay the marginal cost of production of the local public good. In the current institutional setting, the marginal cost of producing one good is the reduction in the other district's good.

structure is given by

$$p_A = \frac{R}{2} + \frac{\theta_A - \theta_B + \lambda\Delta\alpha}{2(1+\lambda)},$$

which is a re-parametrization of (4). Under private information the policy that solves the political game is given by[15]

$$p_A = \frac{R}{2} + \frac{3/2(\theta_A - \theta_B) + \lambda\Delta\alpha}{2(1+\lambda)},$$

which is a re-parametrization of (10).

Discussion

How do the three institutional structures described above compare in terms of incentives and welfare? In a decentralized structure, each district specific lobby exerts uncontested influence, but the policy choice reflects better the district's social preferences. With uniform centralized public good provision, the policymaker takes into account the average preference of the two districts. In such a setting with independent budgets, lobbies have aligned interests. Private information makes their coordination more difficult by giving extra bargaining power to the policymaker. This in turn favors the use of a uniform policy in terms of welfare.

A common pool two stage integrated budget calls also for a centralized decision, possibly with some degree of flexibility with respect to local policies. In such structure, lobbies have polarized preferences and compete strongly for the public good allocation. Their political influence is weakened because of this competition. Private information, however, hinders this *competition* effect and to stimulate political capture by the more extreme lobby. This suggests that budget centralization with flexible policies has some clear political economy advantage compared to uniform centralized decisions and independent budgets under perfect information. However,

[15]Notice that the expression depends on the amount of resources R available for the public good. Under this particular institutional setting, we assume that this variable is exogenously chosen prior to the realization of the lobbies types. It is not difficult, however, to show that this expression will never reproduce the level of public good achieved in a centralized decision with separate budgets, no matter how much resources are available, provided the amount of resources is not itself a function of the lobbies' types.

the latter institutional setting may recover again some advantages as the information problem on the lobbies' side becomes more stringent.

6 Tariff protection in customs unions

The creation of the World Trade Organization motivated by the increasing number of regional trade agreements. That sparkled a large literature on preferential trade agreements (PTAs), recognizing lobbying and political influence as central elements of trade policy making (see, for instance, the related literature in Section 3). In such models, both the decisions to enter into the trade agreement and the tariff levels are endogenously chosen by governments subject to the pressure from special interest groups. This situation is generally modeled as perfect information game between lobbies and governments. Our model of political influence under asymmetric information allows us to reconsider the issue of PTAs when there is private information on the side of protectionist lobbies. We analyze the implications of these information structures, according to the sectoral characteristics of the lobbying groups, namely whether they represent competing or vertically related industries. We consider both cases in turn.

Lobbies from horizontal competing industries

Consider two small open countries A and B that trade with the rest of the world. In each country there is a protectionist lobby that employs resources to obtain tariff protection against foreign imports. Without a trade agreement between the two countries, each lobby demands protection from the government of her own country. In a customs union, the lobbies from both countries compete to influence the common level of trade protection decided by the customs union. Additionally, lobbies have private information about their political strength as a group.

More precisely, we consider a simple partial equilibrium model with a good x that can be imported by both countries A and B.[16] When the domestic price of good

[16]There is also a numeraire good produced from labor only in a one-to-one rate of transformation.

x in country $i \in \{A,B\}$ is p_i, the domestic demand for good x is given by

$$x_i(p_i) = a - bp_i,$$

with $a,b > 0$. In each country, good x is produced using labor and a specific factor that is in limited supply. Consequently, producers have capacity constraints. To simplify the analysis, we assume that the marginal cost of production is zero for production below the output capacity. Therefore, the sector's competitive profits are given by $\pi_i(p_i) = \gamma p_i$, where γ is the capacity constraint. For simplicity we set $\gamma = 1$.

Each government collects import taxes. The tariff revenue is given by

$$TR = (p_i - p^e)(x(p_i) - y(p_i)),$$

where p^e is the international price of good x, $y(p)$ is the home supply of x which, by the envelope theorem, is equal to γ. With such specifications, the sum of the firm's profits, consumer surplus, and the government's tariff revenue gives the welfare of the society, which takes the following quadratic form

$$W_i(p_i) = \overline{w} - \frac{b}{2}(p_i - p^e)^2,$$

where $\bar{w}$ is a constant that is a function of the parameters. Notice this is a rescaled version of the welfare function presented in Section 2.

A political influence game takes place within each economy. The lobby of each country offers contributions C_i to the policymaker in order to influence the tariff decision. Each economy has a lobby that represents the producers of good x. Lobbies are "principals" of the political game. Their utility function is given by[17]

$$V(\theta_i, p_i, C_i) = \theta_i p_i - C_i.$$

[17]This utility function comes from the fact that lobbies care about the sector's profits and dislike giving money contributions. We assume the production function has a capacity constraint given by one. Then profits are given by p_i. Plus, lobbies have an organization cost of providing contributions so that one dollar put in the lobby turns into $1/\theta_i$. This allows us to represent the lobbies preferences by the given utility function.

Notice that the lobby's preference is linear in the policy p_i. This is a little different from the quadratic function[18] presented in Section 2. Yet the main results are identical in this framework.

Policymakers are agents in the political game. The two countries may form a customs union or retain a non-coordinated trade policy. Without the agreement, the policy decision is decentralized. Each country delegates its trade policy decision to a national policymaker who chooses the import tariff of the economy or, equivalently, the economy's domestic price p_i. In country i, the policymaker's preferences are given by

$$U_i(p_i, C_i) = C_i + \lambda W_i(p_i),$$

where λ is the relative preference between contributions and welfare.

If the two countries sign a customs union agreement, they delegate the policy choice to a single policymaker who is restricted to setting a uniform policy (the tariffs of the two economies are the same). This is a centralized decision making setting. In this case the policymaker's preferences are given by

$$U(p, C_A, C_B) = \Sigma_i C_i + 2\lambda W(p).$$

The model is a linear version of our baseline model,[19] with $\alpha_A = \alpha_B = p^e$. Assuming that θ's are drawn from an i.i.d. uniform distribution over $\left[\underline{\theta}, \bar{\theta}\right]$, with $3\underline{\theta} > \overline{\theta}$, we can apply the results from Section 3. Domestic prices without a trade agreement (with perfect and with asymmetric information) are therefore given by

$$\check{p}(\theta_i) = p^e + \frac{\theta_i}{\lambda b}.$$

Under a customs union with perfect information these prices are given by

$$\overline{p}\left(\theta_i, \theta_j\right) = p^e + \frac{\theta_i + \theta_j}{2\lambda b},$$

[18] Here, the utility function has an infinite bliss point. The value θ now measures the constant marginal benefit of the policy.

[19] We have not developed the model with a linear objective function, but all the results remain, except that expressions are slightly different.

where it is easy to see that the customs union implements the average tariff. Under a customs union with privately informed lobbies, they become

$$p^*\left(\theta_i,\theta_j\right)=p^e+\frac{1}{2\lambda b}\left(\frac{3}{2}\left(\theta_i+\theta_j\right)-\overline{\theta}\right)=\overline{p}(\theta_i,\theta_j)-\frac{1}{2\lambda b}\left(\overline{\theta}-\frac{\theta_i+\theta_j}{2}\right).$$

It is simple to see that $\overline{p}\left(\theta_i,\theta_j\right)-p^*\left(\theta_i,\theta_j\right)\geq 0$. Therefore, there is less protection in a customs union agreement when lobbies have private information. The intuition is that the *information transmission* effect increases the cost of political influence, granting more bargaining power to the policymaker. As a consequence, lobbies' private information under a customs union leads to a fall of protection, and an increase in imports and social welfare.

From a social welfare perspective it is important to notice that the two countries' optimal policy is free trade. Consequently, this model is similar to our linear example with $\alpha_A=\alpha_B$. Thus, under perfect information, customs union agreements are always welfare superior to the decentralized protectionist game in each country. Therefore, there is no *uniformization* effect associated with centralized decision making. Only the *preference dilution* effect remains, which promotes the customs union regime (i.e., centralized decision making). When lobbies have private information, the *information transmission* effect provides an additional boost in favor of the customs union mechanism.

Lobbies from vertically related industries

Consider now a context where one country has a lobby representing an upstream industry while the other has a lobby representing a downstream industry. A customs union agreement forces lobbies of vertically related industries to influence the same policymaker. The two lobbies find themselves with polarized preferences. The downstream producer wants import subsidies for her inputs while the upstream producer wants protection against foreign competition. For simplicity, we assume that the upstream sector has a quadratic cost of producing y units of the input $cost\,(y)=y^2+(\delta-\theta)\,y$. Denoting the input's international price by p^e, home prices are equal to the international price plus tariffs. This gives the following profit

function

$$\pi_U(p) = \frac{1}{2}(p - (\delta - \theta_U))^2.$$

The downstream sector employs labor (l) and the input (x) from the upstream industry to produce the final good (z). The production function is given by $z = l + ((\gamma + \theta) - x/2)x$, which generates a linear demand for the input $x = \gamma - p$. The total cost is given by $cost = -\frac{1}{2}(p - (\gamma + \theta_D))^2 + z$, which is separable in z and p. Thus, the downstream sector's profit function writes as

$$\pi_D(p) = (p^* - 1)z + \frac{1}{2}(p - (\gamma + \theta_D))^2,$$

and the lobbies' preferences are then given by

$$V_i(p_i, \theta_i, C_i) = \pi_i(p_i) - C_i.$$

The policymaker of the customs union cares about revenues and both sector's profits. His preferences are given by

$$U_i(p_i, C_i) = C_i + \lambda W(p_i).$$

We take $\gamma > \delta$ and assume,[20] for simplicity, that $\gamma - p^e = p^e - \delta$. This assumption ensures that the home market clearsat the international price p^e.

In the absence of a trade agreement, the two countries set policies separately. We assume that the upstream sector is in country A and the downstream sector is in country B. The policy in country A (upstream lobby) is given by

$$\check{p}(\theta_U) = \frac{\lambda p^e - (\delta - \theta_U)}{\lambda - 1} > p^e$$

and the policy in country B (downstream lobby) is given by

$$\check{p}(\theta_D) = \frac{\lambda p^e - (\gamma + \theta_D)}{\lambda - 1} < p^e.$$

With a customs union agreement the policymaker now cares for the welfare in

[20] This assumption makes the results clearer, but it is absolutely not necessary.

both countries. His preferences are given by

$$\Sigma C + \lambda \left[\pi_D (p) + \pi_U (p) + (p - p^e) (x(p) - y(p)) \right].$$

Under perfect information, the policy that emerges from the lobby game is given by

$$\overline{p}(\theta_U, \theta_D) = p^e + \frac{\theta_U - \theta_D}{2(\lambda - 1)}.$$

The input price in a customs union can be greater or smaller than the international price, depending on the relative strength of the two lobbies. If the lobbies are equally strong, their influence cancels out and there is no tariff.

If the lobbies' strength is the private information, now their competition is weakened and the policy is given by

$$p^*(\theta_U, \theta_D) = p^e + \frac{3}{2} \frac{\theta_U - \theta_D}{2(\lambda - 1)} = \overline{p}(\theta_U, \theta_D) + \frac{\theta_U - \theta_D}{4(\lambda - 1)}.$$

Whenever a lobby is stronger, it will achieve more influence when lobbies have private information.

Discussion

To sum up, when lobbies represent national industries that are horizontal competitors, their incentives are aligned since both desire a greater tariff against the rest of world (import tariffs are strategic complements). In this context, information transmission reduces the political capture and private information on the lobbying side makes it more likely for the custom union agreement to be welfare improving. On the contrary, when national lobbies represent vertically related industries, they tend to have polarized policy preferences with respect to trade protection. As a consequence, part of their influence cancels out with competition and only the more extreme lobby exerts influence. Private information and its associated *information transmission* effect then mitigates the impact of competition and reduces the welfare benefits of a customs union agreement.

The preceding simple examples suggest that under perfect information a cus-

toms union agreement is more likely to be welfare superior when countries have lobbies in vertically related industries than when national lobbies compete on the same market. Information transmission, on the other hand, increases the benefits of agreements of countries with lobbies on the same industry while it tends to reduce the benefits of agreements of countries with lobbies on vertically related industries. As such, information transmission may therefore alter significantly the welfare properties of customs unions agreements.

Obviously, this model is extremely simple and the results must be viewed as illustrative of how lobbies' private information may interact with the trade policy mechanisms discussed in the literature. Direct trade effects are important to qualify the potential gains from a customs union agreement. Nonetheless, the *information transmission* effect that we identify certainly remains in more complex situations. Finally, when lobbies have private information, centralization of decision making gives policymakers additional bargaining power to negotiate with other rent-seekers. Hence, the *information transmission* effect is likely to have a stake at the decision to form a customs union.

7 Conclusions

In this paper, we considered the tradeoff between centralized and decentralized policy making when policymakers are subject to capture by privately informed lobbies. We identified a new *information transmission* effect in the political game under centralized structures that changes the way lobbies interact. When lobbies interests are aligned, information transmission reduces capture in centralized decision making structures. The basic insight comes from two features. First, in centralized systems, policies tend to integrate cross-entity specificities and therefore create strategic informational interdependencies for privately informed lobbies. Each lobby's optimal influence strategy depends on privately known characteristics of rival lobbies. Second, centralization forces competition for political influence to be focused on one central policymaker. Since this competition is information revealing, the common policymaker has a privileged position to obtain valuable private information about each lobby's characteristics. Therefore, centralization allows the policymaker to en-

joy information rents, increasing his bargaining capacity in bilateral relationships with interest groups. As a consequence, the cost of political influence increases and the extent of political capture declines.

When the lobbies preferences are polarized, the opposite effect emerges. Centralized decision with polarized preferences forces the lobbies into a greater competition, which reduces in rent seeking lobbying. *Information transmission* effect, however, reduces this competition, diminishing the benefits of centralization.

The framework we used to highlight this insight clearly abstracts from many dimensions relevant to the comparison between centralized and decentralized systems. Enriching the model would, however, generate greater strategic informational interdependence across lobbies that is necessary to get the *information transmission* effect. This reinforces the case for centralized systems. More substantially, one may think about enriching the political process of policy determination under centralization. For example, one may think of a more complex decision processes involving bargaining between district representatives, each being subject to influence. It would be interesting to see how such variations in the political structure interact with privately informed rent-seeking groups. Another worthwhile extension would be to allow the possibility of lobbies holding efficiency improving private information. In that case, lobbying activity could play a positive social role. Whether it increases or decreases the relative benefits of centralization is an interesting questions that would merit further investigation.

Finally, we applied our model to examples such as local public good provision and the incentives to form customs union agreements. We hope that these simple applications pave the way for the investigation of other political economy contexts where the interplay between political influence competition and asymmetry of information may generate rich and interesting insights for the optimal allocation of decision rights in public policy areas.

Appendix

Proof of Proposition 1. This proof presents the computations for obtaining the first-order condition of problem (7) in detail. The proof follows Martimort and Moreira

(2010) closely. We begin with the "aligned preferences" setting.

Following the tradition of the literature, we eliminate the contribution from the objective function (7) before computing the best-responses. We write

$$E\left[C\left(p\left(\hat{\theta}_i,.\right),\hat{\theta}_i\right)\right]=\int_{\underline{\theta}}^{\overline{\theta}}C\left(p\left(\hat{\theta}_i,\theta_j\right),\hat{\theta}_i\right)f\left(\theta_j\right)d\theta_j,$$

and we integrate this expression by parts to get

$$\begin{aligned}\int_{\underline{\theta}}^{\overline{\theta}}C\left(p\left(\hat{\theta}_i,\theta_j\right),\hat{\theta}_i\right)f\left(\theta_j\right)d\theta_j &= -\left(1-F\left(\theta_j\right)\right)C\left(p\left(\hat{\theta}_i,\theta_j\right),\hat{\theta}_i\right)|_{\underline{\theta}}^{\overline{\theta}}\\ &\quad+\int_{\underline{\theta}}^{\overline{\theta}}\left(1-F\left(\theta_j\right)\right)\frac{\partial C}{\partial p}\left(p\left(\hat{\theta}_i,\theta_j\right),\hat{\theta}_i\right)\frac{\partial p}{\partial\theta_j}\left(\hat{\theta}_i,\theta_j\right)d\theta_j.\end{aligned}$$

In what follows we omit the arguments of $p\left(\hat{\theta}_i,\cdot\right)$ and its derivatives for sake of exposition. Substituting the policymaker first-order condition (6) in the equation above gives

$$E\left[C\left(p,\hat{\theta}_i\right)\right]=C\left(p\left(\hat{\theta}_i,\underline{\theta}\right),\hat{\theta}_i\right)-E\left[\left(\frac{\partial C}{\partial p}\left(p,\cdot\right)+\lambda W'\left(p\right)\right)\frac{1-F\left(\cdot\right)}{f\left(\cdot\right)}\frac{\partial p}{\partial\theta_j}\right].$$

Then, inserting this last expression back into (7) leads to the following problem

$$\max_{\hat{\theta}_i}\quad E\left[-\tfrac{1}{2}\left(p-\theta_i\right)^2+\left(\tfrac{\partial C}{\partial p}\left(p,\cdot\right)+\lambda W'\left(p\right)\right)\tfrac{1-F(\cdot)}{f(\cdot)}\tfrac{\partial p}{\partial\theta_j}\right]-C\left(p\left(\hat{\theta}_i,\underline{\theta}\right),\hat{\theta}_i\right).$$

We now differentiate this expression to obtain the first-order condition of problem (7)

$$\begin{aligned}&E\left[-\left(p-\theta_i\right)\frac{\partial p}{\partial\theta_i}+\left(\frac{\partial^2 C}{\partial^2 p}\left(p,\cdot\right)+\lambda W''\left(p\right)\right)\frac{1-F\left(\cdot\right)}{f\left(\cdot\right)}\frac{\partial p}{\partial\theta_i}\frac{\partial p}{\partial\theta_j}\right]\\ &\qquad+E\left[\left(\frac{\partial C}{\partial p}\left(p,\cdot\right)+\lambda W'\left(p\right)\right)\frac{1-F\left(\cdot\right)}{f\left(\cdot\right)}\frac{\partial^2 p}{\partial\theta_i\partial\theta_j}\right]\\ &\qquad-\frac{\partial C}{\partial p}\left(p\left(\hat{\theta}_i,\underline{\theta}\right),\hat{\theta}_i\right)\frac{\partial p}{\partial\theta_i}\left(\hat{\theta}_i,\underline{\theta}\right)-\frac{\partial C}{\partial\theta_i}\left(p\left(\hat{\theta}_i,\underline{\theta}\right),\hat{\theta}_i\right) = 0.\end{aligned}\tag{12}$$

We then integrate by parts the term in the second line of (12), which gives

$$\begin{aligned} & -\left(\frac{\partial C}{\partial p}\left(p,\hat{\theta}_i\right)+\lambda W'(p)\right)\frac{\partial p}{\partial \theta_i} \\ -E\left[\left(\left(\frac{\partial^2 C}{\partial^2 p}(p,\cdot)+\lambda W''(p)\right)\frac{\partial p}{\partial \theta_j}+\frac{\partial^2 C}{\partial \theta_j \partial p}(p,\cdot)\right)\frac{(1-F(\cdot))}{f(\cdot)}\frac{\partial p}{\partial \theta_i}\right] & \qquad (13) \\ +E\left[\left(\frac{\partial C}{\partial p}(p,\cdot)+\lambda W'(p)\right)\frac{\partial p}{\partial \theta_i}\right]. & \end{aligned}$$

Substituting (13) back into the first-order condition (12) and using (6) gives

$$\begin{aligned} E\left[\left(-(p-\theta_i)+\frac{\partial C}{\partial p}(p,\cdot)+\lambda W'(p)-\frac{\partial^2 C}{\partial \theta_j \partial p}(p,\cdot)\frac{1-F(\cdot)}{f(\cdot)}\right)\frac{\partial p}{\partial \theta_i}\right] & \qquad (14) \\ -\frac{\partial C}{\partial \theta_i}\left(p\left(\hat{\theta}_i,\underline{\theta}\right),\hat{\theta}_i\right) &= 0. \end{aligned}$$

Using a boundary condition for the contribution, we can further simplify this expression. The boundary condition comes from the policymaker's participation constraint. If the rival lobby is low type, the policymaker cannot lie to the lobby. The lobby, then, has no reason to leave him rents. In such a case the policymaker gets his reserve utility. That implies that

$$C\left(p\left(\hat{\theta}_i,\underline{\theta}\right),\hat{\theta}_i\right)+C\left(p\left(\hat{\theta}_i,\underline{\theta}\right),\underline{\theta}\right)+\lambda W\left(p\left(\hat{\theta}_i,\underline{\theta}\right)\right)=\lambda W\left(p^e\right),\ \forall\hat{\theta}_i.$$

Differentiating this expression with respect to $\hat{\theta}_i$ gives

$$\left[\frac{\partial C}{\partial p}\left(p\left(\hat{\theta}_i,\underline{\theta}\right),\hat{\theta}_i\right)+\frac{\partial C}{\partial p}\left(p\left(\hat{\theta}_i,\underline{\theta}\right),\underline{\theta}\right)+\lambda W'\left(p\left(\hat{\theta}_i,\underline{\theta}\right)\right)\right]\frac{\partial p}{\partial \theta_i}\left(\hat{\theta}_i,\underline{\theta}\right)+\frac{\partial C}{\partial \theta_i}\left(p\left(\hat{\theta}_i,\underline{\theta}\right),\hat{\theta}_i\right)=0.$$

Using (6) it is straightforward to see that the last term of (14) is zero. This further simplifies the first-order condition (14) to

$$E\left[\left(-(p-\theta_i)+\frac{\partial C}{\partial p}(p,\cdot)+\lambda W'(p)-\frac{1-F(\cdot)}{f(\cdot)}\frac{\partial^2 C}{\partial \theta_j \partial p}(p,\cdot)\right)\frac{\partial p}{\partial \theta_i}\right]=0.$$

Additionally, given the concavity of the functional (7), the second-order condition

of the problem is simplified to

$$E\left[\frac{\partial p}{\partial \theta_i}(\theta_i,.)\right]=0.$$

Following Martimort and Moreira (2010), we require truth-telling and focus on pointwise optimization. The first- and second-order conditions become

$$\begin{aligned} -(p-\theta_i)+\frac{\partial C}{\partial p}(p,\theta_j)+\lambda W'(p)-\frac{1-F(\theta_j)}{f(\theta_j)}\frac{\partial^2 C}{\partial \theta_j \partial p}(p,\theta_j) &= 0, \quad (15)\\ \frac{\partial p}{\partial \theta_i} &\geq 0, \end{aligned}$$

for all $(\theta_i,\theta_j)\in\Theta^2$.

The computation for the polarized case is similar, but not identical. The nature of lobbying competition is, however, different, which leads to different steps to eliminate the contribution from (7). The intuition is that, since lobbies have opposing preferences, they now desire to face low type rivals. So the "bad" state of nature, where they leave zero rents for the policymaker, is $\bar{\theta}$. The departing point, nevertheless, is the same

$$E\left[C(p,\hat{\theta}_i)\right]=\int_{\underline{\theta}}^{\bar{\theta}} C(p,\hat{\theta}_i)\,f(\theta_j)\,d\theta_j.$$

Then, we use integration by parts in a slightly different way to obtain

$$\int_{\underline{\theta}}^{\overline{\theta}} C(p,\hat{\theta}_i)\,f(\theta_j)\,d\theta_j = F(\theta_j)\,C(p,\hat{\theta}_i)\,|_{\underline{\theta}}^{\overline{\theta}}-\int_{\underline{\theta}}^{\overline{\theta}}\left(F(\theta_j)\right)\frac{\partial C}{\partial p}(p,\hat{\theta}_i)\,\frac{\partial p}{\partial \theta_j}d\theta_j.$$

The following steps basically replicate the ones for the aligned setting. For sake of exposition we omit these steps. Again we require truth-telling and focus on pointwise optimization. The first-order condition is given by

$$-(p-\theta_i)+\frac{\partial C}{\partial p}(p,\theta_j)+\lambda W'(p)+\frac{F(\theta_j)}{f(\theta_j)}\frac{\partial^2 C}{\partial \theta_j \partial p} = 0, \qquad (16)$$

for all $\left(\theta_i, \theta_j\right) \in \Theta$.

Notice that the only difference between (16) and (15) is the hazard rate. By denoting the hazard rates by $H\left(\theta_j\right)$, both (16) and (15) can be expressed as (8). This completes the proof. The Online Appendix features a continuation of this proof. The continuation presents the algebra leading to the expression for equilibrium policies under centralization. □

Proof of Proposition 2. In this proof, we compare the welfare of decentralized and centralized structures. We begin with the aligned setting under perfect information and we compute the expected value of the difference between the welfare of the two structures.

Remember each district's welfare is given by

$$W_i\left(p_i\right) = -\frac{1}{2}\left(p_i - \alpha_i\right)^2.$$

For centralized structures we evaluate the W_i function at the policy under centralization (3). The expressions for welfare are

$$W_i\left(\overline{p}\right) = -\frac{1}{2}\left(\frac{\theta_A + \theta_B - 2\alpha_A - \lambda\left(\alpha_i - \alpha_{-i}\right)}{2\left(1+\lambda\right)}\right)^2,$$

where $i \in \{A, B\}$ and $i \neq -i$. We then sum the two expressions to compute the welfare of the entire economy

$$W\left(\overline{p}\right) = -\frac{1}{4\left(1+\lambda\right)^2}\left[\begin{array}{c}\left(\theta_i + \theta_j\right)^2 - 2\left(\alpha_A + \alpha_B\right)\left(\theta_i + \theta_j\right) \\ +\lambda\left(2+\lambda\right)\Delta\alpha + 2\left(\alpha_A^2 + \alpha_B^2\right)\end{array}\right]. \tag{17}$$

We now compute the welfare in decentralized structures. Evaluating W_i at (1) gives

$$W_i\left(\check{p}_i\right) = -\frac{1}{2}\left(\frac{\theta_i + \lambda\alpha_i}{1+\lambda}\right)^2,$$

where $i \in \{A,B\}$. Summing the two expressions, we compute the society's welfare

$$W\left(\check{p}_A,\check{p}_B\right) = -\frac{1}{2\left(1+\lambda\right)^2}\left[\theta_i^2+\theta_j^2-2\left(\alpha_A\theta_i+\alpha_B\theta_j\right)+\alpha_A^2+\alpha_B^2\right]. \qquad (18)$$

We now compute the difference between (17) and (18). This difference is given by the following expression

$$W\left(\check{p}_A,\check{p}_B\right)-W_A\left(\bar{p}\right)-W_B\left(\bar{p}\right) = -\frac{1}{4\left(1+\lambda\right)^2}\left[\ \left(\theta_i-\theta_j\right)^2-2\left(\theta_i-\theta_j\right)\Delta\alpha-\lambda\left(2+\lambda\right)\Delta\alpha^2\ \right].$$

The expected value of this expression is given by

$$E\left[W\left(\check{p}_A,\check{p}_B\right)-W\left(\bar{p}\right)\right] = -\frac{1}{4\left(1+\lambda\right)^2\Delta\theta^2}\int_{\underline{\theta}}^{\overline{\theta}}\int_{\underline{\theta}}^{\overline{\theta}}\left[\begin{array}{c}\theta_i^2-2\theta_i\theta_j+\theta_j^2\\ -2\left(\theta_i-\theta_j\right)\Delta\alpha-\lambda\left(2+\lambda\right)\Delta\alpha^2\end{array}\right]d\theta_i d\theta_j.$$

Using straightforward algebra we get the following expression for this integral, which we denote by

$$\Omega(\Delta\theta) = E\left[W\left(\check{p}_A,\check{p}_B\right)-W\left(\bar{p}\right)\right] = -\frac{1}{4\left(1+\lambda\right)^2}\left[\frac{\Delta\theta^2}{6}-\lambda\left(2+\lambda\right)\Delta\alpha^2\right]. \qquad (19)$$

Notice that the sign of Ω depends on the expression inside brackets. If Ω is positive, then decentralization is welfare superior. On the other hand, if Ω is negative, centralization is welfare superior. Notice that Ω is decreasing with respect to $\Delta\theta$ and increasing with respect to $\Delta\alpha$. Moreover, for any given $\Delta\alpha$, take $\widetilde{\Delta\theta} = \Delta\alpha\sqrt{6\lambda\left(1+\lambda\right)}$. Then, $\Omega(\widetilde{\Delta\theta}) = 0$. For any $\Delta\theta > \widetilde{\Delta\theta}$, Ω is negative and centralization is welfare superior, which proves the proposition. □

Proof of Proposition 3. The proof of Proposition 3 follows closely the proof of Proposition 2. We compute the expected welfare difference between the decentralized and centralized structures under the aligned setting with asymmetric information.

The society's welfare in decentralized structures is the same as under perfect information (the policies are the same). The society's welfare under this structure

is, thus, given by (18). For the centralized structure, the information transmission now affects the lobbies strategies and, consequently, the equilibrium policy. Each district's welfare is given by

$$W_i(p^*) = -\frac{1}{2}\left(\frac{3(\theta_A+\theta_B)-2\underline{\theta}-4\alpha_i-2\lambda(\alpha_i-\alpha_{-i})}{4(1+\lambda)}\right)^2,$$

where $i \in \{A,B\}$ and $i \neq j$. The expected difference between the welfare of decentralized and centralized structures is given by the following expression

$$W^A\left(\check{p}^A\right)+W\left(\check{p}^B\right)-W^A(p^*)-W^B(p^*) = -\tfrac{1}{4(1+\lambda)^2\Delta\theta^2}\times$$
$$\int_{\underline{\theta}}^{\overline{\theta}}\int_{\underline{\theta}}^{\overline{\theta}}\left[\begin{array}{c}\theta_i^2-2\theta_i\theta_j+\theta_j^2-\lambda(2+\lambda)\Delta\alpha^2-2\left(\theta_i-\theta_j\right)\Delta\alpha\\ -\left(\bar{\theta}-\frac{\theta_i+\theta_j}{2}\right)^2+2\left(\theta_i+\theta_j-\left(\alpha^A+\alpha^B\right)\right)\left(\bar{\theta}-\frac{\theta_i+\theta_j}{2}\right)\end{array}\right]d\theta_i d\theta_j$$

Straightforward algebra leads to the following expression for this difference, which we denote by

$$\Psi(\Delta\theta) = -\frac{1}{4(1+\lambda)^2}\left[\frac{17\Delta\theta^2}{24}-\lambda(2+\lambda)\Delta\alpha^2+\Delta\theta\left(2\underline{\theta}-\left(\alpha^A+\alpha^B\right)\right)\right]. \tag{20}$$

Again, a positive Ψ indicates decentralization is welfare superior while a negative Ψ indicates centralization is welfare superior. It is also straightforward to show that for any $\Delta\alpha$ there exists a $\widehat{\Delta\theta}$ such that $\Psi(\widehat{\Delta\theta})=0$. For any $\Delta\theta > \widehat{\Delta\theta}$, Ψ is negative and centralization is welfare superior. Finally, we may write

$$\Psi(\Delta\theta) = \Omega - \frac{1}{4(1+\lambda)^2}\left[\frac{13}{24}\Delta\theta^2+\Delta\theta\left(2\underline{\theta}-(\alpha_A+\alpha_B)\right)\right],$$

from which it is clear that $\Psi < \Omega$. The value $\widetilde{\Delta\theta}$ is, by definition, such that $\Omega\left(\widetilde{\Delta\theta}\right)=0$. Since $\Psi<\Omega$, then $\Psi\left(\widetilde{\Delta\theta}\right)<0$ and centralization is welfare superior for $\widetilde{\Delta\theta}$. This implies that $\widetilde{\Delta\theta} > \widehat{\Delta\theta}$, which concludes the proof. □

Proof of Propositions 4 and 5. The mechanics of these proofs mimics that of Proposition 2 and 3. We skip the algebra and present the final expressions for the welfare

difference between decentralized and centralized structures in polarized settings under perfect and private information. The welfare difference under perfect information is denoted by

$$\Phi(\Delta\theta,\Sigma\theta) = -\frac{1}{4(1+\lambda)^2}\left[\frac{\Delta\theta^2}{6} + \Sigma\theta^2 - \Sigma\theta\Delta\alpha - \lambda(2+\lambda)\Delta\alpha^2\right].$$

It is straightforward to see that Φ is monotonically decreasing with respect to both $\Delta\theta$ and $\Sigma\theta$. Thus, for any $\Delta\alpha$ and $\Sigma\theta$, there exists $\widehat{\Delta\theta}$ such that $\Phi(\widehat{\Delta\theta},\Sigma\theta) = 0$. For any $\Delta\theta > \widehat{\Delta\theta}$ ($\Sigma\theta > \widehat{\Sigma\theta}$), $\Phi(\Delta\theta,\Sigma\theta) < 0$ and centralization is welfare superior. Analogously, for any $\Delta\alpha$ and $\Delta\theta$, there exists $\widehat{\Sigma\theta}$ such that $\Phi(\Delta\theta,\widehat{\Sigma\theta}) = 0$. For any $\Sigma\theta > \widehat{\Sigma\theta}$, $\Phi(\Delta\theta,\Sigma\theta) < 0$ and centralization is welfare superior.

The welfare difference under private information is given by

$$\Lambda(\Delta\theta,\Sigma\theta) = -\frac{1}{16(1+\lambda)}\left[\frac{11}{3}\Sigma\theta^2 + \frac{1}{6}\Delta\theta^2 - 8\Sigma\theta\Delta\alpha - 4\lambda(2+\lambda)\Delta\alpha^2\right].$$

Again it is straightforward to check that Λ is decreasing with respect to both $\Delta\theta$ and $\Sigma\theta$. Thus, for any $\Delta\alpha$ and $\Sigma\theta$, there exists $\widetilde{\Delta\theta}$ such that $\Lambda(\widetilde{\Delta\theta},\Sigma\theta) = 0$. For any $\Delta\theta > \widetilde{\Delta\theta}$, $\Lambda(\Delta\theta,\Sigma\theta) < 0$ and centralization is welfare superior. Analogously, for any $\Delta\alpha$ and $\Delta\theta$, there exists $\widetilde{\Sigma\theta}$ such that $\Lambda(\Delta\theta,\widetilde{\Sigma\theta}) = 0$. For any $\Sigma\theta > \widetilde{\Sigma\theta}$, $\Lambda(\Delta\theta,\Sigma\theta) < 0$ and centralization is welfare superior. Additionally, it is simple to check that $\Phi > \Lambda$ for every combination of parameters. This implies that $\widetilde{\Delta\theta} > \widehat{\Delta\theta}$ and $\widetilde{\Sigma\theta} > \widehat{\Sigma\theta}$, which concluded the proof. □

References

Austen-Smith, D. (1995). Campaign contribution and access. *American Political Science Review 89*, 566–81.

Austen-Smith, D. and J. Wright (1992). Competitive lobbying for a legislature's vote. *Social Choice and Welfare 9*, 229–57.

Bardhan, P. and D. Mookherjee (2000). Capture and governance at local and national levels. *American Economic Review 90*(2), 135–139.

Bennedsen, M. and S. Feldmann (2006). Information lobbying and political contributions. *Journal of Public Economics 90*, 631–56.

Bernheim, D. and M. Whinston (1986). Menu auctions, resource allocation, and economic influence. *The Quarterly Journal of Economics 101*, 1–31.

Besley, T. and S. Coate (2003). Centralized versus decentralized provision of local public goods: a political economy approach. *Journal of Public Economics 87*(12), 2611–2637.

Bordignon, M., L. Colombo, and U. Galmarini (2008). Fiscal federalism and lobbying. *Journal of Public Economics 92*(12), 2288–2301.

De Melo, J., A. Panagariya, and D. Rodrik (1993). *New Dimensions in Regional Integration*, Chapter The new regionalism: a country perspective. Cambridge University Press.

Grossman, G. and E. Helpman (1994). Protection for sale. *American Economic Review 84*, 833–50.

Grossman, G. and E. Helpman (1995). The politics of free-trade agreements. *American Economic Review 85*(4), 667–690.

Inman, R. and D. Rubinfeld (1997). Rethinking federalism. *Journal of Economic Perspectives 11*(4), 43–64.

Krishna, P. (1998). Regionalism and multilateralism: a political economy approach. *Quarterly Journal of Economics 113*(1), 227–252.

Lima, R. C. and H. Moreira (2014). Information transmission and inefficient lobbying. *Games and Economic Behavior 86*(282-307).

Lockwood, B. (2002). Distributive politics and the costs of centralization. *Review of Economic Studies 69*(2), 313–337.

Loeper, A. (2011). Coordination in heterogeneous federal systems. *Journal of Public Economics 95*(7-8), 900–912.

Maggi, G. and A. Rodriguez-Clare (2007). A political-economy theory of trade agreements. *American Economic Review 97*(4), 1374–1406.

Martimort, D. and H. Moreira (2010). Common agency and public good provision under asymmetric information. *Theoretical Economics 5*, 159–213.

Martimort, D. and A. Semenov (2008). Ideological uncertainty and lobbying competition. *Journal of Public Economics 92*, 456–81.

Maskin, E. and J. Tirole (1990). The principal-agent relationship with an informed principal: the case of private values. *Econometrica 58*, 379–409.

Oates, W. E. (1972). *Fiscal federalism*. Harcourt Brace, New York.

Ornelas, E. (2005a). Endogenous free trade agreements and the multilateral trading system. *Journal of International Economics 67*(2), 471–497.

Ornelas, E. (2005b). Rent destruction and the political viability of trade agreements. *Quarterly Journal of Economics 120*(4), 1475–1506.

Potters, J. and F. Van Winden (1992). Lobbying and asymmetric information. *Public Choice 74*, 269–92.

Redoano, M. and K. A. Scharf (2004). The political economy of policy centralization: direct versus indirect representative democracy. *Journal of Public Economics 88*(3-4), 799–817.

Richardson, M. (1993). Endogenous protection and trade diversion. *Journal of International Economics 34*(3-4), 309–324.

Riley, J. (1979). Informational equilibrium. *Econometrica 47*(2), 331–359.

Seabright, P. (1996). Accountability and decentralization in government: an incomplete contracts model. *Journal of Public Economics 40*(1), 61–89.

Spence, M. (1973). Job market signaling. *The Quarterly Journal of Economics 87*, 355–74.