# Group Specific Public Goods and Political Competition

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**Abstract**

We study the provision of multiple types of public goods through political competition in a probabilistic voting set-up. There are multiple groups, and we consider both a generic public good as well as a group-specific public good for each group. These group-specific public goods provide identity payoffs that are relative: own-group public goods provide utility, while other-group public goods provide disutility. We use the extent of disutility as a measure of "identity distance" between a pair of groups. We show that the equilibrium provision of group-specific public goods responds to the political clout of groups, which is a product of within-group cohesiveness and group size. Moreover, a higher identity distance between two groups will reduce the amount of identity good for both groups, but more so for the smaller and the more "fringe" group with respect to other groups. We also show that the more central a group is in the identity network, the more identity good it can attract. Also, increased identity fractionalization reduces the extent of identity good provision for all groups.

***Keywords-*** Public goods, identity goods, vote consolidation, political clout, social networks

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# 1 Introduction

Societies frequently exhibit divisions among various groups rooted in social identities (race, religion, language, caste, etc). Much like generic public goods that benefit all members of society, there exist group-specific public goods that are enjoyed by all members of the group but not by non-members. Moreover, much like generic public goods, these group-specific public goods are also often provided by the government and financed by taxes.

Quite often, these group-specific public goods are closely related to a sense of identity of the group. These could be a place of worship for a religious group, a job reservation policy for a racial minority, or local public services provided in areas where most of the population belongs to a specific group. They have the feature that not only do they provide utility to the group enjoying them, but they also provide disutility to the groups that are excluded from enjoying them. In this paper, we specifically model group-specific identity goods as a source of disutility to other groups. Going one step forward, we think of the society as composed of multiple groups, and the "identity distance" between a pair of groups is measured by the extent of disutility that one group obtains from specific public goods provided to the other group.

In this paper, we ask how political competition determines the taxes as well as the mix of tax-financed generic and group-specific public goods in the society when groups not only care about their own group's specific public goods but also dislike other group's specific public goods. Since the group specific public good has the feature that one gets utility from own-group public good but disutility from rival-group public goods, we term them as identity goods. We will reserve the term public goods for the generic public goods which are valued by agents in all groups the same way.

A benevolent leader or a planner acting in the societal interest (and therefore maximizing the sum of agent utilities) may treat the various social groups uniformly. Nonetheless, politicians driven by electoral motives often seek to court the "swing voters" from the different factions by offering targeted transfers, disproportionately benefiting certain segments of the society. Such pork-barrel ideas are extensively documented in positive political science literature (Cox and McCubbins, 1986; Lindbeck and Weibull, 1987; Dixit and Londregan, 1995, 1996, 1998). While the existing models in this literature incorporate various aspects such as diverse preferences, ideologies, and tax burden shared by other groups in the political competition outcome for targeted public goods, they often overlook the direct animosity among groups which can have direct consequences for allocation of public goods. We employ the standard probabilistic voting model (Lindbeck and Weibull, 1987), later used in the textbook by Persson and Tabellini (2002), commonly used to study public goods provision through electoral competition.

We expect political competition to deliver the redistribution in an efficient way. However, in the political equilibrium, such economically efficient policies may not be adopted.[1]. Our first insight is that there might be underprovision or overprovision of generic public goods as well as identity goods (targeted group-specific public goods) if there is a heterogeneity in political clout of the different groups. There is overprovision compared to social optimum if the poorer group has higher political clout and there is underprovision if the richer group has higher clout. The reason for this is simply that the richer group always bears a higher share of taxation; hence, the relative political clout of rich versus poor determines the extent of public goods as well as identity goods. This result is in contrast with a strand of literature that finds a negative relationship between ethnic heterogeneity and public goods provision (Alesina et al. (1999), Alesina et al. (2000)) for generic public goods and Munshi and Rosenzweig (2015) for local public goods. These papers assume that there is a scale benefit to public goods which is reduced due to ethnic diversity, either through the demand side or through the supply side. We, on the other hand, assume no such scale benefit and consider the relative political clout of the richer and poorer groups as the source of deviation from the optimal provision of public/identity goods.

Our second finding, which is broadly in line with the existing finding, is that a higher

[1]See Stigler (1972), Weingast et al. (1981), Wittman (1989, 1995), Besley and Coate (1998) for more about efficiency and political competition

inter-group distance (i.e., higher disutility from rival identity goods) results in a decline in the provision of identity good for the concerned groups. While politicians are trying to please the voters through the group-specific public good for a concerned group, they can not do it at the cost of the utility of the other groups, which results in the lower identity good for the concerned group in the political equilibrium.

We later provide a characterization of identity good provision based on identity networks which shows that (i) larger groups and more centrally located groups get higher quantity of identity goods, and (ii) increased fractionalization of groups hurts all groups concerned.

Public goods provision in the face of ethnic fractionalization has been studied by others, in particular, by Esteban and Ray (2011). In fact, our preference specification as coming from utility from own-group identity good and disutlity from other-group identity good borrows a specification in Esteban and Ray (2011). Howeever, while they (and others in this literature on fractionalization and political conflict) typically consider a contest model to allocate the prizes, we consider a model of electoral politics. We emphasize that the electoral channel is an important device to decide the allocation of public goods. Moreover, while the contest models work with a fixed budget to be allocated across different public goods, our framework allows for the level of taxes as well as the mix of tax-financed public and identity goods to be determined simultaneously in equilibrium.

In our model, we have a society that is divided into $n$ mutually exclusive and exhaustive groups, and the utility of any individual has four components: private consumption, generic public goods, own-group public good, and rival-group public good, which is a source of disutility. Candidates commit to a policy, and a policy tuple is the two kinds of public goods (a generic public good and a specific good for each group) and a tax rate. The additive structure allows us to obtain an equilibrium. Assuming that both candidates are office-motivated, there is a policy convergence.

In equilibrium, we show that, unlike the social planner's solution, the political competition caters to the political clout of the groups. Moreover, the lower the within-group variance in preference, the more politically effective the group is. This is measured by a 'cohesiveness' parameter (inverse of preference variance) in our model, one for each group. The political clout of a group depends on its size and cohesiveness. We demonstrate that the income being similar, there will be a higher provision of group-specific public good if the group with more cohesive votes desire so. Moreover, in the convergent political equilibrium, we can have either under-provision or over-provision of public goods depending on whether the group with higher political clout has a higher or lower income share. Next, we provide an alternative interpretation of our model with a social network structure of the society. We demonstrate that a group that is more central in the society can attract more identity goods. Further, in the case of a society having subgroups, we show that a group with lower within-group fragmentation can attract more identity goods, showcasing the importance of social harmony for higher societal welfare.

While politicians have the option to entice votes from the economically disadvantaged through direct cash transfers or from the affluent members through tax advantages, similar mechanisms for identity-based group-specific transfers may not always be readily available. Nonetheless, in the context of interest groups, there can be disguised mechanisms for such transfers. Consider two illustrative instances from Tullock (2013). Firstly, a government, in order to please affluent individuals, may choose to keep land "unspoiled" to attract visits from such individuals. However, if the land contains potential mineral resources, the government effectively forgoes potential mineral royalties by maintaining its pristine status. Secondly, consider a strategic allocation of common infrastructure projects such as roads. A government constructing roads may opt to route them through or nearby areas predominantly inhabited by a particular community rather than selecting the optimal location. This strategic decision increases the value of real estate belonging to that community, thereby facilitating indirect, disguised transfers to that specific group. Another example of disguised transfers could involve the direct allocation of cash transfers from tourism promotion funds to a religious site by designating it as a tourist attraction. Through this declaration, funds are effectively transferred to please a selective religious community under the guise of promoting tourism. Moreover, a representative citizen model by Coate and Morris (1995) shows that despite having the option of disguise transfers, identical politicians will make efficient transfers to the special interests.

In terms of the group identities and public good redistribution, our model is closest to Fernández and Levy (2008) and Ghosh and Mitra (2022). The class and preference conflict is discussed in the Fernández and Levy (2008), demonstrating how preference diversity affects rich-poor conflict about redistribution. There are, however, interest groups within the poor category only. The question of discrimination against minorities in a democracy vs dictatorial regime is addressed in the Ghosh and Mitra (2022). This paper models the majority as the largest group and their population size as the dimension of ethnic dominance. The results show that with a higher ethnic dominance, there is a higher provision of ethnically targetable goods, and lower ethnic dominance induces higher generic public goods. The results are the opposite for the dictatorship. The key intuition behind this is that with low ethnic dominance, the minority group has a higher incentive to rebel as they will get more public goods by ousting the dictator, and hence, even the dictator caters to such conditions. In our model, we have a generic public good as well as a group-specific public good. Lizzeri and Persico (2005) show the drawbacks of electoral competition, particularly concerning the proliferation of the number of political parties, in the sense of inefficiencies in redistribution as parties can promise targeted public goods and universal public goods to the voters. The paper, however, does not have targeted, identity-based goods for the groups. Moreover, unlike Alesina et al. (1999), we have a one-shot voting decision, and we allow for the provision of generic public goods and multiple group-specific public goods. When we provide a social identity network framework as an alternative way of interpretation, one of the questions that we address is how within-group fragmentation affects the provision of group-specific public goods, which is also asked by Dasgupta and Neogi (2018) in the contest settings. Our network-based approach solidifies that result and also differs slightly from the result in terms of lesser spillover of the within-group fragmentation. It is imperative to note that while different taxation-based incentives may be perceived as indirect targeted transfers, identity-based goods are financed from the common pool of tax resources and may entail direct disutility for other groups along with the monetary burden they share. This distinction underscores the importance of the direct provision of identity-based goods and their utility consequences in the society.

Following the approach of Alesina et al. (1999) and consequent literature, which analyses public good redistribution with increasing preference diversity, we allow different groups to have different preferences over the generic public good that is enjoyed by everyone. In essence, different groups may exhibit different valuations over the same public good. To elucidate further, consider a decision for investment in public education. Given that a higher proportion of white children opt for private schooling, the white ethnicity group may assign a lower value to public education compared to the black ethnicity group. Moreover, we restrict ourselves to only one type of generic public good but have different group-specific public goods for each group. Further, we entail intra-group ideological variation, where individuals within each political group may have differing ideological leanings toward the parties owing to an exogenous idiosyncratic shock, which will be discussed in the model.

Our model contributes to the existing literature in several ways. Firstly, it helps to explain why certain groups in society receive identity-specific benefits such as ethnicity-based preferential college admissions, affirmative actions, or caste-based job reservations while others are excluded from the same opportunities. The groups that are excluded may be more vulnerable, more deserving, or have strong preferences, but they may still be unable to access these benefits, courtesy of the political dynamics at play. Our model presents one of the possible explanations for this essential observation. Secondly, our model represents a more comprehensive structure and a flexible political framework of society in the context of generic public goods and group-specif goods preferences and their allocation. Our model is flexible enough to accommodate relevant insights from Alesina et al. (1999), Lizzeri and Persico (2005), Fernández and Levy (2008), and Ghosh and Mitra (2022) with respect to the citizen preferences and allocation of public goods. Additionally, we offer a novel method for determining the allocation of both generic public goods and identity-specific goods using social networks prevalent in the society. Finally, our model contributes to the growing literature on the role of identity in electoral politics of contemporary democratic and liberal societies.

The subsequent sections of the paper are organized as follows. Section 2 delineates the foundational framework of the central model. In section 3, we provide the main results pertaining to the central model for inefficiencies arising due to electoral competition. Next, in section 4, we study the under-provision and over-provision of public goods by restricting the model to two groups. In section 5, we briefly provide a short extension of the model, which presents an alternative interpretation of the model along with divisions within groups in terms of the social identity networks prevalent in the society. Before moving to the conclusion in section 7, we discuss the generic public good allocation and utility consequences if the group-specific public goods are banned by the society or the politicians are not responsible for the provision of such goods.

## 2 The Model

We study the provision of public goods and identity based, group-specific public goods in a society through electoral competition between two parties. There is a unit mass of agents in the society, and they are divided into $n$ mutually exclusive and exhaustive groups denoted as $i = 1, 2, ...n$. Each group $i$, has $\beta_i > 0$ share of members. We assume (for simplicity) that each member in group $i$ has a common income $y_i > 0$. We shall denote the income of the society by $y$, which can be expressed as $y = \sum_{i=1}^{n} \beta_i y_i$.

There are two parties, $A$ and $B$. Each party $K$ commits to a policy platform $\mathbf{q}_K$ which is a tuple of a tax rate $t^K \in [0, 1]$, a generic public good $G^K > 0$ and a group-specific public good $G_i^K$ for each group $i$. We assume complete commitment to the platforms, *i.e.,* parties implement what they promise. In the central model, parties are win-motivated and obtain a payoff $w$ from holding the office. However, the model can be easily extended to illustrate how the results change if parties care about particular groups. It is important that the total expenditure on public goods be equal to the taxes raised so there is no distortion in taxation.

$$yt = G^K + \sum_{i=1}^{n} G_i^K \tag{1}$$

Voters exhibit preferences concerning post-tax income (consequently private consumption), a generic public good, and group-specific public goods. We conceptualize these group-specific goods as *identity goods*, which are characterized by the feature that an agent not only prefers to have more of it for his own group but also prefers the other groups to have less of it. These are goods that enhance one's own identity over others, *e.g.,* places of worship if we think of religion as the group and ethnicity-based college scholarships if we think of ethnicity as a group. These goods inherently have benefits that can be antagonistic in nature. However, one must note that the degree of antagonism or affinity between groups varies. For instance, consider caste-based groups. Perhaps by virtue of both being castes of equal order, one caste has a higher affinity (or low animosity) to another caste than it has to a relatively very high or a very low-ordered caste. To that extent, the disutility to an individual from one caste from a given level of identity good for another caste of equal order would be lower than the disutility from the same amount provided to a caste of relatively very high or very low order.

We capture the value of identity good provided to group $j$ for group $i$ by the parameter $b_{ij}$. We posit that if $i \neq j$, $b_{ij} \leq 0$, with the interpretation that larger numerical values of $b_{ij}$ imply more antagonistic nature or animosity of relationship between identity $i$ and identity $j$. However, this assumption can be easily relaxed without any major changes in the main model or results. Moreover, we assume $b_{ij} = b_{ji}$. On the other hand, the value for one's own identity good is $b_{ii} > 0$. We also assume that $0 < b_{ii} < 1$. The term $b_{ii}$ also captures the relative valuation of the public good and group-specific good by the group $i$. Therefore, the relationship between identity groups is captured by the symmetric matrix $B$ with its diagonal elements positive and all other elements non-positive. For $i \neq j$, we shall denote $-b_{ij}$ for expressing the *inter-group distance*.

We shall write the utility derived by a voter from group $i$ from party $K's$ platform as

$w_i(\mathbf{q}_K)$, where

$$w_i(q_K) = y_i(1-t^K) + (1-b_{ii})\alpha \log(1+G^K) + b_{ii}\alpha \log(1+G_i^K) + \sum_{j=1, j\neq i}^{n} b_{ij}\alpha \log(1+G_j^K) \quad (2)$$

The electorate gets a common exogenous shock $\delta$, which is realized just before the elections, and it is uniformly distributed over $\left[\frac{-1}{2\psi}, \frac{1}{2\psi}\right]$. A voter $j$ from group $i$ also gets an idiosyncratic shock in the favour of one party or another based on a myriad of factors that are important to the specific voter but do not depend on the campaign platform. This shock is modeled as a random variable $\gamma^{ij}$ drawn from a uniform distribution over $\left[\frac{-1}{2\phi_i}, \frac{1}{2\phi_i}\right]$, denoting the difference in utility from party $B$ and party $A$. Note that the distribution varies for each group. We assume that the parameter $\alpha > 1$. The parameter $\phi_i$ measures how cohesively a particular group votes in the election. The cohesion of the group is based on the ideological heterogeneity within the group. Given a realization of $\gamma^{ij}$, a voter $j$ in group $i$ votes for party $A$ over $B$ if

$$w_i(q_A) > w_i(q_B) + \delta + \gamma^{ij}, \quad (3)$$

and for $B$ over $A$ if the inequality goes in the other direction. This concludes the foundational framework of the central model. After discussing the benchmark, first-best results, we will discuss the political competition and outcomes of the political competition.

# 3 Results

## 3.1 Public good provision

Before getting into the positive question of what policies are implemented under electoral competition, we first pose the normative question of determining the platform that maximizes utilitarian social welfare.

### 3.1.1 First best

The "planner's problem" is to maximize the sum of voter utilities subject to the budget constraint. This can be written as

$$
\begin{aligned}
& \max_{t,G,G_1,..G_n} y(1-t) + \sum_{i=1}^{n} \beta_i (1-b_{ii})\alpha \log(1+G) + \sum_{i=1}^{n} \beta_i \left[ \sum_{j=1}^{n} b_{ij}\alpha \log(1+G_j) \right] \\
& \text{subject to} \\
& yt = G + \sum_{i=1}^{n} G_i, \\
t \in \; & [0,1], G \geq \varepsilon, G_i \geq \varepsilon, \; \varepsilon > 0
\end{aligned}
$$

We form a lagrangian and solve this. Note that since the logarithm of zero is undefined, we ensure that by choosing $1+G_i$(instead of using only $G_i$) to be bounded away from zero. This form can accommodate corner solutions. Without this arrangement, we can also work with a model by assuming that there is some lower bound of minimum positive public good say $\varepsilon$ that must be provided. However, this $\varepsilon$ is low enough that we will admit a solution at $\varepsilon$ only if the problem with nonnegative $G's$ has a corner solution for the same argument.

**Proposition 1** *The welfare maximizing (first best) allocation of public goods is given by*

$$
\begin{aligned}
G^s &= \max\left\{ \alpha \sum_{i=1}^{n} \beta_i (1-b_{ii}) - 1, 0 \right\} \\
G_i^s &= \max\left\{ \alpha \sum_{j=1}^{n} \beta_j b_{ji} - 1, 0 \right\}, \forall i
\end{aligned}
$$

**Proof.** In appendix ■

To see the intuition, note that the society's marginal benefit from the generic public good is $\alpha \frac{\sum_{i=1}^{n} \beta_i (1-b_{ii})}{1+G}$, while the marginal cost is a lost consumption of 1 unit for the society as a whole. Equating the two, we get the expression for $G^s$. An extra unit of identity good for group $i$ creates a utility of $\alpha b_{ii} - 1$ to the group $i$ and a disutility of $\alpha b_{ij} - 1$ to every member of group $j$. The total marginal benefit is, therefore, the marginal utility/disutility weighted by the group sizes. We equate the marginal benefit to the marginal cost of 1 to obtain the expression for $G_i^s$.

Now, $G^s > 0$. if $\alpha > \frac{1}{\sum_{i=1}^n \beta_i(1-b_{ii})}$ that is $\alpha > \frac{1}{1-\sum_{i=1}^n \beta_i b_{ii}}$. An implication of the above proposition is that it is socially optimal to provide an above-minimal amount of identity good to group $i$ if and only if

$$\beta_i b_{ii} > \frac{1}{\alpha} - \sum_{j, j \neq i} \beta_j b_{ji}$$

This will be true if either (i) group $i$ is large enough or (ii) group $i$ does not have very strong antagonistic relationships with other groups and large groups in particular. In a social network setting, we provide a simple yet interesting way to interpret this result in section 5. Moreover, an increase in inter-group distance, *i.e.,* the numerical value of $b_{ij}$ will reduce the socially optimal identity good for both groups $i$ and $j$. Notice that the optimal public good provision does not depend on the incomes of groups.

The socially optimal tax can be thus obtained from proposition (1) as

$$t^s = \frac{1}{y}\left[G^s + \sum_{i=1}^n G_i^s\right]$$

Now, an increase in the valuation of one's own identity good ($b_{ii}$) will correspond to raised taxes, while an increase in inter-group distance will reduce taxes and lead to higher private consumption. This observation underscores the existence of a trade-off between polarization and economic growth, even at the social planner's level.

#### 3.1.2 Electoral Competition

Our model of electoral competition follows the standard structure in probabilistic voting (Lindbeck and Weibull, 1987; Persson and Tabellini, 2002; Polo, 1998). Recall that a voter in group $i$ votes for $A$ or $B$ based on (3). Fixing a platform $q_A$ for party $A$ and $q_B$ for party $B$, we identify the "swing voter" in group $i$ as the voter with realized value of $\gamma$ given by

$$\gamma_i^* = w_i(q_A) - w_i(q_B) - \delta \tag{4}$$

Voters $j$ in group $i$ with realized value $\gamma^{ij}$ larger than $\gamma_i^*$ will vote for $B$ and those with value lower than $\gamma_i^*$ vote for $A$. Therefore, the vote share for $A$ *within* group $i$ is

$$\pi_{Ai} = \Pr(\gamma^{ij} \leq \gamma_i^*) = \frac{1}{2} + \phi_i \left[ w_i(q_A) - w_i(q_B) - \delta \right] \tag{5}$$

Therefore, given a pair of platforms $q = (q_A, q_B)$, the vote share of party $A$ is

$$\pi_A(q) = \frac{1}{2} + \sum_{i=1}^{n} \beta_i \phi_i \left[ w_i(q_A) - w_i(q_B) \right] - \delta \sum_{i=1}^{n} \beta_i \phi_i$$

From now on, we shall write $\Delta w_i(q)$ to denote $w_i(q_A) - w_i(q_B)$. Hence,

$$\pi_A(q) = \frac{1}{2} + \sum_{i=1}^{n} \beta_i \phi_i \Delta w_i(q) - \delta \sum_{i=1}^{n} \beta_i \phi_i \tag{6}$$

Thus, in order to maximize the vote share, party $A$ maximizes $\sum_{i=1}^{n} \beta_i \phi_i \Delta w_i(q)$ and party $B$ minimizes the same. Since the parties are ex-ante identical, we will have convergence, *i.e.,* both parties will offer the same platform $q_A = q_B = q^*$. The following proposition delineates the equilibrium platform $q^*$.

**Proposition 2** *In the political equilibrium, each party offers the same platform* $q_A = q_B = q^*$*. The allocation of public goods in* $q^*$ *is given by*

$$\begin{aligned} G^* &= \max \left\{ \frac{\alpha \sum_j \beta_j \phi_j (1 - b_{jj})}{\sum_j \beta_j \phi_j \left( \frac{y_j}{y} \right)} - 1, 0 \right\} \\ G_i^* &= \max \left\{ \frac{\alpha \sum_j \beta_j \phi_j b_{ji}}{\sum_j \beta_j \phi_j \left( \frac{y_j}{y} \right)} - 1, 0 \right\} \text{ for all } i \end{aligned}$$

**Proof.** In appendix ■

In order to attract votes from a group, each party targets its policies to the pivotal voter, and the probability weight of the pivotal voter (as of any other voter in a uniform distribution) in group $i$ is $\phi_i$. By providing one unit more of the neutral public good, a party creates a per capita marginal benefit of $\alpha \frac{1-b_{ii}}{1+G}$ units for group $i$. The probability of a voter being pivotal and from group $i$ is $\beta_i \phi_i$, this is denoted as the "political clout" of group $i$. Thus, the political clout of the group depends on both its size and the cohesiveness of votes. The expected marginal benefit from the generic public goods for pivotal voters is, therefore, $\frac{\alpha}{1+G}\sum_j \beta_j\phi_j(1-b_{jj})$. The expected marginal benefit of $G_i$ is obtained by balancing the marginal utility $b_{ii}$ to group $i$ and the marginal disutilities $b_{ij}$ to groups $j \neq i$, again considering the political clout of each group. The aggregate benefit of one extra unit of the identity good offered to group $i$ *as considered by either party while deciding on its platform* is therefore $\frac{\alpha}{1+G}\sum_j \beta_j\phi_j b_{ji}$.

The cost of a unit of a public good is 1 unit of lost consumption for the society in the aggregate, but this is unevenly distributed across the groups and, hence, across the pivotal voters. To finance an extra unit of any public good (generic or identity good), an extra unit of tax revenue ($ty$) has to be raised, which requires the tax rate to go up by $\frac{1}{y}$. Since the per capita income in group $i$, the pivotal voter in group $i$ has to give up consumption worth $\frac{y_i}{y}$. The cost of a unit of extra public good as considered by each party for group $i$ is $\frac{y_i}{y}\phi_i\beta_i$, which is the weight of the pivotal voter from group $i$. The effective marginal cost for the platform decision of either party is therefore, $\sum_j \beta_j\phi_j\left(\frac{y_j}{y}\right)$. We get $G^*$ and $G_i^*$ in Proposition (2) by equating the marginal benefit and marginal cost for platform decision.

Notice that the equilibrium allocation differs from the socially optimal allocation by the cohesion terms $\phi_i$. This is established formally by the next corollary.

**Corollary 1** *If $\phi_i = \phi$ for all $i$, then $G^* = G^s$ and $G_i^* = G_i^s$ for all $i$.*

The proof of the above corollary is immediate. This corollary implies that in a hypothetical scenario if all groups have equally cohesive votes (or similar ideological heterogeneity), we will have a socially optimal provision of a generic public good as well as group-specific public goods even with political competition. Notice that both over-provision and under-provision of public goods is possible under electoral competition.

# 4 Special case $n = 2$

We now illustrate some of the basic features of our results in the important case where there are only two identity groups, 1 and 2, in the society. We will assume that $b_{11} = b_{22}$ *i.e.,* both groups care equally about their own identity good. Let the degree of antagonism or animosity between the two groups be written as $b_{12} = b_{21} = -b$.

## 4.1 Generic public good

First, we look at the distortion from the first best due to electoral incentives, which political parties care about. The next result says that if the group with higher cohesiveness is also the one with higher per capita income, then we will have under-provision of the generic public good.

**Remark 1** *Compared to the first best, when both groups have similar preferences for the group-specific public good ($b_{11} = b_{22}$), the generic public good is over-provided if $(\phi_1 - \phi_2)(y_1 - y_2) < 0$ and is under-provided if $(\phi_1 - \phi_2)(y_1 - y_2) > 0$.*

The first best generic public good provision level is $\alpha[\beta_1(1 - b_{11}) + \beta_2(1 - \beta_{22})] - 1$. The equilibrium provision obtained from proposition (2) can be written as $\alpha X^* - 1$ where

$$X^* = \frac{\phi_1\beta_1(1 - b_{11}) + \phi_2\beta_2(1 - b_{22})}{\phi_1\frac{\beta_1 y_1}{y} + \phi_2\frac{\beta_2 y_2}{y}}, \tag{7}$$

while the first best is $G^s = \alpha[\beta_1(1 - b_{11}) + \beta_2(1 - b_{22})] - 1 = \alpha X^s - 1$. Notice that $X^*$ is really a ratio of two weighted averages of $\phi_1$ and $\phi_2$ : the weights in the numerator are population proportions of the two groups, and the weights in the denominator are the income shares of the two groups, 1 and 2. We are not furnishing a separate proof since the above result is a straightforward product of this observation.

To see the result in an intuitive way, observe that the group with higher per capita income has a relatively higher tax burden for financing the public good. Since the equilibrium allocation distorts the first best towards the group with higher cohesiveness, there is under-provision if the more cohesive group has to share a higher burden and over-provision in the opposite case.

Expression (7) also helps enunciate how the electoral provision of the generic public good $G$ depends on the model parameters. In order to avoid making too many assumptions on the parameter space, we express the comparative statics for the extent of distortion, *i.e.,* $|G^* - G^s|$. Since remark (1) tells us the direction of distortion, we can then figure out the effect on the levels of provision of $G$.

Since the source of the distortion is that different groups have different levels of cohesiveness, an increase in the difference between $\phi_1$ and $\phi_2$ will increase the distortion. Considering income, first note that there will be no change in public goods provision if income increases proportionately for both groups. On the other hand, if the income inequality $\frac{y_1}{y_2}$ increases, then the distortion worsens.

The size distribution of the groups does not affect the direction of distortion, but it does affect the extent. There is a size $\beta^* \in (0,1)$ such that the distortion is maximized at $\beta_1 = \beta^*$. The reason for this is the following: at very high or very low values of $\beta_1$, essentially the majority group determines both the social optimal as well as the electoral equilibrium and the variation of cohesiveness across groups fails to matter. The next result elucidates the provision of generic public good when there is no variation across the income dimension in the society.

**Remark 2** *Compared to the first best, when both groups have similar incomes i.e., $y = y_1 = y_2$, and one of the groups has more consolidated votes, generic public goods are over-provided if that group has a stronger preference for the generic public goods. That is, if $y = y_1 = y_2$ and $\phi_1 > \phi_2$, generic public good is over provided if $b_{11} < b_{22}$*

The intuition behind the marginal cost-benefit analysis behind this remark is similar to remark 1. When both groups are not different across the income dimension, but they have different political support to offer in terms of the consolidated votes, politicians cater to this situation by offering higher generic public goods to the influential group if it has a stronger preference for the generic public good, and it under provides if it has lower preferences for the generic public good. This remark disentangles the direct impact of vote cohesiveness on the under-provision or over-provision of the generic public good. Now, we provide a similar set of conditions for the identity goods.

### 4.2 Identity goods

We start with a comparison with the first best. For simplicity, let both groups have the same income such that $y_1 = y_2$. The next remark tells us that under-provision or over-provision of identity goods depends only on variation in cohesiveness: the group with higher cohesiveness has more identity goods than the first best, and the group with lower cohesiveness has fewer. Of course, this relationship is weak since we have to take into account corner solutions.

**Remark 3** *If $\phi_1 > \phi_2$, we must have over-provision of identity good 1 and under-provision of identity good 2 if $b_{11} > b_{21}$, i.e., $G_1^* \geq G_1^s$ and $G_2^* \leq G_2^s$. If $\phi_1 < \phi_2$, then the inequalities are reversed.*

**Proof.** In appendix. ■

In the first-best solution (Proposition 1), the amount of identity good for any group is determined as a population-weighted combination of the utility/disutilities from the good to every group. The equilibrium solution weights these by the respective cohesiveness terms for each group. Since $\phi_1 > \phi_2$, this increases the positive weight (utility for group 1) and reduces the negative weight (disutility for group 1) on $G_1$, leading to its over-provision. On the other hand, the effect on $G_2$ is exactly the opposite - the disutility for group 1 is exacerbated, and the utility for group 2 is mitigated in equilibrium, leading to its under-provision.

We can also establish a version of remark (3) in the extensive margin and a sharper case $b_{11} = b_{22} = 1$. It is socially optimal to provide an above-minimal quantity of identity good $G_i$ if and only if

$$b < \frac{\alpha\beta_i - 1}{\alpha\beta_{-i}}$$

where $j \neq i$. In equilibrium, the corresponding threshold is

$$b < \alpha \frac{\phi_i \beta_i}{\phi_j \beta_j} - 1.$$

Letting $\beta_1 > \beta_2$, we get a range $\left(\frac{\beta_2}{\beta_1} - \frac{1}{\alpha\beta_1}, \frac{\beta_1}{\beta_2} - \frac{1}{\alpha\beta_2}\right)$ for the disutility parameter $b$ within which it is socially optimal to provide the identity good only to the majority group. In equilibrium, this range becomes $\left(\frac{\phi_2\beta_2}{\phi_1\beta_1} - \frac{\phi_1\beta_1(y_1/y)+\phi_2\beta_2(y_2/y)}{\alpha\phi_1\beta_1}, \ \frac{\phi_1\beta_1}{\phi_2\beta_2} - \frac{\phi_1\beta_1(y_1/y)+\phi_2\beta_2(y_2/y)}{\alpha\phi_2\beta_2}\right)$. Thus, if the majority is also more cohesive, *i.e.,* $\phi_1 > \phi_2$, then the corresponding interval for equilibrium provision expands, leading to a range where $G_1$ is provided where it is suboptimal and $G_2$ is not provided when it is optimal. If, on the other hand, $\phi_1 < \phi_2$, the above range shrinks and we have the opposite result.

For further analysis in section (4.2), we shall assume that the equilibrium provision of both goods is positive. Then, the equilibrium amount of identity good for group 1 can be written as $\alpha X_1^* - 1$ where

$$\begin{aligned} X_1^* &= \frac{\beta_1\phi_1 b_{11} - b\beta_2\phi_2}{\beta_1\phi_1\frac{y_1}{y} + \beta_2\phi_2\frac{y_2}{y}} \\ &= \frac{b_{11} - bC_2}{\frac{y_1}{y} + C_2\frac{y_2}{y}}, \text{ where } C_2 = \frac{\beta_2\phi_2}{\beta_1\phi_1} \end{aligned} \tag{8}$$

and symmetrically for group 2.

From inspection of expression (8), we can say that the amount of identity good provided to a group in equilibrium is increasing in its political clout and decreasing in the rival's clout. Thus, an increase in group size or group cohesiveness will attract identity goods from the rival group.

In general, an increase in disutility $b$ from the rival identity good (antagonistic nature of the relationship between group identities) will reduce the extent of identity good provided to both groups. But a change in $b$ affects the group will lower political clout more, *i.e.,* the difference in identity good provision $|G_1^* - G_2^*|$ increases in the disutility parameter.

If the per capita income for both groups increases at the same rate, we have growth in overall income without a change in inequality. Then, there is no change in the amount of any public good, and the entire increased income goes into private consumption. If, on the other hand, the per capita income of the more cohesive group grows faster than that of the less cohesive group, the denominator in (8) increases. This will depress the amount of identity good for both groups, just as it will depress the amount of generic public good. On the other hand, an increase in inequality in favor of the less cohesive group will raise the amount of identity good for both groups.

It must be noted that all the results provided for the $n = 2$ case above extend qualitatively to a setting where there are more than two groups. We study the two-group case since as it provides sharper results that are easier to see and interpret. Now, we turn to the more general case of $n$ groups and provide an alternative way to interpret the model presented in the paper.

## 5 Networks and identity goods

When the society comprises more than two groups, we can conceptualize the interrelationship between these groups in terms of a social network. For simplicity, we will maintain the assumption that $b_{ii} = b_{jj}$ for all $i, j$, *i.e.,* each group values its own identity good the same way. Now, for any pair of groups $(i, j)$, the term $-b_{ij} = d_{ij}$ denotes the "identity distance" between the groups. Note that we need to assume that $b_{ij}$ is non-zero for any two groups $i, j$. This could be based on ideology, beliefs, practices, history of past alignment or animosity, the particular dimension(s) of identity that divides the groups, and so on. In order to focus on the role of identity distance on identity good provision, we assume that $b_{ij} \neq 0$ for any $i, j$ and $\phi_i = \phi$ for all $i$. This has the consequence that the equilibrium provision is the first best.

$$G_i^* = G_i^s = \alpha \sum_{j=1}^{n} \beta_j b_{ji} - 1 \ \ \forall i$$

Suppose that there are $n$ nodes representing the groups. The "weight" of node $i$ is $\beta_i$.

We assume that $b_{ij} \neq 0$ and define the following distance function:

$$d_{ij} = \begin{cases} -b_{ij} & if \quad i \neq j \\ 0 & if \quad i = j \end{cases}$$

Here is an important definition that we need for insight into the paper.

**Definition 1** *For a collection of nodes $A$, the **A-centrality** of a node $i \in A$ is its weighted distance from all nodes in $A$*

$$C_i^A = \frac{1}{\beta_A} \sum_{j \in A} d_{ij} \beta_j, \ \textit{where} \ \beta_A = \sum_{j \in A} \beta_j$$

*If $A$ is the set of all nodes, then we simply call it centrality and write it as*

$$C_i = \sum_j d_{ij} \beta_j$$

*The $A$-centrality of group $i$ measures the expected identity distance between a member of group $i$ and another individual randomly picked from the set of groups included in $A$.*

The *$A$-centrality* thus can be seen as how central a group is in the society. The lower value of the centrality measure implies that the group is more central in the society in the sense that other groups have lesser hostility or animosity towards this group. The following remark stipulates the two factors that drive the allocation of identity goods.

**Remark 4** *Allocation of identity good for group $i$ is given by*

$$G_i^* = \alpha[b_{ii}\beta_i - C_i] - 1$$

The proposition posits that the identity goods provision for a group increases both with its own size and in its centrality in the social network. Firstly, a larger group, in terms of population, possesses a higher potential to gain identity goods, owing to its ability to supply more votes. This is why large majorities often enjoy more identity goods. Secondly, the concept of centrality plays a major role whereby a more "central" group will have a lower value of disutility that others will suffer from an extra unit of identity good provided to the group. Consequently, there will be a lower number of votes lost from others by offering the group more identity goods. To illustrate the second factor, think of a particular country (say, India) with a majority religion (say, Hinduism) that has various sects, but there is one central sect (say, the North Indian version) that is not too far from any other sect within the religion. Then, this group (North Indian, Ramayana-based version) will attract more identity goods (temples) than other sects within Hinduism and will come to dominate the cultural identity of the said religion within the country.

Next, we wish to consider the following question: suppose that there are multiple groups (say religions) in the society and multiple subgroups (sects) within each group (religion) (*e.g.,* caste groups within Hinduism and Shia/Sunni sects within Islam). How does identity good provision depend on such underlying social network structures? A similar question to this is addressed by Dasgupta and Neogi (2018) using contests but in slightly different settings. Nonetheless, our model provides more flexibility and certain advantages over the contest approach. As mentioned earlier, we do not need a fixed budget, and there is no requirement or waste of effort as well. The intuitive reason is politicians' win motivations, and groups have something to offer to the politicians anyway: the votes. While the intuitive modeling approach may entail envisioning groups as nodes residing within separate, disconnected components, such a depiction might not be useful in our context of dynamics between the identity-based groups in a social network. Instead, we model larger identity differences as distances between nodes in the respective components.

Formally, akin to the bipartite graphs, we consider two sets of nodes, $A$ and $B$. Let there be $m$ nodes in the set $A$ and $n$ nodes in $B$. These two sets correspond to different components: we postulate that for any two groups belonging to different components, the identity distance is $c$. This is a measure of polarization or a degree of inter-group disparities present in the components of the society.

**Definition 2** *For a collection of nodes $A$, the fractionalization within the collection, written* ***A-fractionalization*** *is defined as the sum of distances between pairs of nodes in $A$, weighted* *by the sum of population weights of the corresponding pairs*

$$F^A = \frac{1}{\beta_A} \sum_{i,j \in A} d_{ij} \beta_{ij}, \text{ where } \beta_{ij} = \beta_i + \beta_j$$

The concept of *A-fractionalization* can be seen as a metric of cohesion within a component in the underlying social network structure. To illustrate this notion with the aforementioned context, consider two religions, each comprising different sects characterized by different practices and diverse beliefs. While these sects can entail commonalities with respect to some of the practices and beliefs as they follow the same overarching religion, they may also harbor some beliefs or practices potentially leading to intra-religious tensions. Now, in this scenario, a religion encompassing sects that follow similar practices and share congruent beliefs about the religion will have lower animosity and consequently exhibit lower inter-group distances within the sects and thus a lower *A-fractionalization* value, indicative of the heightened cohesion and diminished inter-group disparities within the component. Conversely, religions marked by greater discord among the sects—manifested through divergent and contradictory practices and conflicting beliefs—would likely exhibit higher *A-fractionalization* values, reflecting the heightened fragmentation and inter-group tensions prevalent within the component (religion).

**Proposition 3** *The amount of identity good for a group $i \in A$ can be expressed as*

$$G_i = \alpha[b_{ii}\beta_i - \beta_A C_i^A - c\beta_B] - 1$$

*Moreover, the total amount of identity good for groups in the sets $A$ and $B$ can be written as*

$$\begin{aligned} G_A &\equiv \sum_{i \in A} G_i = \alpha \left[ \mathcal{B}_A - \beta_A F^A - mc\beta_B \right] - m \\ G_B &\equiv \sum_{i \in A} G_i = \alpha \left[ \mathcal{B}_B - \beta_B F^B - nc\beta_A \right] - n \end{aligned}$$

*where $\mathcal{B}_i = \sum_{j \in A} b_{jj} \beta_j$*

**Proof.** In appendix. ■

Thus, the total amount of identity good attributed to the set $K \in \{A, B\}$ comprises three components: (i) the population weight of $K$, (ii) the fractionalization within $K$, and (iii) population weight of the rival set, weighted by the degree of inter-group disparities in the components of the society which is $c$. Notice that a more fragmented group with a higher A-fractionalization value gets a lower identity good, signifying the importance of within-group cohesivity. Moreover, higher inter-group disparities also result in lower identity goods. These results are similar to that of Dasgupta and Neogi (2018). However, we do not have spillover in the other component; hence, unlike this paper, internal change in fragmentation of, say, $A$ does not affect identity good for $B$ unless there is an overall change in the parameter $c$. This proposition further underscores the value of the social fabric in terms of the lower identity distances for society's welfare.

## 6 Banning group-specific public goods

Consider a case where politicians are not allowed to provide identity-based, group-specific goods or are not responsible for the provision of such goods. The society, as a whole, can decide to do so to avoid any vote bank politics. In such a scenario, a natural yet important question arises: Who benefits from such action? Despite the existence of demand for such goods, there is no role in the policy platforms. This case can provide us with another important benchmark along with the first best for social welfare implications. The politician's job is simply the decision to select the optimal level of generic public good and, thus, indirectly to select the optimal level of taxation.

For simplicity, let us restrict ourselves to only two groups, say Group 1 and Group 2. Let $b_{12} = b_{21} = -b$.

$$\begin{aligned} w_1(q) &= y_1(1-t) + (1-b_{11})\alpha \log(1+G) + b_{11}\alpha \log(1+G_1) - b \log G_2 \\ w_2(q) &= y_2(1-t) + (1-b_{22})\alpha \log(1+G) + b_{22}\alpha \log(1+G_2) - b \log G_1 \end{aligned}$$

Now, candidates $A$ and $B$ can only promise generic public goods subject to the budget constraint, which is now simply $yt = G$. The candidate $k$ thus has a policy vector $q_k = (t, G)$. Now, from equation 5, vote share of party $A$ with policy $q_A$ will be:

$$\pi_A(q) = \frac{1}{2} + \beta_1\phi_1[w_1(q_A) - w_1(q_B)] + \beta_2\phi_2[w_2(q_A) - w_2(q_B)] - \delta(\beta_1\phi_1 + \beta_2\phi_2)$$

Let, $\Delta w_i(q) = w_i(q_A) - w_i(q_B)$. Since both parties are ex-ante identical, we have convergence. Parties try to maximize the vote share. So, they maximize say $\mathcal{L} = \beta_1\phi_1\Delta w_1(q) + \beta_2\phi_2\Delta w_2(q)$ such that $G = yt$. Now, consider $\Delta w_i(q)$,

$$\begin{aligned}\Delta w_i(q) &= y_i(t_B - t_A) + (1 - b_{ii})\alpha[\log(1 + G^A) - \log(1 + G^B)] \\ &= \frac{y_i}{y}(G^B - G^A) + (1 - b_{ii})\alpha[\log(1 + G^A) - \log(1 + G^B)]\end{aligned}$$

Hence,

$$\begin{aligned}\frac{\partial[\beta_1\phi_1\Delta w_1(q) + \beta_2\phi_2\Delta w_2(q)]}{\partial G^A} &= \beta_1\phi_1\left[\frac{-y_1}{y} + \alpha\frac{1 - b_{11}}{1 + G^A}\right] + \beta_2\phi_2\left[\frac{-y_2}{y} + \alpha\frac{1 - b_{22}}{1 + G^A}\right] = 0 \\ &\implies \\ \hat{G}^A = \hat{G}^B &= \alpha\frac{\beta_1\phi_1(1 - b_{11}) + \beta_2\phi_2(1 - b_{22})}{\beta_1\phi_1(y_1/y) + \beta_2\phi_2(y_2/y)} - 1\end{aligned}$$

Which is the same as that of the political equilibrium outcome. This result has an important implication. Even when the decision space for the politicians is curtailed, they can not go beyond the preferences of the citizens. Thus, we do not see any under-provision or over-provision for the generic public good compared to the political equilibrium with full decision space. The politicians promise only what the electorate demands. Now, we move on to the important question: who benefits from such a move? or what the necessary conditions are for any group to be better off due to banning group-specific public goods?

Consider the utility of a group $i$, under political equilibrium ($w_i^*$), and utility under the new regime where group-specific public goods are banned ($\hat{w}_i$). Let, $Z_i = \frac{b_{ii}\alpha\log(1+G_i) - b\alpha\log(1+G_{-i})}{G_1+G_2}$ be per unit utility derived by group $i$ from the provision of group-specific public goods.

**Remark 5** *A group $i$ is better off under the new regime with banned group-specific public* *goods if its normalised per capita income is higher than the per unit utility derived from the total provision of group-specific public goods.*

**Proof.** In appendix. ■

The remark stipulates a necessary condition for group $i$ to be better off when politicians are not providing group-specific public goods. The intuition behind this result is straightforward: a higher income also implies a higher contribution to the tax pool as a group. Note that for each additional unit of public good of each type, taxes need to be raised by $\frac{1}{y}$, and the group with income share $\frac{y_i}{y}$ pays higher tax in such case. Thus, it will be better off (compared to the political equilibrium) to ban the group-specific public goods if it has an income share that is higher than the per unit utility derived from the total provision of group-specific public goods. This result also leads to an important observation if the rich group derives lesser per unit utility from the total provision of identity goods. If it is worse off by banning group-specific public goods, then both groups are worse off. Moreover, if the poor group is better off by banning group-specific public goods, so is the rich group.

## 7 Conclusion

In this paper, we constructed a probabilistic voting model to analyze the determination of generic public goods and identity goods when an electorate is divided into groups. Our analysis incorporates the inherent diversity of preferences among distinct groups within the electorate while also accounting for the direct disutility incurred by the groups from the provision of identity goods to other groups. We demonstrate that variation in political clouts wielded by different groups leads to deviation from the first best outcome. More specifically, we provide a comprehensive set of necessary conditions when there is under-provision or over-provision of the generic public goods as well as group-specific identity goods due to political competition. Our findings provide a more resonant understanding of the challenges and opportunities inherent in achieving optimal societal welfare.

We have demonstrated that political competition can give rise to intriguing results where a more cohesive group having a higher preference for identity goods will be able to wield its clout to get the desired redistribution. Moreover, in scenarios where preferences are equal across groups, we find that a more cohesive group with higher income levels may lead to the under-provision of generic public goods. This underscores an important observation that influential people might succeed at keeping their income to themselves instead of using it for greater public good. Furthermore, our analysis reveals that even with equal incomes, the preferences of a more cohesive group play a pivotal role in determining whether there is under-provision or over-provision of generic public goods. These findings highlight the nuanced interplay between group cohesion, income levels, and preferences in shaping the outcomes of political competition while determining the resource allocation within society.

Our analysis relied on several simplifying assumptions and specific functional forms to maintain tractability within the model. Most importantly, we assumed that the cohesion parameter for the groups to be exogenously given, which needs further exploration. It will be intriguing to investigate how the results change when the cohesion parameter is endogenous and affected by the identity goods. In such a scenario, the political platform of parties would not only impact the direct utility of voters but also shape the voting behavior of the electorate by either fostering polarization or stimulating social unity among groups. Moreover, we also assumed the symmetric nature of the degree of animosity or hostility of the groups towards the identity good of other groups. Indeed, it is possible that both groups have different levels of animosity towards each other. Moreover, we assumed the political parties to be office-motivated, although the model can be easily extended to other motivations. Finally, the social network structure developed in the paper can be used for coalition formation and bargaining within the groups for achieving the political aspirations of the groups.

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# A Appendix

## A.1 Proof of Proposition 1:

Let,

$$\mathcal{L} = y(1-t)+\sum_{i=1}^{n}\beta_i(1-b_{ii})\alpha\log(1+G)+\sum_{i=1}^{n}\beta_i\left[\sum_{j=1}^{n}b_{ij}\alpha\log(1+G_j)\right]-\lambda(G+\sum_{i=1}^{n}G_i-yt)$$

$$\begin{aligned}
\frac{\partial\mathcal{L}}{\partial t} &= -y+\lambda y = 0\\
\frac{\partial\mathcal{L}}{\partial G} &= \frac{\alpha[\sum_{i=1}^{n}\beta_i(1-b_{ii})]}{1+G}-\lambda = 0\\
\frac{\partial\mathcal{L}}{\partial G_i} &= \frac{\alpha\sum_j\beta_j b_{ji}}{1+G_i}-\lambda = 0
\end{aligned}$$

Solving these equations, we get the desired results for $G, G_i$, and $t$ for all $i$.

## A.2 Proof of Proposition 2

In order to maximize the vote share, party $A$ maximizes $\mathcal{L} = \sum_{i=1}^{n}\beta_i\phi_i\Delta w_i(q) - \lambda(G^A + \sum G_j^A - yt)$ and party $B$ minimizes the same. Since the parties are ex-ante identical, we will have convergence, *i.e.*, both parties will offer the same platform $q_A = q_B = q^*$. We thus provide proof only for $A$.

$$\begin{aligned}
\Delta w_i(q) &= w(q_A) - w(q_B)\\
&= y_i(t_B - t_A) + (1-b_{ii})\alpha[\log(1+G^A) - \log(1+G^B)]\\
&\quad + \sum_j b_{ij}\alpha(\log(1+G_j^A) - \log(1+G_j^B)
\end{aligned}$$

Now consider

$$\begin{aligned}
\frac{\partial \mathcal{L}}{\partial t^A} &= -\sum_{i=1}^{n} \beta_i \phi_i y_i + \lambda y = 0 \\
\frac{\partial \mathcal{L}}{\partial G} &= \frac{\alpha[\sum_{i=1}^{n} \beta_i \phi_i (1 - b_{ii})]}{1+G} - \lambda = 0 \\
\frac{\partial \mathcal{L}}{\partial G_i} &= \frac{\alpha \sum_j \beta_j \phi_j b_{ji}}{1+G_i} - \lambda = 0
\end{aligned}$$

Solving these equations, we get the desired result for the equilibrium platform of both $A$ and $B$.

### A.3 Proof of Remark 3

$$G_1^* - G_1^s = \alpha(X_1^* - X_1^s)$$

Hence, now consider,

$$\begin{aligned}
X_1^* - X_1^s &= \frac{b_{11}\beta_1\phi_1 - b\beta_2\phi_2}{\beta_1\phi_1\frac{y_1}{y} + \beta_2\phi_2\frac{y_2}{y}} - (b_{11}\beta_1 - b\beta_2) \\
&= b_{11}\beta_1\left(\frac{\phi_1}{\phi'}\right) - b\beta_2\left(\frac{\phi_2}{\phi'}\right) - (b_{11}\beta_1 - b\beta_2) \\
&= b_{11}\beta_1\left[\left(\frac{\phi_1}{\phi'}\right) - 1\right] - b\beta_2\left[\left(\frac{\phi_2}{\phi'}\right) - 1\right], \\
\text{where } \phi' &= \phi_1\frac{\beta_1 y_1}{y} + \phi_2\frac{\beta_2 y_2}{y}.
\end{aligned}$$

Since $\phi' \in (\phi_2, \phi_1)$, we have the first term positive and the second term negative. Hence, $G_1^* - G_1^s > 0$. Similarly, for $G_2^* - G_2^s$

$$\begin{aligned}
X_2^* - X_2^s &= \frac{b_{22}\beta_2\phi_2 - b\beta_1\phi_1}{\beta_1\phi_1\frac{y_1}{y} + \beta_2\phi_2\frac{y_2}{y}} - (b_{22}\beta_2 - b\beta_1) \\
&= b_{22}\beta_2\left[\left(\frac{\phi_2}{\phi'}\right) - 1\right] - b\beta_1\left[\left(\frac{\phi_1}{\phi'}\right) - 1\right] < 0
\end{aligned}$$

### A.4 Proof of Proposition 3

$$
\begin{aligned}
G_A &\equiv \sum_{i\in A} G_i \\
&= \sum_{i\in A} \alpha\left(b_{ii}\beta_i - \beta_A C_i^A - c\beta_B\right) - 1 \\
&= \alpha\left[\mathcal{B}_A - \sum_{i\in A}\left(\sum_{j\in A} d_{ij}\beta_j\right) - mc\beta_B\right] - m \\
&= \alpha\left[\mathcal{B}_A - \sum_{i,j\in A} d_{ij}(\beta_i+\beta_j) - mc\beta_B\right] - m \\
&= \alpha\left[\mathcal{B}_A - \sum_{i,j\in A} d_{ij}\beta_{ij} - mc\beta_B\right] - m \\
&= \alpha\left[\mathcal{B}_A - \beta_A F^A - mc\beta_B\right] - m
\end{aligned}
$$

Similarly, we can write the equation for $G_B$ This proof also establishes the following result: For any collection A of nodes, we must have

$$F^A = \sum_{i\in A} C_i^A$$

### A.5 Proof of Remark 5

**Proof.** Equivalently, the group $i$ will be better off under the political equilibrium if:

$$
\begin{aligned}
w_i^* - \hat{w}_i &> 0 \\
y_i(\hat{t} - t^*) + b_{ii}\alpha\log(1+G_i) - b\alpha\log(1+G_{-i}) &> 0 \\
y_i(t^* - \hat{t}) &< b_{ii}\alpha\log(1+G_i) - b\alpha\log(1+G_{-i}) \\
\frac{y_i}{y}(G_1+G_2) &< b_{ii}\alpha\log(1+G_i) - b\alpha\log(1+G_{-i}) \\
\frac{y_i}{y} &< \frac{b_{ii}\alpha\log(1+G_i) - b\alpha\log(1+G_{-i})}{G_1+G_2}
\end{aligned}
$$

■

### A.6 Comparative stats for section 6, banning group-specific public goods:

Note that $G_i^* = \alpha X_i^* - 1$. Now, without loss of generality, let $y_1 > y_2 \implies \frac{y_1}{y} > \frac{y_2}{y}$.

**Case i:** $Z_1 < Z_2$

If the rich group is worse off $\frac{y_1}{y} < Z_1$, both groups are worse off by banning group-specific public goods.

If $\frac{y_2}{y} > Z_2$ poor group is better off, then both groups are better off.

If $Z_1 < \frac{y_2}{y_2} < \frac{y_1}{y} < Z_2$ or $Z_1 < \frac{y_2}{y_2} < Z_2 < \frac{y_1}{y}$, then only rich group is better off.

**Case ii:** $Z_1 > Z_2$

Ambiguous

Now, let $b_{11} = b_{22}$

$Z_1 = \frac{\alpha b_{11}\phi_1 \log(\alpha X_1) - b\alpha\phi_2 \log(\alpha X_2)}{\alpha(X_1+X_2)-2}$ and $Z_2 = \frac{\alpha b_{22}\phi_2 \log(\alpha X_2) - b\alpha\phi_1 \log(\alpha X_1)}{\alpha(X_1+X_2)-2}$.

$$Z_1 - Z_2 = \alpha\frac{(b_{11}+b)\phi_1 \log(\alpha X_1) - (b_{22}+b)\phi_2 \log(\alpha X_2)}{\alpha(X_1+X_2)-2}$$

$$Z_1 - Z_2 = \alpha(b_{11}+b)\frac{\phi_1 \log(\alpha X_1) - \phi_2 \log(\alpha X_2)}{\alpha(X_1+X_2)-2}$$

$$Z_1 - Z_2 = \alpha(b_{11}+b)\frac{(\phi_1-\phi_2)\log\alpha + \phi_1 \log X_1 - \phi_2 \log X_2}{\alpha(X_1+X_2)-2}$$

### A.7 Other Results/Observations:

**1.1** First best tax and identity goods public goods is falling in b. For b large enough, both groups get zero identity goods.

**Proof:**

$\frac{\partial G_1^s}{\partial b} = -\beta_2$,

$\frac{\partial G_2^s}{\partial b} = -\beta_1$

$\frac{\partial t^s}{\partial b} = \frac{-\beta_2-\beta_1}{y} = \frac{-1}{y}$

Now, $G_i^s = 0$ if $\beta_i b_{ii} - \beta_{-i} b \leq \frac{1}{\alpha}$ that is $\frac{\beta_i b_{ii}}{\beta_{-i}} - \frac{1}{\alpha\beta_{-i}} \leq b$

Thus if $b \geq \frac{\beta_i b_{ii}}{\beta_{-i}} - \frac{1}{\alpha\beta_{-i}}$ for $i = 1, 2$ both $G_1^s = G_2^s = 0$

**1.2** First best public good is independent of $b$.

In the utility functions as well as equilibrium provision, $G$ is independent of $b$ as we have additive separation.

**1.3** First best minority group identity good falls faster in b.

**Proof:** Let $\beta_1 > \beta_2$.

Hence, $-\beta_1 < -\beta_2$

$\frac{\partial G_2^s}{\partial b} < \frac{\partial G_1^s}{\partial b}$

**1.4** If minority group has larger $b_i i$, it is possible that for low $b$, minority identity good is higher but for higher $b$, minority identity good is lower than majority group.

**3.1** As own group $b_{ii}$ increases, generic public goods falls, rival group public good is constant. Taxes fall as long as own public good is zero. Once $b_{ii}$ crosses a threshold, own group public good becomes positive and tax rate becomes constant: tax money now starts shifting from generic to own public good for the relevant group. This hurts the rival group as they are getting less generic public good but same amount of identity good.

**Proof:** Without loss of generality let us do the analysis for $i = 1$.

We have, $G^* = \frac{\phi_1\beta_1(1-b_{11})+\phi_2\beta_2(1-b_{22})}{\phi_1\beta_1(y_1/y)+\phi_2\beta 2(y_2/y)} \implies \frac{\partial G^*}{\partial b_{11}} = \frac{-\phi_1\beta_1}{\phi_1\beta_1(y_1/y)+\phi_2\beta 2(y_2/y)}$.

Now, $G_1^* = 0 \implies t^* = \frac{G^*+G_2^*}{y} \implies \frac{\partial t^*}{\partial b_{11}} = \frac{\partial G^*}{\partial b_{11}} = \frac{-\phi_1\beta_1}{\phi_1\beta_1(y_1/y)+\phi_2\beta 2(y_2/y)}$. Note that as $b_{11}$ rises, $1 - b_{11}$ goes down, and hence the generic public good goes down further, and $G_1^*$ goes up. At the same time, rival group if still having the same value of $b_{22}$ will get same amount of identity specific good but a lesser generic public good as group 1 now wants less of it.

**4.1** In political equilibrium taxes are weakly decreasing in $b$.

**Proof:**

$t^* = \frac{G^*+G_1^*+G_*^2}{y} \implies \frac{\partial t^*}{\partial b} = -\alpha\frac{\beta_1\phi_1+\beta_2\phi_2}{\beta_1\phi_1(y_1/y)+\beta_2\phi_2(y_2/y)} < 0$.

**4.2** The equilibrium tax rate can be higher lower than social optimal. If the group with higher clout has higher $b_{ii}$, then, then there are two effects on the equilibrium taxes. As this group wants higher identity good, tax rate will tend to rise above social opt. On the other hand, as this group wants lower generic public good, tax rate will be depressed below social optimal. For low d, the first effect dominates as a large amount of identity good is provided. For high d, the latter effect dominates since no identity good is provided in equilibrium.