



Ethnic Heterogeneity and Public Goods Provision

Etnik Heterojenlik ve Kamu Malı Teminatı

Uğur ÖZDEMİR¹ , Yüksel Alper ECEVİT² 

ABSTRACT

The level of public goods provided in a society is important not only because it contributes to social inclusion and strengthens a shared sense of citizenship, but also because it is a fundamental pre-condition for long term growth and development. Studying the determinants of public goods provision levels, hence, becomes an important exercise. The negative association between ethnic heterogeneity and public goods provision is one such robust empirical finding in political science and economics. Despite the abundance of scholarly work on the topic, the causal mechanisms offered in the literature do not pay attention to the political process involved. The rational choice approaches simply model the relationship as a voluntary contribution game. This paper addresses this gap by offering a theoretical mechanism based on a legislative bargaining framework. We also provide a discussion on a potential extension of the framework where ethnic groups are endogenous.

Keywords: Public goods, Ethnic heterogeneity, Legislative bargaining

JEL Classification: H41, C78

ÖZ

Bir toplumdaki kamu malları düzeyi, sadece toplumsal kapsayıcılık ve paylaşılan bir vatandaşlık duygusunu güçlendirmesi açısından değil, uzun vadeli büyüme ve gelişme için temel bir önkoşul olması açısından da önem arzeder. Bu yüzden, kamu malı tedarikini belirleyen etkenler üzerine çalışmalar yapmak oldukça önemli bir çabadır. Etnik heterojenlikle kamu malları tedarik düzeyi arasındaki negatif ilişki de, siyaset bilimi ve ekonomideki bu yöndeki sağlam bir ampirik bulgudur. Konu üzerine yapılmış çalışmaların fazlalığına rağmen, literatürde önerilen nedensellik mekanizmaları, varolan siyasi süreçleri dikkate almamıştır. Rasyonel seçim yaklaşımları bu ilişkiyi basit bir gönüllü katkı oyunu olarak modellemektedirler. Bu makale, yasama meclisi pazarlık oyunu modeline dayalı bir teorik mekanizma önererek literatürdeki bu boşluğu doldurmayı hedefliyor. Ayrıca, bu modelin, etnik grupların endojen olduğu genişletilmiş bir halini de tartışıyoruz.

Anahtar kelimeler: Kamu malları, Etnik heterojenlik, Yasama meclisi pazarlık oyunları

JEL Sınıflaması: H41, C78



DOI: 10.26650/ISTJECON2020-833105

¹Dr., Edinburgh University, Politics and International Relations, Edinburgh - United Kingdom

²Dr., Cukurova University, Political Science and International Relations, Adana, Turkey

ORCID: U.Ö. 0000-0001-6736-7008;
Y.A.E. 0000-0002-9267-0962

Sorumlu yazar/Corresponding author:

Uğur ÖZDEMİR,
Edinburgh University, Politics and International Relations, Edinburgh, United Kingdom
E-posta/E-mail: ugur.ozdemir@ed.ac.uk

Başvuru/Submitted: 29.11.2020

Kabul/Accepted: 06.12.2020

Atıf/Citation: Ozdemir, U., & Ecevit, Y.A. (2020). Ethnic heterogeneity and public goods provision. *Istanbul İktisat Dergisi - Istanbul Journal of Economics*, 70(2), 247-266.
<https://doi.org/10.26650/ISTJECON2020-833105>



1. Introduction

Why are some societies able to generate high levels of public goods whereas others are not? This is a central question in economics and political science. This question becomes even more important in communities where fundamental public goods such as clean drinking water and adequate sanitation are not provided at sufficient levels, which in turn hinders economic and social development (Sachs, 2005). One factor that has been suggested as a potential obstacle decreasing the level of public goods provided is social heterogeneity, and ethnic diversity in particular. In fact the negative association between ethnic heterogeneity and public goods provision is one of the most robust empirical findings in political economy (Banerjee, Iyer, & Somanathan, 2005; Kuijs, 2000; Alesina, Baqir, & Easterly, 1999; Porta, de Silanes, Shleifer, & Vishny, 1999; Miguel & Gugerty, 2005; Kimenyi, 2006).

The literature provides a number of different mechanisms through which ethnic diversity leads to low public good provision. One experimental paper on ethnic communities in Uganda, (Habyarimana, Humphreys, Posner, & Weinstein, 2007) identifies three families of mechanisms which they call "preferences", "technology" and "strategy selection" and claim that the previous academic literature is using one of these mechanisms. K. Jackson (2017), on the other hand, makes a different classification of the previous studies - those which invoke mechanisms based on variations in preferences between different ethnic groups and studies which use mechanisms based on the idea that the efficiency of coordination is higher within ethnic groups.

In this paper, we argue that we need to first distinguish between two very different channels through which public goods are provided - through government provision and through coordination of direct contributions by members of society. It is clear that the vast majority of public goods are provided through the former channel. Rather surprisingly, all the mechanisms offered in the

literature account for the latter.¹ In this study we aim to address this theoretical gap by providing a discussion of how political processes and institutions can be introduced into a model that links ethnic diversity and public goods under-provision. Our modelling strategy is based on incorporating social diversity in a model of legislative bargaining over public goods provision.

The remainder of the paper is organised as follows. We first provide a review of the literature, keeping our focus mainly on measurement and theoretical approaches as their aggregate predictions of their empirical findings are similar but their policy implications are not due to difference in their theories (K. Jackson, 2007). Then we discuss the literature on legislative bargaining which lays the foundation of the model we propose. Next, we introduce our model and discuss a further extension to make the group endogenous. We conclude by discussing potential areas of further research.

2. Ethnic Heterogeneity and Public Goods Provision

The scholarly literature on ethnic diversity and provision of public goods has gained momentum in the last two decades. The literature has its roots in earlier works such as Mauro (1995), Easterly and Levine (1997) which focus more broadly on ethnic fractionalization and national economic outcomes. It is generally agreed that ethnic diversity has a negative effect on economic growth, with the primary causal mechanism being inefficient government policies as a result.

The literature focuses directly on provision of public goods identify and expands on five main areas of interest regarding social heterogeneity and public goods:

1. What is the total level of the public goods?
2. Who has the access to the public goods?
3. How should we measure the level of public goods - as spending or outcomes?
4. How should we measure ethnic diversity?
5. What is the mechanism which through which social heterogeneity influences public goods provision?

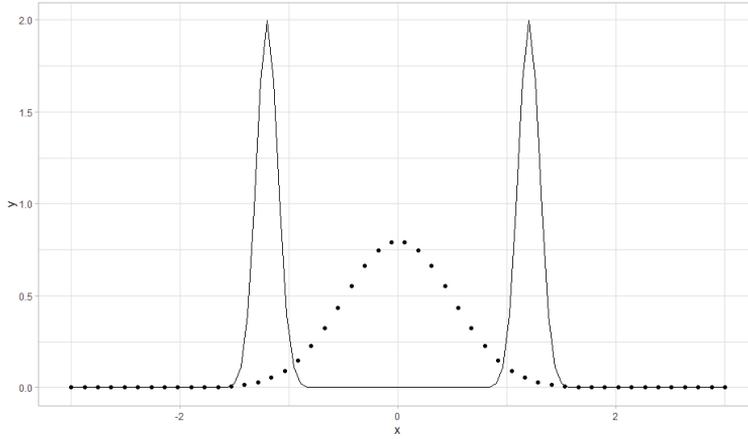
¹ (Alesina et al., 1999) can be regarded as an exception. We will, however, discuss the extent to which they incorporate the political process below.

In this paper, we are mainly interested in question number five regarding the mechanism but we will incorporate discussions on measures of ethnic diversity in our literature review, as it directly feeds into the theoretical frameworks developed in these earlier works. Ethnic heterogeneity has a straightforward intuitive meaning but it is not that easy when it comes to formally defining and operationalizing the definition (Posner, 2004). In a seminal paper, Alesina et al. (1999) argue that the preference variation among ethnic groups is the underlying reason for public goods under-provision. In their model, individuals first vote on the size of the public good and then on the type of the public good. For the latter, individuals have ideal points on a continuous linear scale. Given a distribution of ideal points, a straightforward application of the median voter theorem leads to the following result:

The equilibrium amount of public good is decreasing in the median distance from the median (MDM) (Alesina et al., 1999).

They interpret MDM as an indicator of polarization of preferences in the society and use Figure 1 to support this interpretation.² Hence they conclude that ethnic diversity leads to a low level of public goods provision. We argue that there is a problem with that interpretation, i.e, MDM does not necessarily capture the underlying preference polarization.

² They do not provide explicit functional forms for the distributions shown in the Figure 1 so we have reproduced their logic using the functional forms stated below the figure.

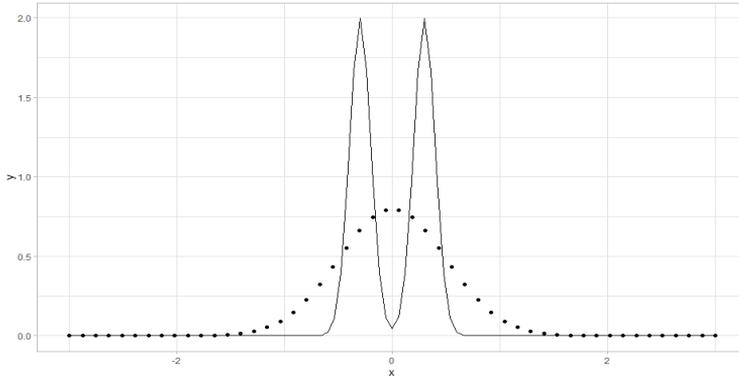
Figure 1. Median Distance from the Median Measure of Polarisation

Source: Alesina et al., 1999.

Note: Dotted curve: Standard normal distribution. Regular curve: Mixture of $N(-1.2,0.1)$ and $N(1.2,0.1)$

Clearly, in this figure, the distribution of the ideal points, hence the society, with a high MDM is more polarized. As it is illustrated in Figure 2, this does not have to be the case. Figure 2 presents two distributions, the uni-modal distribution is a Normal distribution with mean 0 and a standard deviation of 0.5. The bi-modal distribution is a mixture of two Normal distributions with means -0.3 and 0.3 and a common standard deviation of 0.1. Hence MDM for the bi-modal distribution is smaller than the uni-modal distribution. According to the measure developed by Alesina et al. (1999), we should be concluding that the blue uni-modal society is more polarised than the bi-modal society. This, however, would be very hard to defend with any definition of heterogeneity or polarisation.

Figure 2. A “counter example” for the Median Distance from the Median Measure of Polarisation



Source: Alesina et al., 1999.

Note: Dotted curve: Standard normal distribution. Regular curve: Mixture of $N(-0.3, 0.1)$ and $N(0.3, 0.1)$

In fact, MDM behaves almost like a proxy for the variance of the distribution and its implications regarding polarization are not very different than the implications of the variance. Hence even though their empirical findings are solid, there is a gap between these findings and what their theory implies.

In fact, measuring any form of polarization is a complicated issue and still an ongoing discussion mainly in public preferential polarization (Hill & Tausanovitch, 2015). Polarisation is often considered as an intensifying disagreement in preferences which might or might not be related to the underlying ethnic identity. There are, however, more specialised measures developed to capture ethnic fractionalization. One of the most commonly used measure is the Reynal-Querol index (Montalvo & Reynal-Querol, 2005). This is an attempt to generalise the ELF index and is based only on the proportion of the ethnic groups present in the society.

Let there be M different ethnic groups in the society and the proportion of ethnic group i be represented by π_i . The RQ measure of polarization has been argued to capture the explanatory power of ethnic conflict better than other measures in the literature.

$$RQ = 1 - \sum_{i=1}^M \left(\frac{\frac{1}{2} - \pi_i}{\frac{1}{2}} \right)^2 \pi_i = 4 \sum_{i=1}^M \pi_i^2 (1 - \pi_i)$$

This measure treats the bipolar world as the world of highest polarization and measures how far the distribution of ethnic groups is from that world.³

An alternative approach is provided by scholars who argue that the efficiency of coordination is higher within ethnic groups than between them (Miguel & Gugerty, 2005; Vigdor, 2004). This approach suggests it is more difficult for the heterogeneous communities to solve the coordination problem and this leads to under-provision of public goods. The policy implication that comes out of this strand of work is that developing and reforming institutions that facilitate inter-ethnic coordination would improve the provision of public goods, hence lead to better development performances.

A more recent line of research focused on a model which incorporates spillovers among different groups into the measure of fractionalization (K. Jackson, 2013). In this formulation, households receive utility from private consumption and the public good:

$$u_i = W_i - x_i + \mu \ln X_i$$

where W is wealth, x is household's contribution to the public good and $\ln X$ is the benefit received from the public good. The paper focuses on solutions that are symmetric within groups and therefore all members of a given ethnic groups contributes the same amount and receives the same benefit, i.e, we can denote i as e and j as e . The critical assumption of this formulation is that the contributions from one's own ethnic group may potentially have a greater effect on the benefit an individual receives from the public good:

$$X_e = p_e N x_e + \alpha \sum_{e' \neq e} p_{e'} N x_{e'}$$

³ In fact, using a behavioural model, (Esteban & Ray, 1999) shows that a symmetric bipolar world maximises conflict.

Here N is the total population, p_e stands for the population share of ethnic group e and $\alpha \in [0,1]$ captures the extent to which the effect of your co-ethnics' contributions on one's utility differ from the contributions of the members of other ethnic groups. Consequently, each group chooses x_e to maximize:

$$U_e = \left[(1 - \tau)p_e N(W - x_e + \mu \ln X_e) + \tau \sum_{j=1}^E p_j N(W - x_j + \mu \ln X_j) \right]$$

where $\tau \in [0,1]$ is used to represent the effectiveness of local institutions in managing inter-ethnic coordination.

It is not totally clear how the variation parameter α makes sense in this case though. Note that, by definition, the public good is enjoyed by all ethnic groups. So why should the contributions from one's ethnic group have a greater effect on the benefit received from a given amount of public good? In fact if you consider the free riding problem among ethnic groups, one's benefit from the public good might be expected to increase as the contribution of his ethnic group decreases.

Another voluntary contribution based model is given in Miguel & Gugerty (2005). Their emphasis is on social sanctions and their theoretical model illustrates how inability to impose social sanctions in diverse communities leads to collective action failures. Accordingly, they show the aggregate local public good contributions and the total threat of social sanctions are weakly declining in ethnic diversity.

The last two models do not have a strategic setup and do not incorporate the political process. Alesina et al. (1999), on the other hand, add a single policy dimension to the public good in addition to the choice of the amount to be provided and employs the median voter theorem to determine the policy outcome. However, as we have argued above, the ethnic polarization measure they have, the median of the distances between the ideal points of the individuals and the median voter's ideal point, does not capture what they intend to capture, hence, it does not constitute a firm foundation for their empirical investigation.

3. Coalitions and Legislative Bargaining

The level of public goods provision in a given society is ultimately the outcome of a policy decision. In models of electoral competition, parties or candidates seek the support of a decisive coalition among the electorate in order to implement these policies (Laver, 2005). For the purpose of of this paper, we will be focusing on policy bargaining models where coalition formation is explicit. Our ultimate goal is to model the public goods provision decision in such a way that the outcome is a function of the underlying heterogeneity structure.

The canonical setup in this strand of work is due to Baron and Ferejohn (1989a). Their model of policy bargaining in groups builds on Rubinstein's seminal work on two-player sequential bargaining (Baron & Ferejohn, 1989a). The Baron-Ferejohn model sets out to investigate a particular policy problem regarding distribution of a resource among members of a legislature using majority rule to decide the outcome. The redistributive policy bargaining setup in the Baron-Ferejohn model captures many important dynamics but is still limited in its scope. Banks & Duggan (2000) provides a generalization to Euclidean policy space where the Baron-Ferejohn model is a special case.

The players in the Baron-Ferejohn game are the members of a legislature, $L = \{1, 2, \dots, n\}$, where n is an odd number and $m = \frac{n+1}{2}$ is the size of the minimal winning coalition. The outcome of the legislative decision making process is an allocation vector of shares of some fixed resource $x = (x_1, \dots, x_n)$. The utility of each legislator i is simply equal to her share in the distribution, x_i . The legislative stage game consists of the following procedure:

1. A legislator is randomly chosen to make a distribution proposal. Legislators can have different recognition probabilities.
2. All members of the legislature vote simultaneously on the proposal - no abstention is allowed.
3. In case a majority supports the proposal, the game ends and the payoffs are realised. In case of a rejection, the stage game repeats - the legislator who made the rejected proposal is eligible to be the proposer again.

In the Baron-Ferejohn setup, a stationary strategy s_i for legislator i has two components:

1. A proposal rule that describes the proposal legislator i will make when he is assigned as the proposer.
2. A voting rule which specifies how the legislator will vote on any possible proposal she faces. Each legislator is interested only in her own payoff and votes to support any proposal which gives her a share over a certain threshold, $x_i \geq y$.

A strategy is stationary if it is not contingent on the history of play in the game, namely, on previous proposals that are rejected, the identity of the proposer, or the way legislators voted on them. A stationary equilibrium in this game is a profile of stationary strategies $s = (s_1, \dots, s_n)$ such that, for each i :

1. Legislator i would not be better off by proposing a different distribution at any stage of the game;
2. Legislator i would not be better off by voting differently on any proposal at any stage of the game;
3. Conditions 1 and 2 hold in every possible subgame, hence the equilibrium is subgame perfect.

Baron and Ferejohn show that the following hold for any stationary equilibrium:

1. The first proposal is always expected where the proposer offers $1/n$ to each player in a random group of $m-1$ players, spares $1-(m-1)/n$ for herself and the rest of the legislators get nothing;
2. Every legislator accepts any proposal which offer her at least $1/n$ and rejects all other proposals;
3. Any minimal winning coalition can form - there is no prediction regarding to nature of the coalitions that could form.

The last property basically implies that we cannot use the canonical Baron and Ferejohn model for the purpose we set out at the beginning of this session. In a follow-up paper (Baron, 1989), Baron develops a model that produces coalition-like behaviour but lacking an important feature of coalitions: there is no policy

related reason for a legislator to prefer being a member of one coalition over the others as the whole game is about sharing a resource and, there are no spillover effects. Since ethnic groups consist of members who share or want something in common, this extension does not seem to be a good fit for our context - we need a model which can account for coalition formation and voting behaviour based on preference similarities. These similarities will be the mechanism through which we can capture the underlying ethnic fractionalization in the society. In the next session, we will develop a model which addresses this idea.

4. A Legislative Bargaining Model of Public Goods Provision

In this section we present a two stage legislative bargaining model of public goods provision which incorporates the ethnic heterogeneity in the society. In the first stage, the decision regarding the public good is made and, in the second stage, the remaining amount of resources is distributed among legislatures. The second stage will be based on the bargaining with externalities model of Calvert and Dietz (2005) - an extension of the Baron-Ferejohn model of legislative politics (Baron & Ferejohn, 1989b) with spillovers.

The legislature consists of a set of members $L=\{1,2,\dots,n\}$ where n is an odd number. Let $m = \frac{n+1}{2}$, so m is the size of a minimal majority. There is a fixed amount of resources, for simplicity, normalized to 1. The utility function of a legislator is given by:

$$u_i(X_p, x) = \sum_{j \in L} a_{ij} x_j + \ln X_p$$

where X_p is the amount of public good, x_i is the private good allocated to legislator i and, a_{ij} s are the spillover parameters. We assume that $a_{ii}=1$ and, $a_{ij}=a_{ji} \leq 1$ for all $i \neq j$. Hence the particularistic benefit received by a legislator affects the utilities of other players to different extents. In our context, these spillovers can be interpreted in two ways. The first interpretation is, each legislator represents one ethnic group and the spillover parameters are measures of how much one ethnic group cares about

the other, or equivalently they measure how close pairs of ethnic groups are in a uni-dimensional policy space. The second interpretation is, each ethnic group is represented by a group of legislators and the spillovers among them is high, if not 1, compared to spillovers with other legislators. In any case the spillover matrix will give us the structure of the ethnic heterogeneity in the legislature.

The fact that the public good enters into the utility function in a logarithmic scale is a common practice in the public goods literature- since it is not possible to reallocate the resources allocated to public goods into different types of "consumptions", the utility function exhibits decreasing marginal utility.

The game form has two stages and consists of the following procedure:

1.1. A legislator is recognised at random to propose a level of public good. The recognition probabilities, p_i are equal $\sum_L p_j = 1$.

1.2. The legislature votes on the proposal simultaneously.

1.3. If a majority votes for the proposal the proposed amount, X_p , then it is accepted, if not, the status quo is $X_p=0$. In any case we move to the second stage.

2.1. A legislator is recognized at random to propose a distribution, $x = (x_1, \dots, x_n)$, of the remaining resources among legislators, namely $\sum_L x_j = 1 - X_p$. The recognition probabilities, p_i are equal and $\sum_L p_j = 1$.

2.2. The legislature votes on the proposal simultaneously.

2.3. If a majority votes for the proposal distribution it is accepted and the game ends, if not, the game is repeated starting at (2.1).

Following the Baron and Ferejohn approach, we only will be looking at the stationary strategies. In our setup, a stationary strategy, s_i , for legislator i consists of:

1. A proposal rule which describes the amount of of public good to be provided in the first stage.
2. A voting rule which specifies how to vote on any public good proposal.
3. A proposal rule describing what distributional proposal, $x = (x_1, \dots, x_n)$, the legislator will be making.
4. A voting rule which specifies how to vote on any distributional proposal.

The equilibrium concept we will be using is the stationary equilibrium, which is basically a subgame perfect equilibrium in stationary strategies. The concept also eliminates weakly dominated strategies.

The second stage of the model is quite complicated and a functional form solution will be presented for a three-legislator case (Calvert & Dietz, 2005). This, however, sufficiently captures the consequences of the heterogeneity we are interested in, as we discuss below.

Let $L=\{1,2,3\}$, $p_i=1/3$, $a_{12}=a_{21}=a$, $a_{23}=a_{32}=\beta$ and $a_{13}=a_{31}=\gamma$. Let p be legislator 1's probability of offering to legislator 2, q be legislator 2's probability of offering to legislator 1 and r be legislator 1's probability of offering to legislator 3. Also let x_{ij} be the share that player i proposes to allocate to player j .

The continuation values are then computed as follows:

$$\begin{aligned}
 V_1 &= \frac{1}{3}(p[1 - (1 - \alpha)x_{12}] + (1 - p)[1 - (1 - \gamma)x_{13}] + q[\alpha + (1 - \alpha)x_{21}] \\
 &\quad + (1 - q)[\alpha + (\gamma - \alpha)x_{23}] + r[\gamma + (1 - \gamma)x_{31}] + (1 - r)[\gamma + (\alpha - \gamma)x_{32}) \\
 V_2 &= \frac{1}{3}(p[\alpha - (1 - \alpha)x_{12}] + (1 - p)[\alpha - (\beta - \alpha)x_{13}] + q[1 - (1 - \alpha)x_{21}] \\
 &\quad + (1 - q)[1 - (1 - \beta)x_{23}] + r[\beta + (\alpha - \beta)x_{31}] + (1 - r)[\beta + (1 - \beta)x_{32}) \\
 V_3 &= \frac{1}{3}(p[\gamma - (\beta - \gamma)x_{12}] + (1 - p)[\gamma - (1 - \gamma)x_{13}] + q[\beta - (\gamma - \beta)x_{21}] \\
 &\quad + (1 - q)[\beta - (1 - \beta)x_{23}] + r[1 - (1 - \gamma)x_{31}] + (1 - r)[1 - (1 - \beta)x_{32})
 \end{aligned}$$

Taking also into account the individual rationality constraints, this yields the following solution:

$$\begin{aligned}
 p &= \frac{-\alpha + \beta + \gamma - 1}{(\beta - 1)(\alpha - \beta + \gamma - 1)} [(\alpha - 1)r + \gamma - \beta] \\
 q &= \frac{-\alpha + \beta + \gamma - 1}{\gamma - 1} \left(\frac{(\alpha - 1)r}{-\alpha - \beta + \gamma + 1} + 1 \right)
 \end{aligned}$$

$$\begin{aligned}
 x_{12} &= \frac{(1-\beta)(\alpha-\beta+\gamma-1)^2}{(\alpha-1)D} & x_{23} &= \frac{(1-\gamma)(-\alpha-\beta+\gamma+1)^2}{(\beta-1)D} \\
 x_{13} &= \frac{(1-\beta)(\alpha-\beta+\gamma-1)^2}{(\gamma-1)D} & x_{31} &= \frac{(1-\alpha)(-\alpha-\beta+\gamma-1)^2}{(\gamma-1)D} \\
 x_{21} &= \frac{(1-\gamma)(-\alpha-\beta+\gamma+1)^2}{(\alpha-1)D} & x_{31} &= \frac{(1-\alpha)(-\alpha-\beta+\gamma-1)^2}{(\beta-1)D}
 \end{aligned}$$

where

$$D = (-\alpha + \beta + \gamma - 1)^2 - 4(1 - \beta)(1 - \gamma)$$

Note that all these are functions of r , which implies a family of fully mixed stationary equilibrium depending on the value of r .

The important corollary that comes out of this particular equilibrium is that if any of the three spillover effects is large, that is if any of the legislators' externalities is great, then all externalities must be similar in magnitude in order for the fully mixed equilibrium to exist. To put it another way, when two legislators are more similar in preferences to one another and less similar to the third, the similar legislators make proposals that favour each other disproportionately often. The implication for this for the first stage of the game would be that if there is such a polarization in the legislator, as indicated by the externality parameters, the similar legislators will not propose a positive amount of public good would like to share the resources in the second stage among themselves.⁴ Hence a heterogeneous legislature will provide less public goods. Although this is a rather stylistic case with three legislators it gives us a valuable insight regarding how more diverse legislatures will lead to lower levels of public goods provision.

4.1. Endogenous Group Formation

In this section we would like to discuss a potential extension of the model we have introduced which can account for the endogenous formation of groups rather than taking them as given. The model incorporates a network formation stage and combines the approaches of Calvert & Dietz (2005) and M.Jackson & Moselle (2002).

⁴ Note that the players have a decreasing marginal utility from the public good.

Let L be the set of players. The game has two stages. In the first stage players form links to each other. For player i , the cost of forming a link to player j is given by c_{ij} . The costs can be interpreted as the communication costs, hence a measure of hostility between the groups. In the second stage, a legislative bargaining game similar to one described above takes place. However, as we stated earlier, the second stage combines the approaches of Calvert & Dietz (2005) and M.Jackson & Moselle (2002). As in the former, it takes into account externalities and as in the latter, it has two dimensions to bargain over: distributive (interpreted as the private good allocations) dimension and the ideological (interpreted as the level of public good in our particular context) dimension. In other words, the decision in the second stage is a vector (y, x_1, \dots, x_n) consisting of an "ideological decision" $y \in [0, 1]$ and a distributive decision x_1, \dots, x_n where $x_i \geq 0$ for all i . The linkage between the two stages of the game is that the players can make offers only to those players whom he is connected to, either directly or indirectly. Let L_i be the set of players to whom player i forms a link.

The utility of a legislator i will then be given by:

$$u_{ij}(x, y, L_i) = y + \sum_{j \in L} a_{ij}x_j - \sum_{j \in L_i} c_{ij}$$

s.t

$$\sum_{j \in L} x_j + y \leq 1$$

The initial cost structure regarding to link formation can be used to represent the ethnic heterogeneity in the society. Hence the original problem will be to ask whether increasing this heterogeneity decreases the equilibrium level of y . One last is that one might presume that a_{ij} s and c_{ij} should be inversely correlated. However this should not be necessarily true; a group might care more about the share of the groups which are geographically closer even if they are more hostile than the ones which are geographically further away.

5. Conclusion and Thoughts for Future Research

In this paper, we have proposed a rational choice theoretical modelling framework to study the association between ethnic heterogeneity and public goods under-provision. Our main goal was to introduce the political decision making processes into the question in order to account for the public goods provided by the governments which account for most of the total public goods. We have employed a legislative bargaining with externalities framework which allows us to explicitly model dependencies among different groups. In a special case with three legislators, our results indicate that an increased diversity among the legislators lead to a lower level of public goods provision. We also discussed a potential way of extending the model so as to make the formation of the ethnic groups endogenous to the bargaining process. There remains, however, many questions that need to be explored further - both within our framework and regarding the association between ethnic diversity and public goods provision in general.

An empirical investigation for the theoretical model we propose would first look at the relationship between heterogeneity of the legislature and heterogeneity of the society, as this diversity representation is needed for our theoretical model to be useful in understanding at the mass level. A natural component of this investigation would be to identify the determinants of the strength of this relationship. One can think of institutional parameters such as different proposal and amendment procedures as one potential set of explanatory variables.

The particularistic benefits in our model can also be interpreted as the local public goods. From this view, the geographical spillovers can also be influential in the coordination game as in the cases of environmental pollution or water resources, hence, the geographical distribution of the ethnic groups will become important. It might be necessary to incorporate the geographical proximities of the ethnic groups either in the spillover parameter or independently in the model, i.e, extending the spillover structure to a two dimensional space.

One remaining theoretical challenge is to integrate a well-defined ethnic polarization measure directly into a public goods provision model and try to get some comparative statics regarding its effects on the level of public goods provision. Here we provide a theoretical thought experiment using a different game theoretical setup. The causal mechanism established in this frame work between the public goods provision levels and ethnic conflict is that the polarization structure of a society changes the targetability calculations made by the politicians. The implications of the model, however, will be more generally about the relationship between heterogeneity and distributional outcomes.

In order to do this, we would like to end with a brief discussion of an alternative model based on the "Colonel Blotto" game. The simplest Colonel Blotto game is as follows: "Two generals want to capture battlefields. The generals will distribute their equal resources to these battlefields. Whoever allocates more resources to a given battlefield captures that field. The generals make their decisions simultaneously. All battlefields have the same value and the goal is to capture the maximum number of captured battlefields."

The analogy we would like to exploit is the following: "Battlefields are ethnic groups and the generals are competing politicians. Whoever provides more resources to an ethnic group gets the support of that group." Hence the main assumption is that the ethnic groups vote together for the candidate who makes a better and credible pledge to them. We would need to extend the original game in a couple of dimensions in order to capture the problem at hand though.

The first important extension is about the strategy set available to the candidates. We would model the choice confronted by the politicians in the lines of Myerson (1993) and assume that the candidates either promise a public good to the society which yields a payoff of G to each ethnic group or, promise a transfer to each group.⁵ We would also have to introduce different values for

⁵ Within the Colonel Blotto setting, one might see the public goods extension as an analogy for spending the resources to build a nuclear weapon rather than sending tanks to different battlefields.

different “battlefields”. This would allow us to represent different sizes of the ethnic groups and give us a chance to see the effect of the polarization on the equilibrium. Here is a more formal definition of the modelling environment:

There are two political candidates competing with identical budget constraints normalised to 1. There are n different groups in the society who vote together. Let s_i represent denote the relative size of group i . The public good yields a utility of G to each group. Candidate i can offer to provide public good or alternatively he can announce a vector of allocations $x_i = (x_1^i, \dots, x_n^i)$ where x_j^i is the resource allocated to group j . All resources have to be spent in order to produce the public good. Groups have no ideological attachments to the candidates and vote for the candidate who promises them the greater utility. Ties are solved by a coin flip. Candidates try to maximise their vote shares.⁶

The set of pure strategies of player i is given by,

$$\sigma_i = \{x \in [0, 1]^n \mid \sum_{j=1}^n x_j \leq 1\} \cup G \quad (1)$$

Let ij represent the promise group j gets from candidate i . The objective of candidate i is then to maximise,

$$\theta_i(\sigma_i, \sigma_j) = \sum_{k=1}^n s_k \mathbf{I}(x_k^i - x_k^j) \quad (2)$$

where \mathbf{I} is the sign function.

This is a zero-sum symmetric game so it will be sufficient to focus on the symmetric equilibria. Our interest is in to see how the relative size distribution of

⁶ Following (Lizzeri & Persico, 2001), one can try to extend the model to majority rule settings and try to see the effects of electoral institutions.

the groups affect the likelihood that the public good is provided in the equilibrium. It is clear that for a large enough G , providing the public good will be a dominant strategy for both players. For our purposes however, it will be sufficient to compare the equilibria for different polarization levels given a fixed G below that dominance threshold. An equilibrium of this game is a pair of n -variate distributions where n is the number of battlefields. The solution is basically a problem of combinatorial optimisation. Borel and Ville (1938) investigates this problem for $n=3$. In an unpublished RAND paper, Gross and Wagner (1950) provide a geometrical method of solving for the equilibrium. Laslier & Picard (2002) follows this methodology in order to provide the conditions for the equilibrium for any finite n . Roberson (2006) extends the model to the case of unequal resource levels.

Peer-review: Externally peer-reviewed.

Conflict of Interest: The author has no conflict of interest to declare.

Grant Support: The author declared that this study has received no financial support.

Hakem Değerlendirmesi: Dış bağımsız.

Çıkar Çatışması: Yazar çıkar çatışması bildirmemiştir.

Finansal Destek: Yazar bu çalışma için finansal destek almadığını beyan etmiştir.

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