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Social Structure, State, and Economic Activity

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Abstract

Most societies in the world contain strong group identities and the culture supporting these groups is highly persistent. This persistence in turn gives rise to a practical problem: how do and should societies with strong group identities organize themselves for exchange and public good provision? In this paper, we develop a theoretical framework – with social structure characterized by number and size of groups as well as quality of ties between them – that allows us to study, normatively and positively, the relationship between social structure, state capacity, and economic activity.

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> Americans of all ages, all conditions, all minds constantly unite. Not only do they have commercial and industrial associations in which all take part, but they also have a thousand other kinds: religious, moral, grave, futile, very general and very particular, immense and very small: Americans use associations to give fetes, to found seminaries, to build inns, to raise churches, to distribute books, to send missionaries to the antipodes; in this manner they create hospitals, prisons, schools. Finally, if it is a question of bringing to light a truth or developing a sentiment with the support of a great example, they associate. Everywhere that, at the head of a new undertaking you a see the government in France and a great lord in England, count on it that you will perceive an association in the United States. Tocqueville [2004], page 489.

> When historians record the history of our time, 300 years from now, the end of the Cold War will be at most a third story in that history. Events in the Middle East will be the second story. When the history of our times is written, the events in Asia, the changes in the lives of so many people so quickly and its ramifications for the global system will be the most important story. Summers [2007], page 4.

I Introduction

The role of groups – based on ethnicity, race, tribe, family – in shaping economic performance remains highly contested. On the one hand, strong group identities limit the scope of cooperative behaviour among strangers and circumscribe the space for broader civic association. This social capital is important for effective functioning of institutions and contract enforcement, an important prerequisite for large scale impersonal exchange. On the other hand, there are societies without strong group identities that do poorly and others with strong identities that perform well. A second difficulty is that many, if not most, societies in the world contain strong group identities and the culture supporting these groups is highly persistent. This persistence poses a practical challenge: how should (and how do) societies with strong group identities organize themselves for large scale exchange?[1]

[1]Weber [1951] offers an early discussion of the role of groups in society. Henrich [2020] provides a recent overview of the research on the role of groups in society. Guiso et al. [2016] provide evidence on persistence of culture over long periods of time.

The "social structure" of a society is characterized not only by the type, number, and size of groups, but also by the quality of bridging ties between them. If the quality of bridging ties (or relations) between two groups is weak, then agents of those two groups will have a harder time to interact, e.g. due to a lack of trust and due to greater asymmetry of information. Within groups, trust and reciprocity are easier to build, but sometimes the most efficient exchanges necessitate interactions across groups. The state can in part compensate for the natural difficulties in conducting economic activities across groups, providing for example contract enforcement, property rights protection, education and infrastructures that facilitate trade. Thus, the potential value of exchanges across groups depends not only on the given social structure but also on the capacity of the state to help such interactions. However, the investment in institutional/infrastructure capacity necessary to facilitate inter-group exchanges is itself endogenous to the social structure: both an authoritarian ruler and a democratic institution must be expected to make the investments and policies that best reflect the interests of the powerful groups in the social structure itself. In this paper we take these issues seriously and provide a normative and positive theory about the mapping from social structure to institutional infrastructure investment and the consequent economic performance.[2]

Individuals belong to groups (that are defined by race, language or religion, depending on the empirical context) and they derive utility from exchange. Exchange with members of one's own group yields a utility that is normalized to one. Exchange with members of a different group occurs only if one's group has a tie with that group. The value of exchange between members of two groups depends on the quality of the tie *and* on the institutional infrastructure. We consider two types of services provided by the state – (1) *pure public goods* (that include public utilities like sewage, electricity, defence) and (2) *institutions and infrastructure* (that include transport facilities but also include legal and police enforcement).[3] The latter group of services facilitate cross-group exchange. Building on the tradition of Tocqueville [2004] and Putnam, Leonardi, and Nanetti [1993] (for a recent paper on this theme, see Jackson and Xing [2021]) we assume that bridging ties and institutional infrastructures are *complementary*.[4] Given a

[2]We are aware that social structure is not a constant and that it may evolve in response to political regime and to infrastructure investments. However, in the present paper, as a first step, the focus is on the effects of a given social structure. We comment on the interactions between bridging capital and political regimes in section VII.

[3]Education could enter the second category, since it increases the shared-culture component and can reduce difficulties to communicate and acquire information.

[4]A number of authors have suggested that informal social ties of trust and the institutional infras-

social structure, define *access* for an individual i in group l as the number of individuals who belong to groups with whom group l has a tie. Aggregate access in a society is the sum total of access across all individuals.

As a normative benchmark, we study the taxation and the allocation of revenue between pure public goods and infrastructure that maximizes the sum of individual utilities. The returns from pure public goods are independent of the social structure while the returns from infrastructure are increasing in access. We distinguish between two types of societies: *bridged* and *segmented*. A society is said to be bridged if it is optimal to invest in both types of public goods, and it is segmented if it is optimal to invest only in the pure public good. There exists a threshold level of aggregate access: below this threshold, the state allocates all revenue to pure public goods; above this threshold the state allocates revenue to both type of public goods. Moreover, the rate of taxation and the share of the revenue allocated to infrastructure is increasing in the level of aggregate access (Proposition 1).

In a society with small groups and a limited access, taxation is low and entirely allocated to pure public goods. Economic exchange takes place mostly within groups but it is at a very low level, as groups are small. As bridging ties expand and the aggregate access grows, the tax rate rises and institutional infrastructure grows; the state now allocates resources to both pure public goods and infrastructure. In a society with large groups and limited access, taxation is low and entirely allocated to pure public goods, but significant economic exchange can still be undertaken as groups are large. As bridging capital grows in this society, investment in infrastructure becomes attractive. However, the large groups set an upper bound on aggregate access and this in turn limits the scope of institutional infrastructure and productive economic exchange. Thus societies with small groups attain higher economic performance when bridging ties are dense, societies with large groups exhibit superior performance when bridging ties are weak (Proposition 2).

We then turn to the study of democratic decision making and show that majority voting on taxation and the allocation of tax revenue can be studied using the preferences of the median voter. There is a threshold access level for the median voter: below this level, tax revenue is allocated entirely to pure public goods and the marginal returns to

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tructure may be substitutes for one another: see Levi and Stoker [2000], Braithwaite and Levi [1998], Fukuyama [1995b] and Gerschenkron [1962]). Our formal model accommodates this possibility by allowing for different types of public goods and state services, but highlights an important form of complementarity between social ties and incentives to provide institutional infrastructures that further help trades across groups. For a related perspective on the relationship between social structure and state investments see Acemoglu and Robinson [2019].

these pure public goods determine the tax rate. Above this threshold, the median voter sets a tax rate that is increasing in access level and the share of infrastructure in budget grows with median access (Proposition 3).

The difference between the utilitarian and democratic outcome turns on the relation between mean and median access. To see this suppose that all groups are of equal size: when median access is smaller than the mean access, institutional infrastructure in a democracy will be smaller than at the social optimum. Conversely, when median access is larger than mean access, tax rate will be higher and institutional infrastructure larger in a democracy as compared to what is socially optimal. In that case, the tax burden is borne disproportionately by the poorly linked and marginalized groups in society. Thus we see that the difference between mean and median access can create tensions in democratic societies either due to economic under-performance or due to economic inequality.

As many countries have authoritarian governments, it is important to discuss them. In the context of our model, one approach would be to suppose that an authoritarian government represents the interests of a single group and ignores the other groups in society.[5] Using our framework, the divergence between the authoritarian government and the utilitarian outcome would be an increasing function of the distance between the mean access and the access of the dominant group that makes the decisions. This general approach is helpful when we turn to the mapping of our model on to the experience of countries (see sections B and C).

The theory predicts that in the utilitarian optimum, higher aggregate access leads to higher tax rates (and larger institutional infrastructure). Similarly, in a political equilibrium, a larger access for the group that makes tax and expenditure decisions leads to higher tax rates. The wedge between mean access and the access of the decision making group creates a gap between socially optimal and politically determined tax rates. To appreciate the scope of these theoretical predictions we would like to relate them to empirical patterns on social structure and state functioning. Unfortunately, we don't have data at a level of granularity that would allow us to measure the distribution of

[5]This obviously determines a biased use of resources in favor of the dominant group, and hence investment in institutional infrastructures should be expected to be lower than both the utilitarian and democratic benchmarks analyzed in this paper. The "selectorate" theory of De Mesquita et al. [2005] predicts that in an authoritarian regime the resources are either allocated to private goods for the (small) winning coalition that supports the regime, or else in pure public goods such as defense or war, while institutional infrastructure to facilitate a balanced development of trade opportunities across groups in society is not contemplated in the framework. See also Deacon [2009] on the propensity of authoritarian regimes to go for transfers rather than investments. However, no paper exists on how an authoritarian regime allocates expenditure between pure public goods and institutional infrastructures.

access in a society. To make progress, we use proxies for access based on well known measures of trust taken from the literature (Knack and Keefer [1997], Glaeser, Laibson, Scheinkman, and Soutter [2000], Aghion, Algan, Cahuc, and Shleifer [2010], Algan and Cahuc [2014], and Cook, Levi, and Hardin [2009]).

Specifically, building on the influential work of Henrich [2020] and Enke [2019], the key measure we use is *out-in-group trust*. This reflects the difference between trust towards outsiders and trust towards group members and in our view offers a good proxy for our notion of access. Motivated by the seminal work of Alesina, Baqir, and Easterly [1999], we would like to study the role of this measure of trust in a setting of social heterogeneity/fragmentation. Our principal statistical finding is that, in line with our theory, there exists a positive correlation between tax/GDP rate and out-in-group trust, *after we control for fragmentation* in a country.

Finally, we discuss the relevance of our theoretical findings on the distinction between median and mean access with the help of country case studies. In countries where some groups are well connected while a majority of the groups are poorly connected, median access is lower than mean access. Well connected elites support institutional infrastructure that serves their economic needs. However, once universal suffrage arrives, the median voter has low access and presses for pure public goods. We use this prediction of the theory to account for the experience of Zimbabwe and South Africa after majority rule was introduced. On the other hand, in societies where the majority of groups are well connected but there exists a significant minority of population that is isolated, the median access will be larger than the mean access. In such countries, democratic politics will lead to large investments in infrastructure. The potentially large minority that does not gain from such investments will press for pure public goods. We relate these theoretical predictions to the persistent tensions between the state and indigenous groups in India and in Latin American countries.

Our paper contributes to the study of the relations between society, markets, and the state. The distinctive feature of our work is that we place all these three elements within a common theoretical framework and we use it to address a classical question – how do (and should) societies with large and small groups organize economic activity? Specifically, our paper bridges two literatures – a theoretical literature on the relation between social structures and markets (see e.g., Hirschman [1997], Kranton [1996], Gagnon and Goyal [2017]) and the large literature on the relation between social and economic heterogeneity and public good provision and institutional infrastructure (see e.g., Meltzer and Richard [1981]Alesina, Devleeschauwer, Easterly, Kurlat, and

Wacziarg [2003], Alesina, Baqir, and Easterly [1999], Boix [2003], Besley and Persson [2013], Scheve and Stasavage [2016], Sokoloff and Zolt [2007], Suryanarayan and White [2021]). The novel elements in our model are the bridging ties between groups and the role of the institutional infrastructure in complementing these bridging ties. This leads us to consider two types of public goods – pure public goods in the sense of Alesina, Baqir, and Easterly [1999] and physical as well as institutional infrastructure (that are studied for instance by Besley and Persson [2013] and Jensen et al. [2023]). Our analysis shows that societies with small groups perform poorly relative to societies with large groups when bridging tie networks are sparse (and access is low): this is because within group exchange dominates out of group exchange, and large groups offer more of that. However, if bridging ties are dense, smaller groups create the potential for greater access and (under the right circumstances) this gives rise to larger institutional infrastructure and higher economic performance. Our paper also highlights the tensions that arise in democratic societies when median and mean access diverge.

II Model

We consider a society of individuals, $N = \{1, .., n\}$, who belong to $M = \{1, .., m\}$ groups, where $m \geq 1$. We will assume that every individual belongs to one and only one group. The size of group j is denoted by s_j ; the vector of group sizes is $\mathbf{s} = \{s_1, .., s_m\}$, so that $\sum_j s_j = n$. The groups are connected through a network of bridging ties. The groups and the bridging ties together constitute a social structure that we denote by G. Our notion of groups could apply to families, lineages, tribes and ethnic groups.[6] Two groups j and j' have a *bridging tie* whenever the expected payoff of a trade between a member of j and a member of j' is above some threshold $\underline{k}$. It takes a minimal amount of trust, information, and enforcement of contracts to make trades possible between groups.

[6]Individuals possess different identity markers such as race gender and religion and it would be more natural to consider cross-cutting group identities. This can be easily accomplished within our framework as follows: we could start with the social structure as a bipartite graph, with individuals on one side and organizations (sports clubs, political parties, churches and trading associations) on the other side. A link would exist between two individuals if they belong to the same organization. The links between individuals and organizations therefore induce a social network of ties between individuals. Our baseline formulation of individuals belonging to groups can be derived from this more micro-founded bipartite representation. Our methods and results would carry over to this alternative model.

Bridging capital, access and utilities

An agent i with income y_i who belongs to a group j of size s_j is said to have *access* to people outside her group equal to

$$a_i(G) = \sum_{j'} G_{jj'} s_{j'}$$

where $0 \leq a_i \leq n - s_i$. This is the number of people in other groups with whom i's group shares bridging ties. Define aggregate access in a society with groups s and network G as $A(G) = \sum_{i \in N} a_i(G)$.

Economic activity is characterized by bilateral exchanges, but exchanges between two agents of different groups are characterized by incomplete information, lack of commitment and lack of trust. A group serves as an informal institution that mitigates (or eliminates) these frictions. We normalize the payoff of an exchange within a group to 1. Agents can carry out exchange with people outside their group – but their awareness of such opportunities and the costs of carrying out such exchange are shaped by the bridging ties their group has with other groups. We will assume that an agent can engage in economic activity with members belonging to another group only if there exists a bridging tie between the respective groups.[7] The information facilitated by a bridging tie may be about economic opportunities or about the behaviour of individuals. Even when bridging ties between groups exist, they will vary in quality: social distance or language differences may affect the value of a tie.[8]

To capture this complexity in a simple form, we assume that in case there exists a tie between two groups, an exchange between two members of such different groups in the absence of government intervention yields a payoff of $k \geq \underline{k}$, where k is assumed to be in any case less than one, to reflect the lower trust, information and enforcement across groups.

The payoff of an agent is her initial income plus the expected gains from exchange. Exchange takes place both within one's group as well as across groups (with probabili-

[7] Bridging ties may reflect a wide range of connections. One natural case arises if members of two groups take part in common associations (see e.g. Varshney [2001], Putnam et al. [2000]). Other examples come from the possibility of intermarriage or military alliances against common enemies (see e.g. König et al. [2017] and Goyal [2023]).

[8] The probabilities of ties across groups in stochastic block models can also be a measure of strength of ties across groups (for a discussion of such models see Goyal [2023]). Alternatively, we may think of ties between groups as reflecting common members – for instance the group of blacks and the group of whites may have stronger ties if for instance most of them share the same religion or language; notions of social distance and how they affect behaviour are discussed in Akerlof [1997].

ties depending on group sizes). The payoff of agent i with income y_i in a group j that is embedded in a network g is

$$u_i = y_i + \frac{s_i - 1}{n - 1} + \frac{a_i}{n - 1}k. \tag{1}$$

One way to motivate this formulation is to suppose that for any individual there is a unique potential partner who is picked uniformly at random from the population and that the agent initiating the trade earns all the gains from trade.[9]

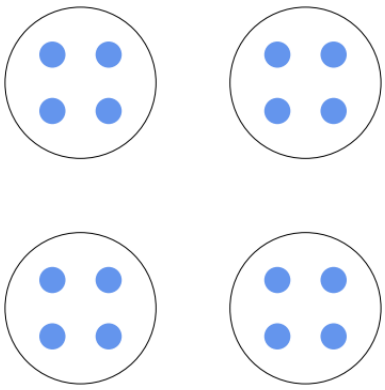
We present some examples to draw out our approach to social structure. Figure 1 presents examples of societies with equal sized groups. In these examples, $n = 16$ and each group contains $s_j = s = 4$ individuals. Figure 1(a) reflects a situation in which the groups have no bridging ties across groups. This means that access is zero for everyone, $a_i(g) = 0$ and $A(g) = 0$. Figure 1(b) corresponds to a situation of moderate and uniform connectivity, every group has links with two other groups. Thus $a_i = 8$ for every $i \in N$, and $A(g) = 128$. Figure (1)c considers a situation where one group has bridging ties with all other groups, who in turn have no other ties. In this case, for a member of the 'hub' group $a_i = 12$, while for members of the 'spoke' groups access $a_i = 4$; moreover aggregate access is $A(g) = 96$. We note that in this society the average access is 6 but the median access is only 4. This distinction between median and mean access plays a major role in our study of institutional infrastructure investment below. Finally, we consider a society in which groups have a dense web of bridging ties with other groups as reflected in a complete network. In this network every person has the same access that is given by $a_i(g) = 12$ and aggregate access is given by $A(g) = 192$.

Figure 2 presents examples of societies with unequal groups. In these examples, $n = 16$, but groups contain 6, 5, 3 and 2 members, respectively. Figure 2(a) reflects a situation in which the two smallest groups have a bridging tie but there are no other ties. This means that access is zero for members of the two larger groups and respectively $a_i(g) = 2$ and $a_i(g) = 3$ for members of the two smallest groups. As a result aggregate access is given by $A(g) = 12$. Figure 2(b) reflects a situation in which the two largest groups have a bridging tie and there are no other ties. This means that access is zero

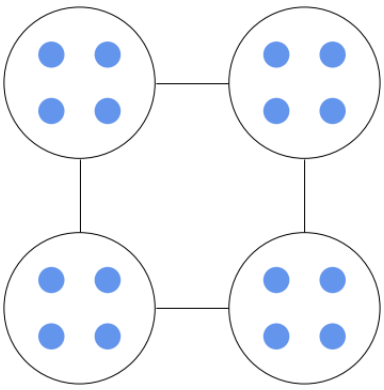
[9]It is possible to provide alternative micro-foundations that build off different frictions: there could be more than one partner, different probabilities to find a partner within the group or outside, different potential gains from trade within the group or outside. For instance, if every insider has probability p_I to be a partner, every outsider probability p_O and gains from trade are π_I with an insider and π_O with an outsider, we would get

$$u_i = y_i + p_I(s_i - 1)\pi_I + a_i p_O k \pi_O$$

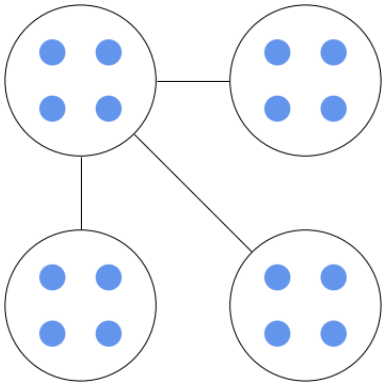
and the benchmark model is a case where $p_I = p_O = \frac{1}{n-1}$ and $\pi_I = \pi_O = 1$.



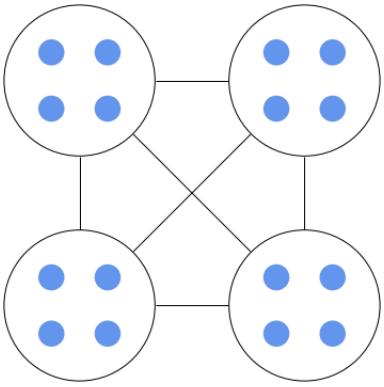
(a) Empty. $A(g) = 0$.



(b) Circle. $A(g) = 128$.

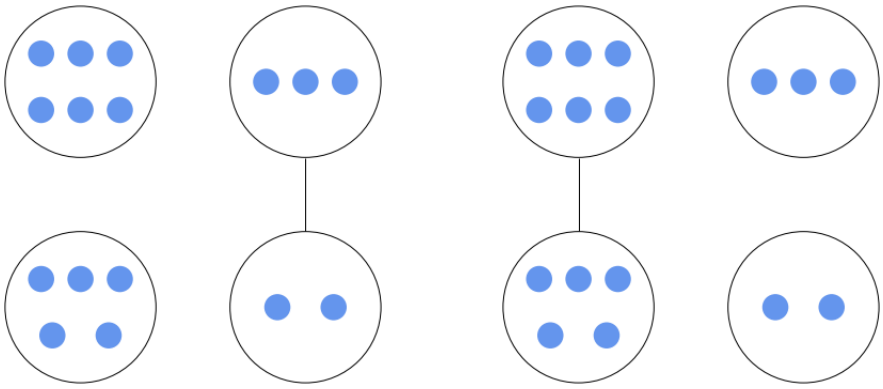


(c) Star: $A(g) = 96$.



(d) Complete: $A(g) = 192$.

Figure 1: Examples of networks with equal size groups: $n = 16$, $m = 4$.



(a) One link: $A(g) = 12$ (b) One link: $A(g) = 60$

Figure 2: Examples of networks with unequal groups: $n = 16$, $m = 4$.

for members of the two smaller groups and respectively $a_i(g) = 5$ and $a_i(g) = 6$ for members of the two larger groups. As a result aggregate access is given by $A(g) = 60$.

The government

The government chooses a linear tax rate τ with $0 \leq \tau \leq 1$, and decides how to use the tax revenue between generic public goods and investments in infrastructures that improve contract enforcement across groups. As a normative benchmark, we will consider the utilitarian optimum. In this case a planner seeks to maximize aggregate utility. We will compare the utilitarian outcome to the outcome under a democratic government (with tax rates and infrastructures determined by the median voter).

Suppose that taxation induces a deadweight loss of $\frac{1}{2}\tau^2$ which reflects distortions and administrative costs. If aggregate income is Y and tax rate is τ then aggregate infrastructure is

$$T = (\tau - \tau^2/2)Y$$

The government chooses a tax rate τ and also chooses how to allocate the revenue T

between two types of expenditures: one, a pure public goods – such as sewage, health, defence – that increases payoffs of every citizen equally: this is denoted by p, and two, investment and expenditures in institutions that is allocated to improve contract enforcement, infrastructure, and information flows, that is denoted by $\eta = T - p$. This could also include the quality of police, legislation and courts (that assist in the enforcement of contracts and laws). Protection of property rights and from abuses can compensate for the lower trust among people of different groups. The two categories are not completely distinct: education is a general public good but education in a common national language helps communication between members of different groups and may fall in this latter category.

Define $Y = \sum_i y_i$ as the aggregate income and recall that $A(g) = \sum_i a_i$ is the aggregate access in a social structure g. Given a tax rate τ, individual utility is given by

$$u_i(g, \tau) = (1 - \tau)y_i + h(p) + \frac{a_i(g)}{n-1}k(1 + F(T - p)) + \frac{s_i - 1}{n-1}$$

where $h(p)$ is the utility from a pure public good and function $F(\cdot)$ reflects the quality of infrastructures. We will assume that $h(0) = 0$, $\lim_{p\to 0} h'(p) = \infty$, $h(.)$ is strictly increasing and strictly concave. We shall also assume that $F(0) = 0$, for any positive η, $F(\cdot)$ is strictly increasing and concave. For simplicity, we will also assume that $\lim_{\eta\to 0} F'(\eta) < \infty$.

III Utilitarian tax rates

The benevolent state sets tax rate and allocates budget between pure public goods, p, and infrastructures, η, to maximize aggregate utility. As returns from both types of activities are strictly positive, the budget will always be binding. So $p + \eta = T$, and we will write $\eta = T - p$ in what follows.

$$\max_{\tau,p} W = (1 - \tau)Y + nh(p) + \frac{A}{n-1}k(1 + F(T - p)) + \sum_i \frac{s_i - 1}{n-1}$$

A Bridged and segmented societies

The government invests zero in infrastructures if aggregate access is zero and it will choose tax rate that solves the equation:

$$nh'((\tau - \tau^2/2)Y)(1 - \tau)Y = Y \tag{2}$$

This equates the marginal returns from pure public goods to the marginal cost of taxation. We can rewrite this equation as follows:

$$\tau = 1 - \frac{1}{nh'((\tau - \tau^2/2)Y)} \tag{3}$$

Under our assumptions that utility $h(\cdot)$ is strictly concave and that $\lim_{p\to 0} h'(p) = \infty$, this equation has a unique solution denoted by τ^*, with an associated level of public goods given by $p^* = ((\tau^* - (\tau^*)^2/2)Y)$. Using this condition, we can infer that

Lemma 1 *The government chooses $\eta > 0$ if and only if marginal returns from infrastructures exceed the marginal rewards from pure public goods at τ^*. In other words, government will invest in infrastructures if and only if*

$$\frac{A}{n-1} kF'(0)(1-\tau^*)Y > Y. \tag{4}$$

A country where condition (4) holds is called **bridged** and a country where the condition fails is called **segmented**.

In a bridged country, the allocation of fiscal resources T between pure public goods and infrastructures is determined by the equalization of the marginal social benefits:

$$nh'(p) = \frac{A}{n-1} kF'(\eta) \tag{5}$$

The derivative of welfare with respect to tax rate in a bridged country is then

$$\frac{\partial W}{\partial \tau} = -Y + (1-\tau)k\frac{A}{n-1} YF'(\eta).$$

The optimal tax rate in this case solves

$$\tau = 1 - \frac{n-1}{kAF'(\eta)}$$

which has a solution if $kAF'(0) \geq n-1$. Denote this solution by τ_{FB}^{bri} with corresponding investments in pure public goods p^{bri} and infrastructures $\eta^{bri.}$

The welfare under the utilitarian optimum is

$$W^* = (1-\tau^{bri})Y + nh(p^{bri}) + \frac{A}{n-1} k\left[1 + F(\eta^{bri})\right] + \frac{\sum_i s_i - 1}{n-1}. \tag{6}$$

where $\eta^{bri} + p^{bri} = (\tau^{bri} - (\tau^{bri})^2/2)Y$. Elementary algebra combined with the implicit function theorem shows that in a bridged country the tax rate and the indirect utilitarian

welfare are increasing in aggregate access A and that utilitarian tax rate is falling in aggregate income.

We summarize our analysis of the utilitarian problem as follows.

Proposition 1 *Suppose that $kAF'(0) \geq n-1$. The utilitarian optimal tax rate in a bridged country, τ_{FB}^{bri}, and the allocation of budget between pure public goods, p^{bri}, and infrastructures, η^{bri}, are the unique solutions to the following system of equations:*

$$\tau_{FB}^{bri} = 1 - \frac{n-1}{kA(g)F'(\eta^{bri})}; nh'(p^{bri}) = \frac{A(g)}{n-1}kF'(\eta^{bri}).$$

Optimal tax rate τ_{FB}^{bri}, infrastructures η^{bri}, and welfare are all increasing in aggregate access $A(g)$ while public goods p^{bri} is decreasing in aggregate access. Optimal tax rate is falling in aggregate income Y.
The utilitarian optimal tax rate in a segmented country, τ_{FB}^{seg} is a solution to:

$$\tau_{FB}^{seg} = 1 - \frac{1}{nh'((\tau^{seg} - (\tau^{seg})^2/2)Y)} \tag{7}$$

Pure public goods, $p^{seg} > 0$, and infrastructures, $\eta^{seg} = 0$. Optimal tax rate is falling in aggregate income Y.

B The role of group sizes

In a segmented society where the state does not invest in making trades easier across groups, the size of groups is irrelevant for welfare. On the other hand, in a bridged society group sizes matters for utilitarian welfare analysis.

The following example illustrates the role of social structure in shaping state functioning.

Example 1 *Utilitarian Optimum: Role of social structure*

Consider 4 groups each with 4 people, so $n = 16$, $s_i = s = 4$. Aggregate access is then 0, 96, 128, and 192 for the empty, clique, circle, and complete network, respectively. Suppose $k = \frac{1}{8}$ and $Y = 1000$. Then, applying Proposition 1, we can show that the optimal tax rate τ is given by 0.058, 0.058, 0.063, and 0.375, respectively. The size of pure public good is 56.7, 56.7, 56.25, and 25 respectively while the size of infrastructures is 0, 0, 4.3, and 279.7 respectively.

So welfare for empty network is 1065.3, for the clique of 3 network is 1066.1 for the circle network it is 1066.4 and for the complete network it is 1157.3. Thus, holding group size fixed, starting at a network where the utilitarian optimal tax rate is positive, adding links raises welfare. These computations are illustrated in figure 3.

■

To develop a feel for the considerations that arise, we next consider a society with group sizes 1.

Example 2 *Role of social structure: small groups.*

Consider a society with $n = 16$. Incomes are as before in the previous example, so that $Y = 1000$. Suppose every group has only one member; so $m = 16$. In this situation, there is no within-group exchange. Then, applying Proposition 1, we can show that the optimal taxation τ is given by 0.058, 0.058, 0.058, and 0.5 respectively. The size of pure public good is 56.7, 56.7, 56.7, and 16, respectively while the size of infrastructures is 0, 0, 0, and 359 respectively.

So welfare for empty network is 1062.1, for the star network is 1062.3, for the circle network it is 1062.3 and for the complete network it is 1284. Thus, holding group size fixed, starting at a network where the utilitarian optimal tax rate is positive, adding links raises welfare. Figure 4 illustrates these computations.

■

With these observations in mind, we now develop the general conditions under which societies with large and small groups do better, respectively.

Consider any distributions of group sizes $\mathbf{s} = (s_i)_i$ and $\mathbf{s}' = (s'_i)_i$. Denote by $\bar{s} = \frac{1}{n}\sum_i s_i$ the average group size. Let $A(\mathbf{s})$ denote the maximal level of aggregate access for this size distribution, i.e., when the network between groups is complete. Note that in the complete network, for each individual i, $s_i - 1 + a_i = n - 1$, and this leads to

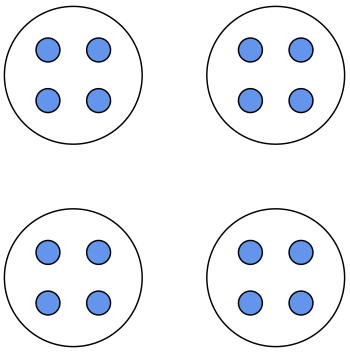
$$\sum_i (s_i - 1 + A(\mathbf{s})) = n(n-1)$$

or, equivalently,

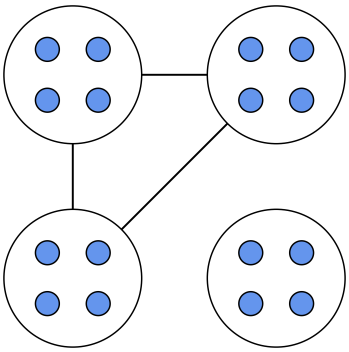
$$A(\mathbf{s}) = n^2 - n\bar{s}$$

Denote by $U(\mathbf{s})$ the gains from trade within, i.e.

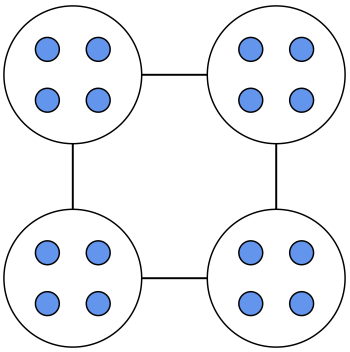
$$U(\mathbf{s}) = \sum_i \frac{s_i - 1}{n-1}$$



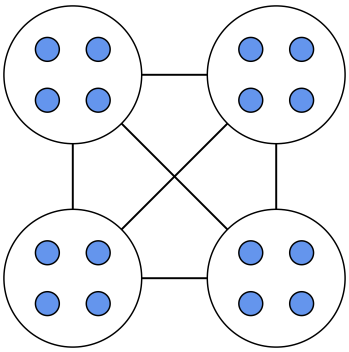
(a) Agg. Access:0
Tax rate: 0.058
Welfare: 1065



(b) Agg. Access: 96
Tax rate: 0.058
Welfare:1066

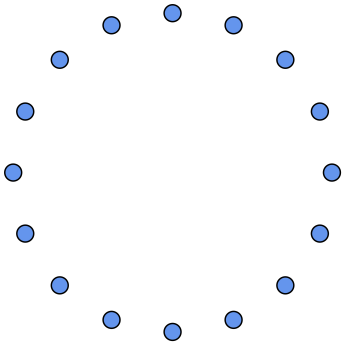


(c) Agg. Access: 128
Tax rate: 0.063
Welfare: 1066

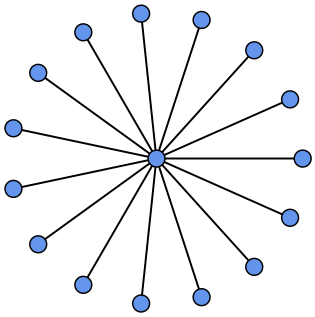


(d) Agg. Access: 192
Tax rate: 0.375
Welfare:1157

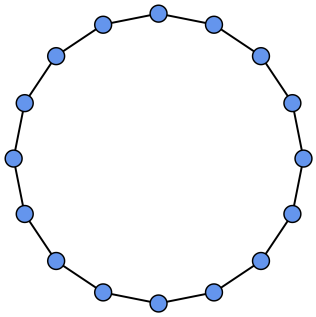
Figure 3: Utilitarian Outcome: effects of networks with large groups



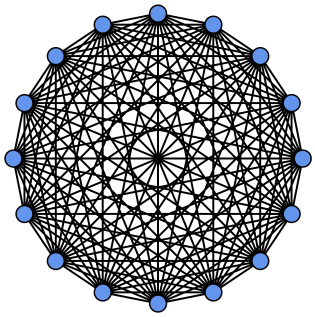
(a) Access:0
Tax rate:0.058
Welfare: 1062.1



(b) Access: 30
Tax rate: 0.058
Welfare: 1062.3



(c) Access: 32
Tax Rate: 0.058
Welfare: 1062.3



(d) Access: 240
Tax Rate: 0.5
Welfare: 1284

Figure 4: Utilitarian Outcome: effects of networks with small groups

and note that

$$U(\mathbf{s}) + \frac{A(\mathbf{s})}{n-1} = n$$

Denote by $\eta(\mathbf{s})$ the level of investment in a bridged society with aggregate access $A(\mathbf{s})$.

If this society satisfies also the condition

$$k[1 + F(\eta(\mathbf{s}))] > 1 \tag{8}$$

it follows that at the utilitarian optimum, gains from a trade to an outsider are larger than gains from trade to an insider. Then the next proposition holds:

Proposition 2 *Consider two bridged societies with the same aggregate income Y and group size distributions $\mathbf{s}$ and $\mathbf{s}'$ such that $\bar{s}' < \bar{s}$.*

1. Given an aggregate access level A feasible for both societies, welfare is higher for societies with larger average group size: $W(\mathbf{s}, A) > W(\mathbf{s}', A)$.

2. Suppose that condition (8) holds for the society with larger group sizes. There is a threshold access A^* for society with group sizes $\mathbf{s}'$ such that $W(\mathbf{s}', A) > W(\mathbf{s}, A(\mathbf{s}))$ for all $A \geq A^*$.

3. Suppose that condition (8) is violated for the society with lower average group size. Then, $W(\mathbf{s}, A(\mathbf{s})) > W(\mathbf{s}', A)$ for all $A \leq A(\mathbf{s}')$.

Proposition 2 helps us appreciate the relative role of group sizes and bridging capital in shaping social welfare. To illustrate these effects let us recall the examples of the society with large groups of size 4 and the society with small groups of size 1. We summarize our computations on welfare in one place for ease of comparison.

Example 3 *Role of social structure: small vs large groups.*

As before consider a society with $n = 16$ and $Y = 1000$. We note that if every group has 4 members, welfare for empty network is 1065.3, for the clique of 3 network is 1066.1 for the circle network it is 1066.4 and for the complete network it is 1157.3. On the other hand, if every group is of size 1, welfare for empty network is 1062.1, for the star network is 1062.3, for the circle network it is 1062.3, and for the complete network it is 1284. A comparison of these welfare levels brings out the relative role of group sizes and bridging capital nicely: in our setting condition 8 is satisfied for the society with large groups. Hence for sufficiently high access levels, a society with smaller groups will have higher welfare. This is indeed the case: the welfare in society with small

groups is 1284 and it is larger than the welfare 1157.3 in the society with large groups (when they both have a complete network of bridging ties).

■

IV Democratic decisions

The simplest democratic decision making benchmark is one where the tax rate and the allocation of tax revenue are chosen by the median voter. For simplicity, in this section, we will assume that individual incomes are equal: $y_i = y$. We start by noting that the preferred policy bundle of individual i solves the following problem:

$$\max_{\tau,p,\eta}(1-\tau)y + h(p) + k\frac{a_i}{n-1}[1+F(\eta)] + \frac{s_i-1}{n-1} \tag{9}$$

$$s.t.\ \ p+\eta = T = (\tau - \tau^2/2)Y. \tag{10}$$

Suppose that $\eta = 0$. In this case, optimal tax for individual i solves the equation:

$$h'((\tau-\tau^2/2)Y)(1-\tau)Y = y \tag{11}$$

Rewriting we get:

$$\tau_i = 1 - \frac{1}{h'((\tau_i - \tau_i^2/2)Y)n} \tag{12}$$

In this case, let the optimal pure public good be given by p^*. It follows that

Lemma 2 *Individual i prefers $\eta > 0$ if and only if*

$$\frac{a_i}{n-1}kF'(0)(1-\tau_i)Y \geq y. \tag{13}$$

If the individual meets condition (13) then the derivative of utility with respect to tax rate is

$$\frac{\partial u_i(g,p,\eta)}{\partial \tau} = -y + (1-\tau)Y\frac{kF'(\eta)a_i(g)}{n-1}$$

The ideal tax rate is

$$\tau_i = 1 - \frac{1}{a_i}\frac{n-1}{knF'(\eta)}$$

This is a valid solution if $\tau \geq 0$, i.e., if and only if $a_i knF'(\eta) \geq n-1$. In this case, utility is given by

$$u_i^*(g, \tau_i, p_i, \eta_i) = \left(\frac{n-1}{ka_i nF'(\eta_i)}\right) y + h(p_i) + \frac{a_i}{n-1} k\left[1 + F(\eta_i)\right] + \frac{s_i - 1}{n-1}. \quad (14)$$

Individual preference for tax rate is increasing in their access, and the preferred tax rate of the median access voter satisfies:

$$\tau_d = 1 - \frac{n-1}{a_d knF'(\eta)}$$

where d is such that a_d is the median access. Agents for whom $a_i > a_d$ prefer a higher tax, agents for whom $a_i < a_d$ prefer a lower tax rate and smaller infrastructures.

Proposition 3 *Suppose all individual incomes are equal. If median voter satisfies condition (13) then the democratic tax rate and allocation of public budget are the unique solutions to the system*

$$\tau_d = 1 - \frac{1}{a_d}\frac{n-1}{knF'(\eta_d)}; nh'(p_d) = \frac{A(g)}{n-1} kF'(\eta_d)$$

The democratic tax rate, τ_d, aggregate tax revenue, T_d, and infrastructures η_d are all increasing in a_d/y while public goods p_d is decreasing in a_d/y. Welfare increases with median access if median access is lower than average access and decreases with median access if median access is higher than average access

If median voter violates condition (13) then the democratic tax rate, τ_d, is the unique solution to:

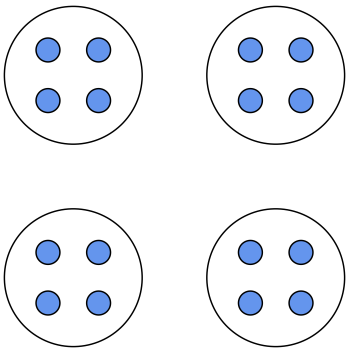
$$\tau = 1 - \frac{1}{nh'((\tau - \tau^2/2)Y)} \quad (15)$$

The democratic tax rate, τ_d, and aggregate state revenue, T_d, are falling in y.

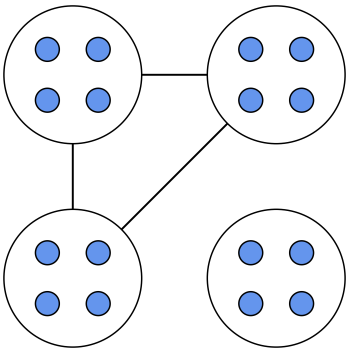
The following example illustrates median voter decisions on tax rate and on institutional infrastructure and the implications of these decisions for welfare.

Example 4 *Democratic Outcomes*

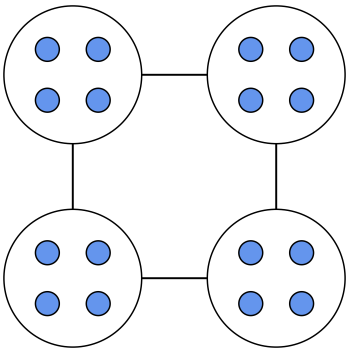
Consider the same society as in Example 1. There are four groups with 4 people, so $n = 16$, $s_i = s = 4$. Median access is 0, 8, 8, and 12 for the empty, clique, circle, and complete network, respectively. As before let us fix $k = \frac{1}{8}$, $Y = 1000$ and $y = \frac{Y}{n} = 62.5$. Then, applying Proposition 3, the median tax rate τ is given by 0.058, 0.063, 0.063, and 0.375, respectively. The size of the pure public good is 56.7, 56.2, 56.25, and 25 respectively while the size of infrastructures is 0, 0, 4.3, and 279.7 respectively. So welfare for



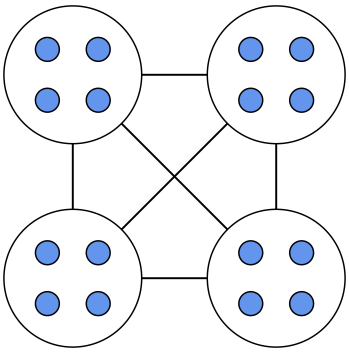
(a) Median Access:0
Tax rate: 0.058
Welfare: 1065



(b) Median Access: 8
Tax rate: 0.063
Welfare:1063



(c) Median Access: 8
Tax rate: 0.063
Welfare: 1066



(d) Median Access: 12
Tax rate: 0.375
Welfare:1157

Figure 5: Democratic Outcome: effects of networks

empty network is 1065.3, for the clique of 3 network is 1063, for the circle network it is 1066.4 and for the complete network it is 1157.3. Figure 5 presents democratic outcomes. ■

V Utilitarian vs Democratic Outcomes

From Proposition 3, the median tax rate is given by

$$\tau_d(g) = \max\{1 - \frac{(n-1)}{ka_d nF'(\eta_d)}, 1 - \frac{1}{nh'((\tau - \tau^2/2)Y)}\}$$

From Proposition 1, the utilitarian optimum tax rate is $\tau_{FB} = \max\{\tau^{bri}, \tau^{seg}\}$. where

$$\tau^{bri}_{FB}(g) = 1 - \frac{n-1}{kA(g)F'(\eta^{bri})}; \tau^{seg} = 1 - \frac{1}{nh'((\tau^{seg} - \tau^{seg^2}/2)Y)}$$

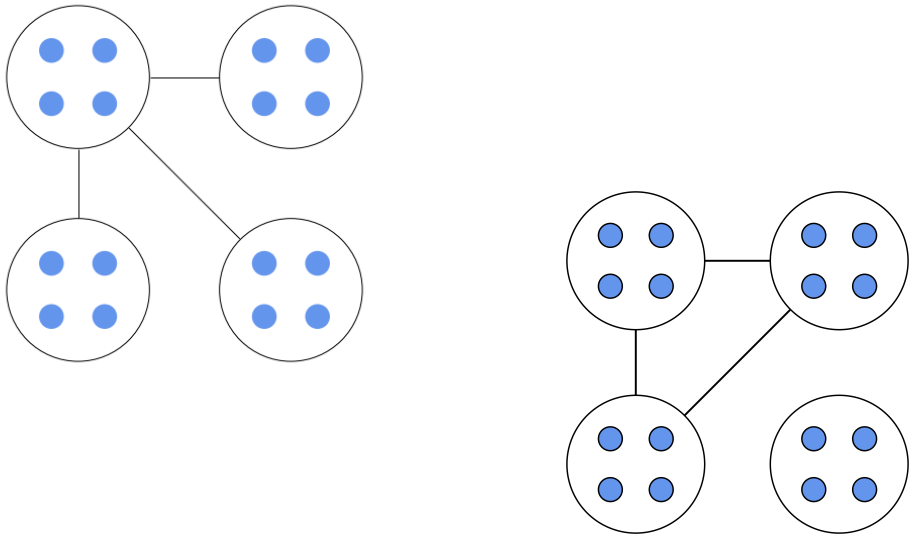
For ease of exposition, let us focus on the case where society is bridged (condition (4) is satisfied) and median voter prefers infrastructures (condition (13) is satisfied). In this situation, we are comparing:

$$\tau_d(g) = 1 - \frac{(n-1)}{ka_d nF'(\eta_d)} \quad \textbf{vs} \quad \tau^{bri}(g) = 1 - \frac{n-1}{kA(g)F'(\eta^{bri})} \tag{16}$$

We see that the relative tax rates will depend on the comparison between average access and median access: utilitarian tax rates are larger (smaller) than democratic tax rates if average access is larger (smaller) than median access. The following example compares the democratic outcomes and utilitarian outcomes.

Example 5 *Utilitarian versus democratic outcome*

When all groups are of equal size and the network is regular the median access is equal to the mean access. The tax rate chosen by the median voter is then equal to that chosen by the utilitarian planner. However, once we move away from regular networks matters are more complicated. To see this let us consider two networks – the star network and the clique of three network. Figure 6 illustrates these two networks. In the star network the median access is smaller than the mean access (4 vs 6), while in the latter the median access is larger than the mean access (8 vs 6). The utilitarian institutional infrastructure is (weakly) larger than the democratic state in the star network, while the



(a) Median smaller than mean (b) Median larger than mean

Figure 6: Mean and median access

converse is true in the case of the clique of three network. It turns out that in our examples the utilitarian and democratic outcomes are the same for the star network. But a comparison of figures 3 and **??** shows the divergence for the clique with 3 network. ■

Turning to a general analysis of networks and many groups, let us suppose that every group has the same size s, i.e., $s_i = s$. Then, access of individual i in group j is proportional to degree $a_i = sd_j$. Denote median degree by d_d and average degree by $\bar{d}$.

Corollary 1 *Suppose that everyone has the same income, every group has the same size and there is investment in infrastructures under both the utilitarian and democratic regimes. Then democratic institutional infrastructure and utilitarian institutional infrastructure are identical if and only if $d_d = \bar{d}$. If $d_d < \bar{d}$ then infrastructures are smaller in a democracy as compared to the first best. If $d_d > \bar{d}$ then formal institutional infrastructure are larger in a democracy as compared to the first best.*

Changes in the network

We next examine the effects of changes in network on institutional infrastructure and economic outcomes. As above, for simplicity, suppose wealth levels are equal and group sizes are also equal.

First consider the addition of links in a network. Assume that in the original network optimal tax rate is positive. Addition of links will increase mean degree and hence raise aggregate access. This will lead to a larger tax rate and larger institutional infrastructure (and a correspondingly larger welfare). In a democratic regime, adding a link will affect tax rate only if it raises the median degree.

Second, consider changes in the distribution of links in the form of a mean preserving spread of degrees. This is a simple and natural way to compare a society in which all groups are relatively similarly connected with a society in which some groups occupy a central position, while many others are peripheral and principally connected to the single central group. By construction, the mean remains unchanged, and so the aggregate access and the utilitarian tax rate remain unchanged. This also means aggregate welfare remains unchanged. However, a mean preserving change in degrees can alter the median degree and this will impact tax rate in a democratic regime. When we move from a society with equally connected groups to a society with a central group, welfare will increase with median degree if and only if median is lower than the mean degree. The following example illustrates these ideas.

Example 6 *Changing networks: Utilitarian vs median voter.*

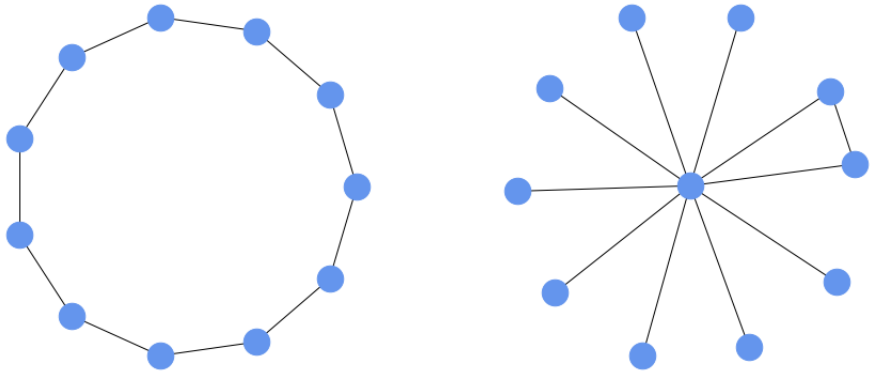
Consider a circle network. The median and mean degrees here are equal to 2. Suppose $n = 11$, $y_i = y = 100$, $k = 0.5$, $Y = 1100$. Suppose that all groups are equal and of size 1 (everything here would extend straightforward manner to the case of equal groups with multiple members).

In this circle network the democratic outcome is the same as the utilitarian. Therefore, $\tau_D = \tau_{FB} = 0.091$ $W_D = W_{FB} = 1133.6$

Next consider the effects of adding a link to the circle: the average degree becomes $\frac{24}{11}$, and $\tau'_{FB} = = 0.167$ and $W'_{FB} = 1144.7$

Thus, adding a link raises utilitarian taxes and aggregate welfare would necessarily go up in the case of a benevolent planner. The tax rate for the democratic case is unchanged because the median voter remains unchanged: $\tau'_D = \tau_D = 0.091$.

Next consider a mean preserving spread from the circle to a star network in which two and only two spokes are linked, as in Figure 7. The average degree is 2 but the



(a) Circle (b) Star

Figure 7: Mean preserving spread in degrees

median degree is now 1. The median tax rate falls wrt the optimal tax: $\tau_D'' = 0.026$ and $W_D'' = 1130.9$

■

VI Empirical analysis

In the utilitarian optimum, higher aggregate access leads to higher tax rates. Similarly, in a political equilibrium, a larger access for the group that makes decisions leads to higher tax rates. The wedge between mean access and the access of the decision making group creates a gap between socially optimal and politically determined tax rates. As we do not have granular data on the distribution of access, to make progress, we use proxies for access and bridging capital – based on measures of trust – and examine their correlation with tax-to-GDP rates. The key measure for us is the difference between trust towards outsiders and trust towards group members – out-in-group trust. The data suggests that out-in-group trust exhibits a positive correlation with tax-to-GDP ratio *after we control for ethnic fragmentation*. These correlations are presented in the first sub-section below. In the following two subsections we present country case studies that further elaborate on our theoretical predictions.

A Bridging capital and taxation

We first present data on tax to GDP ratio and then develop measures of generalized and inter-group trust levels as proxies for access. Then we examine the correlation between these two measures.

We start with data on aggregate tax revenue from OECD. We note that the OECD database reports total tax revenue (central, states/regional and local government) as a percentage of GDP. In our study, we wish to cover countries from different parts of the world. We consider all the countries from the World Value Survey about which we also can recover related measures of fractionalization. The list of countries we cover is as follows:

> Argentina, Armenia, Australia, Bangladesh, Brazil, Canada, Chile, China, Columbia, Cyprus, Ecuador, Egypt, France, Germany, Greece, Guatemala, India, Indonesia, Italy, Japan, Kazakhstan, Kenya, Kyrgyzstan, Maldives, Mexico, Mongolia, Morocco, Myanmar, Netherlands, New Zealand, Nigeria, Pakistan, Peru, Philippines, Romania, Russia, Serbia, Singapore, Slovakia, South Africa, South Korea, Thailand, Tunisia, Turkey, UK, Ukraine, Uruguay, US, Vietnam, Zimbabwe .

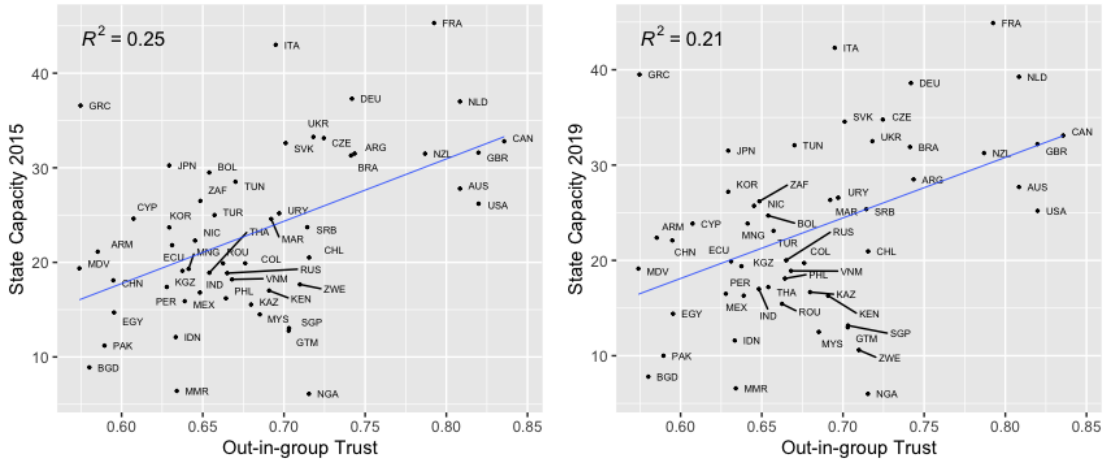
Table 3 in Appendix presents data on tax/GDP ratio in these countries. We see that there is a very wide range from 0.06 for Nigeria all the way to 0.45 for France and we see that the differences across countries are fairly stable over time. There are many reasons for this great variation in tax to GDP ratios, and group heterogeneities are among them – Alesina, Baqir, and Easterly [1999]. We will control for such group heterogeneities in some form.

Following the large literature on trust in economics and cultural anthropology, we define generalized trust using the following question, Q57, from the World Values Surveys (Glaeser et al. [2000], Henrich [2020]:

> Generally speaking, would you say that most people can be trusted or that you cannot be too careful in dealing with people?

There are two possible responses 1 and 0. Let us define the level of generalized trust as follows:

$$Gen\_Trust = \frac{\text{\# Individuals ``Most People Can be Trusted''}}{\text{\# Individuals answered Q57}}$$



(a) 2015 (b) 2019

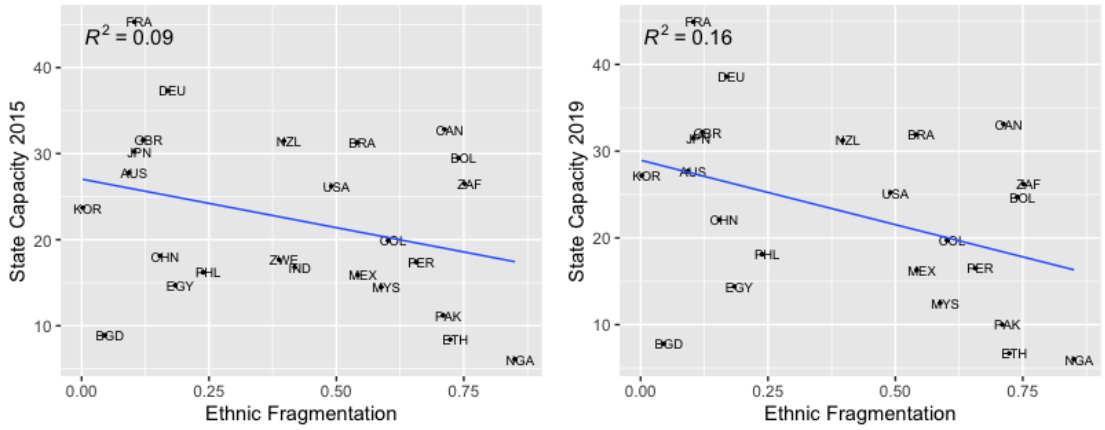
Figure 8: Scatter Plots: Out-In Group Trust vs Tax/GDP

There has been a concern in the literature that generalized references may conflate trust issues: for example, if someone only meets people from within their own isolated community then they may answer 1 to the above question, but this would be misleading as it would only indicate high trust toward own group members and not people in general. To overcome this potential confound, following Henrich [2020] and Enke [2019], we distinguish between different sets of people and examine how much individuals trust (1) their family, (2) their neighbours, (3) people they know, (4) people they don't know, (5) adherents to religions other than their own, (6) foreigners. Let us define in-group trust as average people's responses to the first three categories. Similarly, let us define out-group trust as the average responses to the latter three categories. Let us then define the difference between two averages (standardized by the trust level of the first three group) as a measure of how much individuals trust outsiders as compared to their own group members:

$$Out\_in\_Group\_Trust = 1 + \frac{\text{Out-group Trust} - \text{In-group Trust}}{\text{In-group Trust}}$$

Figure 8 presents a scatter plot for out-in-group trust and aggregate tax to GDP ratio, for two years 2015 and 2019. We see that the correlation is positive and that the R^2 is given by 0.25 and 0.21, respectively, for the years 2015 and 2019.

Let us examine the relationship between out-in-group trust and tax/GDP ratio more closely. We note that generalized trust is potentially correlated with out-in-group trust



(a) 2015 (b) 2019

Figure 9: Scatter Plots: Ethnic fragmentation vs Tax/GDP

so we would like to ask if out-in-group trust helps explain aggregate tax to GDP ratio after we control for generalized trust. A second remark is motivated by the two elements of social structure in our model – group partitions and bridging capital. Following the large literature on fractionalization we would like to ask how much does out-in-group trust correlate with tax/gdp ratio, once we control for group partitions.

Recall from Alesina, Devleeschauwer, Easterly, Kurlat, and Wacziarg [2003] that measure of ethno-linguistic fractionalization (ELF) is defined as the probability two randomly selected individuals belong to different groups. Formally, the ethnic fragmentation index of country j is defined as follows:

$$Ethnic_j = 1 - \sum_{i=1}^{N} s_{ij}^2$$

where s_{ij} is the share of group i $(i = 1 \cdots N)$ in country j. Table 4 in the Appendix presents the fragmentation measures for our list of countries based.

To develop a feel for the data, Figure 9 presents a scatter plot on the relation between ethnic diversity and aggregate tax/GDP ratio. The negative relation is consistent with the well known results of Alesina, Baqir, and Easterly [1999] on public good provision in American cities. We next turn to a statistical study of the relative impact of out-in-group trust, generalized trust and fragmentation on aggregate tax revenue.

Table 1 presents the results of our OLS regression. Model 1 regresses Tax/GDP ratio

in 2019 against Out-in Group Trust

$$t2019_i = Out\_in\_group\_Trust_i + \epsilon_i$$

Model2 is a panel data regression of Tax/GDP ratio in 2015 to 2021 against Out-in Group Trust, controlling for generalized trust.

$$t2019_i = Out\_in\_group\_Trust_i + Gen\_Trust_i + \epsilon_i$$

Model3 is a panel data regression of Tax/GDP ratio in 2015 to 2021 against Out-in Group Trust, controlling for ethnic fragmentation and population.

$$t2019_i = Out\_in\_group\_Trust_i + Ethnic_i + \epsilon_i$$

Model 4 regresses Tax/GDP ratio in 2019 against Out-in Group Trust, controlling for general trust, ethnic fragmentation and population.

$$t2019_i = Out\_in\_group\_Trust_i + Gen\_Trust_i + Ethnic_i + Population2015_i + \epsilon_i$$

Table 1: Tax/GDP and Out-In-Group Trust(All Countries)

	Dependent variable:			
	t2019			
	(1)	(2)	(3)	(4)
Out_In_Group_Trust	61.722***	43.954**	60.282***	54.219***
	(17.666)	(20.004)	(16.032)	(19.019)
Gen_Trust		14.763*		4.916
		(8.361)		(8.152)
Ethnic			−17.234***	−16.254***
			(4.370)	(4.691)
Constant	−18.483	−9.727	−10.857	−8.210
	(12.122)	(12.858)	(11.231)	(12.132)
Observations	50	50	49	49
R^2	0.203	0.252	0.402	0.407
Adjusted R^2	0.186	0.221	0.376	0.367
Residual Std. Error	8.432 (df = 48)	8.252 (df = 47)	7.441 (df = 46)	7.493 (df = 45)
F Statistic	12.206*** (df = 1; 48)	7.931*** (df = 2; 47)	15.474*** (df = 2; 46)	10.294*** (df = 3; 45)
Note:				*p<0.1; **p<0.05; ***p<0.01

The coefficient for out-in-group trust is positive and large and statistically signifi-

cant at the 1% level, the coefficient for generalized trust in not statistically significant, and the coefficient for ethnic fragmentation is negative and statistically significant at the 1% level (our results on the negative impact of ethnic fragmentation are consistent with the findings of Alesina, Baqir, and Easterly [1999]). We obtain similar estimates of coefficients for other years.

B Case studies on group Size and bridging capital

The previous section provides a high level overview of the statistical relations between bridging capital and tax/GDP ratio. In that analysis we rely on a particular measure of bridging capital – out-in-group-trust. This section supplements that analysis with case studies of few countries. We will use a 2×2 classification of countries corresponding to small and large groups and weak and strong bridging ties (Table 2).

1. Consider first the *top-right* cell in Table 2: groups are large and bridging capital is weak. The theory suggests that the utilitarian optimum (and democratic politics) will support little tax revenue. Let us use the theory to understand the experience of Nigeria and Congo (for a general analysis of state failure in Africa, see Bates [2015], Tanku [2021], Acemoglu and Robinson [2019]).

BridgingCapital / *Groups*	Large	Small
Large	South Korea	Congo, Nigeria
Small	Weird Societies	Russia

Table 2: Countries Experience: Summary

Nigeria is the largest country by population in Africa. It became independent from Britain on October 1, 1960. The country is segmented into three large geographic regions, each of which is dominated by a single ethnic group: the west by the Yoruba (who constitute 21% of the population), the east by the Igbo (constituting 18% of the population), and the north by the Hausa-Fulani (constituting 31% of population). All in all, Nigeria has over 250 ethnic groups.

Nigeria's regional stresses – that are a reflection of ethnic competitiveness, educational inequality, and economic imbalance – came to the fore very soon after independence (Williams [2019]). The south complained of northern domination, and

the north feared that the southern elite was bent on capturing power. There was unrest and disorder in the west followed by a military coup in 1966. This coup in turn created tensions across ethnic groups and the regions. By May 1967 the eastern region declared itself independent under the name of the Republic of Biafra. This was followed by a civil war that went on for over 2 years. The Biafra region collapsed in January 1970. However, a military dictatorship continued through the 1970's. The dictatorship was able to take advantage of the high oil prices to introduce a number of changes and improvements. Elections took place in 1979 and led to a brief spell of democratic government that lasted until 1983. This period was followed by another long period of military dictatorship that lasted until 1999. Nigeria has had regular democratic elections and presidents have changed since 1999.

Viewing Nigeria through the lens of our model the great ethnic diversity and the size of the three major ethnic groups (Yoruba, Igbo, and Hausa-Fulani) and the tension between these major groups, suggests a society in which cross-group access is limited. Consistent with this limited bridging capital, we find that tax revenue has remained low: one indication of this is the size of tax revenue. In 2022, the tax to gross domestic output ratio was 6.3% (Financial Times September 20, 2022).).

The Democratic Republic of the Congo (in what follows, simply, Congo) has a population of 68 million and is the largest country in Sub-Sahara Africa. Congo gained independence from Belgium in 1960. In 2020 the per capita income was around 580 USD, a figure that is less than one percent of Switzerland's per capita income. The low income is reflected in a life expectancy that is 20 years less than Switzerland's. This record of economic performance must be seen against the background of Congo's extraordinary wealth of natural resources: it has some of the world's largest reserves of copper, diamonds, cobalt, and coltan (Van Reybrouck [2014]).

The population belongs to over 200 ethnic groups. In addition, there exist close affinities between ethnic groups and groups in adjoining countries: as a result, developments in Congo are closely connected to those in neighboring countries such as Rwanda and Uganda. There exist enmities between these groups and these ties are an important aspect of the great war in Congo (1996-1997, 1998-2003). For a study of the role of linkages in shaping war, see König et al. [2017] and Goyal [2023]. In view of the many (large and small) groups and the deep enmities between them, we would expect access to be limited. Our theory predicts that tax-rate in Congo will be small. In line with this prediction, the tax to GDP

ratio in Congo for the year 2019 was low, at 7.5% (https://www.oecd.org/tax/tax-policy/).[10] The state has failed to provide public goods and basic governance.

2. We next take up the *bottom-left* cell in Table 2: groups are small and bridging capital is high. The theory predicts that these are the ideal circumstances for high tax rates. These conditions describe WEIRD societies such as United States, Australia, New Zealand and most of North Western Europe (see Tocqueville [2004], Putnam et al. [1993]). Much has been written about these countries: of the limited scope of kinship groups, of the individualist psychology of their people, and of the strength of out-in-group ties (see Henrich [2020]). In line with our theory, in these countries the tax to GDP ratio is above 20% and for some of these countries it is over 45% (see Table 3).

3. Consider now the *bottom-right* cell in Table 2: groups are small and bridging capital is weak. The theory predicts that tax rates will be modest. We use this cell to understand the experience of Russia.

   In Russia (and in other former communist countries in Eastern Europe) kin-based groups are weak and bridging capital is also weak. This is partly due to its pre-communist history, but it is also because, over its long period of rule, from 1917 to 1990, the communist party actively sought to eliminate political opposition and restrict associational life (Putnam, Leonardi, and Nanetti [1993] and Fukuyama [1995a]). The following lines may turn out to be prescient.

   Many of the formerly Communist societies had weak civic traditions before the advent of Communism, and totalitarian rule abused even that limited stock of social capital. Without norms of reciprocity and networks of civic engagement, the Hobbesian outcome of the Mezzogiorno – amoral familism, clientelism, lawlessness, ineffective government, and economic stagnation seems likelier than successful democratization and economic development. Palermo may represent the future of Moscow. Putnam, Leonardi, and Nanetti [1993], page 183.

   Attempts to contain civic associations have continued after the fall of communism; for an overview of these developments, see Snegovaya [2015]. In line with our theory, Table 3 tells us that the tax-to-GDP ratio of Russia is modest (around 20%) in recent years.[11]

[10] For a study of how collaboration with local communities can help is raising taxes in Congo, see Balan et al. [2022] and De Herdt and Titeca [2019].

[11] The tax to GDP ratio has historically been low (it was low before large scale oil commenced in the

4. The final category, in the top left of the table, can perhaps be illustrated with a discussion of South Korea: groups are prominent and bridging capital is modest. We draw on Kohli [2004] in our discussion of the South Korean experience. After the Korean war, South Korea was characterized by cohesive politics, that is, by centralized and purposive authority structures that penetrate deep into the society. One of the roots of this deep penetration of the state into society was Japanese occupation - Japan had experience in state directed development. In view of the war and the recent experience of colonization, the state in Korea equated rapid economic growth with national security. The state carved out a number of identifiable links with society's major economic groups. Especially notable among the social links was a close alliance between the state and producer or capitalist groups. An important corollary of this political arrangement is a tight control over labor. As a result, politics in Korea was repressive and authoritarian, with leaders often using ideological mobilization (e.g., nationalism and/or anticommunism) to win acceptance in the society. The state in South Korea under Park Chung Hee proved to be a successful agent to lead industrialization.

C Median versus mean access

We do not have data on bridging ties at a level of granularity that allows us to distinguish between median access and the mean access. This is something that must be left for future work. In this section, we discuss at a high level the situation in a number of countries and we relate that to political tensions in these countries. Mutatis mutandis, everything we say here can also be applies to the divergence between the utilitarian and the authoritarian outcome.[12]

Consider the case where median is smaller than the mean degree. One instance of such a situation is a society composed of a few small groups that are well connected, while most of the groups are very poorly connected. A prominent example of this is a settler society in which the colonising groups are small but well-connected, while the vast majority of the population is constituted of indigenous groups and these groups have limited bridging ties. Examples of such societies include Zimbabwe and South Africa and a number of Latin American countries. In this setting, the corollary says that the utilitarian tax rate and infrastructures is larger than that chosen by a democratic

1960's.)

[12] In the latter case, the government will choose to maximize the utility of the group in power, who may or may not be the group with the median access.

society. This difference grows with the divergence between median and mean access. This in turn has implications for the scale of state and the nature of private economic activity: in the democratic society the state will be mostly concerned with pure public goods. The utilitarian optimal may entail significant cross-group exchange, whereas the democratic society might support minimal cross-group exchange. A further corollary concerns welfare: as the gap between mean and median degree grows, there will be increasing pressure on the democratic regime.

To elaborate on these observations, we first take up the case of South Africa (and contrast it with Brazil). Our discussion draws heavily on Lieberman [2003]. Direct income taxation is an attractive source of revenue income because it is equitable. However, the empirical record of direct taxes is mixed: in some countries, virtually no revenue is collected, while in others a small amount of income tax revenue has been collected. Only in a few developing countries is income tax collected effectively and efficiently. A comparison of Brazil and South Africa is instructive: by the 1990's Brazil collected about 5 percent of GDP; South Africa on the other hand collected close to 15 percent of its GDP in incomes taxes. What is the reason for such big differences in tax regimes?

By way of background, it is useful to note that until the 1990's the two countries have similar levels of per capita income and similar levels of industrial development and the size of the state was relatively large when compared with other upper middle-income countries. The two countries are also very unequal in their income distribution and these inequalities have traditionally been associated with racial differences. Both countries also share a legacy of colonialism and slavery. Lieberman [2003] makes use of the notion of the National Political Community: this is the official, state-sponsored definition of the nation, which is specified in constitutions or other key policy documents during critical moments of political change. He argues that historically constructed definitions of National Political Community (NPC) were different in South Africa and Brazil. The explicit form of exclusion that was embodied in South Africa's institutionalized white supremacy ultimately legitimated the state in the eyes of white-owned firms and high-income individuals. This facilitated strong cross-language and cross-class ties and supported a set of integrated direct tax policies that remain to this day. By contrast, in Brazil, class relations unfolded in almost the exactly opposite manner. The federal constitution helped make regional identities politically salient, and the virtually all-white upper class groups came to see their interests as more competitive than as shared. No business organization developed that could articulate a truly national set of business or class interests. A sense of ethno-regional heterogeneity remained a source

of deep division among upper-class groups in Brazil.

In Zimbabwe there is a very small minority of white settlers, but an overwhelming majority of the population is black African. At independence, in 1980, Zimbabwe was a relatively prosperous but an unequal country. In the initial years, the new government focused on expanding education and health services (that is consistent with our theoretical predictions on pure public goods in the presence of limited access). However, gradually, pressures toward redistribution grew and led to large scale migration of the white minority. Over time, as the economy shrank and pressures grew for greater redistribution, institutions were undermined. This brought about further deterioration in the economy.

We next comment on two countries in Latin America. In Mexico, the people of mixed indigenous and European ancestry â€“ Mestizos â€“ constitute around 60% of the population, indigenous people constitute around 8-10%, and a significant fraction of the rest of the population identifies itself as being European. The country is characterized by extremes of wealth and poverty, with a limited middle class wedged between an elite cadre of landowners and investors on the one hand and masses of rural and urban poor on the other hand (Britannica [2020]). As in India, the indigenous communities have sought greater autonomy as reflected in Zapatistas.

We next discuss Peru. Mestizos constitute 60% of the population, Amerindians constitute 30% of the population, while Europeans (descendants of Spanish colonizers and other Europeans) constitute around 6% of the population. There are also small minorities of Aymara people and people of Japanese ancestry. Economic inequality in Peru overlaps strongly with ethnicity. A small group of people of European ancestry hold power in government and industry, while Spanish-speaking mestizos make up the middle class of Peruvian society, and the indigenous peoples constitute the very poor. As in the other countries we have discussed, in Peru too the indigenous communities have relatively limited social connections (Britannica [2020]).

Historically, in both Mexico and Peru, the state has been controlled by the minority group of European colonists and their successors. Once the countries allowed for voting rights to all adults (1953 in Mexico and 1979 in Peru), strong political pressures for redistribution arose. As a result, these two countries, and other countries in Latin America, have been subject to cycles of populism - riding on a promise of redistribution â€“ interspersed with periods of financial and political crises; for an overview of the Latin American experience, see (Dornbusch and Edwards [2007] and Cárdenas [2010]).[13]

[13]The factors we highlight are broadly consistent with the record of property tax changes across States

Consider next the case where the median is larger than the mean degree. One instance of such a situation is a society where a majority of the population belongs to well connected groups but there also exists a significant minority of the population belonging to groups that are isolated. Examples of such societies include India and the United States: they have relatively large indigenous groups that are relatively isolated from each other and from the majority groups (for evidence on favour exchange in rural communities in India and friendships ties in the United States, see Goyal [2023]). In this setting, the corollary suggests that the utilitarian tax revenue is smaller than that chosen by a democratic society. As before, the difference between ideal and realized tax revenue and institutional infrastructure grows with divergence between median and mean degree. The larger tax revenue and infrastructure/institutions support economic activity by the majority while the minority pays for the taxes but does not benefit from it. The democratic outcome entails significant cross-group exchange for the dominant majority, while the rest of the society gets by with mostly within group exchange. Thus there will be large payoff inequality between the well connected majority and the marginalized minority. This inequality creates political tensions and calls for greater redistribution toward groups excluded by the market, which such a society will struggle to meet.

We discuss the case of India here. There is a significant population of tribal groups "these groups are sometimes referred to as Adivasis (original inhabitants), and classified as Scheduled Tribes in official government documents. In 2020, these Scheduled Tribes constituted around 9% of the population – i.e., over a 100 million people. Most of these tribal groups live in relatively remote parts of the country and have limited social ties with other groups (for some evidence on social ties across groups in Indian villages see Goyal [2023]). These tribal groups have been negotiating for political autonomy and economic rights over forests and land for over a hundred years (even before Indian independence from the British). There is a history of these negotiations breaking down and this has given rise to long-lasting insurgencies. The northeastern states of Mizoram, Manipur, and Nagaland are one example of this. However, the tensions between the government and the tribal groups have expanded over time and now cover a large part of Central and south Eastern India, stretching across the states of Jharkhand, Chattisgarh, Odisha, Andra Pradesh and Madhya Pradesh.

The tribal groups are supported by the Communist Party of India (Maoist) and their

in the American South over the period 1820-1910. Jensen, Pardelli, and Timmons [2023] present evidence on significant tax rates imposed on the rural elite by themselves and largely spent on expansion of railroads (that largely benefitted the plantation owners, i.e., the rural rich) and they link them to the potential economic advantages accruing to this small group of families.

struggles with the Indian state now constitute one of the largest and most protracted insurgencies in the world. Over the past two decades, more than a 100,000 soldiers have been dispatched to surround the Maoist strongholds in the Centre and the East of India; for a rich and micro-level study of this conflict, see Shah [2019]. In line with our model, spurred on by groups with good access, the Indian state invests in transport infrastructure and contract enforcement. The state also seeks to extend its control over land and forest and mineral resources that were traditionally held by tribal groups. The tribal communities with their limited human capital and minimal access have different priorities. This pressure gives rise to a tension between the state the tribal groups as illustrated by the following quote.

> Even at the cusp of the new millennium, as the world marvelled at India's economic growth rates, there was no provision of electricity or running water, health care or sanitation in any of the villages.... Efforts to encourage literacy were also negligible, and in most of the villages I visited, up to 90% of the Adivasi population were illiterate. Shah [2019], page 31.

VII Concluding remarks

This paper introduces a formal theory of how the social structure of a society determines normative and positive preferences for different levels and composition of state functions, and the consequent implications for economic exchange and equality of opportunities. We have shown that size of groups and the quality and quantity of bridging ties across groups both matter, and in non trivial ways. The predictions are meant to be general and highlighting just the key concepts and relationships, but the high level empirical investigation shows that future research should consider the insights of this paper seriously, perhaps trying to construct more granular measures of bilateral ties between groups and exploiting more the descriptive and causal predictions of our network theory.

The analysis has focused on the case where expenditures are allocated between pure public goods and institutional infrastructure. Redistribution is a major function of modern governments and a natural question concerns the incentives to redistribute versus such expenditures. We extended our model to allow for rich and poor citizens and we studied voting between pure redistribution and investments in institutional infrastructure. We found that the poor would vote for pure redistribution or institutional infrastructure depending on the distribution of access in a society, in particular, there is

a threshold level of median access: below this threshold the median votes for pure redistribution and above that it votes in favour of institutional infrastructure. The possibility of redistribution leads on to the discussion of next steps in our approach.

Among the most important next steps, both theoretically and in terms of historical evolution, we think that studying the dynamic evolution of bridging ties will be very important: investments in infrastructures can have feedback effects on future access and hence future investments, while conflicts can of course constitute natural set-backs in the process. Indeed, based on preliminary investigations, we conjecture that in a model where bridging ties are endogenous, there will exist multiple stable states one in which bridging capital and infrastructures are large and one in which they are both small. Another important future research could be an analysis of the implications of our theory for the democratization question: intuitively, in a country where a ruling elite can expect that after democratization the democratic government will have good reasons to continue investing in trade infrastructures, the fear of democratization must be lower than in societies where the ruling elite can reasonably expect full redistribution and mainly pure public good provision after democratization.

References

D. Acemoglu and J. A. Robinson. *The Narrow Corridor: States, Societies, and the Fate of Liberty*. New York: Penguin Random House, 2019.

P. Aghion, Y. Algan, P. Cahuc, and A. Shleifer. Regulation and distrust. *The Quarterly journal of economics*, 125(3):1015–1049, 2010.

G. A. Akerlof. Social distance and social decisions. *Econometrica: Journal of the Econometric Society*, pages 1005–1027, 1997.

A. Alesina, R. Baqir, and W. Easterly. Public goods and ethnic divisions. *The Quarterly journal of economics*, 114(4):1243–1284, 1999.

A. Alesina, A. Devleeschauwer, W. Easterly, S. Kurlat, and R. Wacziarg. Fractionalization. *Journal of Economic growth*, 8(2):155–194, 2003.

Y. Algan and P. Cahuc. Trust, growth, and well-being: New evidence and policy implications. In *Handbook of economic growth*, volume 2, pages 49–120. Elsevier, 2014.

P. Balan, A. Bergeron, G. Tourek, and J. L. Weigel. Local elites as state capacity: How city chiefs use local information to increase tax compliance in the democratic republic of the congo. *American Economic Review*, 112(3):762–97, 2022.

R. H. Bates. *When things fell apart*. Cambridge University Press, 2015.

T. Besley and T. Persson. *Pillars of Prosperity: The Political Economics of Development Clusters*. New Jersey: Princeton University Press, 2013.

C. Boix. *Democracy and redistribution*. Cambridge University Press, 2003.

V. Braithwaite and M. Levi. *Trust and governance*. Russell Sage Foundation, 1998.

Britannica. *Encyclopaedia Britannica*. 2020.

M. Cárdenas. State capacity in latin america. *Economía*, 10(2):1–45, 2010.

K. S. Cook, M. Levi, and R. Hardin. *Whom can we trust?: How groups, networks, and institutions make trust possible*. Russell Sage Foundation, 2009.

T. De Herdt and K. Titeca. *Negotiating public services in the Congo: State, society and governance*. Bloomsbury Publishing, 2019.

B. B. De Mesquita, A. Smith, R. M. Siverson, and J. D. Morrow. *The logic of political survival*. MIT press, 2005.

R. T. Deacon. Public good provision under dictatorship and democracy. *Public choice*, 139:241–262, 2009.

R. Dornbusch and S. Edwards. *The macroeconomics of populism in Latin America*. University of Chicago Press, 2007.

B. Enke. Kinship, cooperation, and the evolution of moral systems. *Quarterly Journal of Economics*, 134(2):953–1019, 2019.

F. Fukuyama. *Trust: The Social Virtues and The Creation of Prosperity*. New York: Free Press, 1995a.

F. Fukuyama. *Trust: The social virtues and the creation of prosperity*. Free press New York, 1995b.

J. Gagnon and S. Goyal. Networks, markets, and inequality. *American Economic Review*, 107(1):1–30, 2017.

A. Gerschenkron. *Economic Backwardness in Historical Perspective*. Harvard University Press, 1962.

E. L. Glaeser, D. I. Laibson, J. A. Scheinkman, and C. L. Soutter. Measuring trust. *The quarterly journal of economics*, 115(3):811–846, 2000.

S. Goyal. *Networks: an economics approach*. MIT Press., 2023.

L. Guiso, P. Sapienza, and L. Zingales. Long-term persistence. *Journal of Eurpoean Economic Association*, 14(6):1401–1436, 2016.

J. Henrich. *The Weirdest People in the World: How the West Became Psychologically Peculiar and Particularly Prosperous*. Penguin Books, 2020.

A. O. Hirschman. *The passions and the interests: Political arguments for capitalism before its triumph*. Greenwood Publishing Group, 1997.

M. O. Jackson and Y. Xing. The complementarity between community and government in enforcing norms and contracts, and their interaction with religion and corruption. *Johns Hopkins Carey Business School Research Paper*, (18-07), 2021.

J. L. Jensen, G. Pardelli, and J. F. Timmons. When do economic elites support increasing taxation? evidence from the american south. *Journal of Politics, forthcoming*, 2023.

S. Knack and P. Keefer. Does social capital have an economic payoff? a cross-country investigation. *The Quarterly journal of economics*, 112(4):1251–1288, 1997.

A. Kohli. *State-directed development: political power and industrialization in the global periphery*. Cambridge university press, 2004.

M. König, M. Rohner, D. Thoenig, and F. Zilibotti. Networks in conflict: Theory and evidence from the great war of africa. *Econometrica*, 85(4):1093–1132, 2017.

R. E. Kranton. Reciprocal exchange: a self-sustaining system. *The American Economic Review*, pages 830–851, 1996.

M. Levi and L. Stoker. Political trust and trustworthiness. *Annual review of political science*, 3(1):475–507, 2000.

E. S. Lieberman. *Race and regionalism in the politics of taxation in Brazil and South Africa*. Cambridge University Press, 2003.

A. H. Meltzer and S. F. Richard. A rational theory of the size of government. *Journal of political Economy*, 89(5):914–927, 1981.

R. D. Putnam, R. Leonardi, and R. Y. Nanetti. *Making Democracy Work: Civic Traditions in Modern Italy*. Princeton, NJ: Princeton University Press, 1993.

R. D. Putnam et al. *Bowling alone: The collapse and revival of American community*. Simon and schuster, 2000.

K. Scheve and D. Stasavage. *Taxing the rich: A history of fiscal fairness in the United States and Europe*. Princeton University Press, 2016.

A. Shah. *Nightmarch: Among India's Revolutionary Guerrilas*. University of Chicago Press, 2019.

M. Snegovaya. Stifling the public sphere: Media and civil society in egypt, russia, and vietnam. *National Endowment for Democracy*, 2015.

K. L. Sokoloff and E. M. Zolt. Inequality and the evolution of institutions of taxation: Evidence from the economic history of the americas. In *The decline of Latin American economies: Growth, institutions, and crises*, pages 83–138. University of Chicago Press, 2007.

L. Summers. The rise of asia and the global economy. *Research Monitor*, 2, 2007.

P. Suryanarayan and S. White. Slavery, reconstruction, and bureaucratic capacity in the american south. *American Political Science Review*, 115(2):568–584, 2021.

A. Tanku. Nigeria's security crises - five different threats. *BBC: https://www.bbc.com/news/world-africa-57860993*, 2021.

A. d. Tocqueville. *Democracy in America*. Folio Society, London., 2004.

D. Van Reybrouck. *Congo: The Epic History of a People*. Harper Collins, 2014.

A. Varshney. Ethnic conflict and civil society: India and beyond. *World politics*, pages 362–398, 2001.

M. Weber. *The Religion of China*. New York: Free Press, 1951.

G. Williams. *State and society in Nigeria*. African Books collective, Oxford, 2019.

Appendix

Table 3: Tax/GDP (Data Source: OECD, IMF)

Country/Year	2015	2016	2017	2018	2019	2020	2021
Argentina	31.5	30.7	30	28.5	28.5	29.8	29.1
Armenia	21.1	21.3	20.8	20.9	22.4	22.4	22.7
Australia	27.8	27.5	28.5	28.6	27.7	28.5	30
Bangladesh	8.9	8.7	8.9	8.5	7.8	8.8	7.6
Bolivia	29.5	27.9	25.9	25	24.7	22.2	22.6
Brazil	31.3	31.6	31.7	32	31.9	31	33.5
Canada	32.8	33.3	33	33.5	33.1	34.3	33.2
Chile	20.5	20.2	20.2	21.3	21	19.4	22.2
China	18.1	17.5	17.4	17	22.1	20.1	22.3
Colombia	19.9	19.1	19	19.3	19.7	18.8	19.5
Cyprus	24.6	23.9	24.3	24.4	23.9	23.1	25.1
Czechia	33.1	34	34.4	35	34.8	34.7	33.8
Ecuador	21.8	19.9	20.2	21.1	19.9	18.7	19.4
Egypt	14.7	14.5	15.3	15	14.4	13.3	NA
France	45.3	45.4	46.1	45.9	44.9	45.3	45.1
Germany	37.3	37.8	37.7	38.5	38.6	37.9	39.5
Greece	36.6	38.9	39.4	40	39.5	38.9	39
Guatemala	12.8	13.2	13.2	13.2	13	12.4	14.2
India	16.8	17.2	17.6	17	17	16.2	17.6
Indonesia	12.1	12	11.6	12	11.6	10.1	10.9
Italy	43	42.2	41.9	41.7	42.3	42.7	43.3
Japan	30.2	30.3	30.9	31.5	31.5	33.2	30.3
Kazakhstan	15.5	14.9	16	17	16.7	14.1	15.6
Kenya	17	17.2	17.5	16.6	16.3	15.8	15.2
Kyrgyzstan	19.1	19.5	19.3	20.3	19.4	17.4	20
Malaysia	14.5	14	13.4	12.5	12.5	11.4	11.8
Maldives	19.4	19.7	20.1	19.4	19.1	19.1	17.7
Mexico	15.9	16.6	16.1	16.1	16.3	17.8	16.7
Mongolia	19.3	19.1	21.4	23.9	23.9	21	24
Morocco	24.6	25.4	25.9	26.2	26.3	27.3	27.1

Continued on next page

Table 3 – *Continued from previous page*

Country/Year	2015	2016	2017	2018	2019	2020	2021
Myanmar	6.4	7.8	6.7	3	6.6	NA	NA
Netherlands	37	38.4	38.7	38.8	39.3	40	39.7
NewZealand	31.5	31.4	31.3	32.2	31.3	33.8	33.8
Nicaragua	22.3	23.3	23.8	23.2	25.7	25.4	27.1
Nigeria	6.1	5.3	5.7	6.3	6	5.5	NA
Pakistan	11.2	11.2	11.4	10.2	10	10.3	10.3
Peru	17.4	16.1	15.2	16.3	16.5	15.2	17.9
Philippines	16.2	16.2	16.8	17.4	18.1	17.8	18.1
Romania	19.9	17.8	16.4	15.3	15.4	15.1	15.9
Russia	18.9	18	19.2	20.5	20	19.4	21.6
Serbia	23.7	24.7	25.4	25	25.4	24.8	25.7
Singapore	13	13	13.8	12.9	13.2	12.6	12.6
Slovakia	32.6	33.2	34.1	34.2	34.6	35.2	35.8
SouthAfrica	26.5	26.1	26.1	26.6	26.2	25.2	27.8
SouthKorea	23.7	24.7	25.4	26.7	27.2	27.7	29.9
Thailand	18.9	18.1	17.5	17.7	17.2	16.5	16.4
Tunisia	28.5	27.9	29.2	29.9	32.1	32.5	32.5
Turkey	25	25.1	24.7	24	23.1	23.9	22.8
UK	31.6	32.2	32.5	32.4	32.2	32.1	33.5
US	26.2	25.9	26.8	24.9	25.2	25.8	26.6
Ukraine	33.3	30.9	32.2	33	32.5	32.6	31.4
Uruguay	25.2	25.6	26.9	27	26.6	26.7	26.5
Vietnam	18.2	18.4	18.4	18.3	18.9	17.7	18.2
Zimbabwe	17.7	15.3	12.8	11.7	10.6	12.8	14.9

Table 4: Fractionalisation(Source: Alesina et al (2003))

Country	year_frac	Ethnic	Language	Religion
Argentina	1986	0.255	0.0618	0.2236
Armenia	1989	0.1272	0.1291	0.4576
Australia	1986	0.0929	0.3349	0.8211
Bangladesh	1997	0.0454	0.0925	0.209

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Table 4 – *Continued from previous page*

Country	year_frac	Ethnic	Language	Religion
Bolivia	1998	0.7396	0.224	0.2085
Brazil	1995	0.5408	0.0468	0.6054
Canada	1991	0.7124	0.5772	0.6958
Chile	1992	0.1861	0.1871	0.3841
China	1990	0.1538	0.1327	0.6643
Colombia	1985	0.6014	0.0193	0.1478
Cyprus	1992	0.0939	0.3962	0.3962
Czechia	1991	0.3222	0.3233	0.6591
Ecuador	1989	0.655	0.1308	0.1417
Egypt	1998	0.1836	0.0237	0.1979
France	1999	0.1032	0.1221	0.4029
Germany	1997	0.1682	0.1642	0.6571
Greece	1998	0.1576	0.03	0.153
Guatemala	2001	0.5122	0.4586	0.3753
India	2000	0.4182	0.8069	0.326
Indonesia	1990	0.7351	0.768	0.234
Italy	1983	0.1145	0.1147	0.3027
Japan	1999	0.0119	0.0178	0.5406
Kazakhstan	1999	0.6171	0.6621	0.5898
Kenya	2001	0.8588	0.886	0.7765
Kyrgyzstan	2001	0.6752	0.5949	0.447
Malaysia	1996	0.588	0.597	0.6657
Maldives		NA	NA	NA
Mexico	1990	0.5418	0.1511	0.1796
Mongolia	1989	0.3682	0.3734	0.0799
Morocco	1994	0.4841	0.4683	0.0035
Myanmar	1983	0.5062	0.5072	0.1974
Netherlands	1995	0.1054	0.5143	0.7222
NewZealand	1996	0.3968	0.1657	0.811
Nicaragua	1991	0.4844	0.0473	0.429
Nigeria	1983	0.8505	0.8503	0.7421
Pakistan	1995	0.7098	0.719	0.3848
Peru	1981	0.6566	0.3358	0.1988

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Table 4 – *Continued from previous page*

Country	year_frac	Ethnic	Language	Religion
Philippines	1998	0.2385	0.836	0.3056
Romania	1998	0.3069	0.1723	0.2373
Russia	1997	0.2452	0.2485	0.4398
Serbia	1991	0.5736	NA	NA
Singapore	2001	0.3857	0.3835	0.6561
Slovakia	1996	0.2539	0.2551	0.5655
SouthAfrica	1998	0.7517	0.8652	0.8603
SouthKorea	1990	0.002	0.0021	0.6604
Thailand	1983	0.6338	0.6344	0.0994
Tunisia	2001	0.0394	0.0124	0.0104
Turkey	2001	0.32	0.2216	0.0049
UK	1994	0.1211	0.0532	0.6944
US	2000	0.4901	0.2514	0.8241
Ukraine	1998	0.4737	0.4741	0.6157
Uruguay	1990	0.2504	0.0817	0.3548
Vietnam	1995	0.2383	0.2377	0.508
Zimbabwe	1998	0.3874	0.4472	0.7363

Proof of Proposition 1.

1. Show, first, that the solution is unique. Note that given τ, and the strict concavity of h and concavity of F, there is a unique $\eta(\tau)$ and $p(\tau)$ that solve

$$\eta + p = (\tau - \tau^2/2)Y \tag{17}$$

$$nh'(p) = \frac{k}{n-1} AF'(\eta) \tag{18}$$

We next show that $\eta(\tau)$ increases with τ. Write $p = (\tau - \tau^2/2)Y - \eta$ and substitute

$$nh'((\tau - \tau^2/2)Y - \eta) = \frac{k}{n-1} AF'(\eta) \tag{19}$$

Take the derivative with respect to τ:

$$nh''((1-\tau)Y-\eta') = \frac{k}{n-1}AF''\eta' \tag{20}$$

$$\eta' = \frac{nh''(1-\tau)Y}{nh''+\frac{k}{n-1}AF''} \tag{21}$$

and since $h''<0$ and $F''<0$, $\eta'>0$.

Next, the equation that characterizes the tax rate is

$$\tau = 1-\frac{n-1}{kAF'(\eta(\tau))} \tag{22}$$

Since $F''<0$ and $\eta'>0$, as τ increases from 0 to 1, the function $1-\frac{n-1}{kAF'(\eta(\tau))}$ decreases from $1-\frac{n-1}{kAF'(0)}$ to $1-\frac{n-1}{kAF'(\eta(1))}$. Therefore, if $kAF'(0)\geq n-1$, there exists a unique solution to the equation.

2. Next, let us derive the comparative statics with respect to aggregate access. Note first that welfare $W(\tau,\eta,p,A)$ is increasing in A. This implies that the maximal level of welfare is also increasing in A. To show that τ and η are increasing in A, we rely on the implicit function theorem. These two parameters are solutions of

$$nh'((\tau-\tau^2/2)Y-\eta) = \frac{k}{n-1}AF'(\eta) \tag{23}$$

$$(1-\tau)\frac{k}{n-1}AF'(\eta) = 1 \tag{24}$$

where we have rewritten equation (22) to obtain part 2 of (23). To simplify computations , introduce $\bar{k}=\frac{k}{n-1}$. Take the derivatives of these two equations with respect to A:

$$nh''((1-\tau)Y\tau'-\eta') = A\bar{k}F''\eta'+\bar{k}F' \tag{25}$$

$$-\tau'\bar{k}AF'+(1-\tau)\bar{k}AF''\eta'+(1-\tau)\bar{k}F' = 0 \tag{26}$$

Express η' as a function of τ' from the second equation in (25).

$$\eta' = \frac{F'}{(1-\tau)F''}\tau'-\frac{F'}{AF''} \tag{27}$$

Substitute in the first equation of (25 to obtain:

$$[nh''(1-\tau)Y - (nh'' + A\bar{k}F'')\frac{F'}{(1-\tau)F''}]\tau' = \bar{k}F' - (nh'' + A\bar{k}F'')\frac{F'}{AF''} = -\frac{nh''F'}{AF''}$$

On the left hand side, the term in front of τ' is negative and the right hand side is also negative, showing that

$$\tau' > 0$$

Then from the first equation

$$-(nh'' + A\bar{k}F'')\eta' = -nh''(1-\tau)Y\tau' + \bar{k}F'$$

where the term in front of η' is positive while the right hand side is positive, showing that

$$\eta' > 0$$

Next, the derivative of public goods $p = (\tau - \tau^2/2)Y - \eta$ with respect to A is

$$p' = (1-\tau)Y\tau' - \eta'$$

and is such that

$$nh''p' = A\bar{k}F''\eta' + \bar{k}F'$$

and since $\eta' = \frac{F'}{(1-\tau)F''}\tau' - \frac{F'}{AF''}$, we have

$$nh''p' = \frac{A\bar{k}}{1-\tau}F'\tau'$$

which shows that

$$p' < 0$$

3. Finally, let us show that the optimal tax rates are falling in aggregate income. In a segmented country, the tax rate solves

$$nh'((\tau - \tau^2/2)Y)(1-\tau) = 1$$

Take the derivative with respect to Y

$$\tau'(-nh' + (1-\tau)Ynh'') = -(\tau - \tau^2/2)nh''(1-\tau)$$

showing that $\tau' < 0$. In a bridged country, the tax rate τ and infrastructures η solve

$$\begin{aligned}(1-\tau)A\bar{k}F'(\eta) &= 1\\ nh'((\tau-\tau^2/2)Y-\eta) &= \bar{k}AF'(\eta)\end{aligned}$$

Take the derivative of the first equation with respect to Y :

$$-\tau' A\bar{k}F' + (1-\tau)A\bar{k}F''\eta' = 0$$

and hence

$$\eta' = \frac{F'}{(1-\tau)F''}\tau'$$

Take the derivative of the second equation

$$nh''((1-\tau)Y\tau' - \eta' + (\tau-\tau^2/2)) = \bar{k}AF''\eta'$$

Leading to

$$\tau'[nh''(1-\tau)Y - \frac{F'}{1-\tau}(\frac{nh''}{F''} + \bar{k}A)] = -nh''(\tau-\tau^2/2)$$

and showing that $\tau' < 0$.

Proof of Proposition 2.

The first part follows from the following observation: since aggregate access is equal, the optimal tax rate will be equal. This means that returns to cross-group exchange will be the same in both groups. However, within group exchange is more extensive in the society with larger groups. Thus the society with larger groups will have a higher welfare.

We now turn to part 2 of the Proposition. Set the tax rate at the utilitarian optimum for groups of size $\mathbf{s}$ with maximal access:

$$W(\mathbf{s}, A(\mathbf{s})) = (1-\tau^*)Y + nh(p^*) + k\frac{A(\mathbf{s})}{n-1}[1+F(\eta^*)] + U(\mathbf{s})$$

Keeping the same tax rate and allocation of public finances, welfare for groups of size $\mathbf{s}'$ is

$$W(\mathbf{s}', A) = (1-\tau^*)Y + nh(p^*) + k\frac{A}{n-1}[1+F(\eta^*)] + U(\mathbf{s}')$$

The difference is

$$W(\mathbf{s}', A) - W(\mathbf{s}, A(\mathbf{s})) = k\frac{A - A(\mathbf{s})}{n-1}[1 + F(\eta^*)] + U(\mathbf{s}') - U(\mathbf{s})$$

The difference is increasing in A and, at the highest possible value $A(\mathbf{s}')$, we see that

$$W(\mathbf{s}', A(\mathbf{s}')) - W(\mathbf{s}, A(\mathbf{s})) = \frac{A(\mathbf{s}') - A(\mathbf{s})}{n-1}[k[1 + F(\eta^*)] - 1]$$

where the last equality comes from noting that

$$U(\mathbf{s}') - U(\mathbf{s}) = -\frac{A(\mathbf{s}') - A(\mathbf{s})}{n-1}$$

Therefore if condition (8) holds at $\mathbf{s}$, $k[1 + F(\eta^*)] > 1$ and $W(\mathbf{s}', A(\mathbf{s}')) > W(\mathbf{s}, A(\mathbf{s}))$. Finally, note that utilitarian welfare at $\mathbf{s}', A$ is higher than $W(\mathbf{s}', A)$. This completes the proof of part 2. The proof of part 3 follows using a similar argument as in part 2.

Proof of Proposition 3.

The democratic public policies solve

$$\max_{\tau,\eta,p}(1-\tau)Y + nh(p) + \frac{k}{n-1}na_d(1 + F(\eta)) + n\frac{s_d - 1}{n-1}$$

leading to welfare

$$W = (1-\tau_d)Y + nh(p_d) + \frac{k}{n-1}A(1 + F(\eta_d)) + \sum_i \frac{s_i - 1}{n-1}$$

Compute the derivative of W with respect to a_d:

$$\frac{dW}{da_d} = -\tau_d' Y + np_d' h' + \frac{k}{n-1}A\eta_d' F'$$

while the first order conditions of the democratic problem tell us that

$$-\tau_d' Y + np_d' h' + \frac{k}{n-1}na_d\eta_d' F' = 0$$

This yields

$$\frac{dW}{da_d} = \frac{kn}{n-1}(\bar{a} - a_d)\eta_d' F'(\eta_d)$$

Since $\eta_d' > 0$ and $F' > 0$, this shows that $\frac{dW}{da_d} > 0$ if $a_d < \bar{a}$ while $\frac{dW}{da_d} < 0$ if $a_d > \bar{a}$.